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 WAIIHEE  

cc: /Marvin T. Miura, Ph.D.
Keahole Airport Master Plan
ENVIRONMENTAL IMPACT STATEMENT
Keahole, North Kona, Hawaii
FINAL
ENVIRONMENTAL IMPACT STATEMENT
FOR THE
KEAHOLE AIRPORT MASTER PLAN
NORTH KONA, HAWAI'I

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: David Moyer
Date: 9/30/88

Responsible Official: David J. Williams
Date: 10/11/88

Prepared By:

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

OCTOBER 1988
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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 Pest Warwick 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
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 9,658 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
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AVIATION DEMAND FORECASTS
KEAHOLE AIRPORT

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<td>Air Taxis</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Carrier</td>
<td>20,510</td>
<td>38,000</td>
<td>46,000</td>
<td>50,000</td>
<td>53,000</td>
</tr>
<tr>
<td>Commuter/Air Taxi</td>
<td>31,473</td>
<td>31,000</td>
<td>37,000</td>
<td>42,000</td>
<td>48,000</td>
</tr>
<tr>
<td>General Aviation</td>
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</tr>
<tr>
<td>Military</td>
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</tr>
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<td>TOTAL</td>
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<td>116,000</td>
<td>133,000</td>
<td>146,000</td>
<td>159,000</td>
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<td>Based Aircraft</td>
<td>36</td>
<td>42</td>
<td>48</td>
<td>53</td>
<td>60</td>
</tr>
</tbody>
</table>

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), 'uhala (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 (NO₂), sulfur dioxide (SO₂), 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 (μg/m³).

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

1-13
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:

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<thead>
<tr>
<th>Authority</th>
<th>Approval Required</th>
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<tr>
<td>Federal Government</td>
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</tr>
<tr>
<td>Federal Aviation Administration</td>
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</tr>
<tr>
<td>State of Hawaii</td>
<td></td>
</tr>
<tr>
<td>State Land Use Commission</td>
<td>Land Use Boundary Amendment</td>
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<tr>
<td>Dept. of Health</td>
<td>NPD2S Permit</td>
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<tr>
<td>Dept. of Transportation, Highways</td>
<td>Construction Within State R.O.W.</td>
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County of Hawaii
Planning Department

Dept. of Public Works
Building Department

Rezoning
SMA Permit

Grading Permit
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.
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
### RUNWAY DATA

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<th>DESCRIPTION</th>
<th>EXISTING</th>
<th>PROPOSED</th>
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<td>INSTRUMENT RUNWAY</td>
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<tr>
<td></td>
<td>NAVAID &amp; VOR</td>
<td>VAS-6</td>
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<td>RUNWAY LENGTH</td>
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### NOTES

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

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</thead>
<tbody>
<tr>
<td>(000)</td>
<td>(000)</td>
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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.
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.
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, commuter 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.
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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:

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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
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.
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
KEAHOLE AIRPORT MASTER PLAN
KEAHOLE AIRPORT, NORTH KONA, HAWAII
STATE PROJECT NO. AH 2011-02
AIP PROJECT NO. AIP 3-15-0008-03
R. M. TOWILL CORPORATION
HONOLULU, HAWAII

LEGEND:

Existing Airfield Facilities
Proposed Airfield Facilities

NOTES:
6,500' x 150' Runway
Parallel 1,000' x 150' Runway
75' Wide Taxiways
36' 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
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
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.
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
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 achievable.

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 inefficiencies.

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
(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.
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.
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 (SO₂) in the Kailua-Kona area. Results of that sampling suggested that the air quality in Kona is excellent. Levels of particulates and SO₂ 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, NO₂; total hydrocarbons, THC; sulfur dioxide, SO₂; 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>
<thead>
<tr>
<th>TABLE 3-1</th>
<th>AIR QUALITY COMPARISON TO STATE STANDARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Averaging Period</strong></td>
</tr>
<tr>
<td><strong>CARBON MONOXIDE (CO)</strong>:</td>
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</tr>
<tr>
<td>State</td>
<td>1 hour</td>
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<tr>
<td>Keahole Airport, 1985</td>
<td>119-448</td>
</tr>
<tr>
<td>Keahole Airport, 1990</td>
<td>131-505</td>
</tr>
<tr>
<td>Keahole Airport, 2005</td>
<td>134-472</td>
</tr>
<tr>
<td>State</td>
<td>1 hour</td>
</tr>
<tr>
<td>Keahole Airport, 1985</td>
<td>182-234</td>
</tr>
<tr>
<td>Keahole Airport, 1990</td>
<td>218-272</td>
</tr>
<tr>
<td>Keahole Airport, 2005</td>
<td>262-346</td>
</tr>
<tr>
<td><strong>NITROGEN DIOXIDE (NO₂)</strong>:</td>
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</tr>
<tr>
<td>State</td>
<td>Annual Arithmetic Mean</td>
</tr>
<tr>
<td>Keahole Airport, 1985</td>
<td>29-32</td>
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<tr>
<td>Keahole Airport, 1990</td>
<td>30-35</td>
</tr>
<tr>
<td>Keahole Airport, 2005</td>
<td>31-37</td>
</tr>
<tr>
<td><strong>SURFUR DIOXIDE (SO₂)</strong></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>24 hours</td>
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<tr>
<td>Keahole Airport, 1985</td>
<td>12-12</td>
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<tr>
<td>Keahole Airport, 1990</td>
<td>12-14</td>
</tr>
<tr>
<td>Keahole Airport, 2005</td>
<td>12-14</td>
</tr>
<tr>
<td><strong>TOTAL SUSPENDED PARTICULATE MATTER (TSP)</strong></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>24 hours</td>
</tr>
<tr>
<td>Keahole Airport, 1985</td>
<td>28-29</td>
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<tr>
<td>Keahole Airport, 1990</td>
<td>28-30</td>
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<tr>
<td>Keahole Airport, 2005</td>
<td>28-30</td>
</tr>
<tr>
<td><strong>TOTAL HYDROCARBONS (THC, as methane)</strong></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>3 hours</td>
</tr>
<tr>
<td>Keahole Airport, 1985</td>
<td>1,649-1,658</td>
</tr>
<tr>
<td>Keahole Airport, 1990</td>
<td>1,650-1,662</td>
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<tr>
<td>Keahole Airport, 2005</td>
<td>1,652-1,662</td>
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<tr>
<td><strong>BACKGROUND LEVELS</strong></td>
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<tr>
<td>CO</td>
<td>100 ug/m³</td>
</tr>
<tr>
<td>NO₂</td>
<td>29 ug/m³ (based on 1975 DOH monitoring at Hilo)</td>
</tr>
<tr>
<td>SO₂</td>
<td>12 ug/m³ (based on 1985-86 DOH monitoring at Kona)</td>
</tr>
<tr>
<td>TSP</td>
<td>28 ug/m³ (based on 1985-86 DOH monitoring at Kona)</td>
</tr>
<tr>
<td>THC</td>
<td>1,645 ug/m³ methane (based on 1979-80 monitoring at the Honolulu International Airport)</td>
</tr>
</tbody>
</table>
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/m³ (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.

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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 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

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

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**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>DPED PROJECTION</th>
<th>SERIES A*</th>
<th>SERIES B**</th>
<th>SERIES C***</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>109,000</td>
<td>106,000</td>
<td>106,000</td>
<td>106,000</td>
</tr>
<tr>
<td>1990</td>
<td>122,600</td>
<td>122,000</td>
<td>124,000</td>
<td>129,000</td>
</tr>
<tr>
<td>1995</td>
<td>134,600</td>
<td>138,000</td>
<td>148,000</td>
<td>167,000</td>
</tr>
<tr>
<td>2000</td>
<td>143,200</td>
<td>155,000</td>
<td>180,000</td>
<td>212,000</td>
</tr>
<tr>
<td>2005</td>
<td>147,600</td>
<td>173,000</td>
<td>180,000</td>
<td>258,000</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>YEAR</th>
<th>ALTERNATIVE I*</th>
<th>ALTERNATIVE II**</th>
<th>ALTERNATIVE III***</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KONA</td>
<td>KOHALA</td>
<td>KONA</td>
</tr>
<tr>
<td>1980</td>
<td>20,000</td>
<td>8,000</td>
<td>20,000</td>
</tr>
<tr>
<td>1985</td>
<td>23,800</td>
<td>12,900</td>
<td>24,900</td>
</tr>
<tr>
<td>1990</td>
<td>27,100</td>
<td>20,700</td>
<td>30,100</td>
</tr>
<tr>
<td>1995</td>
<td>30,200</td>
<td>30,400</td>
<td>35,000</td>
</tr>
<tr>
<td>2000</td>
<td>33,200</td>
<td>39,400</td>
<td>39,400</td>
</tr>
</tbody>
</table>

* Assumes no additional Kona hotels, additional Kona resort condos, and existing planned development projects.
** Assumes complete Kaeouhu 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>
<thead>
<tr>
<th>INDUSTRY</th>
<th>1960</th>
<th>1970</th>
<th>1980</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>6.8</td>
<td>19.6</td>
<td>17.4</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>3.6</td>
<td>2.6</td>
<td>1.1</td>
</tr>
<tr>
<td>Transportation</td>
<td>0.9</td>
<td>3.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Communication/Utilities</td>
<td>0.6</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Wholesale/Retail Trade</td>
<td>8.3</td>
<td>11.2</td>
<td>11.3</td>
</tr>
<tr>
<td>Finance/Insurance/Real Estate</td>
<td>N/A</td>
<td>3.3</td>
<td>7.1</td>
</tr>
<tr>
<td>Business/Repair Services</td>
<td>0.6</td>
<td>2.0</td>
<td>16.2</td>
</tr>
<tr>
<td>Personal Services</td>
<td>8.9</td>
<td>17.0</td>
<td>15.2</td>
</tr>
<tr>
<td>Health Services</td>
<td>6.2</td>
<td>2.4</td>
<td>--</td>
</tr>
<tr>
<td>Education</td>
<td>4.5</td>
<td>5.6</td>
<td>--</td>
</tr>
<tr>
<td>Other Professional Services</td>
<td>1.2</td>
<td>2.9</td>
<td>--</td>
</tr>
<tr>
<td>Public Administration</td>
<td>1.9</td>
<td>3.5</td>
<td>--</td>
</tr>
<tr>
<td>Agriculture</td>
<td>37.5</td>
<td>8.6</td>
<td>8.2</td>
</tr>
<tr>
<td>Others</td>
<td>24.5</td>
<td>15.6</td>
<td>15.7</td>
</tr>
<tr>
<td>TOTAL EMPLOYED/JOBS</td>
<td>3,859</td>
<td>3,886</td>
<td>8,000</td>
</tr>
<tr>
<td>TOTAL POPULATION</td>
<td>8,743</td>
<td>8,836</td>
<td>19,707</td>
</tr>
</tbody>
</table>

*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

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

**SOURCE:** *Visitor Plant Inventory, Hawaii Visitor's Bureau, Feb. 1986.*
### TABLE 4-6

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

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

**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.

5-1
### TABLE 5-1

24-HOUR ACCUMULATION TRAFFIC COUNT
(1976-1984)

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

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

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).
8. 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 (MALS). 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

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.

6-5
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
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
Winona Char, Principal
(Flora and Fauna)

Peat Marwick Main & Co.
Donald Maddison, Principal
(Noise)

Parsons Brinckerhoff,
Julian Ng, Traffic Engineer
Quade and Douglas, Inc.
(Traffic)

J. W. Morrow, Environmental
J. W. Morrow, Principal
Management Consultant
(Air Quality)

Chiniago, Inc.
William Barrera, President
(Archaeology)
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 Kualoa Airport Environmental Impact Statement preparation notice to:

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

HOLUALOA MANAGEMENT CORPORATION
P.O. Box 323 • Pahoa, HI 96725

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

— EP —
March 9, 1988

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

Subject: Keahole Airport Master Plan & Noise Compatibility Program (Ref. AIR-EP 88.131)

Dear Mr. Miyamoto:

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 experience.

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

Sincerely,

Jim
Capt. James H. Mooney
Honolulu Area Safety Coordinator

March 14, 1988

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

Dear Mr. Miyamoto:

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

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

Sincerely,

Albert Lono Lehman
Planning Director

cc: West Hawaii Planning Coordinator
April 6, 1988

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

Dear Ed:

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

Because of the urgent need to expand the capacity of Kauhale 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 running as there is already an airport on site 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

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 Kauhale Airport.

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

Very truly yours,

Edward V. Nishikawa
Director of Transportation
R. M. TOWILL CORPORATION

RECORD OF PUBLIC HEARING
KEAHOLE AIRPORT MASTER PLAN
ENVIRONMENTAL IMPACT STATEMENT

DATE: April 13, 1988
PLACE: Kealakeke Elementary School Cafeteria
TIME: 7:00 P.M.

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

OPENING STATEMENT Mr. Paul Matsutomo:

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 commence here at Kealakeke School on April 11, 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 Matsutomo. I am a Commissioner on Transportation, appointed by the Governor under Chapter 26-15, Hawaii Revised Statutes. I am commissioned by the Director of Transportation to chair this public hearing on his behalf.

The following quests are here tonight: Deputy Director of Transportation, Jeanne Schultz; Owen Miyasato, Airports Division Chief from Oahu, Frank Kamehane, Airport District Manager from Hawaii; Wally Nishigata and Dean Nakagava of the Airport Division.

The purpose of this hearing is to comply with Section 91-7, 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.

RECORD OF PUBLIC HEARING
KEAHOLE AIRPORT MASTER PLAN EIS
PAGE 2

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 when 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 Kay. 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. Tovill Corporation

Good evening, my name is Chester Koga with the firm of R.M. Tovill Corporation, a planning and engineering firm in Honolulu. I am the senior planner in the planning department. R.M. Tovill 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 you find this presentation informative.

Let me first review the overall plan for the airport. The master plan for the Kaheole Airport takes into account the planning for the Kaheole 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 Kaheole 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 Kaheole 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. Kaheole 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 have had an opportunity to use Kaheole'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 with 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 Kaheole 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 Kaheole 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 helicopter 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: 2 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 Malaahoa 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 brown and red portions of the noise contour map (areas where noise level are 75 dN or greater) and the yellow portions are where noise levels are 60 dN or less. The noise contours indicate the 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. If you have any specific questions, please come forward and ask them.

RECESS

Mr. Paul Matsusoto: 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?

Mr. Matsusoto: The next person is Hoo Whittington.

Mr. Noe Whittington, Kohala Coast Resort Association:
Good evening, my name is Nohelani Whittington with the Kohala Coast Resort Association. I would like to read to you an interesting letter I received from the American Embassy in Sudan, and it said:

"I'm responding to United's beautiful ad about the Big Island and Kohala Resorts. Believe me when you are stuck in a storm like the one in House of the Garden Beckocks, cast for a new assignment and will be stopping in Hawaii for some rest and recuperation. We are very interested in the American Embassy's wife Mrs. John Lavan.

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 like to give you a move quickly. Thank you.

Mr. Paul Matsuzato: We have no other interested persons. If this group would like to discuss anything further, 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 north. And also about that time some sort of a program was published in Reader's Digest of seven years ahead in the world where hope still on the drawing boards, like the Concorde, could fly and land on water. And still here 20 years later nothing has happened. I would like to know what happened to those people. They had engineer and contractors were building the airport at the same time. And now is the Airport half completed. The Airport half completed. This seems more of a bureaucratic bungling or what happened?

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

Mr. Bell: Do you have an answer?
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 very 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 dictates. It would be great if we can build the two parallel runways today, both 10,000 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 Hawai‘i. 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.

Mr. 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 immigration people and we are looking 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 Hawai‘i 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 Matsuzato:
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 tourist. I own an airplane, a twin engine airplane, and have had it based at the airport for the last 14 years and have been 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 today 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 isn't such it demands two runways, but I do think that the runway should go to 13,000 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 as we went to adding then 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 it's 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 engine 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 money. So those are my two comments. Thank you very much.

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

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

Mr. Batch: (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. Miyasato: The reason I am rather reluctant to talk is because normally public hearings is 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 this project 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 consultant in the 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 Honomua, will that stop the airport from expanding further in the future?

Mr. Miyasato: 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 707 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. Miyasato: 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 happened 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 need schools, you need roads, water systems, all of these 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 I-hanger. 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. Koza 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 use. 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 to the Dept. of Accounting and General Services. That agency was the one that was supposed 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 tail 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. Matsuzato:
One more time. Sign your name and speak up. Are there any takers? No takers. Will Samburn are you willing to talk again? If there are others to speak to make it fair? Pete, do you want to say anything else? Anybody else?

CLOSING STATEMENT

Mr. Matsuzato:
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 testimony 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 Koqa
Senior Planner
K.H. Tewlill Corporation

Attachments: Written Testimony By Will Sanburn
Notice of Public Hearing
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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 Cafeteria
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. These 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.
State Department of Transportation
Airports Division
Honolulu International Airport
Honolulu, Hawaii 96815

Dear Sir:

Subject: Kahului Airport Master Plan
Environmental Impact Statement

As developer of Kahului, including Kahului Village and the Kahului Beach
Resort, South Kahului, Island of Hawaii, we would like to compliment the
Airports Division on the completeness and general content of the Kahului
Airport Master Plan and the Kahului 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 Maui 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
Kahului with over 1200 rooms in the early fall this year. This hotel
will require additional carrier capacity into Kahului. Our guests much
prefer wide body direct service.

2. Phase II - Runway Extension - We suggest that you explore the
possibility of combining the additional 1500 feet to 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 stabilization and other construction costs.

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 embark and disembark by boarding bridges.
We would like to suggest that, since the 727's and the 100'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 Kahului 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 air-
craft. Additional boarding bridges may be needed as overseas traffic
increases.

4. We respectfully ask that Kahului Land Company, Suite 310, Paauilo Tower,
1001 Bishop Street, Honolulu, Hawaii 96813 be added to the list of
individuals, organizations and agencies contacted and to be consulted
above 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,

Willie L. Inabum
Director of Business Relations

WES/En
cc: T. Rohr
B. Diffley
B. Hunt
SECTION 12
COMMENTS RECEIVED ON DRAFT EIS
June 8, 1988

Dear Dr. Muray:

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

Enclosure

cc: Mr. Jack Nakagawa
     Mr. William Bas
     Mr. Jack Halting
June 20, 1988

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

Dear Sir:

We have reviewed the Keahole Airport Master Plan Environmental Impact Statement and feel the document adequately addresses the major environmental issues. We feel particularly pleased with the section on noise and the noise mitigation measures.

Thank you for the opportunity to comment.

Sincerely,

H. Peter L'Orange
President

HPL135

Mr. L. Peter L'Orange, President
Hawaii Leward Planning Conference
P. O. Box 638
Kailua Kona, Hawaii 96745-0638

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
Hualalui International Airport
Honolulu, Hawaii 96819
Attention: Mr. Dean Nakagawa
Phone: 836-6526

Truly yours,

Daren Miyamoto
Airports Administrator

CK1w6
Dr. Harvin 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: 548-8527
during design and construction of the roadway network.

Very truly yours,

TEHANE TOSINAGA  
State Public Works Engineer

cc: Mr. Dean Nakagawa  
Mr. William Rose Jr.

---

Mr. Tezama 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

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CK=m5
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.

HONI T. KAO, P.E.
Chief Engineer

Dwigs

cc: Dean Nakagawa, DOT Airports Div.

August 12, 1988

Mr. Hugh Y. Ono, P.E.
Department of Public Works
County of Hawaii
35 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: 836-0826

Yours truly yours,

Owen Miyamoto
Airports Administrator

CK:s5
MEMORANDUM

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

From: Deputy Director for Environmental Health

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

July 6, 1988

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 10 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 construction of any injection wells.

   If you have any questions, please contact the Drinking Water Program at telephone 548-2325.

**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 Kekaha WWTP.

---

Dr. Marvin T. Iiura
July 6, 1988
Page 2

2. If Comment No. 1 is not a feasible alternative, then the self-contained sewerage system and pump station must conform to Section 7, Act 287, SLH 1985.

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

---

cc: DHO, Hawaii
    Mr. Dean Nakagawa, DOT
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 (9 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
Hawai`i International Airport
Honolulu, Hawai`i 96819
Attention: Mr. Dean Nakagawa
Phone: 836-6526

Very truly yours,

[Signature]

Dean Nakagawa
Airports Administrator
June 8, 1988

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 Kahului Airport Master Plan

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

Thank you for the opportunity to comment.

Sincerely,

[Signature]
Executive Director

cc: [Name], Department of Transportation

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 29350
Honolulu, Hawaii 96820-1760

Dear Mr. Conant:

SUBJECT: Kahului Airport Environmental Impact Statement

Thank you for your comments of July 8, 1988 relating to the expansion of the Kahului 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: 836-0516

Very truly yours,

[Signature]
Airports Administrator
DEPARTMENT OF THE ARMY  
U.S. Army Engineer District - Honolulu  
Ft. Shafter, Hawaii 96856  

Planning Branch  

July 12, 1988  

Dr. Farvin Miura  
Office of Environmental Quality Control  
465 South King Street, Room 105  
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,  

Kikou Cheung  
Chief, Engineering Division  

Copy furnished:  

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

August 12, 1988  

Mr. Kikou Cheung, Chief  
Engineering Division  
Department of the Army  
U.S. Army Engineer District, Honolulu  
Ft. Shafter, Hawaii 96856-5409  

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: 836-6525  

Very truly yours,  

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

CK:CS
July 20, 1988

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

Dear Mr. Ulvelling:

SUBJECT: Kona International Airport Environmental Impact Statement

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

The Department of Transportation discourages noise sensitive uses in areas of 60 LDN or greater. However, such uses may be allowed in these areas with every effort to ensure that effective noise mitigation measures are employed and that the project will not have a significant adverse impact on the community. This may be achieved by means of a certification under 55-69 LDN impact 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 have any questions or additional comments or suggestions, please direct them to:

Airports Division, Planning Section
Department of Transportation
Honolulu International Airport
Honolulu, Hawaii 96819
Attention: Mr. Dean Nakagawa
Phone: 836-6326

Very truly yours,

John Miyamoto
Airports Administrator

cc: Mr. Dean Nakagawa
State Airports Division, DOT
Honolulu International Airport
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 3-4, the year 2005 operations are projected as 52/hour. This would cause large noise contours, as many operations would occur at night when runway capacity is limited to 50/hour. The state airport plan forecasts 160,000 operations per year in 2005, which equates to 10 operations per hour. This is probably closer to the correct value, with 52 operations per hour as a peak value. (The current peak is 1/hour). 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 handled 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 A: Final Report: Noise Compatibility Program, Chapter 3. 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 Oahu II and Kona II resort developments cited on page 3-4 include land to be used for residential development which is "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 Kona resort will experience noise levels of 70 to 75 decibels (Final EIS Oahu II, September 1995). Figure 15: Gordon, Erickson & Associates, 1990. According to the Oahu 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 threat from reduced flap angles with increased landing speeds possible.

Natural Hazard: On page 3-4, it is stated that the terrain, is outside the tsunami evacuation zone. Given that the elevation of the airport is 40 ft, 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 County telephone directory includes Kauai, Airport and that the area was evacuated by the County Civil Defense during the May 7, 1986 warning.

Dr. Minno Miura
July 21, 1988
Dr. Marvin Mihra

July 21, 1988

We appreciate the opportunity to comment on this Draft EIS.

Yours truly,

Jacqueline Miller
Associate Environmental Coordinator

cc: L. Stephen Lau
Dean Makogawa, DOT
Jack Hulingh
George Curtis
Keith Chave
Belinda Tilley
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 Honolohau 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 Kona District. 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.

Notes: 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 152 operations per hour is a projection of future operations. An operation is measured as a take-off, landing, or touch and go. 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 Kohala project will be exposed to some aircraft noise impacts. The Kona 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 noise levels in excess of 55 Ldn and the granting of aeronautical 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 Nakamura
Phone: 836-6536

Very truly yours,

Owen Miyamoto
Airports Administrator
July 22, 1988

Mr. Marvin Niura
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. Niura:

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

Thank you for the opportunity to review the report.

Sincerely,

Patricia Englehard
Director

P.E.N.

cc: Mr. Dean Nakagawa

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
Hawaii International Airport
Honolulu, Hawaii 96819

Attention: Mr. Dean Nakagawa
Phone: 835-5526

Very truly yours,

Dennis Miyamoto
Airports Administrator

CK:w5
November 25, 1988

TO: Roger Evans, OCEA

FROM: Salton H. Nagata, State Parks Administrator

SUBJECT: Draft RIS -- Kahului Airport Master Plan
Kahului area, North Kona, Hawaii (65-560)

PWE 7-7-88, part 3

HISTORIC SITE 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 61, H.R. (the State's historic preservation law), and the Federal Aviation Administration must comply with the National Historic Preservation Act. Both need to coordinate with our historic Sites Section to cover the compliance matters.

The archaeological study upon which the historic preservation reviews conclusions are based is attached as Appendix E (Nagata 1987, Kahului Airport, Hawaii: Archaeological Survey of Five Areas Proposed for Airport Expansion). We note that this study covers most of the expansion areas on Figure 2-3. But other expansion facilities shown on Figure 2-3, such as service road X, 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-E) do not seem to have been covered by this archaeological study or the survey report for the south ramp area (Nagata 1988, Kahului Airport, Hawaii: Archaeological Survey of South Ramp & Ground Transportation Expansion). If any area has yet to be surveyed archaeologically, it may need to undergo historic preservation review.

Ignoring this problem, based on a review of the Appendix E report, we believe that the area covers have been adequately surveyed and all historic sites have been found, totaling 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 site information were recorded for 3 sites (10,677, 10,676, 10,685) making them "no longer significant." This means only 3 significant historic sites (10,677, 10,676, 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 "no adverse effect".

Roger C. Evans
Page 2
July 28, 1988

However, the draft RIS 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) that the criteria of the Hawaii and National Registers of Historic Places, 3 significant sites (10,677, 10,676, 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 RIS 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 in significant enough to warrant preservation in incorrect. The 3 sites are significant, and they could be preserved. However, since they are only significant for their information content, archaeological data recovery in 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 61 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 historic preservation review process to be considered complete. This ensures that the work is done according to plan.

We recommend that the RIS text include a paragraph at the end of the Mitigation Measures agreeing to and summarizing these points.
Roger C. Evans  
Page 3  
July 26, 1988  

In sum, for the EIS 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 (568-7460).

We would like to address one additional concern. The Manaloa 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, 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.

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

CT: D. Nakagawa, DOT

Edward K. Shimizu  
August 12, 1988  

STATE OF HAWAI'I  
DEPARTMENT OF TRANSPORTATION  
AIRPORTS DIVISION  
HONOLULU INTERNATIONAL AIRPORT  

Mr. Ralston H. Nagata  
Administrator  
Division of State Parks  
Department of Land and Natural Resources  
State of Hawaii  
P. O. Box 623  
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  
Hilo International Airport  
Hilo, Hawaii 96720  
Attention: Mr. Dean Nakagawa  
Phone: 936-6262

CK:05  

Owen Miyamoto  
Airports Administrator
July 25, 1988

COPY

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

Dear Dr. Miura:

Subject: Draft Environmental Impact Statement (DEIS)
Haleiwa Airport Master Plan

The Department of Agriculture has revised 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

cc: R. M. Towill Corporation
July 26, 1988

Mr. Richard H. 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 96814
Attention: Mr. Dean Nakagawa
Phone: 336-6526

Very truly yours,

Edward Y. Hirata
Director of Transportation

cc: T. Tovill Corporation
The Honorable Marvin T. Hiura, Director
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

SUBJECT: Review of Kahului Airport Master Plan, North Kona

THK: 7-3-43

Dear Dr. Hiura:

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 NPSR and HELA facilities. However, precautions should be taken during the extensive construction activities proposed, to prevent debris, excavated materials, petroleum products and other potential contaminants from impacting coastal waters, especially near the NPSR and HELA 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 Leiback of our Office of Conservation and Environmental Affairs, at 548-7837, if you have any questions.

Very truly yours,

WILLIAM M. PAPATY, Chairperson
Board of Land and Natural Resources

Edward Y. Tsubata

cc: V. K. Towill Corporation
APPENDIX A

TRAFFIC ASSESSMENT
SECTION 1
INTRODUCTION

1.1 INTRODUCTION
The State of Hawaii, Department of Transportation (DOT) in early 1986 projected that the Kekaha Airport will serve a total of 4,100,000 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 Kauai Highway. This assessment report was prepared as part of the Master Plan update for the Kekaha Airport.

1.2 STUDY LOCATION
The project site is on the west coast on the island of Kauai. Kekaha Airport is located on the west side of Queen Kauai Highway with the Kekaha 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 Lihue, Kauai (Lihue-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 | Flow
|------------------|-----------------|-------|
| 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 flow operate separately
| E                | virtually impossible | flow is controlled by slow vehicles

Table 2
LEVEL OF SERVICE CRITERIA (UNIGNALIZED INTERSECTIONS)

<table>
<thead>
<tr>
<th>Reserve of Capacity</th>
<th>Level of Service</th>
<th>Expected Delay to Controlled Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 400</td>
<td>A</td>
<td>Little or no delays</td>
</tr>
<tr>
<td>300 - 399</td>
<td>B</td>
<td>Short traffic delays</td>
</tr>
<tr>
<td>200 - 299</td>
<td>C</td>
<td>Average traffic delays</td>
</tr>
<tr>
<td>100 - 199</td>
<td>D</td>
<td>Long traffic delays</td>
</tr>
<tr>
<td>0 - 99</td>
<td>E</td>
<td>Very long traffic delays</td>
</tr>
<tr>
<td>≤ 0</td>
<td>F</td>
<td>Demand exceeds capacity; extreme delays</td>
</tr>
</tbody>
</table>
SECTION 2
EXISTING CONDITIONS

2.1 ROADWAY SYSTEM

The two-lane Queen Kaahumanu Highway is the main ground transportation link between Kona 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.

Kaahole 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 Kaahole Airport Access Road forms a T-intersection, with Kaahole Airport Access Road being the arm of the "T" in 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 Kaahole 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 island 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/Kaahole 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 analysis (1985 Highway Capacity Manual) shows that north of the intersection, LOS A 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 B 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 Kaahole Airport Access Road approach also operate at LOS A while the left turns are at LOS B. Field observations confirm the analysis 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 for 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.
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 85 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 Kauhaua Highway, LOS A describes
conditions north of the airport, with the traffic volume being 10 percent
of capacity. South of the airport, the volume is 30 percent of capacity
and conditions are LOS C. Analysis of the unsignalled intersection show
that the northbound left turn operates 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 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

<table>
<thead>
<tr>
<th>Date (hour ending)</th>
<th>Queen Kauhaua Highway</th>
<th>Kauhaua Airport</th>
<th>Total Access Rd. Tag</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 1980 (12:15 PM)</td>
<td>229</td>
<td>109</td>
<td>56</td>
</tr>
<tr>
<td>April 1982 (5:30 PM)</td>
<td>275</td>
<td>213</td>
<td>140</td>
</tr>
<tr>
<td>August 1984 (3:00 PM)</td>
<td>320</td>
<td>268</td>
<td>165</td>
</tr>
<tr>
<td>August 1987 (3:15 PM)</td>
<td>458</td>
<td>375</td>
<td>269</td>
</tr>
</tbody>
</table>

(HB = northbound, SB = southbound, EB = eastbound, VB = westbound)

Source: State Highways Division (Station 6-P), except 1987 data.

SECTION 3

FUTURE CONDITIONS

3.1 MASTER PLAN TARGET YEAR

The target year for the Kauhaua Airport Master Plan is 2003. Estimated PM
peak hour traffic volumes for year 2003 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 Kauhaua Highway and passenger projections for
the airport. The 24-hour traffic count of the approach and departure
legs at the intersection of Queen Kauhaua Highway and Kauhaua 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 7.6 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 2003, 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 = 5,221).
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 1990s, 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 ROADSYS
The Kona 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 Kasinga 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 Kasinga Highway will result in lowered levels of service; LOS E would describe conditions south of the airport if the projected volumes are realised. 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 summarises 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 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 HIGHSU LEVELS OF SERVICE

<table>
<thead>
<tr>
<th></th>
<th>Queen Kasinga Highway</th>
<th>Kasahe Airport Access Road</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>North of Site</td>
<td>South of Site</td>
</tr>
<tr>
<td>1987 Average Day</td>
<td>B (0.19)</td>
<td>C (0.30)</td>
</tr>
<tr>
<td>1987 Peak Day</td>
<td>B (0.22)</td>
<td>D (0.36)</td>
</tr>
<tr>
<td>2005 Average Day</td>
<td>D (0.45)</td>
<td>E (0.71)</td>
</tr>
<tr>
<td>2005 Peak Day</td>
<td>D (0.53)</td>
<td>E (0.86)</td>
</tr>
</tbody>
</table>

* assuming 2-lane highway
LOS = level of service
V/C = volume-to-capacity

Table 5
UNIGNALIZED INTERSECTION CONDITIONS

<table>
<thead>
<tr>
<th>Level of Service (Percentage of Capacity)</th>
<th>Kasahe Airport Access Road</th>
<th>Queen Kasinga Highway</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left Turn</td>
<td>Right Turn</td>
</tr>
<tr>
<td>1987 Average Day</td>
<td>C (214)</td>
<td>A (622)</td>
</tr>
<tr>
<td>1987 Peak Day</td>
<td>D (182)</td>
<td>A (560)</td>
</tr>
<tr>
<td>2005 Average Day</td>
<td>F (-178)</td>
<td>E (1)</td>
</tr>
<tr>
<td>2005 Peak Day</td>
<td>F (-183)</td>
<td>F (-125)</td>
</tr>
</tbody>
</table>

If highway speed = 65 miles per hour:
2005 Average Day                         | F (-165)  | E (7)     | 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

Evaluation 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 Kahului 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.

4. Conclusions

The planned roadway improvements to the Kahului 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 turn.
- The widening of the 2-lane access road to a 4-lane divided roadway should occur before year 2004.
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BOTANICAL SURVEY
KEHOLE AIRPORT MASTER PLAN
District of North Kona, Island of Hawai‘i

by
George K. Linney

PREPARED FOR:
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PREPARED BY:
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Botanical/Environmental Consultants
Honolulu, Hawai‘i

SEPTEMBER 1987
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 was found on the prehistoric pahoehe lava flow south of the maintenance building. The presence of mongoose in the woody scrub, fringe areas around the airport and car rental lot 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

Al visits has been conducted for the areas adjacent to Keahole Airport. Walker (1975) made an intensive survey of the adjacent Natural Energy Laboratory of Hawaii (NELA) 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 dominica), the Wandering Tattler or 'Ula (Heteroscelus incanus), and the Huddie Turnstone or 'Akele (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 cristatellus), 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 urva) 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 sandheimi) over the agricultural park site.

Fifteen bird species were reported from the nearby Kohala-Iki and 'O'one II by Kjørgaard (1986a, 1986b). Four of these species, the 'Ulua, Kolea, Great Frigatebird or 'Iwa (Fregata minor palmeri), and the Black-crowned Night-heron or 'a'uku (Nycticorax nycticorax hawaiiensis), 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 Manakin (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 Kohala-Iki and 'O'one II study sites, particularly on pahoehe substrate and in the lava tubes and caves that dot the pahoehe flows. The majority of the material was old and the following species were reported: Feral Cat (Felis catus), 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 occurrence on the study site for species which had been extirpated from the area.
C. H. Langmore 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 just beyond the quarry. This portion of the parcel is very sparsely vegetated pahokee, 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 fountgne grass, a most exotic characteristic of lava fields in this part of the island. It is a bunch-grass that tends to occupy most areas over which it is minimally suited to vegetation. In less hostile environments it crowds out smaller native plants and threatens native trees and shrubs, large, dry clumps presenting a serious fire-hazard. Other than this, it probably contributes to the production of soil on the base lava. Another plant of almost equal numbers, but far less stature and biomass, is 'uhulua. It is a common weed of dry, waste places throughout the islands. The third most common plant is naipo-pilo, the native copa. 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. Naipo-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 hair sword-fern (Nephrolepis multiflora), a very aggressive and persistent exotic weed able to survive in crevices 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 carpet-weed (Malva pusilla) 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 (makai) side of the parcel: a single 'ohia-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 removed 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 (Calolepis procera). They have not 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 finely 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 roadside (wayside) weeds growing adjacent to the tarmac of the car-rental sites. In-
crossed 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 across from 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, 'uhuha, and naia-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 (Melinis minutiflora), klu (Kagricia fernandezii), kiawe (Prosopis pallida), wai'i (Bodnantella viscosa), and to a lesser extent 'uhuha (Leptospora 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 perfumery industry. 'Uhulu is considered a Polynesian introduction. An inconspicuous shrub, it was used in early Hawaii and throughout the Pacific as a fish poison. Kiawe, also an exotic, is the dominant tree of lowland Hawaii, 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 in the tubes is 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 nitida), 'iwa'iwia (Gymnostachys decora), wood-fern (Thelypteris carinata), holly fern (Ceratotheca falcata), la'ue (Physetodes scopulodora) and mua (Pisolobus 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 wind some 15 to 18 feet tall, a height it could not reach out on the open lava fields under the current climatic conditions. There were two other significant finds in this cave: Popenia cookiana and Plectranthus parviflora. 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-wa-'ai. 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 WEIGHING 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 naia-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 littke 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 aggressive 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 "Hawaiian", 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 over-used 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 seasonality is 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 drip-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)
<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>COMMON NAME</th>
<th>BIIOGEOGRAPHIC STATUS</th>
<th>PARCEL NO.</th>
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<tr>
<td><strong>FERNS AND FERN ALLIES</strong></td>
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<tr>
<td>Adiantaceae</td>
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<td></td>
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<tr>
<td><em>Doryopteris decora</em> Brack.</td>
<td>'iwa'iwa</td>
<td>X</td>
<td>o o s</td>
</tr>
<tr>
<td>Aspleniaceae</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Cyrtomium falcatum</em> (Langsd. &amp; Fisch.)</td>
<td>holly fern</td>
<td>X</td>
<td>o o s</td>
</tr>
<tr>
<td><em>Nephrolepis multiflora</em> (Roxb.) Jarret ex Morton</td>
<td>sword fern</td>
<td>X</td>
<td>u u c</td>
</tr>
<tr>
<td><em>Thelypteris torresiana</em> Gaud.</td>
<td>wood fern</td>
<td>X</td>
<td>o o r</td>
</tr>
<tr>
<td>Polypodiaceae</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><em>Phymatodes scolopendria</em> (Burm.) Ching</td>
<td>lau'a'e</td>
<td>X</td>
<td>o o lu</td>
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<tr>
<td>Psilotaceae</td>
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<td></td>
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<tr>
<td><em>Psilotum nudum</em> L.</td>
<td>moa</td>
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<td><strong>FLOWERING PLANTS</strong></td>
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<td><strong>MONOCOTS</strong></td>
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<td>Cyperaceae</td>
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<td><em>Fimbrystylis pycnocephala</em> Hbd.</td>
<td>fimbry</td>
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<td>Gramineae</td>
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<tr>
<td><em>Cynodon dactylon</em> (L.) Pers.</td>
<td>Bermuda grass</td>
<td>X</td>
<td>s o o</td>
</tr>
<tr>
<td><em>Digitaria</em> sp.</td>
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<tr>
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<td><em>Heteropogon contortus</em> (L.) Beauv. ex R. &amp; S.</td>
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<td>I/P</td>
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<tr>
<td><em>Melinis minutiflorus</em> Beauv.</td>
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<td>o</td>
</tr>
<tr>
<td><em>Pennisetum setaceum</em> (Forsk.) Chiov.</td>
<td>Fountain grass</td>
<td>X</td>
<td>a</td>
</tr>
<tr>
<td><em>Rhynochelytrum repens</em> (Willd.) C. E. Hubb.</td>
<td>Natal redtop</td>
<td>X</td>
<td>lc</td>
</tr>
</tbody>
</table>

**DICOTS**

*Anacardiaceae*

- *Schinus terebinthifolius* Raddi
  - Christmasberry

*Asclepiadaceae*

- *Asclepias physocarpa* (E. Meyer) Schlechter
  - Gomphocarpus
  - Crownflower

*Caparraceae*

- *Capparis sandwichiana* DC.
  - Malai-pilo

*Compositae*

- *Bidens pilosa* L.
  - Spanish needle
- *Emilia coccinea* (Sims) G. Don
  - Orange-flowered emilia
- *Pluchea symphitifolia* (Miller) Gillis
  - Pluchea
- *Tridax procumbens* L.
  - Coat buttons

*Euphorbiaceae*

- *Chamaesyce hirta* (L.) Millsp.
  - Hairy spurge
- *Chamaesyce hypericifolia* (L.) Millsp.
  - Spurge
<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Status 1</th>
<th>Status 2</th>
<th>Status 3</th>
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<td>X</td>
<td>o</td>
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<td>Labiatae</td>
<td>comb hyptis</td>
<td>X</td>
<td>o</td>
<td>u</td>
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<tr>
<td>Hyptis pectinata</td>
<td>'ala'ala-wai-nui</td>
<td>I</td>
<td>o</td>
<td>o</td>
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<td>Plectranthus parviflorus</td>
<td>klu, huisache</td>
<td>X</td>
<td>o</td>
<td>o</td>
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<td>Leguminosae</td>
<td>partridge pea, lau-ki</td>
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<td>u</td>
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<td>Acacia farnesiana</td>
<td>beggarstick</td>
<td>X</td>
<td>o</td>
<td>c</td>
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<td>X</td>
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<td>Desmodium tortuosum</td>
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<td>Indigofera suffruticosa</td>
<td>wild bush-bean</td>
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<td>Leucaena leucocephala</td>
<td>kiawe, mesquite</td>
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<td>Macroptilium lathyroides</td>
<td>'auhauhau, 'auhola</td>
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<td>Prosopis pallida</td>
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<td>Tephrosia purpurea</td>
<td>threadstem carpetweed</td>
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<td>Malvaceae</td>
<td>'ohi'a-lehua</td>
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<td>Mollugo cerviana</td>
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APPENDIX C

FAUNA SURVEY
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3.2 Recommendations

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PREPARED BY:
CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawaii

SEPTEMBER 1987
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 dominica), the Vanderweg Tattler or Uitihi (Heteroscelus incanus), and the Rudy 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 Francolinus ( 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, Kraus (1977) also recorded most of the species observed by Walker including a pheasant species (Phasianus sp.). In addition, Kraus also observed a Hawaiian Owl or Pueo ( Aego pillemes sandwichensis) over the agricultural park site.

Fifteen bird species were reported from the nearby Kohana-Iki and 'O'one II by Kjærgaard (1986a, 1986b). Four of these species, the 'Uitihi, Kolea, Great Frigatebird or 'Iwa (Fregata minor palmerstoni), and the Black-crowned Night-heron or 'ahu'u (Nycticorax nycticorax haeckl'i), were found along the coastal margin or around the anchialine ponds. The remaining eleven species recorded were: Grey Francolinus, Rock Dove ( Columba livia), Barred Dove, Common Barn-owl ( Tyto alba), Melodius Laughing-thrush ( Garrulax canorus), Japanese White-eye, Blue-winged Manakin ( 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'one 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 sylvestris), 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 0545 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 occurrence on the study site for species which had been extirpated from the area.
2.1 FAUNAL HABITATS

The areas proposed for expansion of the Kahului 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, 'akakia ('Acalypha indica var. americana), maile-pilo (Coprosma sandwicensis), and other shrubby species covers the prehistoric pahoehe 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 pahoehe 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 (Hawai’i 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 scraps, e.g., snack bars, trash cans, waiting areas, 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 Majesty (Zosterops japonicus): Foreign
   Japanese White-eye were commonly seen in trees and shrubs around the terminal.

4. Common Indian Myna or Myna (Acridotheres cristatellus): 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. Northern Cardinal or Northern Cardinal (Cardinalis cardinalis): Foreign
   One Cardinal was heard in the maokepoo (Casarea samoa) trees bordering the airport.

7. Yellow-billed Cardinal (Paroaria capitata): Foreign
   One individual was observed feeding on the fruit of the golden-fruited palm (Chrysalidocarpus 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 (Kjærgaard 1986a). It is reported to be common on the nearby Kahana-Kea 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 plukenet seeds (Plukenetia (symphytifolia)).
Manuscript

1. Mongoose or Indian Mongoose (Herpestes auropunctatus): Foreign
   Although no animals were actually observed, fresh mongoose scat (or droppings)
   were found in kōa-bale (Acacia succuncta) 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
   pāhōhohe 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
   (Cryptoblephasaurus koutouai speculimolarius), 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 semicivis), 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, Kjærgård 1988a).

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


APPENDIX D

NOISE COMPATIBILITY PROGRAM

CHAPTER 1
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 this required development. In addition, a Noise Compatibility Program will be developed for the Airport Environments 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.
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Chapter 1
INTRODUCTION

BACKGROUND

The Noise Compatibility Program for Kehole 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 Kehole 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 Kehole 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 quieter 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 Kehole 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 Pat Walker, and concerned citizens. Public information sessions and briefings were also held.

In addition, FAA Kehole 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.
The traffic projection was checked against projected population increases for the County of Hawaii. The de facto 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 de facto 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 Kona-Mauna Kea Highway provides 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 Kahuna 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 Kahuna 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 85 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 show 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 volume exceeds capacity (LOS F).

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Day</th>
<th>Peak Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>V/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>B (0.19)</td>
<td>C (0.30)</td>
</tr>
<tr>
<td>2001</td>
<td>B (0.21)</td>
<td>D (0.36)</td>
</tr>
<tr>
<td>2002</td>
<td>D (0.45)</td>
<td>E (0.71)</td>
</tr>
<tr>
<td>2003</td>
<td>D (0.55)</td>
<td>E (0.86)</td>
</tr>
</tbody>
</table>

* assuming 2-lane highway

LOS = level of service
V/C = volume-to-capacity

Table 5

<table>
<thead>
<tr>
<th>Level of Service (Capacity)</th>
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<tbody>
<tr>
<td>Left Turn</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>1987 Average Day</td>
</tr>
<tr>
<td>1987 Peak Day</td>
</tr>
<tr>
<td>2005 Average Day</td>
</tr>
<tr>
<td>2005 Peak Day</td>
</tr>
</tbody>
</table>

If highway speed = 45 miles per hour:

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Day</th>
<th>Peak Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>V/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>F (-165)</td>
<td>E (70)</td>
</tr>
<tr>
<td>2001</td>
<td>F (-180)</td>
<td>F (-61)</td>
</tr>
</tbody>
</table>

-8-
APPENDIX E

ARCHAEOLOGICAL SURVEY
KE-AHOE AIRPORT, HAWAII: ARCHAEOLOGICAL SURVEY OF FIVE AREAS PROPOSED FOR AIRPORT EXPANSION

Prepared for:

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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
Cluff and Riley (1968-69) noted that 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, the 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 4. Site 10675, Looking South

Figure 5. Site 10678, Looking West
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 urial 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 proba-

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 on 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 (Cypraecapitatus), a limpet (Cellana exarata), a nerite (Nerita picea), and a toothed pearl (Tsognomon 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 13. SITE10679-B, Petroglyph

Figure 14. Site 10680-A, Looking West
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 ex- arata) and a nerita (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.

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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.

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1968 Archaeological Surface Survey of the Kailua-Kawaiahae Road [Section I, Honokohau to Keahole Point] and the Keahole Point Airport. Department of Land and Natural Resources, State of Hawaii, Honolulu.

Cluff and Thomas Riley

Cordy, Ross

Peterson, Jennie E.
APPENDIX F

AIR QUALITY
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ERANGIG AIRPORT
NORTH KONA, HAWAII
March, 1988

Prepared for
R. M. Towill Corporation
and
State of Hawaii
Department of Transportation
Airports Division

Prepared by
J. W. Morrow
Environmental Management Consultant
Kailua, Hawaii
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<td>January Wind Rose, Keahole Airport</td>
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<th>FIGURE</th>
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<tr>
<td>3</td>
<td>Frequency Distribution of Wind Direction in Percentages: Keahole Airport (January)</td>
</tr>
<tr>
<td>4</td>
<td>Frequency Distribution of Wind Direction in Percentages: Keahole Airport (August) Airport</td>
</tr>
<tr>
<td>5</td>
<td>Projected Emissions, 1985-2005, Keahole Airport</td>
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<tr>
<td>6</td>
<td>AVAP Modeling Receptor Grid, Keahole Airport</td>
</tr>
<tr>
<td>7</td>
<td>Carbon Monoxide - 1990, Typical Hourly Variation</td>
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</tbody>
</table>
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 "pahoehe" 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 the 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. 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 environment. The specific purpose of this analysis is to estimate emissions and ambient impact for 1985 aircraft operations as well as projected operations for 1990 and 2005.
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 T3 & T5).

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 gram per vehicle mile (g/vehicle mile) basis and set for specified categories of vehicle, e.g., light duty gasoline-powered vehicles (LDGV), light duty diesel vehicles (LDDV), 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 (HAAQSS). 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, 1968, 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 (NO$_2$) standard
- elimination of the 3-hour non-methane hydrocarbons standard
- adoption of a lead standard

The CO, ozone, and annual NO$_2$ 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

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Sampling Period</th>
<th>Federal Standards</th>
<th>State Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total Suspended Particulate Matter (TSP)</td>
<td>Annual Geometric Mean</td>
<td>75</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Maximum Average in Any 24 Hours</td>
<td>250</td>
<td>150</td>
</tr>
<tr>
<td>2. PM-10</td>
<td>Annual</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Maximum Average in Any 24 Hours</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>3. Sulfur Dioxide (SO$_2$)</td>
<td>Annual Arithmetic Mean</td>
<td>80</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Maximum Average in Any 24 Hours</td>
<td>360</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Maximum Average in Any 3 Hours</td>
<td>1,300</td>
<td>1,300</td>
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<tr>
<td>4. Nitrogen Dioxide (NO$_2$)</td>
<td>Annual Arithmetic Mean</td>
<td>100</td>
<td>70</td>
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<td>5. Carbon Monoxide (CO)</td>
<td>Maximum Average in Any 8 Hours</td>
<td>10,000</td>
<td>5,000</td>
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<td></td>
<td>Maximum Average in Any 1 Hour</td>
<td>40,000</td>
<td>10,000</td>
</tr>
<tr>
<td>6. Photochemical Oxidants (as O$_3$)</td>
<td>Maximum Average in Any 1 Hour</td>
<td>240</td>
<td>100</td>
</tr>
<tr>
<td>7. Lead (Pb)</td>
<td>Maximum Average in Any Calendar Quarter</td>
<td>1.5</td>
<td>1.5</td>
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</table>

- 4 -
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 occurring 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 854 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 iodine [25].
### Table 2
Summary of Aerometric Data Collected at Kona-Hilo, Hawai'i 1985 - 1986

<table>
<thead>
<tr>
<th>MONTH</th>
<th>SAMPLES</th>
<th>MIN.</th>
<th>MAX.</th>
<th>MEAN</th>
<th>SAMPLES</th>
<th>MIN.</th>
<th>MAX.</th>
<th>MEAN</th>
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<td>10</td>
<td>8</td>
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<tr>
<td>Oct 85</td>
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<td>7</td>
<td>10</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Nov 85</td>
<td>5</td>
<td>6</td>
<td>11</td>
<td>9</td>
<td>5</td>
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<tr>
<td>Dec 85</td>
<td>5</td>
<td>6</td>
<td>10</td>
<td>12</td>
<td>5</td>
<td>5</td>
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<tr>
<td>Jan 86</td>
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<td>11</td>
<td>9</td>
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<td>5</td>
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</tr>
<tr>
<td>Feb 86</td>
<td>5</td>
<td>8</td>
<td>11</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Mar 86</td>
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<td>8</td>
<td>11</td>
<td>9</td>
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<td>5</td>
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<td>Apr 86</td>
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<td>9</td>
<td>5</td>
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<tr>
<td>May 86</td>
<td>5</td>
<td>12</td>
<td>17</td>
<td>13</td>
<td>5</td>
<td>5</td>
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<tr>
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**Total Suspended Particulates (TSP) 24-Hour Concentrations (µg/m³)**

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**Sulfur Dioxide (SO₂) 24-Hour Concentrations (µg/m³)**

**Source:** Department of Health

### Table 3
SPECIAL AIR MONITORING DATA
Kona & Hilo, Hawai'i 1983

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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 windrosettes. 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).
### TABLE 4

ANNUAL WIND ROSES
KEAHOLE AIRPORT

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<th>7 - 10</th>
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**TOTAL:** 0.03466 | 0.30222 | 0.20145 | 0.15006 | 0.0032 | 0.0017 | 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 1972)
### TABLE 5
JANUARY WIND ROSE*
KEAHOLE AIRPORT

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TOTAL    | 0.07421 | 0.82767 | 0.39459 | 0.04554 | 0.00000 | 0.00000 | 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 1972)
### Table 6

**ADJUSTED WIND ROSES**

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<td>0.0000</td>
<td>0.0000</td>
<td>0.00184</td>
</tr>
</tbody>
</table>

*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 1986, 1990, and 2005 [1,29]. Hourly traffic data were from two sources: data from the major air carriers serving Honolulu, and from ground vehicles (GVV) data. GVV data were estimated based on number of air carrier arrivals and was based on the actual GVV data or, in the case of ground service vehicles (GSV), on the City and County of Honolulu vehicle registrations [32].

#### 5.2 Emission Factors

Airplane take-off and landing factor (IFL) emissions factors were derived from the 'in-use' mode (TIM) and engine emission factors taken from two U.S. Environmental Protection Agency (EPA) emissions models [33,34]. Motor vehicle emissions factors for carbon monoxide, nitrogen oxides, and non-methane hydrocarbons were source emissions model (MAME) [35]. These emission factors were developed for the city of Honolulu vehicle emissions [36]. Fraction of vehicle traveled was assumed to be directly for all ground service vehicles (GSV) and aircraft fueling operations were taken from the same EPA publication [36].

#### 5.3 Annual Emissions

Estimates of annual emissions of the five major pollutants - carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO2), particulate matter (PM), and carbon monoxide (CO) - are presented in Table 6. The results are presented in Table 7. The 2005 emissions for the city of Honolulu show an increase of 6.2% of the county inventory for specific pollutants with CO being the major source category followed by NOx at the top. The table also shows the annual emissions from roads and parking lots over the 1985 - 2005 period. This is due to the federal motor vehicle emission control program, which because it mandates tighter emission standards for new vehicles, appears to offset the projected increase in traffic.
### TABLE 7
1990 EMISSIONS INVENTORY
COUNTY OF HAWAII

<table>
<thead>
<tr>
<th>SOURCE CATEGORY</th>
<th>PM</th>
<th>SOx</th>
<th>NOx</th>
<th>CO</th>
<th>HC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam Electric Power Plants</td>
<td>253</td>
<td>3,253</td>
<td>1,300</td>
<td>66</td>
<td>22</td>
</tr>
<tr>
<td>Gas Utilities</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fuel Combustion in Agricultural Industry</td>
<td>2,252</td>
<td>996</td>
<td>178</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Refinery Industry</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Petroleum Storage</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Metallurgical Industries</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mineral Products Industry</td>
<td>1,000</td>
<td>14</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Municipal Incineration</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Motor Vehicles</td>
<td>253</td>
<td>177</td>
<td>3,018</td>
<td>42,117</td>
<td>4,035</td>
</tr>
<tr>
<td>Construction, Farm and Industrial Vehicles</td>
<td>40</td>
<td>32</td>
<td>454</td>
<td>1,515</td>
<td>152</td>
</tr>
<tr>
<td>Aircraft</td>
<td>6</td>
<td>5</td>
<td>46</td>
<td>1,850</td>
<td>174</td>
</tr>
<tr>
<td>Vessels</td>
<td>11</td>
<td>91</td>
<td>63</td>
<td>66</td>
<td>29</td>
</tr>
<tr>
<td>Agricultural Field Burning</td>
<td>1,600</td>
<td>0</td>
<td>0</td>
<td>20,627</td>
<td>2,846</td>
</tr>
</tbody>
</table>

**TOTAL:** 5,715 4,547 5,741 65,902 7,258

**SOURCE:** State Department of Health
### Table 8

**Annual Emissions by Source Category**

**Ewa Airport**

1985 - 2005

<table>
<thead>
<tr>
<th>Source</th>
<th>CO</th>
<th>NOx</th>
<th>HC</th>
<th>SO2</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1985</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>260</td>
<td>30</td>
<td>83</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Parking</td>
<td>8</td>
<td>0.1</td>
<td>1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Ground Serv. Vehicles</td>
<td>1</td>
<td>11</td>
<td>14</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fuel Storage/Handling</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Aircraft</td>
<td>715</td>
<td>128</td>
<td>140</td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td>1,085</td>
<td>169</td>
<td>202</td>
<td>17</td>
<td>26</td>
</tr>
<tr>
<td><strong>1990</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>274</td>
<td>39</td>
<td>37</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Parking</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ground Serv. Vehicles</td>
<td>55</td>
<td>12</td>
<td>15</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fuel Storage/Handling</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Aircraft</td>
<td>839</td>
<td>192</td>
<td>170</td>
<td>19</td>
<td>26</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td>1,217</td>
<td>243</td>
<td>228</td>
<td>23</td>
<td>38</td>
</tr>
<tr>
<td><strong>2005</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>233</td>
<td>52</td>
<td>27</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Parking</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ground Serv. Vehicles</td>
<td>121</td>
<td>15</td>
<td>19</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fuel Storage/Handling</td>
<td>5</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Aircraft</td>
<td>1,102</td>
<td>320</td>
<td>239</td>
<td>27</td>
<td>34</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td>1,551</td>
<td>388</td>
<td>295</td>
<td>28</td>
<td>48</td>
</tr>
</tbody>
</table>

**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**

**Ewa Airport**

1985 - 2005

<table>
<thead>
<tr>
<th>Source</th>
<th>CO</th>
<th>NOx</th>
<th>HC</th>
<th>SO2</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1985</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>24.8</td>
<td>17.6</td>
<td>21.3</td>
<td>12.5</td>
<td>17.5</td>
</tr>
<tr>
<td>Parking</td>
<td>0.8</td>
<td>0.3</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Ground Serv. Vehicles</td>
<td>2.4</td>
<td>1.7</td>
<td>1.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Fuel Storage/Handling</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Aircraft</td>
<td>66.0</td>
<td>75.6</td>
<td>69.5</td>
<td>84.3</td>
<td>74.4</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>1990</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>22.6</td>
<td>15.9</td>
<td>16.3</td>
<td>13.7</td>
<td>20.6</td>
</tr>
<tr>
<td>Parking</td>
<td>0.7</td>
<td>0.8</td>
<td>0.8</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Ground Serv. Vehicles</td>
<td>7.8</td>
<td>4.8</td>
<td>6.4</td>
<td>2.6</td>
<td>2.4</td>
</tr>
<tr>
<td>Fuel Storage/Handling</td>
<td>0.0</td>
<td>0.0</td>
<td>2.8</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Aircraft</td>
<td>59.0</td>
<td>78.9</td>
<td>74.5</td>
<td>81.4</td>
<td>71.0</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>2005</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roads</td>
<td>15.0</td>
<td>13.6</td>
<td>9.0</td>
<td>17.4</td>
<td>27.0</td>
</tr>
<tr>
<td>Parking</td>
<td>0.3</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Ground Serv. Vehicles</td>
<td>7.0</td>
<td>3.6</td>
<td>6.3</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Fuel Storage/Handling</td>
<td>0.0</td>
<td>0.0</td>
<td>3.5</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Aircraft</td>
<td>56.9</td>
<td>82.5</td>
<td>81.0</td>
<td>80.3</td>
<td>70.8</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**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 material 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, NOX, 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 daily operation of the airport and the lack of 24-hour meteorological data, the model was run for a 24-hour period (6:00 AM to 6:00 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 roadside pollutant concentrations under prevailing southwesterly wind conditions, 40 receptor locations were selected on the northeast (auaka) 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 11). 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 indicated. The modeling results simply indicate the more general impact of airport activities on the surrounding environment. 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 1.648 mg/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
### RESULTS OF AVAP MODELING
#### KAHONALO UPLANDS
1985 - 2005

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Year</th>
<th>Averaging Period</th>
<th>Beginning of Maximum Concentrations (ug/m3)</th>
<th>Ending of Maximum Concentrations (ug/m3)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>1985</td>
<td>1-hr</td>
<td>119 - 448</td>
<td>11:00 AM</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td>1990</td>
<td></td>
<td>131 - 505</td>
<td>11:00 AM</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td></td>
<td>132 - 972</td>
<td>12:00 AM</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>1985</td>
<td>8-hr</td>
<td>182 - 220</td>
<td>6:00 PM</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td>1990</td>
<td></td>
<td>218 - 274</td>
<td>6:00 PM</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td></td>
<td>262 - 346</td>
<td>7:00 PM</td>
<td>02</td>
</tr>
<tr>
<td>Total Hydrocarbons</td>
<td>1985</td>
<td>2-hr</td>
<td>1,649 - 1,664</td>
<td>5:00 PM</td>
<td>04</td>
</tr>
<tr>
<td></td>
<td>1990</td>
<td></td>
<td>1,650 - 1,662</td>
<td>11:00 AM</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td></td>
<td>1,659 - 1,662</td>
<td>21:00 AM</td>
<td>02</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>1985</td>
<td>24-hr</td>
<td>29 - 32</td>
<td>12:00 AM</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td>1990</td>
<td></td>
<td>30 - 35</td>
<td>12:00 AM</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td></td>
<td>31 - 37</td>
<td>12:00 AM</td>
<td>02</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>1985</td>
<td>24-hr</td>
<td>12 - 12</td>
<td>12:00 AM</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>1990</td>
<td></td>
<td>12 - 18</td>
<td>12:00 AM</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td></td>
<td>12 - 14</td>
<td>12:00 AM</td>
<td>02</td>
</tr>
<tr>
<td>Total Suspended Particulate Matter</td>
<td>1985</td>
<td>24-hr</td>
<td>28 - 29</td>
<td>12:00 AM</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>1990</td>
<td></td>
<td>28 - 30</td>
<td>12:00 AM</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td></td>
<td>28 - 30</td>
<td>12:00 AM</td>
<td>02</td>
</tr>
</tbody>
</table>

**NOTES:**
1. **AVAP** = Airport Visually Air Pollution Model
2. ug/m3 = micrograms per cubic meter
3. Background levels:
   - CO = 100 ug/m3 (≥ 9.1 mg/m3)
   - TSP = 28 ug/m3 (based on 1985-86 DOH monitoring at Ewa)
   - NO = 29 ug/m3 (based on 1975 DOH monitoring at Hilo)
   - CO2 = 12 ug/m3 (based on 1985-86 DOH monitoring at Ewa)
   - THC = 1,646 ug/m3 (methane based on 1977-85 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 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 offsite 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 the most significant, the principal contributor in the Kona 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 Kapiolani Highway under prevailing daytime southeasterly winds. The hourly variation is similar to the other pollutants and corresponds with peak source activity at the airport and along the highway.
<table>
<thead>
<tr>
<th>Source</th>
<th>CO</th>
<th>NOx</th>
<th>THC</th>
<th>SO2</th>
<th>TSP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1986</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aircraft</td>
<td>57.1</td>
<td>50.0</td>
<td>88.5</td>
<td>0.0</td>
<td>75.5</td>
</tr>
<tr>
<td>Airport Sources</td>
<td>20.7</td>
<td>25.0</td>
<td>6.6</td>
<td>0.0</td>
<td>13.3</td>
</tr>
<tr>
<td>Emissions</td>
<td>12.2</td>
<td>25.0</td>
<td>4.9</td>
<td>0.0</td>
<td>11.2</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>0.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Receptor Location:</td>
<td>03</td>
<td>03</td>
<td>03</td>
<td>n/a</td>
<td>02</td>
</tr>
<tr>
<td><strong>1990</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aircraft</td>
<td>64.2</td>
<td>50.0</td>
<td>90.1</td>
<td>100.0</td>
<td>69.3</td>
</tr>
<tr>
<td>Airport Sources</td>
<td>26.4</td>
<td>25.0</td>
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**FIGURE 7:** CARBON MONOXIDE - 1990

*CONCENTRATION (mg/m³)*

*TOTAL HOURS VARIATION* (9W 90TH)
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 oxide, 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


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.


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References (Cont'd)


32. City & County of Honolulu, Department of Data Systems. Age Distribution of Registered Vehicles in the City & County of Honolulu (unpublished report), September, 1986.


