EXECUTIVE CHAMBERS

HONOLULU

JOHN WAIHEE
GOVERNOR

December 19, 1988

'88 DEC 27 A8:07

Mr. Edward Y. Hirata
Director
Department of Transportation
State of Hawaii

Dear Mr. Hirata:

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

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

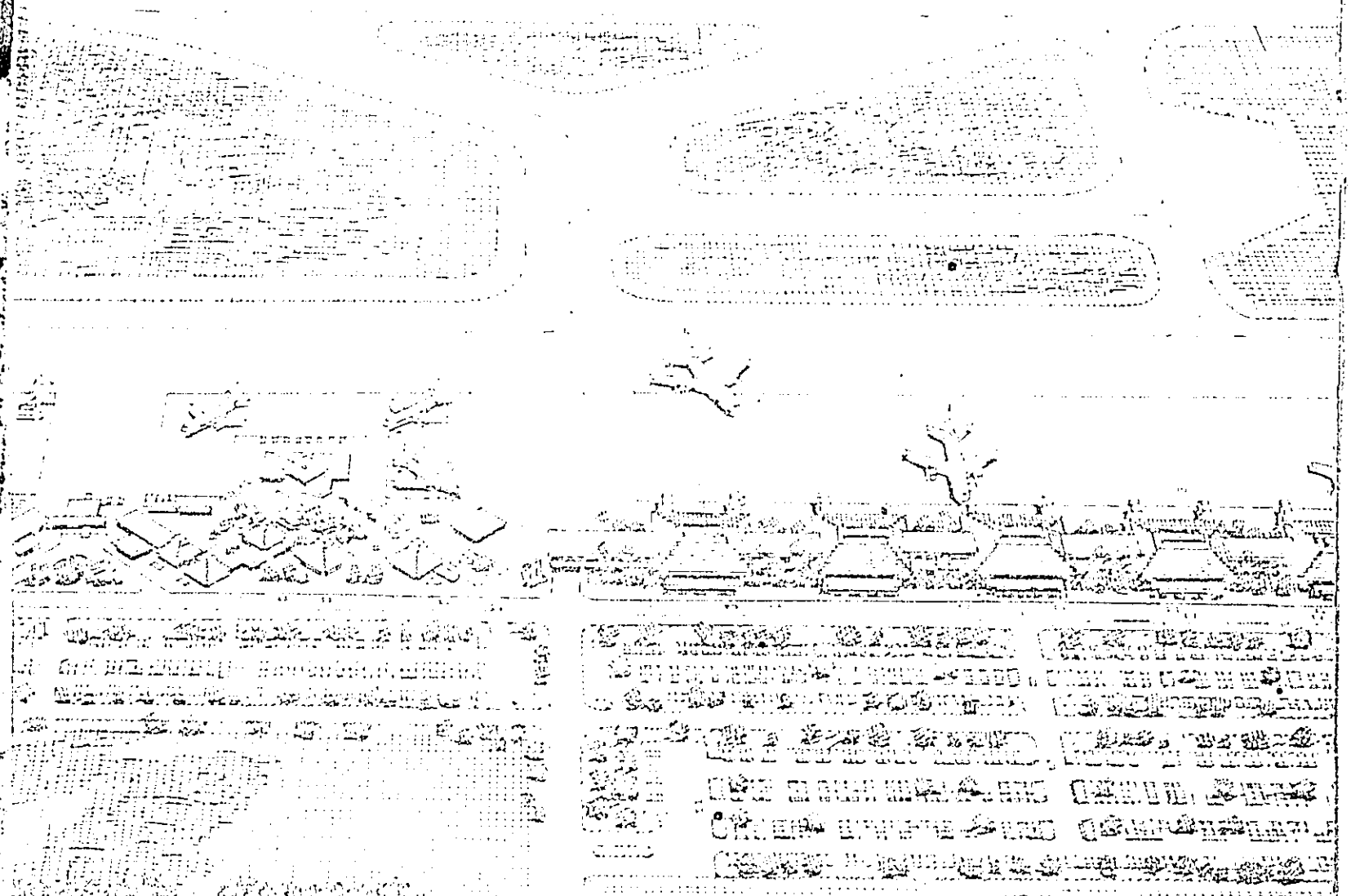
With kindest regards,

Sincerely,

JOHN WAIHEE

cc: Marvin T. Miura, Ph.D.

Keahole Airport Master Plan
ENVIRONMENTAL IMPACT STATEMENT
Keahole, North Kona, Hawaii



State of Hawaii
Department of Transportation
Airports Division

October 1988

FINAL

ENVIRONMENTAL IMPACT STATEMENT

FOR THE

KEAHOLE AIRPORT MASTER PLAN

NORTH KONA, HAWAII

TMK: 7-2-05:7 and
7-3-43:3, 6 thru 35, 37 thru 40
and 43 thru 47

This document has been prepared pursuant to
Chapter 343, Hawaii Revised Statutes and
The National Environmental Policy Act

PROPOSING AGENCIES:

State of Hawaii
Department of Transportation
Airports Division
Honolulu International Airport
Honolulu, Hawaii

Federal Aviation Administration
Honolulu District Office
300 Ala Moana Blvd.
Honolulu, Hawaii 96813

Responsible Official: _____

Date: 9/30/88

Responsible Official: _____

Date: 10/11/88

Prepared By:

R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

OCTOBER 1988

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

SECTION 1

Introduction and Summary

SECTION 1
INTRODUCTION AND SUMMARY

1.1 PURPOSE

The original Keahole Airport Master Plan, formulated in 1968, called for the initial development of two 6,500-foot long parallel runways. The plan also recommended that these runways be extended to 12,000 feet by 1985. This recommendation was based on annual forecasts of 4 million passengers and 188,000 aircraft operations by 1985. The actual annual aviation activity tabulated for 1985 was 1,485,813 passengers and 93,878 aircraft operations, significantly less than the levels projected in 1968.

In early 1986, the State of Hawaii Department of Transportation (DOT), Airports Division, reexamined their passenger and aircraft operation forecasts as part of the Statewide Airport System Plan (SASP). This study projected annual passenger and aircraft activity for all DOT airports through the year 2005. An estimated 4,160,000 passenger enplanements and deplanements and 159,000 annual aircraft operations are projected by the SASP for Keahole Airport by the year 2005.

In April 1986, the State of Hawaii, Department of Transportation, Airports Division, initiated a comprehensive planning study of Keahole Airport under the Federal Aviation Administration Airport Improvement Program. The firm of R. M. Towill Corporation was contracted to undertake the Master Plan Update Program. The purpose of the study was to determine the type and extent of aviation facilities needed at Keahole Airport through the year 2005 and to prepare a Master Plan to satisfy these demand requirements. In addition, a Noise Compatibility program was prepared by Peat Marwick Main & Company for the airport environs that documented existing noise levels and resulting impacts on surrounding uses and predicted future noise levels. Further, a program to abate and mitigate noise impacts was developed. The Noise Compatibility Program was developed in accordance with the requirements of Federal Aviation Regulations, Part 150, "Airport Noise Compatibility Planning."

The Dept. of Transportation, Airports Division, has determined that an environmental impact statement is required pursuant to Chapter 200 of Title 11, Administrative Rules, subchapter 5(b) and the National Environmental Policy Act. The environmental impact statement has been prepared in accordance with Chapter 343, Hawaii Revised Statutes, National Environmental Policy Act (40 CFR Part 6), and the rules and regulations of the Office of Environmental Quality Control.

The environmental impact statement includes relevant information on the proposed action, existing environmental conditions, and an assessment of probable impacts and possible mitigation measures.

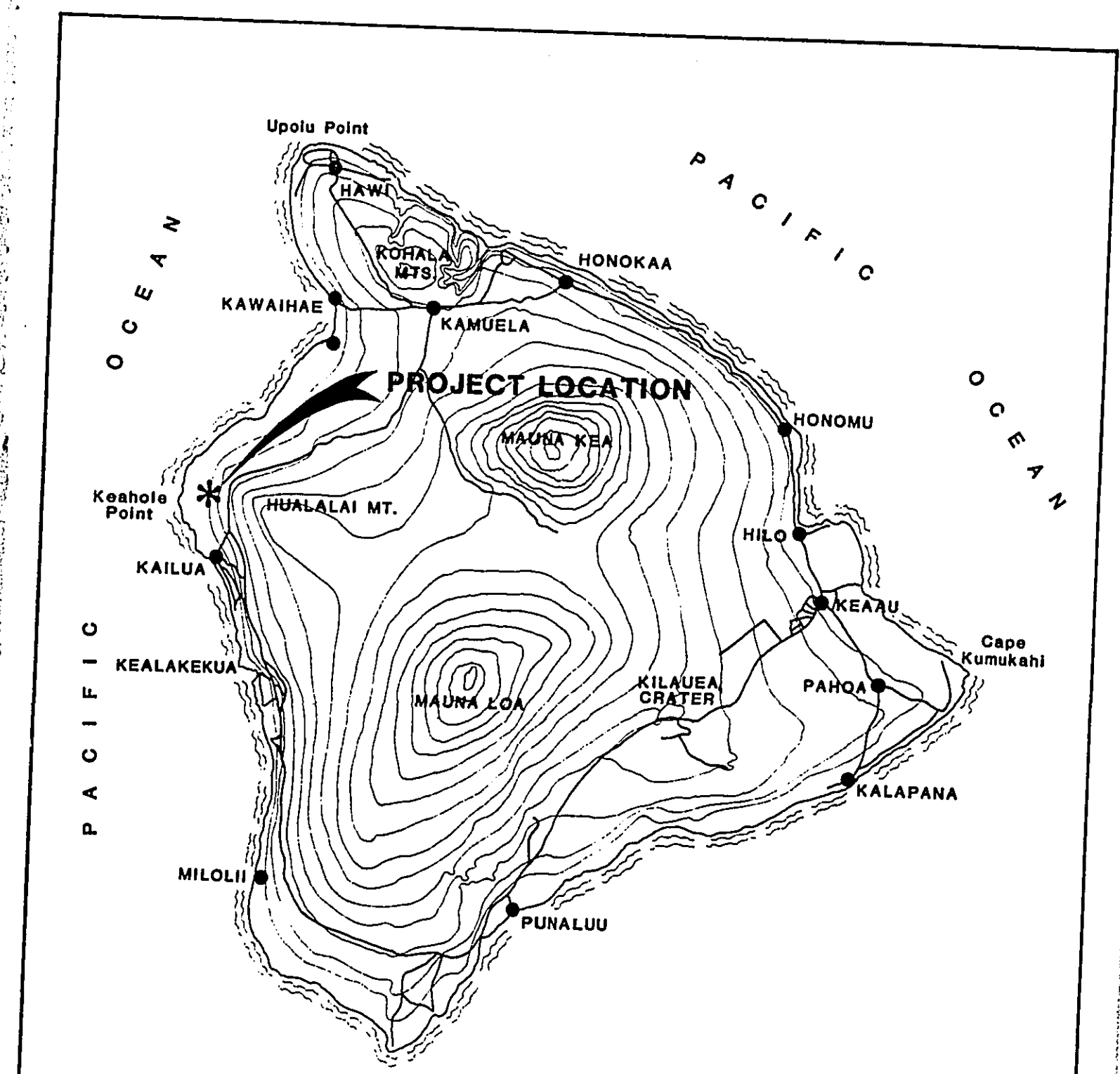
The environmental impact statement and the master plan shall be used as basic documents to support proposed State land use boundary amendments and redesignation to the County's zoning.

1.2 PROJECT LOCATION

The Keahole Airport is located on the west side of the Island of Hawaii in the North Kona District (see Figure 1-1). The airport is located west of the Queen Kaahumanu Highway, and is approximately seven (7) miles north of Kailua, Hawaii. The airport property encompasses approximately 4,000 acres of land. Of this total, approximately 421 acres to the south has been leased to the Hawaii Ocean Science and Technology Park (HOST) and 322 acres to the west has been leased to the Natural Energy Laboratory of Hawaii (NELH).

1.3 PUBLIC PARTICIPATION PROGRAM

An integral part of the Master Plan program was the public participation program. The program was made up of two components: (1) public informational meetings and (2) a Technical Advisory Committee. Four public informational meetings were held during the development of the Master Plan. These meetings served to inform interested parties in the community on the progress of the Master Plan development and to solicit community input on the proposed airport improvements. A Technical Advisory Committee was organized for the purpose of reviewing and commenting on detailed aspects



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

4 0 4 8 12 16
SCALE IN MILES

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LOCATION MAP

FIGURE 1-1

of the Master Plan and Noise Compatibility Program. The Technical Advisory Committee was made up of community leaders, business leaders, airport users, and representatives from governmental agencies. The members of this committee and their affiliations are listed in Table 1-1.

In addition to the informational meeting, a public hearing was conducted to accept testimony on the Keahole Airport Master Plan and environmental issues associated with the airport's development. A record of the public hearing is appended to this document.

1.4 FORECAST AND PROJECTIONS

1.4.1 Aviation Demand Forecasts

Table 1-2 presents forecasts of aviation demand at Keahole Airport for 1985 through 2005. The annual forecasts were prepared as part of an update to the State Airport System Plan, and are from a report entitled "Hawaii State Airport System Plan, Aviation Demand Forecast," June 1986. As described in that report, aviation demand at the airport will continue to grow as a result of the increase in tourists to Hawaii as well as the general economic growth of the State. The total passenger volume at Keahole Airport is forecasted to nearly triple, from 1,485,813 in 1985 to 4,160,000 in 2005. The forecasted annual growth rates are 7.9 percent from 1985 to 1990, 6.5 percent from 1990 to 1995, 3.6 percent from 1995 to 2000, and 2.3 percent from 2000 to 2005. The overseas share of total passengers is forecasted to increase from 9 percent in 1985 to 40 percent in 2005.

The volume of cargo and mail is forecasted to increase substantially from 9,558 tons in 1985 to 25,500 tons in 2005.

Total aircraft operations are forecasted to increase from 93,878 in 1985 to 159,000 in 2005. Air carrier and commuter/air taxi operations are expected to increase moderately from 55 percent of total operations in 1985 to 63 percent in 2005. About 10 percent of the air carrier operations is expected to be air cargo.

TABLE 1-1

TECHNICAL ADVISORY COMMITTEE MEMBERSHIP

The Honorable Virginia Isbell
Representative, 5th District

The Honorable Paul T. Oshiro
Chairman, Transportation Committee
Representative, 46th District

Federal Aviation Administration
- Air Traffic Manager
- Airports Division

Public Planning Agencies
- Board of Land and Natural Resources
- County of Hawaii Governors Office
- County of Hawaii County Council
- County of Hawaii Planning Department
- County of Hawaii Department of Public Works
- County of Hawaii Department of Research and Development

Airport Tenants
- Hemmeter Aviation Services
- Hertz Rent-A-Car
- Host International
- Kona Helicopters, Inc.

Air Transport Association

Airline Pilots Association

High Technology Development Corporation

Natural Energy Laboratory of Hawaii

Local Industry and Community Interests
- Bank of Hawaii
- Bishop Estate
- Commission on Transportation
- First Hawaiian Bank
- Hawaii Island Economic Development Board
- Hawaii Leeward Planning Conference
- Huehue Ranch
- Kamehameha Development, Inc.
- Kohala Resort Association
- Kona-Kohala Chamber of Commerce
- Kona Palisades Community Association
- Mauna Kea Properties, Inc.
- Mauna Lani Resort, Inc.
- Outdoor Circle
- Na Ala Hele

TABLE 1-2

AVIATION DEMAND FORECASTS
KEAHOLE AIRPORT

ANNUAL FORECASTS	ACTUAL 1985	FORECAST 1990	1995	2000	2005
Passengers (Enplaned and Deplaned)					
Air Carrier					
Overseas	129,933	330,000	620,000	900,000	1,150,000
Interisland	1,293,639	1,850,000	2,380,000	2,675,000	2,860,000
Commuter Airlines/ Air Taxis	62,241	95,000	120,000	140,000	150,000
TOTAL	1,485,813	2,275,000	3,120,000	3,715,000	4,160,000
Cargo and Mail (Enplaned and Deplaned)					
Cargo (Tons)	8,212	12,000	16,000	20,000	22,000
Mail (Tons)	1,346	2,000	2,500	3,000	3,500
TOTAL	9,558	14,000	18,500	23,000	25,500
Aircraft Operations					
Air Carrier	20,510	38,000	46,000	50,000	53,000
Commuter/Air Taxi	31,473	31,000	37,000	42,000	48,000
General Aviation	22,313	25,000	28,000	32,000	36,000
Military	19,583	22,000	22,000	22,000	22,000
TOTAL	93,879	116,000	133,000	146,000	159,000
Based Aircraft	36	42	48	53	60

SOURCE: Hawaii Department of Transportation, Airports Division, "Hawaii State Airport System Plan, Aviation Demand Forecasts," June 1986.

1.4.2 Hourly Runway Capacity

Hourly runway capacity for Keahole Airport was estimated using Peat Marwick Main's Runway Capacity Model. The runway capacity is 60 operations per hour. Existing peak operations are 31 operations per hour. The number of operations in the year 2005 is projected at 52 operations per hour.

1.5 PROPOSED ACTION

1.5.1 Airfield Facilities

The major facilities proposed for the airfield consist of a 4,500-foot runway extension, additional taxiways, new and larger holding bays, and widened runway shoulders. The 4,500-foot extension will bring the ultimate length of the runway to 11,000 feet. The proposed improvements are based on the projected aviation demands and available airfield capacity through the year 2005. Master planning studies have indicated that a second runway will not be necessary until beyond 2005.

The proposed extension will occur towards the north, where there is ample undeveloped land. Included in the planned upgrades are additional lighting and navigational systems, strengthening of the existing airfield pavement, and alterations to the surrounding airspace.

1.5.2 Terminal and Airport Support Facilities

The proposed terminal and airport support facilities expansion has been organized to allow for future expansion of the airport beyond the year 2005. Relocation of certain facilities was necessary to provide efficiency in airport operations.

Major terminal facilities proposed include an expanded interisland terminal, new overseas terminal, expanded air cargo/mail facilities, new general aviation facilities, air taxi/commuter facilities, new heliport, expanded parking facilities, car rental area, airport maintenance area, fuel storage and fixed base operator parcels.

The terminal complex is proposed to be laid out in a linear pattern which closely resembles the existing layout of major facilities. Expansion of

the terminal complex, parking facilities and ground transportation extends to the north of the existing facilities. Major expansion to the south includes general aviation facilities, heliport, fixed base operator parcels and air cargo/mail facilities.

1.6 RATIONALE FOR ACTION

The Statewide Airport System Plan (SASP) projected annual passenger and aircraft activities to the year 2005. The study indicated a substantial increase in aviation activities. Annual aviation activity for 1985 was tabulated at 1,485,813 passengers and 93,878 aircraft operations. Aviation activity for Keahole Airport in 2005 is projected at 4,160,000 passengers and 159,000 aircraft operations. The airport is currently experiencing some inefficiencies in airport operations with the present demand.

Location of major facilities is based on expansion capability and efficiency in airport operations.

Airfield expansion will provide unrestricted operations for the expected aircraft types (based on the projections of the SASP).

1.7 SUMMARY OF IMPACTS AND MITIGATION MEASURES

1.7.1 Physical Environment

1.7.1.1 Land Use

Keahole Airport is located on land owned by the State of Hawaii and encompasses 3,191.41 acres. Portions of the property have been transferred to the Hawaii Ocean Science and Technology Park and the Natural Energy Laboratory of Hawaii for a total of 743 acres. The existing airport utilizes approximately 432 acres. An additional 212 acres will be required for the expansion of the airport.

The additional 212 acres will require a State Land Use District Amendment to reclassify the lands from "Conservation" to "Urban." A County zoning amendment is also required to change the lands from "Open" to "General Industrial."

The surrounding land uses are presently compatible with the airport operations. However, future development in areas affected by aircraft noise should be limited as stated in Subsection 3.7, Noise.

1.7.1.2 Natural Hazards

Because the Island of Hawaii is located in Earthquake Zone 3, risks to life and property are present at the Keahole Airport site. Structures built shall conform to the seismic provisions of the Uniform Building Code.

1.7.1.3 Geology and Soils

Soils consist of aa and pahoehoe lava flows. These soil types may contain lava tubes which may collapse during excavation or construction. Extensive soil testing and borings should be conducted during the design phase. Care should be taken during grading operations in the event lava tubes are discovered.

1.7.1.4 Flora

The project site is a sparsely vegetated lava field. The predominant plants consist of fountain grass (Pennisetum setaceum), 'uhaloa (Waltheria indica), and maia-pilo (Capparis sandwichiana). None of the native or Polynesian-introduced species found are considered rare, threatened or endangered.

1.7.1.5 Fauna

Nine species of birds, skeletal material of donkey and goat, mongoose and one skink species was found on the land proposed for expansion of the Keahole Airport. Most of the bird and mammal species were found in the vicinity of the terminal and car rental lots where nesting sites, food and water were available. The fauna encountered is not considered threatened or endangered by the Federal and/or State governments.

1.7.1.6 Noise

Aircraft noise levels will increase with the projected increase in aircraft operations. Because of the large airport site and its location adjacent to the ocean, effects of aircraft noise on the surrounding community have not

been significant. There are no incompatible land uses located in areas affected by Ldn (day-night sound level) 60 or higher.

As part of the overall planning for the airport, a Noise Compatibility Program has been developed pursuant to Federal Aviation Regulations, Part 150. The Noise Compatibility Program focuses on two aspects of the noise problem. First, to continue to emphasize existing noise abatement procedures and to adopt new measures to abate noise, if necessary. Secondly, to adopt new measures to mitigate the effect of noise in the future.

Four noise abatement measures are recommended for Keahole:

A. Build high speed taxiways.
B. Change flight patterns.
C. Enforce prescribed flight track use.
D. Limit aircraft types to Stage 3 aircraft.

Eight noise mitigation measures recommended for implementation are:

A. Continuation of comprehensive planning and urban growth management by Hawaii County to ensure land use compatibility.

B. Sequencing of the implementation of capital improvements and public works projects to be consistent with land use compatibility objectives.

C. Institution of zoning changes in the airport environs to encourage airport compatible development and adoption of a height/noise/safety overlay zone.

D. Requirement for acoustical treatment of new noise sensitive land uses that might be permitted to locate in areas exposed to noise levels of Ldn 60 or higher.

E. Amendment to the subdivision regulation to require sound-proofing and the dedication of avigation easements.

F. Adherence to fair disclosure law so that all people moving into an existing or potential noise area are informed of the condition.

G. Institution of tax incentives to encourage the retention of open space use in the airport environs.

H. Encouragement of the continuance of Federal mortgage insurance policies which limit the issuance of such policies in areas exposed to high levels of aircraft noise.

1.7.1.7 Air Quality

Impact analysis based on the Airport Vicinity Air Pollution (AVAP) Model indicates that despite the projected increase in air and ground operations, air quality in the airport vicinity will be minimally affected. Concentration estimates for carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and total suspended particulates (TSP) were well below applicable State and Federal standards. Total and non-methane hydrocarbon concentrations were also estimated, although there are no longer standards for the latter. The results indicated levels well below the previous State standard of 100 micrograms per cubic meter (ug/m^3).

The blockage of the normal northeasterly tradewinds by Mauna Loa and Mauna Kea and the resulting reduced ventilation in the Kona area can result in a buildup of pollutant concentrations. Close monitoring and periodic reevaluation of pollutant levels should be done as future developments expand in the area.

1.7.1.8 Visual Resources

The natural state of the lava fields will be obliterated by the construction of buildings, roadways and pavement coverings. To create a pleasing visual environment, landscaping will be used to enhance the area and screen unattractive facilities. Formal gardens within the terminal

complex will also be designed and developed. Some of the existing architectural design themes will be incorporated into the design of new buildings to maintain the "tropical village" design character of the airport.

1.7.1.9 Historic or Cultural Resources

Six sites in the eastern section of the proposed airport expansion area will be affected. Three of the sites lacked cultural materials and are significant only for their information content which have been recorded and are no longer significant. The other three sites consisted of a large lava tube and two habitation caves. These sites will undergo archaeological data recovery to retrieve any scientific or cultural information, thus impacts will be converted to a "no adverse effect." All of the sites were significant for their information content only and does not warrant preservation according to the criteria of the National and Hawaii Registers of Historic Places. An archaeological mitigation plan shall be prepared and reviewed with the State Historic Sites Section prior to the start of construction.

1.7.2 Social and Economic Conditions

1.7.2.1 Human Settlement Patterns

The most recent residential development in the vicinity of the airport was the Keahole Agricultural Park which contains three residences. Kona Palisades Subdivision is the next closest residential development. Other built-up areas include the Kaloko Industrial Park and the Honokohau Harbor. Future residential or resort development, adjacent to the airport, should be restricted.

1.7.2.2 Economy

Business and employment trends in the Kona area have changed dramatically from an agriculturally based economy to an economy largely based on the visitor industry. Service related employment, the construction industry and wholesale/retail trades have also increased as a result of the visitor industry.

During the past 15 years, the State of Hawaii has experienced an increase of 146 percent in the number of overnight visitor accommodations. On the

Island of Hawaii, the Kona area has the greatest concentration of units. It represents 61.7 percent of the total island's units.

The expansion of the Keahole Airport will result in approximately 2,053 direct and 3,592 indirect construction related jobs. Long term permanent employment will also be created with the expanded facilities.

Expanded airport facilities will help to support the visitor industry and the nearby high technology park by providing an efficient means of transporting people and goods.

1.7.3 Public Facilities

1.7.3.1 Access, Circulation and Parking

Queen Kaahumanu Highway at Keahole Airport Access Road provides a separate turn lane into the airport proper from the north and a deceleration lane to the south. Exit from the two-lane Keahole Airport Access Road has a left turn lane with right turns channelized by a striped traffic island into an acceleration lane. During average day, peak hour conditions the two-lane Queen Kaahumanu Highway is well under capacity. No significant traffic delays are experienced at the intersection of Queen Kaahumanu Highway and Keahole Airport Access Road. For both the peak day and average day peak hour, the capacity of this intersection is sufficient to handle the existing volume of vehicles.

Projections indicate that by the year 1994, the intersection of Queen Kaahumanu Highway and the Airport Access Road will require signalization. The airport access road should be widened from two to four lanes before the year 2004.

Two new service roads will branch off of the main access road and the peripheral road will be widened to ease traffic around the terminal area.

Public and employee parking facilities will be expanded.

1.7.3.2 Potable Water Supply

Four wells and an underground shaft in the Kahaluu area provide the airport with a source of potable water. The existing transmission line is adequate

to service the airport during peak or fire conditions and will be extended to the north to supply the proposed terminal facilities. Additional water lines will be used to serve the proposed general aviation area and lease parcels.

Some future source water development may be required. The demand for water system development is shared by all projects planned for the northern Kona area.

Flow restriction devices can be used to avoid waste of this valuable resource.

1.7.3.3 Wastewater Treatment and Disposal

The new self-contained sewerage system will consist of gravity collection pipelines, a sewage pump station and a sewage treatment plant. There is no local municipal sewerage system. Treated effluent disposal will be by injection wells. Effluent reuse for irrigation purposes will extend the life of the injection wells.

1.7.3.4 Storm Water Drainage

Dry wells, swales and culverts will be used to convey and dispose storm water runoff. The basalt lava rock cover in the area provides good conditions for infiltration and subsurface flow. Therefore, excess runoff from the expanded airport facilities will not significantly affect adjacent developments.

1.7.3.5 Power and Telecommunications

Source transmission is via a 69 KV overhead line along the Queen Kaahumanu Highway. A 12.47 KV underground line links the airport to a Hawaii Electric Light Co. (HELCO) substation on Queen Kaahumanu Highway. Any necessary offsite improvements to the electrical system will be provided by HELCO as part of their regional system upgrades.

Emergency power generation facilities, located on the airport proper, will require upgrading to accommodate the additional equipment planned at the airport.

1.7.3.6 Lighting System

Additional lighting will be required with the expansion of the airport. The additional airfield lighting will cause visual impacts due to the necessary unobstructed views of these facilities. Terminal and parking lot lighting will utilize glare shields to reduce the amount of stray light. The electrical system expansion for the proposed lighting facilities will need coordination with HELCO for review of the required regional system upgrades.

1.7.3.7 Fueling System

The present refueling system using tanker trucks will be replaced by a system of underground pipelines, refueling hydrants, fueling service pits and two bulk fuel storage and pumping facilities. Because of possible seismic movement in the area, pipelines should be designed to tolerate some shifting. Impermeable concrete foundations for aboveground storage tanks should be designed to contain any spillage.

1.7.3.8 Police Service

The Keahole Airport will need to contract additional police officers and security guards for the expansion of the airport. Similarly, the airlines will require more security screening guards at the departure gates.

1.7.3.9 Crash, Fire, Rescue Facilities and Medical Services

The crash, fire, rescue facilities satisfy the requirements for an INDEX C airport. The existing facilities have sufficient space to support additional rescue personnel and equipment for the expanded airport.

Paramedical services are provided by the crash, fire, rescue unit. Ambulances are dispatched from Fire Station No. 7, located in Kailua, and the closest hospital is the Kona Hospital.

1.7.3.10 Solid Waste Collection and Disposal

Solid waste will be disposed into dumpsters and trucked to Kaloko Sanitary Landfill by a private firm contracted by the Dept of Transportation, Airports Division.

1.8 RELATIONSHIP TO LAND USES AND POLICIES

Expansion of the Keahole Airport is generally consistent with the overall goals and objectives for the development of the State of Hawaii. The expanded airport facilities will serve as a major support facility, transporting people and goods within the Hawaiian Island chain and providing a direct link to the mainland. The growing visitor industry and the increasing high technology facilities in West Hawaii will benefit from the expanded air carrier and air cargo operations.

The economy of the Island of Hawaii will increase by the addition of numerous employment opportunities, both short term construction and long term permanent employment.

The expansion of the airport will limit certain types of future development in the near vicinity. Future urban development (i.e., residential, schools) within areas exposed to high levels of noise will not be permitted.

1.9 ALTERNATIVES CONSIDERED

Alternative plans were developed to provide a range of development options for the Keahole Airport. The various facilities shown on the alternative plans could be recombined, deleted or supplemented to arrive at an ultimate plan.

1.9.1 Airfield Alternatives

Five airfield alternatives were considered: three single runway and two dual runway configurations. The plans considered included:

- Extension of the existing runway to 8,000 feet
- Extension of the existing runway to 9,500 feet
- Extension of the existing runway to 11,000 feet
- Extension of the existing runway to 11,000 feet and construction of a second parallel runway of 11,000 feet
- Retention of the existing 6,500-foot runway and construction of a second parallel runway of 11,000 feet

1.9.2 Terminal Alternatives

Four terminal area alternatives were developed for consideration. The terminal area alternatives retained the linear pattern of the existing terminal area. The major differences between the terminal area plans were the location of major uses. The locations of the major uses adjacent to the runway are as follows (south to north):

Alternative 1 - GA, Air Cargo, Commuter, ATCT, Interisland, Overseas, Heliport

Alternative 2 - GA, Heliport, Commuter, ATCT, Interisland, Overseas, Cargo

Alternative 3 - Air Cargo, Commuter, ATCT, Interisland, Overseas, GA Heliport

Alternative 4 - Heliport, GA, Commuter, Cargo, Interisland, Overseas/Interisland

1.10 PERMITS AND APPROVALS

The following permits and approvals are required prior to implementation of the project:

Authority	Approval Required
Federal Government	
Federal Aviation Administration	Approval of the Airport Layout Plan
State of Hawaii	
State Land Use Commission	Land Use Boundary Amendment
Dept. of Health	NPDES Permit
Dept. of Transportation, Highways	Construction Within State R.O.W.

<u>County of Hawaii</u>	
Planning Department	Rezoning SMA Permit
Dept. of Public Works	Grading Permit
Building Department	Building Permit

SECTION 2
Proposed Development Plan

SECTION 2
PROPOSED DEVELOPMENT PLAN

The purpose of the expanded airport facilities is to meet projected aviation demands, provide unrestricted operations for all aircraft types and site major facilities for operational efficiency.

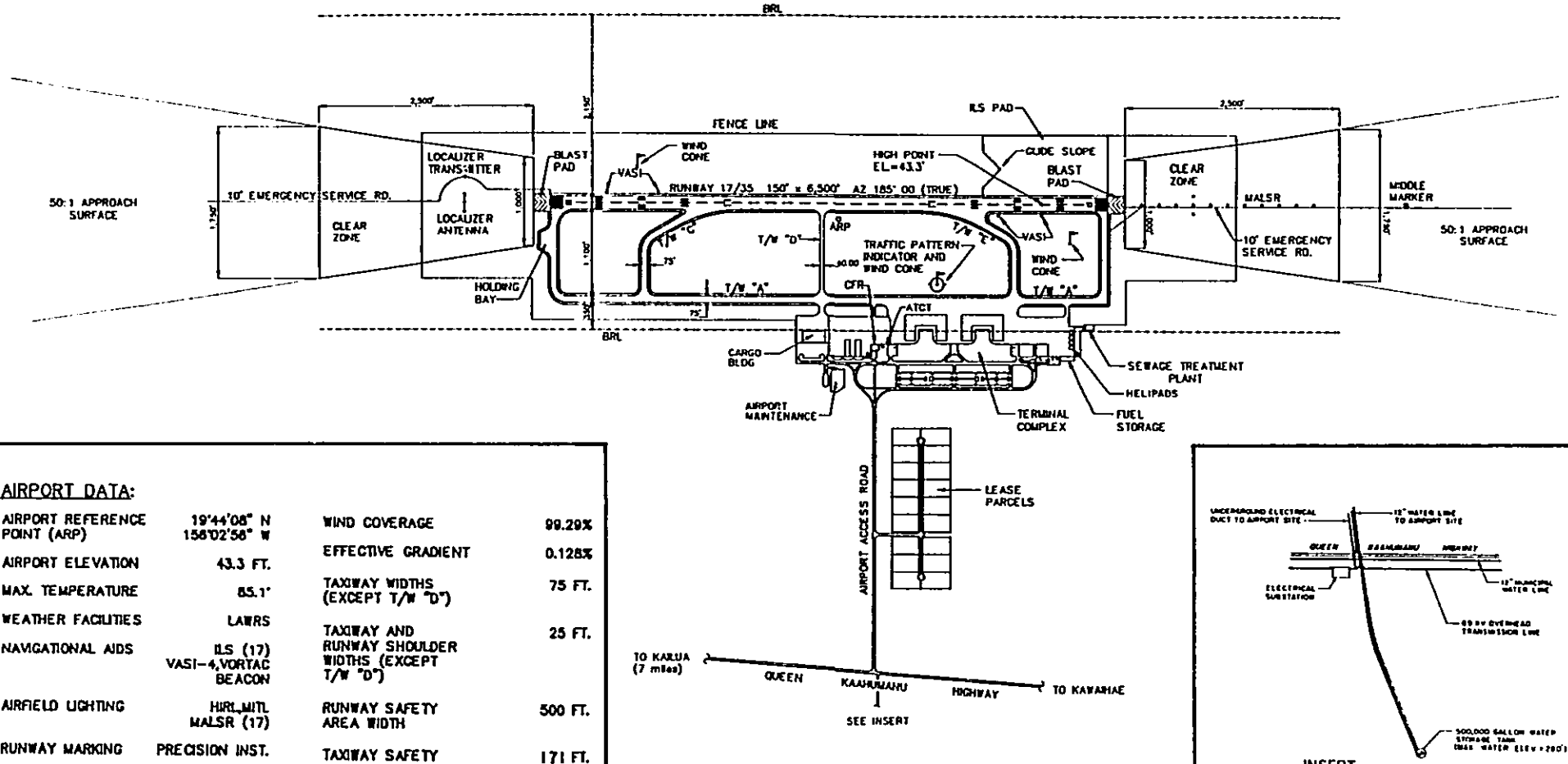
This section describes the proposed development plan for the expansion of the Keahole Airport. Because of the complexity of the airport facilities, description of the proposed action has been divided into two areas: (1) Airfield Facilities and (2) Terminal and Airport Support Facilities. Existing facilities for each of these areas are described first, followed by a description of the proposed action.

2.1 AIRFIELD FACILITIES

2.1.1 Existing Airfield Facilities

The existing airfield at Keahole Airport consists of a single runway and parallel taxiway system (Figure 2-1). This basic configuration is the result of planning and design efforts conducted in the 1960's. The design aircraft used then was an early version of the B-737. The types of aircraft now using the airfield range from single engine commuters to wide body overseas aircraft. Primary use is by interisland and local commuter aircraft with occasional use by the military.

The runway is 6,500 feet long by 150 feet wide and is oriented in a near north-south direction. The two approaches are designated: 17 (approaches from the north) and 35 (southerly approaches). Runway 17 sustains 80 percent of the operations. Design, marking, and illumination of the runway is for precision instrument, all-weather use. The length of the runway, and the limited pavement strength place load restrictions on departing overseas aircraft.



AIRPORT DATA:

AIRPORT REFERENCE POINT (ARP)	19°44'08" N 156°02'56" W	WIND COVERAGE	99.29%
AIRPORT ELEVATION	43.3 FT.	EFFECTIVE GRADIENT	0.128%
MAX. TEMPERATURE	85.1°	TAXIWAY WIDTHS (EXCEPT T/W "D")	75 FT.
WEATHER FACILITIES	LAWRS	TAXIWAY AND RUNWAY SHOULDER WIDTHS (EXCEPT T/W "D")	25 FT.
NAVIGATIONAL AIDS	ILS (17) VASI-4,VORTAC BEACON	RUNWAY SAFETY AREA WIDTH	500 FT.
AIRFIELD LIGHTING	HIRL,MITL MALSR (17)	TAXIWAY SAFETY AREA WIDTH	171 FT.
RUNWAY MARKING	PRECISION INST.		
PAVEMENT STRENGTH	65,000 LBS (S) 110,000 LBS (D) 184,000 LBS (DT)		

Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

1000' 0 1000' 2000'
SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

EXISTING AIRFIELD LAYOUT

FIGURE 2-1

An Instrument Landing System (ILS) is available on Runway 17 approaches. The VORTAC navigational locator beacon is located some distance away at the site of the Old Kona Airport, near Kailua.

The parallel taxiway system at Keahole Airport is a basic but efficient system for ground circulation of aircraft. Two end taxiways and two runway exits facilitate aircraft movement to and from the runway. The pavement width of all taxiways is 75 feet. A minor taxiway, located at midfield, has a pavement width of 40 feet. This taxiway may be used only by light commuter airplanes and rescue vehicles. All taxiways, except for the midfield taxiway, are lighted.

A holding bay, located along the south end taxiway, is used for temporary storage of interisland or smaller aircraft waiting final takeoff clearance. This holding bay is also used as a means for allowing aircraft bypasses.

The runway and all taxiways, except for the midfield taxiway, are enhanced by 25 feet wide stabilized (paved) shoulders. In addition, graded safety areas lie adjacent to these shoulders to assist airplanes which veer off the pavement. The structural pavement consists of flexible asphalt.

Aircraft parking areas, located along the west side of the terminal complex, consist of commuter, air carrier, general aviation, and air cargo aprons. With the exception of the air carrier apron, all aprons have flexible asphalt pavement construction. The air carrier aprons use reinforced concrete for a rigid pavement construction.

The airfield is currently classified within the Federal Aviation Administration (FAA) Airplane Design Group IV and follows the dimension criteria specified therein. Other airfield layout and design aspects have been established in accordance with the FAA criteria for Civil Transport Airports.

2.1.2 Proposed Airfield Facilities

The proposed airfield expansion is shown in Figure 2-2, "Airfield Layout Plan." The purpose of the proposed expansion is to meet the projected aviation demands and ultimately allow unrestricted operations for the expected aircraft types. A lengthening of the existing runway by 4,500 feet is proposed to bring the length ultimately to 11,000 feet. The extension will take place towards the north where ample land is available. The development of additional facilities to support this extension include: an extension of the main (parallel) taxiway towards the north, two additional runway exit taxiways, a new north end taxiway, a short bypass taxiway near midfield, and two new holding aprons (one sized for interisland aircraft and the other sized for overseas aircraft). The parallel runway and taxiway configuration will be maintained. Widening of the stabilized shoulders to 35 feet is also proposed to reduce jet blast effects from the outboard engines of larger aircraft.

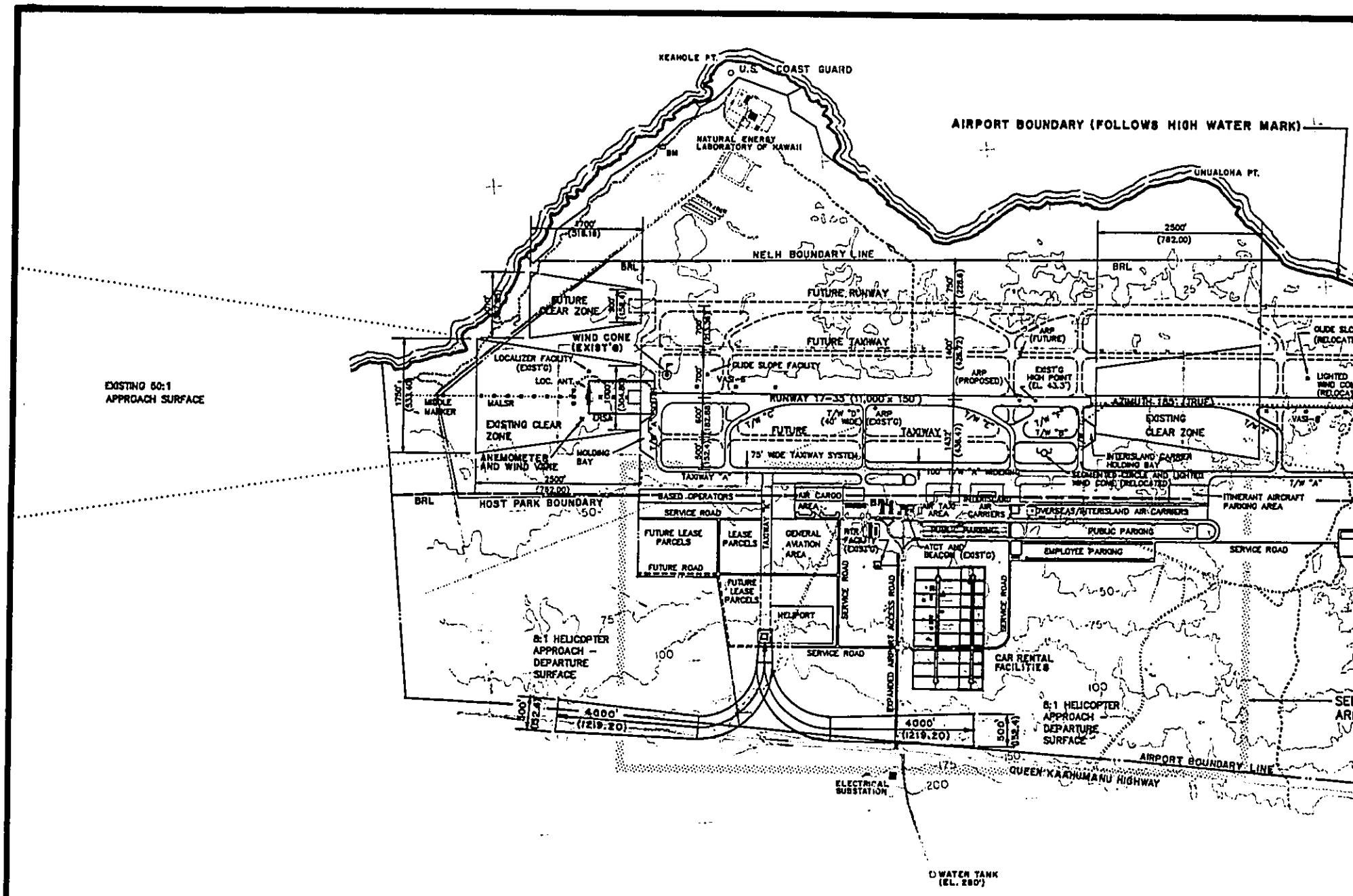
Other proposed facilities include the installation of ILS facilities on Runway 35 to make precision instrument landings available on either approach. The airspace and clear zones surrounding the airport will also be altered in accordance with FAA criteria. After the proposed upgrades, the airfield will fall within the FAA Airplane Design Group V category for Civil Transport Airports.

2.2 TERMINAL AND AIRPORT SUPPORT FACILITIES

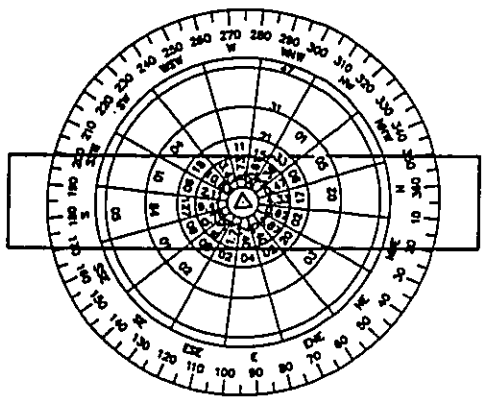
2.2.1 Existing Terminal Facilities

The existing Keahole Airport terminal complex shown on Figure 2-3 includes the following airport support facilities:

Air Carrier Facilities
Fixed Base Operators
General Aviation
Air Cargo and Mail
Helicopter Pad
Air Taxi and Commuter Facilities
Ground Transportation - Service and Ready Area
Utilities



WIND ROSE



Period of Record: Nov. 1961 to Dec. 1963
15 MPH Cross Wind Coverage = 99.29%
= 28.82% Calm Winds, 0 to 5 MPH

LEGEND

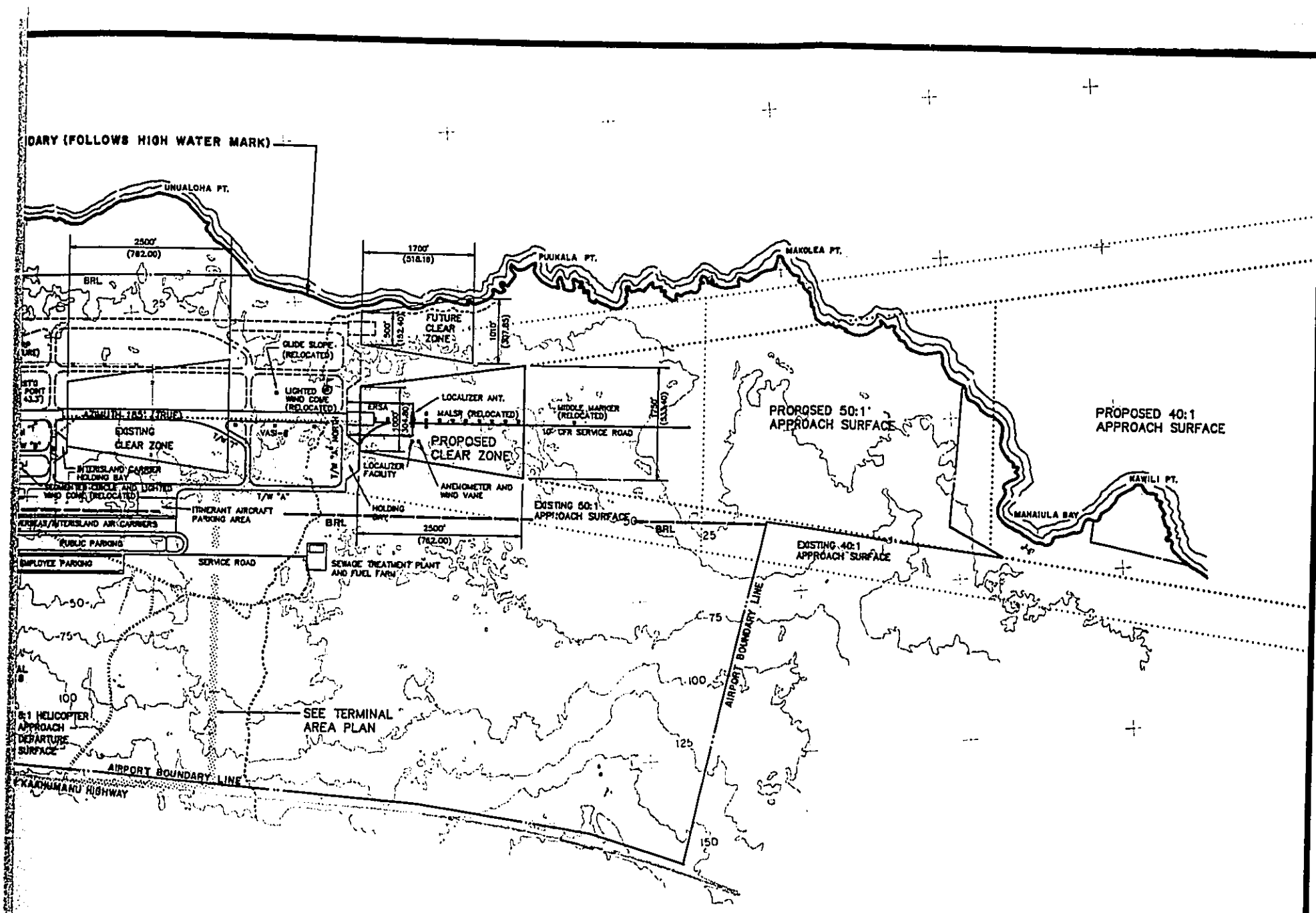
DESCRIPTION	EXISTING	PROPOSED
AIRFIELD FACILITIES		
TERMINAL FACILITIES		
AIRPORT BOUNDARY		
APPROACH SURFACE		
CLEAR ZONE		
BUILDING / STRUCTURE		
BUILDING RESTRICTION LINE	BRL	BRL
FENCE LINE		
GROUND CONTOUR		
ROADS:		
PAVED		
UNPAVED		

AIRPORT DATA

DESCRIPTION	EXISTING	PROPOSED
AIRPORT REFERENCE POINT		
(ARP) COORDINATES:		
LATITUDE	19°44'08"	19°44'31.5"
LONGITUDE	156°02'56"	156°02'54.4"
AIRPORT ELEVATION	43.3 FT.	43.3 FT.
MEAN MAXIMUM DAILY TEMP. (HOTTEST MONTH)	85.1°	85.4°
WEATHER FACILITIES	LAWRS	AWOS
AIRPORT AND TERMINAL NAVIGATIONAL AIDS	ILS (LOC/DME, GS,MM,MALSR), VASI-4,HIRL, MITL,RTR, BEACON, VORTAC	ILS (LOC/DME, GS,MM,MALSR), VASI-6,HIRL MITL,RTR, BEACON, VORTAC
PAVEMENT:		
RUNWAY	ASPHALT	ASPHALT
TAXIWAYS	ASPHALT	ASPHALT
AIR CARRIER / AIR CARGO APRONS	CONCRETE/ ASPHALT	CONCRETE

RUNWAY DA

DESCRIPTION
RUNWAY IDENTIFICATION
INSTRUMENT RUNWAY
APPROACH SURFACES
APPROACH LIGHTING
NAVIGATIONAL AIDS
RUNWAY LIGHTING
RUNWAY MARKING
EXTENDED RUNWAY SAFE
SAFETY AREA WIDTH
EFFECTIVE GRADIENT
PAVEMENT STRENGTH:
SINGLE
DUAL
DUAL TANDEM
WIND COVERAGE
RUNWAY GROOVING



RUNWAY DATA

EXISTING	PROPOSED	DESCRIPTION	EXISTING		PROPOSED	
		RUNWAY IDENTIFICATION	17	35	17	35
		INSTRUMENT RUNWAY	YES	NO	YES	YES
44'08"	19°44'31.5"	APPROACH SURFACES	50 : 1	50 : 1	50 : 1	50 : 1
02'56"	156°02'54.4"	APPROACH LIGHTING	MALSR, VASI-4	VASI-4	MALSR, VASI-6	MALSR, VASI-6
3 FT.	43.3 FT.					
5.1°	85.4°	NAVIGATIONAL AIDS	ILS	NONE	ILS	ILS
		RUNWAY LIGHTING	HIRL		HIRL	
WRS	AWOS	RUNWAY MARKING	PRECISION INSTRUMENT		PRECISION INSTRUMENT	
OC/DME, I,MALSR), -4,HIRL, TL,RTR, ACON, RTAC	ILS (LOC/DME, GS,MM,MALSR), VASI-6,HIRL MITL,RTR, BEACON, VORTAC	EXTENDED RUNWAY SAFETY AREA	NONE	NONE	YES	YES
		SAFETY AREA WIDTH	400 FT.		500 FT.	
		EFFECTIVE GRADIENT	0.128%		0.076%	
		PAVEMENT STRENGTH:				
		SINGLE	65,000 LBS.		130,000 LBS.	
		DUAL	110,000 LBS.		210,000 LBS.	
		DUAL TANDEM	184,000 LBS.		572,000 LBS.	
PHALT	ASPHALT	WIND COVERAGE	99.29%		99.29%	
PHALT	ASPHALT	RUNWAY GROOVING	6,500 FT. x 150 FT.		11,000 FT. x 150 FT.	
CRETE/ PHALT	CONCRETE					

NOTES

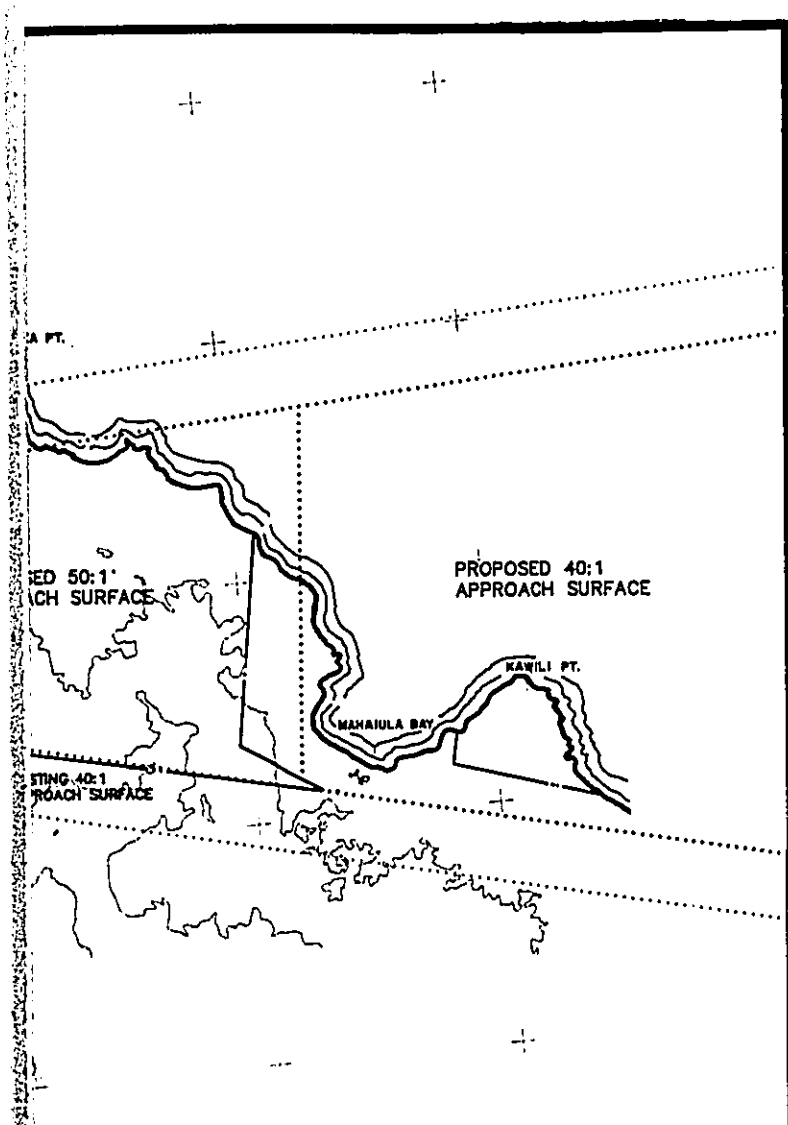
1. FACILITIES FOR FUTURE DEVELOPMENT SHOWN AS ----------
2. ALL ELEVATIONS REFERRED TO MEAN SEA LEVEL (MSL).
3. RUNWAY AZIMUTH AND COORDINATES BASED ON THE HAWAIIAN PLANE COORDINATE GRID SYSTEM, ZONE 1.

TRUE NORTH
DEC. 11° 7.5'E (1987)

0 1000' 2000' 3000'
GRAPHIC SCALE IN FEET

(0) (500) (1000)
GRAPHIC SCALE IN METERS

R.M. TO
HONOL
DATE
DWG. N



Airports Division

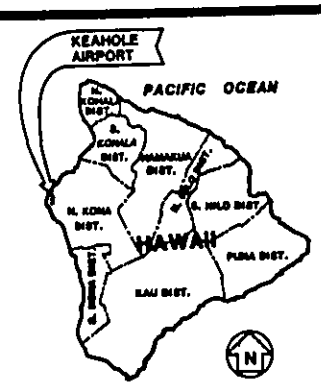
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

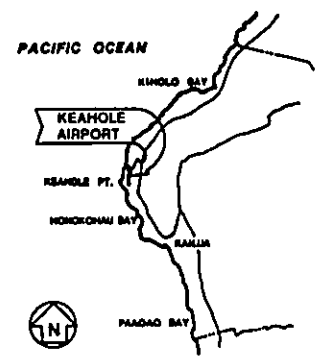
KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO.: AH 2011-02
AIP PROJECT NO.: AIP 3-15-008-03

AIRFIELD LAYOUT PLAN



LOCATION PLAN
NOT TO SCALE



VICINITY MAP

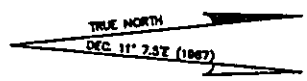
GRAPHIC SCALE IN MILES

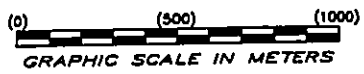
S

S FOR FUTURE DEVELOPMENT
AS ----------

VATIONS REFERRED TO MEAN
EL (MSL).

AZIMUTH AND COORDINATES
N THE HAWAIIAN PLANE
ATE GRID SYSTEM, ZONE 1.



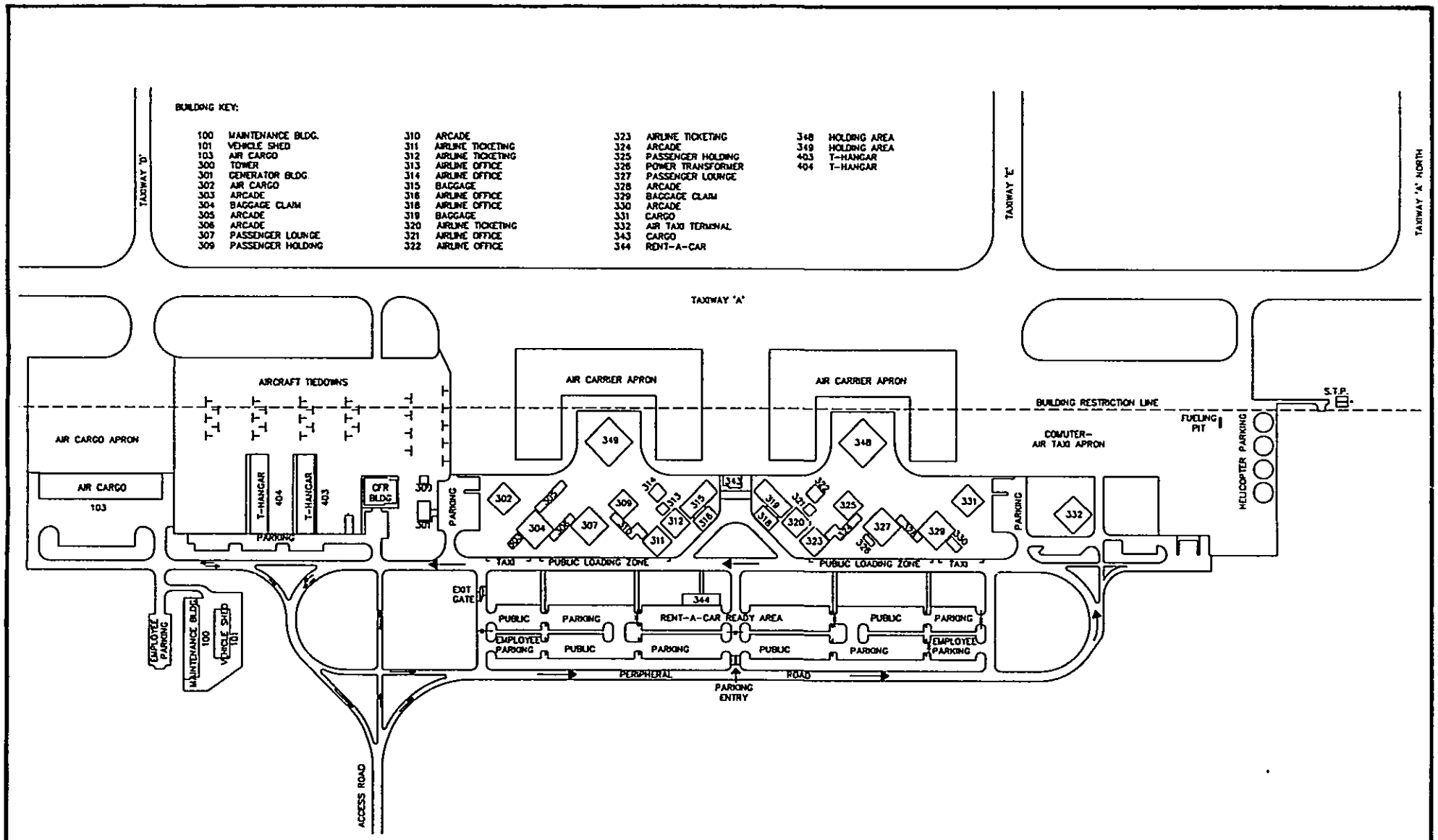


R.M. TOWILL CORPORATION
HONOLULU, HAWAII

DATE OCT 1987

DWG. NO.

FIGURE 2-2



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

100' 0 100' 200' 300'
SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:

Traffic Flow

Fence

EXISTING TERMINAL LAYOUT

FIGURE 2-3

Buildings within the main terminal are arranged in a linear manner, running in a north/south direction, paralleling the runway. The main terminal houses passenger and airline service facilities for two interisland and one overseas commercial carrier. Airline ticket operations, baggage handling, baggage claim areas, offices, maintenance facilities, lounges, passenger holding areas and concessions utilize 20 of the 32 terminal buildings. The remaining 12 buildings consist of arcades, cargo buildings, air cargo facilities, operations facilities and an air taxi/commuter terminal.

Terminal buildings are made mostly of wood and have an "island style" design. Landscaping around these wooden terminal buildings enhances the appearance of a tropical village.

Other existing buildings in the vicinity of the main terminal include: maintenance buildings, vehicle shed, air cargo building, general aviation T-hangers, air traffic control tower, generator building, crash/fire/rescue and rent-a-car buildings.

Parking areas are available for employees, buses and limousines, taxis and public parking. There are a total of 111 employee parking stalls throughout the airport proper. An additional 60 stalls located within the public parking area are being utilized for employee parking. Available bus and limousine stalls number 12 and 8, respectively. Eight stalls along the road fronting the terminal complex are reserved for taxis as well as a section to the north of the public parking area. Public parking can accommodate 300 vehicles, less the 60 stalls used for employees. The central area of the parking lot contains the rent-a-car customer service and ready facilities. The car rental companies have a total of 98 parking stalls.

The ground transportation service area is located to the east of the parking lot on 16 acres of land. It is subdivided into 12 one-acre lots, all currently under lease.

Vehicles enter the airport via Queen Kaahumanu Highway and travel along a two-lane access road to the terminal facilities. Upon reaching the public parking area the roadway becomes a one-way system. This peripheral road, with two 12-foot wide lanes, has a speed limit of 25 miles per hour.

Utilities available on the airport proper consist of water, sewer, drainage, electrical and telephone/audio systems. Water is supplied by a 12-inch pipeline fed by a 12-inch municipal water main running along Queen Kaahumanu Highway. The main sewer collection system is a 12-inch gravity line that connects to an on-site package sewage treatment plant.

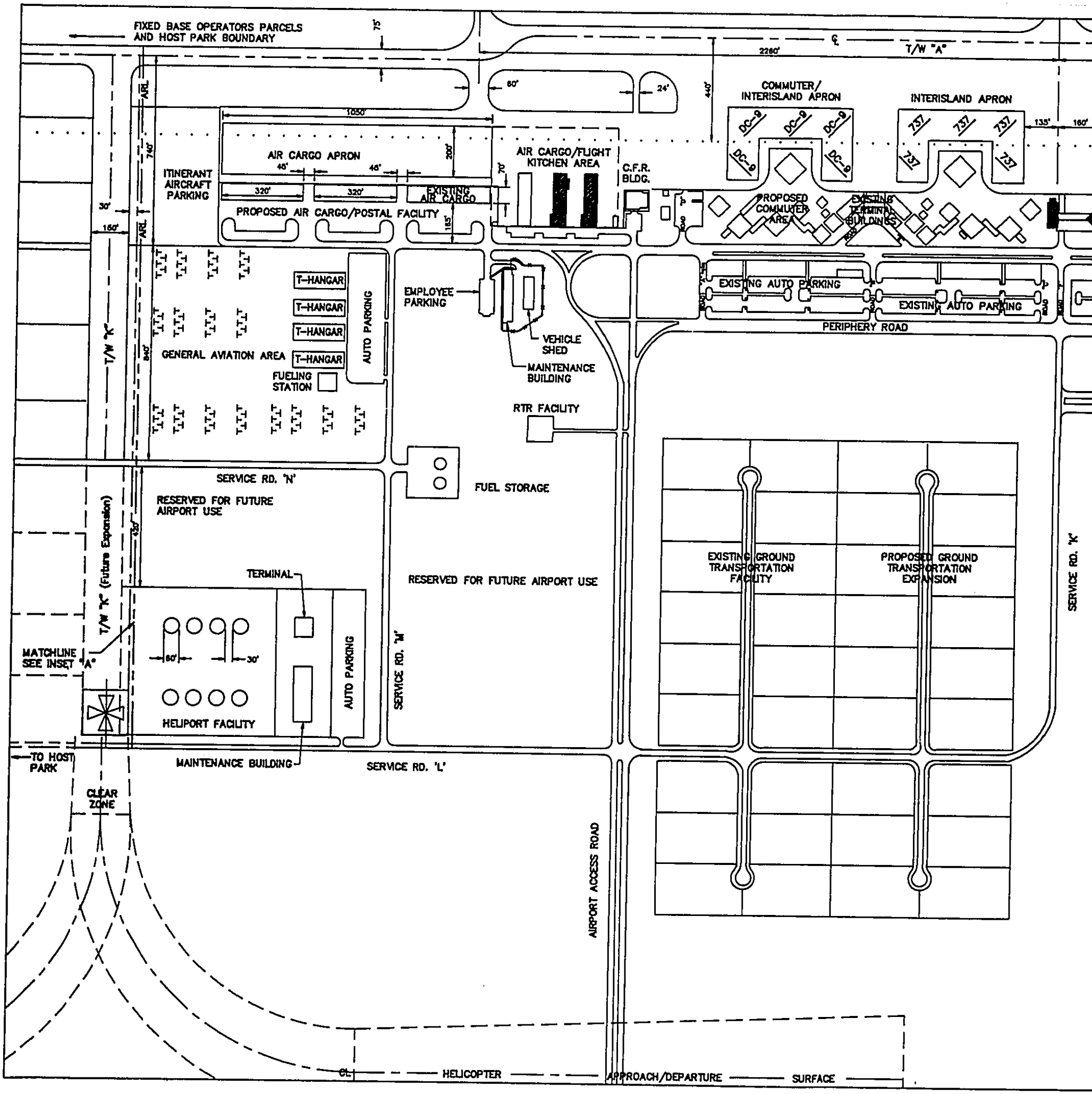
Airport terminal drainage is handled by a system of swales, ditches and concrete bridge culverts to collect and direct storm water runoff to natural sump areas, drainageways or dry wells.

A 12.47 KV underground transmission line links the airport to a HELCO substation at Queen Kaahumanu Highway. This electrical duct follows the south side of the airport access road terminating at the electrical control building near the terminal for distribution. This electrical control building also includes areas for telephone, lighting and emergency generator equipment. The telephone line is brought in through the same underground duct bank as the 12.47 KV power line to the generator building. An audio system is utilized in the terminal area for paging and flight announcements.

Existing fueling facilities include fuel tanks for aviation gas and Jet A fuel constructed above ground and enclosed by a chain link fence located on the north side of the airport. Tanker trucks are used for aircraft refueling.

2.2.2 Proposed Terminal Facilities

The proposed terminal complex as shown in Figure 2-4 will continue the linear pattern of the existing facilities and expand to the north. The new terminal building will include a 2-story structure for arrivals, departures, ticketing, baggage handling, holding and passenger amenities.


FIXED BASE OPERATORS PARCELS AND HOST PARK BOUNDARY
75'
℄ T/W "A"
2260'
60'
24'
440'
COMMUTER/ INTERISLAND APRON
INTERISLAND APRON
DC-9
757
135'
160'
ARL
740'
1050'
AIR CARGO APRON
45'
45'
200'
ITINERANT AIRCRAFT PARKING
320'
320'
EXISTING AIR CARGO
AIR CARGO/FLIGHT KITCHEN AREA
70'
C.F.R. BLDG.
PROPOSED AIR CARGO/POSTAL FACILITY
185'
30'
160'
PROPOSED COMMUTER AREA
EXISTING TERMINAL BUILDINGS
T/W "K"
840'
T-HANGAR
T-HANGAR
T-HANGAR
T-HANGAR
AUTO PARKING
GENERAL AVIATION AREA
FUELING STATION
EMPLOYEE PARKING
VEHICLE SHED
MAINTENANCE BUILDING
EXISTING AUTO PARKING
EXISTING AUTO PARKING
PERIPHERY ROAD
RTR FACILITY
SERVICE RD. 'N'
RESERVED FOR FUTURE AIRPORT USE
FUEL STORAGE
EXISTING GROUND TRANSPORTATION FACILITY
PROPOSED GROUND TRANSPORTATION EXPANSION
SERVICE RD. 'K'
T/W "K" (Future Expansion)
420'
TERMINAL
RESERVED FOR FUTURE AIRPORT USE
MATCHLINE SEE INSET "A"
60'
30'
AUTO PARKING
SERVICE RD. 'M'
HELIPORT FACILITY
MAINTENANCE BUILDING
SERVICE RD. 'L'
TO HOST PARK
CLEAR ZONE
AIRPORT ACCESS ROAD
℄ HELICOPTER APPROACH/DEPARTURE SURFACE

T/W "A"

1060'

880'

INTERISLAND APRON

757 757 757 757 757

135' 160'

INTERISLAND/OVERSEAS APRON

210' 350' 280' 35'

ITINERANT AIRCRAFT PARKING

EXISTING TERMINAL BUILDINGS

PROPOSED TERMINAL BUILDING

210'

40'

FUTURE TERMINAL EXPANSION

EXISTING AUTO PARKING

PROPOSED PUBLIC PARKING

PROPOSED PUBLIC PARKING

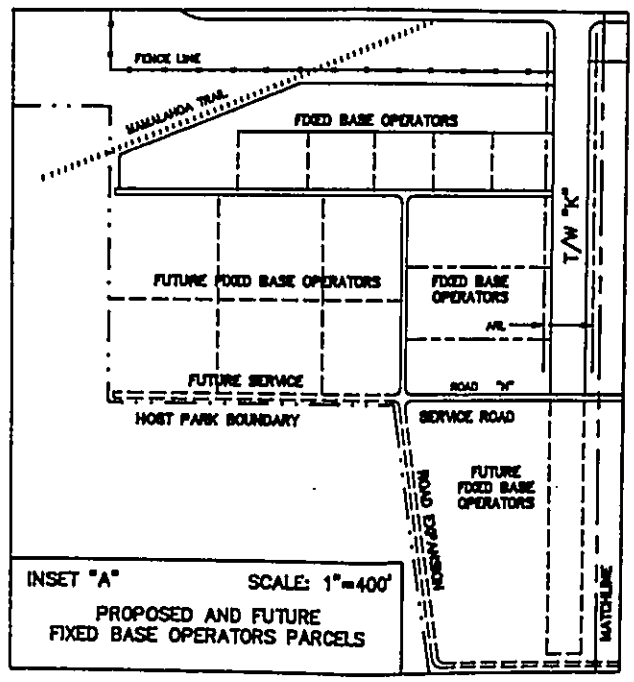
RIPHERY ROAD

PROPOSED EMPLOYEE PARKING

STP AND FUEL STO

PROPOSED GROUND TRANSPORTATION EXPANSION

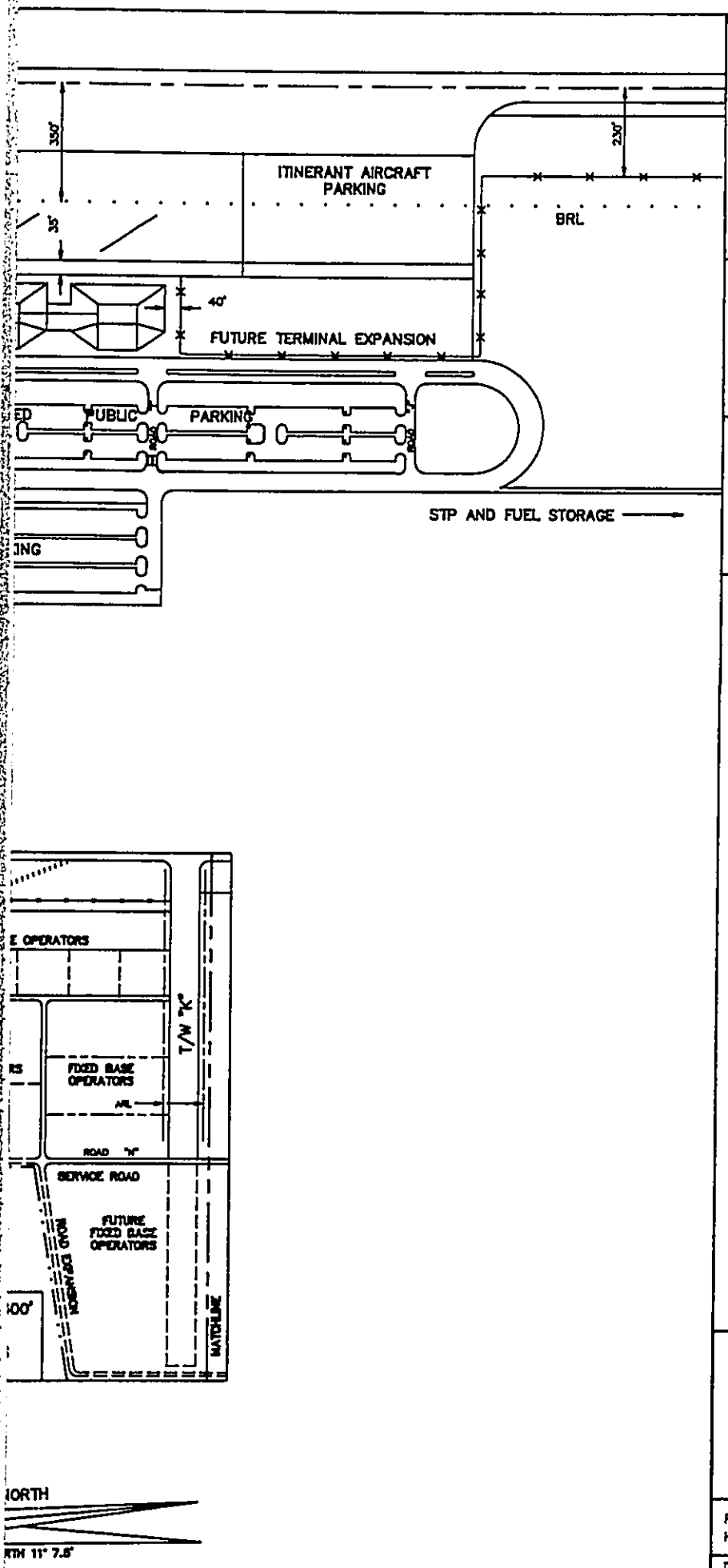
SERVICE RD. 'K'



TRUE NORTH

MAG. NORTH 11° 7.5'

ACE



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO.: AH 2011-02
AIP PROJECT NO.: AIP 3-15-008-03

TERMINAL AREA LAYOUT PLAN

LEGEND:

- EXISTING PAVED ROADS
- PROPOSED ROADWAY IMPROVEMENTS
- EXISTING BLDGS.
- PROPOSED BLDGS.
- EXISTING TO BE DEMOLISHED
- FENCE LINE
- BUILDING RESTRICTION LINE
- AIRCRAFT RESTRICTION LINE

N

200 0 200 400
SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

DATE OCT 1987

DWG. NO.

FIGURE 2-4

The new terminal building will include some of the interisland facilities and all of the overseas facilities. Because of the expansion to the north, the air taxi/commuter terminal, helicopter parking area and the sewage treatment plant have been relocated.

Air taxi/commuter facilities will be relocated to the south of the terminal. Buildings currently being used by the interisland carriers will be transferred to the air taxi/commuter carriers. They will be assigned two of the four gates in that area. All existing interisland and overseas facilities will be shifted to the north, moving some of the interisland facilities into the new terminal buildings. The interisland carriers will occupy seven existing gates and four new gates. Overseas carriers will utilize two gates leaving one gate open for use during peak hour periods or for charter flights.

Public and employee parking lots will be expanded. An additional 540+ public parking stalls will be developed to the north of the existing public parking lot, following the same parking pattern. New employee parking will be located east of the expanded public parking and peripheral road and have 290 stalls.

The peripheral road will be increased to four lanes between the public and employee parking. The road increases to five lanes between the terminal and public parking with an island dividing the lanes into three and two lanes. The two-lane segment will be adjacent to the public parking lot. Within the two lanes, bus, taxi and limousine loading areas have been designated along the island.

Access to the sewage treatment plant and fuel storage area is off the peripheral road going north between the public and employee parking lots.

Ramp access to the flight line is provided at five locations. Access points shall be controlled by gates and limited to authorized vehicles only. Vehicular traffic on the flight line is located between the

hardstand and taxiway without crossing between or around aircraft. The roadway will connect air carrier operations with the air cargo, postal facility and flight kitchen.

The air cargo and flight kitchen areas have been relocated to the south of the terminal complex where the fixed base operators and general aviation hangars were located. The two existing hangar buildings will be relocated to the new general aviation area. The air cargo apron will remain in its present location and two more buildings will be added to the south.

Eight fixed based operator parcels are located south of the air cargo apron. East of the air cargo apron is the general aviation area. New facilities provide 60 aircraft parking spaces and four hangar buildings. A fueling station and vehicle parking lot are also available.

Approximately 13 acres east of the general aviation area have been designated for the heliport. A structure of about 10,000 square feet for operating and service areas and passenger holding space is planned.

An additional 22 acres are reserved for expansion of the ground transportation service facilities adjacent to the existing facilities. Customer service and ready area will remain in the parking lot adjacent to the terminal.

The two-lane airport access road will be widened to a four-lane divided roadway. Service Road "K" will serve as an access to the ground transportation service area and used for other airport operations. This service road provides a secondary access to the terminal area. Service Roads "L" and "M" will provide access to the heliport, general aviation area and aviation lease parcels.

The airport utility systems will be expanded concurrently to serve the proposed development phases. The utilities will include the upgrade of water, sewerage, drainage, electrical, telephone, and fuel facilities.

Water will continue to be supplied from a 12-inch line along the Queen Kaahumanu Highway. Fire and maximum flow storage will be provided by the 500,000-gallon tank located mauka of the airport. The water source is located to the south in Kahaluu. Water may be transported to the airport via existing 20-, 16- and 12-inch lines, with a series of storage and pressure regulating reservoirs and booster pumps. These facilities are owned and maintained by the Hawaii County Department of Water Supply. The airport's on-site water system will consist of a 12-inch main servicing the entire length of the terminal complex. Pipelines will also loop around the car rental parcels and the heliport and general aviation area.

The airport's sewerage system will undergo considerable renovation with the demolition of the existing prefabricated sewage treatment plant (STP) and the construction of a new larger STP further north. This new STP is planned to be located about 1 mile north of the existing terminal facilities. The proposed plant will provide secondary level treatment with effluent disposal by means of deep injection wells and irrigation reuse. An expanded gravity system consisting of 8, 12 and 24-inch pipelines will be used to collect sewage from the entire airport complex. The existing 12-inch collector line will remain intact and be supplemented by a 24-inch line extension to service proposed terminal expansions to the north. In addition, new 8- and 12-inch pipelines will be used to collect sewage generated from the general aviation area, lease parcels, and car rental parcels. The gravity flows will converge to a sewage pumping station (SPS), to be located near the parking area off the north end of the overseas terminal. The SPS will be an underground package facility with minimal aboveground appurtenances. The SPS will pump the sewage to the STP via a new force main.

An alternative to on-site sewage treatment is the pumping of sewage to the future Kealakehe Wastewater Treatment Plant (WWTP). Construction of the Kealakehe WWTP is scheduled to begin in 1988 and is planned to be located near the Honokohau Small Boat Harbor. This plant will replace the current

treatment works of the Kailua-Kona sewerage system and will provide secondary treatment with an ocean outfall for effluent disposal. Initial plant capacity will be 2.8 mgd. Although a possibility, this alternative was not pursued due to cost constraints.

The proposed drainage system includes additional dry wells coupled with an expanded system of swales and underground drain lines or culverts. These dry wells will be 10 to 30 feet deep, sited in inconspicuous locations, and covered with protective grating. Drainage is not expected to be a problem due to the porous nature of the ground.

The airport electrical and telephone distribution facilities will be upgraded to support the increased loadings. The electrical control building, which houses the electrical and telephone distribution switches and backup power generators, will undergo some structural expansion. This facility is located between the rescue facility and the control tower. An existing electrical substation, located at the intersection of the airport access road and the Queen Kaahumanu Highway, is maintained and will be expanded, as necessary, by the Hawaii Electric Light Company.

The fuel system, which has recently been upgraded to include a storage tank and a fueling pit north of the existing terminal, will be renovated and replaced with a system of fueling hydrants providing direct service to the aircraft aprons. The hydrant system will be utilized primarily by overseas and interisland air carriers. General aviation, commuter, and helicopter operations will be served by fueling pits. Two fuel storage areas are proposed. The main site will be located north of the new terminal, adjacent to the new STP. This facility will be used for storage of jet fuel and aviation gas for air carrier use. The second facility will store jet fuel and aviation gas for general aviation, commuter, and helicopter users. This site will be located west of the existing maintenance facility.

Landscaping will be used to enhance the airport proper and screen unattractive facilities. The terminal area and parking lots will have a unified landscaping treatment. Additional landscaping will be used to enhance the airport access road and screen facilities such as the ground transportation service area and maintenance area. The new buildings will be designed with some of the architectural characteristics of the existing buildings.

2.3 IMPLEMENTATION PROGRAM

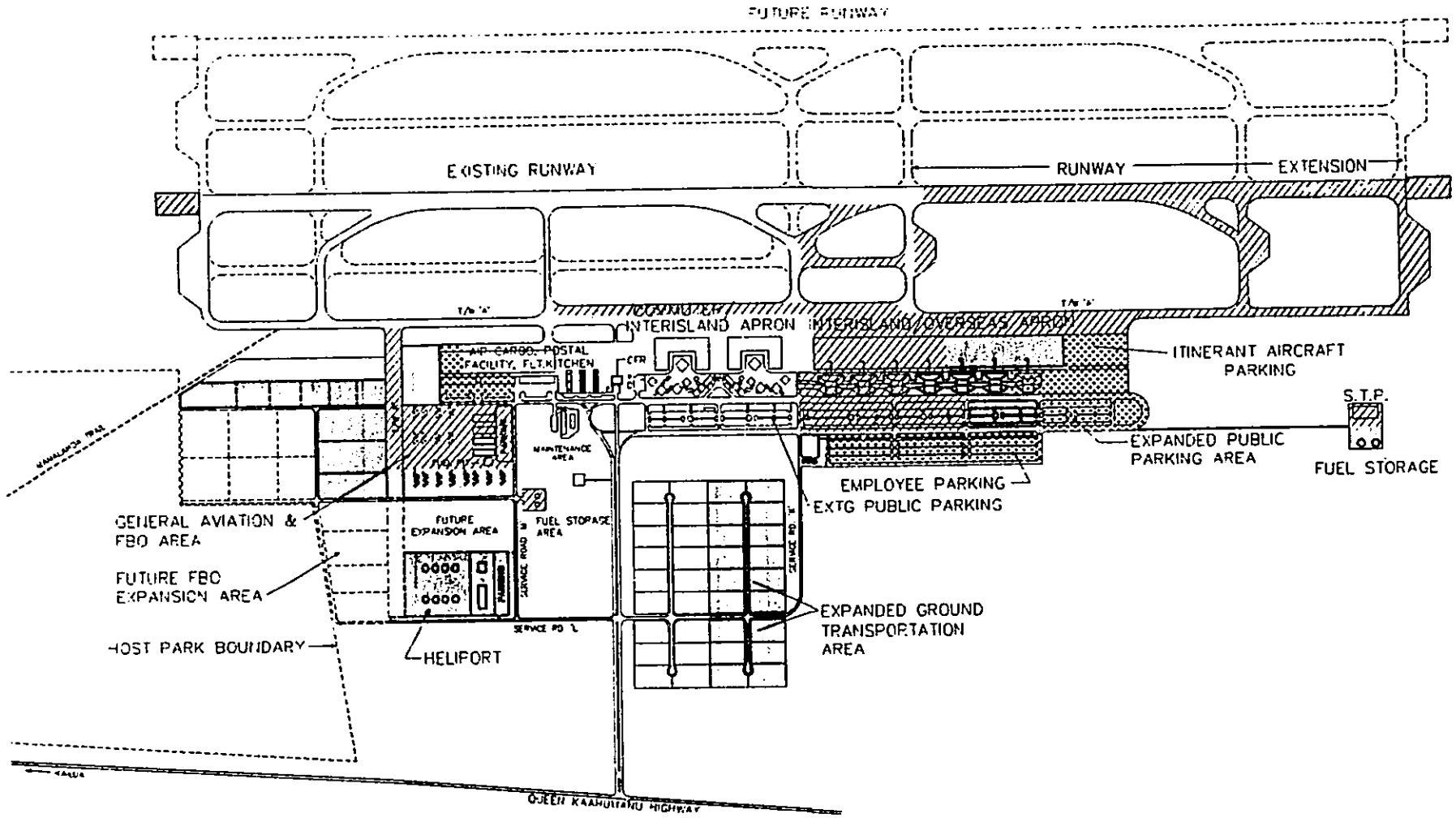
2.3.1 Overview

Expansion of the Keahole Airport is recommended for implementation in three development phases with the following time horizons: Phase 1 (1990), Phase 2 (1995), and Phase 3 (2005) (see Figure 2-5). The actual development may not coincide with the referenced time frames because of funding limitations and/or administrative priorities.

2.3.2 Master Plan Cost Estimate

The costs for planned improvements were based on construction bid tabulations of projects completed or in progress at the Keahole Airport as well as for other airport projects in the State. Cost figures were also obtained from previous projects undertaken by the consultant. All airport user facilities (e.g., airline space, car rental area, cargo area) costs are based on providing space only with roughed-in utilities. Finish costs are to be borne by the user. Site improvement costs for the airfield and roadways were calculated by taking area and quantity measurements for the space required. The utilities systems costs were based on required capacity and the facilities required to provide that capacity. The projected costs are intended to represent the magnitude of cost that can be anticipated.

The cost estimate for the recommended plan is $169.59 million. All costs were calculated using 1987 dollars. The cost estimate does not include the cost of furniture, equipment, interior finishing, or moving expenses.



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA
HAWAII

STATE PROJECT NO AH 2011-02
AIP PROJECT NO AIP 3-15-0008-03

N
400 0 400 800
SCALE IN FEET

R M TOWILL CORPORATION
HONOLULU HAWAII

LEGEND:

- Phase 1
- Phase 2
- Phase 3
- Future Runway

IMPLEMENTATION PLAN

FIGURE 2-5

2.3.3 Development Phasing

It is recommended that the Keahole Airport be developed in phases to ease the financial burden to the State and to provide for a smooth transition as new facilities are developed. The projects that are recommended for each of the development phases are described below. A summary of costs for each of the development phases is presented in Table 2-1.

Phase 1 (1990) - The first development phase is proposed to be developed in two increments. The first increment includes the development of three new terminal gates and terminal support facilities. Terminal facilities are proposed to be developed first because of the current inefficiencies being experienced at the airport. Currently, there is inadequate space to meet projected demands. If the airfield facilities are developed first, the terminal area facilities will not be adequate to accommodate the larger number of passengers anticipated. Further, airline ground support facilities will not be able to accommodate the projected growth in aircraft operations.

With the development of the new terminal, the general aviation parking area, communter airline facilities, helicopter parking area, and fueling facilities will need to be relocated. A large portion of the General Aviation Area will include the construction of two hangars to accommodate the displaced activities.

The second increment of the Phase 1 development involves improvements to the airfield. The principal airfield improvement proposed for this increment is the extension of the existing runway to 11,000 feet. Other improvements in this increment include an upgrade of the existing pavement strength, new taxiways, holding bays, and stabilized shoulders. The improvements proposed conform to FAA Design Group "V" standards for transport airports. This added 4,500 feet will allow aircraft to fly non-stop between Keahole and midwestern states without the need for a refueling stop.

TABLE 2-1

PHASING PLAN COST ESTIMATE
KEAHOLE AIRPORT MASTER PLAN
(Cost of Million $)

ITEM	TOTAL COST (MIL $)	PHASE 1 (1990)	PHASE 2 (1995)	PHASE 3 (2005)
GENERAL SITE WORK	$ 20.29	$13.41	$ 4.70	$ 2.18
AIRFIELD COST	48.75	48.75	.00	.00
TERMINAL COSTS	76.94	24.89	26.73	25.32
ROADWAY INFRASTRUCTURE	5.54	0.82	2.72	2.00
UTILITIES INFRASTRUCTURE	18.07	9.90	5.31	2.86
GRAND TOTAL ($ Mil.)	$169.59	$97.77	$39.46	$32.36

SOURCE: R. M. Towill Corporation, June 1987.

Phase 2 (1995)

Facilities proposed for development in Phase 2 include further expansion of the terminal and terminal support facilities, such as roadway improvements, further expansion of the general aviation area, and development of a new heliport.

Phase 3 (2005)

The third phase of the airport development proposes further terminal expansion, employee parking facilities, and air cargo facilities.

2.4 RATIONALE FOR PROPOSED ACTION

The recommended plan for expansion of the airfield facilities was developed to meet projected aviation demands and allow unrestricted overseas operations. Present facilities for overseas operations restrict the aircraft's take-off and landing weights because of the inadequate pavement strength and runway length. The expanded airfield facilities will provide enhanced capabilities for flights to overseas destinations.

Expansion capability and flexibility guided the recommended terminal plan. Evaluation of the alternatives included a number of factors such as:

Forecasts and Projections
Aircraft Mix on the Ramp
Future Expansion Capabilities
Automobile Traffic Circulation
Location and Proximity of Major Facilities
Minimum Operational Disruptions During Construction

The recommended plan separates terminal facilities for air carrier operations from the smaller commuter, general aviation and heliport facilities. This layout eliminates aircraft mix on the ramp. Location of most of the facilities is in areas that will allow for future expansion beyond the 20-year planning period. In order to utilize most of the

existing facilities and minimize operational disruptions during construction, the plan incorporates the overall design theme of the existing facilities. Some of the facilities have been relocated to the south. These facilities will be accessed by a new service road off the main access road.

2.5 PERMITS AND APPROVALS

The following permits and approvals are required prior to implementation of the project:

Authority	Approval Required
Federal Government	
Federal Aviation Administration	Approval of the Airport Layout Plan
State of Hawaii	
State Land Use Commission	Land Use Boundary Amendment
Dept. of Health	NPDES Permit
Dept. of Transportation, Highways	Construction Within State R.O.W.
County of Hawaii	
Planning Department	Rezoning
	SMA Permit
Dept. of Public Works	Grading Permit
Building Department	Building Permit

2.6 ALTERNATIVES CONSIDERED

Five airfield alternatives and four terminal area alternatives were considered as possible development plans. The major features of these alternatives and the reason for their selection or non-selection are presented below.

2.6.1 Airfield Alternatives

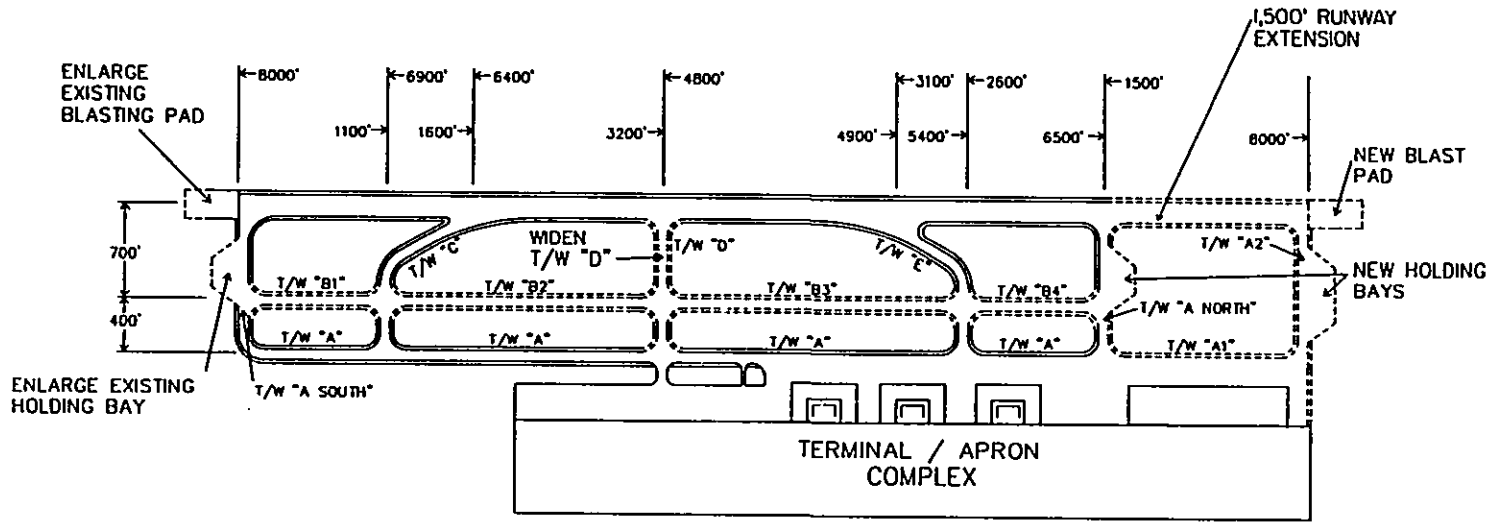
These alternatives are meant to consider different levels of airfield service to local, interisland, and overseas users, while satisfying the projected aviation demand requirements. The projected aviation demands were obtained from the SASP (prepared by Wilson, Okamoto & Assoc.) for the State DOT Airports Division. A study of airport requirements was thus prepared (based on the SASP findings) to determine the required facilities for Keahole Airport through the planning year of 2005. Results of this analysis indicated that the capacity of the existing single runway will suffice through 2005. However, it should be extended to meet the demands for more overseas service.

The current runway length of 6,500 feet places some limitations on take-off and landing weights. Presently, the critical design aircraft (DC-30) may take-off at less than 80 percent of maximum allowed. An ultimate runway length of 11,000 feet was recommended in an attempt to provide unrestricted service to overseas destinations.

The five airfield alternatives can be divided into single and dual runway schemes. Three alternatives propose extensions to the existing runway towards the north and two alternatives propose the construction of a second runway towards the west.

A. Airfield Alternative No. 1

In this alternative, the existing runway is proposed for extension to 8,000 feet toward the north (Figure 2-6). A length of 8,000 feet will increase aircraft takeoff weights to about 85 percent of maximum allowed. Other new facilities accompanying this alternative include an extension of the main (parallel) taxiway towards the north, a new parallel bypass taxiway between the runway and the main taxiway, an overseas and an interisland aircraft holding bay, enlargement of the existing south holding bay, establishment of extended runway safety areas (ERSA's), widened stabilized shoulders, and larger blast pads. Changes in



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

400' 0 400' 800' 1200'
SCALE IN FEET

R M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:

——— Existing Airfield Facilities

------ Proposed Airfield Facilities

NOTES:
8000' x 150' Runway
75' Wide Taxiways
35' Shoulders
Based on Airplane Design Group V Requirements

AIRFIELD ALTERNATIVE 1 LAYOUT PLAN

FIGURE 2-6

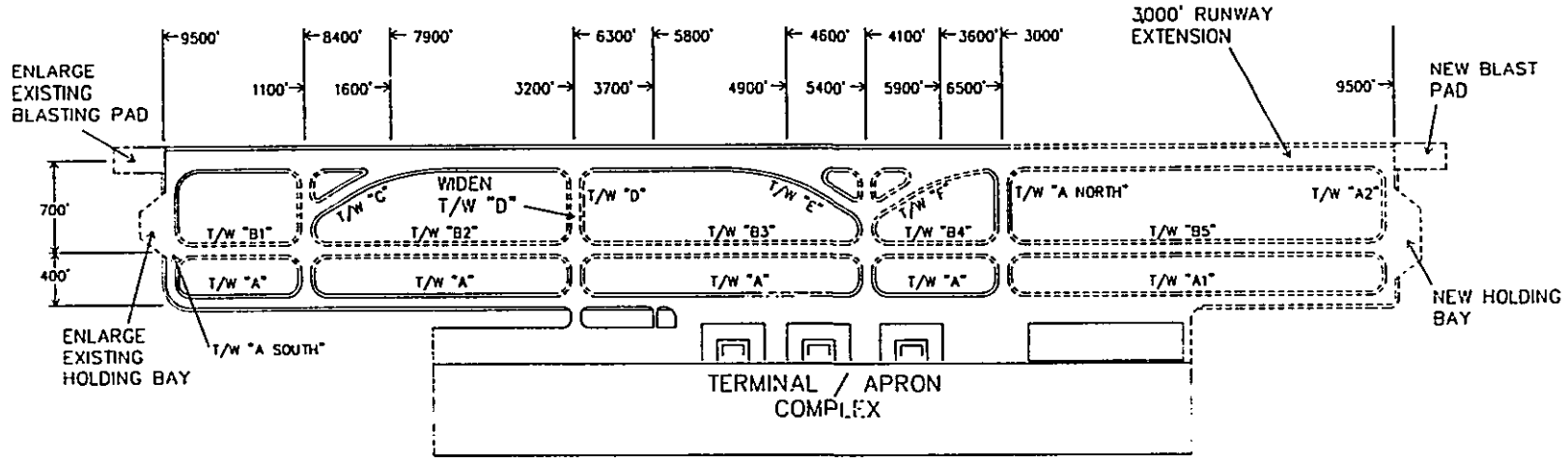
FAA regulatory clear zones and airspace surfaces are also inclusive. This alternative still places weight restrictions on expected aircraft types and was therefore not selected.

B. Airfield Alternative No. 2

This alternative is similar to Alternative No. 1, except that the runway is extended by 3,000 feet to a length of 9,500 feet (Figure 2-7). The extension will occur in the northerly direction. Other improvements include an extension of the main taxiway, development of a new parallel bypass taxiway, a new runway exit, an overseas holding bay along the new north end taxiway and enlargement of the south holding bay, ERSA's, widened stabilized shoulders, and larger blast pads. This alternative allows most aircraft to takeoff at near 90 percent of their allowable maximum weights, however, was not selected because of the continued weight limitations.

C. Airfield Alternative No. 3

Alternative No. 3 proposes a runway extension to an ultimate length of 11,000 feet (Figure 2-8). This alternative includes the improvements proposed in Alternative No. 2. An additional upgrade included with this plan is the widening of the taxiway along the terminal area, fronting the air carrier aprons. Widening of this taxiway was necessary to reduce the potential of traffic congestion at this busy midfield location. This alternative was selected because the runway length of 11,000 feet will allow unrestricted operations of expected overseas aircraft. This indicates that expected aircraft may operate at up to 100 percent of their allowable takeoff weights. Necessary pavement strengthening and changes in FAA regulated airspace surfaces and clear zones are other components of this alternative, as in the other alternatives.



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

400' 0 400' 800' 1200'
SCALE IN FEET

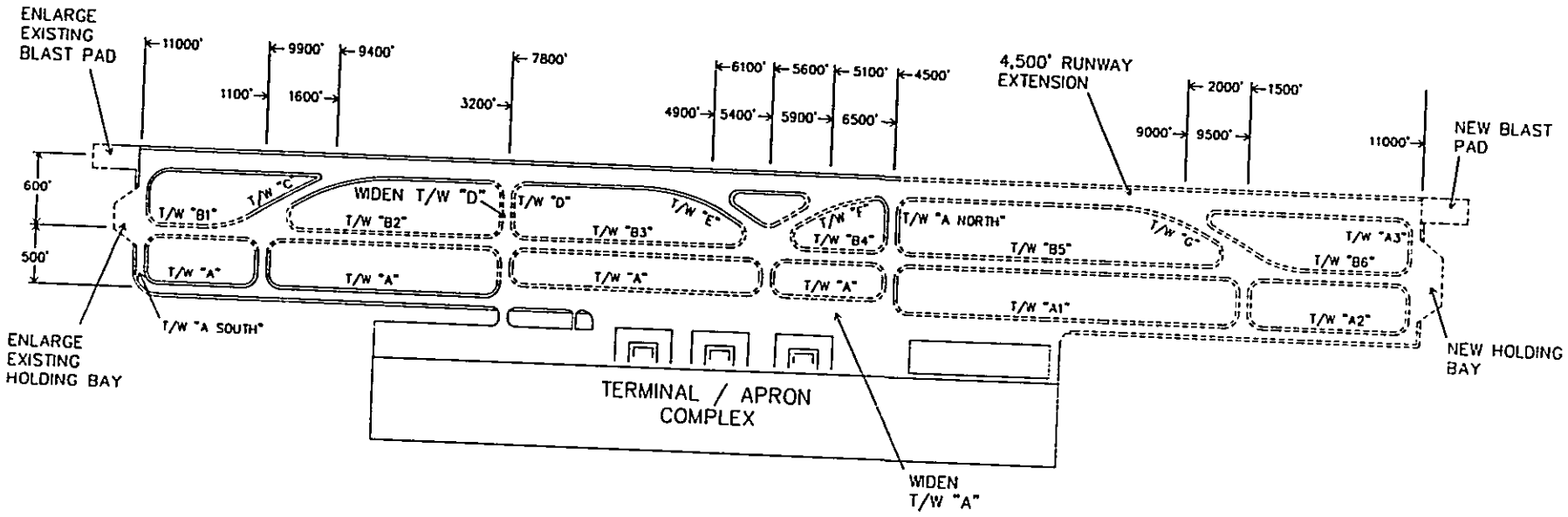
R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:
——— Existing Airfield Facilities
- - - - - - Proposed Airfield Facilities

NOTES:
9,500' x 150' Runway
75' Wide Taxiways
35' Shoulders
Based on Airplane Design Group V Requirements

AIRFIELD ALTERNATIVE 2 LAYOUT PLAN

FIGURE 2-7



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

400' 0 400' 800' 1200'
SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:
——— Existing Airfield Facilities
- - - - - - Proposed Airfield Facilities

NOTES:
11,000' x 150' Runway
75' Wide Taxiways
35' Shoulders
Based on Airplane Design Group V Requirements

AIRFIELD ALTERNATIVE 3 LAYOUT PLAN

FIGURE 2-8

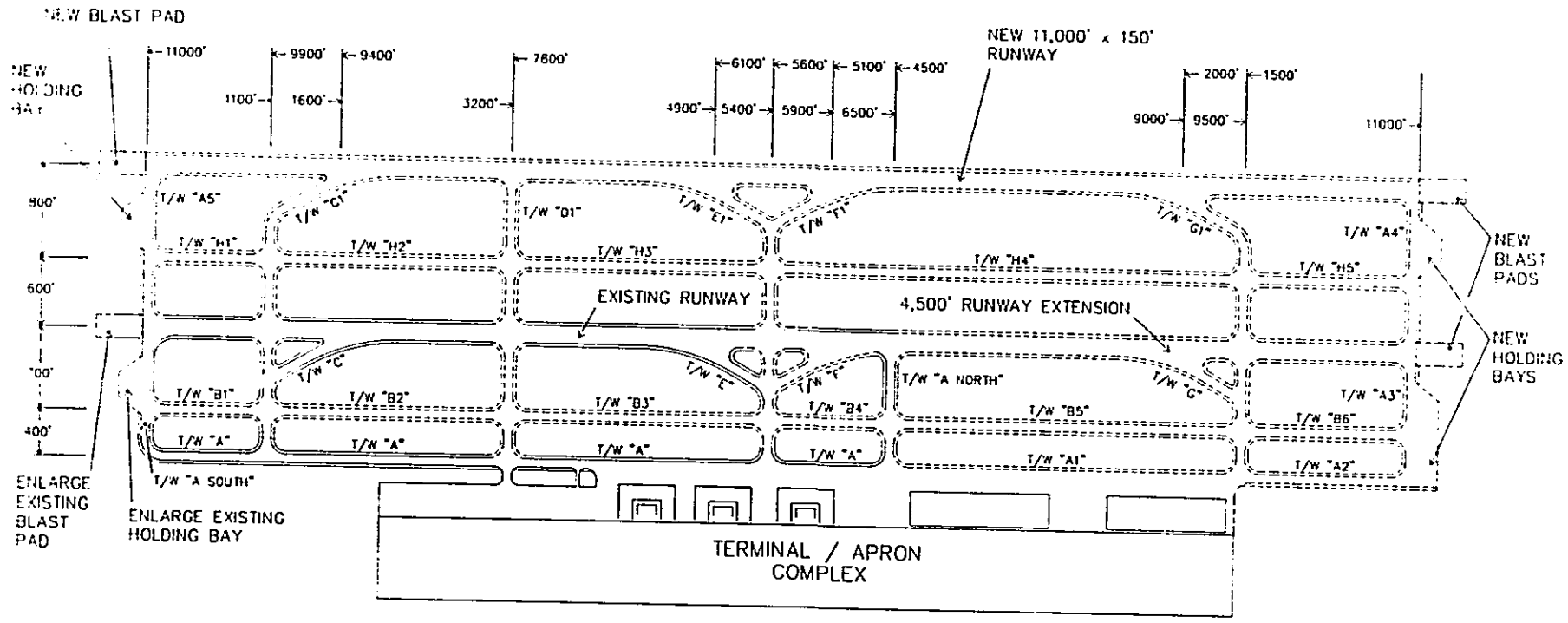
D. Airfield Alternative No. 4

The new facilities proposed in Alternative 4 (Figure 2-9) include an extension to the existing runway to 11,000 feet toward the north, a new (parallel) 11,000-foot runway 1,400 feet to the west, a 6,500-foot long bypass taxiway running parallel to the existing runway, a new taxiway running parallel to the new 11,000-foot long runway, new exits and entrances from both the extended runway and parallel runway, three new overseas holding bays, enlargement of the existing south holding bay and larger blast pads. Pavement strengthening and changes in FAA regulatory airspace surfaces are other included upgrades.

E. Airfield Alternative No. 5

This alternative retains the existing runway for use by interisland and local traffic and proposes a parallel 11,000-foot long runway to accommodate unrestricted overseas traffic (Figure 2-10). The new runway is proposed about 1,400 feet to the west of the present runway. The south end thresholds of both runways will be in line and the north end thresholds will be staggered by 4,500 feet. The new runway will be accessed by a system of 7 taxiways (4 exits and 3 entrances). A new bypass taxiway is proposed to parallel the existing 6,500-foot long runway along with a widening of the taxiway which fronts the air carrier aprons. A total of 3 new holding bays are proposed (1 interisland and 2 overseas). Enlargement of the existing south holding bay is also proposed. This alternative offers the benefits of a backup runway as well as encouragement of aircraft traffic separation.

The demand projections do not require the development of a second runway until some time in the future. Alternatives No. 4 and 5 were developed to establish preliminary concepts well before demands reach the threshold levels that would require a second runway. A dual runway scheme makes use of a backup runway for



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

400' 0 400' 800' 1200'
SCALE IN FEET

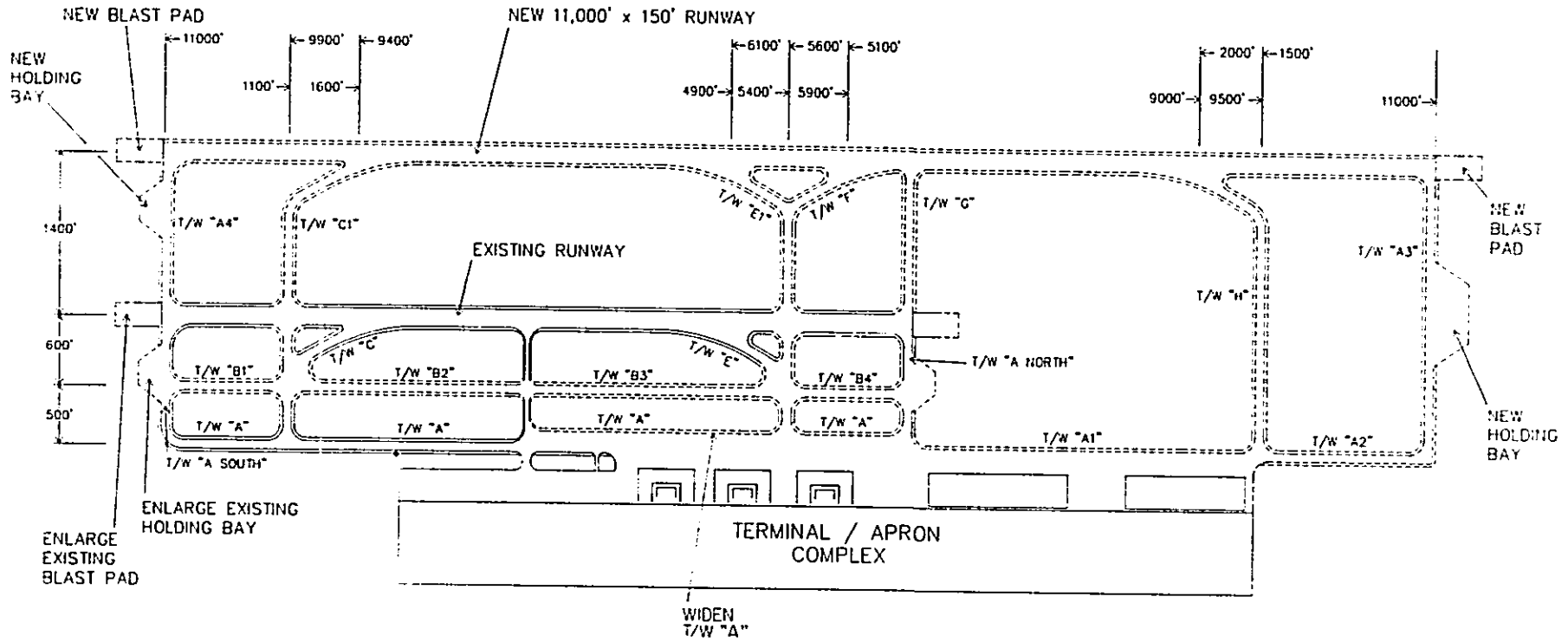
R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:
——— Existing Airfield Facilities
- - - - - - Proposed Airfield Facilities

NOTES:
Parallel 11,000' x 150' Runways
75' Wide Taxiways
35' Shoulders
Based on Airplane Design Group V Requirements

AIRFIELD ALTERNATIVE 4 LAYOUT PLAN

FIGURE 2-9



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

400' 0 400' 800' 1200'
SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:
——— Existing Airfield Facilities
- - - - - Proposed Airfield Facilities

NOTES:
6,500'x150' Runway
Parallel 11,000'x150' Runway
75' Wide Taxiways
35' Shoulders
Based on Airplane Design Group V Requirements

AIRFIELD ALTERNATIVE 5 LAYOUT PLAN

FIGURE 2-10

increasing airport acceptance rate, reducing runway delays, and reducing possibilities of interrupted service due to runway closure.

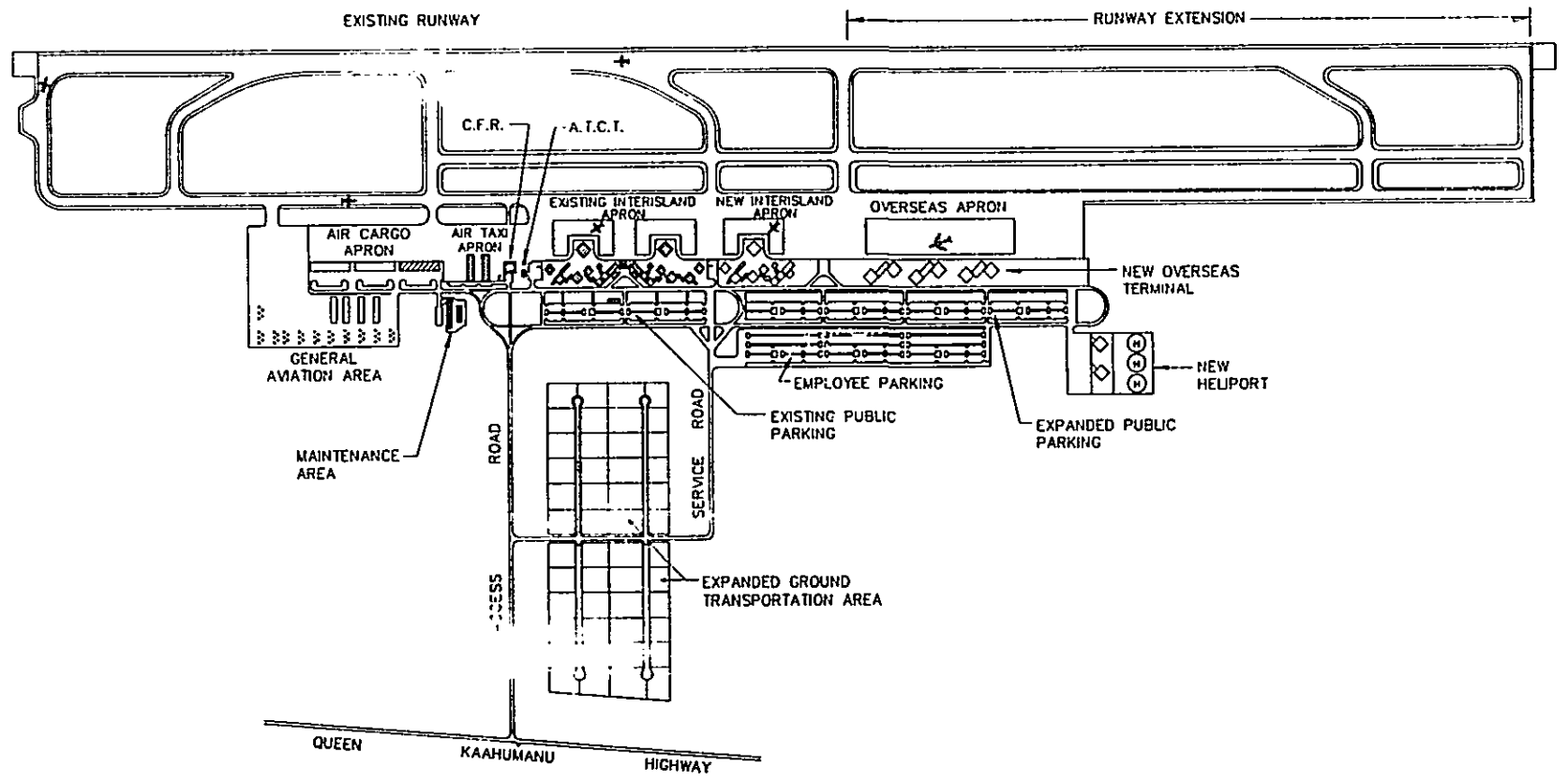
Alternatives 4 and 5 (with two runways) were not selected due to the following reasons: 1) anticipated difficulty of justifying Federal assistance for a second runway at the present time; 2) demand/capacity projections indicate a surplus capacity with the single runway; and 3) annual operations will not exceed the annual service volume to cause significant aircraft delays to the year 2005.

2.6.2 Terminal Alternatives

Alternatives considered located major uses in various areas of the airport proper to check for compatibility, future expansion potential, traffic circulation and minimum operational disruptions during expansion. Three methods were used to differentiate the alternative plans. The first method sited major facilities in various locations to evaluate their effect on airport operations. The second method varied the size of certain facilities and the third method varied the spatial relationship among uses. Because the existing airport facilities are in the south end of the airport property major expansion is in a northerly direction. Features identical to all alternatives include the location of the public and employee parking lots, the four-lane divided access road and the peripheral road. These features are as described in the recommended plan.

A. Terminal Alternative No. 1

This alternative expands the terminal complex for air carrier operations to the north (Figure 2-11). Four additional gates for interisland carriers were laid out in a similar fashion to the existing facilities. Separate facilities for overseas carriers extend further north provided by three gates. A new heliport is situated at the end of the peripheral road and east of the public parking lot. South of the existing terminal are the air



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

400' 0 400' 800' 1200'
SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:

- Existing Buildings
- New Buildings

TERMINAL ALTERNATIVE 1 LAYOUT PLAN

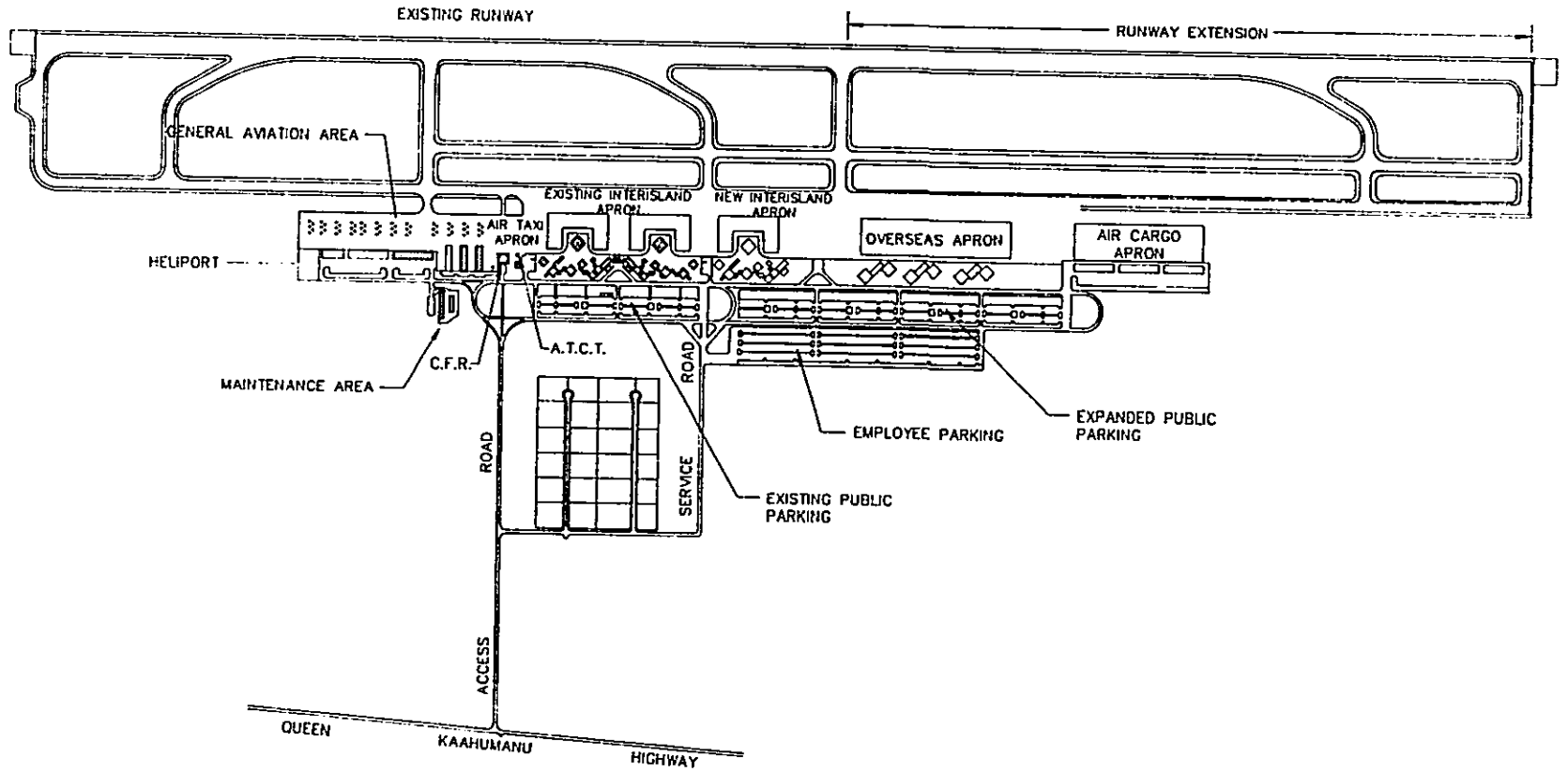
FIGURE 2-11

taxi/commuter and the air cargo facilities. Air taxi/commuter facilities replace the general aviation facilities. The air cargo operations remain at its present location and expands south with two additional buildings. The location of the general aviation facilities is east of the expanded air cargo apron. Twenty-four lots for ground transportation service facilities were added adjacent to the existing parcels. A service road off the airport access road provides access to the ground transportation service area and leads to an area between the interisland terminal. Location of this service road also provides direct access to the ramp.

Location of the air cargo operations to the north, and general aviation and heliport facilities to the south of the terminal, will limit future expansion of the terminal facilities to the north as well as to the south. In this scenario the circulation loop is again located between the interisland facilities, forcing automobiles to travel the entire length of the peripheral road to get to the particular interisland facility. Air carrier operations in this alternative will not allow aircraft push-out via tugs. Total space provided for the interisland facilities would limit the addition of other interisland carriers. For these reasons this alternative was not selected.

B. Terminal Alternative No. 2

Expansion of the interisland and overseas carrier facilities is similar to Alternative No. 1 (Figure 2-12). Expanded interisland facilities follow the existing terminal layout and overseas facilities expand to the north. Facilities for the air cargo are located north of the overseas terminal. Air taxi/commuter and general aviation facilities are located south of the existing terminal. The former general aviation facilities will be used by the air taxi/commuter operations. The general aviation facilities will utilize the air cargo facilities and expand to the south. East of the general aviation facilities is the



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

400' 0 400' 800' 1200'
SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:

- Existing Buildings
- New Buildings
- Proposed Taxiways

TERMINAL ALTERNATIVE 2 LAYOUT PLAN

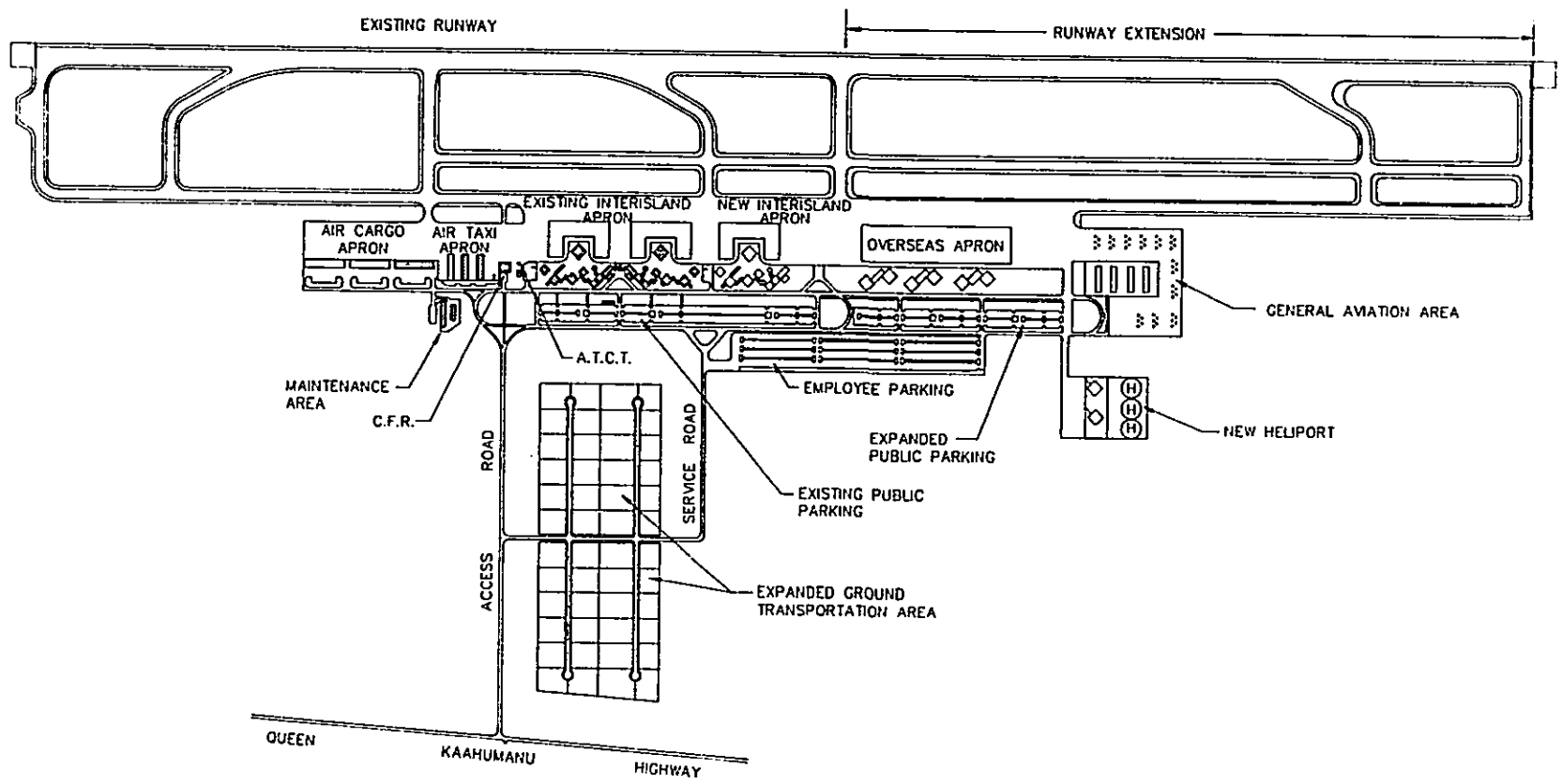
FIGURE 2-12

heliport. Ground transportation service parcels provide an additional 12 lots north of the existing lots. Location of the service road is the same as Alternative No. 1, providing access to the ground transportation and direct access to the ramp between the interisland terminal area.

This alternative was not selected because the location of the heliport will limit future terminal expansion to the north. The location of the heliport and general aviation facilities on opposite sides of the airport is not desirable because of their similar operational requirements. The separation of interisland and overseas operations in this alternative will allow aircraft to power in and power out, but not allow push out via tugs. The layout of the interisland facilities will limit the addition of another interisland carrier. The circulation loop off the peripheral road is located between the interisland terminal facilities. This location forces vehicles to travel the entire length of the peripheral road to get to the particular interisland facility to the north of the loop. This would cause unnecessary traffic on the peripheral road.

C. Terminal Alternative No. 3

Air carrier facilities are again similar to Alternative No. 1 (Figure 2-13). Interisland terminal facilities duplicate the existing layout, and overseas terminal facilities extend to the north. The general aviation area is located north of the overseas terminal and is accessed at the north end of the peripheral road. The heliport is due east of the general aviation facility. South of the existing terminal is the air taxi/commuter facilities (replacing the general aviation operations) and expansion of the existing air cargo facilities. Thirty-six additional ground transportation service parcels have been added adjacent to the existing facilities. The service road, although in the same location for access to the ground



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

400' 0 400' 800' 1200'
SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:

- Existing Buildings
- New Buildings

TERMINAL ALTERNATIVE 3 LAYOUT PLAN

FIGURE 2-13

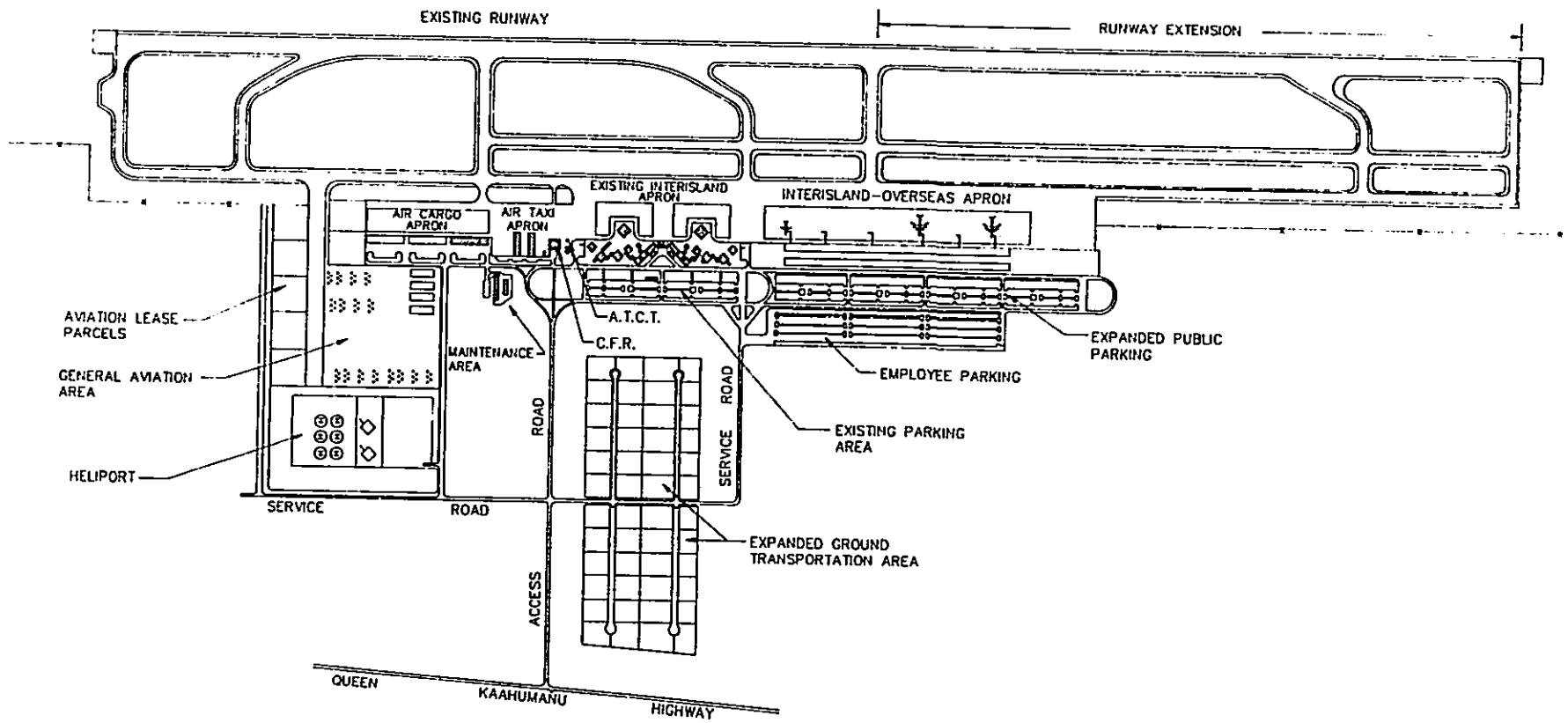
transportation area, does not provide direct access to the ramp. The circulation loop has been relocated between the interisland and overseas terminal facilities.

This alternative was not selected because location of the general aviation and heliport limits future expansion of the terminal facilities to the north, where more land is available. The existing interisland carriers will be able to operate out of their own complex. However, should another interisland carrier enter the market, there will be a limit of total space for each carrier. The air carrier parking positions in this concept do not allow for aircraft push-out via tugs.

D. Terminal Alternative No. 4

This alternative combines some of the interisland and overseas terminal facilities (Figure 2-14). Interisland and overseas passengers will enplane and deplane via jetways off a two-story departure structure. Ticketing, baggage handling, holding and passenger amenities will be in a one-story structure facing the roadway. South of the existing terminal is the air taxi/commuter operations and expansion of the existing air cargo area. The general aviation and heliport facilities are to the east of the air cargo area. A few aviation lease parcels have been added in this vicinity. The ground transportation service area provides an additional 36 lots near the existing facilities. The service road provides access to the ground transportation and direct access to the ramp between the interisland terminal area. A second service road to the south will provide access to the heliport and general aviation area.

Alternative 4 was selected because it provided the best solutions for future airport expansion and efficiency in airport operations. In this concept the smaller general aviation facilities and heliport have been relocated to the south, away from air carrier operations. Collocation of the general aviation



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

400' 0 400' 800' 1200'
SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:

- Existing Buildings
- New Buildings
- Fence

TERMINAL ALTERNATIVE 4 LAYOUT PLAN

FIGURE 2-14

and heliport facilities is desirable because of their similar operational requirements. The interisland and overseas terminal is being proposed as two-story structures. This design allows passengers to enplane and deplane via jetways. The ticketing, baggage handling, holding and passenger amenities will be a one-story structure facing the roadway. Aircraft parking in this alternative allows the aircraft to power in and power out as well as push out via tugs. Future expansion of most of the airport facilities in this layout is more achieveable.

2.7 "No Action" Alternative

The terminal and airfield facilities presently experience inefficiencies in operations. If expansion is not implemented, the facilities will not be able to accommodate the projected forecasts and demands to the year 2005.

Growth of the Kona district will be indirectly affected if the airport facilities were not expanded. The existing facilities will not be able to accommodate the projected increase in population and growth of the tourist industry. Non-expansion will limit the amount of people and goods traveling through Kona.

The existing terminal facilities were originally designed for only two carriers. Presently, there are two interisland and one overseas carriers operating in spaces designed for two. Expansion of the facilities would provide each carrier with sufficient operating space, thereby eliminating operational inefficiences.

The existing airfield facilities are inadequate to sustain jet blast effects of larger overseas aircraft. The shoulders need to be widened and stabilized to avoid erosion and possible engine ingestion of dust and loose gravel. Lengthening of the runway and pavement strengthening would allow critical design aircraft (i.e., DC-10-30) to land and takeoff at the

maximum landing and takeoff weights. Currently, overseas aircraft leaving Keahole Airport require stop-over on the Island of Maui or Oahu for refueling before proceeding on to the mainland. Improvements to the runway will allow non-stop travel beyond the west coast as well as increased air cargo activities.

SECTION 3

Impacts on the Physical Environment

SECTION 3
IMPACTS ON THE PHYSICAL ENVIRONMENT

3.1 GEOGRAPHY AND CLIMATE

The Keahole Airport is located on the western edge of Hualalai mountain and consists almost entirely of barren aa and pahoehoe lava flows created during the eruption of 1801. The average slope of the land is less than 5 percent. Elevation at the Queen Kaahumanu Highway is approximately 120 feet above mean sea level. The runway elevation is 43.3 feet above mean sea level.

The climate in the North Kona area is classified as semi-arid. The mean annual rainfall is less than 20 inches along the coastline. At higher elevations along the leeward side of Hualalai, rainfall averages 75 inches. The wet periods occur from May through September, which are the usual dry months of the year for the rest of the State. Evaporation rates are typically high, in the general range of 0.18 inches per day during winter and 0.36 inches per day during summer as measured at Anaehoomalu. There are no pan evaporation measurements for the Keahole area. (Source: HOST, 1986).

The average temperature at the airport is 78 degrees with a maximum recorded temperature of 92 degrees and a minimum of 54 degrees.

The Kona area is characterized as having a diurnal (land/sea) wind pattern. The resulting winds blow gently from the sea during the night, switching directions during the day. The exception to this pattern occurs during the periods of "Kona" weather during the winter months when low pressure fronts cause strong southerly winds, in some instances approaching 30 to 40 knots.

A. Impacts

No significant changes to the regional climate are anticipated as a result of this project.

3.2 LAND USES AND OWNERSHIP

When the Keahole Airport was opened in 1970 it was built a considerable distance from any existing commercial, resort or residential developments. At that time, the surrounding lands were designated State Conservation and County zoned Open or Unplanned. In the intervening years the lands surrounding the airport have largely maintained their undeveloped status.

3.2.1 Ownership

Expansion of the Keahole Airport will be contained within the existing airport boundary which is owned by the State of Hawaii. The property consists of approximately 4,000 acres. About 421 acres are being leased to the Hawaii High Technology Development Corporation for development of the Hawaii Ocean Science and Technology (HOST) Park. The Natural Energy Laboratory of Hawaii (NELH) leases an additional 322 acres of the airport property.

3.2.2 Existing Land Use

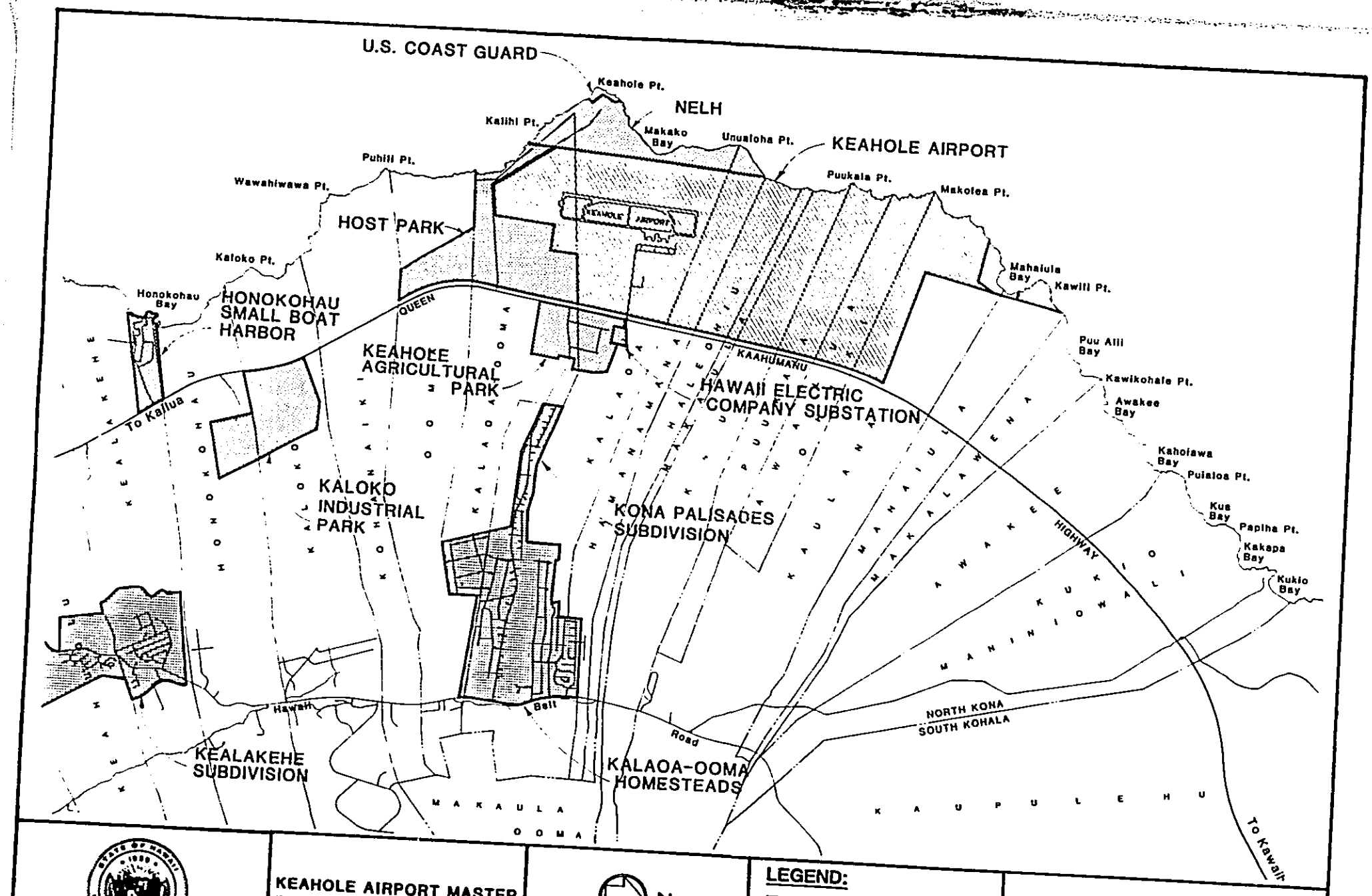
Within a mile radius of the airport control tower there are three residences that are part of the Keahole Agricultural Park (see Figure 3-1). The next closest developed area is the Natural Energy Laboratory facilities at Keahole Point. The NELH facilities are 1.2 miles from the tower and approximately 4,000 feet west of the southern end of the runway.

The closest residential development is the Kona Palisades Subdivision which is approximately 1.8 miles east of the tower. Other developed areas in the vicinity of the airport include the Kaloko Industrial Park and Honokohau Harbor, both located south of the airport at a distance of approximately 3.4 miles and 3.9 miles, respectively.

The closest developed area to the north of the airport is approximately 4 miles away at Mahaiula Bay.

3.2.3 State Land Use

The State Land Use classification for the Keahole Airport and areas surrounding the airport is shown in Figure 3-2. The airport proper



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN
KEAHOLE AIRPORT NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

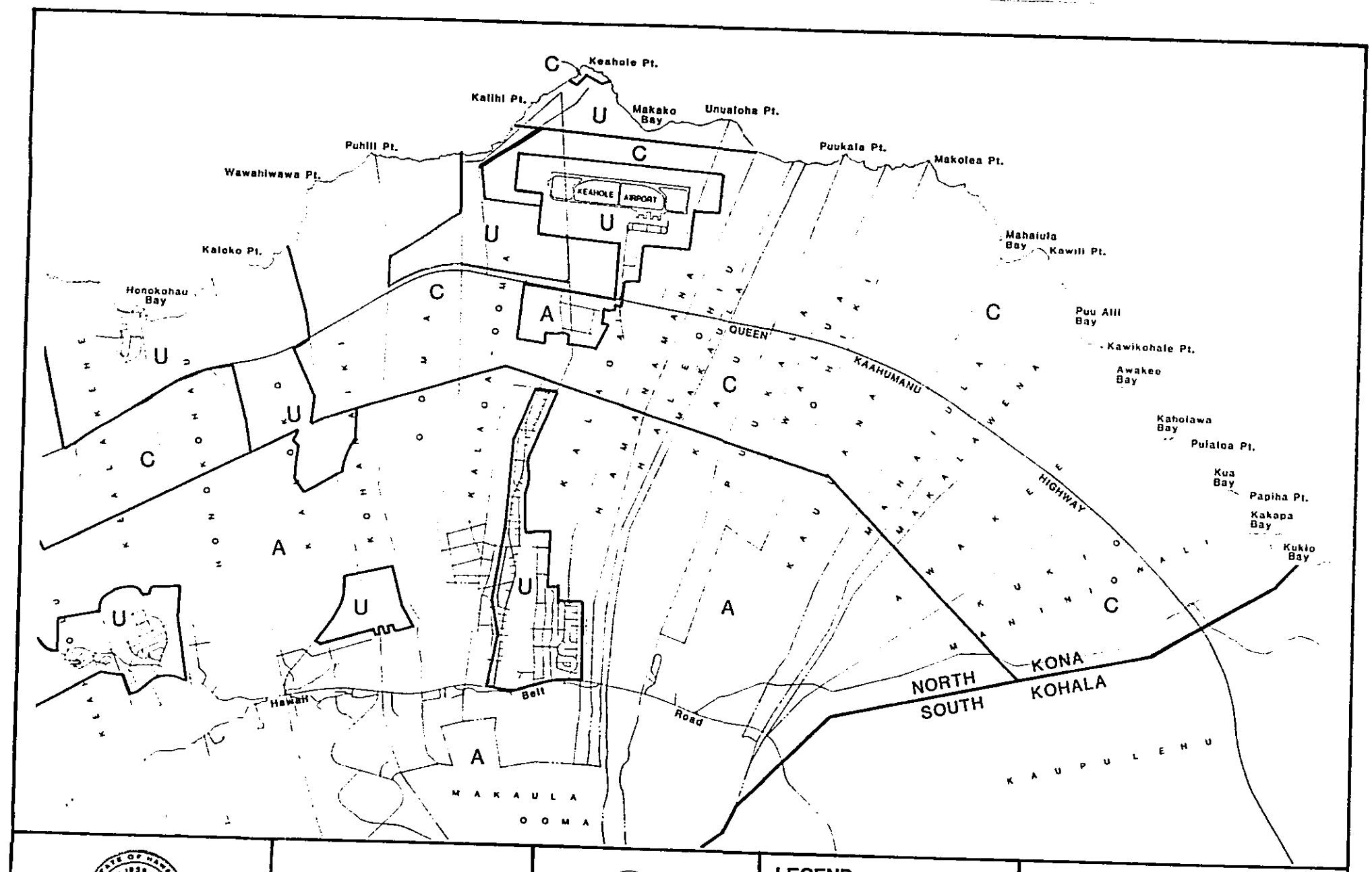
2000' 0 2000' 4000' 6000'
SCALE IN FEET

R M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:
- Industrial
- Residential
- Airport
- Open

EXISTING LAND USE

FIGURE 3-1



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

2000' 0 2000' 4000' 6000'
SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:

C Conservation
A Agriculture
U Urban

STATE LAND USE DISTRICT MAP

FIGURE 3-2

(roadways, terminal area, runways) is classified as Urban. This area is approximately 432 acres. The site of the Hawaii Natural Energy Laboratory along the seaward side of the airport, and the HOST Park site are also classified Urban. The remaining lands within the airport boundary are classified Conservation. The land mauka (east) of the Queen Kaahumanu Highway is classified as Agriculture. This is the site of the Keahole Agricultural Park. The next Urban designation is the Honokohau Small Boat Harbor. The areas makai (west) of the highway are still designated Conservation.

Reclassification of approximately 212 acres of State Conservation lands to Urban designation will be sought (see Figure 3-3).

3.2.4 County Zoning

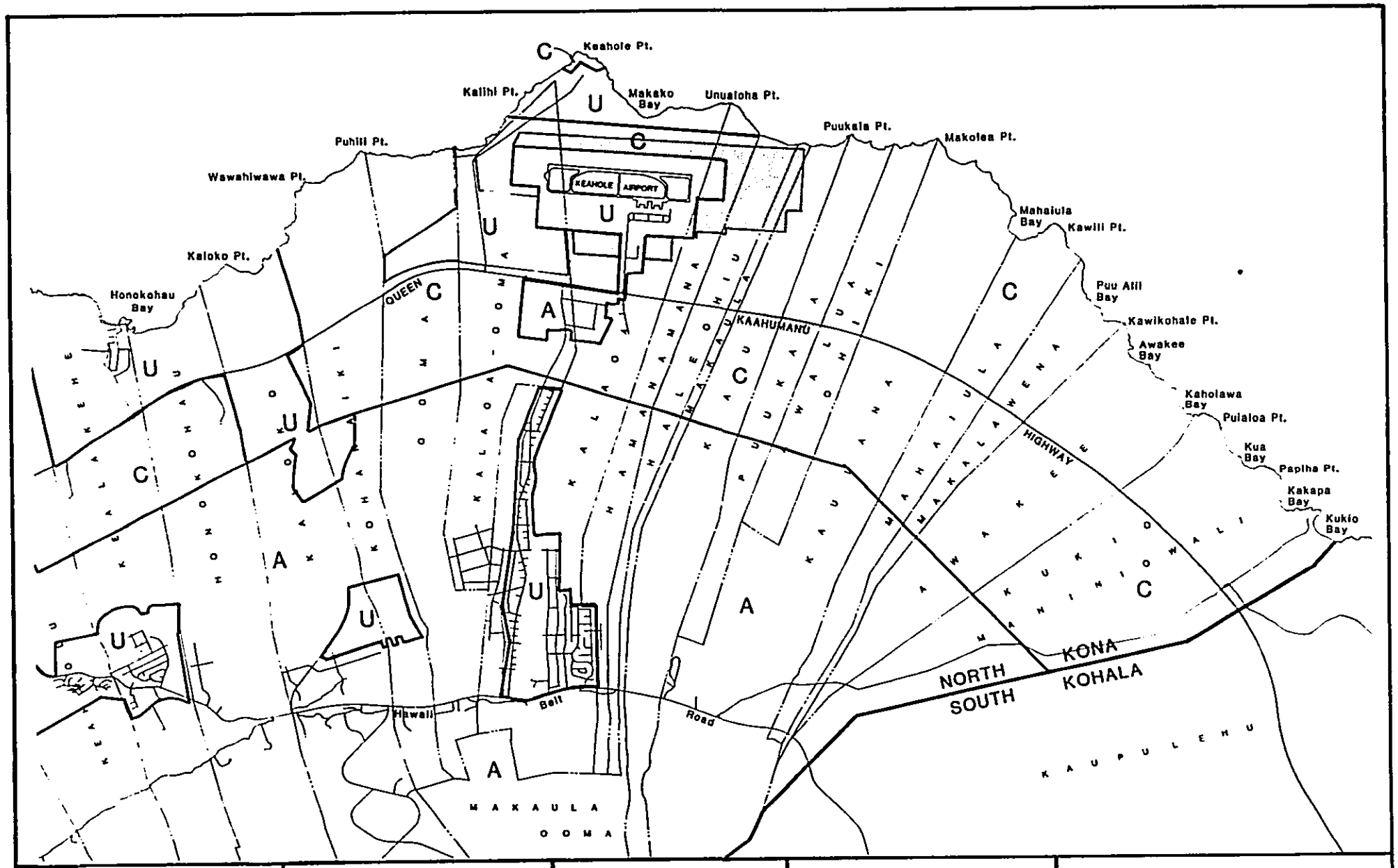
The Keahole Airport proper, NELH and HOST Park, are zoned General Industrial by the County of Hawaii. All other areas within the airport boundary are zoned Open. The zoning of the area surrounding the airport is shown in Figure 3-4. Currently, none of the land surrounding the airport is zoned for resort or residential uses.

A County zoning amendment is required to change the same 212 acres from Open to General Industrial.

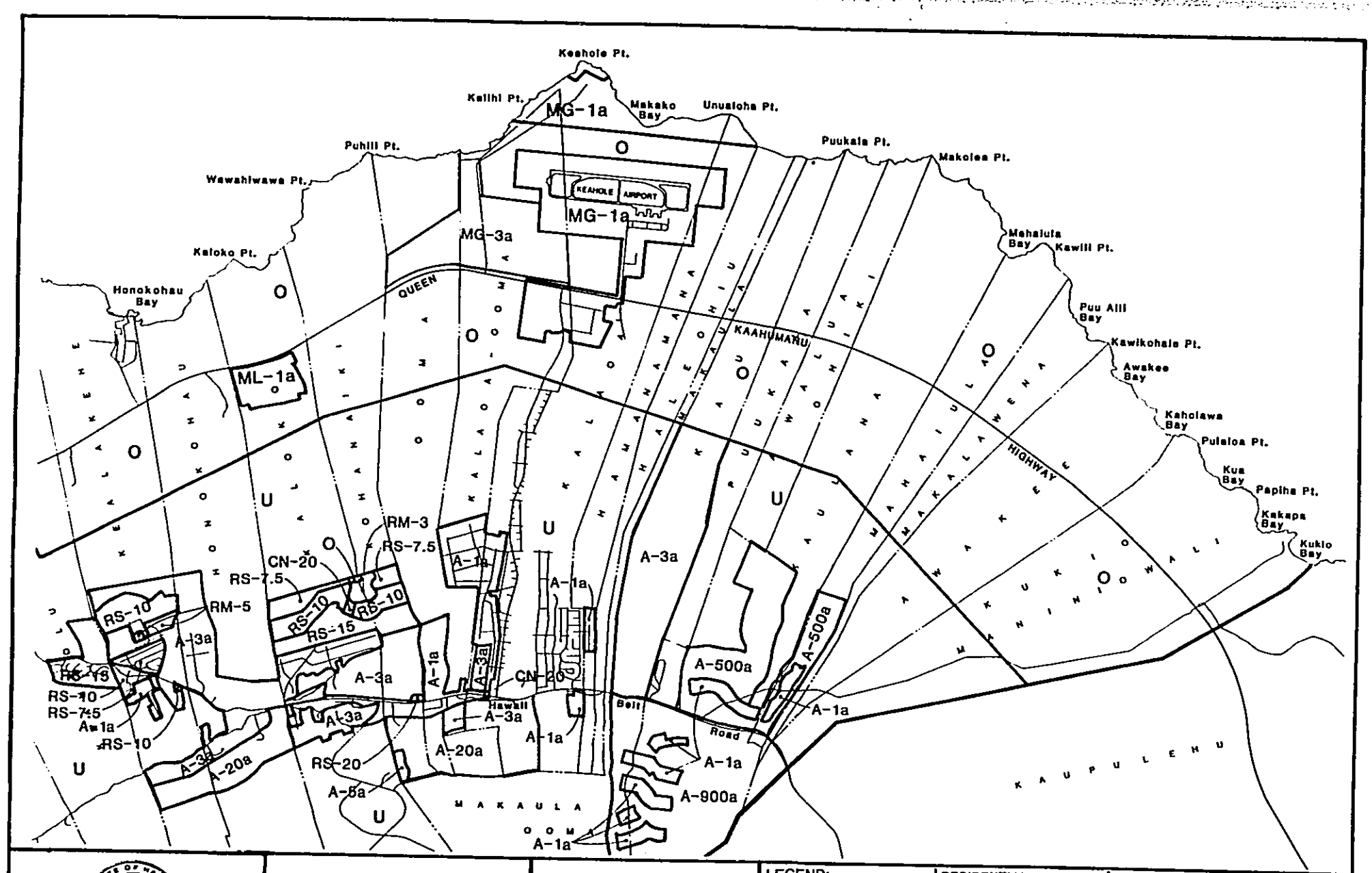
A. Impacts

The proposed airport expansion will not affect the existing land uses significantly. The undeveloped status of the adjacent land uses is compatible with the airport.

Expansion of the airport will limit certain types of future development in the area where lands are currently designated State Conservation and County zoned Open. If the Part 150 Program is implemented, lands affected by noise contours of Ldn 60+ will be restricted for land uses such as residential development, schools and churches.



Airports Division DEPARTMENT OF TRANSPORTATION STATE OF HAWAII	KEAHOLE AIRPORT MASTER PLAN KEAHOLE AIRPORT, NORTH KONA, HAWAII STATE PROJECT NO. AH 2011-02 AIP PROJECT NO. AIP 3-15-0008-03	N 400' 0 400' 800' 1200' SCALE IN FEET R. M. TOWILL CORPORATION HONOLULU, HAWAII	LEGEND: C Conservation A Agriculture U Urban ☐ Expansion Area	**STATE LAND USE CLASSIFICATION** FIGURE 3-3



Airports Division DEPARTMENT OF TRANSPORTATION STATE OF HAWAII	**KEAHOLE AIRPORT MASTER PLAN** KEAHOLE AIRPORT, NORTH KONA, HAWAII STATE PROJECT NO. AH 201-02 AIP PROJECT NO. AIP 3-15-0008-03	N 2000' 0 2000' 4000' 6000' SCALE IN FEET R. M. TOWILL CORPORATION HONOLULU, HAWAII	**LEGEND:** AGRICULTURE A-1a 1 Acre A-3a 3 Acres A-5a 5 Acres A-20a 20 Acres A-500a 500 Acres A-900a 900 Acres INDUSTRIAL MG-1a General Industrial 1 Acre ML-1a Limited Industrial 1 Acre UNPLANNED U Unplanned	RESIDENTIAL SINGLE FAMILY: RS-7.5 7,500 Sq. Ft. RS-10 10,000 Sq. Ft. RS-15 15,000 Sq. Ft. RS-20 20,000 Sq. Ft. MULTIPLE FAMILY: RM-3 3,000 Sq. Ft./Unit RM-5 5,000 Sq. Ft./Unit COMMERCIAL CN-20 Neighborhood commercial 20,000 Sq. Ft. OPEN O Open	**COUNTY ZONING MAP** FIGURE 3-4

The proposed Ooma II and Kohanaiki resort developments contain residential uses and will be affected by aircraft generated noise. A large portion of the proposed Ooma II development falls within the Ldn 60+ contours (see Subsection 3.7 Noise in this section).

B. Mitigation Measures

Recommend to State and County planning officials to limit future land uses affected by aircraft noise to those compatible with the airport.

3.3 NATURAL HAZARDS

The Keahole area, as well as the entire Island of Hawaii, is located in Earthquake Zone 3 (on a scale of 0-3). The airport is located outside of any floodway or flood fringe zones as described by the FEMA (Federal Emergency Management Agency) Flood Insurance Rate Map (FIRM). The terminal buildings at Keahole Airport are outside the evacuation zone for tsunami hazards. The limits of the evacuation zone are west of the existing runway.

A. Impacts

Risks to life and property caused by a natural disaster such as an earthquake are present at this site.

B. Mitigation Measures

Structures built in this earthquake zone are subject to seismic provisions of the Uniform Building Code. Structures shall be designed and constructed to resist stresses produced by lateral seismic forces. For example, masonry or concrete structures shall have the principal reinforcement spaced not more than 2 feet on center using frames designed to carry all vertical loads. The frames will have joints capable of resisting forces by bending.

3.4 SOILS

The U.S. Department of Agriculture, Soil Conservation Service, has classified the soil type as aa (rLV) and pahoehoe (rLW) lava flows. The

lava flows have practically no soil covering and are virtually devoid of vegetation. The Land Study Bureau's Detailed Land Classification Report for the Island of Hawaii has designated the lands at the airport as Class E, lands that are very poor and least suited for agriculture.

A. Impacts

There is a possibility of encountering lava tubes within these soil types. Existence of lava tubes poses a threat to life and property in the event that they collapse during excavation and construction.

B. Mitigation Measures

Extensive soil testing and borings should be made prior to design and construction. Care should be taken during grading operations in the event that lava tubes are discovered.

3.5 FLORA

A botanical survey of the lands proposed for the expansion of the Keahole Airport was conducted on August 26, 1987 which is attached as Appendix B. A total of 46 vascular plants was found. Thirteen species are native to the island or were introduced by early Polynesians and the remaining 33 were exotic.

The predominant species found in the study area consisted of fountain grass, 'uhaloa, and maia-pilo. The fountain grass is a bunch grass that can occupy areas minimally suited to vegetation. In less hostile environments this grass crowds out smaller plants and threatens trees and shrubs. Its large dry clumps present a serious fire hazard. Another common weed of dry, waste places throughout the island is the 'uhaloa. This weed was found in almost equal numbers as the fountain grass throughout the site. The third predominant plant species found was the maia-pilo, the native caper. It has a growth form of a shrub or prostrate ground cover. The maia-pilo flower is a large, white, showy flower with a very sweet fragrance. Unfortunately, the flower blooms only at night and withers in the early morning sun.

Other plant species found on the lava fields were too minor to be considered significant. More unusual fern species were found in lava tubes discovered on the site. The lava tubes provided shelter from the sun and wind as well as higher humidity. These species would normally not be expected in this area.

A. Impacts

None of the plant species found on the site are considered rare, threatened or endangered and the proposed project poses no threat to these species.

B. Cumulative Impacts

Planting of new landscaping within the airport expansion area will add to the flora diversity.

3.6 FAUNA

A survey of the terrestrial vertebrate fauna for the proposed airport expansion was conducted on August 26, 1987. The study included areas already developed for the existing airport. Most of the habitats were found in areas that provided food, water and nesting sites. Nine species of birds, three mammals and one reptile were found.

The bird species found were all foreign or introduced. The more abundant bird species included the zebra dove or barred dove, common Indian myna or myna and house sparrow or English sparrow. The doves were observed in areas where people have dropped food. Nests have been built by the myna and sparrow under the eaves of buildings in the area. Most of the bird species were observed around the terminal, in landscaped areas and in scrub vegetation near the maintenance building.

Mongoose or Indian mongoose was not observed, however, droppings were found in the shrubs along the fence of the car rental lots. Skeletal material of donkey was found on the pahoehoe lava flow and goat skeletons and droppings were found in lava tubes and caves.

Only one reptile, a skink species, was observed among the rocks near the opening of the large lava tube.

A. Impacts

There were no threatened or endangered vertebrate animal species observed on the property.

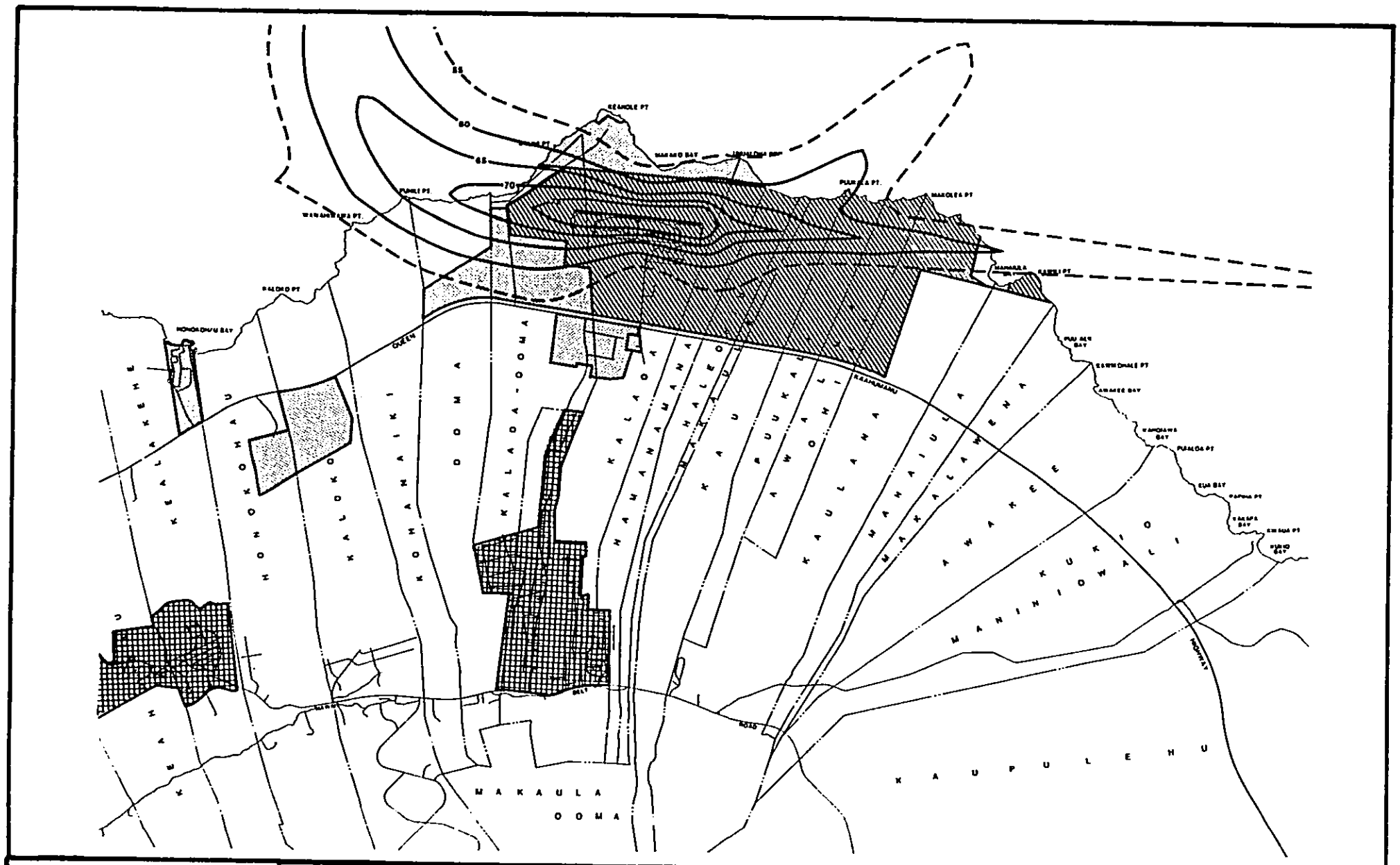
B. Cumulative Impacts

Foreign bird species, mammals, skink and gecko species are expected to increase in numbers as there will be more available habitat.

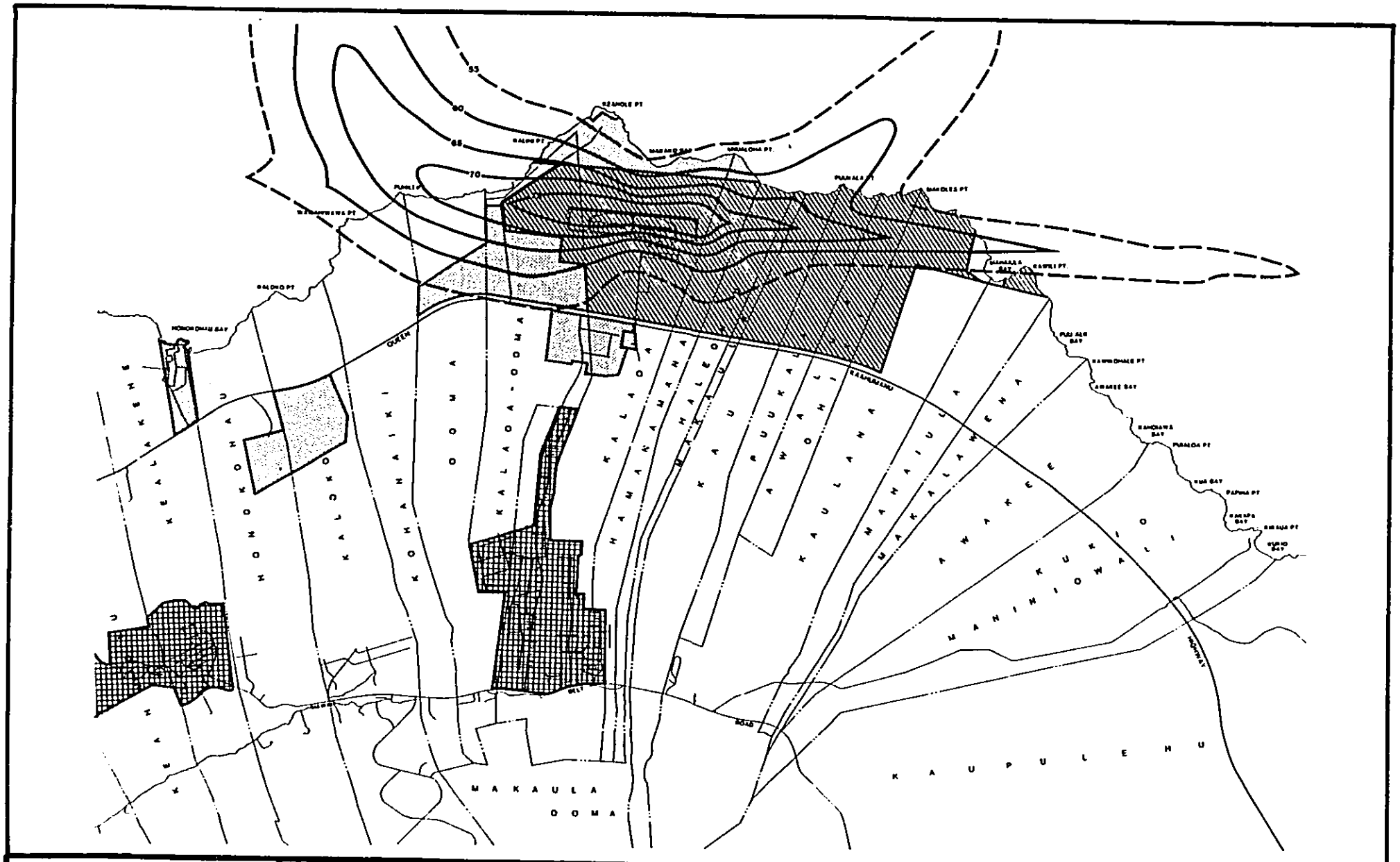
3.7 NOISE

The Noise Compatibility Program and Noise Exposure Maps were prepared in conformance with the Federal Aviation Regulations (FAR) Part 150, "Airport Noise Compatibility Planning." The Noise Compatibility Program was developed jointly with the Keahole Airport Master Plan to ensure consistency among recommendations. Noise Exposure Maps were prepared for the years 1985, 1990 and 2005. These maps showed existing and predicted aircraft noise levels (see Figures 3-5, 3-6, and 3-7).

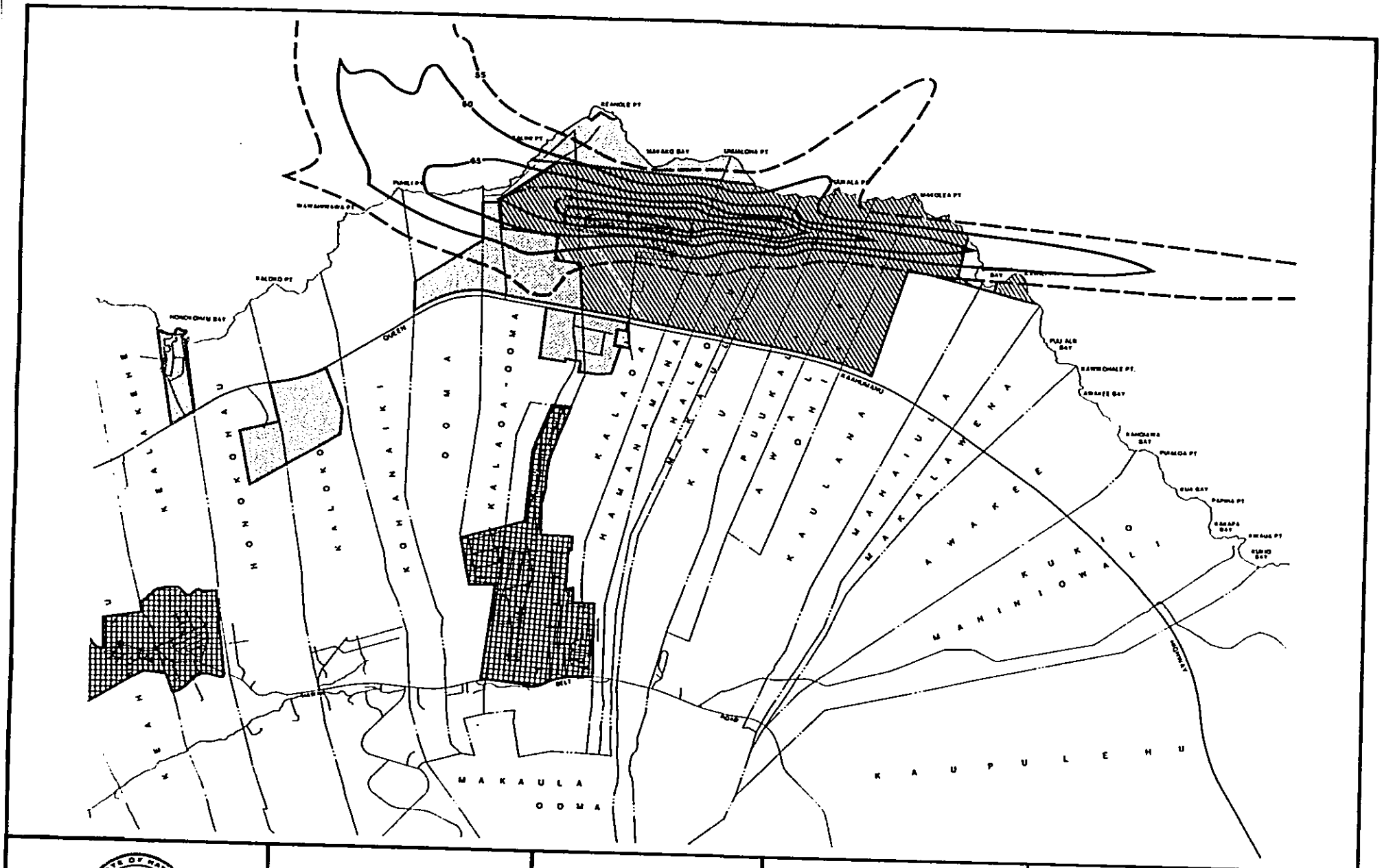
Most of the lands are State Conservation or County zoned Open and are currently undeveloped. Because of the large size of the airport property and its close proximity to the ocean, effects of aircraft noise on the surrounding environment have not been significant. The nearest residential developments are the Keahole Agricultural Park, containing three residences, and the Kona Palisades Subdivision. These residences are outside of the Ldn 60 or greater contours. Eight complaints due to noise exposure during the fiscal year 1985 were received at the Keahole Airport Office as a result of overflights of the Kona Palisades Subdivision. The Keahole Airport Tower responds to 2 to 3 complaints per month generally due to overflights.



Airports Division DEPARTMENT OF TRANSPORTATION STATE OF HAWAII	**KEAHOLE AIRPORT MASTER PLAN** KEAHOLE AIRPORT, NORTH KONA HAWAII STATE PROJECT NO AH 2011-02 AIP PROJECT NO AIP 3-15-0008-03	N SCALE IN FEET R. M. TOWILL CORPORATION HONOLULU, HAWAII	LEGEND: INDUSTRIAL RESIDENTIAL AIRPORT OPEN —60— Ldn Value	**1985 NOISE EXPOSURE MAP** FIGURE 3-5



Airports Division DEPARTMENT OF TRANSPORTATION STATE OF HAWAII	**KEAHOLE AIRPORT MASTER PLAN** KEAHOLE AIRPORT, NORTH KONA HAWAII STATE PROJECT NO AH 2011-02 AIP PROJECT NO AIP 3-15-0008-03	N SCALE IN FEET R M. TOWILL CORPORATION HONOLULU, HAWAII	LEGEND: INDUSTRIAL RESIDENTIAL AIRPORT OPEN —60— Ldn Value	**1990 NOISE EXPOSURE MAP** FIGURE 3-6



Airports Division
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII

KEAHOLE AIRPORT MASTER PLAN

KEAHOLE AIRPORT, NORTH KONA, HAWAII

STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03

N

SCALE IN FEET

R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:
- INDUSTRIAL
- RESIDENTIAL
- AIRPORT
- OPEN
- —60— Ldn Value

2005 NOISE EXPOSURE MAP

FIGURE 3-7

Proposed developments just south of the airport environs include the Hawaii Ocean Science and Technology (HOST) Park, the O'oma II Resort and the Kohanaiki Resort. The HOST Park is planned for a high technology aquaculture park with related facilities which are compatible with the airport. The proposed Ooma II and Kohanaiki resorts have a potential for incompatibility because they include residential development. Part of the proposed resorts fall within the Ldn 60+ contours.

A. Impacts

Expansion of the Keahole Airport will not cause significant aircraft noise impact to the existing land uses and to the community. Currently, there are no incompatible land uses within the Ldn 60+ contours.

The proposed Ooma II Resort development to the south has a significant amount of land within the Ldn 60+ contours. Some of the land will be used for residential development which is an incompatible land use because of the high noise levels generated by the aircraft.

Noise resulting from single event overflights of the nearby residential development is probable.

Noise generated during construction of the airport expansion will not adversely affect noise sensitive facilities. The airport is not close enough to noise sensitive areas to create disturbances due to outdoor construction.

B. Abatement Measures

Four noise abatement measures have been recommended as follows:

1. Build high-speed exit taxiways to reduce the need for more power sometimes required to exit via perpendicular taxiways.

2. Changing flight patterns by routing aircraft over less sensitive areas can reduce the noise exposure. Air carrier flights from Hilo are sometimes routed between the Kona Palisades and the airport. Aircraft generally follow the informal noise abatement procedures, but aircraft do occasionally fly too close to the subdivision. Airlines will recommend to their pilots to use the downwind approach over the ocean provided weather conditions permit and flight patterns do not affect the FAA's ability to properly sequence aircraft in and out of Keahole Airport.

3. Enforce prescribed flight track use. Adherence to the prevalent flight tracks would result in the least number of people being exposed to high levels of aircraft noise. Some deviations occur on departure of the air tour aircraft and result in noise complaints. The State, FAA and aircraft operators have developed informal procedures for the air tour aircraft. The aircraft will have a runway heading long enough to reach an altitude of 1,500 feet by the time they are abeam the Air Traffic Control Tower.

4. Limit aircraft types to Stage 3 aircraft which are quiet technology aircraft.

C. Mitigation Measures

Because there are no remedial measures that can help to improve the compatibility of existing incompatible land uses, preventive measures to help reduce the probability of incompatible land uses have been recommended.

Comprehensive planning and urban growth management to maintain compatibility with the airport and its environs need to be conducted. Noise sensitive land uses in areas currently and

predicted at Ldn 60 or greater should be prohibited. Noise sensitive uses include schools, churches and residential developments.

Timing of capital improvement program and public works projects strongly influences land use trends and demands. The undeveloped status of the existing airport environs limits urbanization because of the lack of infrastructure improvements.

Zoning changes to encourage airport compatible development should be implemented in areas exposed to high levels of aircraft noise. Building height limitations and restricted land uses based on aircraft safety criteria and aircraft noise exposure should be adopted as a zoning overlay.

Noise-sensitive uses in areas exposed to 60 Ldn are discouraged. However, should such uses be permitted, every effort should be made to ensure that effective noise mitigation measures are employed and avigation easements are required. There should also be a noise disclosure for developments within the 55-60 Ldn impacted area.

To mitigate impacts to noise-sensitive uses, soundproofing of noise-sensitive structures exposed to aircraft noise levels of Ldn 60 or greater should be a requirement. This requirement can be enforced through amendment of the Building Code. Single family or manufactured housing should not be permitted in areas exposed to noise levels above Ldn 70, regardless of the degree of soundproofing.

New or redeveloped structures exposed to Ldn 60 or greater should require the granting of an avigation easement. The easement should be shown on subdivision plat maps and enforced when requesting rezoning, subdivision approval or a building permit. This procedure will inform the tenants as well as protect them

from the noise exposure in the area. In relation to this, adherence to the law requiring fair disclosure is recommended. Fair disclosure statements will inform persons of the presence of noise levels and avigation easements. This statement then becomes part of the deed and provides some protection to the Airports Division against future noise-related litigation.

Some landowners pay taxes on open space land, such as agriculture, at a rate computed for "higher or better" use.

Reduction of taxes for landowners within such areas of the airport environs would provide them an incentive to retain ownership of these properties rather than selling for urban development.

The Federal Housing Administration (FHA) mortgage insurance policies and practices should continue. Mortgage insurance for areas exposed to Ldn 75 is not normally provided. Adequate soundproofing to achieve an interior noise level of 45 Ldn in areas above Ldn 65 is recommended.

3.8 AIR QUALITY

An air quality study was conducted for the expansion of the Keahole Airport. The focus of the air quality study was the impact on surrounding environs due to the increase in airport activities. The Federal Clean Air Act does not view a commercial airport such as Keahole as a direct source of air pollution. However, it is defined as an indirect source of air pollution because it will attract and concentrate aircraft and motor vehicles.

In 1985-86 the State monitored the air quality for total suspended particulates (TSP) and sulfur dioxide (SO_2) in the Kailua-Kona area. Results of that sampling suggested that the air quality in Kona is excellent. Levels of particulates and SO_2 were well below the State and Federal standards, partly due to the low level of industrial development.

The worst air pollution in Hawaii County is caused by the volcanic activity and subsequent forest fires. Analysis of airborne particulate matter showed unusually high concentrations of selenium, arsenic, indium, gold and sulfur with exceptionally high concentrations of iridium.

The average annual temperature is 78°F. Average monthly temperature varies by only 6 degrees from the warmest to the coolest months. The annual average rainfall for the Keahole Airport area is 20 inches. The climate along the leeward coastal areas is typically semi-tropical, semi-arid.

Winds in the Kona area are not the typical northeast tradewinds. The winds are characterized by a strong land-seabreeze regime with onshore winds during the day and offshore winds at night. The Airport Vicinity Air Pollution (AVAP) Model (Argonne National Laboratory, 1974) was used to estimate pollutant concentrations under worst conditions on the land side of the airport. A receptor array was therefore established across Queen Kaahumanu Highway so as to be downwind under the prevailing southwesterly winds.

The most significant contributor of pollutants impacting the surrounding airport environs is the aircraft. They contributed the highest percentage of the five major pollutants (carbon monoxide, CO; nitrogen dioxide, NO_2; total hydrocarbons, THC; sulfur dioxide, SO_2; and total suspended particulate matter, TSP). Despite the emissions from airport operations, ambient concentrations of these pollutants were well under the State and Federal standards. The unique non-tradewind, diurnal wind pattern, however, can result in build-up of pollutant concentrations in the Kona area. Because of this potential, pollutant concentrations should be monitored and periodically reevaluated as future developments arise.

Table 3-1 compares the State standards for ambient air quality to the modeling results at the Keahole Airport including projections for the years 1990 and 2005. Comparison was made with State standards because they are more stringent than the Federal standards; therefore, compliance with State standards infers compliance with Federal standards. Concentration estimates

TABLE 3-1

AIR QUALITY COMPARISON TO STATE STANDARDS

	Averaging Period	Concentrations (ug/m³)
CARBON MONXOIDE (CO):		
State	1 hour	10,000
Keahole Airport, 1985		119-448
Keahole Airport, 1990		131-505
Keahole Airport, 2005		134-472
State	1 hour	5,000
Keahole Airport, 1985		182-234
Keahole Airport, 1990		218-272
Keahole Airport, 2005		262-346
NITROGEN DIXOIDE (NO_2):		
State	Annual Arithmetic Mean	70
Keahole Airport, 1985	24 hours	29-32
Keahole Airport, 1990		30-35
Keahole Airport, 2005		31-37
SURFUR DIOXIDE (SO_2)		
State	24 hours	365
Keahole Airport, 1985		12-12
Keahole Airport, 1990		12-14
Keahole Airport, 2005		12-14
TOTAL SUSPENDED PARTICULATE MATTER (TSP)		
State	24 hours	150
Keahole Airport, 1985		28-29
Keahole Airport, 1990		28-30
Keahole Airport, 2005		28-30
TOTAL HYDROCARBONS (THC, as methane)		
State	3 hours	None
Keahole Airport, 1985		1,649-1,658
Keahole Airport, 1990		1,650-1,662
Keahole Airport, 2005		1,652-1,662

BACKGROUND LEVELS

CO	-	100 ug/m³	
NO_2	-	29 ug/m³	(based on 1975 DOH monitoring at Hilo)
SO_2	-	12 ug/m³	(based on 1985-86 DOH monitoring at Kona)
TSP	-	28 ug/m³	(based on 1985-86 DOH monitoring at Kona)
THC	-	1,648 ug/m³	methane (based on 1979-80 monitoring at the Honolulu International Airport)

also include a "background level" for each pollutant based on either compliance with standards. While there are no longer State or Federal standards for hydrocarbons, they were included because airports are usually significant contributors of hydrocarbon emissions. In the case of Keahole, subtracting the background methane level from the total hydrocarbons estimate indicates that the ambient concentration of non-methane hydrocarbon would still meet the previous State standard of 100 ug/m^3 (micrograms per cubic meter).

A. Impacts

The airport and its environs are a significant contributor of carbon monoxide, nitrogen oxides, and hydrocarbons, and to a lesser extent, particulate matter and sulfur dioxide. The increase in airport activity to the year 2005 will also result in an increase in air pollutants. Impact on the surrounding environment is not expected to be significant based on modeling results which indicated no present or future violations of State or Federal standards.

The blockage of normal tradewinds by the two large mountain masses east of Kona reduces natural ventilation and can result in a build-up of air pollutants in the area.

B. Mitigation

As the Kona area develops, close monitoring and periodic reevaluation of pollutant build-up resulting from the reduced natural ventilation should be conducted.

3.9 VISUAL RESOURCES

Because of the open nature of the landscape surrounding the airport, the airport facilities stand out in stark contrast to the open lava fields. The airport facilities are located below and to the west of the Queen Kaahumanu Highway. Views from the highway present a panoramic view of the North Kona coastline. Views from the airport present a panoramic view of Hualalai to the east.

Visual aspects within the airport proper consist of landscaping among the open design of the wooden hut-shaped buildings to create a "tropical village" appearance. Landscaping within the existing airport proper is found mostly in the terminal and parking lot areas. Gardens throughout the terminal complex enhance the sparsely vegetated surroundings. Trees and low shrubs have been planted within and around the parking lot area to provide shade and to screen these otherwise unattractive facilities. Other landscaping around the maintenance area have been planted to screen it from view.

The ground transportation service area contains very little landscaping. This area is enclosed by a chain link fence with cars parked along the interior. Structures contain a mix of wooden and metal buildings painted in a variety of colors. Visually this area is currently considered an "eye sore" because of the nature of its operations.

Other areas with little landscaping include the entrance to the airport at Queen Kaahumanu Highway, the airport access road and the foot of the access road.

Protective barriers to reduce the effects of jet blasts are currently being used. These barriers consist of rock walls and dense landscaping on the terminal side.

The terminal complex contains structures made mostly of wood. The "hut-like" design of these structures gives the viewer the impression of a tropical village. The buildings contain few walls and thus take advantage of the natural breezes for air circulation.

New structures that have been added to the airport are made of concrete block and metal and do not complement the wooden structures. However, because of the function of certain operations (e.g., hangars), the use of metal structures is more practical.

A. Impacts

The natural state of the lava fields will be obliterated by the proposed expansion of the Keahole Airport. The lava fields within the expansion area will be covered with buildings, roadways or pavement.

B. Mitigation Measures

An overall design theme reflecting a Hawaiian Island setting will be utilized. Some of the architectural design characteristics will be maintained by using wood shake roofs and lava rock walls. Landscaping along the front of the new 2-story terminal will screen the sheer size of this structure. Gardens similar to those in the existing terminal facilities will be incorporated in the new terminal complex.

To create a more pleasing visual environment for users of the airport and related facilities, landscaping will be used. Enhancement is proposed at the entrance to the airport, along the airport access road including the medial strip and the area at the foot of the airport access road.

The new parking lot should follow the same landscaping concept used for the existing parking lot.

Rock walls and internal landscaping as protective barriers from jet blast should be incorporated.

The use of landscaping to screen unattractive areas such as the ground transportation service and maintenance buildings will enhance the overall appearance of the airport proper.

3.10 HISTORIC AND ARCHAEOLOGICAL RESOURCES

With the development of the Keahole Airport, much of the lands within the airport boundaries have been altered. As a result, sites of historic or cultural significance have been obliterated or removed, e.g., the Kings

Highway. There is a petroglyph field east of the public parking lot that has been preserved in its natural state.

An archaeological survey was performed for the expansion areas of the Keahole Airport. A total of six sites were discovered in the southeast portion of the proposed expansion. Three of the sites lacked associated cultural materials and are significant only for their information content which have been recorded and documented in Appendix E, making them no longer significant.

The three remaining significant sites consisted of habitation caves and a large lava tube. One of the habitation cave sites had lava tubes extending 10 meters in two directions. The entrance had an arrangement of stones forming a stairway leading down to a living area. A second habitation cave was found measuring 5 by 6 meters and consisted of a low lava tube extending west of the main chamber with a pile of rocks at the entrance for ease of access. The largest site was a lava tube extending approximately 300 meters. This lava tube contained two entrances where the roof had collapsed. One of the entrances consisted of a crude wall immediately inside the overhang. The other entrance had four petroglyphs containing lettering.

A. Impacts

All of the sites found are located within the area planned for expansion of the Keahole Airport and will be affected during construction.

B. Mitigation Measures

Three of the six sites have been recorded and are no longer significant. The three remaining sites will undergo archaeological data recovery. The habitation cave containing the stairway will be archaeologically excavated to retrieve any scientific information prior to construction. The second habitation cave will require mapping and a further check for

cultural remains in the low lava tube. The large lava tube will be mapped and archaeologically excavated and filled during construction.

None of the sites warranted preservation according to the Hawaii and National Registers of Historic Places.

SECTION 4

Impacts on the Socio-Economic Environment

SECTION 4
IMPACTS ON THE SOCIO-ECONOMIC ENVIRONMENT

4.1 HUMAN SETTLEMENT PATTERNS

Residential development in the vicinity of the airport has been limited since the development of the airport in 1970. The most recent development was the Keahole Agricultural Park, located east of the Queen Kaahumanu Highway, which was completed in 1985. The Agricultural Park consists of 2,608 acres divided into 5-acre and 15-acre lots. The construction of a single-family residence by each lessee is allowed in the agricultural park.

The next closest area of residential development is the Kona Palisades Subdivision located east of the Queen Kaahumanu Highway. The closest home currently to the Keahole Airport (Terminal Building) is approximately 1.8 miles away.

Other built up areas to the south include the Kaloko Industrial Park and the Honokohau Harbor which are 3.4 miles and 3.9 miles, respectively, away from the airport.

A. Impacts

Expansion of the Keahole Airport will not affect the existing human settlement pattern. However, future residential development in areas exposed to noise levels of Ldn 60 or greater should not be permitted.

4.2 POPULATION CHARACTERISTICS

In the past three decades the entire State of Hawaii has seen a near doubling of its population. Of the four counties, Maui has experienced the most dramatic change in population, followed by the Island of Hawaii. Oahu still has the largest number of people, however the percentage change in population has been greater on the neighbor islands.

Population changes within the various districts on the Island of Hawaii are shown in Table 4-1. Of the nine districts on the island, all but three

TABLE 4-1

POPULATION BY DISTRICT, HAWAII COUNTY

DISTRICT	YEARS 1960	1970	1980	1984	PERCENT CHANGE 1960-70	1970-80	1960-80
PUNA	5,030	5,154	11,775	6,530	2.5	128.5	134.1
S. HILO	31,553	33,915	42,320	44,301	7.5	24.8	34.1
N. HILO	2,493	1,881	1,691	1,576	-24.5	-10.1	-32.2
HAMAKUA	5,221	4,648	5,146	5,192	-11.0	10.7	-1.4
N. KOHALA	3,386	3,326	3,256	3,403	-1.8	-2.1	-3.8
S. KOHALA	1,538	2,310	4,607	5,972	50.2	99.4	199.5
N. KONA	4,451	4,832	13,898	18,226	8.6	187.6	212.2
S. KONA	4,292	4,004	5,809	6,730	-6.7	45.1	35.3
KAU	3,368	3,398	3,704	4,473	0.9	9.0	10.0

SOURCE: State Data Book, 1985, State of Hawaii, Dept. of Planning and Economic Development. Hawaii County General Plan (Preliminary Draft), May 1986, County of Hawaii, Planning Department.

showed an increase in population. The district with the most significant change was the North Kona district which had a 212.2 percent increase in population since 1960. The most dramatic rise in population was during the period between 1970 and 1980.

The North Hilo, Hamakua, and North Kohala districts had declines in population which were due, in part, to the decline in the sugar industry and closing of sugar mills.

The future population of the State of Hawaii and of the individual counties has been estimated by the Department of Business and Economic Development. Demographers estimate that the State will increase in population by 35.2 percent between 1980 and 2005. The population of the Island of Hawaii is expected to grow at the same rate.

The County of Hawaii Planning Department has also projected the County's population growth using different assumptions. These projections are shown in Table 4-2. By comparison, the projections made by the Department of Business and Economic Development are conservative.

The County of Hawaii has also made population projections for the Kona and Kohala districts (see Table 4-3). These projections are based on three development scenarios ranging from limited development in the district, to significant expansion of visitor accommodations which is expected to spur population growth in the districts.

Based on comparative figures for the entire State, residents of Hawaii County have median incomes below that of the other counties in the State. Unemployment figures for 1980 suggest that the rate of unemployment for the County of Hawaii is higher than the State average. In contrast to the entire Island of Hawaii, the North and South Kona districts have significantly lower unemployment rates (5.2 percent and 5.7 percent) than the rest of the counties.

TABLE 4-2

POPULATION PROJECTIONS - HAWAII COUNTY GENERAL PLAN

YEAR	DPED PROJECTION	SERIES A*	SERIES B**	SERIES C***
1985	109,000	106,000	106,000	106,000
1990	122,600	122,000	124,000	129,000
1995	134,600	138,000	148,000	167,000
2000	143,200	155,000	180,000	212,000
2005	147,600	173,000	180,000	258,000
Percent Change 1985-2005		63.2	104.7	143.5

* Assumes modest growth (2 percent/year).
** Assumes modest growth (3.7 percent/year).
*** Assumes optimistic growth (4.7 percent/year).

SOURCE: Hawaii County General Plan, Preliminary Draft, May 1986, County of Hawaii, Planning Department.

TABLE 4-3

ALTERNATIVE KONA-KOHALA POPULATION PROJECTIONS
(1980-2000)

YEAR	ALTERNATIVE I*		ALTERNATIVE II**		ALTERNATIVE III***	
	KONA	KOHALA	KONA	KOHALA	KONA	KOHALA
1980	20,000	8,000	20,000	8,000	20,000	8,000
1985	23,800	12,900	24,900	11,700	26,200	10,400
1990	27,100	20,700	30,100	17,600	32,900	15,300
1995	30,200	30,400	35,000	25,900	39,900	22,200
2000	33,200	39,400	39,400	32,000	46,300	28,200

* Assumes no additional Kona hotels, additional Kona resort condos, and existing planned development projects.
** Assumes complete Keauhou hotel development, additional Kona resort condos.
*** Assumes significant expansion of visitor accommodations in Kona.

SOURCE: Kona Regional Plan (Draft), Hawaii County, Planning Department, Table IX-19, 1982 (Revised).

A. Impacts

Population growth for this area will indirectly increase because of direct and indirect employment opportunities created by the expansion of the airport.

B. Mitigation Measures

Additional residential housing may be needed to accommodate this expected growth in population.

4.3 ECONOMY

4.3.1 Business and Employment

Business and employment trends in the Kona area can be characterized as having moved from a principally agriculturally based employment center to one where the visitor industry is the largest employer. In 1950, 52 percent of the employed persons listed their primary employment as being in agriculturally related fields. By 1970 the employment characteristics of the area had changed dramatically. Service related employment, primarily the visitor industry, had increased from 8.2 percent of the work force to 17 percent. The agricultural industry declined from 52 percent to 8.6 percent of employed persons.

The change in employment characteristics of the work force is shown in Table 4-4. Other employment sectors that showed increases were the construction industry and wholesale/retail trades. The growth in these industries can be associated with the increased activity in the visitor industry.

4.3.2 Tourism

Until recent times the primary economic activity in the Kona area was agriculture. As noted previously, more than 50 percent of the work force was employed in the agriculture industry.

By the 1970's the importance of the agriculture industry and the visitor industry had reversed. This section describes the major features of the visitor industry and its impacts on the Kona area.

TABLE 4-4

EMPLOYMENT BY INDUSTRY IN KONA*
(Percent of Work Force 1970-1980)

INDUSTRY	1960	1970	1980
Construction	6.8	19.6	17.4
Manufacturing	3.6	2.6	1.1
Transportation	0.9	3.7	3.9
Communication/Utilities	0.6	2.0	4.0
Wholesale/Retail Trade	8.3	11.2	11.3
Finance/Insurance/Real Estate	N/A	3.3	7.1
Business/Repair Services	0.6	2.0	16.2
Personal Services	8.9	17.0	15.2
Health Services	6.2	2.4	--
Education	4.5	5.6	--
Other Professional Services	1.2	2.9	--
Public Administration	1.9	3.5	--
Agriculture	37.5	8.6	8.2
Others	24.5	15.6	15.7
TOTAL EMPLOYED/JOBS	3,859	3,886	8,000
TOTAL POPULATION	8,743	8,836	19,707

*KONA = North and South Kona Districts.

SOURCE: Kona Regional Plan (Draft, November 1983), County of Hawaii, Planning Department.

4.3.2.1 Visitor Accommodations

During the past 15 years, the number of visitor accommodations in the State increased by 146 percent. This number represents an increase of 39,385 units from 1970 to 1986. The Island of Maui had the most dramatic increase in hotel units, a 414 percent increase, followed by Hawaii and Kauai, and finally Oahu.

In terms of visitor accommodations on the Island of Hawaii, the Kona area has the greatest concentration of units, representing 61.7 percent of all the island's units (see Table 4-5) and is followed by the Waimea-Kawaihae-Kohala area. These two areas combined represent 80+ percent of the 7,280 units for visitor accommodations on the Island of Hawaii. Table 4-5 also shows the type of units available for short term use. Of the 7,280 units, 71.8 percent of the units are hotel units with the remaining representing resort condominiums.

The average occupancy rate for the island was 57.6 percent for calendar year 1985. By comparison, the hotels in Waikiki posted average annual occupancy rates of 80.8 percent for the same period. Maui averaged 78.5 percent, with Kauai showing 69.7 percent. While the visitor accommodations on the Island of Hawaii are on the increase, it appears that the Island of Hawaii is not yet a strong competitive alternative to Waikiki or West Maui.

4.3.2.2 Visitors (Past and Projected)

The State Department of Business and Economic Development and the County of Hawaii both project that statewide tourism will continue to grow through the year 2005. These projections show growth from an estimated 4,000,000+ visitors in 1980 to 8.183 million in the year 2005. Table 4-6 shows visitor projections to the year 2005 and also presents an estimate of the average daily visitor counts.

If planned developments are any indication of future tourism growth in Hawaii, then the development market is planning to meet the expected growth demand. In 1986, the planned visitor industry plant inventory included

TABLE 4-5

UNIT TYPE BY AREA - HAWAII

DISTRICT	NO. OF UNITS	% HOTEL	% CONDO	% OF ISLAND
HILO-HONOKAA	1,323	89.8	10.2	18.2
NAALEHU-KAU	48	27.1	72.9	0.7
VOLCANO	37	100	0	0.5
WAIMEA-KOHALA	1,383	90.9	9.1	19.0
KONA	4,489	60.9	39.1	61.7
TOTAL	7,280	71.8	28.2	100.0

SOURCE: Visitor Plant Inventory, Hawaii Visitor's Bureau, Feb. 1986.

TABLE 4-6

STATEWIDE VISITOR INDUSTRY PROJECTIONS (1982-2005)
(Thousands)

YEAR	VISITOR ARRIVALS	VISITOR CENSUS	AVERAGE HAWAII COUNTY ESTIMATE
1982	4,243	105	N/A
1985	4,884	124	837
1990	6,083	156	1,096
1995	7,052	179	1,337
2000	7,786	198	1,485
2005	8,183	208	1,553

SOURCE: State Data Book, 1985, State of Hawaii, Dept. of Planning and Economic Development.

34,286 planned hotel units and 26,794 condominium units. Of this total less than 10 percent were expected to be completed by 1987.

Of the four counties in the State, the County of Hawaii, particularly West Hawaii, accounted for approximately 43 percent of the planned hotel units and 57 percent of the planned condominium units. There are currently 35 projects in West Hawaii that are in varying stages of planning and development. If all of the currently planned projects achieve fruition, then West Hawaii can anticipate having accommodations for approximately 70,000 persons (based on average party size of 1.85 persons [HVB, 1985]) - perhaps by the year 2010. However, it is probably unrealistic to expect that all of these planned projects will, in fact, be implemented. Nevertheless, the expected increase in visitor plant inventory along with planned residential developments will result in major increased demands on many services and facilities, the Keahole Airport being one of them.

A. Impacts

Expansion of the Keahole Airport will create a variety of jobs. Short term construction employment and indirect construction related employment will add to the island's economy during the course of build-out. An estimated 2,053 direct and 3,592 indirect construction related jobs will be generated.

Long term permanent employment for airport related and airport support facilities will be generated.

More visitors are expected because the airport will be able to accommodate additional flights. The attraction of more visitors will also result in added employment in the visitor industry.

SECTION 5

Impacts on Public Facilities and Services and Airport Support Utilities

SECTION 5
IMPACTS ON PUBLIC FACILITIES AND SERVICES AND AIRPORT SUPPORT UTILITIES

5.1 ACCESS, CIRCULATION AND PARKING

5.1.1 Access

5.1.1.1 Queen Kaahumanu Highway Intersection

Access to the Keahole Airport is off of the Queen Kaahumanu Highway which extends from Kailua to Kawaihae. The highway is 24 feet wide (one 12-foot lane each way) within a 300-foot right-of-way.

Traffic counts made at the intersection of Queen Kaahumanu Highway and the airport access road by the Department of Transportation are shown in Table 5-1.

Based on current operating conditions on the highway, the existing capacity of the highway is estimated at 2,500 vehicles per hour. During peak hour conditions, the highway has adequate capacity to accommodate current usage.

5.1.1.2 Access Road

The airport access road is a 24-foot wide roadway with 10-foot wide shoulders along both sides. The access road has a design speed limit of 45 miles per hour and stretches 3,050 feet from the Queen Kaahumanu Highway intersection to the airport site. There are no facilities for exclusive pedestrian or bicycle use.

The existing accessway is adequate for current demands. During emergencies, service roads at both ends of the runway or unpaved roads (used during construction) from Queen Kaahumanu Highway may be used for airport access.

5.1.2 Traffic Circulation

Vehicles entering the airport from the Queen Kaahumanu Highway travel along the two-lane access road to the terminal facilities. Upon reaching the public parking area, the roadway becomes a one-way system. This peripheral road has two 12-foot wide lanes with a speed limit of 15 miles per hour.

TABLE 5-1

24-HOUR ACCUMULATION TRAFFIC COUNT
(1976-1984)

DATE	PLAN SEGMENT						TOTAL
	A	B	C	D	E	F	
4/76	1,594	1,581	858	851	992	1,012	3,444
8/78	2,304	2,233	1,127	1,183	1,516	1,531	4,947
4/80	2,107	2,113	775	643	1,455	1,581	4,337
4/82	2,707	2,549	1,487	1,520	1,696	1,821	5,890
8/84	3,484	3,607	1,966	1,945	2,333	2,371	7,923

A = South leg bound to Kailua.
B = South leg bound to Kawaihae.
C = North leg bound to Kawaihae.
D = North leg bound to Kailua.
E = West leg to the airport.
F = West leg leaving the airport.

SOURCE: Department of Transportation, Highways Div., 1986.

The traffic pattern appears to be satisfactory with smooth vehicular movement during average concentrations. Queuing occurs at the loading areas and intersections during periods of aircraft arrivals and departures.

5.1.3 Parking Facilities

Parking at Keahole Airport is provided for the following users: employees, buses and limousines, taxi, public, and curbside. Provisions for each are described below.

There are five areas for employee parking: adjacent to the maintenance building (30 stalls), south end of public parking area (26 stalls), and north end of public parking (26 stalls), adjacent to the crash/fire/rescue building (11 stalls), and adjacent to the tower (18 stalls). In addition, employees currently use 60 stalls in the public parking area.

There are a total of four areas for bus and limousine parking, one each at both ends of the terminal adjacent to the baggage claim areas. Bus parking is limited to a total of 12 stalls while limousine parking is limited to 8 stalls.

There are eight stalls reserved for taxi operations. They are located adjacent to the baggage claim areas. In addition, taxi parking is designated towards the north end of the public parking area. Currently, taxi operations are limited to a single operator.

Public parking is provided via an airport concessionaire. The public parking lot can accommodate 300 vehicles. As previously noted, 60 stalls are used for employee parking. The public parking lot is used for short-term parking (less than 3 hours) and long-term (overnight) parking. Currently, the parking lot is generally full during peak periods and long holiday weekends.

A. Impacts

The existing access road, circulation roadways and parking facilities are inadequate to service the projected demands for the expansion of the airport.

B. Mitigation Measures

Projected capacity at the intersection of the airport access road and the Queen Kaahumanu Highway indicates a need for traffic signals prior to the summer of 1994.

The airport access road will be increased from a two-lane roadway to a four-lane roadway divided by a median strip before the year 2004.

The peripheral road between the public parking area and the proposed employee parking area will be increased from two lanes to four lanes. The peripheral road fronting the terminal will be widened to five lanes. The five lanes will be separated by an island into three and two-lane roadways. The two lane segment adjacent to the public parking will be designated for bus, taxi and limousine parking, and baggage truck loading zone and through traffic.

An additional 540+ public parking spaces will be added adjacent to the existing public parking. A new employee parking area has been sited to the east of the public parking. A total of 290 employee parking stalls will be provided.

5.2 POTABLE WATER SUPPLY

The proposed expansion of the airport will require peak hour demand rates of roughly 1.4 mgd. As airport flow rates fluctuate greatly during the day, peak to average flow ratios can be as large as a factor of 10. The existing 12-inch line servicing the airport is adequate to carry the projected flows during peak or fire conditions and will be extended to

cover the new terminal facilities. Additional 8 and 12-inch water lines will be used to serve the remainder of the proposed development parcels. There will be continued use of the existing off-site transmission and storage facilities, maintained by the Hawaii County Department of Water Supply (DWS). Source water is obtained from four wells and an underground shaft south in the Kahaluu area.

A. Impacts

The existing water transmission links along the Queen Kaahumanu Highway are adequate, however, some source water development may be required. It should be noted that the demand for source development is shared by all projects planned for the northern Kona area. The "Hawaii County Water Master Plan," prepared in 1980 indicates an abundance of groundwater.

For the immediate needs of the expansion, there will be the impact of increased draws on the water system. In addition, there will be some impacts from the future construction of pipelines and appurtenances off the airport site during regional water system upgrades (by the Hawaii County DWS).

B. Mitigation

Until additional sources are on-line, airport water use guidelines should be established for flow monitoring and regulation. Fixture designs should include flow restriction devices to avoid waste of this valuable resource. Future off-site facilities will be phased in on an as needed basis. Such phasing will allow smoother transitions between construction projects. Effluent reuse for irrigation will reduce potable water demands.

5.3 WASTEWATER TREATMENT AND DISPOSAL

The proposed sewerage system will consist of gravity collection pipelines, a sewage pump station (SPS), and a sewage treatment plant (STP). The peak sewage generation rate is estimated at about 1.2 mgd. The gravity system will be used to collect sewage from all airport facilities. Pumping will be necessary to convey sewage from the terminal area to the treatment plant

located to the north. The treatment plant will be designed for secondary treatment and will dispose the effluent into injection wells approximately 30 feet deep. A portion of the treated effluent can be used for irrigation of airport landscaping.

A. Impacts

Since the new sewerage system will be self contained, no impacts will result on local municipal systems. The treated effluent will be diluted with the groundwater and be naturally filtered and purified prior to eventual migration to the ocean. No significant impacts are anticipated to Class AA coastal waters.

Without proper maintenance of the treatment plant saturation of the underlying basalt may occur and some odors will be generated. Therefore, proper maintenance of the treatment plant is necessary to insure no odor or injection well clogging problems.

B. Mitigation Measures

Most of the treated effluent will be dispersed over a wide area through effluent reuse irrigation systems. This will reduce leachate build-up concentration levels and maintenance requirements, thereby extending the life of the injection wells. Effluent spray contact with humans can be minimized by providing sufficient landscaped buffer zones that use potable water.

A program of groundwater monitoring and coastal water quality may be executed prior to STP development to ensure compliance with applicable water quality standards and to establish baseline data on water quality.

Because of the relatively small requirements of the sewage treatment plant a prefabricated package type treatment plant will be developed. Plant maintenance may be contracted to a private operation contractor specialized in maintaining private sewage treatment facilities. Periodic inspections by qualified State personnel should also be conducted. The closest development to the STP will be the new terminal facilities, located approximately 0.5 miles to the south offering sufficient buffer space for the dispersal of any odors.

The sewage pump station will be a buried package facility. Odors are not anticipated in the vicinity from a properly designed and maintained SPS facility.

5.4 STORM WATER DRAINAGE

The existing drainage system at the airport performs satisfactorily as a result of favorable geologic characteristics. Layers of basalt lava rock cover most of the area, making for excellent infiltration and subsurface flow conditions. The present system of dry wells, swales, and culverts is planned to be expanded as more areas are developed. There is no municipal drainage system in the area.

A. Impacts

There are no defined waterways of any kind in the area which will be disrupted by the proposed expansion. Collected runoff will be disposed of in deep pits. The airfield and terminal improvements will significantly increase the amount of impervious area thereby increasing the amount of runoff.

Adequate drainage is available in the surrounding terrain, so the increased runoff generated from the airport facilities will be accommodated resulting in no impacts on adjacent developments (HOST Park and NELH).

B. Mitigation Measures

Dry wells are proposed along with a collection system for the disposal of on-site generated runoff. The quantities of runoff disposed by these new dry wells are estimated to be 10 cfs per dry well. Runoff entering from off-site areas will be diverted around the development (if necessary) by perimeter swales. The terminal and airfield drainage facilities will be designed to accommodate 5-year storm intensities. Other measures proposed include the preparation of guidelines for the prevention of chemical and fuel spills and guidelines for the general safety of the public with respect to the various drainage facilities.

5.5 POWER AND TELECOMMUNICATIONS

The offsite power system is maintained by the Hawaii Electric Light Company (HELCO). A substation, located at the intersection of the Airport Access Road and Queen Kaahumanu Highway, will be used to provide electrical power for the expanded airport facilities. Source transmission is via a HELCO 69KV overhead line along the Queen Kaahumanu Highway. The current capacity of the HELCO system is 127MW with peak demands reaching 102MW.

On-site airport power and communications links consist of underground ducts along the airport access and circulation roads. Emergency back-up generators and additional electrical and telecommunications switching facilities will occupy the electrical control building, near the control tower. This building will need some improvement to accommodate the additional back-up power generators.

A. Impacts

The proposed improvements will place additional demands on the HELCO power system. No other significant impacts are anticipated.

B. Mitigation Measures

Improvements to the off-site electrical system will be performed as necessary by HELCO as part of their regional system upgrades.

5.6 LIGHTING SYSTEM

The proposed airfield and terminal lighting system at the airport will be expanded significantly to illuminate the longer runway and added terminal buildings and parking lot. The airfield will utilize high intensity white/yellow edge lighting along the runway (HIRL) and medium intensity blue lighting along the taxiways (MITL). Flashing approach lights are proposed along the extended runway centerline about 2,500 feet off each end of the runway (MALSR). Bright omni-directional runway end/threshold lights will be used to alert pilots of their location in relation to the runway ends. Red and green beams of light are used to inform incoming aircraft of their approach slopes (VASI). A rotating green/white civil airport beacon on top of the control tower will also be operating. Parking lot lighting will utilize overhead lamps suspended on aluminum poles.

A. Impacts

There will be some impacts as a result of the increased amount of airport lighting. The electrical demand from lighting is estimated at 60KW. This will impact the HELCO power system servicing the airport.

Airfield approach lighting facilities will be located at various sites far from the airport proper. Disturbance of the terrain will occur in isolated patches off both ends of the runway. Light emitted from these facilities may cause some visual impacts, as they may contrast with the presently undeveloped surroundings.

B. Mitigation Measures

There are no proposed mitigation measures for the proposed airfield lighting facilities. The clear visibility of these facilities from their intended directions is essential for their function and for the safety of aviators. Terminal and parking lot lighting will utilize glare shields to reduce the amount of stray light.

The electrical power demands of the lighting facilities (and the remainder of the airport expansion) will need to be coordinated with HELCO for review of necessary regional system upgrades.

5.7 FUELING SYSTEM

The fueling system will consist of a system of underground pipelines, refueling hydrants, fueling service pits, and two bulk fuel storage and pumping facilities. Two systems will be separately installed: one for air carrier users and one for general aviation, commuter, and helicopter users. The air carrier system will utilize a hydrant fueling system, with fuel pumped from the bulk storage area directly to hydrants beneath the air carrier apron. Location of the fuel storage area for this system will be adjacent to the sewage treatment plant, about 1 mile north of the existing terminal. In the second system, fuel will be pumped to two fuel service pits: one located in the general aviation apron and one located at the heliport. The location of the second fuel storage area will be near the existing maintenance facility.

A. Impacts

The impacts resulting from the expanded fueling facilities include possible contamination of groundwater and coastal waters from accidental leaks and spills. In addition, increased traffic from fuel trucks will result from the need to maintain the required fuel storage levels.

B. Mitigation Measures

Possible solutions for these impacts involve design and construction of the fueling system. Storage tanks may be constructed above ground, with impermeable concrete foundations designed to contain any spillage. Pipelines may be installed with flexible couplings or joints to account for some of the possible seismic movements. Improvements to the airport access and circulation roads will facilitate the delivery of fuel by large trucks.

5.8 POLICE SERVICES

The Keahole Airport has its own security force which consists of police officers contracted from Hawaii County and terminal security guards who are contracted from Freeman Guard Service. In addition to these services, security screening is provided at the departure gates. These guards are contracted by the airlines.

A. Impacts

The present security force is inadequate to accommodate the expanded airport facilities.

B. Mitigation Measures

Keahole Airport will need to contract more police officers and security guards to maintain the security of the airport. Additional security screening guards at the departure gates will need to be contracted by the airlines.

5.9 CRASH, FIRE, RESCUE FACILITIES AND MEDICAL SERVICES

Crash/fire/rescue (CFR) facilities at Keahole Airport satisfy requirements for an INDEX C airport as described in Federal Aviation Regulations (FAR) Part 139.49. Major equipment available on-site includes: two fire fighting vehicles with 1,500-gallon water and 150-gallon light water (aqueous film forming foam) capacities and one vehicle with 500-gallon water and 50-gallon light water capacity. The CFR building (Bldg. No. 347), which occupies an area of 5,544 SF, is relatively new and is in good condition. Three shifts of seven, seven, and eight persons plus the CFR chief form a total crew of 23 persons.

Paramedical services are provided by the crash/fire/rescue unit. Ambulances are dispatched from Fire Station No. 7, approximately 9 miles away. The closest hospital (Kona Hospital) is located approximately 20 miles away from the airport.

A. Impacts

There are no significant impacts on the crash/fire/rescue facilities as a result of the expanded airport facilities. The crash/fire/rescue facilities are sufficient to meet the needs of the proposed airport expansion.

5.10 SOLID WASTE COLLECTION AND DISPOSAL

Solid waste collection and disposal is currently contracted with a private firm. Refuse is collected from 8 to 9 dumpsters three times a week and disposed at the Kaloko Sanitary Landfill.

A. Impacts

The volume of solid waste is expected to triple with the development of the proposed facilities.

B. Mitigation Measures

The current practice of trucking the refuse to Kaloko Sanitary Landfill is recommended for future operations. Additional dumpsters should be provided for immediate storage of solid waste.

SECTION 6

Relationship to Plans, Policies and Controls

SECTION 6
RELATIONSHIP TO PLANS, POLICIES AND CONTROLS

6.1 FAA REQUIREMENTS

Construction of the runway extension, new terminal buildings and support facilities requires the approval of the Airport Layout Plan by the Federal Aviation Administration. The proposed Airport Layout Plan is presently being reviewed by FAA for their approval.

6.2 HAWAII STATE PLAN

The Hawaii State Plan was developed to serve as a guide for future development of the State of Hawaii. The Plan identifies, in general, the goals, objectives, policies and priorities for the development and growth of the State. The Plan provides guidelines that will help to complement the overall development of the State and its people.

The proposed expansion of the Keahole Airport is generally consistent with the objectives and policies of the Hawaii State Plan. The following describes the compatibility of the proposed project in relation to the various elements planned for the State of Hawaii.

6.2.1 Population (HRS Section 226-5)

Expansion of the Keahole Airport will help to provide an increase in economic activities and employment opportunities for the North Kona District, Island of Hawaii. This increase in the economy will complement the projected population growth for the North Kona District by providing additional employment opportunities. The expanded airport will indirectly increase population growth because of the increased economic activity.

6.2.2 Economy (HRS Section 226-6 Through 10)

The proposed project will create a variety of employment opportunities that will benefit the economy. Short term construction employment and long term airport related and airport support facility employment will be available.

Expansion of the airport will help to support the growth of the visitor industry by providing additional interisland and overseas flights to accommodate the projected tourist growth. This increase will have a multiplier effect on additional employment opportunities in the visitor industry.

Receipt of Federal funding for the proposed project is probable. The Federal government may pay as much as 90 percent of the construction cost for the proposed runway extension and 75 percent of the terminal expansion.

6.2.3 Physical Environment (HRS Section 226-11, 12, 13)

The airport serves as a major support facility for local residents, resort and high technology developments within close proximity. Expansion of the airport will provide additional support which will encourage future urban development in the vicinity. The effects of noise exposure from aircraft operations, however, will limit certain types of urban development within the Ldn 65+ noise contours.

6.2.4 Transportation (HRS Section 226-17)

The proposed project will promote an efficient and convenient movement of people and goods. The project is designed to accommodate present and future development needs in the community.

6.3 STATE FUNCTIONAL PLANS

The twelve State Functional Plans were adopted by the State Legislature. These plans were formulated to specify in greater detail the policies, guidelines and priorities set forth in the Hawaii State Plan. The twelve functional plans include Energy, Transportation, Water Resources, Historic Preservation, Recreation, Health, Education, Housing, Conservation Lands, Higher Education, Agriculture and Tourism.

The proposed airport expansion helps to achieve some of the goals of the functional plans. Recreation, Education, Higher Education and Agriculture Functional Plans are not directly related to this project and are therefore not discussed.

6.3.1 State Energy Functional Plan

The buildings at the Keahole Airport are proposed to be designed to help conserve energy. The lack of walls in most of the existing structures will be maintained, utilizing the natural breezes for air circulation.

6.3.2 State Transportation Functional Plan

The Keahole Airport Master Plan Report, August 1987, was developed to update the objective of the Statewide airport system. The Master Plan projects expansion and improvements to the year 2005. It also takes into consideration expansion of the airport beyond the year 2005, allowing for ease in future updates of the Statewide airport system.

Major expansion of the Keahole Airport includes the extension of the runway and additional terminal facilities to accommodate interisland and overseas operations. Additionally, the facilities on the airport proper have been reorganized and expanded to provide efficiency in airport operations. This reorganization eliminates the mix of light and heavy aircraft on the apron.

Air cargo facilities have been expanded and combined into one location. Access to these facilities at the base of the access road separates traffic to the air cargo facilities and terminal area. This separate access relieves some of the traffic congestion along the peripheral road.

Public and employee parking facilities, airport access road, ground transportation support facilities and the highway access are also being expanded to accommodate the future aviation demands.

6.3.3 State Water Resources Development Functional Plan

Some of the treated sewage effluent will be used to irrigate the landscaping within the airport proper. Use of treated effluent will help to reduce the demand on the municipal water system.

6.3.4 State Historic Preservation Functional Plan

An archaeological survey was conducted in the areas planned for expansion of the Keahole Airport. The sites found will be recorded and/or archaeologically excavated to retrieve any scientific information of significance. All of these sites lacked significant cultural remains that would warrant preservation.

6.3.5 State Health Functional Plan

A new wastewater treatment facility will be constructed to accommodate the projected demands. Some of the effluent will be used to irrigate the landscaped areas of the airport. The use of treated effluent will help to conserve the potable water supply.

A Noise Compatibility Program was performed to evaluate land use compatibility in the airport environs exposed to noise generated by aircraft operations. Because much of the surrounding lands are undeveloped, the noise compatibility program emphasized measures for maintaining land use compatibility around the airport environs.

6.3.6 State Conservation Lands Functional Plan

The proposed project is situated on State Conservation land. The land consists mostly of barren pahoehoe and aa lava flows. Studies conducted by Char & Associates indicated no rare or endangered plant or animal species in the areas proposed for expansion of the airport.

A petition will be filed with the State Land Use Commission to reclassify the land from Conservation to Urban.

6.3.7 State Tourism Functional Plan

By the 1970's the primary economic activity in the Kona area had changed from the agricultural industry to the visitor industry. The Keahole Airport began operations in July 1970. During the past 15 years, the airport experienced a 365 percent increase in interisland passenger activity. In 1983, Keahole Airport began overseas operations. According to FAA design guidelines, the existing runway is inadequate to accommodate most overseas aircraft at their maximum certificated takeoff weights. Expansion of the facilities will remove this restriction and allow non-stop flights to areas beyond the West Coast.

Expansion of the Keahole Airport will allow air carrier operators to increase the number of interisland flights to accommodate the demands of the visitor industry. Overseas operations can also increase with the added facilities and upgraded airfield requirements. The expanded airport will serve as a major support facility, transporting people and goods, to the growing visitor industry in West Hawaii.

6.4 STATE LAND USE LAW

The proposed Keahole Airport expansion is situated in the State Land Use Conservation District. The State Department of Transportation will petition the Land Use Commission for a District Boundary Amendment to reclassify the property to Urban in order to allow for expansion of the airport. The proposed airport expansion is contiguous to the present Urban District.

6.5 HAWAII COUNTY GENERAL PLAN

The Hawaii County General Plan contains policies for long-range comprehensive development of the Island of Hawaii. Expansion of the Keahole Airport is consistent with the overall objectives of the general plan.

The growing population of the North Kona District and the rapid growth in the visitor industry encourages the expansion of the airport. Present demands result in inefficiencies in the airport operations at Keahole Airport. Expansion of the airport will provide a more efficient movement of people and goods.

With the expansion of the Keahole Airport numerous job opportunities will be created. Short term construction employment and long term airport related and airport support employment will be available. This increase in employment opportunities provides its residents the opportunity for a choice of a variety of occupations.

The site is consistent with the Land Use Allocation Map of the Hawaii County General Plan. The map designates the areas planned for expansion as Industrial use. A County zoning change from Open to General Industrial will be required after the Land Use Boundary Amendment is approved by the Land Use Commission.

6.6 KONA REGIONAL PLAN (DRAFT)

The Kona Regional Plan serves as a guide to implement the goals, policies and standards of the Hawaii County General Plan. The Keahole Airport is located in the Kona region. Expansion of the airport is consistent with the overall objective for the development of this area.

6.7 HAWAII COUNTY ZONING

The existing Keahole Airport is zoned General Industrial by the County of Hawaii. The lands on which the proposed expansion of the Keahole Airport is situated are zoned Open by the County of Hawaii. A zoning amendment to change approximately 212 acres from Open to General Industrial will be sought before proceeding with design and construction of the airport expansion.

6.8 COASTAL ZONE MANAGEMENT/SPECIAL MANAGEMENT AREA (HRS Chapter 205A)

The Keahole Airport is within the Shoreline Management Area. The proposed expansion of the Keahole Airport will not directly impact the coastal resources of the area, nor will the proposed development foreclose access to recreational opportunities. Historic, scenic and open space resources within the airport boundaries are to be preserved, however, they will not be open to the public because of public safety reasons. The Keahole Airport buildings are outside of the tsunami inundation zone.

A Special Management Area Permit will be sought from the County of Hawaii.

SECTION 7

Relationship Between Local Short Term Uses and the Human Environment and the Maintenance and Enhancement of Long Term Productivity

SECTION 7

RELATIONSHIP BETWEEN LOCAL SHORT TERM USES AND THE HUMAN ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

The proposed improvements planned for the Keahole Airport are within lands owned by the State of Hawaii that have been set aside for use by the Department of Transportation for airport purposes. Aside from the areas that are currently developed, the remaining lands on the airport property are in an undeveloped state. The undeveloped lands have been designated Conservation by the State Land Use Commission.

The further expansion of the airport will foreclose the option of developing these lands for other purposes. Because of noise concerns, any other use of airport lands will require close scrutiny to ensure compatibility with airport operations.

The expansion of the airport's runway will limit the types of development surrounding the airport to those that are compatible with airport operations and to those that are not noise sensitive. The expansion of the airport will thus impact upon the zoning of adjacent and nearby properties.

SECTION 8

Irreversible and Irretrievable Commitments of Resources

SECTION 8

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

It is anticipated that the construction of the proposed project will commit the necessary construction materials, energy, human resources (in time), and money. The project development will result in a commitment of land for a long term period. Commitment of land for the proposed action will foreclose certain use options of the land and adjacent lands.

SECTION 9

List of Individuals, Organizations and Agencies Consulted

SECTION 9

LIST OF INDIVIDUALS, ORGANIZATIONS AND AGENCIES CONSULTED

FEDERAL

Department of Transportation

Federal Aviation Administration - Air Traffic Manager

- Airports Division

Department of the Army

Department of the Interior

U.S. Fish and Wildlife Service

Department of Agriculture

Soil Conservation Service

STATE

Department of Land and Natural Resources

Department of Transportation

Department of Business and Economic Development

Department of Agriculture

Office of Environmental Quality Control

State Land Use Commission

Department of Accounting and General Services

The Honorable Virginia Isbell

COUNTY OF HAWAII

Office of the Mayor

County Council

Department of Water Supply

Department of Public Works

Planning Department

Office of Economic Development

INDIVIDUALS AND ORGANIZATIONS

Air Transport Association
Airline Pilots Association
Bank of Hawaii
Big Island Air
The Estate of Pauahi P. Bishop
Chamber of Commerce
First Hawaiian Bank
Hawaii Island Economic Development Board
Hawaii Leeward Planning Conference
Hemmeter Aviation Services
Hertz Rent-A-Car
High Technology Development Corporation
Honolulu Airline Committee
Host International
Huehue Ranch
Kohala Resort Association
Kona Helicopters, Inc.
Kona-Kohala Chamber of Commerce
Kona Palisades Community Association
Mauna Kea Properties, Inc.
Mauna Lani Resort, Inc.
Na Ala Hele
Natural Energy Laboratory of Hawaii
Outdoor Circle
Sierra Club - Moku Loa Group

SECTION 10

List of Preparers

SECTION 10
LIST OF PREPARERS

R. M. Towill Corporation	Bruce T. Tsuchida, Principal-in-Charge Chester Koga, Project Manager Joanne Hiramatsu, Staff Planner Roy T. Tsutsui, Project Engineer Greg Hiyakumoto, Civil Design Engineer
Char & Associates (Flora and Fauna)	Winona Char, Principal
Peat Marwick Main & Co. (Noise)	Donald Maddison, Principal
Parsons Brinckerhoff, Quade and Douglas, Inc. (Traffic)	Julian Ng, Traffic Engineer
J. W. Morrow, Environmental Management Consultant (Air Quality)	J. W. Morrow, Principal
Chiniago, Inc. (Archaeology)	William Barrera, President

SECTION 11
Preparation Notice Comments Received and Record of Public Hearing

SECTION 11

PREPARATION NOTICE COMMENTS RECEIVED AND RECORD OF PUBLIC HEARING

I. Michael Kasser

Please send us a copy of the Waiale Airport environmental impact statement preparation notice to.

I Michael Kasser
P.O. Box 323
Holualoa, HI 96725

HOLUALOA MANAGEMENT CORPORATION
P.O. Box 323 • Holualoa, Hawaii 96725

-EP

State Department of Transportation
Airports Division
Honolulu International Airport
Honolulu, HI 96819

6059

AIR LINE PILOTS ASSOCIATION
HONOLULU AREA SAFETY COORDINATOR
3 Puukani Place
Kailua, HI 96734 Tel (808) 262-8623

March 9, 1988

Mr. Owen Miyamoto
Airports Administrator
Department of Transportation
Airports Division
Honolulu International Airport
Honolulu, Hawaii 96819

Subject: Keahole Airport Master Plan & Noise Compatibility Program (Ref: AIR-EP 88.1331)

Dear ~~Mr. Miyamoto:~~ Owen:

Thank you for the copies of the Master Plan Executive Summary and the Preparation Notice for the Environmental Impact Statement which I received today. They are excellently prepared and most responsive to the needs of the community.

Personally, and also on behalf of the Airline Pilots Association, I offer you my sincere thanks for the opportunity to be a member of your Technical Advisory Committee for these projects. It was a thoroughly enjoyable exerience.

I request to continue to represent the Air Line Pilots Association as a consulted party on the Environmental Impact Statement.

Sincerely,

Capt. James H. Mooney
Honolulu Area Safety Coordinator

6079

COUNTY OF HAWAII

PLANNING DEPARTMENT

25 AUPUNI STREET • HILO, HAWAII 96720
(808) 961-8288

DANTE K. CARPENTER
Mayor

ALBERT LONO LYMAN
Director

TIM LUI-KWAN
Deputy Director

March 14, 1988

Mr. Owen Miyamoto
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

Dear Mr. Miyamoto:

Keahole Airport Master Plan
EIS Preparation Notice

Please be advised that the County of Hawaii Planning Department wishes to be a consulting party in the EIS preparation process.

If you should have any questions concerning this, please contact us.

Sincerely,

ALBERT LONO LYMAN
Planning Director

KK/kb

cc: West Hawaii Planning Coordinator

2637
6784

HAWAII LEEWARD PLANNING CONFERENCE

DIRECTOR'S OFFICE
Apr 7 3 19 PM '88
DEPT. OF TRANSPORTATION

April 6, 1988

Ed Hirata
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

Dear Ed:

I was very pleased to see the EIS preparation notice for the Keahole Airport Expansion.

Because of the urgent need to expand the capacity of Keahole Airport we would like to suggest that you commence design work immediately running the design work concurrently with the EIS. The need for the EIS is a federal one and seeing as there is already an airport on sight we do not believe that the extension of the runway will cause any major environmental problems.

Your serious consideration of our suggestion will be greatly appreciated.

Sincerely,

H. Peter L'Orange
President

HPL:sjs

AIR-4

AIR 8556

April 12, 1988

Mr. H. Peter L'Orange
President
Hawaii Leeward Planning Conference
P. O. Box 635
Kailua-Kona, Hawaii 96745-0635

Dear Mr. L'Orange:

Thank you for your letter of April 6, 1988 concerning the program for the expansion of Keahole Airport.

I see no major obstacle to the preparation of the environmental impact statement for the project. Every effort will be made to assure a minimum of delay in the completion of the design and construction of this important undertaking.

Very truly yours,

Edward Y. Hirata
Director of Transportation

R. M. TOWILL CORPORATION

420 WAIAKAMILO RD • SUITE 411
HONOLULU, HAWAII 96817-4941
(808) 842-1133
FAX (808) 842-1937

Engineering • Planning • Photogrammetry • Surveying • Construction Management • Energy Systems

RECORD OF PUBLIC HEARING
KEAHOLE AIRPORT MASTER PLAN
ENVIRONMENTAL IMPACT STATEMENT

DATE: April 13, 1988
PLACE: Kealakehe Elementary School Cafetorium
TIME: 7:00 P.M.

HEARING OFFICER: Mr. Paul Matsumoto, Commission on Transportation, State of Hawaii

OPENING STATEMENT Mr. Paul Matsumoto:

Good evening ladies and gentlemen. It is now 7:01 p.m. and I hereby declare the public hearing concerning the Keahole Airport Master Plan EIS is now commenced here at Kealakehe School on April 13, 1988 in accordance with the Notice of Public Hearing advertised in the Honolulu Star Bulletin and Advertiser (March 11, 1988) and Hawaii Tribune Herald and West Hawaii Today (March 14, 1988) (See Exhibit A). My name is Paul Matsumoto. I am a Commissioner on Transportation, appointed by the Governor under Chapter 26-19, Hawaii Revised Statutes. I am commissioned by the Director of Transportation to chair this public hearing on his behalf.

The following guests are here tonight: Deputy Director of Transportation, Jeanne Schultz; Owen Miyamoto, Airports Division Chief from Oahu; Frank Kamahele, Airport District Manager from Hawaii; Wally Nishigata and Dean Nakagawa of the Airport Division.

The purpose of this hearing is to comply with Section 91-3, Hawaii Revised Statutes, by affording all interested persons an opportunity to submit data, views or arguments, orally or in writing, with respect to the Keahole Airport Master Plan EIS.

When your name is called, please come forward before the microphone, state your name, address, organization, if any, and interest. Unless you are called to order by me or until your time is up, you may speak freely with respect to the subject matter.

We ask that you limit your testimony to five (5) minutes so that others may have an equal opportunity to be heard. Those who represent large groups or want more time will be given an opportunity to speak further, for a reasonable length of time, after every one else has been given a chance to speak for the allotted five minutes.

In order that the testimonies be kept relevant and material to the issues, we ask that you address yourself to the subject of this hearing.

Written submission will be received at any time prior to April 29, 1988 to the Engineering Branch, Airports Division, Honolulu International Airport, Honolulu, Hawaii 96819.

In order that each and every interested person may be given a fair opportunity to be heard at this public hearing, we request that you observe the following procedures:

If you wish to speak and have not done so already, please enter your name on the sign up sheet together with your address, the organization you represent, if any, and await your turn.

The general agenda for tonight will be as follows: First, Ms. Jeanne Schultz, Deputy Director of Transportation, will introduce the Consultants preparing the EIS for the Airports Division. The Consultant will make a short presentation followed by a 15-minute recess. When we resume, we will then receive your testimonies.

We are here tonight to solicit factual testimonies from you on the EIS. This hearing is not intended to be a popular referendum.

The proceedings of this hearing will be recorded. It is important that you speak into the microphone and clearly state your testimonies. Testimonies should be factual, brief, unemotional, and free of any political references.

We will not get into the details of the Master Plan for the Keahole Airport. Ms. Schultz.

PRESENTATION

Ms. Jeanne Schultz:
Thank you Paul. I would like to introduce the Consultant who has been working on the Keahole Master Plan for the last two years and is now working on the EIS for the Airport. I understand that this EIS will be one of the first for the neighbor island airports and that is Chester Koga; Chester is a senior planner with R.M. Towill Corporation in Honolulu and he is going to take us through a short presentation prior to your opportunity to address the group. Thank you.

Chester Koga, R.M. Towill Corporation

Good evening, my name is Chester Koga with the firm of R.M. Towill Corporation, a planning and engineering firm in Honolulu. I am the senior planner in the planning department. R.M. Towill is a planning and engineering firm based in Honolulu and is locally owned and operated.

We have approximately 130 employees working in various disciplines such as civil engineering, planning and survey.

This evening I would like to present a brief summary of the master plan and some of the components of the master plan. Most of the material that I will be addressing have been presented previously at other public meetings. For those of you who have not had an opportunity to hear what is being planned I hope you find this presentation informative.

Let me first review the overall plan for the airport. The master plan for the Keahole Airport takes into account the planning for the Keahole Airport up to the year 2005.

We are looking at the possibility for major expansion at the airport to accommodate the future growth in the area. Currently the airport is in a state where current runway facilities are inadequate to accommodate large overseas carriers flying DC-10's and 747's and these planes can only land with less than a full load. In cases where they take off from Keahole with a full load of passengers, they are required to fly to Kahului and/or Honolulu to refuel prior to heading out to mainland destinations.

The second item that is being addressed is the need to expand existing terminal facilities. For any of you that have had the occasion to fly out from Keahole to a mainland destination know that United currently shares facilities with Aloha and this is a less than desirable situation. Other kinds of improvements we are looking at is the current ground transportation. The ground transportation area is much too inadequate to meet future needs. We are looking at the possibility of doubling the ground transportation area. Other kinds of things we are looking at include new and expanded general aviation facilities. Keahole is at a point now where there is insufficient and inadequate parking spaces for large corporate as well as private jets. For those of you that may or may not have had an opportunity to use Keahole's helicopter facilities know that we do not now have formal facilities for helicopter operations.

These are just some of the needs that the master plan addresses. Let me run through some of the basic improvements that we are looking at. Let me start first

the runway can accommodate all of the interisland aircraft. It is a little short for overseas aircraft to travel to mid-west mainland destinations. We are proposing that the runway be extended by 4,500 feet to bring the runway length to 11,000 feet. This will allow unlimited potential for takeoffs from Keahole to most mainland destinations - West Coast and as far as Chicago. The extension of the runway also means that we will need to improve some of the taxiways and holding bays. One of the things we included in the Master Plan was, in the event that aircraft use exceed our projections, we have made provisions of setting aside land for a future parallel runway, should aircraft operations exceed current projections.

To support all the aircraft that are being projected terminal expansion is required. Currently we have approximately 1 million passengers we need to accommodate annually. It is projected that passenger projections at Keahole will exceed 4 million by the year 2005. With the arrival of larger aircraft we are planning for new terminal facilities that can accommodate both overseas aircraft as well as interisland planes. This new terminal is proposed as a two story structure where departures will occur from the second level, with ticketing and baggage handling occurring on the lower level. (Exhibit showing terminal facilities).

Right now because the commuter, general aviation parking, and helicopter facilities are located on the northern end of the existing terminal facilities, these facilities will need to be relocated to the south end of the airport. Towards the south end of the airport property the HOST Park project is currently be constructed. New facilities proposed for the south end of the airport include new facilities for general aviation, a heliport facility, and areas for fixed base operators. In addition we are looking at expansion of the ground transportation facilities.

In terms of the development timetable, whenever year one is, which can be within the next one to two years, we are proposing that the runway be extended by 3,000 feet to bring the runway to 9,500 feet. (Note: 3 exhibits, Phase 1, Phase 2 and Phase 3 development plans). Building of additional terminal space, additional public parking space, and an area for general aviation. The development program is sequenced such that within the next 15 years to 20 years all phases of the airport improvements will be in place. In addition to some of the ground facilities, we have provisions to expand the roadway capacity. Right now we have the two lane roadway for entering and exiting the airport. We are proposing the roadway to be increased by an

This generally represents all of the facilities being proposed for Keahole Airport.

In the EIS preparation we have had to look at a number of factors with regard to the development of the airport. In the process of our investigations, we have looked at traffic impacts both within the airport and at the intersection of Queen Kaahumanu Highway. We have also conducted an archaeological study. We do have one historic site, the Mamalahoa Trail, which at one time passed through the airport. Portions of the trail have been destroyed during the initial development of the airport. The trail continues from the HOST Park through the airport and along the shoreline. The remaining portion within the airport will be preserved. Habitation sites have been located within the airport site. These sites will be further researched and findings documented prior to any construction activity.

Other kinds of special studies done for the EIS include an air quality analysis to address what the impact would be with the expanded aircraft operations and expanded traffic activity on air quality.

As part of the Master Plan and EIS process we have also conducted a noise study and a Noise Compatibility Program. Noise contours to examine existing noise conditions and future noise conditions have been prepared. (Note: three exhibits, 1985 Noise Contours, 1990 Noise Contours, 2005 Noise Contours). The bright red portions of the noise contour map (areas where noise level are 75 Ldn or greater) and the yellow portions are where noise levels are 60 Ldn or less. The noise contours indicate the Keahole Airport is in a good location because there are no noise sensitive uses close to the airport. With the expansion of the airport, the noise contours will get larger, but still be away from any existing noise sensitive uses. For those of you who live in this area know that there have been a number of proposals for resort and residential uses to the south of the airport that will be impacted by aircraft noise.

This concludes my presentation. At the break, if you have any specific questions, please come forward and ask them.

RECESS

Mr. Paul Matsumoto:
We will now have a break. If you people desire to continue or otherwise we can have a 10 minute recess. Just to allow persons to prepare questions and testimony, or we can continue and do away with the ten minute recess, do you want to continue?

ED. NOTE: General audience indication to continue.

May I have the sheet of paper that have the names of persons wishing to testify. We have at this time the first speaker, Will Sanburn. Will you state your name and the group you represent.

PRESENTATION OF TESTIMONY

Mr. Will Sanburn, Waikaloa Beach Resorts:

I'm Will Sanburn representing Waikaloa and Developer of Waikaloa Beach Resorts. I have submitted written testimony and will be very brief. I think the airport is located beautifully as far as environmental impacts are concerned and do not think you will have any problems. I would like you to get on with it, plan it, because we are opening a big hotel in Waikaloa in September and our people do not like DC-8's. They want to come from Chicago in 747's, so anything we can do to help you to move it. Move it. Thank you very much.

Written Testimony: Exhibit B.

Mr. Pete L'Orange, Hawaii Leeward Planning Conference:
My name is Pete L'Orange, president of Hawaii Leeward Planning Conference, a non-profit planning corporation represents 38 major investors in West Hawaii starting with Oceanic Properties in Kohala down to MAC Farms in Honomalino. I have been working on this airport expansion since 1983. We did the first feasibility study for expansion and found it very feasible then, unfortunately there was a suit against DOT, Duty Free for some contract violation or questions about minority races so all planning monies from the Federal government was held up. I agree with what Will said and we should move ahead rapidly. There is an airport there, there has been an EIS done when the airport was first built. I don't see any major new issues as far as land use, there may be some traffic and noise thing that need to be addressed but I believe there are relatively minor. I hope that the consultant from R.M. Towill can move ahead, if there are any problems we are willing to help DOT, R.M. Towill, Owen, Jeanne Schultz in any way we can to expedite this because there is a real need and would like to see it move real fast. Thank you.

Mr. Matsumoto: The next person is Noe Whittington.

Ms. Noe Whittington, Kohala Coast Resort Association:

Good evening, my name is Nohelani Whittington with the Kohala Coast Resort Association. (This side of the island, pointing). I would like to read to you an interesting letter I received from the American Embassy in Cartan, Sudan. and it says:

"I'm responding to United's beautiful ad about the Big Island and Kohala Resorts. Believe me when you are stuck in a place like Cartan, Sudan with a desert, no trees and sand storms a picture like the one in House and Garden beckons. In early 1989 my husband and I will be coming from the far east for a new assignment and will be stopping in Hawaii for some rest and recuperation. We are very interested in the Kohala Coast and would like more information." Signed the American Embassy's wife Mrs. John Lawson.

This is just the type of letters we receive on a weekly basis from all over the world and we at the Kohala Coast Resorts would just like you to move quickly. Thank you.

Mr. Paul Matsumoto:
We have no other interested person. If this group would like to discuss anything further because we only have three persons signed in. If you have any questions you may ask any one of the resource persons. But you must state your name.

Mr. Al Bell, private citizen:

My name is Al Bell, I moved to Kona in February 1969 My first employment here was working for the architects, the engineers and the contractors building the existing airport. At that time there was a master plan. A beautiful plan for a double runway extending thousands of feet to the north. And also about that time there was an article in Readers Digest of seven places in the world where huge supersonic aircraft which were not even flying yet, some still on the drawing boards, like the Concordia, could fly in and out of Kona over non-populated areas and take off and land over water. And still here 20 years later nothing has happened. I would like to know what happened to those original plans, and why it was stopped right in the middle of it. The same engineers and contractors were building the boat harbor and airport at the same time. All at once everything stopped, half completed. The boat harbor half completed, the airport half completed. This some more of bureaucratic bungling or what happened?

Mr. Paul Matsumoto: You want a little bit of an answer to that?

Mr. Bell: Do you have an answer?

Mr. Matsumoto: We get the experts. . . On my left

Ms. Schultz:
The gentlemen's question should be directed to Owen since I have been a deputy since August and the answer should come from someone who has been around longer.

Mr. Bell:
The writer of that story in Reader's Digest has also suggested that Kona Coast of Hawaii could become a port of entry to the United States from all over the world from supersonic freight planes that could come in here and distribute their goods from here all the way to Chicago.

Mr. Matsumoto: . . . .(unintelligible). . .

Mr. Owen Miyamoto:
May I answer that comment. I was involved in the original planning of the Keahole Airport. In fact I was on the team that was involved in selecting the site, selecting the alignment and taking the measurements that were necessary to do the project that exists today. Yes, the Master Plan as we originally envisioned it did include two parallel runways both 12,000 feet long plus a runway that was 3,500 feet long. The real reason that we never built it all immediately of course was the simple matter of money. All that we could afford and all that we could see at that time was the need to build a 6,500 feet runway for interisland service which was far better than the runway at the old Kona Airport site, which is presently a park today. And that was the only thing we had here in the Kona Coast and so it was a major improvement when it opened. The 6,500 length was selected because at that time the overseas carriers indicated no interest in serving both Hilo and Kona and at that time of course, Hilo Airport had a longer runway and all of the service was going to Hilo and that was the side they would serve. Because they were involved in the financing of the improvements at the Keahole Airport, they indicated a strong a resistance to building anything more than a simple interisland runway, and this is what we built.

I think as we progress with this project, as Chester has indicated to you, work will continue on in phases. It may seem like the gentleman stated, like beaucratic bungling but I think it is just plain good economic sense to build only what you need as the need arises. But as long as you provide enough space and provide for the planning and design so that it can be expanded as the need arises I think we are on the right tract, and I hope you agree to this approach. The resource of the Airports Division are limited and we

have to spread all the monies we earn, primarily in Honolulu, spread it around the entire State to build all of the projects that we want. There are demands for our funds for Kahului, demands for our funds in Lihue airport, and now even on Lanai and Molokai. Lanai, as you have heard, has a major resort development going on there and we are way behind on that project as well so it is our job in the Department of Transportation to try to allocate limited resources and build as the demand indicates. It would be great if we can build the two parallel runways today, both 12,000 feet long, and an international terminal with customs and immigration and all of those things, but Jeanne can comment on that because she is working on a special task force to encourage more international travel to the State of Hawaii. One of the things we need to do is bring more international traffic to the neighbor islands. But again, there is a strong reluctance, at this time anyway, to provide international service to any place except Honolulu. So this is what we have to do and approach it in a very pragmatic and practical standpoint.

Ms. Jeanne Schultz:
I'll comment on the international side. The Director, Ed Hirata, and the Governor are very seriously looking at the international side and what we hope to do is diversify the visitor mix so that we get a larger percentage of international and not be totally dependent on the Mainland U.S. And to do that we have plans that are coming together for HIA in Honolulu but we are also looking at the neighbor islands and we have to deal with the Federal side. We are already talking to them in Washington about additional customs and immigrations people and we are look at a decent longer runway to accomplish this. One of the biggest factors is the marketing side. The foreign international airlines that are currently serving Hawaii are somewhat reluctant to go to another location because they have to duplicate their infrastructure; but there are many European carriers from three different countries that are interested in coming in so this is a special task force that has been set up and I have been working with the Department of Business and Economic Development and also the Dept. of Commerce and Consumer Affairs which has the corporate knowledge for the State when aviation was regulated. So there will be more in the future and it is definitely being taken into consideration for this particular project.

Mr. Paul Matsumoto:
Well, I have been asked again to have whoever wants to speak to please sign your name on the sign up sheet. Please have them sign first, otherwise it is not legal.. . . .

Mr. Gordon Bartch, Private Citizen

My name is Gordon Bartch and I am here as an individual tonite. I own an airplane, a twin engine airplane, and have had it based at the airport for the last 14 years and have been the past president of the Kona Chamber of Commerce 10 years ago, and 10 years ago we believed that the airport was in strong need of development and expansion. There are just two points that I would like to make tonite is the engineering report that was given to us apparently the first phase of the runway extension is 3,000 feet to bring it to 9,500 feet, and I think that aside from the argument that a parallel runway is necessary, we can live with one runway, I do not see a major problem with that. The airplane mix isn't such that it demands two runways, but I do think that the runway should go to 11,000 feet immediately. By the time we get to building it I think the need for it will be very apparent that we need the longer runway.

The other point that I'd like to make is that I'm not sure that we are planning really in depth and far enough ahead and we just got through moving the T-hangars less than 2 years ago and went to some hearing at that time and voiced concern about the runway extension and facilities. There are some of us who would like to build our own t-hangars. It bothered me when the hangars were moved the one hangar went to two hangars an now we are moving them again in such a short period of time. It appears to me this shows great lack of foresight and planning and that could have been avoided with a little imagination. I really think now that the proposed site for the hangars are around the corner, that's fine, and I see four hangars. This could have been avoided. Now, that proposed site there should have provisions made for FBO's to put up decent hangars. The T-hangars are fine for single engined airplanes but are very limited. We already have had to modify the one out here to accept what is considered a light twin. I think with Kona's future we are going to have based here some very sophisticated twin engine airplanes, jets, and those sort of things and we do need some hangar facilities for that, and I think now is the time to make provisions for land space for those hangar facilities. They would be put up with private monies. So those are my two comments. Thank you very much.

Mr. Paul Matsumoto:
Do you want to answer that (to Owen Miyamoto). Lack of money as I understand. Right now you are saying why can't we make it 11,000 feet?

Mr. Bartch: . . . (unintelligible). . .

Ms. Schultz:
This is one of the things we are addressing in this special task force is which neighbor island terminal do we start looking at first and when do we plan for the runway lengthening.

Mr. Bartch: . .(unintelligible). . . .

Mr. Matsumoto:
Your point is well taken. We should check on this. Right now we have Brenda Reynolds.

Brenda Reynolds, Big Island Limousine:
Good evening, my name is Brenda Reynolds of Big Island Limousine Service, ground transportation operators. I'm asking a question, When do you plan to start on this future proposed airport?

Mr. Miyamoto:
The reason I am rather reluctant to talk is because normally public hearings are a chance for you to talk and tell us what you think about it, but I am happy to answer your question.

I think as we went through this whole the master planning process, many of you were part of that planning process. We had several public informational meetings and noted that construction would follow as quickly as possible. We have already selected the project managers for the project so and the design work will be starting real soon. We hope to break ground on some of the work later this year or early next year. But we intend to do the work as quickly as possible. We have already talked to the consultants, is there ways of fast tracking this project, in other words making a lot of things occur at the same time so we can get it completed. The start is not as important as the finish. We want to finish as early as possible, that's our goal.

. . .(unintelligible exchange). . .

Ms. Reynolds:
The other point that comes to my mind knowing what Honolulu has gone through with the expansion, What's going to stop us from growing any further here on the Big Island? We will have the largest Hyatt Regency in the world on this island. By the time the Hyatt is completed we will have more than 4 million people here by 2000. So my point is we have a new resort development just outside of Honokaa, will that stop the airport from expanding further in the future?

Mr. Miyamoto:
The plan that we have here show a total in and out of 4 million by the year 2005, that could be expanded even further. We said that the single runway was adequate for our forecast for the year 2005. Actually even if it were doubled we can get along with a single runway. When we get to that stage we are probably talking about a second runway. The land for a second runway is available so that we can double the capacity very easily for this airport and we can do it as the need arises. If the traffic comes as you are saying it will come I think that the design is such that we can add strings to the pearl necklace that we have here and expand as the traffic grows. The first phase will require only two or three gates 747 gates and that is more than adequate for the hotel rooms currently planned in this area.

Ms Reynolds:
Excuse me but I still have another question. This future plan that you have there how many airlines is it designed to accommodate?

Mr. Miyamoto:
We do not have a specific number, but based on what has happened at Kahului for instance, we could easily handle the number of airlines at Kahului with this plan, and that would be 4 overseas, and three interisland. One of the things that I would like to caution the group as enthusiastic as you are about this project, I hope that you as citizens of this community take a good look at the other needs because I hope that what happended at Maui does not happen here in Kona. And I think you understand what I mean. That is a problem that I'm sorry that I cannot help you with because my special area is airports, but I always get concerned about this because we get a lot of criticism about our planning. As a government bureaucrat I see that problem as a real problem. We have to all get together to tell the county, tell the other state agencies there are other needs besides the airport. You can't get along with only hotels and airports. You needs schools, you need roads, water systems, all of those things and it all takes a lot of effort. And I don't see it yet.

Ms. Reynolds: I agree with you. Thank you.

Mr. Paul Matsumoto: Mr. Phil Towle. Your turn.

Mr. Phil Towle Civil Air Patrol:

I am Phil Towle, acting Commander for the Civil Air Patrol Squadron here in Kona. Our problem is pretty minor in comparison to transpacific, transcontinental traffic.

State throughout all of the islands. We have one plane housed here at Keahole right now in the t-hangar. We have received an appropriation from the previous Administration to provide a new building, new training facilities for us at Keahole. So far we have not been able to find any indication of where it might be. My question may be directed to Mr. Koga of the Towill Corporation. Has there been any consideration for a building for the Civil Air Patrol or who do we contact to find out about what planning there might be, if any for it? We do have an appropriation for it and it is in the Governor's hand right now and we would like to get on with it.

Mr. Miyamoto:
I'd better answer that question, I don't want to put Chester on the spot. Because actually, in our planning we do not plan for specific uses. For instance, we don't plan an area for United Air Lines, we don't plan an area for Big Island Limousine. We just say general areas. The Civil Air Patrol should fit very nicely in our general aviation area, and that's what we intend to do. We are aware of the $250,000 appropriations, but it was made out the the Dept. of Accounting and General Services. That agency was the one that was suppose to build that building for you. We were waiting for them to do that. They said that they were not in the hangar building business and they are new to it so we ended up with the job. We are asking for the funds for that project and it will be part of the plan for general aviation.

I should also answer the comment about the hangars, unfortunately we are going to move the hangars again but the time they were placed there it was never anticipated that we would have that type of overseas traffic and growth in that area. It was bad planning, I'd be the first to admit it because obviously we have to move it for a second time. The location where the hangars are presently is right in the middle of what will become next to a busy airline activity area. So you can see the flag at the left end of the terminal area that indicate the general aviation area. Once we build that we will be out of the way of airline activities. We can place the Civil Air Patrol and provide lease lots for those people who want to build their own hangars and we can develop that area very nicely, free of the congestion of the passenger terminal. Right now, unfortunately the hangars are located in a very congested area right between air cargo and the passenger terminal, a bad spot.

Mr. Towle:
I am still trying to ask, who do we contact to find out about details for this? Who is the source for this, the DOT, Airports Division?

Mr. Miyamoto: I am. I am the one.

Mr. Towle: Here at the airport?

Mr. Miyamoto:
I am with the Airport Administration in Honolulu and we take care of all of the airports throughout the State so we have the responsibility for providing hangar facilities throughout the State. This is one of the programs that we have. The planning for the CAP hangar will be done in Honolulu, but with input from the Kona Squadron of the CAP.

Mr. Towle: That's what we were wondering about.

Mr. Miyamoto:
As soon as we are ready to start the project we will contact you and arrange a meeting here with you in Kona so that we can sit down and get the details of what you need to put in the building.

Mr. Towle:
Do I understand that you will contact us?

Mr. Miyamoto: Yes

Mr. Towle:
I hope not too far in the future. Thank you very much

Mr. Miyamoto: Your welcome.

Mr. Matsumoto:
One more time. Sign your name and speak up. Are there any takers? No takers, Will Sanburn are you willing to talk again?. . . If there others to speak to make it fair? Pete, do you want to say anything else? Anybody else?

CLOSING STATEMENT

Mr. Matsumoto:

Some of you learned more about the Master Plan EIS and may not be ready to submit statements tonight. The State Department of Transportation will continue to accept written statements through April 29, 1988.

If you are not able to complete your written testimony within this period, please call the Department of Transportation for an extension of time. The number to call is 836-6526. I assure you that any reasonable request will be considered. It is the Department's expectation that your testimony will be a valuable addition to the studies which they are conducting.

The staff of the Department of Transportation will weigh the effects of your testimonies and information presented tonight together with factual data they already have.

If it is believed that the data, views, or arguments indicate a necessity for any revisions, these revisions will be made.

We thank you for taking the time to attend and to participate in this hearing.

It is now 7:51 p.m. and I declare this public hearing concerning the Keahole Airport Master Plan EIS is hereby concluded.

Thank you very much.

Respectfully submitted:

Chester Koga

Chester Koga
Senior Planner
R.M. Towill Corporation

Attachments: Written Testimony By Will Sanburn
Notice of Public Hearing

ATTENDANCE

GROUP: LOCATION: DATE:

NAME	ORGANIZATION/ADDRESS	PHONE NO.
Will [illegible]	Waikoloa	
Reginald Reynolds	Big Island Limousine Ser. - D.O.&OF 5560-KL	325-1088
Brenda Reynolds	Big Island Limousine Ser.	" "
Peter Young	PO Box 2665 Kamuela 96743	885-4200
Jim Mooney	ALPA	262 8623
[illegible]	NLPC	2292234
[illegible]	[illegible]	329-7033
[illegible] Whittington	Kohala Coast Resort Assoc	885-4915
Bill Stayton	Kamehameha Schools/Bishop Estate	322-6088
Charles Koga	R.M. Towill	
Frank Kamahele	Airport District Manager	
Mac Whittington	Kohala Coast Resorts Assn.	
Gordon Bartsch	76-6165 Alii Drive Kona	
Phil Towle	Civil Air Patrol PO Box 2307 Kailua 96745	
Al Bell	P.O. Box J, Kealakekua, 96751	

ATTENDANCE

GROUP: LOCATION: DATE:

NAME	ORGANIZATION/ADDRESS	PHONE NO.
Dean Nakagawa	DOT-A / HIA	
David Welhouse	FAA HNL-ADO	
Bob Abraham	Hawaiian Independent Refinery Inc	547-3210
Bob [illegible]	[illegible] Air Terminal	[illegible]-1381
[illegible]	Kailua	——
[illegible]	Office of the Governor	[illegible]
M.H. + Doris Millard	Kona Aviation/KOA	329-4631
[illegible]	[illegible]	[illegible]
Debora [illegible]	National Car Rental - AFO	329-1614
Al Bell	Private	3241555
Bob [illegible]	[illegible] (Ex-[illegible] Kona Tow[illegible])	3265[illegible]
Owen Miyamoto	DOT- Airport Div.	
Joanne Schultz	Dep Director - DOT	
Paul Matsumoto	Commissioner	

DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION

EXHIBIT "A"

PUBLIC HEARING

NOTICE IS HEREBY GIVEN of a public hearing to be held by the Department of Transportation, Airports Division, of the State of Hawaii under the provisions of the National Environmental Policy Act (40 CFR Part 1500-1508) and the Federal Aviation Administration Order No. 5050.4A for the following action at the date and time specified:

DATE: Wednesday, April 13, 1988
TIME: 7:00 P.M.
PLACE: Kealakehe Elementary School
Cafetorium
PROPOSED ACTION: Keahole Airport Master Plan
Environmental Impact Statement

The Department of Transportation, Airports Division, is in the process of preparing an environmental impact statement to assess the impacts of planned improvements recommended in the Keahole Airport Master Plan. The master plan for the airport documents a series of facility improvements designed to accommodate the anticipated increase in passenger and aircraft operations to the year 2005.

The Keahole Airport is located west of Queen Kaahumanu Highway and is approximately 7 miles north of Kailua. The airport property encompasses approximately 4,000 acres of land, of which approximately 743 acres have been leased for other uses. The area currently used for aviation purposes is approximately 1,400 acres.

The major airfield improvements recommended consist of a 4,500 feet runway extension, new and larger holding bays and additional taxiways. The extension of the existing runway will provide an 11,000 feet long runway strong enough to support wide body overseas aircraft. This extension will allow unrestricted overseas service of expected aircraft types. The terminal facilities proposed include facilities for air carriers, public spaces and operational areas. Major terminal facilities recommended include: expanded interisland terminals, overseas terminal, air cargo and mail facilities, air taxi/commuter facilities, heliport, expanded car rental facilities, airport maintenance area, new general aviation area, fuel storage and area for lease by aviation interests. The proposed terminal complex is laid out in a linear pattern which closely resembles the existing facilities. A development program is included in the overall plan.

The Master Plan report is on file at the Airports Division Office, Keahole Airport Manager's Office, and District Office of the Federal Aviation Administration. An environmental impact statement preparation notice is available for public review at the Airports Division Office, Keahole Airport Manager's Office, District Office of the Federal Aviation Administration, and Kailua Public Library. A copy of the preparation notice can be obtained by writing to State Department of Transportation, Airports Division, Honolulu International Airport, Honolulu, Hawaii 96819.

All interested persons are invited to attend. Those persons desiring to testify may register prior to the public hearing at the public hearing site and are encouraged to submit one copy of their testimony.

Attendance at the public hearing is not a prerequisite for submission of testimony. Written testimony which is received by the Airports Division at the above address prior to the public hearing will be included with the transcripts of the hearing and will be considered in the evaluation of the proposed action.

EXHIBIT "B"

WAIKOLOA

April 8, 1988

State Department of Transporation
Airports Division
Honolulu International Airport
Honolulu, Hawaii 96819

Dear Sir:

Subject: Keahole Airport Master Plan
Environmental Impact Statement

As developer of Waikoloa, including Waikoloa Village and the Waikoloa Beach Resort, South Kohala, Island of Hawaii, we would like to compliment the Airports Division on the completeness and general content of the Keahole Airport Master Plan and the Keahole Airport preparation notice. We would like to see the plan implemented as soon as possible.

Our comments are listed below:

1. Phase I (1990) - We strongly urge that Increment 1 and Increment 2 proceed as soon as possible concurrently so that the new terminal and the extended runway will be complete and ready for use at the same time. Strengthening and extension of the runway could proceed at the same time the terminal expansion is moving ahead without either project interfering with the other.

   With the extreme competitiveness in the world tourism market existing today, it is important for West Hawaii to proceed as fast as possible with facilities necessary to receive additional visitors by jumbo jets from as many cities as possible in the United States and even foreign countries. As you know, we are opening the Hyatt Regency Waikoloa with over 1200 rooms in the early fall this year. This hotel will require additional carrier capacity into Keahole. Our guests much prefer wide body direct service.

2. Phase III - Runway Expansion - We suggest that you explore the possibility of combining the additional 1500 feet be added to the runway under Phase III with the Phase I runway extension. Our reason for this is that we feel this relatively small addition would cost considerably less if it were combined with the major extension of the runway thus avoiding duplicate mobilization and other construction costs.

3. Air Carrier Facilities - Boarding Bridges - We note that on page 11 of the Master Plan it is proposed that the inter island terminal facilities will provide for passengers to enplane and deplane by boarding bridges. We would like to suggest that, since the 737's and the DC9's currently being used by the inter island carriers generally have their own boarding ladders, that the need does not exist for boarding bridges. Furthermore, the process as presently done using two doors is considerably faster than using boarding bridges and only one door. Weather at Keahole is generally good with relatively little rainfall. Therefore, we suggest that the present system be retained. If this is done, it would mean saving of money by not having to have the inter island departure area enlarged to a two-story structure and would eliminate the cost of the boarding bridges.

   We note that only two boarding bridges are planned for the overseas aircraft. Additional boarding bridges may be needed as overseas traffic increases.

4. We respectfully ask that Waikoloa Land Company, Suite 2610, Pauahi Tower, 1001 Bishop Street, Honolulu, Hawaii 96813 be added to the list of individuals, organizations and agencies contacted and to be consulted shown in Section 8, Page 28 of the preparation notice.

Again, we wish to congratulate the Airports Division for the fine job in preparing the Master Plan and the preparation notice.

Sincerely,

Willis H. Sanburn
Director of Business Relations

WHS/fn
c: T. Rohr
B. Diffley
B. Hunt

1001 Bishop Street Suite 2610 Pauahi Tower Honolulu, Hawaii 96813 Phone (808) 545-3220 Telex 287147

SECTION 12
Comments Received on Draft EIS

SECTION 12

COMMENTS RECEIVED ON DRAFT EIS

JOHN WAIHEE
GOVERNOR

DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

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

0324k

June 8, 1988

RMT		WES	
DK		BTT	BT
RYK		WD	
REC'D JUN 1			RMTC
GSY		YJK	

JH 6/20

CK

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

Dear Dr. Miura:

Subject: Draft Keahole Airport Master Plan
Environmental Impact Statement (EIS)

The development of larger facilities at Keahole Airport will result in several environmental impacts as discussed in the draft document. We are concerned, in particular, with potential negative impacts to water resources adjacent to the Natural Energy Laboratory of Hawaii and HOST Park. Both facilities depend on the availability of uncontaminated ground and nearshore waters for their success. To protect the large public and private investment in these developments, the expansion program at Keahole Airport should proceed in a manner that carefully preserves water quality from uncontrolled contaminant release and migration, especially from the underground domestic wastewater disposal system and expanded fuel storage facilities proposed for the airport. Impacts should be quantified if possible to permit informed decisions on mitigating measures which should be a part of the approved development plan. The draft EIS treats these measures as suggestions.

Thank you for the opportunity to comment on the draft EIS.

Sincerely,

MAURICE H. KAYA
Energy Program Administrator

MHK/hk

Enclosure

cc: Mr. Dean Nakagawa
Mr. William Bass
Mr. Jack Ruizingh

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819

August 12, 1988

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULT.

IN REPLY REFER TO

AIR-ETS
88.2377

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

Dear Mr. Kaya:

SUBJECT: Keahole Airport Environmental Impact Statement

Thank you for your comments of June 8, 1988 relating to the Draft Environmental Impact Statement for the Keahole Airport.

We have reviewed your comments regarding the potential impacts to groundwater and nearshore waters from the expansion of the Keahole Airport. We share your concerns that the airport expansion not affect the success of the NELH and HOST Park developments. The wastewater disposal system will include secondary treatment of the wastewater prior to disposal. To reduce the total quantity of effluent disposal, we are proposing to use most of this water for irrigation. Because the offshore deep water pipe will be drawing water from depths of 2,000 feet and approximately one mile offshore, we believe that there will be little impact to this water source.

Our conclusions in assessing the potential impact on groundwater and nearshore waters were based on the special study performed for the HOST Park Final EIS of August 1985 which includes the airport site.

The expanded fueling facilities will be contained within a specially designed area to prevent seepage of fuels into the ground.

Your cooperation in the planning of this project is greatly appreciated. Should you have any additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

Owen Miyamoto
Airports Administrator

CK:ws

7853 TOWILL

AIRCOA
AMFAC, INC
BANK OF HAWAII
BEALL CO
B P BISHOP ESTATE
CALIFORNIA KEHALA CORP
CAPE COD INVESTMENT CO
DH REALTY
FIRST HAWAIIAN BANK
GENTRY PACIFIC LIMITED
W H GRIESEMER
HALE KEA FARMS
HAWAII LAND MANAGEMENT, INC
HONOKAHUA MANAGEMENT, INC
HUEHUE RANCH
KAILUA-KONA CHEVRON
KAMEHAMEHA INVESTMENT CORP.
KALIPULEHU DEV INC
KEALAKEKUA RANCH, LTD

HAWAII LEEWARD PLANNING CONFERENCE
PO BOX 635 • KAILUA-KONA, HAWAII 96745-0635

JOHN		WES	
DK		BTT	
RYK		WD	
REC'D JUN 2 ''		RMTC	
GSY		YJK	

June 20, 1988

Dean Nakagawa
State of Hawaii Dept. of Transportation
Honolulu International Airport
Honolulu, HI 96819

Dear Sir:

We have reviewed the Keahole Airport Master Plan Environmental Impact Statement and feel the document adaquately addresses the major environmental issues. We feel particulary pleased with the section on noise and the eight noise litigation measures.

Thank you for the opportunity to comment.

Sincerely,

H. Peter L'Orange
President

HPL:sjs

KEHENA BEACH, INC
LANIHAU PARTNERS, L.P.
LILIUOKALANI TRUST
LYLE ANDERSON
MAC FARMS OF HAWAII, INC
MAHPA, DEV., INC
MAUNA KEA LAND CORP
MAUNA LANI RESORT, INC
OCEANIC PROPERTIES
PAUKA RANCH
PUAKEA BAY RANCH
QUEEN'S HEALTH SYSTEMS
R. W. JEROMAU ENTERPRISES
R. W. TOWILL CO
REALTY INVESTMENT
SIGNAL PROPERTIES
TAIYO HAWAII CO., LTD
TRANSCONTINENTAL/RAMOLOA
WEST HAWAII CONCRETE

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT • HONOLULU HAWAII 96819

August 12, 1988

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DIAN T. KOCHI
JEANNE K. SCHULTZ

IN REPLY REFER TO

AIR-ETS
88.2384

Mr. L. Peter L'Orange, President
Hawaii Leeward Planning Conference
P. O. Box 635
Kailua-Kona, Hawaii 96745-0635

Dear Mr. L'Orange:

SUBJECT: Keahole Airport Environmental Impact Statement

Thank you for your comments of June 20, 1988 relating to the expansion of the Keahole Airport.

Your cooperation and continued interest in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

for Owen Miyamoto
Airports Administrator

CK:w5

OFFICE BANK OF HAWAII BUILDING, KAILUA-KONA • PHONE 329-2324

JOHN WAIHEE
GOVERNOR

RMT		WES	
DK		BTT	
RYK		WD	
REC'D JUN 2			PMTC
GSY		YJK	

(P)1581.8

JUN 23 1988

CK 7/11 OTA

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

Dear Dr. Miura:

Subject: Keahole Airport Master Plan
Draft EIS

Thank you for the opportunity to comment on the subject draft EIS dated May 1988.

We note that the future road network in the vicinity of the southern boundary indicates a connection to the adjacent Hawaii Ocean Science and Technology (HOST) Park. We support this item and recommend close coordination between the Department of Transportation and HOST Park staffs.

We recommend that the Department of Transportation contact

Ms. Kari Berg, HOST Park Project Administrator
High Technology Development Corporation
220 South King Street, Suite 840
Phone: 548-8927

during design and construction of the roadway network.

Very truly yours,

TEUANE TOMINAGA
State Public Works Engineer

RY:jk
cc: Mr. Dean Nakagawa
Mr. William Bass Jr.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT • HONOLULU HAWAII 96819

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIDA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

IN REPLY REFER TO

AIR-ETS
88.2385

August 12, 1988

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

SUBJECT: Keahole Airport Environmental Impact Statement

Thank you for your comments of June 23, 1988 relating to the expansion of the Keahole Airport.

We will coordinate with the HOST Park staff during the design and construction phase of the roadway network, specifically the connection to HOST Park.

Your cooperation in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

Owen Miyamoto
Airports Administrator

CK:w5

TOWILL

7892

DEPARTMENT OF PUBLIC WORKS

COUNTY OF HAWAII · 25 AUPUNI STREET · HILO, HAWAII 96720 · TELEPHONE (808) 961-8321

HUGH Y. ONO
Chief Engineer

BRUCE C. McCUNE
Deputy Chief Engineer

RMT		WES	
DK		BTT	
RYK		WD	
REC'D JUN		RMTC	
GSY		YJK	

June 23, 1988

MR MARVIN HIURA
OFFICE OF ENVIRONMENTAL
QUALITY CONTROL
465 SOUTH KING STREET ROOM 104
HONOLULU HI 96813

SUBJECT: KEAHOLE AIRPORT MASTER PLAN - DRAFT EIS
North Kona, Hawaii

Thank you for the opportunity to review the subject document.

We have a question in regards to drainage. On pages 5-7, it is stated that the drywells are estimated to drain 40 to 130 cfs per drywell. What is the basis for this seepage rate? It seems to be on the high side.

HUGH Y. ONO, P.E.
Chief Engineer

DHM:aa

cc: Dean Nakagawa, DOT Airports Div.

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT · HONOLULU HAWAII 96819

EDWARD Y HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCH
JEANNE K. SCHULTZ

IN REPLY REFER TO
AIR-ETS
88.2382

August 12, 1988

Mr. Hugh Y. Ono, P.E.
Department of Public Works
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Ono:

SUBJECT: Keahole Airport Environmental Impact Statement

Thank you for your comments of June 23, 1988 relating to the Draft Environmental Impact Statement for the Keahole Airport.

We have reviewed your comments regarding the drainage improvements and noted that we overstated the drainage flows. The flow rate should be 10 cfs per dry well. Your cooperation and continued interest in the planning of this project is greatly appreciated. Should you have any additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

Owen Miyamoto
Airports Administrator

CK:w5

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

TOWILL
8/28
BT 8/9
CK —
JH —

COPY

In reply, please refer to:
EPHSD

July 6, 1988

MEMORANDUM

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

From: Deputy Director for Environmental Health

Subject: Draft Environmental Impact Statement (DEIS) for Keahole Airport Master Plan, North Kona, Hawaii

Thank you for allowing us to review and comment on the subject DEIS. We provide the following comments:

Underground Injection Control (UIC)

1. The proposed self-contained sewerage system for this project intends to dispose of secondary treated effluent by way of injection wells approximately 30 feet deep. Registration and a permit to operate the injection wells are required by the UIC Program.

2. Additional dry wells are proposed to dispose of storm water runoff. Registration and a permit to operate drainage dry wells are also required by the UIC Program.

   In areas of risk to fuel and chemical spills, precautionary measures must be taken to contain the spills and prevent them from draining into the dry wells or any other areas of drainage into the subsurface.

3. Application for the necessary permits to operate must be made before constructinn of any injection wells.

If you have any questions, please contact the Drinking Water Program at telephone 548-2235.

Wastewater Disposal

1. The Department of Health's preferred alternative to the self-contained sewerage system and injection wells would be to pump the wastewater to the proposed Kealakehe WWTP.

2. If Comment No. 1 is not a feasible alternative, than the self-contained sewerage system and pump station must conform to Section 7, Act 282, SLH 1985.

If you have any question, please call Ted Saito of the Wastewater Treatment Works Construction Grants Branch at 548-4127.

BRUCE S. ANDERSON, Ph.D.

cc: DHO, Hawaii
Mr. Dean Nakagawa, DOT ✓

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT • HONOLULU HAWAII 96819

EDWARD Y HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K UCHIMA
RONALD N HIRANO
DAN T KOCHI
JEANNE K SCHULTZ

IN REPLY REFER TO

AIR-ETS
88.2380

August 12, 1988

Bruce Anderson, Ph.D.
Deputy Director for
Environmental Health
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Anderson:

SUBJECT: Keahole Airport Environmental Impact Statement

Thank you for your comments of July 6, 1988 relating to the expansion of the Keahole Airport. The information you provided with regard to underground injection control and wastewater disposal was helpful and will be incorporated into the Final EIS.

The alternative to the wastewater disposal on site versus pumping to the proposed Kealakehe WWTP was considered the preferred alternative at this time because of the distance to the proposed facility (4 miles). The system as proposed will conform to Section 7, Act 282, SLH 1985.

Your cooperation in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

Owen Miyamoto
Airports Administrator

CK:w5

TOWILL

JOHN WAIHEE
GOVERNOR

Joseph K. Conant
Executive Director

STATE OF HAWAII
Department of Business and Economic Development
Housing Finance and Development Corporation
P. O. Box 29360
Honolulu, Hawaii 96820-1760

IN REPLY REFER TO:

88:PLNG/107B JT

July 8, 1988

RMT		WES	
DK		BTT	BI
RYK		WD	
REC'D JUL 2.		RMTC	
GSY		YJK	

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

Dear Dr. Miura:

Re: Draft Environmental Impact Statement (EIS) for the Keahole Airport Master Plan

JH

We have reviewed the subject draft EIS and have no comments to offer.

Thank you for the opportunity to comment.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dean Nakagawa,
Department of Transportation

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT • HONOLULU HAWAII 96819

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

IN REPLY REFER TO

AIR-ETS
88.2387

August 12, 1988

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

Dear Mr. Conant:

SUBJECT: Keahole Airport Environmental Impact Statement

Thank you for your comments of July 8, 1988 relating to the expansion of the Keahole Airport.

Your cooperation in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

Owen Miyamoto
Airports Administrator

CK:w5

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

REPLY TO ATTENTION OF

Planning Branch

July 12, 1988

RMT		WES	
DK		BTT	DT
RYK		WD	
REC'D JUL		PMTC	
GSY		YJK	

SH

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

Dear Dr. Miura:

Thank you for the opportunity to review the Draft Environmental Impact Statement (DEIS) for the Keahole Airport Master Plan, North Kona, Hawaii. The following comments are offered:

a. A Department of the Army (DA) permit would be required for any fills or structures below the mean high water mark. Figure 2-2 of the DEIS shows that the airport boundary follows the high water mark. Since no work will be conducted below this datum, a DA permit will not be required for the project.

b. Based on the most recent (March 31, 1988) Flood Insurance Rate Maps, the project site is located outside any flood hazard zone.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

Copy furnished:

Mr. Dean Nakagawa
State of Hawaii Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT • HONOLULU HAWAII 96819

EDWARD Y HIRAT
DIRECTOR

DEPUTY DIRECTORS
JOHN K UCHIYAMA
RONALD N HIRAI
DAN T KOCHI
JEANNE K SCHUL

IN REPLY REFER TO

AIR-ETS
88.2386

August 12, 1988

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

Dear Mr. Cheung:

SUBJECT: Keahole Airport Environmental Impact Statement

Thank you for your comments of June 20, 1988 relating to the expansion of the Keahole Airport.

We concur that the expansion area is outside of the mean high water mark and the flood hazard zone.

Your cooperation in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

Owen Miyamoto
Airports Administrator

CK:ws

DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

KAMAMALU BUILDING, 250 SOUTH KING ST., HONOLULU, HAWAII
MAILING ADDRESS: P.O. BOX 2359, HONOLULU, HAWAII 96804 TELEX: 7430250 HIDPED

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

July 20, 1988

MEMORANDUM

TO: Marvin Miura, Director
Office of Environmental Quality Control

FROM: Roger A. Ulveling

SUBJECT: Draft Environmental Impact Statement
Keahole Airport Master Plan, May 1988
Keahole, North Kona, Hawaii

We have reviewed the subject Draft Environmental Impact Statement (DEIS) and offer the following comments for your consideration:

Based on testimony submitted to the Land Use Commission, it is our understanding that the State Department of Transportation has a policy of recommending that no residential or resort condominium units be allowed in areas with noise contours greater than 60 Ldn.

Page 3-10 states that "soundproofing of noise-sensitive structures exposed to aircraft noise levels of Ldn 60 or greater should be a requirement through amendment of the Building Code. Single family or manufactured housing should not be permitted in areas exposed to noise levels above Ldn 70, regardless of the degree of soundproofing". Page 3-9 states that "noise sensitive land uses in areas currently and predicted at Ldn 60 or greater should be prohibited. Noise sensitive uses include schools, churches and residential developments".

The State Department of Transportation has also recommended than an avigation easement should be granted in areas exposed to Ldn 55 or greater rather than Ldn 60 as stated on page 3-10.

The policy of the State Department of Transportation should be clarified in the Final EIS.

Thank you for the opportunity to comment.

[signature]

cc: Mr. Dean Nakagawa ✓
State Airports Division, DOT
Honolulu International Airport

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819

EDWARD Y. HIRATA, DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

IN REPLY REFER TO
AIR-ETS
88.2383

August 12, 1988

Mr. Roger A. Ulveling, Director
Department of Business and Economic
Development
State of Hawaii
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Ulveling:

SUBJECT: <u>Keahole Airport Environmental Impact Statement</u>

Thank you for your comments of July 20, 1988 relating to the Draft Environmental Impact Statement on the Keahole Airport.

The Department of Transportation discourages noise sensitive uses in areas of 60 LDN or greater. However, should such uses be allowed in these areas, every effort should be made to ensure that effective noise mitigation measures are employed and avigation easements are required. Furthermore, there should be a noise disclosure for developments in the 55-60 LDN impacted areas. The Final EIS will further clarify the Department's position.

Your cooperation and continued interest in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

[signature]
Owen Miyamoto
Airports Administrator

CK:ws

University of Hawaii at Manoa

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

July 21, 1988
RE:0502

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

Dear Dr. Miura:

Draft Environmental Impact Statement
Keahole Airport Master Plan
Keahole, North Kona, Hawaii

The Keahole Airport Master Plan incorporates a comprehensive planning study under the Federal Aviation Administration Airport Improvement Program. The purpose of the study was to determine the type and extent of aviation facilities needed at Keahole Airport through the year 2005. In addition, a Noise Compatibility program was prepared for the airport environs. Further, a program to abate and mitigate noise impacts was developed.

We have been assisted in this review by Keith Chave, Oceanography; George Curtis, Hawaii Natural Energy Institute; and Belinda Tilley, Environmental Center. We offer the following comments.

In general most of the environmental issues have been adequately covered in the Draft EIS. However, the wastewater treatment and description of the present settings should be expanded and we offer the following comments on these topics.

Wastewater Treatment: In accordance with the EIS rules, section 11-200-17, 'Content requirements: Draft EIS', a description of the existing sewer collection system and its geographic location in relation to the airport should be included in the Final EIS. In addition, the cumulative effects of multiple sewage discharges from the proposed resort developments on the coastal and ground water in the surrounding areas should be discussed in the Final EIS.

According to Figure 2.2 the sewage treatment plant will be located just north of the main airport complex. However, injection wells should be located well north of the airport to avoid potential contamination of surface water near the Natural Energy Laboratory of Hawaii. The locations of the proposed injection wells should be shown on a map of the site and a discussion of the cumulative risk to the coastal waters should be added to the Final EIS.

Noise: On page 1-4, the year 2005 operations are projected as 52/hour. This would cause large noise contours, as many operations would occur at night since the runway capacity is limited to 60/hour. The state airport plan forecasts 160,000 operations per year in 2005, which equates to 18 operations per hour. This is probably closer to the correct value, with 52 operations per hour as a peak value. (The present peak is 31/hr.) The proposed expansion will not increase the capacity of the runway, but of the balance of the facilities. We understand that the airport expansion will allow flights of fully fueled long range aircraft and that the noise impacts created by these aircraft are expected to be balanced by retirement of older, noisier aircraft, such as DC-9's. Furthermore, we understand that these conclusions are based on minimal measurement data but that the numerical model used is considered to produce conservative results. Unfortunately, the specific analyses (Appendix A) on which these conclusions are based were not included within Appendix D: Final Report, Noise Compatibility Program, Chapter 1. We suggest that these analyses, or a summary thereof if they are voluminous, be included in the Final EIS.

It appears that there may be a major conflict with regard to noise effects on land use near the airport by 2005. The proposed Ooma II and Kohanaiki resort developments cited on page 3-8, include land to be used for residential development which is "an incompatible land use because of the high noise levels generated by the aircraft." The FAA guidelines state that all land uses are considered compatible with noise levels of less than 65 decibels. However, the Ooma resort will experience noise levels of up to 75 decibels (Final EIS Ooma II, September 1986, Figure 15: Gordon Bricken & Associates, 1986). According to the Ooma II report, a longer runway, as is now proposed, should reduce noise impacts to the benefit of surrounding lands. It should allow higher elevations over developed areas and lower thrust from reduced flap angle with increased landing speeds possible.

Natural Hazards: On page 3-4, it is stated that the terminal is outside the tsunami evacuation zone. Given that the elevation of the airport is 43', it appears reasonable to conclude that the area is indeed outside the tsunami evacuation zone. However, we note that the evacuation zone shown in the Hawaii Company telephone directory includes Keahole Airport and that the area was evacuated by the County Civil Defense during the May 7, 1986 warning.

We appreciate the opportunity to comment on this Draft EIS.

Yours truly,

Jacquelin Miller
Associate Environmental Coordinator

cc: L. Stephen Lau
Dean Nakagawa, DOT ✓
Jack Huizingh
George Curtis
Keith Chave
Belinda Tilley

JOHN WAIHEE
GOVERNOR

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819

IN REPLY REFER TO:

August 12, 1988

AIR-ETS
88.2379

Ms. Jacquelin Miller
Environmental Center
University of Hawaii
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Ms. Miller:

SUBJECT: Keahole Airport Environmental Impact Statement

Thank you for your comments of July 6, 1988 relating to the expansion of the Keahole Airport. The information provided with comments was helpful and will be incorporated into the Final EIS.

Wastewater Treatment: The closest connection to the municipal wastewater system is located at the Kaloko Industrial area, some four plus miles south of the Keahole Airport. There are plans at present for the construction of a pump station in the vicinity of the Honokohau Harbor, however, no specific timetables have been forwarded. Because of the distance, a decision to develop an on-site system was made based on economic considerations. The system as proposed will conform to Section 7, Act 282, SLH 1985.

We share your concerns that the airport expansion not affect the surface waters of the NELH development. The wastewater disposal system will include secondary treatment of the wastewater prior to disposal. To reduce the total quantity of effluent disposal, we are proposing to use most of this water for irrigation. Because the offshore deepwater pipe will be drawing water from depths of 2,000 feet and approximately one mile offshore, we believe that there will be little impact to this water source.

Our conclusions in assessing the potential impact on groundwater and nearshore were based on the special study performed for the HOST Park Final EIS of August 1985 which includes the airport site.

Noise: The current operations at Keahole Airport is limited to approximately 15 hours per day (6 a.m. to 9 p.m.). The 31 operations per hour cited in the Draft EIS is based on actual counts and the 52 operations per hour is a projection of future operations. An operation is measured as a take-off, landing, or touch and go. Because of the increase in projected operations, it is anticipated that noise impact will increase in the near term but decrease as older, noisier aircraft are retired. The noise contours were developed based on the projected operations and on the projected mix of aircraft. The Integrated Noise Model (INM) was calibrated using actual noise measurements from ground monitoring stations.

The noise contours shown in the Draft EIS were developed on base year and forecasted projections. Our findings indicate that the Kohanaiki project will be exposed to some aircraft noise impacts. The Ooma II project will be subjected to noise levels in excess of 65 Ldn. The Department of Transportation has testified before the Land Use Commission that it is in favor of disclosure requirements for properties with noise levels in excess of 55 Ldn and the granting of avigation easements in favor of the State where properties are affected by noise levels 60 Ldn or greater.

Natural Hazards: Please be advised that the airport shown in the Hawaii County phone book is the old Kona Airport and not the Keahole Airport. As stated in your letter, the Airport was evacuated during the May 7, 1986 warning, this was done as a precaution in the interest of public safety.

Your cooperation in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

Owen Miyamoto
Airports Administrator

CK:w5

Danie K. Carpenter
Mayor

Ronald Ibarra
Managing Director

DEPARTMENT OF PARKS & RECREATION
COUNTY OF HAWAII

Patricia G. Engelhard
Director

Ronald Okamura
Deputy Director

July 22, 1988

Mr. Marvin Miura
Office of Environmental Quality Control
465 So. King Street, Room 104
Honolulu, HI 96813

Subject: Keahole Airport Master Plan
Keahole, North Kona, Hawaii

Dear Mr. Miura:

We have reviewed the subject report and have neither comments nor objections to offer.

Thank you for the opportunity to review the report.

Sincerely,

Pat Engelhard

Patricia Engelhard
Director

PE:GM:ai

enc. (EIS being returned)

/ cc: Mr. Dean Nakagawa

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT • HONOLULU HAWAII 96819

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

IN REPLY REFER TO

AIR-ETS
88.2381

August 12, 1988

Ms. Patricia Englehard
Director
Department of Parks and
Recreation
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Ms. Englehard:

SUBJECT: Keahole Airport Environmental Impact Statement

Thank you for your comments of July 22, 1988 relating to the expansion of the Keahole Airport.

Your cooperation in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

Owen Miyamoto
Airports Administrator

CK:w5

BT 8/3/88
CIC - -
JH -----

July 26, 1988

MEMORANDUM

TO: Roger Evans, OCEA

FROM: Ralston H. Nagata, State Parks Administrator

SUBJECT: Draft EIS -- Keahole Airport Master Plan
Kaloaa area, North Kona, Hawaii (88-560)
TMK 7-3-43: part 3

HISTORIC SITES SECTION CONCERNS:

This master plan and its proposed projects seem to involve federal funding. Therefore, two historic preservation laws must be complied with. The Department of Transportation must comply with Chapter 6E, H.R.S. (the State's historic preservation law), and the Federal Aviation Administration must comply with the National Historic Preservation Act. DOT needs to coordinate with our Historic Sites Section to cover the compliance matters.

The archaeological study upon which the historic preservation review conclusions are based is attached as Appendix E (Barrera 1987. Ke-Ahole Airport, Hawaii: Archaeological Survey of Five Areas Proposed for Airport Expansion.). We note that this survey covers most of the expansion areas on Figure 2-2. But other expansion facilities shown on Figure 2-2, such as service road K, the sewage treatment plant access road, and the expanded main access road, the fuel storage area between the general aviation area and the main access road (Fig. 2-4) do not seem to have been covered by this archaeological study or the study of the south ramp area (Barrera 1988. Ke-ahole Airport, Hawaii: Archaeological Survey of South Ramp & Ground Transportation Expansion). If some areas have yet to be surveyed archaeologically, they will still need to undergo historic preservation review.

Ignoring this problem, based on a review of the Appendix E report, we believe that the areas it covers have been adequately surveyed and all historic sites have been found, totalling 6 sites. Sufficient information is presented to evaluate significance, and we agree that all sites are significant only for their information content and that reasonable amounts of this significant information were recorded for 3 sites (10,675, 10,676, 10,680) making them "no longer significant". This means only 3 significant historic sites (10,677, 10,678, 10,679) remain in the project area. We also agree that archaeological data recovery is an appropriate mitigation plan for the treatment of these 3 sites, converting the "adverse effect" to a "no adverse effect".

However, the Draft EIS text (1-9, 3-15 & -16) does not use the correct historic preservation terminology covered in the laws, so it needs to be revised. The wording in our previous paragraph can serve as an example, or the wording in Appendix E can be used. The key points that must be clearly emphasized are (1) according to the criteria of the Hawaii and National Registers of Historic Places, 3 significant sites (10,677, 10,678, 10,679) still remain in the project area, and (2) impacts will be converted to a "no adverse effect" with the execution of an acceptable archaeological data recovery plan.

The Draft EIS text should delete references to "scientific value" as this is not one of the criterion of significance for the Hawaii Register of Historic Places, and has no legal meaning. Also, statements referring to "more significant sites" or the "most significant site" are inaccurate and should be deleted; sites are either significant or not, they are not more or less significant. Also, the statement that none of the sites is significant enough to warrant preservation is incorrect. The 3 sites are significant, and they could be preserved. However, since they are only significant for their information content, archaeological data recovery is an acceptable alternative treatment -- not because they are not significant enough, simply because of the nature of their significance.

Additionally, although archaeological data recovery is an acceptable general mitigation plan, compliance with the historic preservation laws will require the following final steps:

1. Prior to actual archaeological data recovery, a detailed archaeological data recovery plan must be approved by the State's Historic Sites Section for Chapter 6E and by the Historic Sites Section (State Historic Preservation Office) and the U.S. Advisory Council on Historic Preservation for the National Historic Preservation Act in the context of a "no adverse effect" determination. This will serve as a scope of work, ensuring proper data recovery plans.

2. The State's Historic Sites Section must verify the successful execution of the archaeological data recovery plan in order for data recovery and the historic preservation review process to be considered complete. This ensures that the work is done according to plan.

We recommend that the EIS text include a paragraph at the end of the Mitigation Measures agreeing to and summarizing these points.

In sum, for the EIS text to adequately portray the historic preservation review process, it needs to be revised. If assistance is needed, please feel free to contact the Historic Sites Section (548-7460).

We would like to address one additional concern. The Mamalahoa Trail and a petroglyph site are two significant sites in the general airport area which merit preservation -- as these sites are significant for multiple criteria. DOT has indicated that these sites will be preserved. The proposed expansions do not directly impact these sites; however, with all the machinery that will be moving around, we believe that extra steps should be taken to preserve these sites. They need adequate buffer zones around them for long-term preservation, and a buffer zone, flagging and pre-construction briefings would be useful to protect them during construction. Additionally, we would recommend consideration be given to possible interpretive development of these sites as part of the Airport Expansion plans.

RECREATION CONCERNS:

If there are state parks concerns, they will be sent down separately.

RALSTON H. NAGATA

cc: D. Nakagawa, DOT

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
HONOLULU INTERNATIONAL AIRPORT • HONOLULU HAWAII 96819

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

IN REPLY REFER TO
AIR-ETS
88.2378

August 12, 1988

Mr. Ralston H. Nagata
Administrator
Division of State Parks
Department of Land and
Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Nagata:

SUBJECT: Keahole Airport Environmental Impact Statement

Thank you for your comments of June 26, 1988 relating to the Draft Environmental Impact Statement for the Keahole Airport.

We have reviewed your comments regarding the potential impacts to sites of historical value. The location for Service Road "K," the expanded airport access road, the access road for the sewage treatment plant, and the fuel storage area were included as part of the archaeological survey. The map will be revised to indicate these areas as part of the archaeological survey.

We will modify the language of the Final EIS to reflect your recommendations. A mitigation program will be established and forwarded to your office for review prior to the start of construction.

Your cooperation in the planning of this project is greatly appreciated. Should you have any additional comments and suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

Owen Miyamoto
Airports Administrator

CK:w5

JOHN WAIHEE
GOVERNOR

SUZANNE D. PETERSON
CHAIRPERSON, BOARD OF AGRICULTURE

ROBERT Y. TSUYEMURA
ACTING DEPUTY
TO THE CHAIRPERSON

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

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

July 25, 1988

COPY

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

Dear Dr. Miura:

Subject: Draft Environmental Impact Statement (DEIS)
Keahole Airport Master Plan
TMK: 7-3-43 Keahole, North Kona, Hawaii
Area: Approx. 432 Acres (Existing airport)
212 Acres (Expansion area)

The Department of Agriculture has reviewed the subject DEIS and has no comments to offer.

Thank you for the opportunity to comment.

Sincerely,

SUZANNE D. PETERSON
Chairperson, Board of Agriculture

cc: Mr. Dean Nakagawa
State Department of Transportation Airports Division

September ., 1988

MR-EP
78.2472

MEMORANDUM

TO: The Honorable Kazu Hayashida, Chairperson
Board of Agriculture

FROM: Director of Transportation

SUBJECT: KEAHOLE AIRPORT ENVIRONMENTAL IMPACT STATEMENT

Thank you for your comments of July 25, 1988 relating to the expansion of the Keahole Airport.

Your cooperation in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Department of Transportation
Airports Division
Planning Section
Honolulu International Airport
Honolulu, Hawaii 96819
Attention: Mr. Dean Nakagawa
Phone: 836-6526

EDWARD A. TOMIA

cc: R. M. Towill Corporation

UNITED STATES
DEPARTMENT OF
AGRICULTURE

SOIL
CONSERVATION
SERVICE

P. O. BOX 50004
HONOLULU, HAWAII
96850

July 26, 1988

Marvin Miura, Ph.D.
Office of Environmental Quality Control
465 S. King Street, Room 104
Honolulu, HI 96813

Dear Dr. Miura:

Subject: Draft Environmental Impact Statement (DEIS) -
Keahole Airport Master Plan, Keahole, N. Kona, Hawaii

We have no comments to offer at this time, however, we would appreciate the opportunity to review the final EIS.

Sincerely,

Herbert J. Lyford acting

RICHARD M. DUNCAN
State Conservationist

cc:
Mr. Dean Nakagawa, State of Hawaii, Department of Transportation,
Honolulu International Airport, Honolulu, HI 96819

SEP [illegible]

AIR-EP
88.2473

Mr. Richard M. Duncan
State Conservationist
Soil Conservation Service
Department of Agriculture
P. O. Box 50004
Honolulu, Hawaii 96850

Dear Mr. Duncan:

Subject: Keahole Airport Environmental Impact Statement

Thank you for your comments of July 26, 1988 relating to the expansion of the Keahole Airport.

Your cooperation in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Department of Transportation
Airports Division
Planning Section
Honolulu International Airport
Honolulu, Hawaii 96819
Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

EDWARD Y. HIRATA
Director of Transportation

cc: [illegible] Towill Corporation

JOHN WAIHEE
GOVERNOR OF HAWAII

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

LIBERT G. LANDGRAF
DEPUTY

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

JUL 2 7 1988

DOC.: 3866E
FILE: 88-560

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

SUBJECT: Review of Keahole Airport Master Plan, North Kona
TMK: 7-3-43

Dear Dr. Miura:

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

The project area is buffered from the marine environment by the shoreline HOST and NELH facilities. However, precautions should be taken during the extensive construction activities proposed, to prevent debris, eroded materials, petroleum products and other potential contaminants from impacting coastal waters, especially near the HOST and NELH facilities who depend upon pristine marine water for their operation.

Thank you again for your cooperation in this matter. Please feel free to call me or Jay Lembeck of our Office of Conservation and Environmental Affairs, at 548-7837, if you have any questions.

Very truly yours,

WILLIAM W. PATY, Chairperson
Board of Land and Natural Resources

SEP

AIR-CP
5.2474

MEMORANDUM

TO: The Honorable William W. Paty, Chairperson
Board of Land and Natural Resources

FROM: Director of Transportation

SUBJECT: KEAHOLE AIRPORT ENVIRONMENTAL IMPACT STATEMENT

Thank you for your comments of July 27, 1988 relating to the expansion of the Keahole Airport.

Your cooperation in the planning of this project is greatly appreciated. If you should have any questions or additional comments and suggestions, please direct them to:

Department of Transportation
Airports Division
Planning Section
Honolulu International Airport
Honolulu, Hawaii 96819
Attention: Mr. Dean Nakagawa
Phone: 836-6526

EDWARD Y. HIRATA

cc: A. N. Towill Corporation

APPENDICES

APPENDIX A

TRAFFIC ASSESSMENT

TRAFFIC ASSESSMENT

KEAHOLE AIRPORT MASTER PLAN

North Kona, Hawaii

PREPARED FOR:

State of Hawaii
Department of Transportation
Airports Division

PREPARED BY:

Parsons Brinckerhoff Quade & Douglas, Inc.
700 Bishop Street, Suite 615
Honolulu, Hawaii 96813

SEPTEMBER 1987

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SECTION 1
INTRODUCTION

1.1 INTRODUCTION

The State of Hawaii, Department of Transportation (DOT) in early 1986 projected that the Keahole Airport will serve a total of 4,160,000 passengers in year 2005. This traffic assessment evaluates conditions at the ground connection to the airport, at the intersection of the airport's access road with the Queen Kaahumanu Highway. This assessment report was prepared as part of the Master Plan update for the Keahole Airport.

1.2 STUDY LOCATION

The project site is on the west coast on the island of Hawaii. Keahole Airport is located on the west side of Queen Kaahumanu Highway with the Keahole Airport Access Road providing the only ingress/egress to the airport (See Figure 1). This traffic assessment evaluates conditions at the intersection formed by these roadways; the intersection is located approximately seven (7) miles north of Kailua, Hawaii (Kailua-Kona), and 4,000 feet east of the airport terminal building.

1.3 LEVELS OF SERVICE

The Highway Capacity Manual defines "Levels of Service" as qualitative measures which describe traffic operational conditions considering speed and travel time, freedom to maneuver, traffic interruptions and delays, comfort and convenience, and safety. For a two-lane highway, the ability to pass a slow moving vehicle is a major consideration in determining the level of service (LOS). Table 1 summarizes the highway level of service descriptions for two-lane rural highways.

The analysis for unsignalized intersections evaluates gaps in the major street traffic flow and calculates capacities available for major street left turns that have to be made across oncoming traffic and for left and right turns onto the highway from the minor street. Table 2 shows the criteria for levels of service for unsignalized intersections.

Table 1

HIGHWAY LEVEL OF SERVICE CRITERIA

Level of Service	Ability to pass	Platooning
A	demand well below capacity	more than 3 is rare
B	approaches passing capacity	common but short
C	near passing capacity	long platoons
D	approaches zero	opposite flows operate separately
E	virtually impossible	flow is controlled by slow vehicles

Table 2

LEVEL OF SERVICE CRITERIA (UNSIGNALIZED INTERSECTIONS)

Reserve of Capacity	Level of Service	Expected Delay to Controlled Movement
≥ 400	A	Little or no delays
300 - 399	B	Short traffic delays
200 - 299	C	Average traffic delays
100 - 199	D	Long traffic delays
0 - 99	E	Very long traffic delays
≤ 0	F	Demand exceeds capacity; extreme delays

SECTION 2
EXISTING CONDITIONS

2.1 ROADWAY SYSTEM

The two-lane Queen Kaahumanu Highway is the main ground transportation link between Kawaihae and Kailua-Kona on the western coast of the island of Hawaii. The roadway is built within a 240-foot right-of-way and typically contains two traffic lanes and paved shoulders, with widening at major intersections to accommodate separate turn lanes. The terrain is generally level and traffic lanes are 12 feet wide. The posted speed limit is 55 miles per hour (mph); in the vicinity of some intersections (but not the airport access road), the speed limit is lowered to 45 mph.

Keahole Airport Access Road provides the only ground access into the airport. It is a paved roadway with two 12-foot traffic lanes, one each for eastbound and westbound traffic. The posted speed limit is 45 mph with reduced speeds of 25 mph at the approaches to the terminal area and to the highway intersection.

The intersection of Queen Kaahumanu Highway with Keahole Airport Access Road forms a T-intersection, with Keahole Airport Access Road being the stem of the "T" to the west. The southbound approach on Queen Kaahumanu Highway contains a deceleration lane for right turns while the northbound approach includes a separate left turn lane. The single lane Keahole Airport Access Road eastbound approach becomes a left turn only lane, controlled by a stop sign, and right turns are channelized by a striped traffic island into an acceleration lane. A refuge area is provided beyond the northbound left turn lane for traffic turning left from the airport access road onto the highway.

2.2 EXISTING TRAFFIC CONDITIONS

The description of existing traffic conditions at the Queen Kaahumanu Highway/Keahole Airport Access Road intersection is based on manual counts and field observations taken on a Thursday in late-August 1987, on a day

before a state holiday, during the PM peak period. The hour with the highest entering traffic (2:15 PM to 3:15 PM) will be referred to as the 1987 peak day, peak hour, and is used to identify worst case conditions. Figure 2 shows the existing peak day, peak hour volumes.

On the two-lane Queen Kaahumanu Highway, the peak day, peak hour volumes are well under capacity. The analyses (1985 Highway Capacity Manual) show that north of the intersection, LOS B describes conditions on the highway, and the volume-to-capacity (V/C) ratio is 0.22. The highway south of the intersection operates at LOS D with a V/C ratio of 0.36.

Analysis of the 1987 peak day, peak hour traffic volumes using the Highway Capacity Manual methodology for unsignalized intersections indicate that the northbound left turn from Queen Kaahumanu Highway operates at LOS A. Right turns from the Keahole Airport Access Road approach also operate at LOS A while the left turns are at LOS D. Field observations confirm the analyses findings.

The State Highways Division has conducted machine counts at the airport access intersection, recording approach and departure volumes at 15-minute intervals for 24-hour periods in 1980, 1982, and 1984. The 1987 manual count included turning movements which can be summed to obtain approach and departure volumes to compare with earlier counts. Table 3 shows the PM Peak Hour counts from these traffic counts at the intersection. The large variation in traffic volumes between counts taken in August and those taken in April appear to be due to the levels of visitor activity in West Hawaii. The 1987 manual count, taken before a long weekend, is also affected by visitor activity.

Based on these historic counts, 1987 "average" day volumes were also estimated. This case represents an average day in the month of August, independent of long weekends when more interisland travel occurs. Lower traffic volumes are expected during other months of the year, since much of the traffic in West Hawaii is related to the visitor industry. The

peak hour of the average day in August is used as a design hour in the evaluation of existing and future conditions. Annual average traffic volumes are estimated to be 86 percent of the August average day volumes.

Figure 3 shows the traffic assignment for the existing average day, peak hour condition. For the two-lane Queen Kaahumanu Highway, LOS B describes conditions north of the airport, with the traffic volume being 19 percent of capacity. South of the airport, the volume is 30 percent of capacity and conditions are LOS C. Analysis of the unsignalized intersection show that the northbound left turns operate at LOS A while LOS A and LOS C describe right and left turns from the airport access road, respectively.

In both the peak day and the average day peak hours, the airport access road operates at LOS C, with volumes approximately 25 percent of capacity. A check of the requirements listed in the Manual on Uniform Traffic Control Devices using the average day peak hour traffic assignment, factored down to the annual average, indicates that peak hour traffic volumes would satisfy warrants for the installation of traffic signals.

Table 3

TRAFFIC VOLUMES - PM PEAK HOUR

Date (hour ending)	Queen Kaahumanu Highway South of Airport SB	Queen Kaahumanu Highway South of Airport NB	Queen Kaahumanu Highway North of Airport SB	Queen Kaahumanu Highway North of Airport NB	Keahole Airport Access Rd. EB	Keahole Airport Access Rd. WB	Total Entering Traffic
April 1980 (2:15 PM)	229	109	56	71	213	115	378
April 1982 (5:30 PM)	275	215	140	105	196	176	551
August 1984 (3:00 PM)	320	268	165	177	256	166	689
August 1987 (3:15 PM)	458	375	269	224	301	263	945

(NB = northbound, SB = southbound, EB = eastbound, WB = westbound)

Source: State Highways Division (Station 8-P), except 1987 data.

SECTION 3
FUTURE CONDITIONS

3.1 MASTER PLAN TARGET YEAR

The target year for the Keahole Airport Master Plan is 2005. Estimated PM peak hour traffic volumes for year 2005 were developed for an average day and for a peak day (Figures 4 and 5).

3.2 TRAFFIC FORECAST

Future daily traffic volumes were forecasted using historic trends of traffic growth on Queen Kaahumanu Highway and passenger projections for the airport. The 24-hour traffic count of the approach and departure legs at the intersection of Queen Kaahumanu Highway and Keahole Airport Access Road, taken by the State Highways Division in August 1984, was used to estimate hourly traffic volumes from the daily traffic.

An earlier State Highways Division count, taken in August 1978, was also used to identify short-term growth rates. Comparisons of the 1978 and 1984 traffic counts indicate average annual increases of 7.4 percent (south of the intersection) and 9.2 percent (north of the intersection) on the highway. A 7.5 percent average annual increase in daily traffic occurred on the airport access road. These annual growth rates were used to project daily traffic volumes to 1987.

For the longer term projection, traffic on the airport access road was estimated to increase in proportion to the increase in the number of air passengers served by the airport. The 4.16 million passengers projected for year 2005, when compared with the 1.49 million passengers served in 1985, indicates an average growth rate of just over five percent per year. Highway and access road traffic was estimated to increase at five percent per year for each year between 1990 and 2005. For the interim period between 1987 and 1990, a growth curve was "fitted" using a six percent growth rate for highway traffic and a rate for the access road which would be related to the passenger total (annual increase = +5.23%).

The traffic projection was checked against projected population increases for the County of Hawaii. The defacto population (resident population plus visitors less residents traveling) projections for the County of Hawaii, prepared by State planners, indicate an annual rate of growth of about 3% in the early 1980s, decreasing to less than 1% beyond year 2000. In 1980, approximately one-fourth of the county's defacto population was in the Kona-South Kohala area; if all of the county's growth were to occur in this area, the annual rate of growth in the area would be 4.9%. The use of a 5% rate of growth for highway traffic, therefore, would result in a high range estimate.

3.3 ROADWAY SYSTEM

The Keahole Master Plan envisions a divided, four-lane access road to the airport. A new 24-foot wide roadway will be constructed parallel to the existing 24-foot access road, with a 24-foot median between roadways. Separate left and right turn lanes will be provided for eastbound traffic approaching the Queen Kaahumanu Highway intersection. No other roadway improvements were assumed for the identification of traffic impacts.

3.4 TRAFFIC IMPACTS

The increased traffic on the two-lane Queen Kaahumanu Highway will result in lowered levels of service; LOS E would describe conditions south of the airport if the projected volumes are realized. North of the airport, the highway will operate at LOS D. Peak day peak hour volumes are estimated to be 86 percent of the highway's capacity south of, and 53 percent north of, the airport. Table 4 summarizes the highway conditions.

At the unsignalized intersection, year 2005 peak day peak hour traffic volumes would exceed the intersection's capacity (Table 5). Controlled movements, such as turns onto the highway and the left turn from the highway toward the airport, would be at LOS F. The analysis for year 2005, average day peak hour volumes shows that the northbound left turn from the highway would operate at LOS D. Right turns from the airport would be at LOS E while the left turn volumes exceed capacity (LOS F).

Table 4

PEAK HOUR HIGHWAY LEVELS OF SERVICE

	PM Peak Hour LOS (V/C Ratio)		
	Queen Kaahumanu Highway		Keahole Airport Access Road
	North of Site	South of Site	
1987 Average Day	B (0.19)	C (0.30)	C (0.24)
1987 Peak Day	B (0.22)	D (0.36)	C (0.25)
2005 Average Day	D (0.45)	E (0.71)	D (0.56)*
2005 Peak Day	D(0.53)	E (0.86)	E (0.61)*

* assuming 2-lane highway
LOS = level of service
V/C = volume-to-capacity

Table 5

UNSIGNALIZED INTERSECTION CONDITIONS

PM Peak Hour

	Level of Service (Reserve of Capacity)		
	Keahole Airport Access Road		Q. Kaahumanu Hwy.
	Left Turn	Right Turn	Left Turn
1987 Average Day	C (214)	A (622)	A (690)
1987 Peak Day	D (162)	A (560)	A (577)
2005 Average Day	F (-178)	E (1)	D (182)
2005 Peak Day	F (-183)	F (-125)	F (- 41)
If highway speed = 45 miles per hour:			
2005 Average Day	F (-165)	E (70)	C (214)
2005 Peak Day	F (-180)	F (- 61)	F (- 12)

3.5 MITIGATION MEASURES

The findings of lower levels of service on the highway south of the airport indicate that improvements may be necessary in the future. The widening of the highway to a four-lane facility or the addition of one lane with the provision of alternating passing zones of minimum one-mile lengths are two possible measures to improve future levels of service. Any highway improvements, however, would be the responsibility of the highway agency.

The problem of insufficient capacity at the intersection of the airport access road, however, is due in part to the increasing traffic using the access road. Signalization of the intersection would provide adequate capacity for the access road traffic. The Planning Application analysis for signalized intersections from the 1985 Highway Capacity Manual shows the intersection operating at under capacity level during the peak hour of the peak day in year 2005.

3.6 INTERIM CONDITIONS

Evaluations of interim conditions were based on the estimates used in the traffic forecast. At an increase equal to five percent per year, the capacity of the unsignalized intersection would be exceeded by the traffic forecast for the peak hour of the peak day in year 1994.

Widening of the Keahole Airport Access Road should occur in year 1993 if the desire is to maintain LOS C or better conditions on the access road; if LOS D is chosen as limiting conditions, widening would be necessary in year 2004. Because the access road is less than a mile in length, LOS D conditions would not represent significant delays.

SECTION 4
CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The planned roadway improvements to the Keahole Airport Access Road will be adequate to serve the traffic volumes expected to be generated by the airport at completion of the Master Plan in 2005. At the intersection of the access road and Queen Kaahumanu Highway, traffic signals will be needed to provide capacity to serve traffic leaving the airport and turning left to travel northbound on the highway. Traffic volumes on the two-lane highway is expected to increase independent of the airport, and near-capacity conditions on the highway are expected. Improvements to the highway may be needed soon after 2005.

4.2 Recommendations for Master Plan

Based on the findings discussed above, the following additions to the master plan are recommended:

- Traffic signals should be installed at the intersection of the airport access road and Queen Kaahumanu Highway prior to the summer of 1994. The signal should be operated as a 3-phase, partial actuated signal, with the left turn from the airport access road and the northbound left turn from the highway being actuated upon demand. A protected phase should be provided for the northbound left turns.
- The widening of the 2-lane access road to a 4-lane divided roadway should occur before year 2004.

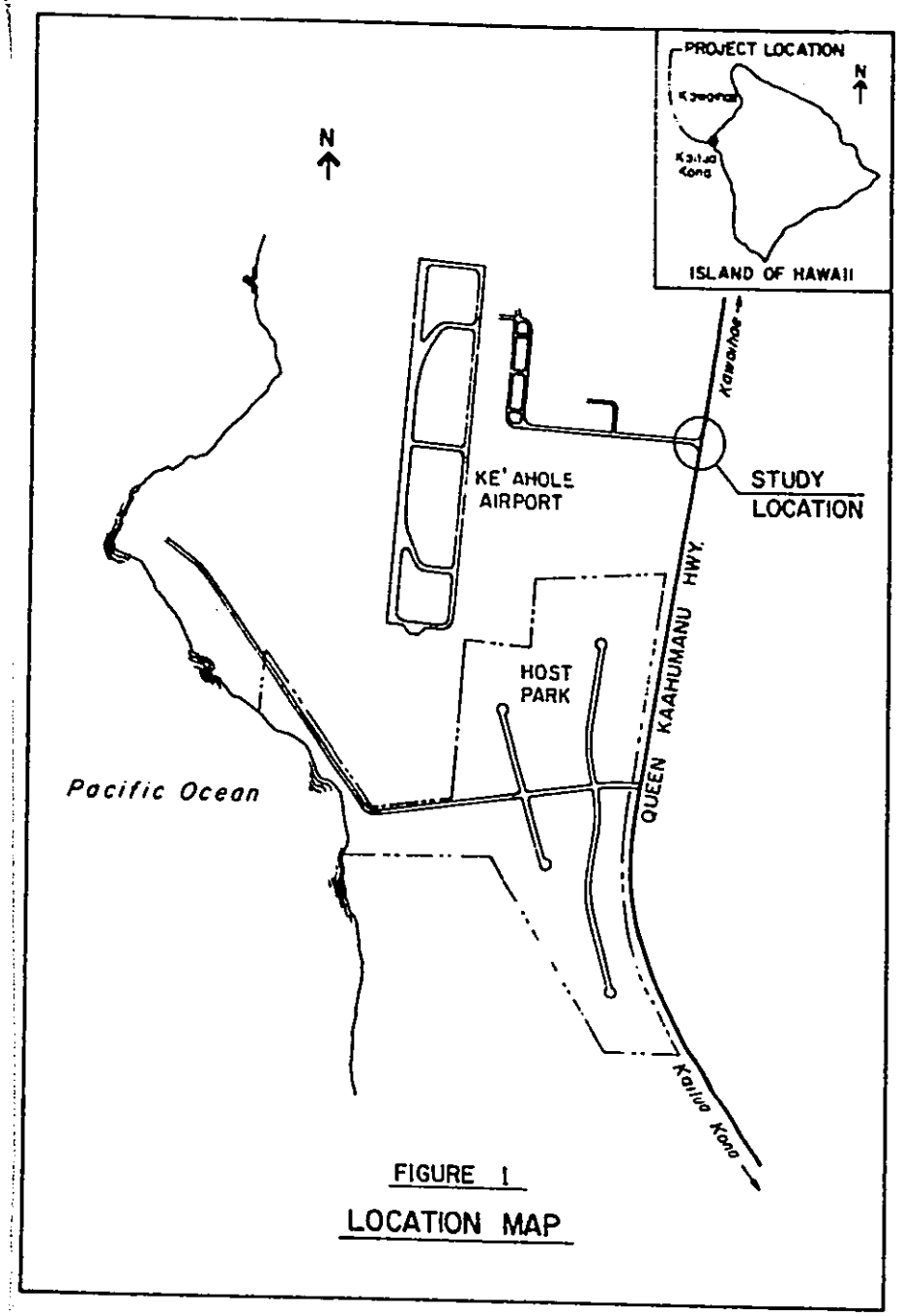


FIGURE 1
LOCATION MAP

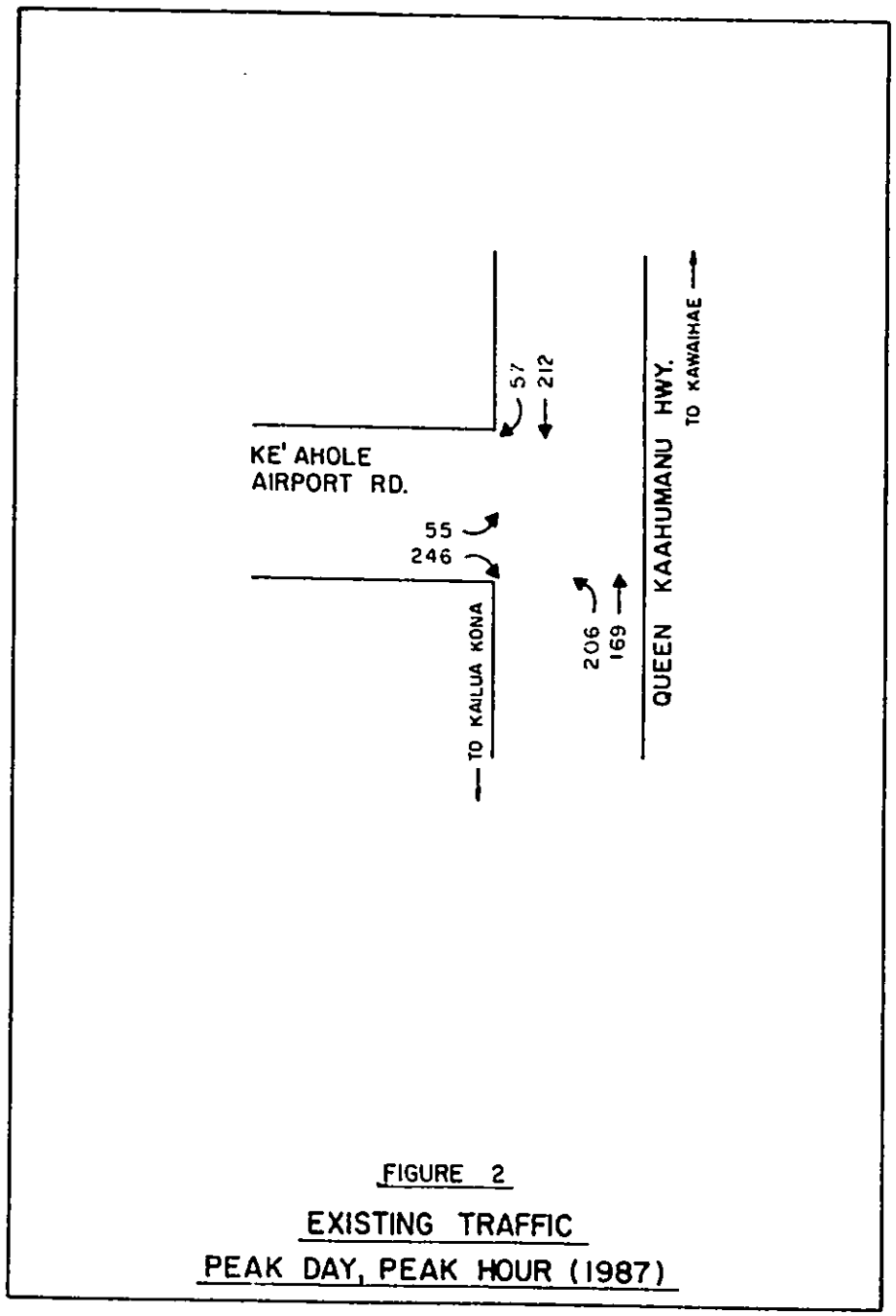


FIGURE 2
EXISTING TRAFFIC
PEAK DAY, PEAK HOUR (1987)

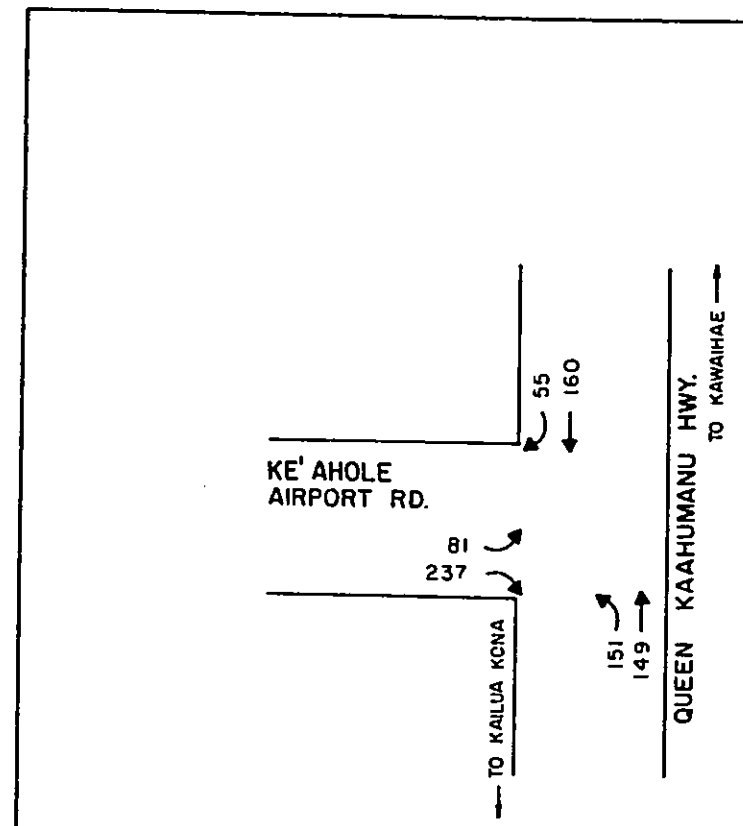


FIGURE 3
TRAFFIC ASSIGNMENT
AVERAGE DAY, PEAK HOUR (1987)

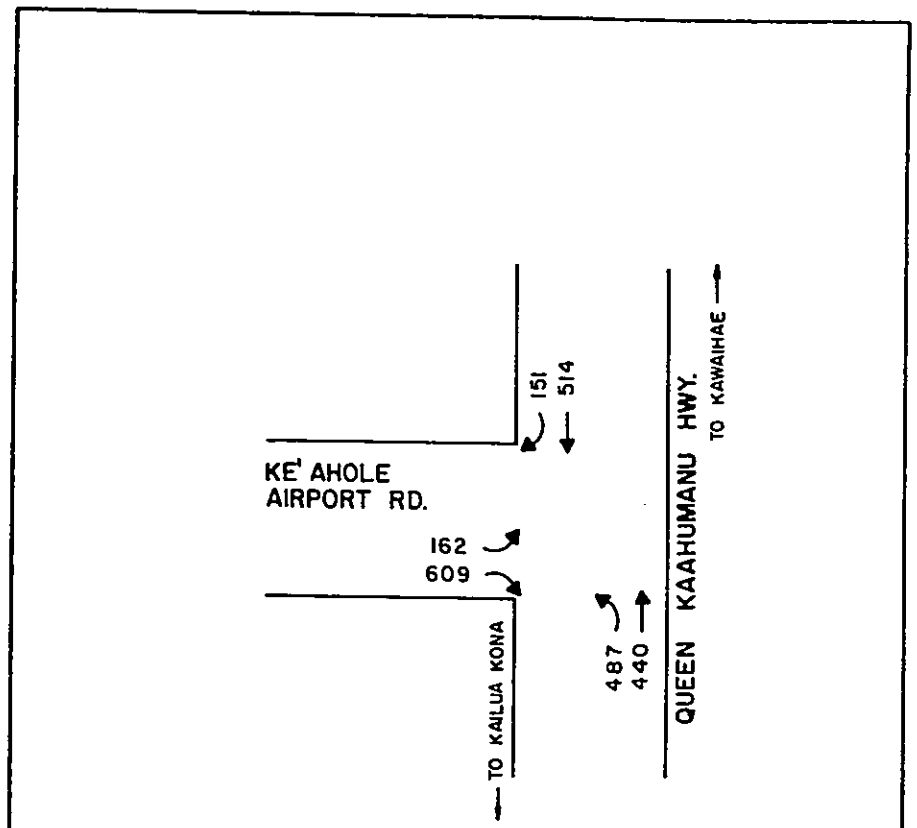


FIGURE 4
TRAFFIC ASSIGNMENT
PEAK DAY, PEAK HOUR (2005)

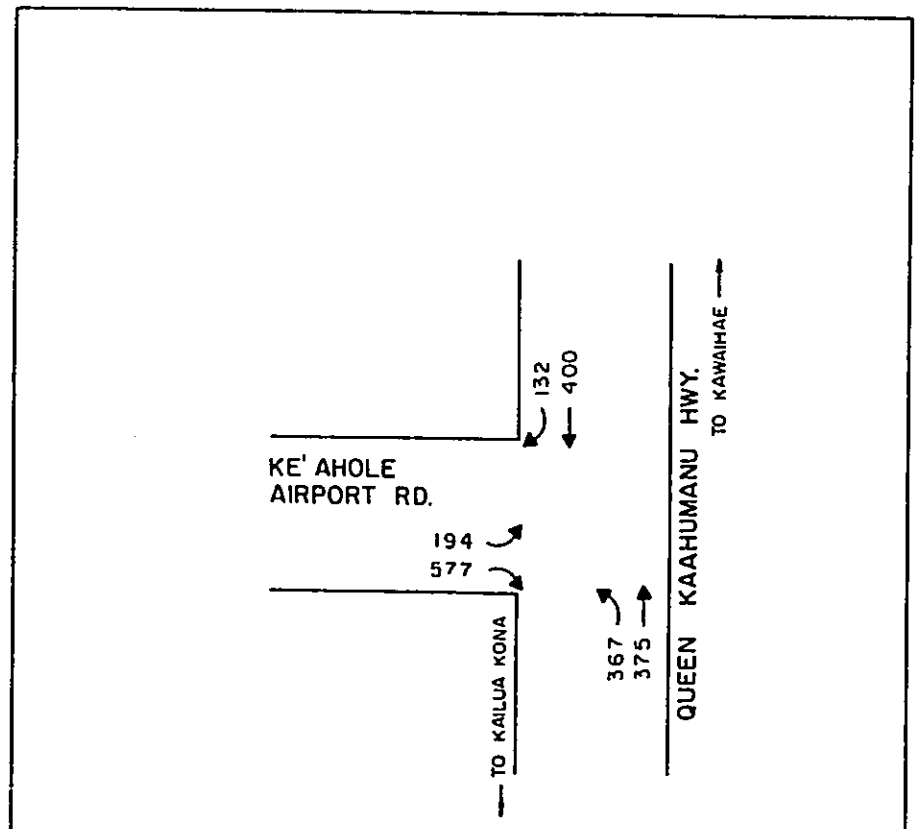


FIGURE 5
TRAFFIC ASSIGNMENT
AVERAGE DAY, PEAK HOUR(2005)

APPENDIX B

BOTANICAL SURVEY

BOTANICAL SURVEY

KEAHOLE AIRPORT MASTER PLAN

District of North Kona, Island of Hawai'i

by

George K. Linney

PREPARED FOR:

R. M. Towill Corporation

PREPARED BY:

CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawai'i

SEPTEMBER 1987

TABLE OF CONTENTS

SECTION 1
INTRODUCTION

1.1 OVERVIEW

A survey of the terrestrial vertebrate fauna on the areas proposed for expansion of the Keahole Airport, as well as the already existing developed areas, was conducted on 26 August 1987. Nine species of birds, all of them foreign or introduced, were recorded from the study site. Skeletal material of donkey and goat were found on the prehistoric pahoehoe lava flow south of the maintenance building. The presence of mongoose in the weedy scrub, fringe areas around the airport and car rental return lots was observed. One skink species was seen in a large lava tube on the study site. None of the fauna encountered during this survey is considered threatened or endangered by the Federal and/or State governments.

1.2 REVIEW OF THE LITERATURE

A number of recent fauna surveys have been conducted for the areas adjacent to or near the Keahole Airport. Walker (1975) made an intensive survey of the adjacent Natural Energy Laboratory of Hawaii (NELH) site and also a portion of the Hawaiian Ocean Science and Technology (HOST) Park. Both sites include coastal areas. Walker recorded eleven avian species. Three of these, the Golden Plover or Kolea (Pluvialis fulva), the Wandering Tattler or 'Ulili (Heteroscelus incanus), and the Ruddy Turnstone or 'Akeke (Arenaria interpres), are migratory shorebird species which winter over in the islands. The other birds recorded are all foreign species and included the following: Gray Francolin (Francolinus pondicerianus), Barred Dove (Geopelia striata), Common Myna (Acridotheres tristis), Japanese White-eye (Zosterops japonicus), House Finch (Carpodacus mexicanus), House Sparrow (Passer domesticus), Cardinal (Cardinalis cardinalis), and Red-crested Cardinal (Paroaria coronata). The Indian Mongoose (Herpestes auropunctatus) was the only mammal observed.

In a study of the nearby Keahole Agricultural Park site, Krauss (1977) also recorded most of the species observed by Walker including a pheasant species

(Phasianus sp.). In addition, Krauss also observed a Hawaiian-Owl or Pueo (Asio flammeus sandwichensis) over the agricultural park site.

Fifteen bird species were reported from the nearby Kohana-Iki and 'O'oma II by Kjargaard (1986a, 1986b). Four of these species, the 'Ulili, Kolea, Great Frigatebird or 'Iwa (Fregata minor palmerstoni), and the Black-crowned Night-heron or 'auku'u (Nycticorax nycticorax hoactli), were found along the coastal margin or around the anchialine ponds. The remaining eleven species recorded were: Gray Francolin, Rock Dove (Columba livia), Barred Dove, Common Barn-owl (Tyto alba), Melodious Laughing-thrush (Garrulax canorus), Japanese White-eye, Nutmeg Mannikin (Lonchura punctulata), House Sparrow, Yellow-billed Cardinal (Paroaria capitata), Cardinal, and House Finch. Only the mongoose was seen during this survey. However, mammalian skeletal material was abundant on the Kohana-Iki and 'O'oma II study sites, particularly on pahoehoe substrate and in the lava tubes and caves that dot the pahoehoe flows. The majority of the material was old and the following species were reported: Feral Cat (Felis catis), Feral Pig (Sus scrofa), Feral Goat (Capra hircus), and Donkey (Equus asinus).

1.3 SURVEY METHODS

The survey work was conducted on 26 August 1987 between the hours of 0645 and 1730. Birds and reptiles were detected both by sight and by their vocalizations. The landscaped areas around the airport were included in the survey as these areas provide water, food and nesting sites in an otherwise marginal habitat. In addition, presence of bird species was determined by indirect means such as by presence of tracks, droppings, and nests.

Mammalian presence and distribution were detected by sight and indirect means. Skeletal material was important in indicating historical occurence on the study site for species which had been extirpated from the area.

C. H. Lamoureux and W. H. Warren have very tentative treatments in manuscript. Where these two differ, Warren's has been followed, primarily because of greater familiarity.

SECTION 2
COMPOSITION OF THE VEGETATION

2.1 FIRST PARCEL

The first parcel of the site for proposed expansion is roughly 250 acres north of the present terminal and runway areas. Adjacent to the terminal area, it is much disturbed, largely graded with a well maintained gravel road leading to a quarry. Beyond this quarry, the road is extremely rough, used mostly by local people to gain access to a small beach. Public access is by gravel road directly from the highway, the two roads intersecting at the quarry. This portion of the parcel is very sparsely vegetated pahoehoe, part of the 1801 flow. On the western (makai) side of the parcel there is a well-maintained emergency-access gravel road, extending from the end of the present runway to near the northern end of the parcel. Elsewhere, the lava is largely undisturbed.

Both in numbers and biomass, the predominant plant on the lava is fountain grass, a noxious exotic characteristic of lava fields in this part of the island. It is a bunch-grass that tends to occupy most areas even minimally suited to vegetation. In less hostile environments it crowds out smaller native plants and threatens native trees and shrubs, its large, dry clumps presenting a serious fire-hazard. Other than this, it probably contributes to the production of soil on the bare lava. Another plant of almost equal numbers, but far less stature and biomass, is 'uhaloa. It is a common weed of dry, waste places throughout the islands. The third most common plant is maia-pilo, the native caper. It is represented by two growth forms. As an upright shrub it may reach heights of three or four feet on the lava here, though taller elsewhere. The crowns tend to be few-branched. As a prostrate ground-cover, it may not exceed a foot or two in height, often just a few inches, but may form a mat of 50 or more square-feet. Maia-pilo flowers are large, showy, and white with a powerful, sweet fragrance. Unfortunately, they

open only at night and wither in the early-morning sun the next day, or else they might be more useful for landscape plantings. Fruit is set, but ripe ones are rare, apparently eagerly sought out by birds.

Two more plants characteristic of the lava fields but too minor to be considered as significant components are noni (Morinda citrifolia), a shrub or small tree introduced by the Polynesians, and used medicinally by them; and also hairy sword-fern (Nephrolepis multiflora), a very agressive and persistent exotic weed able to survive in cracks in the rock and in lava tubes.

Along the edges of roads or other disturbed areas, fountain grass increases in density, and a number of low-statured exotic weeds, such as threadstem carpetweed (Mollugo cerviana) and hairy spurge (Chamaesyce hirta) are found. As these others tend to be no more than minor constituents of the vegetation, they are enumerated only in the species list. There was, however, one noteworthy find at the eastern (mauka) side of the parcel: a single 'ohi'a-lehua tree (Metrosideros polymorpha) about 9 to 10 feet in height. Much farther inland it becomes the characteristic forest tree, but had not been expected so close to the terminal buildings (within 1000 feet). Gravel has been quarried right up to the base of the tree, and it is in imminent danger of being bulldozed. It was noted that perhaps five others are present in the area between this parcel and the highway, all of greater stature. The only other woody plants in this parcel were two crownflower bushes (Calotropis procera). They have apparently spread here from a population of about a dozen and a half along the highway just south of the airport entrance. These in turn may have originated from a planting nearby. Seeds are wind-dispersed, and may be carried for miles. These are small trees with highly furrowed, quite decorative bark, and large purple-and-white flowers. The light green branches and foliage are covered with a dense white fuzz.

2.2 SECOND PARCEL

The second parcel, some 15 acres adjacent to the present car-rental facilities, appears to have been similarly, but more densely vegetated. However, it has now largely been graded, and the major vegetative components are ruderal (wayside) weeds growing adjacent to the tarmac of the car-rental sites. In-

creased water, supplied from the tarmac run-off, probably accounts for their great abundance in this area. Because they are associated with the edge of the tarmac, rather than the lava field, they are not considered to be significant components of the natural environment and will not be discussed in detail here. They are, however, included in the species list.

2.3 THIRD PARCEL

The third parcel is approximately 130 acres, roughly "L"-shaped, adjacent to and mauka of the present runway in the south of the airport property. It is mostly of prehistoric pahoehoe, though small patches of 'a'a are present. It is much more heavily vegetated than the other two parcels, though the same species predominate in all: fountain grass, 'uhaloa, and maia-pilo. The greater density, and perhaps the larger number of species, may be the result of a more favorable habitat provided by the older, weathered lava. Of the species found only on this parcel, almost all of them are single individuals or small colonies probably representing offspring of a single individual. This was true of lantana (Lantana camara), molasses grass (Melinus minutiflorus), klu (Acacia farnesiana), kiawe (Prosopis pallida), a'ali'i (Dodonaea viscosa), and to a lesser extent 'auhuhu (Tephrosia purpurea). The first three are exotic weeds: the first a shrub brought into Hawaii for its colorful flowers; the second a poor pasture-grass; the third, a shrub or small tree brought in for a defunct perfume industry. 'Auhuhu is considered a Polynesian introduction. An inconspicuous shrub, it was used in early Hawai'i and throughout the Pacific as a fish poison. Kiawe, also an exotic, is the dominant tree of lowland Hawai'i, and in areas adjacent to the study site forms savanna or forest. Within the study area the single specimen of kiawe was only a broad, low shrub.

Many of the more unusual species were found only in lava tubes, where the shelter from sun and wind, along with the higher humidity, provide protected habitat. Otherwise, many of these species would not usually be expected in the area. Because the plants of the lava tubes are such unusual finds for this area, a short discussion follows. The most characteristic element is the ferns. Many are limited to a single lava tube, and each tube has a different set of ferns and fern allies. These are sword-fern (Nephrolepis multiflora),

'iwa'iwa (Doryopteris decora), wood-fern (Thelypteris torresiana), holly fern (Cyrtomium falcatum), lau'e (Phymatodes scolopendria) and moa (Psilotum nudum). Only the second and last of these is native. In one particularly large lava tube, perhaps as much as 100 feet long by 30 feet wide by 15 feet high, ferns are abundant. The entrance of this lava tube is marked by a noni some 15 to 18 feet tall, a height it could never reach out on the open lava fields under the current climatic conditions. There were two other significant finds in this cave: Peperomia cookiana and Plectranthus parviflorus. They are unrelated, but similar in appearance and habitat requirements, and often found together on almost bare rocks. The Polynesians referred to them by the same name, 'ala'ala-wai-nui. They are characteristic of slightly moister areas a few hundred feet higher and farther inland.

SECTION 3
POTENTIAL PROBLEMS AND CONCERNS

3.1 FLORAL ELEMENTS NEEDING PROTECTION

There are no plant communities or individual species located in the study site requiring protection. This is not to say that some measure of care could not be exercised when the area is developed. Some elements of the present vegetation might be incorporated in the future landscaping. Onsite 'ohia is clearly adapted to the harsh environment, and might well be used in the landscaping, as might the maia-pilo. There does not seem to be any botanical impediment to the development of the study area, though the presence of the very large lava tube suggests there may be geological problems. That one feature poses a serious threat to operators of heavy equipment and suggests the presence of others not yet discovered.

For the most part, there is little of botanical interest within the three parcels that comprise the study site. In the north, the lava is of such recent age that it has not been heavily colonized by plants. To the east, it has already been disturbed by quarrying and grading. In the south, while vegetated and largely undisturbed, the harshness of the environment and prevalence of more agressive and better-adapted weeds has so degraded the vegetation, that little of merit is found there.

3.2 RECOMMENDATIONS FOR LANDSCAPING

It would seem advisable for the landscape architect to set a theme or particular goal, if problems with maintenance are to be avoided in the future. Potential themes could be "Tropical", making bold use of color or verdure, or "Desert", emphasizing the sunniness and aridity of the local climate, or "Hawaii", stressing local heritage through selective use of native and Polynesian-introduced species. Desirable goals would include reducing maintenance (irrigation, litter, pruning) and avoiding structural damage from tree branches and roots.

The advantages of using appropriate native plants are that they are already adapted to the harshness of the climate, requiring less soil and water than many widely-used landscape plants; they pose less threat to the near-by native vegetation should they escape from cultivation; they have not been so overused as to become prosaic; and they have not-inconsiderable cultural interest. Their disadvantages are that they have relatively few really showy representatives; landscapers have less experience with them and their cultural requirements; there are no large, pre-existing stocks, and so they must be propagated as needed; and appropriate choices are not always made, with resultant problems and disappointment. Some of these problems stem from selecting the correct species, but choosing stocks that are adapted to different conditions. Disappointment is also likely when seasonalities are not considered. Some species are seasonal in their growth and flowering, and if these are not balanced, they will produce a seasonally drab display. A more esoteric problem can arise if native plants are brought in from elsewhere and then escape or otherwise interact with the surrounding native plants. Cross-pollination with cultivated plants, for instance, can threaten the genetic integrity of the wild population of plants nearby.

Exotics have similar advantages and disadvantages. They are already commercially available and have been selected or bred for a showy effect. Many already in Hawaii, however, tend to be somewhat over-used, and there are real concerns about bringing in new species to Hawaii, because of the threat of new invasive species escaping cultivation and becoming serious pests. Few of them are well-adapted to the harsh conditions in the Keahole area, and their use could entail increased maintenance or result in a shabby appearance. It is possible to use plants which require little or no irrigation once established, though that would eliminate many highly floriferous species. If the goal is to go for a bold splash of color against the starkness of the lava, with a few exceptions most choices would require at least a minimal amount of irrigation, perhaps a great deal.

The use of trees or other large, woody plants involves problems of crown and root spread. If installed too close to structures or pavement, periodic pruning of branches and roots may be required in order to prevent damage to structures or vehicles. Because of the nature of the lava, roots would tend to grow especially long and shallow, unless extensive site preparation is made. This involves the preparation of particularly deep beds of moisture-retentive soil. It is also necessary to consider the ultimate spread of the canopy, and to place no structures or pavement within that area.

Presence of soil and water is conducive to weed growth. Future weeding would be diminished by the use of drip-irrigation (or dribble-irrigation for larger plants) and mulching with black polyethylene. Two to four inches of crushed lava would conceal the plastic and keep the soil cool.

SECTION 4
SPECIES LIST

4.1 TERMS AND SYMBOLS

On the following pages is a list of all those species of vascular plants found during the Keahole Airport Expansion botanical survey. They are organized by family and scientific name. Each entry includes a common or Hawaiian name (if known), biogeographic status, and relative abundance on each parcel. The following symbols and abbreviations are used:

SCIENTIFIC NAME

cf. - resembling species listed, but identity uncertain
s.l. - in the broad sense
sp. - an unidentified species

BIOGEOGRAPHIC STATUS

E - endemic, native only to the Hawaiian Islands
I - indigenous, native to the islands, but also to other geographic areas
P - Polynesian introduction before arrival of western man
X - exotic, introduced intentionally or accidentally since the arrival of western man

PARCEL

1 - area to north of present terminal
2 - area adjacent to car rental facility
3 - area to southeast of present terminal facilities

RELATIVE ABUNDANCE

o - not seen (absent on parcel)
s - single individual
r - rare, less than 10 individuals
u - uncommon, not a significant component
c - common, a significant component
a - abundant, a dominant component
l - localized, found only in patches, number of patches may vary (used only in conjunction with another letter)

SPECIES LIST

SCIENTIFIC NAME	COMMON NAME	BIOGEOGRAPHIC STATUS	PARCEL NO. 1	2	3
FERNS AND FERN ALLIES					
Adiantaceae					
Doryopteris decora Brack.	'iwa'iwa	I	o	o	s
Aspleniaceae					
Cyrtomium falcatum (Langsd. & Fisch.)	holly fern	X	o	o	s
Nephrolepis multiflora (Roxb.) Jarret ex Morton	sword fern	X	u	u	c
Thelypteris torresiana Gaud.	wood fern	X	o	o	r
Polypodiaceae					
Phymatodes scolopendria (Burm.) Ching	lau'ae	X	o	o	lu
Psilotaceae					
Psilotum nudum L.	moa	I	o	o	s
FLOWERING PLANTS					
MONOCOTS					
Cyperaceae					
Fimbrystylis pycnocephala Hbd.	fimbry	I	o	o	u
Gramineae					
Cynodon dactylon (L.) Pers.	Bermuda grass	X	s	o	o
Digitaria sp.	crab-grass	X	s	o	o

SCIENTIFIC NAME	COMMON NAME	STATUS	1	2	3
Eragrostis tenella (L.) Beauv.	love-grass	X	lc	u	u
Heteropogon contortus (L.) Beauv. ex R. & S.	pili	I/P	o	o	u
Melinus minutiflorus Beauv.	molasses grass	X	o	o	s
Pennisetum setaceum (Forsk.) Chiov.	fountain grass	X	a	a	a
Rhynchelytrum repens (Willd.) C. E. Hubb.	Natal redtop	X	lc	c	lc
DICOTS					
Anacardiaceae					
Schinus terebinthifolius Raddi	Christmasberry	X	r	r	u
Asclepiadaceae					
Asclepias physocarpa (E. Meyer) Schlechter	gomphocarpus	X	o	o	s
Calotropis procera (Ait.) Ait. f.	crownflower	X	r	o	o
Capparaceae					
Capparis sandwichiana DC.	maia-pilo	E	c	c	c
Compositae					
Bidens pilosa L.	Spanish needle	X	o	u	o
Emilia coccinea (Sims) G. Don	orange-flowered emilia	X	u	u	u
Pluchea symphytifolia (Miller) Gillis	pluchea	X	r	r	r
Tridax procumbens L.	coat buttons	X	lc	lc	u
Euphorbiaceae					
Chamaesyce hirta (L.) Millsp.	hairy spurge	X	lc	u	u
Chamaesyce hypericifolia (L.) Millsp.	spurge	X	o	s	o

SCIENTIFIC NAME	COMMON NAME	STATUS	1	2	3
Phyllanthus debilis Klein ex Willd.	phyllanthus	X	o	r	o
Labiatae					
Hyptis pectinata (L.) Poit.	comb hyptis	X	o	u	o
Plectranthus parviflorus Willd.	'ala'ala-wai-nui	I	o	o	lr
Leguminosae					
Acacia farnesiana (L.) Willd.	klu, huisache	X	o	o	s
Chamaecrista nictitans (L.) Moench.	partridge pea, lau-ki	X	lu	u	o
Desmodium tortuosum (Sw.) DC.	beggarstick	X	o	c	o
Indigofera suffruticosa Mill.	indigo	X	o	o	u
Leucaena leucocephala (Lam.) deWit	koa-haole, popinac	X	u	u	u
Macroptilium lathyroides (L.) Urb.	wild bush-bean	X	lu	u	o
Prosopis pallida (Humb. and Bonpl. ex Willd.) HBK	kiawe, mesquite	X	o	o	s
Tephrosia purpurea (L.) Pers.	'auhuhu, 'auhola	P	o	o	lu
Malvaceae					
Sida fallax Walp.	'ilima	I	r	r	u
Molluginaceae					
Mollugo cerviana (L.) Ser.	threadstem carpetweed	X	lc	o	o
Myrtaceae					
Metrosideros polymorpha Gaud.	'ohi'a-lehua	E	s	o	o

SCIENTIFIC NAME	COMMON NAME	STATUS	1	2	3
Passifloraceae					
Passiflora foetida L.	love-in-a-mist	X	o	r	u
Piperaceae s.l.					
Peperomia cookiana C. DC.	'ala'ala-wai-nui	E	o	o	lu
Portulacaceae					
Portulaca oleracea L.	common purslane	X	r	u	u
Portulaca pilosa L.	'ihi	X	o	u	u
Rubiaceae					
Morinda citrifolia L.	noni	P	u	u	u
Sapindaceae					
Dodonaea viscosa Jacq.	a'ali'i	I	o	o	s
Sterculiaceae					
Waltheria indica L. var. *americana* (L.) R. Br. ex Hosaka	'uhaloa, hi'aloa	I?	c	a	a
Verbenaceae					
Lantana camara L.	lantana	X	o	o	s

LITERATURE CITED

Char, W.P 1985. Vegetation and terrestrial fauna at NELH/HOST Park. Prepared for The Traverse Group, Inc. (TGI), Honolulu, June 1984.

Char, W.P. 1986a. Biological survey, proposed 'O'oma II Project, North Kona, Island of Hawaii. Prepared for Helber, Hastert, Van Horn & Kimura, Honolulu, June 1986.

Char, W.P. 1986b. Botanical survey, proposed Kohana-Iki Resort Community, North Kona, Island of Hawaii. Prepared for Helber, Hastert, Van Horn & Kimura, Honolulu, June 1986.

APPENDIX C

FAUNA SURVEY

FAUNA SURVEY

KEAHOLE AIRPORT MASTER PLAN

District of North Kona, Island of Hawai'i

by

Winona P. Char

PREPARED FOR:

R. M. Towill Corporation

PREPARED BY:

CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawaii

SEPTEMBER 1987

TABLE OF CONTENTS

SECTION 1
INTRODUCTION

1.1 OVERVIEW

A survey of the terrestrial vertebrate fauna on the areas proposed for expansion of the Keahole Aiport, as well as the already existing developed areas, was conducted on 26 August 1987. Nine species of birds, all of them foreign or introduced, were recorded from the study site. Skeletal material of donkey and goat were found on the prehistoric pahoehoe lava flow south of the maintenance building. The presence of mongoose in the weedy scrub, fringe areas around the airport and car rental return lots was observed. One skink species was seen in a large lava tube on the study site. None of the fauna encountered during this survey is considered threatened or endangered by the Federal and/or State governments.

1.2 REVIEW OF THE LITERATURE

A number of recent fauna surveys have been conducted for the areas adjacent to or near the Keahole Airport. Walker (1975) made an intensive survey of the adjacent Natural Energy Laboratory of Hawaii (NELH) site and also a portion of the Hawaiian Ocean Science and Technology (HOST) Park. Both sites include coastal areas. Walker recorded eleven avian species. Three of these, the Golden Plover or Kolea (Pluvialis fulva), the Wandering Tattler or 'Ulili (Heteroscelus incanus), and the Ruddy Turnstone or 'Akeke (Arenaria interpres), are migratory shorebird species which winter over in the islands. The other birds recorded are all foreign species and included the following: Gray Francolin (Francolinus pondicerianus), Barred Dove (Geopelia striata), Common Myna (Acridotheres tristis), Japanese White-eye (Zosterops japonicus), House Finch (Carpodacus mexicanus), House Sparrow (Passer domesticus), Cardinal (Cardinalis cardinalis), and Red-crested Cardinal (Paroaria coronata). The Indian Mongoose (Herpestes auropunctatus) was the only mammal observed.

In a study of the nearby Keahole Agricultural Park site, Krauss (1977) also recorded most of the species observed by Walker including a pheasant species (Phasianus sp.). In addition, Krauss also observed a Hawaiian-Owl or Pueo (Asio flammeus sandwichensis) over the agricultural park site.

Fifteen bird species were reported from the nearby Kohana-Iki and 'O'oma II by Kjargaard (1986a, 1986b). Four of these species, the 'Ulili, Kolea, Great Frigatebird or 'Iwa (Fregata minor palmerstoni), and the Black-crowned Night-heron or 'auku'u (Nycticorax nycticorax hoactli), were found along the coastal margin or around the anchialine ponds. The remaining eleven species recorded were: Gray Francolin, Rock Dove (Columba livia), Barred Dove, Common Barn-owl (Tyto alba), Melodious Laughing-thrush (Garrulax canorus), Japanese White-eye, Nutmeg Mannikin (Lonchura punctulata), House Sparrow, Yellow-billed Cardinal (Paroaria capitata), Cardinal, and House Finch. Only the mongoose was seen during this survey. However, mammalian skeletal material was abundant on the Kohana-Iki and 'O'oma II study sites, particularly on pahoehoe substrate and in the lava tubes and caves that dot the pahoehoe flows. The majority of the material was old and the following species were reported: Feral Cat (Felis catis), Feral Pig (Sus scrofa), Feral Goat (Capra hircus), and Donkey (Equus asinus).

1.3 SURVEY METHODS

The survey work was conducted on 26 August 1987 between the hours of 0645 and 1730. Birds and reptiles were detected both by sight and by their vocalizations. The landscaped areas around the airport were included in the survey as these areas provide water, food and nesting sites in an otherwise marginal habitat. In addition, presence of bird species was determined by indirect means such as by presence of tracks, droppings, and nests.

Mammalian presence and distribution were detected by sight and indirect means. Skeletal material was important in indicating historical occurence on the study site for species which had been extirpated from the area.

SECTION 2
SURVEY RESULTS

2.1 FAUNAL HABITATS

The areas proposed for expansion of the Keahole Airport provide only marginal wildlife habitat. Very sparse vegetation, primarily fountain grass (Pennisetum setaceum), is found on the parcels north of the runway and adjacent to the present car rental facilities. Scrub vegetation composed of fountain grass, 'uhaloa (Waltheria indica var. americana), maia-pilo (Capparis sandwichiana), and other shrubby species covers the prehistoric pahoehoe flow south of the present maintenance building. A more detailed discussion of the vegetation, as well as a plant species checklist, can be found in the botanical survey report.

The landscaped areas around the terminal and car rental lots were also included in the survey as most of the bird and mammal species occur here. These landscaped areas provide trees for nesting sites as well as food and water. Expansion of the airport property will result in more available habitat for the species already present. An out-migration into these newly landscaped areas is expected.

Very few species utilized the areas away from the terminal. A few birds such as the Lace-necked Dove (Streptopelia chinensis) and the House Finch were observed in the areas of the pahoehoe flow where the scrub vegetation was thickest.

2.2 ANNOTATED SPECIES LIST

Common and scientific names of the bird species are in accordance with those listed in Hawaii's Birds (Hawaii Audubon Society 1984).

Birds

1. Zebra Dove or Barred Dove (Geopelia striata): Foreign
Individuals and small flocks of this species were observed around the terminal and car rental areas. Very tame; commonly observed around areas where people have dropped food scrapes, i.e., snack bars, trash cans, waiting area, etc.

2. Lace-necked Dove or Spotted Dove (Streptopelia chinensis): Foreign
This species was observed occasionally around the terminal area and infrequently

in the scrub vegetation near the maintenance building.

3. Japanese White-eye or Mejiro (Zosterops japonicus);Foreign
Japanese White-eye were commonly seen in trees and shrubs around the terminal.

4. Common Indian Myna or Myna (Acridotheres tristis); Foreign
The Myna is one of the more abundant species around the airport. In the evening, the birds are especially numerous in the large trees around the terminal. Both the Myna and the House Sparrow have built nests under the eaves of buildings in the area.

5. House Sparrow or English Sparrow (Passer domesticus); Foreign
One of the more abundant species in the airport area. Often building nests in and around buildings.

6. Cardinal or Northern Cardinal (Cardinalis cardinalis): Foreign
One Cardinal was heard in the monkeypod (Samanea saman) trees bordering the airport.

7. Yellow-billed Cardinal (Paroaria capitata): Foreign
One individual was observed feeding on the fruit of the golden-fruited palm (Chrysolidocarpus lutescens). This species was introduced to the Kona area in the 1930's, but was not documented in the region until the early 1970's (Kjargaard 1986a). It is reported to be common on the nearby Kohana-Iki area.

8. Yellow-fronted Canary (Serinus mozambicus): Foreign
A pair of birds was observed foraging in a grassy area within the terminal. Airport personnel report that this species is quite common around the airport especially during the early morning hours.

9. House Finch or Linnet (Carpodacus mexicanus): Foreign
Also known locally as Papayabird. Four birds were seen in the scrub vegetation south of the maintenance building. The birds were observed feeding on pluchea seeds (Pluchea symphytifolia).

Mammals

1. Mongoose or Indian Mongoose (Herpestes auropunctatus): Foreign
Although no animals were actually observed, fresh mongoose scat (or droppings) were found in koa-haole (Leucaena leucocephala) shrubs along the fence of the car rental return lots.

2. Other mammal species
Very old skeletal material of donkey (Equus asinus) was found on the prehistoric pahoehoe flow south of the maintenance building. Old droppings from goats (Capra hircus) were found in a number of lava tubes and caves in the same area. One almost complete, adult, goat skeleton was found in a very large lava tube (see botanical survey report for detailed description of site). Goat and donkey no longer are found in this area.

Reptiles
One skink species, tentatively identified here as a Snake-eyed Skink (Cryptoblepharus boutoni poecilopleurus), was observed among rocks at the opening of the large lava tube.

2.3 THREATENED OR ENDANGERED SPECIES

No threatened or endangered vertebrate animal species were observed from the study site during the course of this survey.

The Hawaiian Hoary Bat (Lasiurus cinereus semotus), the only native land mammal, may fly over the study site on its way to nearby ponds and coastal areas where it is known to feed (Kramer 1971, van Riper and van Riper 1982, Kjargaard 1986a).

SECTION 3
DISCUSSION AND RECOMMENDATIONS

3.1 SUMMARY OF FINDINGS

The areas proposed for expansion of the airport consist mostly of sparsely vegetated lava flows which provide poor habitat for wildlife. The majority of the wildlife observed during the study occurred in areas which were landscaped or periodically maintained.

All of the species encountered were foreign species which have been introduced into the islands either accidentally or intentionally by man. Nine species of birds were recorded; the most numerous being those species commensal with man — House Sparrow, Myna, and Barred Dove.

Although only one skink species was observed, there may be other gecko and skink species present on the study site. None of these terrestrial reptiles is native to the islands.

The mongoose was the only extant mammal recorded, however, a few other introduced species such as the House Mouse (Mus musculus), Roof Rat (Rattus rattus), Polynesian Rat (Rattus exulans), and Feral Cat (Felis catus) are likely to occur in and around the airport facilities.

3.2 RECOMMENDATIONS

No recommendations are offered at this time. The areas proposed for the airport expansion do not provide suitable habitat for native terrestrial species and the project is not expected to have a significant impact on the native wildlife. At present the areas proposed for expansion provide only marginal habitat even for the foreign species. When the expansion project is completed, the foreign bird species as well a number of mammal and skink and gecko species already present in the area are expected to increase in numbers as there will be more available habitat.

LITERATURE CITED

Hawaii Audubon Society. 1984. Hawaii's Birds. 3rd edition. Revised. R. J. Shallenberger, editor. Honolulu.

Kjargaard, M. S. 1986a. Terrestrial faunal survey, proposed Kohana-Iki Resort Community, North Kona, Island of Hawai'i. Prepared for Helber, Hastert, Van Horn & Kimura, Honolulu, June 1986.

Kjargaard, M. S. 1986b. Terrestrial faunal survey. In: Char, W. P. and M. S. Kjargaard. Biological survey, proposed 'O'oma II project, North Kona, Island of Hawai'i. Prepared for Helber, Hastert, Van Horn & Kimura, Honolulu, June 1986.

Kramer, A. J. 1971. Hawaiian Land Mammals. Charles Tuttle Co., Rutland, Vermont.

Krauss, B. 1977. Report on the flora and fauna at Keahole, Kona, Hawaii. Prepared for M. & E. Pacific, Inc., Honolulu, August 1977.

van Riper, S. C. and C. van Riper III. 1982. A Field Guide to the Mammals in Hawaii. Oriental Publ. Co., Honolulu.

Walker, R. L. 1975. Flora and fauna of the Ke'ahole Point Natural Energy Laboratory Site, Island of Hawaii. Prepared for R. M. Towill Corp., Honolulu, November 1975.

APPENDIX D

NOISE COMPATIBILITY PROGRAM
CHAPTER 1

KPMG Peat Marwick

Airport Consulting Services

Final Report

Noise Compatibility Program Keahole Airport, Hawaii

Prepared for

State of Hawaii
Department of Transportation
Airports Division
August 1987

Peat Marwick Main & Co., Airport Consulting Services
Post Office Box 8007 • San Francisco International Airport • San Francisco California 94128-8007 • 415-571-7722

PREFACE

In April 1986, the State of Hawaii, Department of Transportation, Airports Division, initiated a comprehensive planning study for Keahole Airport under the Federal Aviation Administration (FAA) Airport Improvement Program. The purpose of the study is to determine the type and extent of aviation facilities needed at Keahole Airport through the year 2005 and to prepare a Master Plan to accomplish the required development. In addition, a Noise Compatibility Program will be developed for the Airport environs so that Airport-compatible land use and transportation plans can be considered for adoption by local units of government in conjunction with their overall planning programs. The Noise Compatibility Program is being developed in accordance with the requirements of Federal Aviation Regulations Part 150, "Airport Noise Compatibility Planning."

This report documenting the Noise Compatibility Program for Keahole Airport is one of several publications that have been prepared as part of the study.

The study, which is scheduled for completion in September 1987, is being conducted by the R. M. Towill Corporation, Peat, Marwick, Mitchell & Co., and Darby and Associates. The study is being coordinated with the Federal Aviation Administration, the Honolulu Airlines Committee, the County of Hawaii, and other federal, State, and local organizations.

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

TABLES

CONTENTS (Concluded)

EXHIBITS

Chapter 1

INTRODUCTION

BACKGROUND

The Noise Compatibility Program for Keahole Airport was prepared in parallel with the preparation of an airport Master Plan. The overall objective of the Master Plan for on-Airport development is to ensure that Keahole can be developed to accommodate changes in the requirements of airline service and passengers, air cargo, ground transportation, and other Airport land uses and development that might occur through the year 2005 and beyond. The Master Plan Update for on-Airport development is described in a separate technical report [1].*

The overall objective of the Noise Compatibility Program is the achievement of land use compatibility in the Airport environs (that area most directly affected by aircraft operations). The objective can be achieved through the implementation of procedures and measures designed to abate and mitigate noise effects. Because much of the area surrounding Keahole Airport is currently undeveloped, major emphasis is given to measures that would ensure that the existing compatibility is maintained and enhanced in the future.

*Numbers in brackets refer to references listed at the end of this report (following Chapter 4).

PURPOSE OF STUDY

The Noise Exposure Maps and Noise Compatibility Program for the Airport, as described in this report, have been prepared in conformance with Federal Aviation Regulations (FAR) Part 150, "Airport Noise Compatibility Planning [2]."

The Noise Exposure Maps and Noise Compatibility Program were prepared jointly with the Master Plan to ensure consistency between the Master Plan recommendations for on-Airport development and Noise Compatibility Program recommendations. For example, the air traffic forecasts--necessary to prepare noise exposure maps--are also necessary to establish Airport requirements. Similarly, recommendations for noise abatement could affect recommendations for Airport layout and other aspects of the Airport planning effort. The primary objective of conducting the study was to develop a plan and program that would efficiently accommodate the long-range aviation demand of the region and, at the same time, ensure the long-term compatibility between the Airport and the surrounding community (the Airport environs).

SUMMARY OF NOISE COMPATIBILITY PROGRAM RECOMMENDATIONS

Noise exposure maps were prepared for the Airport for the years 1985, 1990, and 2005. The day-night sound level (Ldn) was used to describe existing and predicted aircraft noise levels. A complete discussion of Ldn, the noise methodology, assumptions, and data used to develop the existing and predicted noise exposure maps are provided in Appendix A.

Because of the large Airport site and its location adjacent to the ocean, effects of aircraft noise on the surrounding community have not been significant. There are currently no incompatible land uses located in areas affected by Ldn (day-night sound level) 60 or higher.

Although aircraft operations at the Airport are expected to increase through the year 2005, the total amount of land exposed to noise levels of Ldn 60 and higher is not expected to increase substantially in that time period. This is due to the replacement of the noisier aircraft being used today by some of the quiet technology aircraft such as the B737-300 and the BAe 146. However, this situation could change if incompatible land uses, such as residences, schools, and hospitals, are permitted to be developed in areas expected to be exposed to high levels of aircraft noise.

Therefore, emphasis in the Noise Compatibility Program is two-fold: (1) to continue to emphasize existing noise abatement procedures and to adopt new measures to abate noise, if necessary, and (2) to adopt new measures to mitigate the effects of noise in the future. These mitigation measures are land use controls that can be applied to prevent or limit the amount of noise-sensitive development that would be permitted to locate in areas exposed to high levels of aircraft noise.

Three noise abatement measures are recommended for Keahole:

- Build high-speed taxiways
- Change flight patterns
- Enforce prescribed flight track use

The eight noise mitigation measures recommended for implementation are:

- Continuation of comprehensive planning and urban growth management by Hawaii County to ensure land use compatibility.
- Sequencing of the implementation of capital improvements and public works projects (such as roadways and utilities) to be consistent with land use compatibility objectives.
- Institution of zoning changes in the Airport environs to encourage Airport-compatible development and adoption of a height/noise/safety overlay zone.
- Requirement for acoustical treatment of new noise-sensitive land uses that might be permitted to locate in areas exposed to noise levels of Ldn 60 or higher.
- Requirement for the dedication of avigation easements to the State of Hawaii for all new or redeveloped noise-sensitive development that would be located in areas exposed to aircraft noise of Ldn 60 or higher.
- Amendment to the subdivision regulations to require soundproofing and the dedication of avigation easements.
- Enactment of fair disclosure ordinances so that all people moving into an existing or potential noise area are informed of the condition.

- Institution of tax incentives to encourage the retention of open space use in the Airport environs.

- Encouragement of the continuance of federal mortgage insurance policies which limit the issuance of such policies in areas exposed to high levels of aircraft noise.

PUBLIC PARTICIPATION

At the outset of the project, a Technical Advisory Committee was formed to review and provide input to the FAR Part 150 Program for Keahole Airport. The invited membership of the Committee is listed in Table 1. Most of the Committee meetings were attended by representatives of the county planning department, staff of the FAA Tower, the State of Hawaii Airport manager, representatives from R. M. Towill Corporation and Peat Marwick, and concerned citizens. Public information sessions and briefings were also held.

In addition, FAA Keahole Tower personnel and planning staff from Hawaii County assisted the study team in assembling much of the basic data required for the noise and land use compatibility analyses.

ORGANIZATION OF REPORT

Chapter 2 provides a summary of the air traffic forecasts used in developing the noise exposure maps and the recommendations in the Master Plan Update. The airfield recommendations, if implemented, would have an effect on future aircraft noise exposure. Existing and planned land use for those portions of Hawaii County surrounding the Airport is also summarized in Chapter 2.

Table 1

TECHNICAL ADVISORY COMMITTEE MEMBERSHIP

The Honorable Virginia Isbell
Representative, 5th District

The Honorable Paul T. Oshiro
Chairman, Transportation Committee
Representative, 46th District

Federal Aviation Administration
- Air Traffic Manager
- Airports Division

Public Planning Agencies
- Board of Land and Natural Resources
- County of Hawaii County Council
- County of Hawaii Planning Department
- County of Hawaii Department of Public Works
- County of Hawaii Department of Research and Development
- Hawaii Leeward Planning Conference

Airport Tenants
- Hemmeter Aviation Services
- Hertz Rent-A-Car
- Host International
- Kona Helicopters, Inc.

Air Transport Association

Airline Pilots Association

Local Industry & Community Interests
- Bank Hawaii
- Bishop Estate
- Commission on Transportation
- First Hawaiian Bank
- Hawaii Island Economic Development Board
- High Technology Development Corporation
- Huehue Ranch
- Kohala Resort Association
- Kona-Kohala Chamber of Commerce
- Kona Palisades Community Association
- Mauna Kea Properties, Inc.
- Manua Lani Resort, Inc.
- Natural Energy Laboratory of Hawaii
- The Outdoor Circle

The traffic projection was checked against projected population increases for the County of Hawaii. The defacto population (resident population plus visitors less residents traveling) projections for the County of Hawaii, prepared by State planners, indicate an annual rate of growth of about 3% in the early 1980s, decreasing to less than 1% beyond year 2000. In 1980, approximately one-fourth of the county's defacto population was in the Kona-South Kohala area; if all of the county's growth were to occur in this area, the annual rate of growth in the area would be 4.9%. The use of a 5% rate of growth for highway traffic, therefore, would result in a high range estimate.

3.3 ROADWAY SYSTEM

The Keahole Master Plan envisions a divided, four-lane access road to the airport. A new 24-foot wide roadway will be constructed parallel to the existing 24-foot access road, with a 24-foot median between roadways. Separate left and right turn lanes will be provided for eastbound traffic approaching the Queen Kaahumanu Highway intersection. No other roadway improvements were assumed for the identification of traffic impacts.

3.4 TRAFFIC IMPACTS

The increased traffic on the two-lane Queen Kaahumanu Highway will result in lowered levels of service; LOS E would describe conditions south of the airport if the projected volumes are realized. North of the airport, the highway will operate at LOS D. Peak day peak hour volumes are estimated to be 86 percent of the highway's capacity south of, and 53 percent north of, the airport. Table 4 summarizes the highway conditions.

At the unsignalized intersection, year 2005 peak day peak hour traffic volumes would exceed the intersection's capacity (Table 5). Controlled movements, such as turns onto the highway and the left turn from the highway toward the airport, would be at LOS F. The analysis for year 2005, average day peak hour volumes shows that the northbound left turn from the highway would operate at LOS D. Right turns from the airport would be at LOS E while the left turn volumes exceed capacity (LOS F).

Table 4

PEAK HOUR HIGHWAY LEVELS OF SERVICE

	PM Peak Hour LOS (V/C Ratio)		
	Queen Kaahumanu Highway		Keahole Airport
	North of Site	South of Site	Access Road
1987 Average Day	B (0.19)	C (0.30)	C (0.24)
1987 Peak Day	B (0.22)	D (0.36)	C (0.25)
2005 Average Day	D (0.45)	E (0.71)	D (0.56)*
2005 Peak Day	D(0.53)	E (0.86)	E (0.61)*

* assuming 2-lane highway
LOS = level of service
V/C = volume-to-capacity

Table 5

UNSIGNALIZED INTERSECTION CONDITIONS

PM Peak Hour

	Level of Service (Reserve of Capacity)		
	Keahole Airport Access Road		Q. Kaahumanu Hwy.
	Left Turn	Right Turn	Left Turn
1987 Average Day	C (214)	A (622)	A (690)
1987 Peak Day	D (162)	A (560)	A (577)
2005 Average Day	F (-178)	E (1)	D (182)
2005 Peak Day	F (-183)	F (-125)	F (- 41)
If highway speed = 45 miles per hour:			
2005 Average Day	F (-165)	E (70)	C (214)
2005 Peak Day	F (-180)	F (- 61)	F (- 12)

APPENDIX E

ARCHAEOLOGICAL SURVEY

KE-AHOLE AIRPORT, HAWAII: ARCHAEOLOGICAL SURVEY OF FIVE AREAS PROPOSED FOR AIRPORT EXPANSION

Prepared for:

R. M. Towill
677 Ala Moana Boulevard
Honolulu, Hawaii 96813

Prepared by:

William Barrera, Jr.

CHINIAGO INC.
P.O. Box 2649
Kamuela, Hawaii 96743

DECEMBER 1987

I. INTRODUCTION

An archaeological survey was conducted on five parcels at Ke-Ahole Airport, North Kona, Hawaii Island [Figure 1]. Survey Area I consists of approximately 150 acres of essentially undisturbed pahoehoe lava, Survey Area II consists of approximately 17 acres previously excavated as a borrow pit, Survey Area III consists of approximately 55 acres previously excavated as a borrow pit, Survey Area IV consists of approximately 130 acres on top of the lava flow of A.D. 1801, and Survey Area V consists of approximately 3 acres on that same lava flow [Figure 2]. The fieldwork was completed in six days by a crew of from one to three people walking sweeps of the survey areas and included plane-table mapping.

The survey areas are relatively flat, and where not disturbed by bulldozing consist primarily of barren pahoehoe lava fields with only scattered clumps of grass. Neither vegetation nor terrain were a hindrance to the fieldwork.

II. PREVIOUS RESEARCH

Reconnaissance projects associated with the initial construction of Ke-ahole Airport and related facilities were begun by the State of Hawaii Department of Land and Natural Resources and the University of Hawaii in 1968 [Ching and Rosendahl 1968] and continued into early 1969 [Ching et al. 1968-1969], and an intensive survey of the airport area was conducted by the State of Hawaii Department of Land and Natural Resources during the Summer of 1969. Unfortunately, very little useful material has been published as a result of these projects. The Historic Sites Section of the State of Hawaii Department of Land and Natural Resources reported in 1985:

> *"One serious problem relates to this work. Evidently, only a preliminary report was prepared [Ching,*

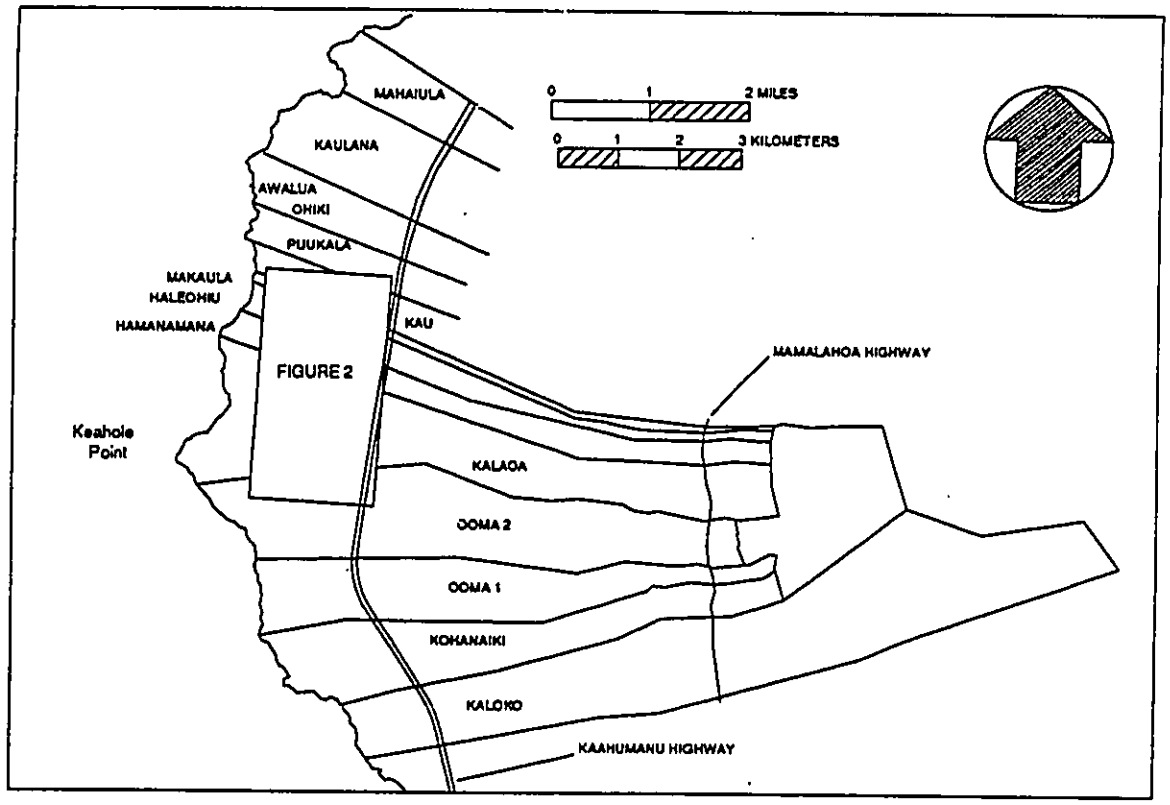


Figure 1. Location of Project Area

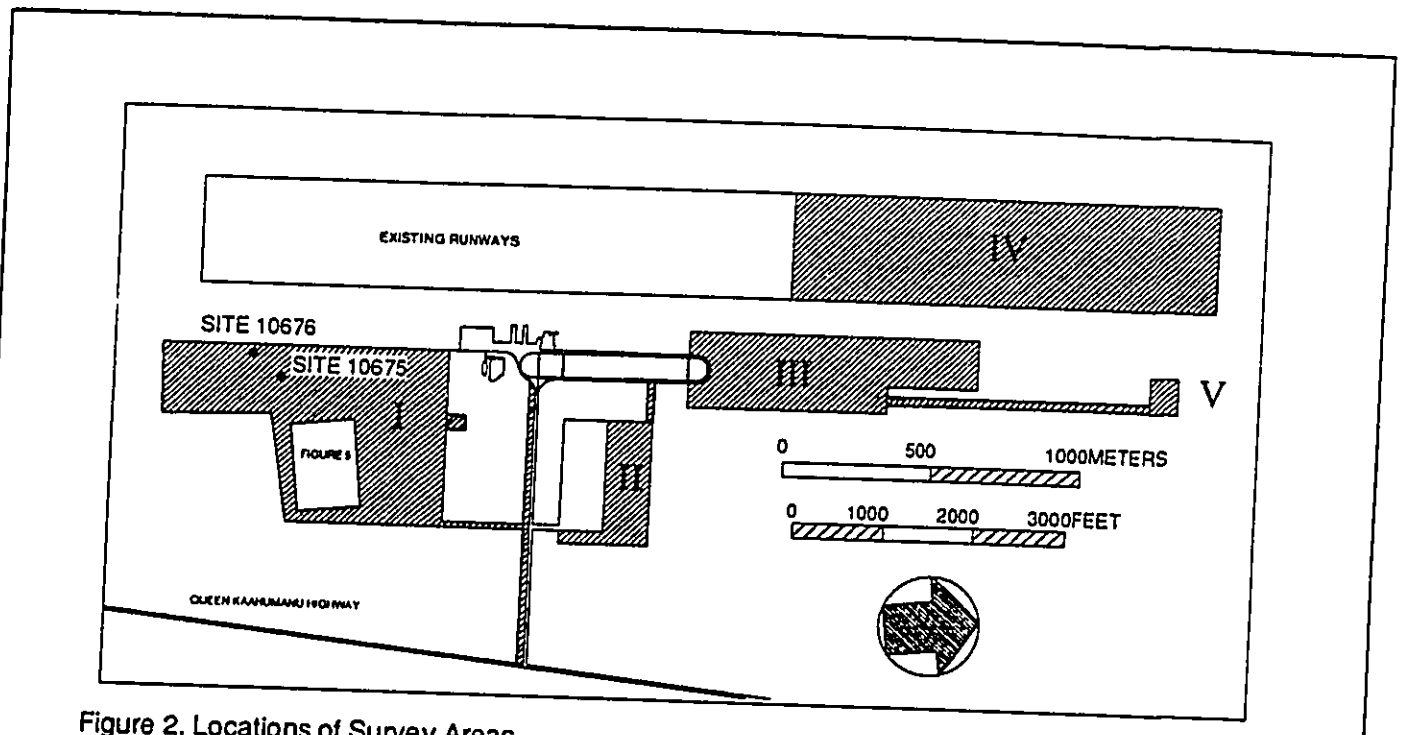


Figure 2. Locations of Survey Areas

Cluff and Riley 1968-69]. The copy of this report in the Historic Sites Section is missing the chapter on the road corridor work and has no site location map with preliminary numbers. Additionally, this preliminary report lists no information for specific sites other than trail information [Peterson 1968-69]. A site map has been attached to our file's report, and it seems to have the final site numbers. Unfortunately, the numbers on this map also do not correlate with any files found in the office. Thus, at present, this sizable survey has limited data that can be used....However, we are trying to track down the missing information" [Cordy 1985:9-12].

Cordy's volume indicates a cairn-marked trail [Site 302] in the survey area [Ibid:20,21]. The only possible evidence of such a feature that we could locate was Site 10676, a rock mound, and possibly Site 10675, an excavated hole in the lava the rocks from which were piled nearby.

In 1979 an intensive survey of two airport emergency service roads was conducted [Barrera 1979], and Bonk [1979] surveyed an area located between the airport and Queen Kaahumanu Highway including portions of Survey Areas II and III of the present survey. The next year Barrera [1980] conducted a survey and dismantled two C-shaped structures in the area south of the terminal building, and earlier this year Barrera conducted an archaeological survey of two areas proposed for south ramp and ground transportation expansion [Barrera 1987].

III. SURVEY RESULTS

No sites were found in Survey Areas II, III, IV or V. Six sites were found in Survey Area I [Figures 2, 3 and 6].

SITE 10675

This is a hole excavated into the pahoehoe bedrock measuring 1.2 by 1.4 meters and 0.7 meters in depth [Figure 4]. No midden or artifacts were found in association with the site.

Its age and function are unknown, but it is probably prehistoric.

SITE 10676

This is a rock mound measuring 0.8 by 2.1 meters and standing to a height of 0.5 meters [Figure

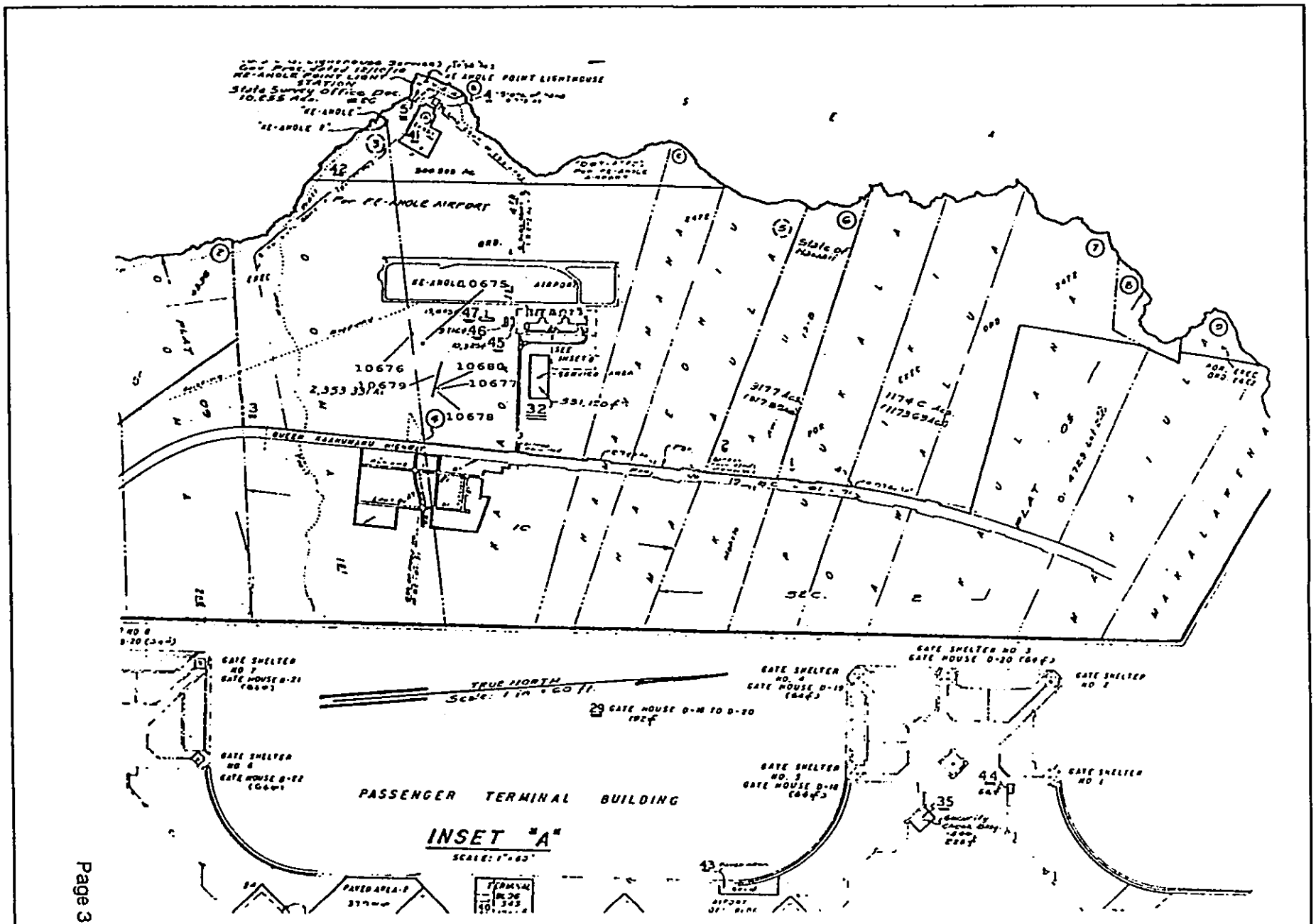


Figure 3. Tax Map Key 7-3-43, Showing Locations of Sites

Figure 4. Site 10675, Looking South

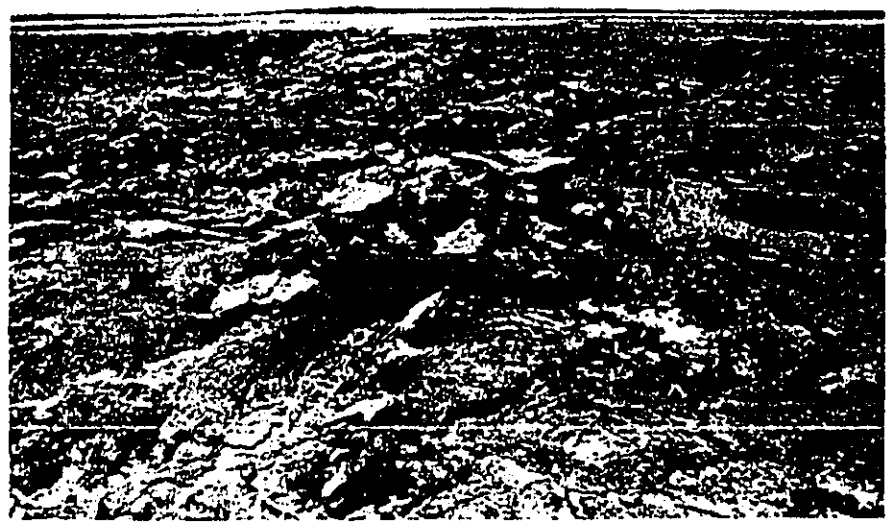


Figure 5. Site 10676, Looking West

5]. It is constructed of basalt cobbles and slabs measuring between 15 by 20 and 25 by 35 centimeters. No midden or artifacts were found in association with the site.

Its age and purpose are unknown, although it may have functioned as a prehistoric trail marker.

desiccated wood, small quantities of ash and large quantities of charcoal. A small pile of debris indicates that the site has been vandalized.

The site probably functioned as a temporary shelter, and, based on dated sites along the coast near Keahole Point, the period of utilization was probably sometime between the sixteenth and eighteenth centuries.

Figure 8. Site 10677, Looking West

SITE 10677

This is a habitation cave with a living area measuring 5 by 10 meters and with a maximum ceiling height of 1.4 meters [Figures 7 and 8]. Low lava tubes extend for approximately 10 meters from the two ends of the cave. An unidentified fern is growing in a moist area on the cave floor at one side of the site. An arrangement of stones forms a stairway providing access via the 1.15-meter drop into the cave through the roof. Midden remains are scarce to moderate and probably extend to a maximum depth of no more than ten centimeters. They consist of the shells of a cowrie (*Cypraea caputserpentis*), a limpet (*Cellana exarata*), a nerite (*Nerita picea*), and a toothed pearl (*Isognomon californicum*), plus sea urchin tests (Echinodermata), fishbone, fragments of coral, nuts of *kukui* (*Aleurites moluccana*), a pandanus key (*Pandanus odoratissimus*), fragments of

SITE 10678

This is a cave measuring 5 by 6 meters with a ceiling height of 2.1 meters. A low lava tube extends to the west from the main chamber. Entrance is via a human-excavated hole in the pahoehoe bedrock [Figure 9], below which is a pile of rocks placed for ease of access. The only midden present, and the only other evidence of human utilization at all, is a single unidentified marine shell on the bare floor of the site.

The site's age and function are unknown, but it is probably prehistoric.

Figure 9. Site 10678, Looking Northwest

Figure 10. Site 10679-A, Looking Southeast

Figure 11. Site 10679-B, Looking South

Figure 12. Site 10679-B, Petroglyph

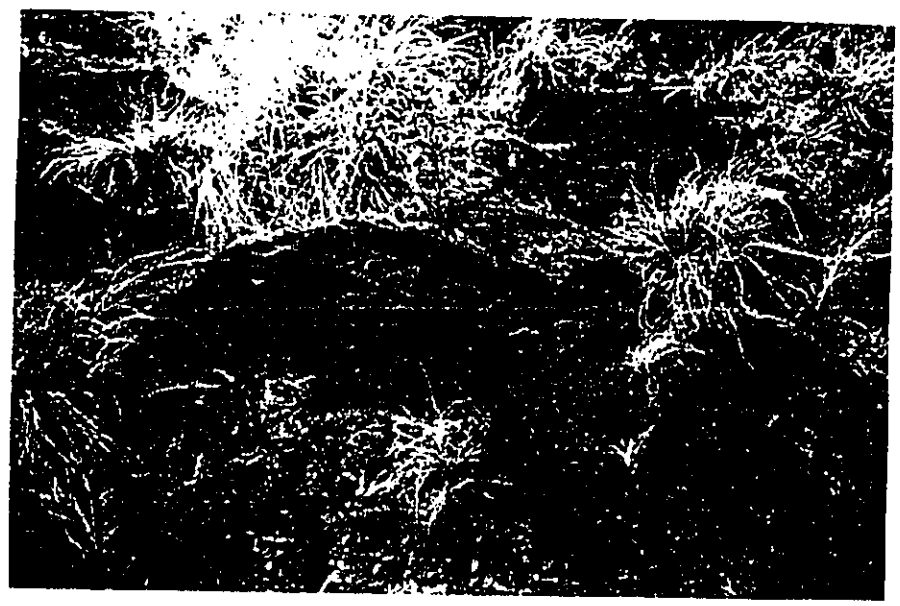


Figure 13. SITE10679-B, Petroglyph

Figure 14. Site 10680-A, Looking West

Figure 15. Site 10680-B, Looking South

SITE 10679

This is a lava tube extending for a distance of approximately 300 meters. It measures up to 6 meters in width and has a ceiling varying in height between about 0.5 and 3 meters. Midden remains, which were found as isolated specimens throughout the entire length of the site, consist of shells of a cowrie (*Cypraea mauritiana*), a limpet [*Cellana exarata*] and a nerite (*Nerita picea*), fragments of coral, a fragment of gourd (probably *Lagenaria siceraria*) and fragments of desiccated wood. No deposits of midden were found. Access to the site is through two places where the roof has collapsed, designated as Features A and B [Figures 10 and 11]. Human modifications consist of a crude stone wall immediately inside the seaward overhang of the easternmost entrance [Feature A] and four petroglyphs consisting of lettering at Feature B [Figures 12 and 13]. Because of its size and complexity the site could not be mapped in the time available.

The absence of any midden deposits and the distance from the coast suggest that the site was used as a temporary shelter. Based on dated sites along the coast near Keahole Point and the historic petroglyphs at Feature B, the period of utilization was probably sometime between the sixteenth century and the middle of the nineteenth century.

SITE 10680

This site consists of two excavations into the pahoehoe bedrock, situated at a distance of 13 meters from each other.

Feature A - This excavation measures 1.7 by 4.6 meters and is 0.3 meters deep [Figure 14].

Feature B - This excavation measures 0.8 by 1.4 meters and is 0.6 meters deep [Figure 15].

Neither midden nor artifacts were found in association with the site.

The site's age and function are unknown, but it is probably prehistoric.

IV. SIGNIFICANCE OF THE SITES

The State Historic Sites Section recognizes three primary grounds for archaeological site preservation:

> *"It is often desirable to preserve certain sites in an area for a variety of reasons--exhibition for the public,*

cultural significance, and long-range scientific research" [Cordy 1985:44].

According to the criteria of the National and State Registers of Historic Places, all of the sites in the project area are significant solely for their information content. None of the sites are of sufficient interest to warrant preservation for purposes of display to the public, nor do any qualify for cultural significance, a category that has in practice been employed for the more impressive types of sites. By this latter measure the petroglyphs at Site 10679-B are neither numerous enough nor sufficiently distinctive to warrant designating them as of cultural significance.

V. RECOMMENDATIONS

Sites 10675, 10676 and 10680 are no longer significant, as all of their relevant details have been recorded and documented in the present report. Archaeological data recovery is recommended as the mitigation measure for Sites 10677, 10678 and 10679. In the case of Site 10677 this would consist of archaeological excavations. In the case of Site 10678 this would consist of mapping and a further check for cultural remains in the low lava tubes extending from each end of the main chamber. Adequate data recovery could be achieved at Site 10679 by mapping and archaeological excavations.

Literature Cited

Barrera, William M., Jr.

1979 *Ke-ahole Airport Emergency Service Roads: Archaeological Survey.* Chiniago Inc.

1980 *Archaeological Survey at Ke-ahole Airport, North Kona, Hawaii Island.* Chiniago Inc.

1987 *Ke-Ahole Airport, Hawaii: Archaeological Survey of South Ramp and Ground Transportation Expansion.* Prepared for Richard M. Sato and Associates. Chiniago Inc.

Bonk, William

1979 "An Archaeological Survey at the Keahole Airport, Kalaoa, North Kona, Hawaii." *Papers in Ethnic and Cultural Studies, 3.* Hilo.

Ching, Francis, Jr. and Paul Rosendahl

1968 *Archaeological Surface Survey of the Kailua-Kawaihae Road [Section II, Honokohau to Keahole Point] and the Keahole Point Airport.* Department of Land and Natural Resources, State of Hawaii. Honolulu.

-----, Deborah Cluff and Thomas Riley

1968-69 *Preliminary Report of Archaeological Surface Survey and Salvage Operations at Keahole, North Kona, Hawaii Island. Section II, Keahole Point Airport and Kailua-Kawaihae Road.* Department of Land and Natural Resources, State of Hawaii. Honolulu.

Cordy, Ross

1985 *Working Paper 1, Hawaii Island Archaeology, Ooma and Kaluoa Ahupua'a, Kekaha, North Kona.* Historic Sites Section, Division of State Parks, Department of Land and Natural Resources, State of Hawaii.

Peterson, Jennie E.

1968-69 "Trails". In: Ching et al., 1968-69, *Preliminary Report of Archaeological Surface Survey and Salvage Operations at Keahole North Kona, Hawaii Island. Section II, Keahole Point Airport and Kailua-Kawaihae Road*, pp. 91-8.

APPENDIX F

AIR QUALITY

AIR QUALITY IMPACT REPORT
KEAHOLE AIRPORT
NORTH KONA, HAWAII

March, 1988

Prepared for

R. M. Towill Corporation

and

State of Hawaii
Department of Transportation
Airports Division

Prepared by

J. M. Morrow
Environmental Management Consultant
Kailua, Hawaii

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

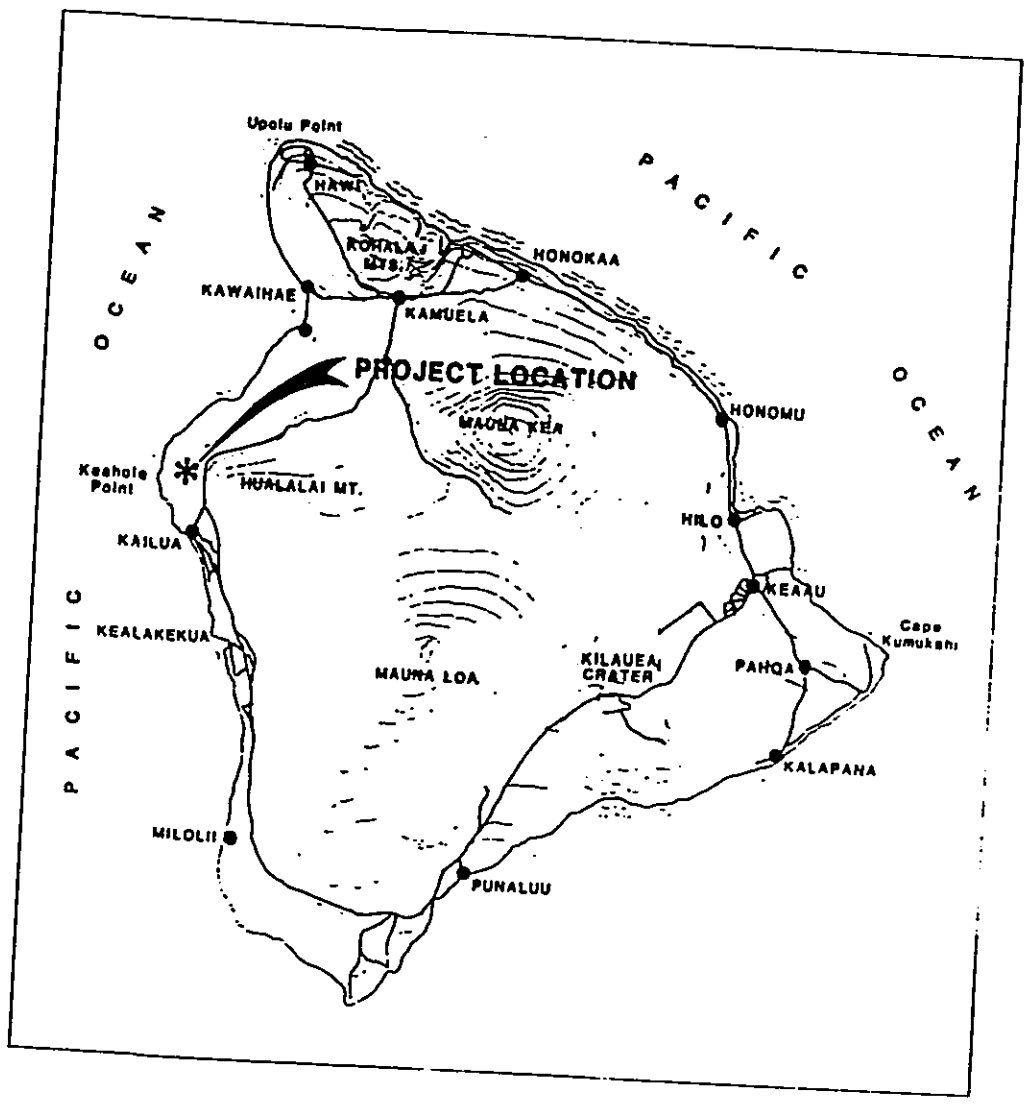
Keahole Airport is located in the the North Kona District on the west side of the Island of Hawaii (Figure 1). It sits on a 4,000 acre parcel of barren "aa" and "pahoehoe" lava created during the eruption of 1801.

In April, 1986, the State of Hawaii, Department of Transportation, Airports Division, initiated a comprehensive planning study for Keahole Airport under the Federal Aviation Administration Airport Improvement Program. The purpose of that study was to determine the type and extent of aviation facilities needed at the airport through the year 2005 and to produce a new Master Plan to accomplish the required development [1,2]. As part of this Master Plan study, an air quality impact analysis has been conducted and the results are reported herein.

A growing commercial airport such as the Keahole Airport is clearly an "indirect" source of air pollution as defined in the federal Clean Air Act [3]. This is because of its very nature of attracting and concentrating mobile sources of pollution, i.e., aircraft and motor vehicles. In addition, the fuel storage and handling associated with these mobile sources is another major source of emissions in an airport area. The airport-related emissions are then affected by local meteorology and terrain and mixed with emissions from other sources in the airport environs to result in ambient levels of pollution. The specific purpose of this analysis is to estimate emissions and ambient impact for actual 1985 aircraft operations as well as projected operations for 1990 and 2005.

FIGURE 1

PROJECT LOCATION
KEAHOLE AIRPORT



2.0 FEDERAL AND STATE REGULATIONS

2.1 Emission Standards

2.1.1 State of Hawaii. The rules governing air pollution control were revised in May, 1986 and are now found under Chapter 60 of the Department of Health's Administrative Rules, Title 11. The State does not regulate aircraft emissions. It regulates motor vehicle emissions only to the extent of prohibiting visible emissions from gasoline-powered vehicles and placing a 5-second time limit on visible smoke from diesel-powered vehicles. The rules also place restrictions on engine idling while parked [4], which, in the case of the airport, would apply primarily to buses vans, and taxis. Another emission control provision applicable to airport operations pertains to fuel storage. Any new storage vessel of more than 250-gallon capacity must be equipped with some type of vapor control system. All storage tanks with a capacity in excess of 40,000 gallons are required to have vapor control systems [5]. These rules apply only to fuels with a vapor pressure equal to or greater than 1.5 pounds per square inch under actual storage conditions, e.g., gasoline.

2.1.2 Federal Government.

2.1.2.1 Aircraft and Aircraft Engines. Since 1980, a number of substantial changes have been made to the federal rules governing aircraft and aircraft engines. In December, 1980, the U.S. Environmental Protection Agency (EPA) delayed compliance with all gaseous standards until January 1, 1983 [6]. In December, 1982, the most extensive amendments were made by EPA [7]. These amendments created new aircraft classes, withdrew all carbon monoxide (CO) and nitrogen dioxide (NO2) standards, and delayed compliance with hydrocarbon (HC) standards until January, 1984. The newly defined classes of aircraft engines included:

Class TP	all aircraft turboprop engines.
Class TF	all turbofan or turbojet engines except engines of Class T3, T8 and TSS.
Class T3	all aircraft gas turbine engines of the JT3D model family.
Class T8	all aircraft gas turbine engines of the JT8D model family.
Class TSS	all aircraft gas turbine engines employed for propulsion of aircraft designed to operate at supersonic flight speeds.

In August, 1984, EPA rejected an appeal by an aircraft engine manufacturer and removed a stay on the smoke emission standard for small (< 26.7 kilonewton thrust) engines [8]. Finally, in October, 1984, EPA amended the exemption for low production engines and provided clarification of the prohibition of fuel venting [9].

With the aforementioned amendments since 1980, the federal rules are presently composed of the following parts [10]:

Subpart A	provides general provisions including exemptions.
Subpart B	prohibits intentional discharge to the atmosphere of fuel from any new or in-use aircraft gas turbine engines.
Subpart C	establishes particulate (smoke) and hydrocarbon standards for new gas turbine aircraft engines (all classes). Particulate standards are based on visibility effects rather than mass emissions; thus, the standard is expressed in terms of a dimensionless "smoke number."
Subpart D	sets particulate (smoke) standards for in-use gas turbine engines (Classes T8 & TF).

It should be noted that the compliance dates for the aforementioned standards have all passed; thus, the standards should all be currently met by new and in-use aircraft engines subject to regulation.

2.1.2.2 Motor Vehicles. The EPA has also promulgated emission standards for newly manufactured motor vehicles [11,12]. Since 1980 there have been numerous amendments to those rules--too many to enumerate in this report. Suffice it to say that the EPA regulates mass emissions of carbon monoxide, hydrocarbons, and nitrogen oxides from motor vehicles. Standards are generally expressed on a grams per vehicle mile (g/veh-mi) basis and set for specified categories of vehicle, e.g., light duty gasoline-powered vehicles (LDV), light duty diesel vehicles, (LDDV), heavy duty diesel vehicles (HDDV), etc. In the case of diesel vehicles, gaseous emission standards are expressed as grams per brake-horsepower hour. Additionally, diesel vehicles are subject to particulate standards, expressed in terms of percent opacity.

The fuel and fuel additives used in motor vehicles are also regulated. Perhaps the most notable aspect of these regulations is the intent to sharply reduce the use of lead additives in gasoline and thereby reduce lead emissions from motor vehicles.

All newly manufactured gasoline powered vehicles are designed and required to burn only unleaded gasoline, i.e., gasoline with a lead content less than 0.05 gram per gallon [13].

2.1.2.3 Petroleum Storage. The EPA has also promulgated new source performance standards (NSPS) for fuel storage tanks which are similar to the State rules [14,15].

2.2 Ambient Air Quality Standards

2.2.1 Hawaii Ambient Air Quality Standards (HAAQS). The Department of Health is the agency charged with promulgating and enforcing ambient air quality standards throughout the state. The existing standards, as amended in April, 1986, are summarized in Table 1 [16]. The principal differences between the pre-1986 and current standards are:

- relaxation of state particulate matter and sulfur dioxide standards so as to make them equivalent to the federal standards.
- elimination of the 24-hour nitrogen dioxide (NO2) standard
- elimination of the 3-hour non-methane hydrocarbons standard
- adoption of a lead standard

The CO, ozone, and annual NO2 standards remain more stringent than their federal counterparts. Finally, as described in the following section, the federal particulate standards were recently revised; thus, the state standards are at this time not the same as the federal standards.

2.2.2 National Ambient Air Quality Standards (NAAQS). The EPA promulgates and enforces the federal air quality standards which are also presented in Table 1. As noted in the table, the federal primary standards are directly health-related while the secondary standards are intended to prevent adverse effects in a number of public welfare-related areas [17]. Two significant revisions have occurred to the NAAQS since 1980. These are listed below:

- hydrocarbons standard was eliminated [18]
- total suspended particulate (TSP) standard was changed to PM-10 standard [19].

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	75	60	60
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	260	150	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)	Annual Arithmetic Mean	100		70
(micrograms per cubic meter)				
5. Carbon Monoxide (CO)	Maximum Average in Any 8 Hours	10,000		5,000
(micrograms per cubic meter)	Maximum Average in Any 1 Hour	40,000		10,000
6. Photochemical Oxidants (as O3)	Maximum Average in Any 1 Hour	240		100
(micrograms per cubic meter)				
7. Lead (Pb)	Maximum Average in Any Calendar Quarter	1.5		1.5
(micrograms per cubic meter)				

This latter change made the annual PM-10 standard an arithmetic average rather than the previously used geometric average and also established a statistical method for determining violations instead of the simple "one allowable exceedance per year" approach.

2.3 State Implementation Plan (SIP). Pursuant to the federal Clean Air Act, the State of Hawaii in 1972 developed a plan for air pollution control called the State Implementation Plan or more commonly SIP [20]. Since, with the previous exception of particulates and sulfur dioxide [21], Hawaii meets all primary and secondary NAAQS, most of its control strategies as originally promulgated were aimed at meeting State standards. Although written into the SIP, these strategies are not considered an official part of the federally approved SIP because the NAAQS are already being met [22]. Thus, in the case of carbon monoxide, hydrocarbons, and nitrogen oxides, the principal pollutants from aircraft and motor vehicles, historical control strategies were aimed at meeting state standards which because of their stringency will insure maintenance of NAAQS. In the case of sulfur dioxide and particulate matter, the two previously designated nonattainment areas were re-designated attainment in 1985 [23].

3.0 EXISTING AIR QUALITY

There is no permanent Department of Health air monitoring station located in the Kona area; however, monitoring was conducted for total suspended particulates (TSP) and sulfur dioxide (SO2) in 1985 - 1986. The results of that sampling are presented in Table 2. They suggest that the air quality in Kona is excellent with both particulate and SO2 levels well below both state and federal standards (see Table 1).

This is not surprising given the current low level of industrial development in the area. The growth and development that has been occuring and continues to occur is more resort oriented and thus is generating automotive pollutants, i.e., carbon monoxide (CO), hydrocarbons (HC), and nitrogen dioxide (NO2), none of which are routinely monitored on the Island of Hawaii.

A brief two-day air sampling program was conducted by the State Department of Transportation in Kailua-Kona in June, 1983. The results revealed that 1-hour ambient carbon monoxide levels were all below 500 micrograms per cubic meter (ug/m3)[24].

It should be noted, however, that the worst air pollution episodes experienced in Hawaii County are due to volcanic activity. While volcanic emissions are somewhat variable and have not been fully characterized, it is well known that visibility (especially in Kona) is affected by the presence of fine particulates resulting directly from volcanic activity and forest fires caused by lava flows. In addition, conditions are also ideal for the formation of secondary pollutants as a result of atmospheric chemistry. There can also be substantial increases in the ambient concentrations of sulfur dioxide and mercury.

Measurements of sulfur dioxide taken during the January, 1983 eruptive phase, for example, indicated 24-hour concentrations as high as 982 micrograms per cubic meter (ug/m3) at the Volcano Observatory and 654 ug/m3 in Hilo. Sulfur dioxide and particulate measurements made during January and March, 1983 in Kona and Hilo are presented in Table 3. Despite the volcanic activity, concentrations were relatively low on most of the days that measurements were made. This may be explained by the infrequent (non-continuous) monitoring and variable wind directions.

Analysis of the airborne particulate matter during the eruption revealed some rather interesting results as unusually high concentrations of selenium, arsenic, indium, gold, and sulfur were found along with strikingly high concentrations of iridium [25].

TABLE 2

Summary of Aerometric Data Collected
at Kailua-Kona, Hawaii
1985 - 1986

	Total Suspended Particulates(TSP) 24-Hour Concentrations (ug/m3)				Sulfur Dioxide (SO2) 24-Hour Concentrations (ug/m3)			
MONTH	SAMPLES	MIN.	MAX.	MEAN	SAMPLES	MIN.	MAX.	MEAN
Sep 85	5	7	10	8	5	<5	<5	<5
Oct 85	5	7	20	14	5	<5	<5	<5
Nov 85	5	6	11	9	5	<5	8	5
Dec 85	5	6	18	12	5	<5	<5	<5
Jan 86	5	4	16	13	5	<5	<5	<5
Feb 86	5	6	26	15	5	<5	<5	5
Mar 86	5	9	20	14	5	<5	<5	<5
Apr 86	4	10	15	13	4	<5	<5	<5
May 86	5	12	17	13	5	<5	<5	<5
Jun 86	5	12	20	15	5	<5	5	<5
Jul 86	5	13	25	18	5	<5	12	6
Aug 86	5	18	28	22	5	<5	<5	<5
ANNUAL	59	4	28	14	57	<5	12	<5

SOURCE: Department of Health

TABLE 3

SPECIAL AIR MONITORING DATA
KONA & HILO, HAWAII
1983

	24-Hour Concentrations (ug/m3			
	Kona		Hilo	
Date	SO2	TSP	SO2	TSP
08 Jan 83	---	---	654.7	22.6
09 Jan 83	---	---	447.7	30.6
12 Jan 83	27.0	23.4	0.6	6.9
14 Jan 83	12.0	22.2	----	----
19 Jan 83	----	----	12.2	17.6
20 Jan 83	18.9	----	----	----
04 Mar 83	4.4	39.1	32.9	53.6
05 Mar 83	0	28.4	----	30.1
07 Mar 83	----	----	0.6	37.0
08 Mar 83	0	11.9	0.6	27.5
10 Mar 83	0	12.8	21.3	38.5
11 Mar 83	----	----	0	28.2

Notes: SO2= sulfur dioxide
TSP= total suspended particulates

SOURCE: Department of Health

4.0 CLIMATE & METEOROLOGY

4.1 Temperature & Rainfall. The airport site is typical of Hawaii's climate with little seasonal or diurnal temperature variation. Monthly temperature averages vary by only about 6 degrees from the warmest months (July and August) to the coolest (January and February) [26]. These leeward coastal areas have a typically semi-tropical, semi-arid climate. Average annual temperature is 78 degrees Fahrenheit.

As in most locations in Hawaii, rainfall is very much affected by local terrain with a gradient which increases with increasing elevation and distance from the shoreline. A good example of this is the 10 - 15 inches of annual rainfall at the proposed Awake'e development site just north of the airport [27] as compared to the 25 inches per year at Kailua-Kona south of the airport [28]. Awake'e is right on the shoreline and more distant from high terrain while Kailua-Kona is beneath the steeper terrain of Puu Hualalai. Annual average rainfall in the Keahole airport area, which is between those two, is approximately 20 inches.

4.2 Surface Winds. Because of the presence of two 13,000 foot volcanic mountain masses northeast and southeast of it, the Kona area is not as dominated by the northeast trade winds as are most other areas of Hawaii. Winds are generally characterized by a diurnal land-sea breeze regime. Daytime onshore winds arise from the more rapid heating of the land surface while nighttime offshore winds result from the more rapid cooling of the land.

One year (1973) of surface wind observations from the old Kona Airport were obtained and processed to produce various windroses. The annual windrose (Figure 2, Table 4) gives a clear indication of the dominance of onshore winds (SSW to WSW) whereas most other locations in Hawaii show a predominance of ENE trade winds. There also appears to be a seasonal variation with the winter months, typified by January, showing a greater diversity of wind direction and lower speeds (Figure 3, Table 5) as compared to August where wind speeds are higher and there is a greater frequency of onshore SSW to WSW winds (Figure 4, Table 6).

FIGURE 2

FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT
KEAHOLE AIRPORT
(ANNUAL 1973)

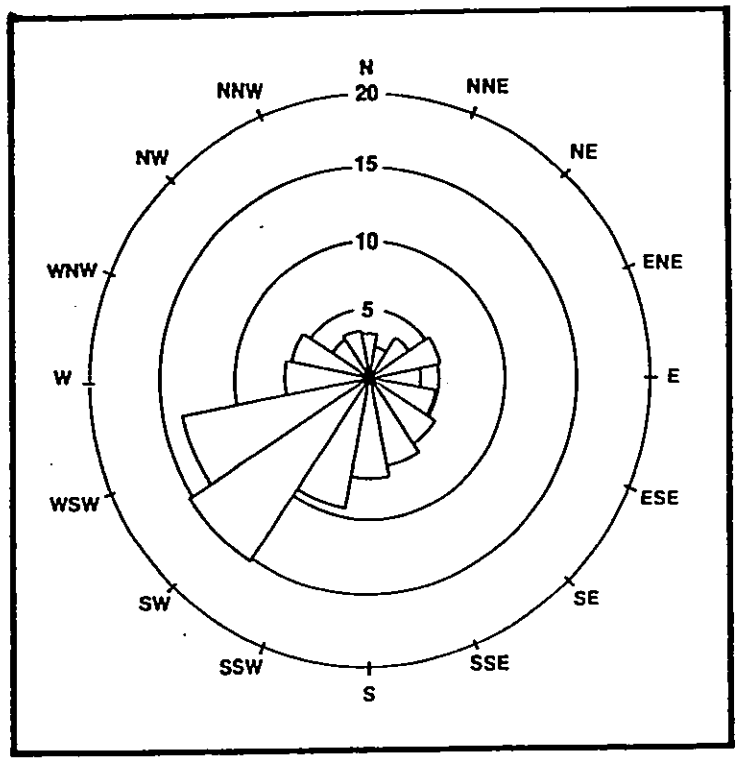


TABLE 4

ANNUAL WIND ROSE*
KEAHOLE AIRPORT

Direction	Wind Speed (Kts) 1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	Total
N	.00193	.00935	.01547	.00564	.00081	.00032	.03353
NNE	.00032	.00371	.00838	.00596	.00258	.00081	.02176
NE	.00064	.01015	.01354	.00677	.00258	.00032	.03401
ENE	.00387	.02869	.01015	.00693	.00177	.00016	.05158
E	.00419	.02434	.00725	.00161	.00000	.00000	.03740
ESE	.00387	.02966	.01564	.00064	.00000	.00000	.04981
SE	.00387	.03337	.01902	.00048	.00016	.00000	.05690
SSE	.00387	.02853	.02821	.00403	.00000	.00000	.06464
S	.00097	.01950	.03385	.01821	.00081	.00000	.07334
SSW	.00226	.01547	.05093	.02676	.00097	.00000	.09539
SW	.00193	.02418	.09317	.03643	.00000	.00000	.15571
WSW	.00226	.02708	.08656	.02192	.00000	.00016	.13798
W	.00081	.01596	.03852	.00596	.00000	.00000	.06125
WNW	.00210	.01467	.03852	.00258	.00000	.00000	.05787
NW	.00097	.00838	.02063	.00290	.00000	.00000	.03288
NNW	.00081	.00919	.02160	.00322	.00016	.00000	.03498
TOTAL:	.03466	.30222	.50145	.15006	.00983	.00177	1.00000

* Based on surface observations, 0600 - 2200 HST daily.

SOURCE: National Weather Service

FIGURE 3

FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT
KEAHOLE AIRPORT
(JANUARY 1973)

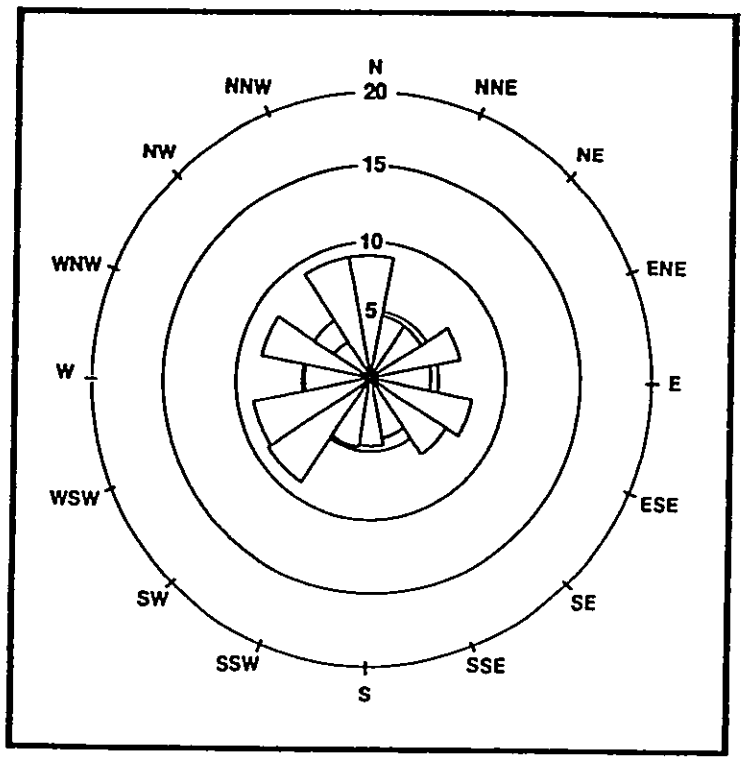


TABLE 5

JANUARY WIND ROSE*
KEAHOLE AIRPORT

Direction	Wind Speed (Kts) 1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	Total
N	.00190	.02846	.05313	.00380	.00000	.00000	.08729
NNE	.00000	.01139	.01898	.01518	.00000	.00000	.04554
NE	.00000	.02087	.02467	.00000	.00000	.00000	.04554
ENE	.00759	.05503	.00190	.00190	.00000	.00000	.06641
E	.01328	.02467	.00569	.00000	.00000	.00000	.04364
ESE	.00949	.04744	.01708	.00000	.00000	.00000	.07400
SE	.00949	.04554	.01139	.00000	.00000	.00000	.06641
SSE	.00759	.02846	.00759	.00000	.00000	.00000	.04364
S	.00190	.02846	.01518	.00380	.00000	.00000	.04934
SSW	.00569	.01898	.02467	.00190	.00000	.00000	.05123
SW	.00190	.03416	.04364	.00949	.00000	.00000	.08918
WSW	.00569	.04175	.03605	.00380	.00000	.00000	.08729
W	.00190	.02467	.02277	.00000	.00000	.00000	.04934
WNW	.00380	.03605	.04175	.00000	.00000	.00000	.08159
NW	.00190	.01708	.01328	.00000	.00000	.00000	.03226
NNW	.00000	.02467	.05693	.00569	.00000	.00000	.08729
TOTAL	.07211	.48767	.39469	.04554	.00000	.00000	1.00000

* Based on surface observations, 0600 - 2200 HST daily.

SOURCE: National Weather Service

FIGURE 4

FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT
KEAHOLE AIRPORT
(AUGUST 1973)

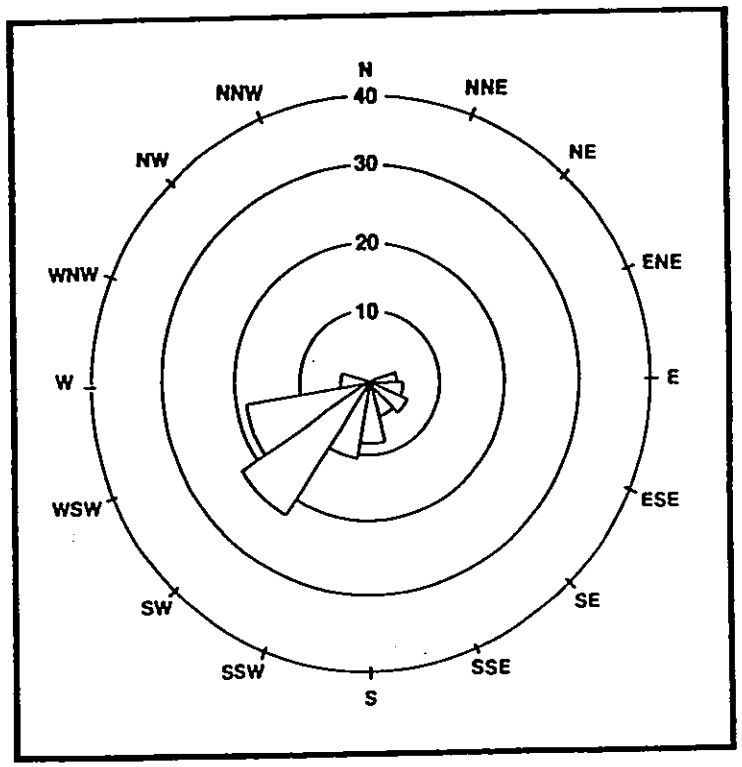


TABLE 6

AUGUST WIND ROSE*
KEAHOLE AIRPORT

Direction	Wind Speed (Kts) 1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	Total
N	.00196	.00784	.00588	.00000	.00000	.00000	.01569
NNE	.00000	.00000	.00196	.00000	.00000	.00000	.00196
NE	.00000	.01373	.01373	.00196	.00000	.00000	.02941
ENE	.00196	.00980	.01373	.00196	.00000	.00000	.02745
E	.00000	.02549	.01176	.00000	.00000	.00000	.03725
ESE	.00784	.01961	.01961	.00000	.00000	.00000	.04706
SE	.00392	.03725	.01765	.00196	.00000	.00000	.06078
SSE	.00196	.02157	.02941	.00000	.00000	.00000	.05294
S	.00588	.01176	.04510	.02549	.00000	.00000	.08824
SSW	.00196	.02353	.04510	.04118	.00000	.00000	.11176
SW	.00000	.02157	.12549	.07843	.00000	.00000	.22549
WSW	.00000	.01961	.13333	.03137	.00000	.00000	.18431
W	.00000	.00392	.03922	.00196	.00000	.00000	.04510
WNW	.00000	.00392	.03137	.00196	.00000	.00000	.03725
NW	.00196	.00784	.01176	.00000	.00000	.00000	.02157
NNW	.00000	.00588	.00784	.00000	.00000	.00000	.01373
TOTAL	.02745	.23333	.55294	.18627	.00000	.00000	1.00000

* Based on surface observations, 0600 - 2200 HST daily.

SOURCE: National Weather Service

5.0 IMPACT ANALYSIS

5.1 Source Activity. Hourly aircraft activity and mix were obtained for the analysis years 1985, 1990,and 2005 [1,29]. Airport access vehicle traffic data were derived from two previous studies [30, 31]. Ground service vehicle (GSV) data were obtained from the major air carriers serving Keahole. GSV fuel use was estimated based on number of air carrier arrivals and experience at Honolulu International Airport. Ground vehicle mix was based on the actual GSV data or, in the case of environs roadways, based on the City & County of Honolulu vehicle registrations [32].

5.2 Emission Factors. Aircraft landing-takeoff (LTO) emission factors were derived from time-in-mode (TIM) and engine emission factors taken from two U.S. Environmental Protection Agency (EPA) publications [33,34]. Motor vehicle emission factors for carbon monoxide, nitrogen oxides, and non-methane hydrocarbons were computed for each of the three study years using EPA's mobile source emissions model MOBILE-3 [35]. These emission factors were localized by use of the 1986 age distribution of registered vehicles in the City & County of Honolulu [32]. Fraction of vehicle miles travelled (VMT) was assumed to be directly proportional to the registration distribution. Emission factors for ground service vehicles (GSV) and aircraft fueling operations were taken from another EPA publication [36].

5.3 Annual Emissions. Estimates of annual emissions of the five major pollutants carbon monoxide (CO), nitrogen oxides (NOx), hydrocarbons (HC), sulfur dioxide (SO2), and particulate matter (PM), were derived using the aforementioned source activity data and emission factors. The results are depicted in Figure 5. It is quite clear that on a tonnage basis alone, carbon monoxide is the most abundant pollutant with NOx and HC about one fifth as much. Sulfur dioxide and PM are only about 3% of the CO values. All pollutants show increases over the 1985 - 2005 period.

For comparative purposes, the State Department of Health's 1980 emissions inventory for the County of Hawaii is presented in Table 7. The airport's 2005 emissions appear to represent from 0.7 to 6.7% of the county inventory for specific pollutants with SO2 being at the low end and NOx at the top. A more detailed breakdown of the major source categories contributing to annual emissions is presented in Table 8. Table 9 simply shows the same data on a percent contribution basis. It is clear from both tables that aircraft are the principal source of all five pollutants in the airport area. Note also the decline in CO and HC emissions from roads and parking over the 1985 - 2005 period. This is due to the federal motor vehicle emission control program [11,12] which because it mandates tighter emission standards for new vehicles appears to offset the projected increase in traffic

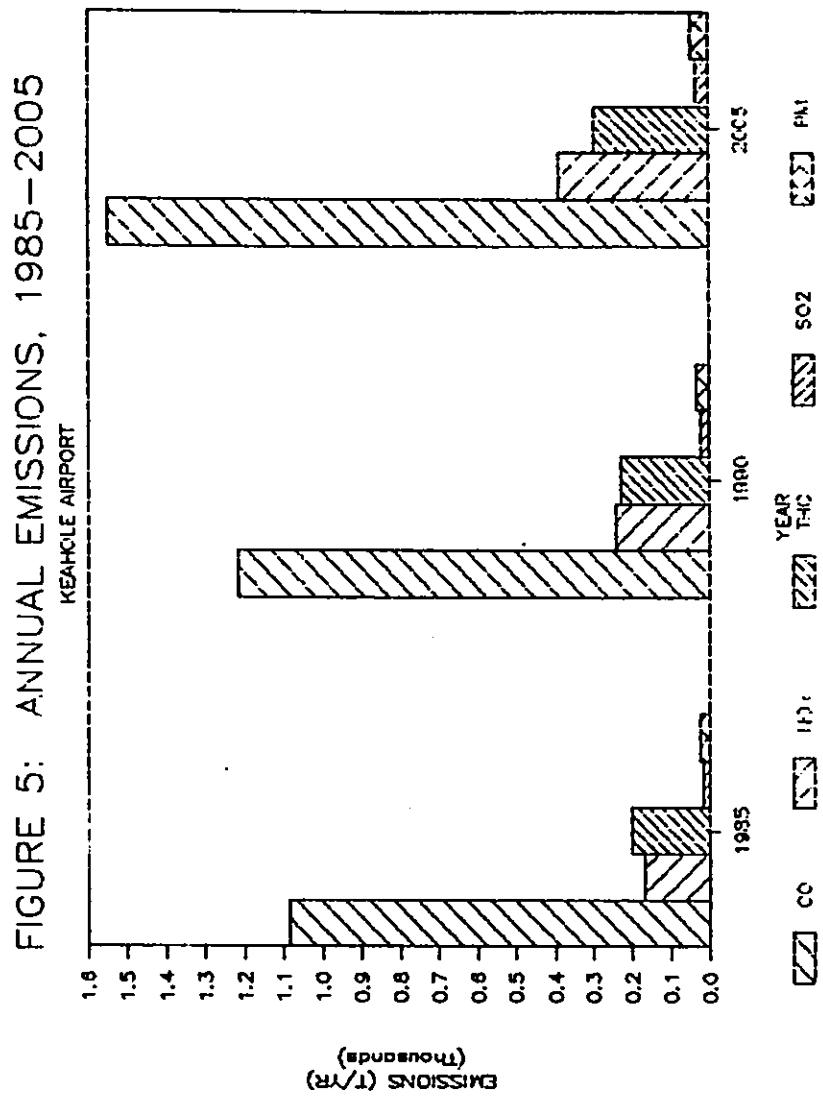


FIGURE 5:

TABLE 7

1980 EMISSIONS INVENTORY

COUNTY OF HAWAII

SOURCE CATEGORY	EMISSIONS (Tons/Year) PM	SOx	NOx	CO	HC
Steam Electric Power Plants	263	3,233	1,309	66	22
Gas Utilities	0	0	11	0	0
Fuel Combustion in Agricultural Industry	2,252	996	798	0	7
Refinery Industry	0	0	0	0	0
Petroleum Storage	0	0	0	0	392
Metallurgical Industries	0	0	0	0	0
Mineral Products Industry	1,080	14	11	0	0
Municipal Incineration	0	0	0	0	0
Motor Vehicles	263	177	3,048	42,177	4,035
Construction, Farm and Industrial Vehicles	40	32	454	1,516	152
Aircraft	6	5	46	1,450	174
Vessels	11	91	63	66	29
Agricultural Field Burning	1,800	0	0	20,627	2,446
TOTAL:	5,715	4,547	5,741	65,902	7,258

SOURCE: State Department of Health

TABLE 8

ANNUAL EMISSIONS BY SOURCE CATEGORY
KEAHOLE AIRPORT
1985 - 2005

Source	Emissions (T/yr) CO	NOx	HC	SO2	PM
1985					
Roads	269	30	43	2	5
Parking	8	<1	1	<1	<1
Ground Serv. Vehicles	91	11	14	1	1
Fuel Storage/Handling	0	0	4	0	0
Aircraft	716	128	140	14	21
TOTAL:	1,085	169	202	17	26
1990					
Roads	274	39	37	3	7
Parking	9	1	1	<1	<1
Ground Serv. Vehicles	95	12	15	1	1
Fuel Storage/Handling	0	0	6	0	0
Aircraft	839	192	170	19	26
TOTAL:	1,217	243	228	23	34
2005					
Roads	233	53	27	6	13
Parking	5	<1	<1	<1	<1
Ground Serv. Vehicles	121	15	19	1	1
Fuel Storage/Handling	0	0	10	0	0
Aircraft	1,192	320	239	27	34
TOTAL:	1,551	388	295	34	48

Notes: CO - carbon monoxide
NOx - nitrogen oxides
THC - total hydrocarbons
SO2 - sulfur dioxide
PM - particulate matter

TABLE 9

PERCENT CONTRIBUTION OF SOURCES TO ANNUAL EMISSIONS
KEAHOLE AIRPORT
1985 - 2005

Source	% Contribution CO	NOx	HC	SO2	PM
1985					
Roads	24.8	17.6	21.3	12.5	17.5
Parking	0.8	0.1	0.3	0.1	0.0
Ground Serv. Vehicles	8.4	6.7	7.0	3.0	3.0
Fuel Storage/Handling	0.0	0.0	1.9	0.0	0.0
Aircraft	66.0	75.6	69.5	84.3	79.4
TOTAL:	100.0	100.0	100.0	100.0	100.0
1990					
Roads	22.5	15.9	16.3	13.7	20.6
Parking	0.7	0.4	0.4	0.2	0.1
Ground Serv. Vehicles	7.8	4.8	6.4	2.6	2.4
Fuel Storage/Handling	0.0	0.0	2.4	0.0	0.0
Aircraft	69.0	78.9	74.5	83.4	77.0
TOTAL:	100.0	100.0	100.0	100.0	100.0
2005					
Roads	15.0	13.6	9.0	17.4	27.0
Parking	0.3	0.1	0.2	0.2	0.1
Ground Serv. Vehicles	7.8	3.8	6.3	2.1	2.1
Fuel Storage/Handling	0.0	0.0	3.5	0.0	0.0
Aircraft	76.9	82.5	81.0	80.3	70.8
TOTAL:	100.0	100.0	100.0	100.0	100.0

Notes: CO - carbon monoxide
NOx - nitrogen oxides
THC - total hydrocarbons
SO2 - sulfur dioxide
PM - particulate matter

volume. NOx, PM, and SO2 emissions, on the other hand, show increases due to increasing source activity, less stringent NOx emission standards, and no standards for PM and SO2.

5.3 Ambient Modeling. While emissions estimates can be informative and helpful in predicting air pollution trends, they are rather crude indicators of ambient air quality. It is air quality or specifically air pollutant concentrations that are more meaningful in terms of predicting health or materiel effects as well as compliance with air quality standards.

In this particular case, an airport vicinity air pollution model (AVAP) developed at the Argonne National Laboratory [37] was employed in order to generate estimates of ambient pollutant levels in the airport area. Normally, hourly concentrations of CO, NO2, HC, TSP, and SO2 would be computed for a 24-hour period in each of the study years using the AVAP model. In this particular case, due to the limited daytime operation of the airport and the lack of 24-hour meteorological data, the model was run for a 14-hour period (6:00 am to 8:00 pm).

Emission factors and source activity as discussed above were input to the model along with even more detailed data regarding source-receptor geometry, runway use, and local meteorology. In order to estimate maximum landside pollutant concentrations under prevailing southwesterly wind conditions, 40 receptor locations were selected on the northeast (mauka) side of the airport. See Figure 6 for all receptor locations.

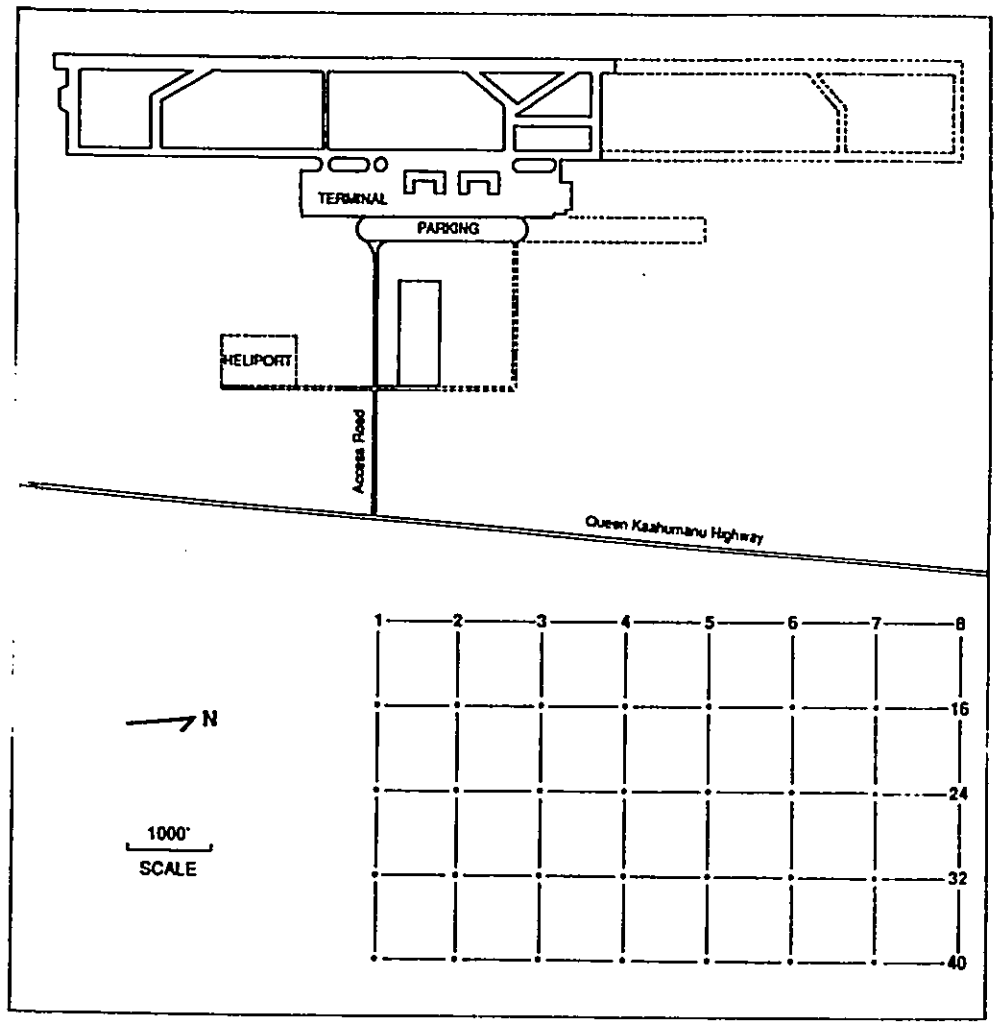
One year (1973) of airport meteorological data were then screened in order to identify the 24-hour period with the greatest number of hours of southwesterly winds and lowest average wind speed. The persistency of direction and low wind speed would insure maximum impact on the selected receptors.

A summary of this modeling is presented in Table 10. Note that for each pollutant a background level has been added to the modeled concentration. CO levels appear to be well below both state and federal 1-hour and 8-hour standards (see Table 1). It should be noted, however, that the receptor grid was not set up to identify CO "hotspots"; therefore, CO levels at such locations, e.g., curbside loading/unloading near the terminal, will be higher than the modeling indicates. The modeling results simply indicate the more general impact of airport activities on the surrounding environs. Onsite air sampling would be the best method of determining CO levels in the "hotspot" areas.

As noted in Section 2, there are currently no ambient hydrocarbon standards. The ambient concentrations of total hydrocarbons (THC) listed in Table 10 include an estimated background level of methane of 1648 ug/m3 based on the 1979-80 measurement data at the Honolulu International Airport. By subtracting this baseline methane concentration from the values in Table 10, one can see that the 3-hour non-methane concentrations would not exceed the

FIGURE 6

AVAP* MODELING RECEPTOR GRID
KEAHOLE AIRPORT
1985 - 2005



LEGEND

*AVAP = Airport Vicinity Air Pollution Model
..... = 1900 - 2005 Expansion

TABLE 10

RESULTS OF AVAP* MODELING
KEAHOLE AIRPORT
1985 - 2005

Pollutant	Year	Averaging Period	Range of Maximum Concentrations (ug/m3)	Ending Hour of Maximum	Location of Maximum
Carbon Monoxide	1985	1-hr	119 - 448	11:00 am	03
	1990		131 - 505	11:00 am	03
	2005		134 - 472	12:00 n	01
	1985	8-hr	182 - 234	6:00 pm	03
	1990		218 - 272	6:00 pm	02
	2005		262 - 346	7:00 pm	02
Total Hydrocarbons (THC) (as methane)	1985	3-hr	1,649 - 1,658	5:00 pm	04
	1990		1,650 - 1,662	1:00 pm	02
	2005		1,651 - 1,662	2:00 pm	02
Nitrogen Dioxide (NO2)	1985	24-hr	29 - 32	12:00 mn	03
	1990		30 - 35	12:00 mn	02
	2005		31 - 37	12:00 mn	02
Sulfur Dioxide (SO2)	1985	24-hr	12 - 12	12:00 mn	all
	1990		12 - 14	12:00 mn	02
	2005		12 - 14	12:00 mn	02
Total Suspended Particulate Matter (TSP)	1985	24-hr	28 - 29	12:00 mn	02
	1990		28 - 30	12:00 mn	02
	2005		28 - 30	12:00 mn	02

NOTES:
1. AVAP = Airport Vicinity Air Pollution Model
2. ug/m3 = micrograms per cubic meter
3. Background levels:
   CO - 100 ug/m3 (= 0.1 mg/m3)
   TSP - 28 ug/m3 (based on 1985-86 DOH monitoring at Kona)
   NO2 - 29 ug/m3 (based on 1975 DOH monitoring at Hilo)
   SO2 - 12 ug/m3 (based on 1985-86 DOH monitoring at Kona)
   THC - 1,648 ug/m3 methane (based on 1979-80 monitoring at the Honolulu International Airport)
4. See Figure 6 for locations of maximum concentrations.

now defunct state standard of 100 ug/m3. Thus, while the airport will continue to contribute to downwind oxidant formation as a result of its emissions of precursors, i.e., non-methane hydrocarbons, exceedances of photochemical (ozone) standards are not presently predicted.

Since the estimated twenty-four hour NO2 concentrations are lower than the annual NO2 standards, it is likely that the airport area will continue to be in compliance with both the state and less stringent federal NO2 standards.

Sulfur dioxide concentrations were very low due to the lack of significant SO2 sources in the airport area. One-hour maxima are well below 3-hour, 24-hour and annual standards; thus, all standards should continue to be met. Since gasoline, diesel fuel, and aviation fuels are all low in sulfur content, SO2 concentrations should continue to be low in the future as well.

Total suspended particulates (TSP) were well within the State's 24-hour standard of 150 ug/m3. The highest 24-hour concentration estimates did not even exceed the State's annual standard; thus, one can infer that that standard also will be met. Since the newly promulgated federal standard for PM-10 is also set at 150 ug/m3, one can conclude that it also will be met.

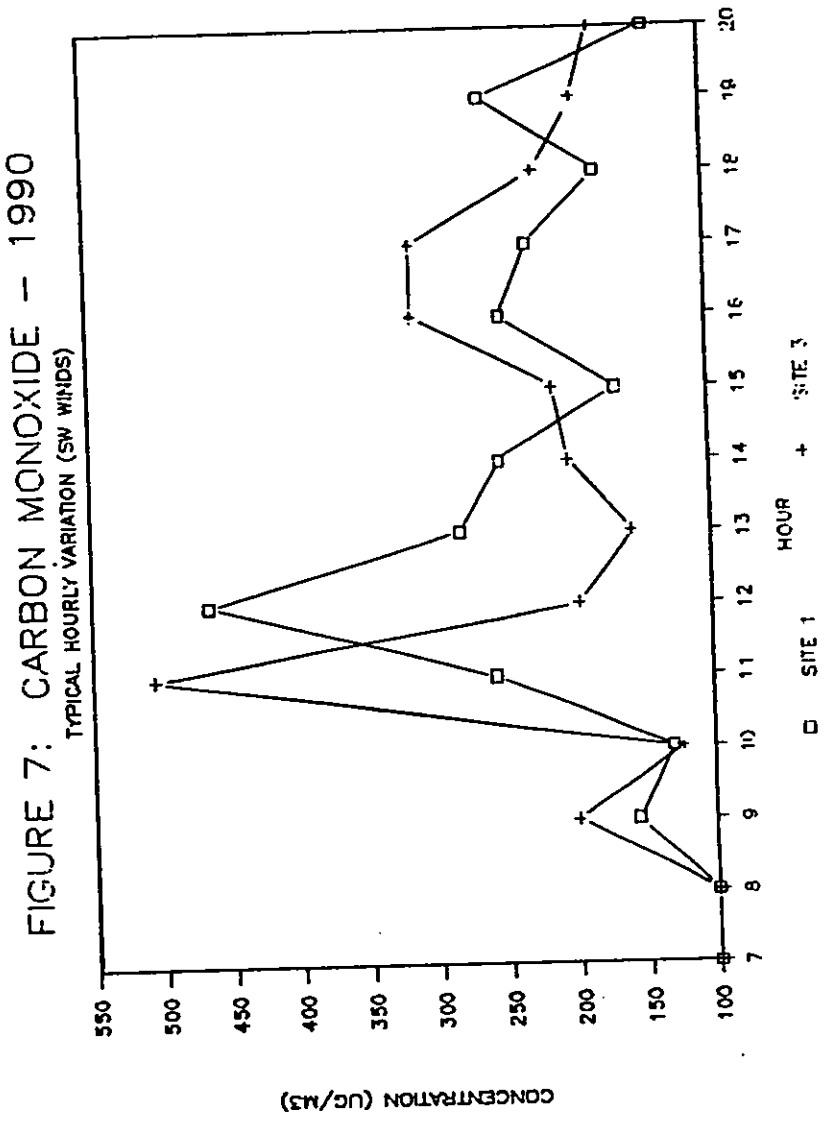
The percentage contributions of aircraft, other airport sources (such as parking lots, ground service vehicles, etc.), and environs sources (roads), are presented in Table 11. In contrast to more densely populated areas such as Honolulu where heavily travelled roads and freeways can be most significant, the principal contributor in the Keahole area appears to be aircraft and airport activities.

Finally, Figure 7 depicts the predicted typical hourly variation in CO concentration at two receptor locations (Nos. 1 and 3) across the Queen Kaahumanu Highway under prevailing daytime southwesterly winds. The hourly variation is similar to the other pollutants and corresponds with peak source activity at the airport and along the highway.

TABLE 11

PERCENT CONTRIBUTION OF SOURCES
TO MAXIMUM ESTIMATED 24-HOUR AMBIENT CONCENTRATIONS
KEAHOLE AIRPORT
1985 - 2005

Source Category	% Contribution CO	NOx	THC	SO2	TSP
1985					
Aircraft	67.1	50.0	88.5	0.0	75.5
Airport Sources	20.7	25.0	6.6	0.0	13.3
Environs Sources	12.2	25.0	4.9	0.0	11.2
TOTAL:	100.0	100.0	100.0	0.0	100.0
Receptor Location:	03	03	03	n/a	02
1990					
Aircraft	64.2	50.0	90.1	100.0	69.3
Airport Sources	26.4	25.0	6.2	0.0	16.4
Environs Sources	9.4	25.0	3.7	0.0	14.2
TOTAL:	100.0	100.0	100.0	100.0	100.0
Receptor Location:	02	03	03	02	02
2005					
Aircraft	60.5	37.5	89.6	100.0	58.7
Airport Sources	33.8	37.5	7.5	0.0	21.7
Environs Sources	5.7	25.0	2.8	0.0	19.5
TOTAL:	100.0	100.0	100.0	100.0	100.0
Receptor Location:	02	03	02	02	02



6.0 CONCLUSIONS

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

- The airport and its environs are a significant source of carbon monoxide, nitrogen oxides, hydrocarbons, and to a much lesser extent, particulate matter and sulfur dioxide. Emissions of these pollutants are projected to increase over the 1985 - 2005 period as a result of increases in aircraft operations and the ground vehicle activity that is generated by those operations.

- Despite the significant emissions, ambient concentrations of these pollutants are projected to remain in compliance with federal and state air quality standards.

- Because of its unique terrain and meteorological characteristics, Kona is more susceptible to buildup of pollutant concentrations and will have to be monitored closely and periodically reevaluated as industrial, commercial, and residential/resort development proceeds in the future.

REFERENCES

1. Peat, Marwick, Mitchell & Co. Airport Consulting Services. "Working Paper: Forecasts, Demand/Capacity, and Facility Requirements - Keahole Airport", September, 1986.

2. State of Hawaii, Department of Transportation, Airports Division. Keahole Airport Master Plan (Executive Summary - Draft) prepared by R. M. Towill Corporation, June, 1987

3. U. S. Congress. Clean Air Act Amendments of 1977 (P.L. 95-95, Section 110, Implementation Plans, August, 1977.

4. State of Hawaii, Department of Health. Title 11, Administrative Rules, Chapter 60, Air Pollution Control, Section 11-60-4, as amended, April, 1986.

5. ibid., Section 11-60-10.

6. U.S. Environmental Protection Agency. Control of Air Pollution from Aircraft and Aircraft Engines, Federal Register, Vol. 45, p. 86946, December 31, 1980.

7. U.S. Environmental Protection Agency. Control of Air Pollution from Aircraft and Aircraft Engines; Emissions Standards and Test Procedures, Federal Register, Vol. 47, p. 58461, December 30, 1982.

8. U.S. Environmental Protection Agency. Control of Air Pollution from Aircraft and Aircraft Engines; Smoke Emission Standard, Federal Register, Vol. 49, p. 31873, August 9, 1984.

9. U.S. Environmental Protection Agency. Control of Air Pollution from Aircraft and Aircraft Engines; Exemption for Low Production Engines, Federal Register, Vol. 49, p. 41002, October 18, 1984.

10. U.S. Environmental Protection Agency. Control of Air Pollution from Aircraft and Aircraft Engines, Code of Federal Regulations, Title 40, Part 87, as amended, July 1987.

11. U.S. Environmental Protection Agency. Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines, Code of Federal Regulations, Title 40, Part 85, as amended, July, 1987.

References (Con't)

12. U.S. Environmental Protection Agency. Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines: Certification and Test Procedures, Code of Federal Regulations, Title 40, Part 85, as amended, July, 1987.

13. U.S. Environmental Protection Agency. Regulation of Fuels and Fuel Additives, Code of Federal Regulations, Title 40, Part 80, as amended, July, 1987.

14. U.S. Environmental Protection Agency. Code of Federal Regulations, Title 40, Part 60, Subpart K, Standards of Performance for Storage Vessels for Petroleum Liquids Constructed After June 11, 1973 and Prior to May 19, 1978, as amended, July, 1987.

15. U.S. Environmental Protection Agency. Code of Federal Regulations, Title 40, Part 60, Subpart Ka, Standards of Performance for Storage Vessels for Petroleum Liquids Constructed After May 18, 1978, as amended, July, 1987.

16. State of Hawaii, Department of Health. Title 11, Administrative Rules, Chapter 59, Ambient Air Quality Standards, as amended, April, 1986.

17. U.S. Environmental Protection Agency. National Primary and Secondary Ambient Air Quality Standards, Code of Federal Regulations, Title 40, Part 50, as amended, July, 1987.

18. U.S. Environmental Protection Agency. National Ambient Air Quality Standards for Hydrocarbons, Federal Register, Vol. 48, p. 628, January 5, 1983.

19. U.S. Environmental Protection Agency. Revisions to National Ambient Air Quality Standards for Particulate Matter, Federal Register, Vol. 52, p. 2463, July 1, 1987.

20. State of Hawaii, Department of Health. Air Pollution Control Implementation Plan, January 21, 1972.

21. U.S. Environmental Protection Agency. Attainment Status Designations; Certain Areas of Arizona, California, and Hawaii, Federal Register, Vol. 44, p. 53081, September 12, 1979.

References (Con't)

22. U.S. Environmental Protection Agency. Approval and Promulgation of Implementation Plans, Code of Federal Regulations, TItle 40, Part 52, Section 52.623, as of July, 1987.

23. U.S. Environmental Protection Agency. Designation of Areas of Air Quality Planning Purposes; Attainment Status Designations in Hawaii, Federal Register, Vol. 50, p. 46436, November 8, 1985.

24. State of Hawaii and County of Hawaii. Alli Highway Project, Kailua-Keauhou, Draft Environmental Impact Statement and Section 4(f) Statement, September 14, 1984.

25. Zoller, W. H. et al. Iridium Enrichment in Airborne Particles From Kilauea Volcano: January, 1983, Science 222: 1118, December, 1983.

26. U. S. Department of Commerce, National Oceanographic and Atmospheric Administration, Environmental Data Service. Hawaii and Pacific Annual Summary, 1974.

27. Helber, Hastert, Van Horn & Kimura. Awake'e Resort, North Kona (Draft Environmental Impact Statement), December, 1986.

28. Helber, Hastert, Van Horn & Kimura. Kohana-Iki Resort Community, Kohana-Iki, North Kona (Draft Environmental Impact Statement), July, 1986.

29. KFC Airports, Inc. Personal communication from Brian Ishii, January, 1988.

30. State of Hawaii, Department of Transportation, Highway Planning Branch. Traffic Count, 1984.

31. Parsons Brinckerhoff Quade & Douglas, Inc. Traffic Assessment: Keahole Airport Master Plan, North Kona, Hawaii, September, 1987.

32. City & County of Honolulu, Department of Data Systems. Age Distribution of Registered Vehicles in the City & County of Honolulu (unpublished report), September, 1986.

References (Con't)

33. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, Volume II: Mobile Sources, AP-42 (Fourth Edition), September, 1985.

34. U.S. Environmental Protection Agency. Air Pollutant Emission Factors for Military and Civil Aircraft, EPA-450/3-78-117, October, 1978.

35. U.S. Environmental Protection Agency. User's Guide to MOBILE-3 (Mobile Source Emissions Model), EPA-460/3-84-002, June, 1984.

36. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, AP-42 (Third Edition) with Supplements 1 - 15, January, 1984.

37. Wang, I.T., L.A. Conley, and D.M. Rote. Airport Vicinity Air Pollution Model User's Guide, Argonne National Laboratory, Energy and Environmental Systems Division, 1974.