FINAL
ENVIRONMENTAL IMPACT STATEMENT

VOLUME III OF V

KAHULUI AIRPORT IMPROVEMENTS
KAHULUI, MAUI, HAWAII

State Project No. AM1011-07

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

and

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION

GOVERNOR, BENJAMIN CAYETANO

September 1997

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
As lead Federal Agency pursuant to the National Environmental Policy Act of 1969

STATE OF HAWAII, DEPARTMENT OF TRANSPORTATION
As lead State Agency pursuant to the Hawaii Revised Statutes, Chapter 343

FINAL ENVIRONMENTAL IMPACT STATEMENT

KAHULUI AIRPORT
PROPOSED AIRPORT MASTER PLAN IMPROVEMENTS
KAHULUI, MAUI, HAWAII

This Environmental Impact Statement (EIS) addresses the potential environmental impacts of the proposed airport master plan improvements including: extending and strengthening Runway 2-20; construction of a parallel Runway 2R-20L; land acquisition; new airport access roadway; commercial and general aviation facilities such as aircraft parking aprons, taxiways, navigational aids, etc.; jet blast protection; and an interim helicopter facility. The EIS also addresses the required information necessary for the State of Hawaii to obtain federal assistance for the development of surface access around the airport from the U.S. Federal Highway Administration, through the Intermodal Surface Transportation Efficiency Act (ISTEA). The EIS is submitted for review pursuant to the following public law requirements: Section 102(2)(c) of the National Environmental Policy Act of 1969; Hawaii Revised Statutes, Chapter 343; and 49 USC 47106 (c)(B) and (C) of the Airport and Airway Improvement Act of 1982, as amended.

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September 1997

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ENVIRONMENTAL IMPACT STATEMENT
KAHULUI AIRPORT IMPROVEMENTS

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NOTE: The shaded text within the Final EIS, indicates changes made to the text of the Draft EIS, pursuant to State of Hawaii, Department of Health, Administrative Rules, 11-200-18.

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WATER SYSTEM

Existing Facilities

The water system serving the Airport is shown on Figure W-1. It consists of a network of 6-inch to 16-inch pipelines, many of which were installed several decades ago. A number of old water lines on the property have been abandoned but are still in place. The newest additions to the system are the 16-inch water mains that extend from Eena Street to Hana Highway via Kala Road, Haleakala Highway, Hemaloa Street and Keolani Place; 12-inch and 8-inch lines at Halai Street and Kaonawai Place; and a 16-inch extension line from the Keolani Place bridge to the entrance of the old passenger terminal.

Except for the metered domestic and irrigation lines and dedicated firelines, the whole network is owned and maintained by the County's Department of Water Supply. It is a part of the County's Central Maui Water System which serves Central Maui which includes Wailuku, Kahului, Kihei, Makena, Spreckelsville and the urban areas of Paia. The source of the Central Maui Water System is the Iao Aquifer located to the northwest of Wailuku on the windward side of the West Maui Mountains. The aquifer has an estimated sustainable yield of 20.1 MGD. The Department of Water Supply has projected an average demand of 30.5 MGD, including water system losses, for the year 2010[1]. Because of this, the County has initiated the development of other water sources in the East Maui Area. Meanwhile, the Department of Water Supply has restricted the

[1]Maui County Water Use and Development Plan, March 1990.

use of County water for irrigation purposes especially on large projects such as roadway landscapes, parks, etc. The proposed Airport Access Road is one example where the use of County water was not allowed for landscape irrigation.

Proposed Water Facilities

1. Irrigation System:

R. T. Tanaka Engineers, Inc. has recently completed a study for the feasibility of using non-potable waters for Airport landscape irrigation. Non-potable irrigation water investigated were: (a) treated sewage or reclaimed water from the Kahului Wastewater Treatment Facility; (b) brackish water from underlying aquifer at Airport lands; and (c) a 50/50 mixture of reclaimed water and brackish water. This report recommended the use of brackish water that could be drawn from underlying groundwater under the airport property.

Figure W-2, shows the source development plan proposed by the feasibility study. It requires the development of brackish wells, installation of pumps and accessories, 6-inch PVC distribution piping and modifications of existing irrigation system as necessary. It would also require the furnishing of safety controls to isolate the brackish water from the existing potable water system.

Existing landscape areas that could be converted to brackish water irrigation are the irrigation systems along Keolani Place (Phases 1 and 2), parking areas, frontal roads and Commuter Facilities. Proposed application areas are the future Airport Access Road and Kanaha Beach Park Expansion.

There are no changes recommended to the existing potable irrigation systems at the East Ramp, specifically the Scenic Flight Area, Airport Tower, T-Hangars and Aircraft Rescue and Firefighting Facilities. Transporting water to these site across the runway from the irrigation well at Aalele Street will be uneconomical. Thus, it is proposed that individual or combined brackish wells be developed in the area should any expansion of these facilities require large quantities of irrigation water; otherwise, the existing potable system should not be replaced.

Salt-tolerant plant varieties and xeriscape should be considered in all future landscaping designs.

2. Domestic Water System:

The recommended improvements to the water system for domestic and fire protection requirements are shown on Figure W-3.

A. Phase 1: Projects included in Phase I construction needing water improvements are the following:

1) Airport Rescue and Firefighting (ARFF) Facility: This facility is located at the East Ramp area and was completed in the later part of 1993. The improvements consisted of 12" and 6" pipelines for fire protection and a 1½" water meter for domestic use. The fire protection was provided with a detector check valve and connects to the existing 12" waterline on Eena Street.

2) ARFF Training Facilities: The 8" waterline at the ground transportation facility should be extended along Alahao Street to the site outside of the Airport Operational Area (AOA). Install 6" pipeline inside the AOA to provide water for training. The new 8-inch on Alahao Road will also serve the future Kanaha Beach Park Expansion.

3) New Cargo Facility (West Side): A new 8" pipeline should be installed along the service road and connected to the existing 8" waterline at the State Department of Land & Natural Resources baseyard. The new 8-inch pipeline will also service future expansion of the cargo facilities.

B. Phase 2: The proposed improvements for Phase 2 projects are described below:

1) Expansion of Ground Transportation Facilities: The existing 8-inch waterline on Kaonawai Place should be extended to serve the new lots. The new lines should be reconnected back to the existing 16-inch waterline on Keolani Place and to the 8-inch line at the Kalialinui Gulch channel. Existing lines that are no longer needed and which would interfere with the development of the lots should be abandoned or removed.

2) T-Hangars Expansion, Cargo Facility (East Side), Commercial Aviation Lease Lots and Scenic Air Tour Facility: These facilities are located at the East Ramp Area near the new ARFF facility. The existing

8-inch across the East Ramp should be extended along Eena Street to tie back to the existing 16-inch pipeline on Kala Street. The new line will serve the proposed Scenic Tour Facilities and at the same time would provide better fire protection flow.

New lines should be installed at the northern end of the East Ramp to accommodate the air cargo, T-Hangars and the commercial aviation lease lots that are proposed for this area. The existing 8-inch line from Hana Highway should be re-routed so that it follows the alignment of the proposed connecting taxiway. Similarly, the existing 12-inch line should also be re-routed along the alignment of the proposed spine road inter-connecting the existing Kaua Street 12-inch line from Hana Highway and the Eena Street 12-inch line. New 6-inch lines should be provided within the roadways of the commercial aviation lease lot subdivision and the new Air Cargo facility. Construction of the additional T-Hangar facilities might also require the realignment of the existing Eena Street 12-inch line.

3) <u>Kanaha Beach Park Expansion</u>: Fire protection and domestic needs for this project will be provided by a new 8-inch waterline to be connected to the 8-inch pipeline on Alahao Street serving the ARFF Training Facility. The new line will be extended

with a 2-inch pipe and connect to the existing 1½-inch waterline serving the Spreckelsville lots to form a loop system.

Irrigation of this project will be by brackish well as described under irrigation system.

C. <u>Phase 3</u>: Phase 3 projects are as follows:

1) <u>Keolani Place Lease Lots, Ground Transportation Facilities Expansion Along Keolani Place and Lease Lots for Flight Kitchen</u>: The 8-inch waterline inside the existing subdivision and the 16-inch pipeline at Keolani Place will provide the fire protection and domestic needs of these proposed projects. Hence, there is no major water improvements involved during the construction of these projects.

2) <u>Additional Cargo Facilities</u>: The cargo facility expansion on the west side of the airport access road will be served by the 8-inch pipeline previously installed during the 1st phase of this facility. No additional water improvements are needed.

3) <u>Spine Road</u>: The existing 12-inch and 16-inch pipelines on Eena Street, Kala Street and Haleakala Highway may be required by the Department of Water Supply to be re-routed along the new alignment of the proposed spine road, especially if the existing roadways are to be closed.

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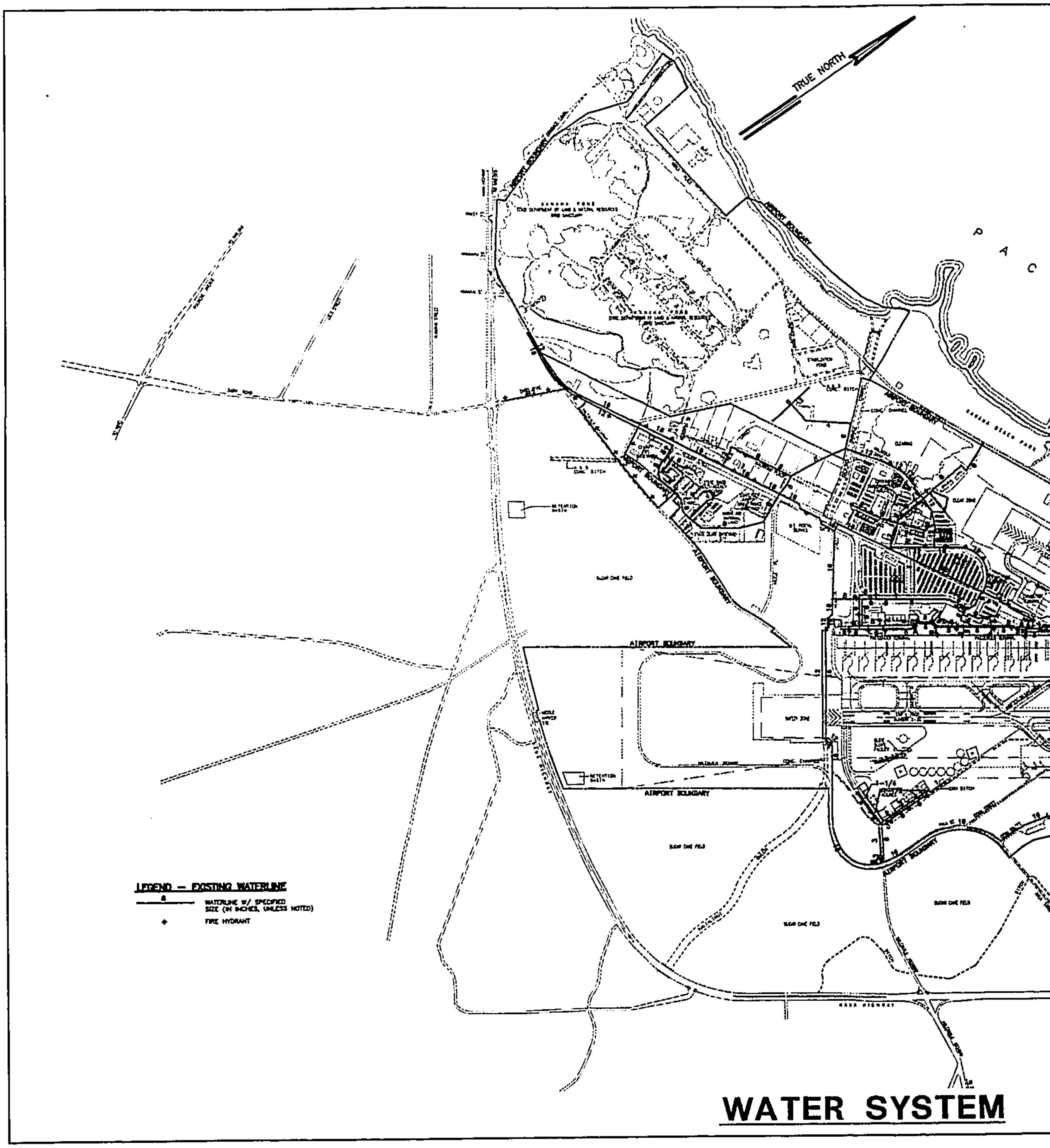
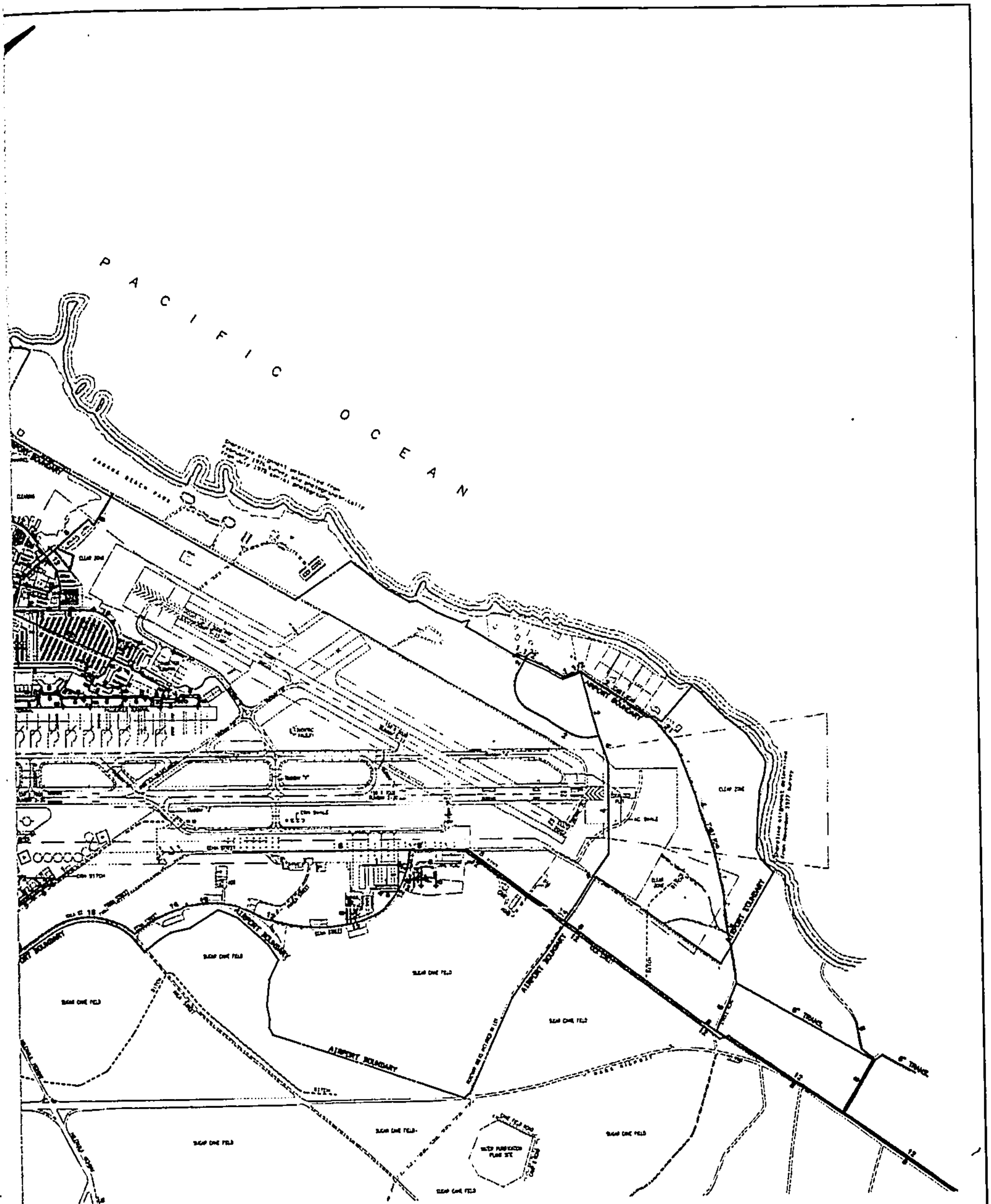
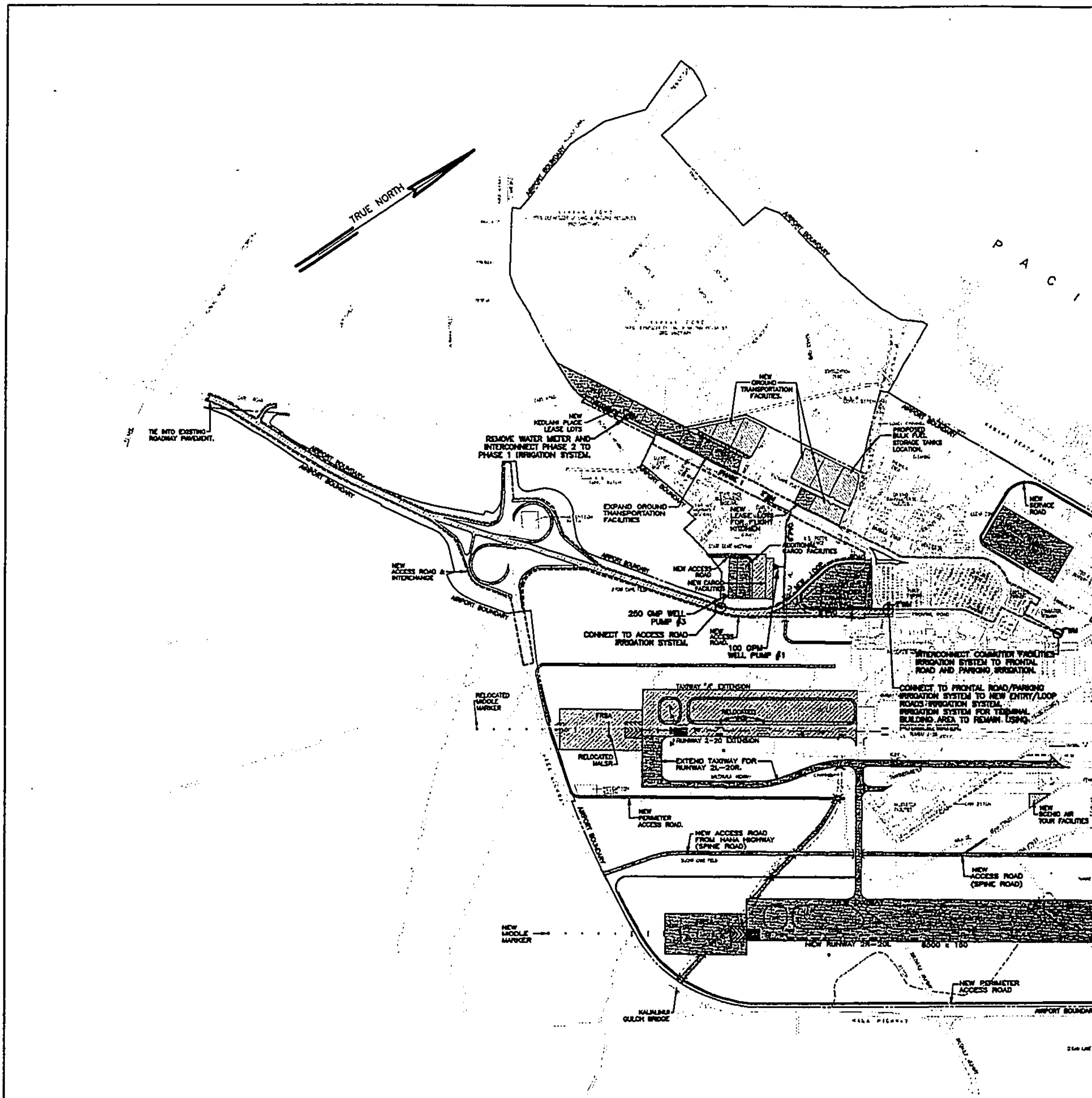


WATER SYSTEM

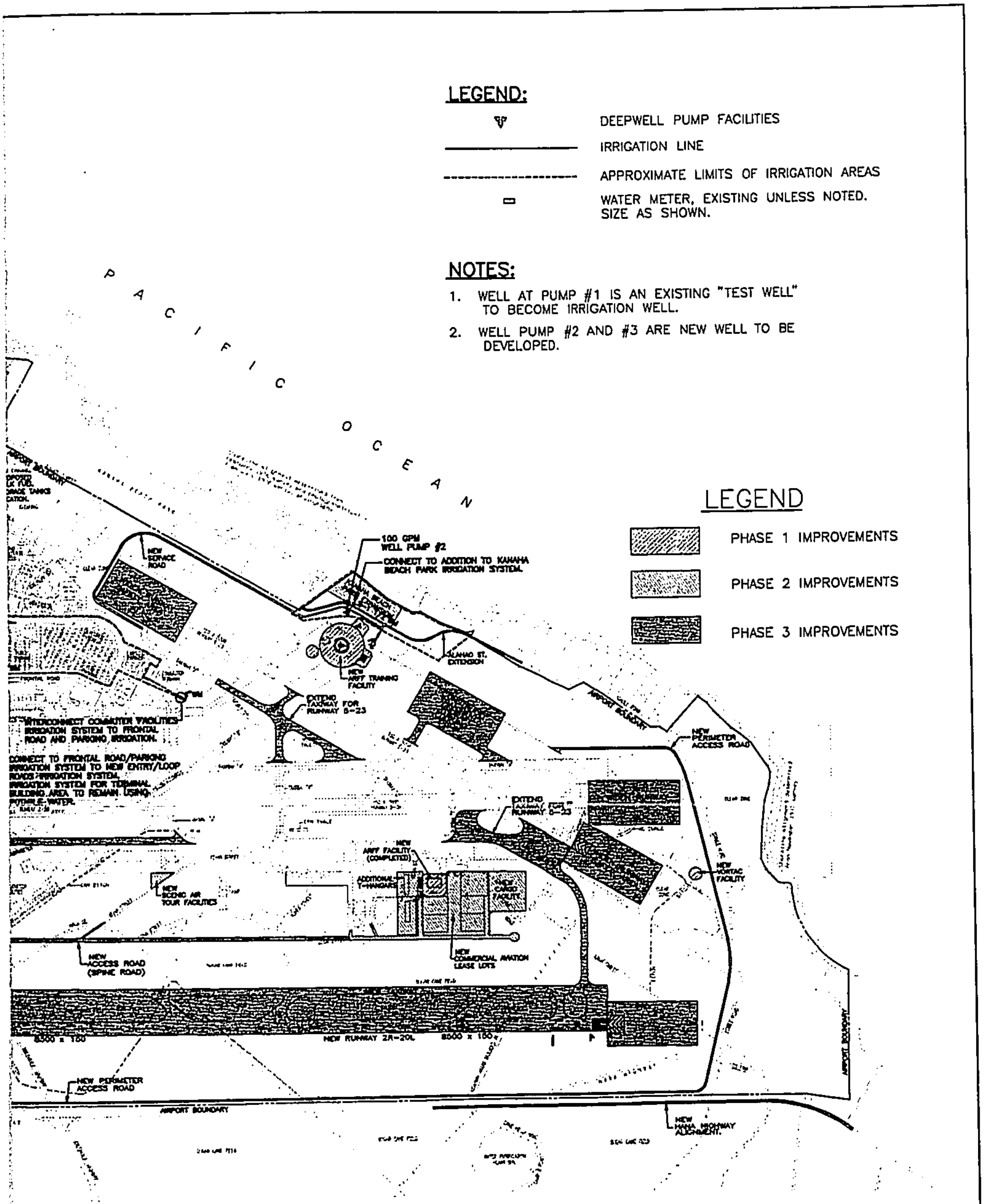


YSTEM

FIGURE W-1



IRRIGATION SYSTEM



SYSTEM

FIGURE W-2

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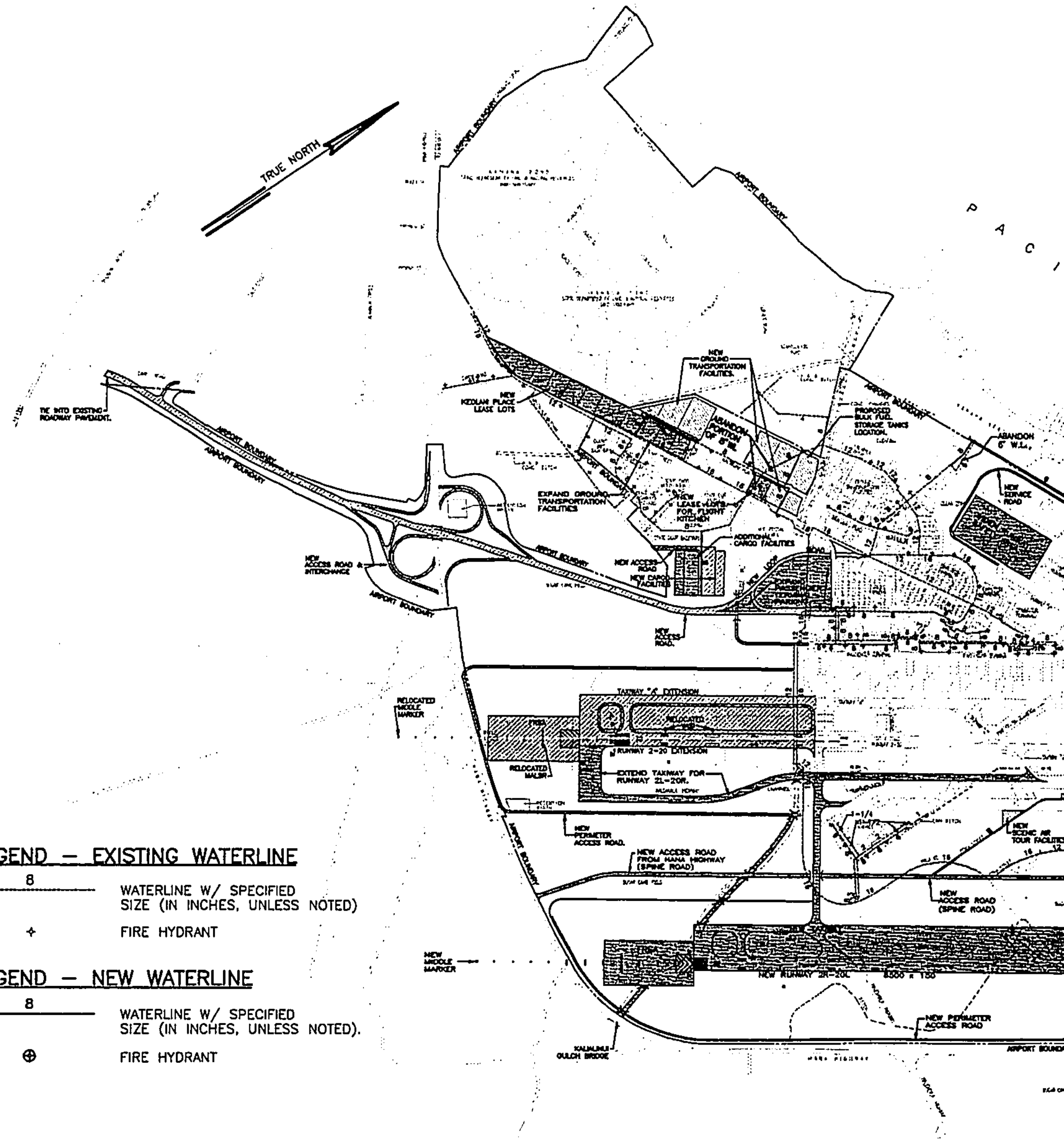

LEGEND – EXISTING WATERLINE

8 — WATERLINE W/ SPECIFIED SIZE (IN INCHES, UNLESS NOTED)

✧ FIRE HYDRANT

LEGEND – NEW WATERLINE

8 — WATERLINE W/ SPECIFIED SIZE (IN INCHES, UNLESS NOTED).

⊕ FIRE HYDRANT

WATER SYSTEM

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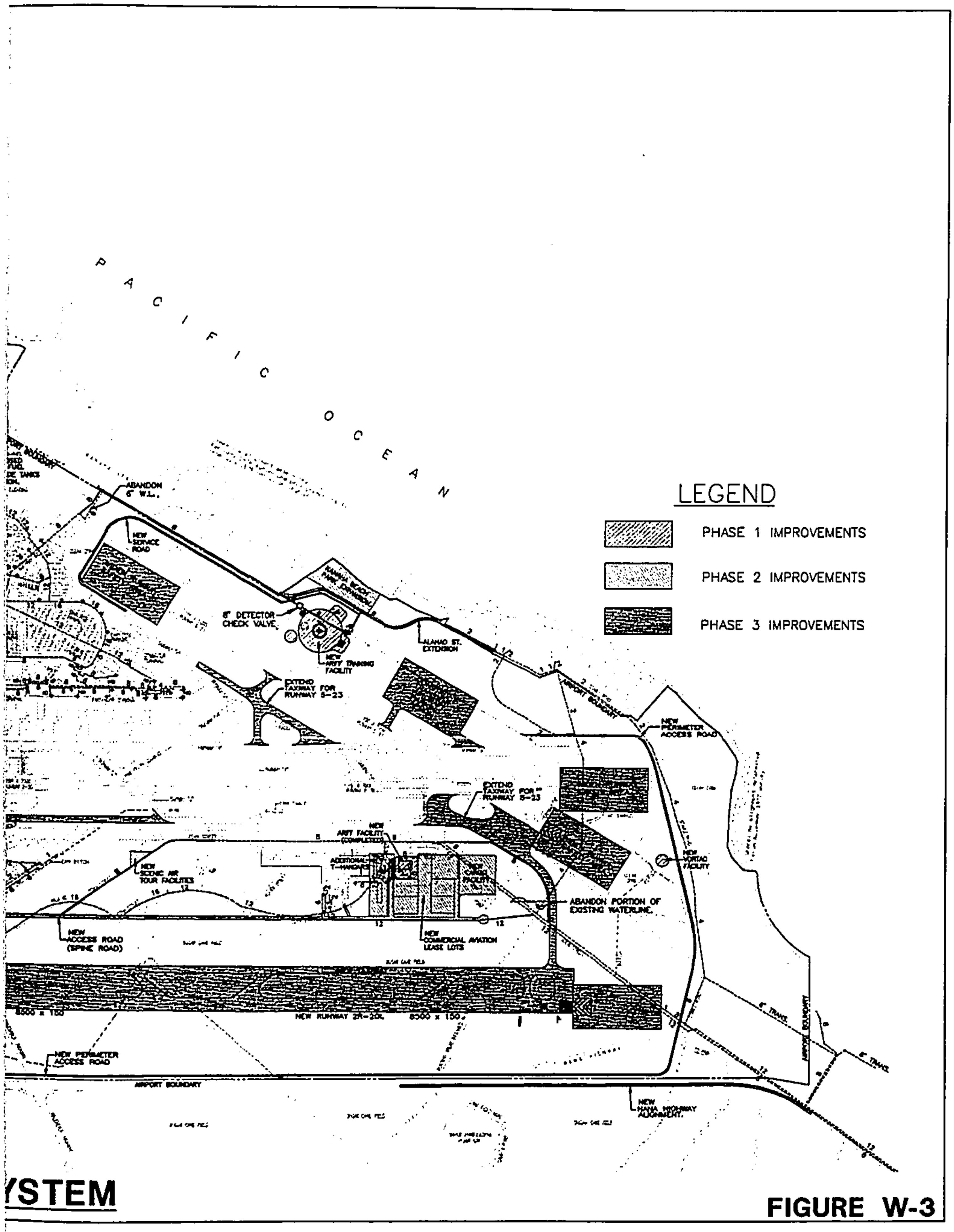


'STEM

FIGURE W-3

SEWER SYSTEM

Existing Sewer System

The existing sewer lines, sewer pump stations, and other wastewater collection and disposal facilities at Kahului Airport and surrounding areas are shown on Figure S-1. The collection system currently serves the Terminal Area, Ground Transportation Subdivision and the Light Industrial Area located in the western portions of the Airport. A system of gravity lines carries wastewater from these areas to a sewer pump station located between Kalialinui Gulch and Kanaha Pond Wildlife Refuge. From there it is pumped through an 8-inch force main to the County's Kahului Wastewater Treatment Plant on the shoreline opposite Kanaha Pond Wildlife Refuge.

All of the facilities such as the helicopter facilities, T-Hangars and Airport Traffic Control Tower, located on the east side of Runway 2-20 are currently served by cesspools. A system of sewer mains once collected wastewater from this area and transmitted it to an injection well located near the old ARFF station. However, these lines are quite old and have been abandoned for some time. The newly completed ARFF facility at the east end of the East Ramp is currently served by a septic tank and two (2) seepage pits.

A 12-inch force main and an 18-inch gravity sewer main crosses the north side of the Airport along Alahao Street and Old Stable Road. It connects the towns of Spreckelsville, Paia, and Kuau with the Kahului Wastewater Treatment Plan. This system is owned and maintained by the County.

Proposed Sewer System

The recommended improvements to the airport existing sewer system are shown on Figure S-2. The proposed improvements will be installed in phases consistent with the development of the facilities recommended in the Master Plan. Sewage collected by the new system will ultimately be conveyed to the County's Kahului Wastewater Treatment Plant. A wastewater assessment fee for the plant expansion costs will be required by the County based upon the projected daily average sewage flow.

1. Phase 1:

   Included in this phase are the installation of sewer systems that will serve existing and new facilities at the East Ramp and the proposed cargo facilities west of the terminal building. The East Ramp system includes a gravity line along the eastern side of the apron, a sewer pump station east of the new ARFF facility and a 4" force main across the runway safety areas, that will connect to the existing County sewer manhole east of the Kanaha Beach Park. When the new system is operable, existing sewage facilities in the area such as cesspools and seepage pits should be abandoned or removed as appropriate. The proposed west side Cargo Facilities will be served by an 8-inch gravity line that will be connected into the existing sewer manhole at the Airport Maintenance Baseyard.

2. Phase 2:

   Phase 2 improvements are as follows:

A. Kanaha Beach Park Expansion: A new 8-inch gravity sewerline will be installed along the new Alahao Street entrance and will tie-in to the County's existing 18" sewerline south of the project area.

B. Ground Transportation Expansion: A new 8-inch gravity line from the existing 10-inch line on Kaonawai Place should be installed to serve the eastern portion of the expansion. Likewise, a new 8-inch gravity line should be installed at the west end of the subdivision road to collect sewage from the west portion of the subdivision. Due to ground topography, this line cannot be connected to the existing sewer manholes at the intersection of Halai Street and Kaonawai Place. Rather, a new 8-inch gravity line should be installed along the west side of the new lots and connect to the existing sewer manhole at the Sewage Pump Station.

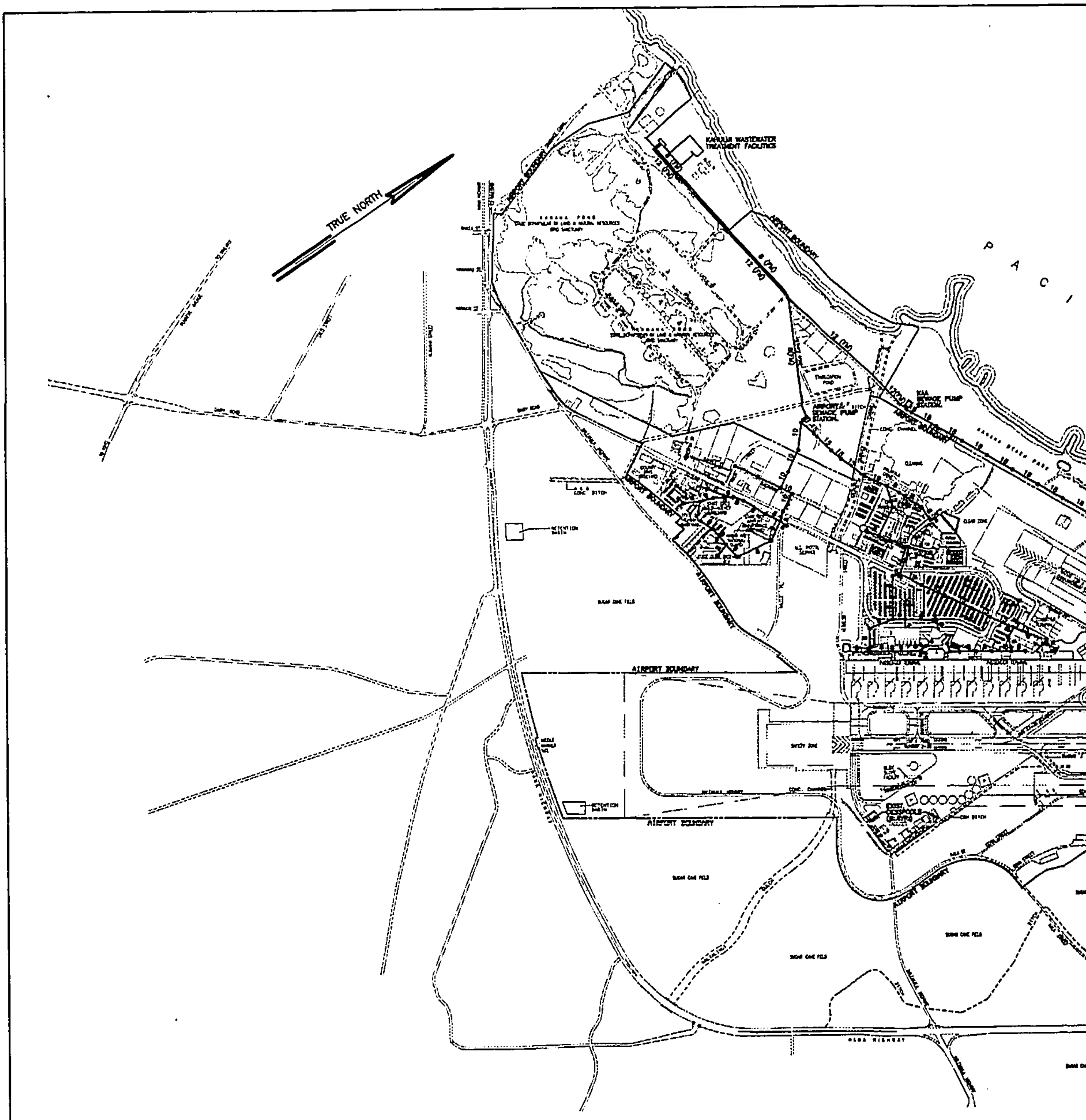
3. Phase 3:

Recommended sewer system expansion under this phase is minimal. The additional air cargo facility on the west side will be served by the new 8-inch sewerline previously installed under Phase 1. The expanded ground transportation facilities along Keolani Place will be served by the new 8-inch gravity line on Kaonawai Place which was installed under Phase 2. Sewage from the proposed Keolani Place lease lots will be handled by a new gravity 8-inch line along the road towards the concrete channel crossing and then pumped via a

4-inch force main into the existing sewer manhole previously installed under Phase 2.

4. Sewage Pump Station (SPS):

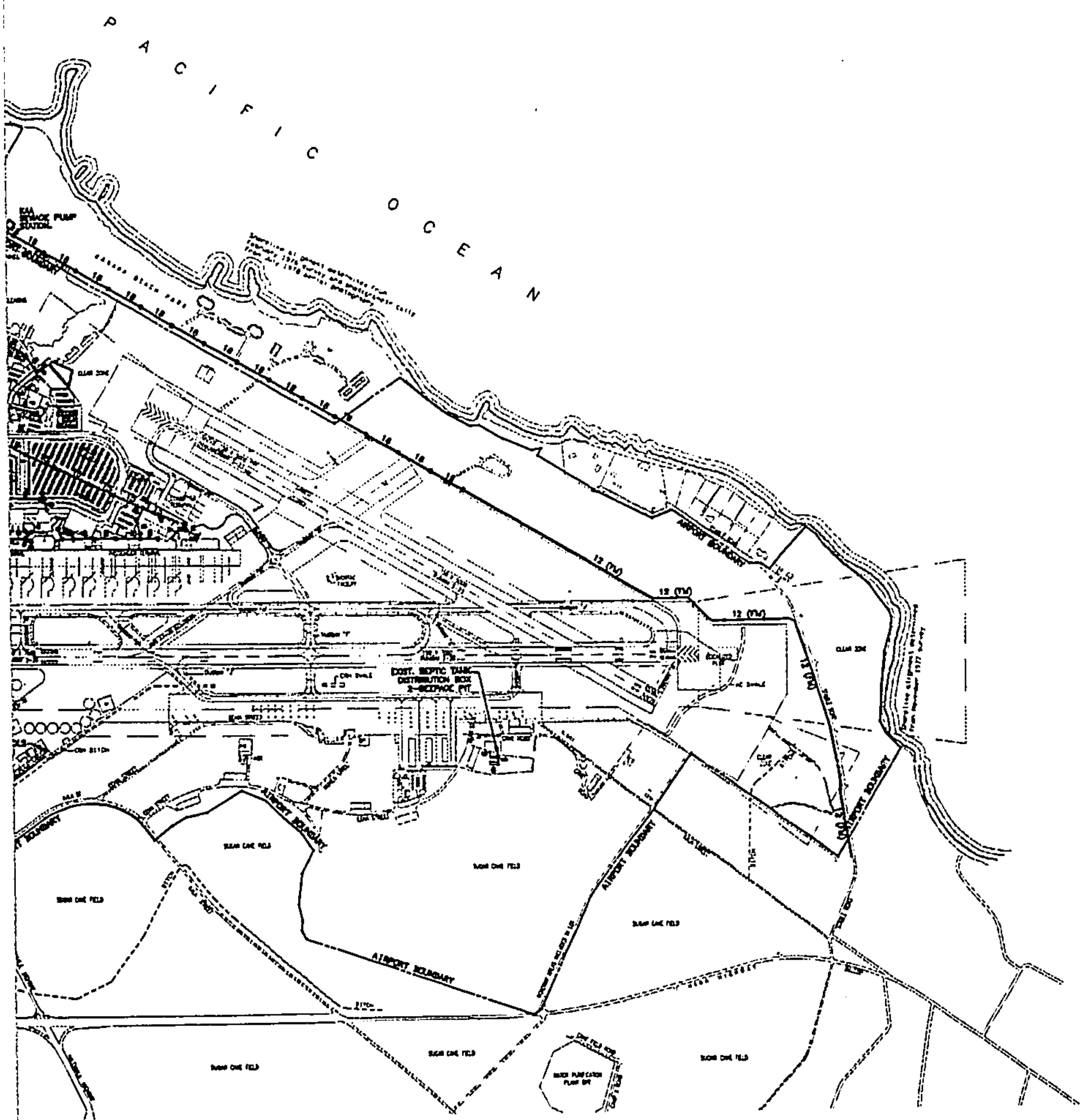
Flows into the existing Airport SPS will increase as the number of passengers using the Airport continues to rise and as the proposed facilities in the west side are developed. The Airports Division should monitor these flows on a regular basis and begin planning for pump station upgrade when peak flows exceed 80 percent of the SPS's design capacity. Similarly, the County of Maui might require the Airports Division to fund any necessary improvements on its collection and pumping systems to accommodate the additional flows from the East Ramp area facilities and Kanaha Beach Park Expansion.



SEWER SYSTEM

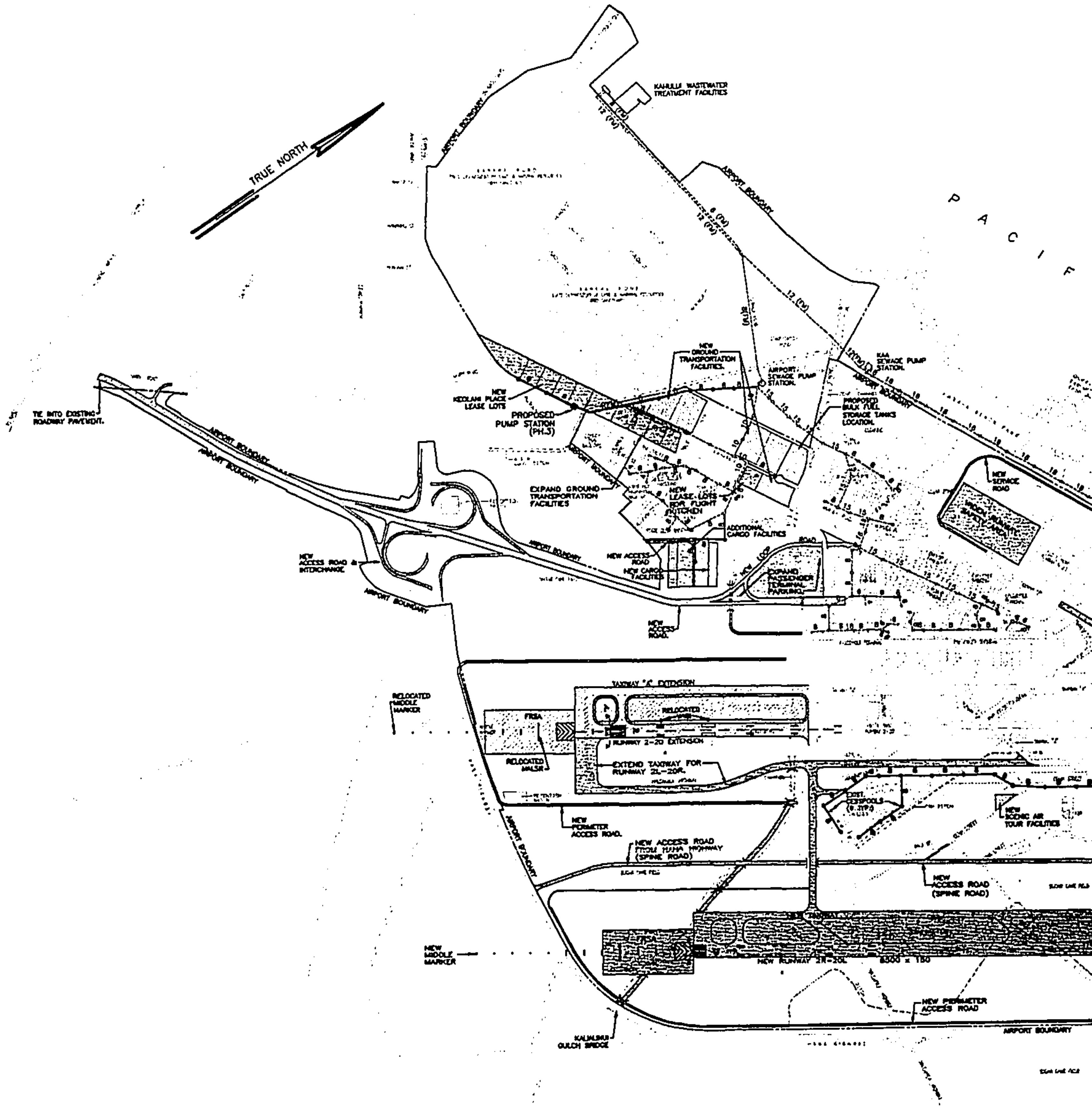
LEGEND - EXISTING SEWERLINE:

8	SEWERLINE W/ SPECIFIED SIZE (IN INCHES, UNLESS NOTED).
12 (FM)	SEWER FORCE MAIN LINE W/ SPECIFIED SIZE (IN INCHES, UNLESS NOTED).
o	SEWER MANHOLE, UNLESS NOTED.

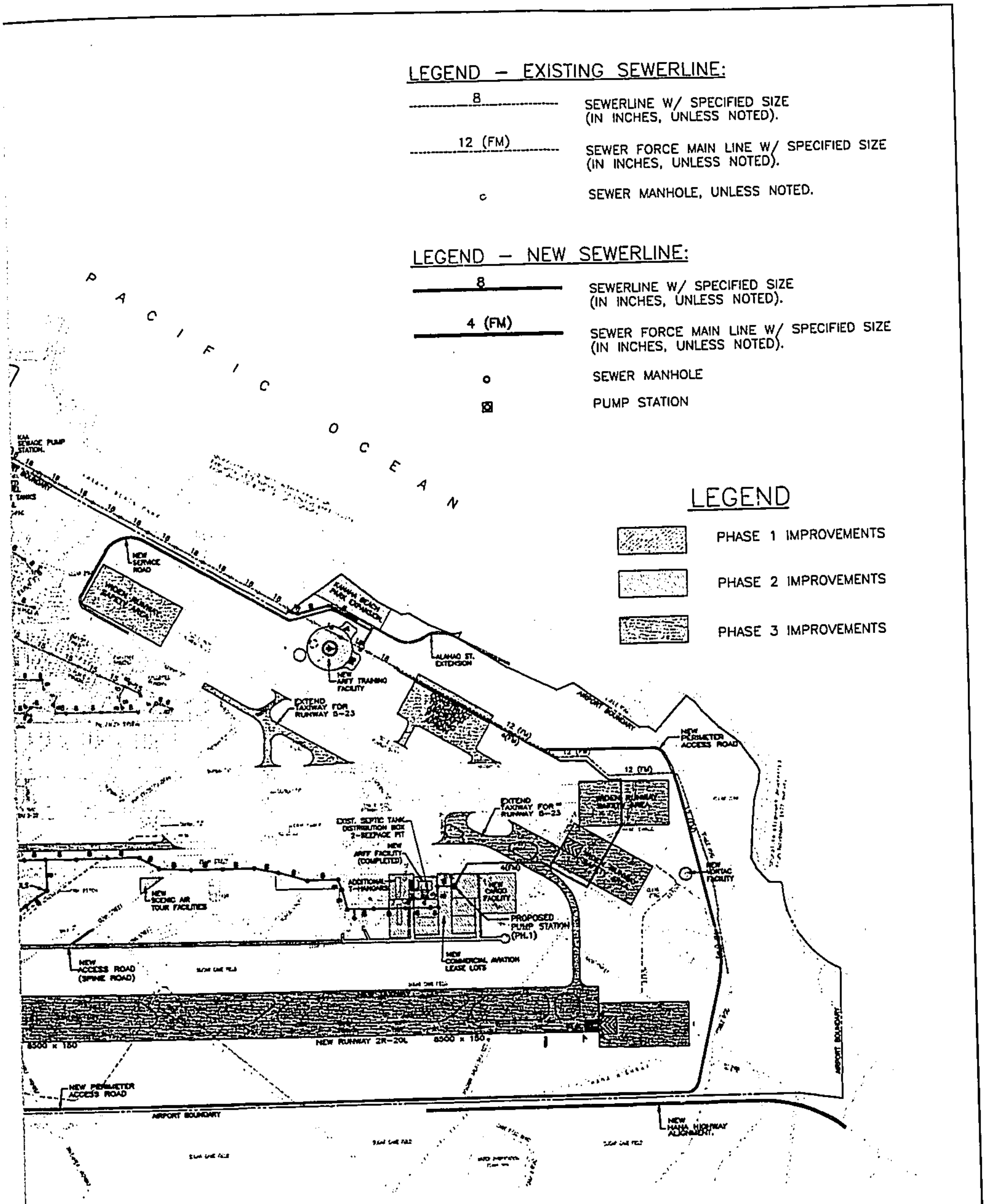


STEM

FIGURE S-1



SEWER SYSTEM



YSTEM

FIGURE S-2

DRAINAGE SYSTEM

Existing Drainage System

The existing drainage system within the Airport property and immediate vicinities is shown on Figure D-1. The drainage system consists of inlets, box or circular culverts, trench drains, and lined or unlined channels. The drainage system will transport runoff to either Kalialinui Gulch or to the undeveloped lands north of Runway 5-23. Runoff entering the gulch will flow directly into the ocean. Runoff that discharges into the open lands via culverts under Runway 5-23 will be trapped in depressions and pockets until it will percolate into the ground or lost to the atmosphere by evaporation.

Kalialinui Gulch is the major drainageway that bisects the airport property. The gulch was improved in 1991 to carry a 100-year storm flow of 7,500 cubic feet per second (cfs). The concrete ditch along the eastern perimeter of Kanaha Pond, although owned by A & B, Inc., is another important part of the airport drainage system. The ditch will intercept runoff from airport lands that flows toward Kanaha Pond and direct it to the Kalialinui Gulch Channel.

The airport property, excluding the Kanaha Pond area, encompasses about 1,255 acres and consist of lands that are paved, undeveloped and cultivated (cane fields). Runoff from these lands, in general, flows in a southeast-northwest direction and will be intercepted by numerous individual drainage systems to be discharged to either Kalialinui Gulch or to the opened lands north

of Runway 5-23. Major drainage areas and collection system include the following:

1. Runoff from the New Passenger Terminal and the adjacent Aircraft Parking Apron is collected in a system of drains and underground pipes. The inland portion of this network drains towards Kalialinui Gulch. The east part, including the Commuter Terminal area, drains towards the shoreline, passing beneath Runway 5-23 via culverts and discharging into open land on the north side of the runway.
2. Runoff from the Passenger Terminal Parking Area, mauka portion of the Ground Transportation Subdivision and portions of Keolani Place near the parking lot is collected in an underground pipe network and discharged into Kalialinui Gulch via culverts and an open channel. Runoff from the lower portion of the Ground Transportation Facilities sheet-flow towards Alahao Street and into the corner of Alahao Street Bridge where it will be collected and discharged to Kalialinui Gulch channel by a 54" culvert.
3. Runoff from the lands between Keolani Place and Kalialinui Gulch that flows towards Kanaha Pond Wildlife Refuge is intercepted by the A & B concrete ditch and directs the flow towards Kalialinui Gulch channel.
4. Runoff from lands to the east of Runway 2-20 is intercepted by a system of swales and lined channels and diverted to the northeastern end of the East Ramp. From there it is carried underground across Runways 2-20 and 5-23 before being discharged into the open land on the north side of Runway

5-23. A portion of the runoff is diverted around the east ends of Runways 2-20 and 5-23 by an unlined and lined swale.

5. Stormwater accumulating between the middle portion of Runway 2-20 and the parallel taxiway (Taxiway "A") is collected by drain and channeled underground beneath the taxiways and Runway 5-23 before being discharged into the open area on the north side of Runway 5-23.

Future Stormwater Drainage System

Future drainage systems will be constructed as needed for the individual improvements as shown on the Airport Master Plan.

1. Phase I:

Phase I improvements that requires drainage improvements are ARFF Facility, ARFF Training Facility, Cargo Facilities, Airport Access Road and Interchange, and Runway 2-20 Extension. Figure D-2 shows the proposed drainage system additions for Phase 1.

A. The ARFF Facility was just recently completed. There was no drainage structures installed for this project. Disposal of onsite runoff relies on surface flow which would either drain into the open lands east of the site or drain across the East Ramp to the existing swales which runs along Runway 2-20.

B. The ARFF Training Facility is currently under design development. No change of drainage pattern or runoff quantity is expected for this project. Surface runoff

will flow into the open lands north of the project where it will be retained and be lost to the ground by infiltration or to the atmosphere by evaporation.

C. New Cargo Facilities. This facility encompasses about 5 to 6 acres. Runoff from this area will be collected by underground culverts and carried to the existing Aalele Street culvert crossing. Offsite runoff will also be diverted by an unlined swale to the Aalele Street culvert crossing. All runoff will eventually discharge into Kalialinui Gulch box culvert.

D. New Access Road and Interchange. Design of this project has been completed. Runoff from a portion of the access road between Hana Highway and the terminal area will be collected by underground drainage system and transported to the Kalialinui Gulch box culvert. Runoff from the roadway portion west of Hana Highway will be collected by underground culverts and directed to existing drainageways that traverse the project. Inlets and culverts will also be installed to pass-off runoff from mauka lands in order to maintain the present drainage pattern.

The proposed Kahului Industrial Park Development by A & B Properties, Inc. will impact the Access Road drainage systems west of Hana Highway. Figure D-2A shows the areas to be developed and the proposed changes to the roadway drainage systems. Phases 1A and 1B are planned for immediate development, whereas Phase 2 could only be developed upon the implementation of the Kahului Flood

Control Project proposed by the State Department of Land & Natural Resources. According to the Drainage Master Plan[1] for the proposed development, runoff from Phase 1A will be discharged into the existing A & B concrete ditch and runoff from Phase 1B will be handled by retention basins to be constructed inside Phase 2 area above the Airport Access Road. The retention basins will also intercept runoff from tributary areas above Phase 2. Due to these proposed drainage facilities, the Drainage Master Plan recommends revisions to the access road drainage systems such as:

1) Deletion of irrigation ditch crossing.
2) Deletion of inlet headwalls accepting storm flows mauka of the roadway. Provide additional roadway drainage inlets and reduce culvert sizes as necessary.
3) Installation of a culvert along the northside of the Access Road to intercept roadway culverts and discharging into the proposed concrete ditch along the west side of Hana Highway.
4) Installation of culverts across the LA-HA ramp to pass off mauka runoff should Phase 2 of the Industrial Park be developed.
5) Enlarging the proposed 4-6' x 6' box culvert crossing at the interchange to be able to handle an ultimate flow of 1,700 c.f.s.

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[1]Offsite Drainage Master Plan for Phase 1 of the Kahului Industrial Park Development, December 1993.

The above changes to the drainage system should be coordinated with the development of Phase 1A and 1B of the Kahului Industrial Park.

E. Runway 2-20 Extension. The extension of Runway 2-20 will also include the extension of Taxiway "A". Runoff accumulated between the runway and the taxiway will be collected by underground drainage system and carried to the Kalialinui Gulch box culvert. Runoff from the east of the runway extension will sheet-flow towards the gulch. Runoff from the west side of the project will sheet-flow towards Haleakala Highway and eventually be collected by the A & B, Inc. concrete ditch; otherwise, it will be collected by the access road drainage facilities, if already in place.

2. Phase 2

Figure D-3 shows the proposed drainage improvements for Phase 2. Included in this phase are the expansion of the Ground Transportation Facilities, Expansion of Kanaha Beach Park, Extension of Alahao Street to the old Stable Road, New Service Road for Commuter Facilities to ARFF Training Facility, New Scenic Air Tour Facilities, T-Hangars Addition, Commercial Aviation Lease Lots and New Cargo Facility (East Side).

A. Expansion of Ground Transportation Facilities. Runoff from this area will be collected by underground drainage culverts on Kaonawai Place and/or open swale to be constructed at the back of the proposed lots. Both systems will discharge into Kalialinui Gulch channel. There are already provisions for connection of these future facilities to the concrete channel.

B. Construction of the New Service Road from the Commuter Facility area to the New ARFF Training Facility and the New Alahao Street Extension is not expected to require drainage facilities. Runoff from these roadways will flow and disperse into the open lands for disposal.

C. Kanaha Beach Park Expansion. It is proposed that a drainage sump will be constructed onsite to retain runoff generated by this project due to the introduction of impervious areas such as paved parking and restroom facilities.

D. New Scenic Air Tour Facilities. No drainage structure is proposed for this project. The area will be graded in such a way that runoff will sheet-flow towards the existing CRM ditch west of the project.

E. Additional T-Hangars, Lease Lots, New Cargo Facility and Associated Access Road. There will be no onsite drainage system proposed for this project. The areas will be graded such that runoff will sheet-flow across the East Ramp towards the existing grassed swale along Runway 2-20. A swale along the proposed access road will be constructed to divert offsite runoff to the existing A.C. swale at the east end of Runway 5-23.

3. Phase 3

The recommended drainage improvements for the last phase of the Airport Master Plan are shown on Figure D-4. The proposed drainage concept and improvement are as follows:

A. Expanded Ground Transportation Facilities. Proposed lots will be graded to drain into Keolani Place or into Kaonawai Place. Runoff will be collected and disposed off by the existing roadway drainage facilities.

B. Keolani Place Lease Lots. Lots will be backfilled and graded to drain into Keolani Place where the runoff will be collected and disposed of by the existing roadway drainage facilities.

C. Additional Cargo Facilities (West Side). A new grassed swale will be constructed mauka of the site to divert mauka runoff to the existing drainage culvert on Aalele Street. Onsite runoff will be collected by the existing drainage facilities installed for the existing cargo facilities.

D. Public Parking Expansion. Runoff from this area will be handled by existing drainage facilities at the site. It does however require the extension of the existing drainage system serving the present parking area and the installation of new inlets.

E. Transient Aircraft Parking Apron. Runoff disposal from this area will rely on surface flow towards the open land north of the site. It does however require the installation of new culverts and grassed swale to redirect existing flows into the open lands.

F. <u>Taxiway Extension for Runway 5-23</u>. This improvement requires the installation of catch basins and drainlines to collect runoff trapped by the new taxiways. The drainlines will be connected to existing culverts or will outlet into existing drainageways.

G. <u>Parallel Taxiway, Runway 2R-20L and East Ramp Access Road from Hana Highway (Spine Road)</u>. Construction of these facilities will require major drainage improvements. Due to the topography of the site, runoff will be disposed either to Kalialinui Gulch or to a new outlet at the east end of Runway 2-20. The southwestern half portion of the project area will drain into Kalialinui Gulch by open swales, catch basins and underground culverts. Kalialinui Gulch will also be realigned by the construction of a concrete-lined channel and the installation of a triple 16' x 12' concrete box culvert. The northeastern portion of the parallel taxiway, runway and lands between the runway and Hana Highway will be drained into a new outlet basin at the east end of Runway 2-20 via open swales and underground culverts. The proposed outlet basin will be designed to contain the projected 50-year storm volume with necessary freeboard and reserve capacity to allow for loss of volume due to sedimentation.

Runoff from a portion of the lands between the new taxiway and the East Ramp access road from Hana Highway will be directed to the existing swale at the end of Runway 5-23.

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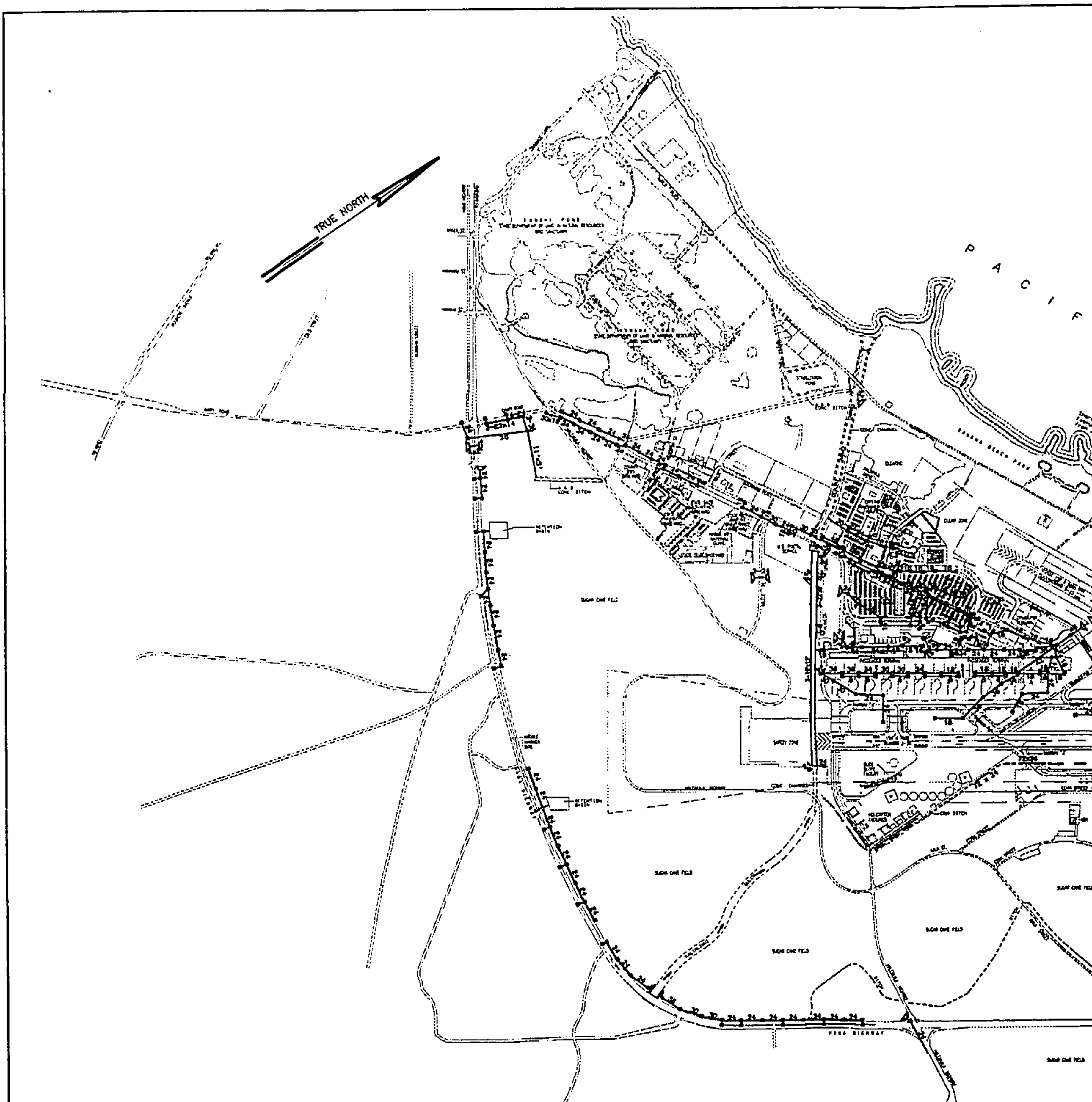
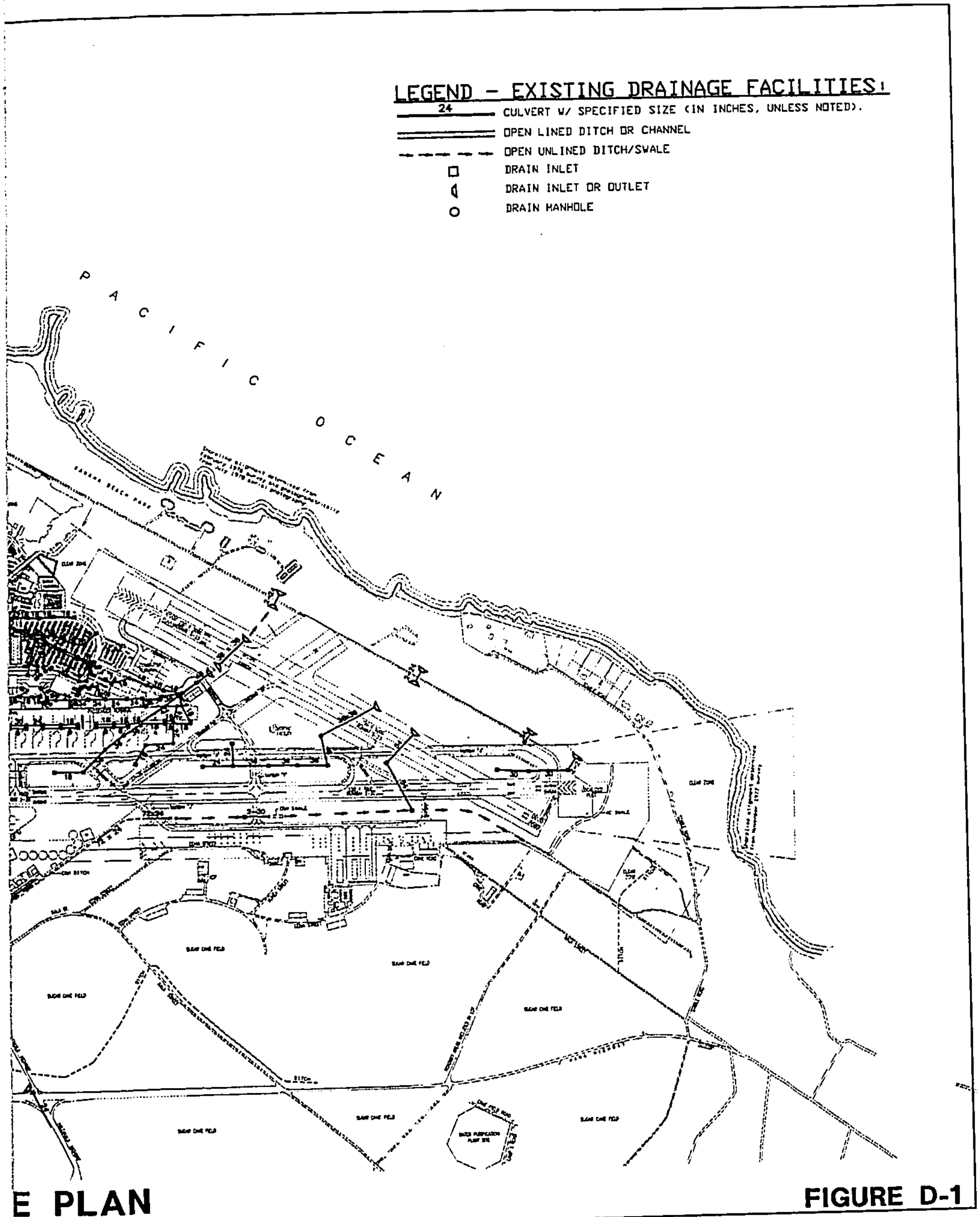
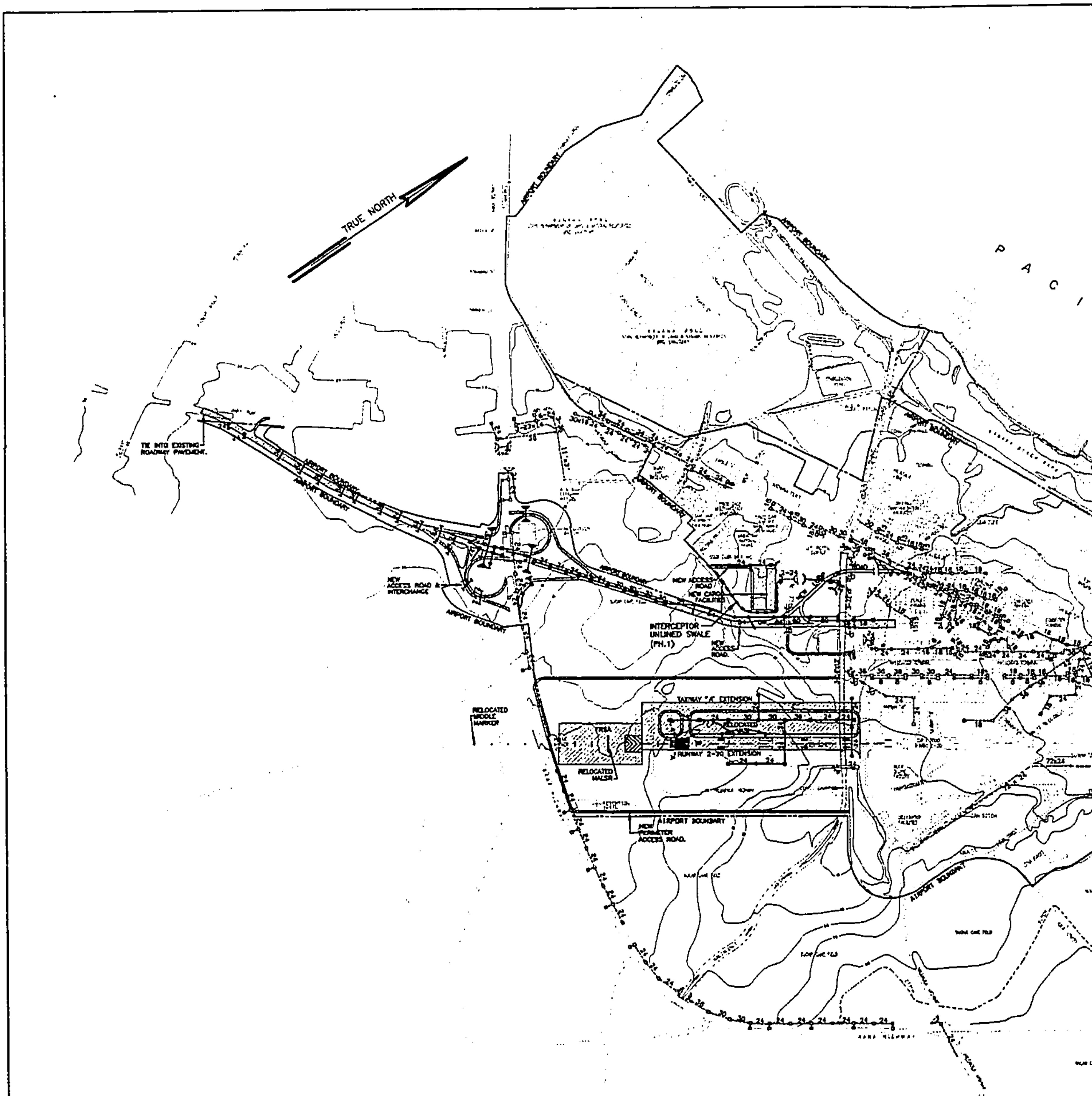


DRAINAGE PLAN

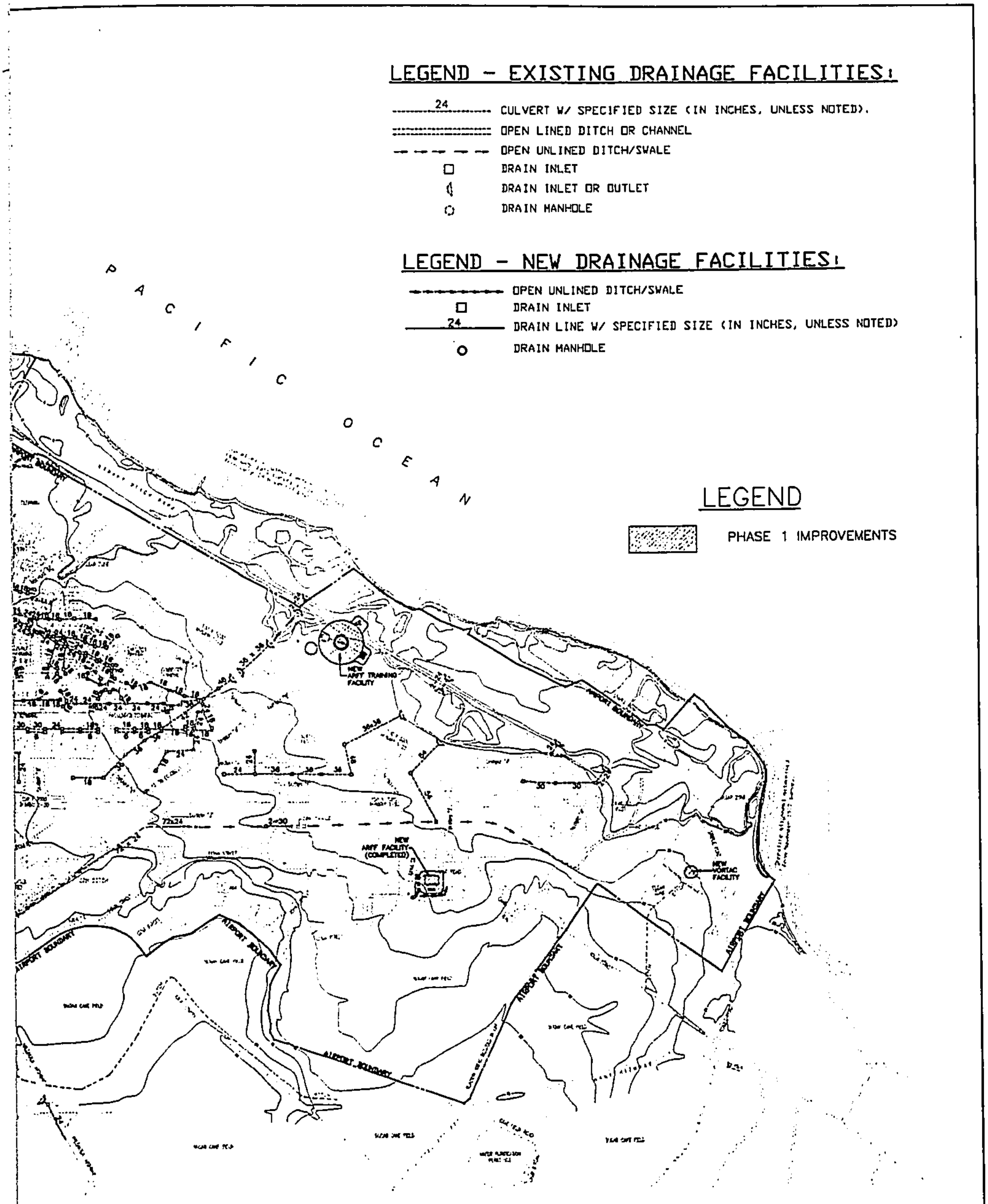


E PLAN

FIGURE D-1

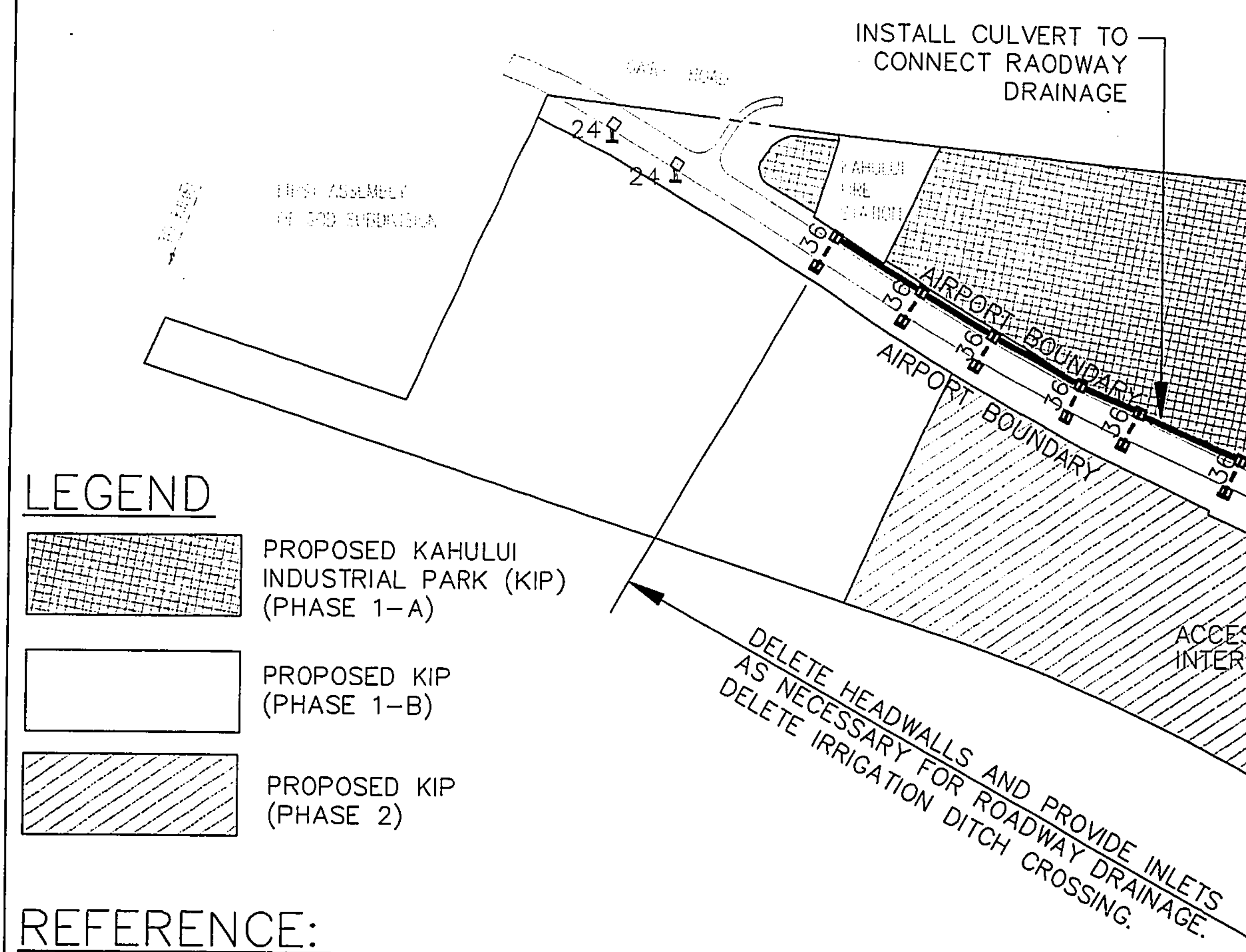


DRAINAGE PLAN



PLAN

FIGURE D-2



REFERENCE:

OFFSITE DRAINAGE MASTER PLAN FOR PHASE 1 OF THE KAHULUI INDUSTRIAL PARK DEVELOPMENT, DECEMBER 1993 BY NORMAN SAITO ENGINEERING CONSULTANT, INC.

PROPOSED REVISIONS FOR THE AIRPORT ACCESS ROAD DRAINAGE SYSTEM

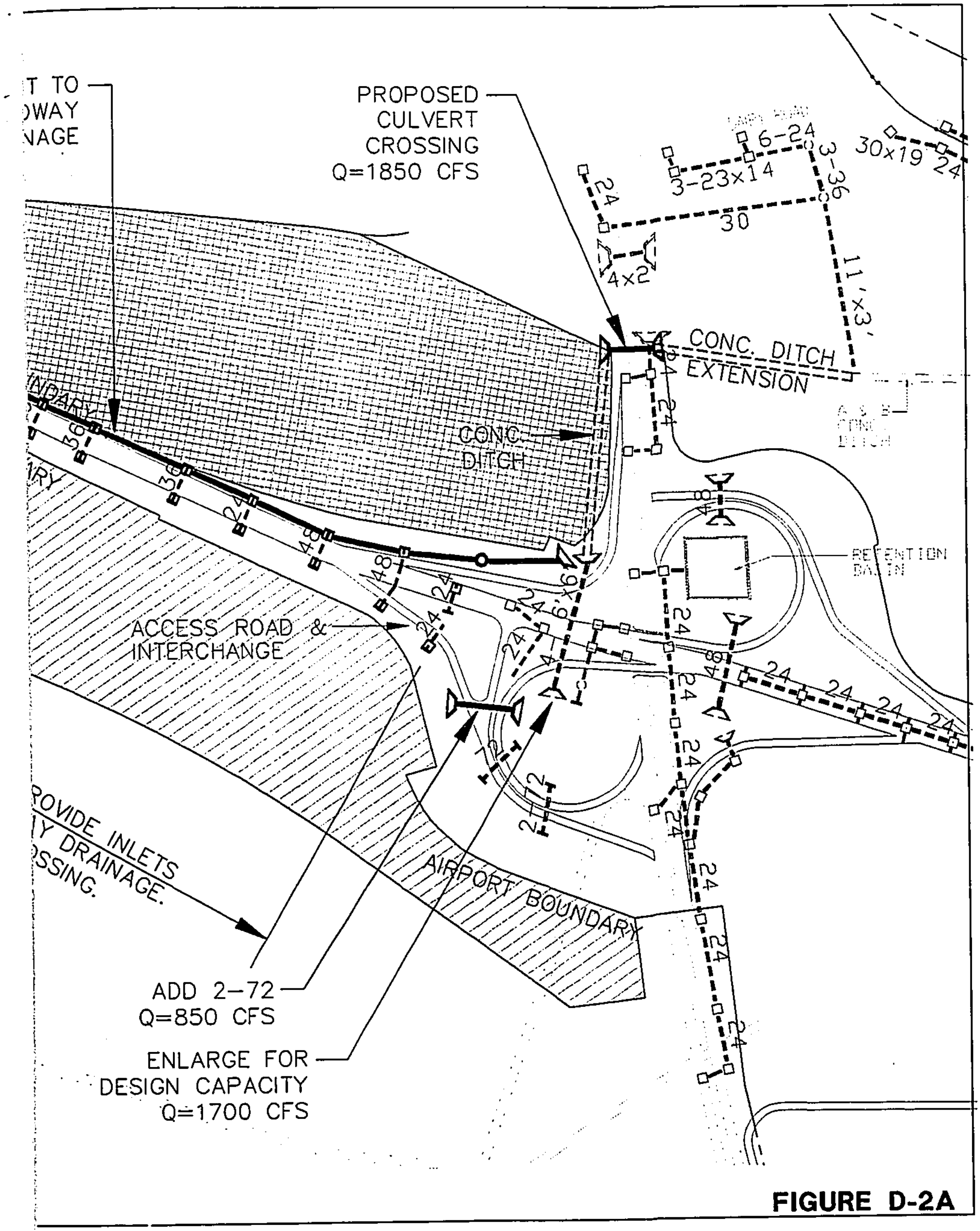
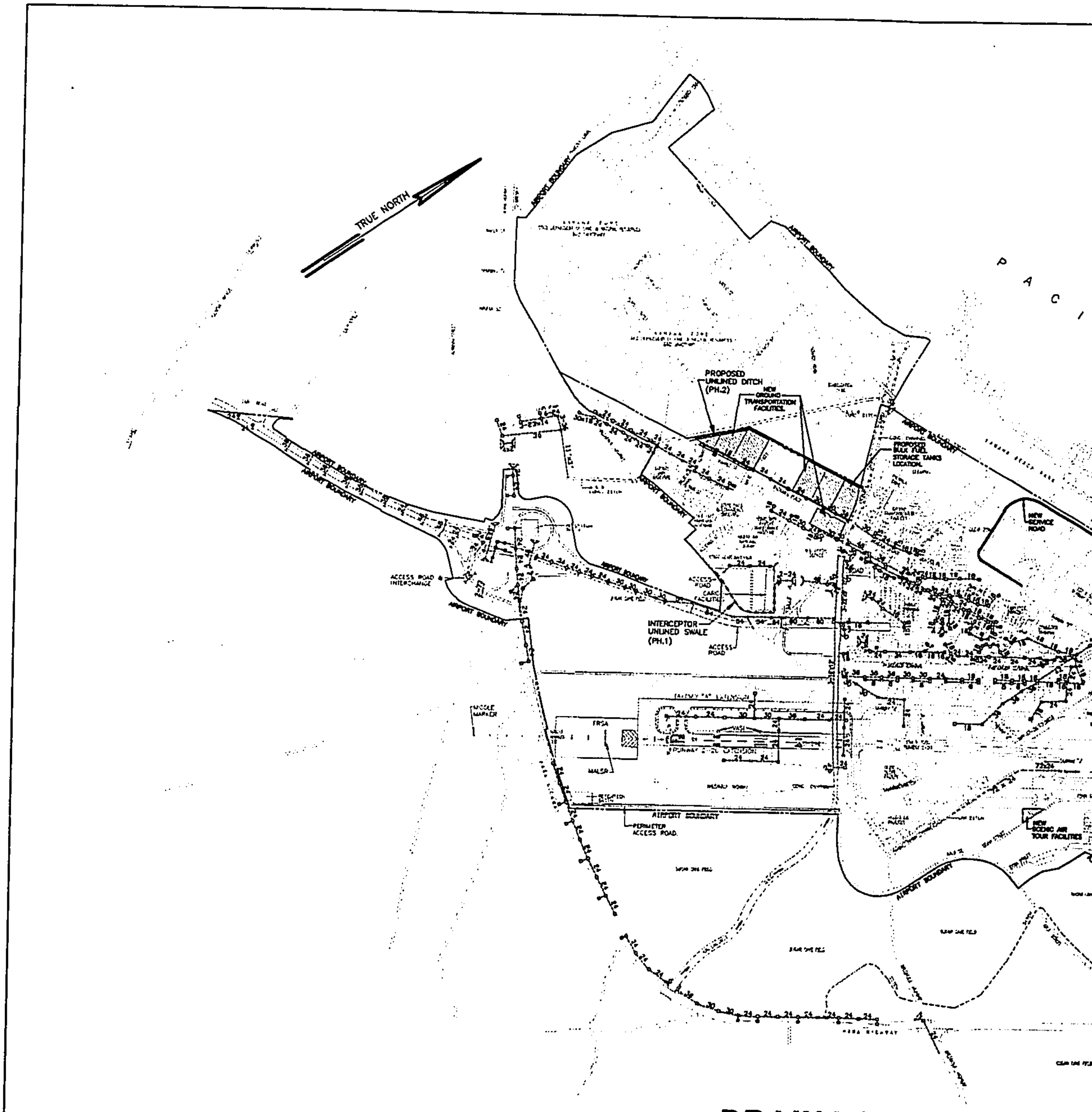
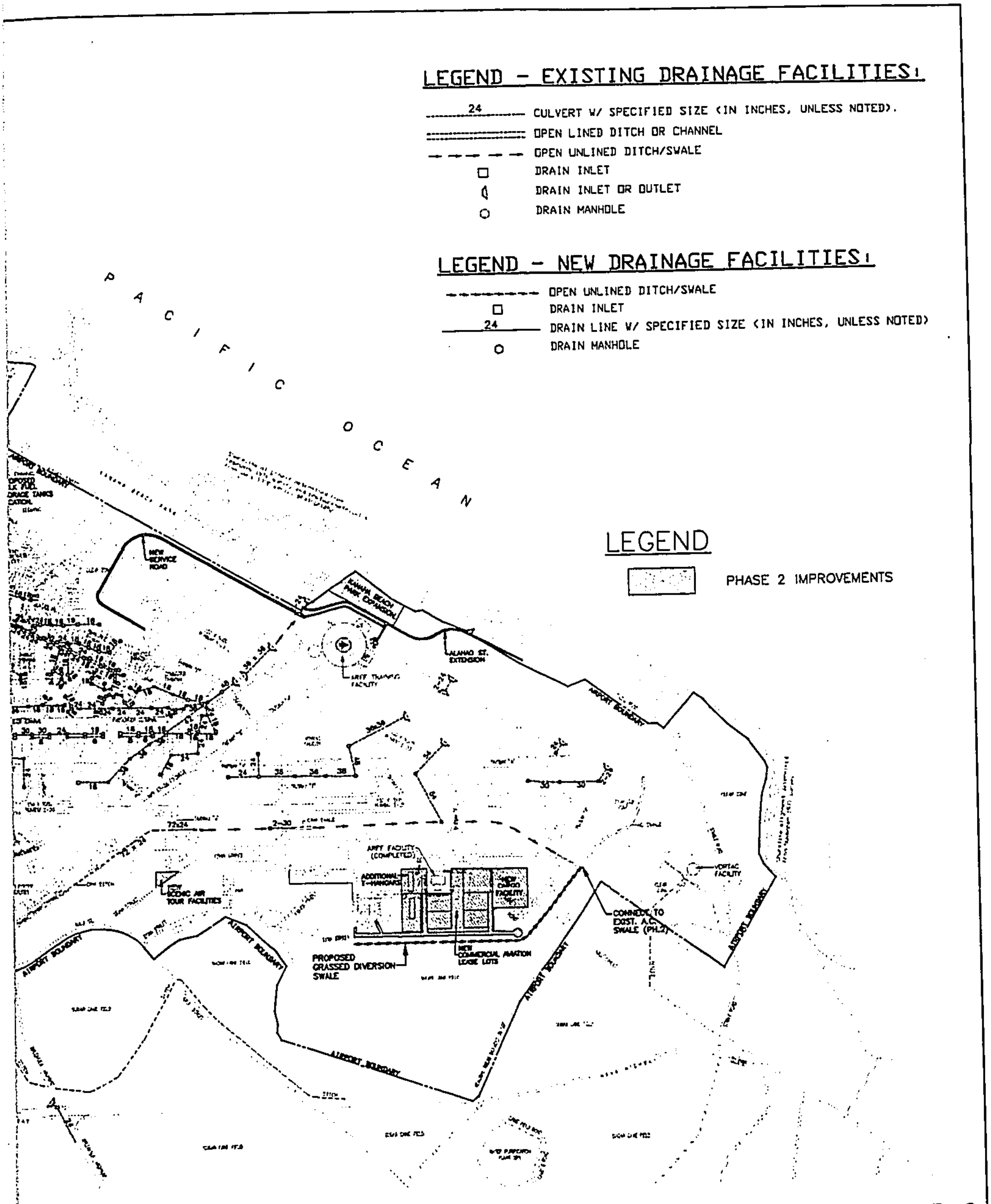

T TO
DWAY
NAGE
PROPOSED
CULVERT
CROSSING
Q=1850 CFS
6-24
3-23x14
3-36
30x19
24
30
4x2
11'x3'
CONC. DITCH
EXTENSION
CONC.
DITCH
RETENTION
BASIN
ACCESS ROAD &
INTERCHANGE
AIRPORT BOUNDARY
ROVIDE INLETS
Y DRAINAGE
SSING.
ADD 2-72
Q=850 CFS
ENLARGE FOR
DESIGN CAPACITY
Q=1700 CFS

FIGURE D-2A

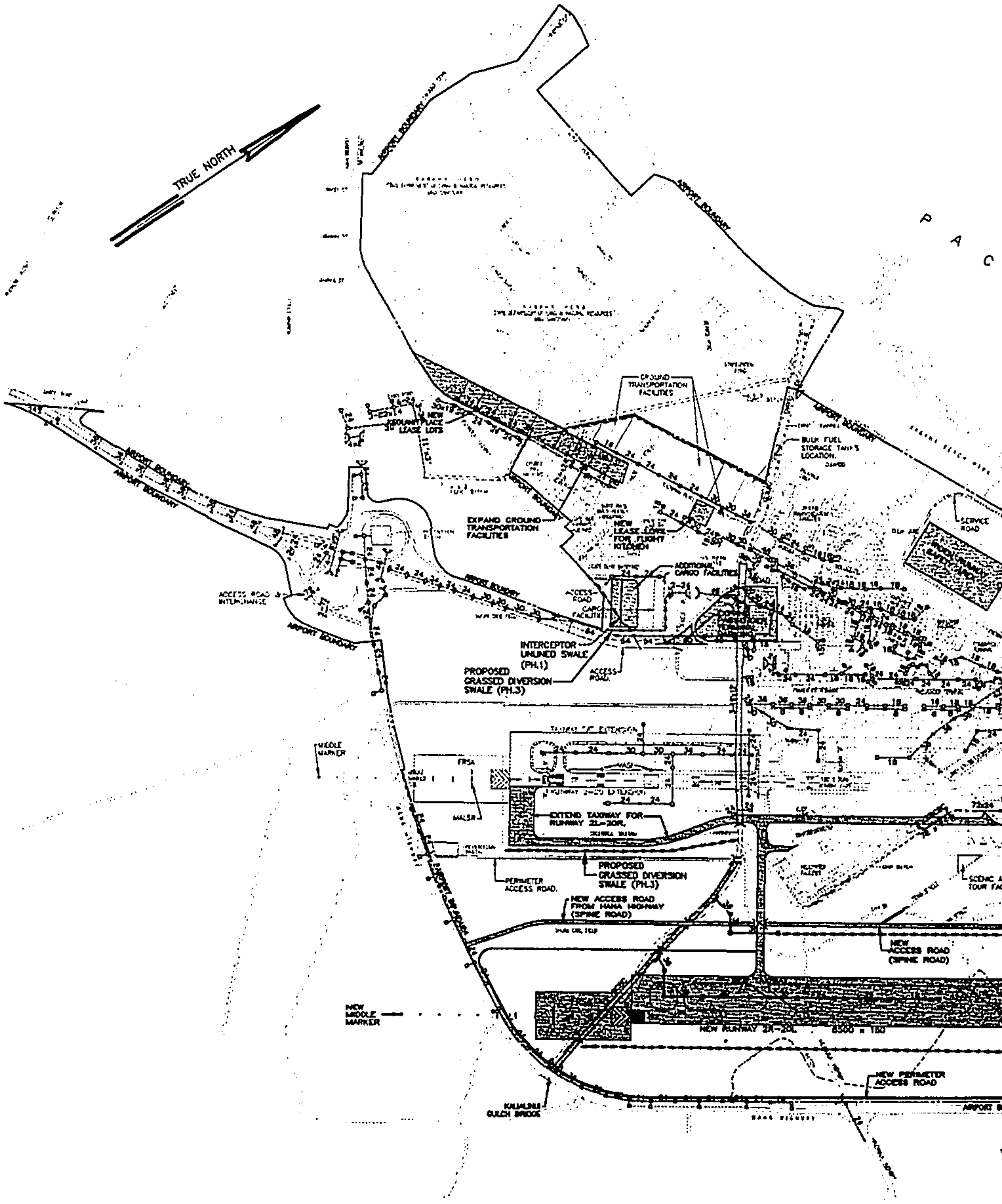


DRAINAGE PLAN

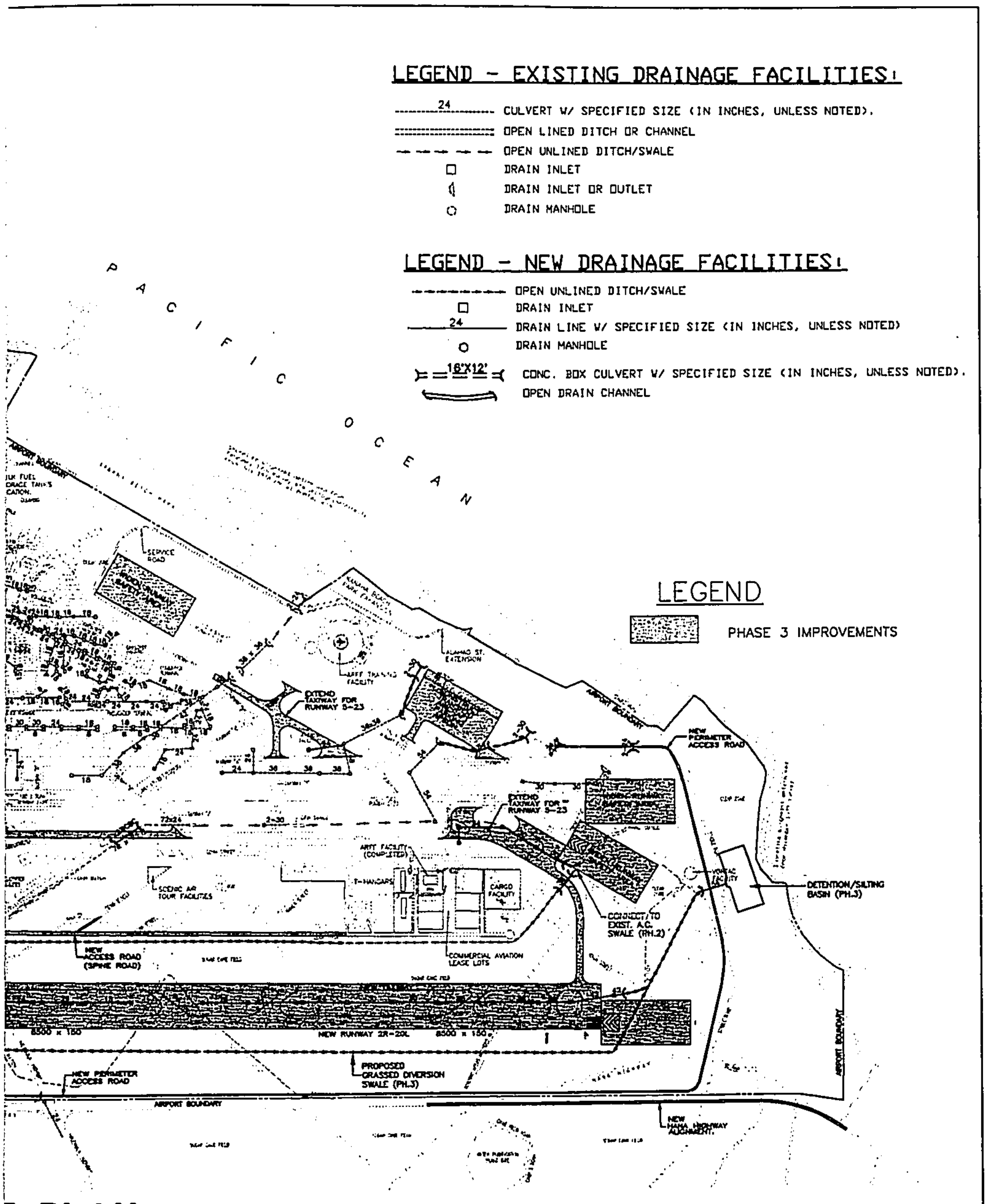


E PLAN

FIGURE D-3



DRAINAGE PLAN



E PLAN

FIGURE D-4

REGULATORY FLOODING

Airport lands along the coast and along the fringes of Kalialinui Gulch are subject to flooding as established by the Flood Insurance Rate Map for Maui County, September 6, 1989, as shown on Figure F-1. Facilities such as the ARFF Training Site, bulk fuel storage tanks, portion of the Ground Transportation Facilities Expansion and Cargo Facilities will be within the flood zones and therefore will be subject to development standards for Flood Hazard Areas as required by Chapter 19.62 of the Maui County Code. It should be noted that flooding along the fringes of Kalialinui Gulch were established before the completion of the gulch's concrete channel and installation of box culverts. Therefore, it is recommended that the Airports Division request the Army Corps of Engineers for the re-evaluation of the regulatory flood zone in this area.

All other airport lands are within Zone "C" where potential flooding is minimal.

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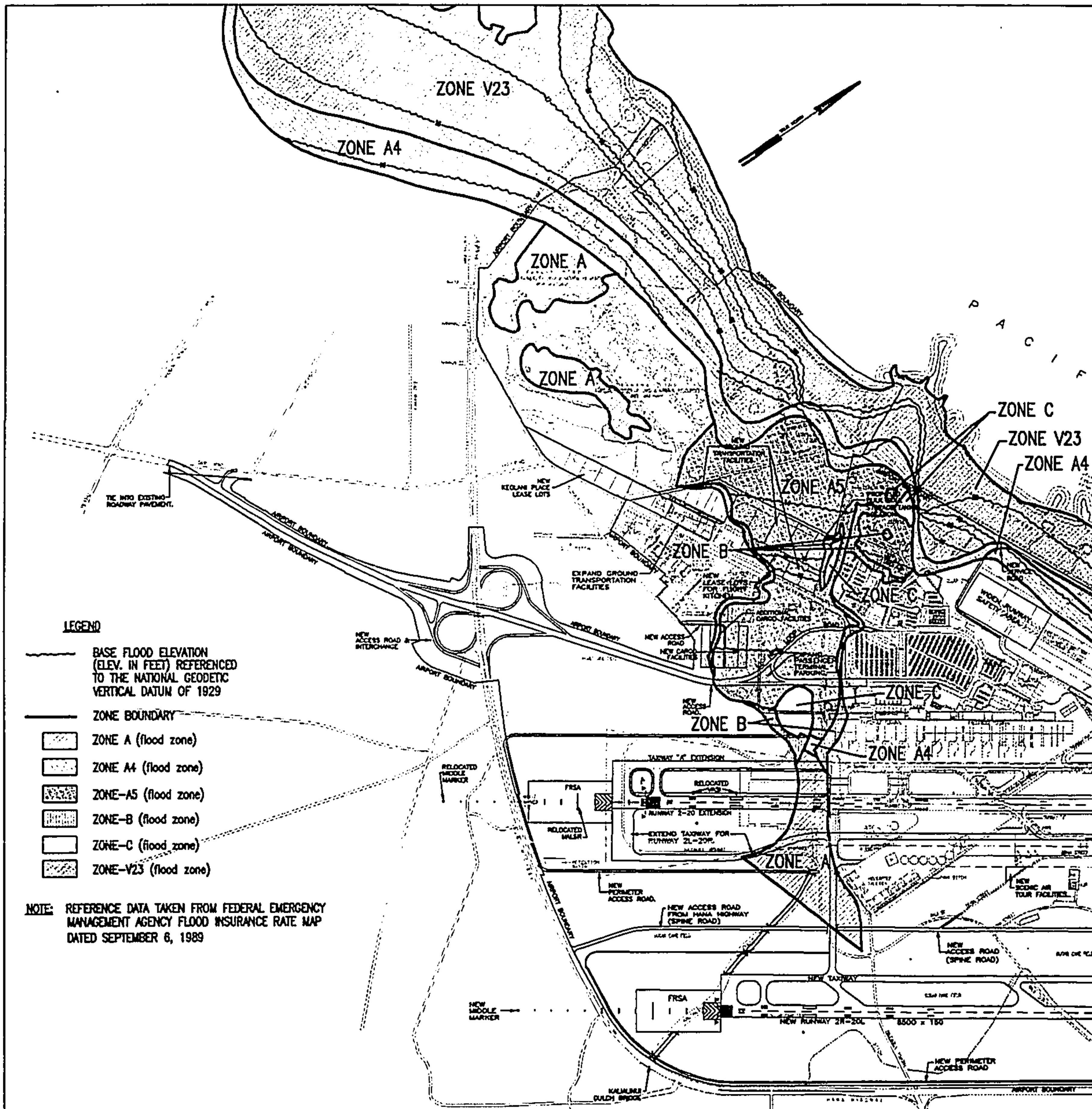
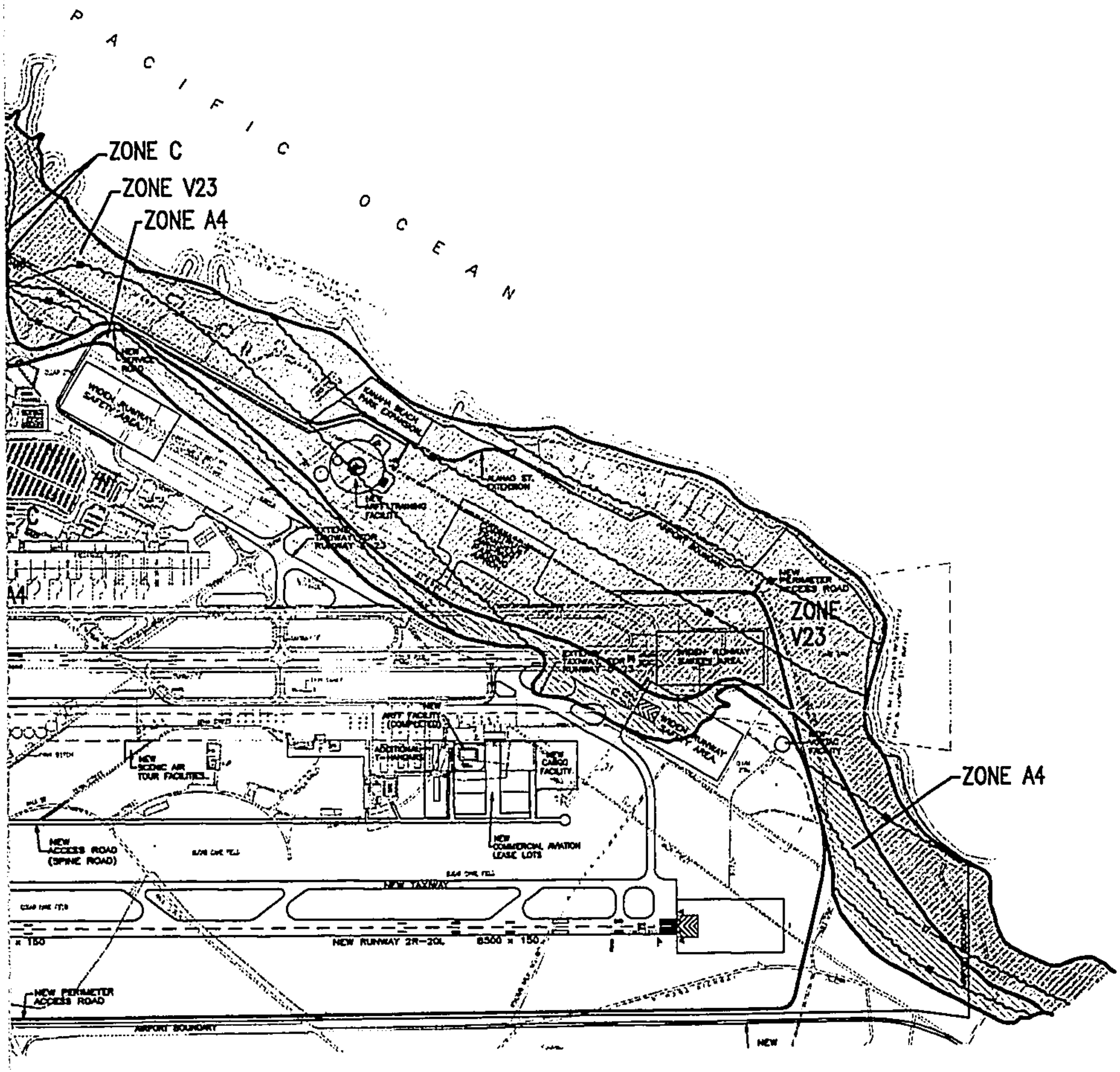


FLOOD HAZARD BOUNDARY



OUNDARY MAP

FIGURE F-1

APPENDIX M

2010 TRAFFIC STUDY

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KAHULUI AIRPORT IMPROVEMENTS

TRAFFIC IMPACT STUDY

Prepared for

Edward K. Noda and Associates

by

WSA

June, 1995

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CHAPTER

ILLUSTRATIONS

TABULATIONS

Table

EXECUTIVE SUMMARY

The State of Hawaii Department of Transportation (State DOT) plans to construct a number of modifications at Kahului Airport in order to improve operations at the facility. These proposed modifications, collectively referred to herein as the Preferred Plan, are intended to serve as the Master Plan of Improvements for Kahului Airport through Year 2010.

This report assesses the traffic-related impacts of the Preferred Plan of airport modifications, and identifies where mitigation actions are appropriate to address potential impacts. The report also includes an assessment of the following:

- Existing (1994) conditions;
- A No Action alternative;
- Alternative modification plans; and
- Possible variations to the Preferred Plan:
  - Scheduled international flight service; and
  - Connection of Alahao Street and Old Stable Road as a public road.

PROJECT DESCRIPTION AND ALTERNATIVES

The Preferred Plan includes a number of modifications that would likely affect ground traffic demands at the Airport, or change traffic circulation near the Airport. Those elements most directly affecting ground traffic are:

- Extension of the primary runway that could facilitate additional direct overseas flights;
- Relocation of helicopter facilities;
- Construction of an Airport Access Road with an interchange at Hana Highway;
- Closure of Haleakala Highway through the Airport;
- Construction of a new Spine Road to serve the East Ramp area; and
- Relocation of Pulehu and Hansen Road connections with Hana Highway.

These modifications are planned for completion by 2010. With the Preferred Plan, the potential maximum growth forecast for Kahului Airport is 7,988,000 interisland and overseas air passengers in Year 2010.[1] This compares to 5,748,600 air passengers in 1994.

Without these modifications (No Action Alternative), 7,726,000 air passengers are estimated to use Kahului Airport in 2010, or 3.4 percent fewer than with the Preferred Plan.[2] The difference is attributed to the increased attractiveness of direct overseas flights to more Mainland cities with the longer runway included in the Preferred Plan.

[1] *Socio-Economic Impact Assessment to proposed Kahului Airport Master Plan Improvements, Draft Report*, prepared for E.K. Noda & Associates, Inc., by Community Resources, Inc., November 1994.

[2] Ibid.

The key features, relative to ground traffic impacts, of the Preferred Plan, the alternative plans, and the variations to the Preferred Plan are summarized in Table 1.

METHODOLOGY

The Maui Long-Range Highway Plan[3] identifies the estimated islandwide traffic demands and planned roadway improvements through the Year 2010. The 2010 forecasts and roadway plans reflect the following levels of anticipated growth, relative to the 1987 base year of the highway plan:

Population	+ 84%
Employment	+ 97%
Transient Accommodations	+111%

With these increases in population and economic activity, islandwide traffic demands are estimated to increase by 119 percent between 1987 and 2010.

These estimated levels of regional traffic growth were incorporated into this traffic study for the proposed modifications at Kahului Airport. This airport traffic study also assumes that the roadway projects included in the *Island-Wide Highway Plan* are constructed by Year 2010. The regional traffic forecasts for the Airport area were adjusted to reflect the following:

1. The traffic volumes to/from Kahului Airport were revised to reflect changes in air passenger forecasts, and the relocation of helicopter or general aviation activities away from the Airport.

2. The area traffic volumes were increased to reflect the large non-airport developments planned along Dairy Road, which are not fully reflected in the earlier Island-wide Highway Plan.

3. The area roadway system and capacities were modified to reflect the changes proposed in the airport alternatives and the Dairy Road developments.

The number of airport-related trips were estimated based on the air passenger forecasts and the numbers of based helicopter and general aviation aircraft.

The State DOT and Maui County were updating the Maui island-wide travel forecasts and highway plans to Year 2020. However, the 2020 forecasts and plans were not available at the time of this traffic study for Kahului Airport.

[3] *Maui Long-Range Highway Planning Study, Island-Wide Final Report*, prepared for State DOT, County of Maui Department of Public Works, and County of Maui Department of Planning by Austin Tsutsumi & Associates, Inc., May 1994.

Table 2

ESTIMATED VEHICLE TRIPS TO/FROM AIRPORT
Kahului Airport Improvements - Traffic Impact Study

Scenario/Location	Design Day		Morning Peak Hour		Afternoon Peak Hour	
	Vehicle Trips	Percent Change[1]	Vehicle Trips	Percent Change[1]	Vehicle Trips	Percent Change[1]
Preferred Plan	27,300	—	1,793	—	1,989	—
No Action Alternative	27,830	+1.9%	1,878	+4.7%	2,138	+7.5%
Alternative #1	27,400	+0.5%	1,838	+2.5%	2,079	+4.5%
Alternative #2	26,640	-2.4%	1,751	-2.3%	1,942	-2.4%
Alternative #3	28,920	+5.9%	1,948	+8.6%	2,215	+11.4%
Alternative #4[2]	28,920	+5.9%	1,948	+8.6%	2,215	+11.4%
Alternative #5[2]	28,710	+5.2%	1,934	+7.9%	2,200	+10.6%
Alternative #6	26,640	-2.4%	1,751	-2.3%	1,942	-2.4%
Preferred Plan with Intl. Service	29,130	+6.7%	1,999	+11.5%	2,123	+6.7%

(1) Percent change as compared to vehicle trips with Preferred Plan.
(2) Helicopter facility is relocated south of Hana Highway, but vehicle trips are included in totals for Kahului Airport.

Wilbur Smith Associates; June 1995

T-34 4/95

Table 1

SUMMARY DESCRIPTION OF ALTERNATIVES FOR YEAR 2010 TRAFFIC ANALYSIS
Kahului Airport Improvements - Traffic Impact Study

Analysis Scenarios	Runway Length (feet) Main/Parallel	Helicopter Location	General Aviation Location	Access Road to East Ramp	Annual Number of Air Passengers[1]
No Action	7,000/None	East Ramp	East Ramp	Haleakala Hwy	7,726,000
Preferred Plan	9,600/8,500	Remote Site	East Ramp	New Spine Rd.	7,986,000
Alternative Plans					
#1	7,000/None	East Ramp	Remote Site	Haleakala Hwy.	7,726,000
#2	8,500/3,500	Remote Site	East Ramp	Kala Rd. Area	7,792,000
#3	9,500/8500	East Ramp	East Ramp	New Spine Rd.	7,986,000
#4	10,500/10,500	South of Hana Hwy.	East Ramp	New Spine Rd	8,053,000
#5	9,500/8,500	South of Hana Hwy.	East Ramp	New Spine Rd	7,988,000
#6	8,500/7,000	Remote Site	East Ramp	Old Stable Rd.	7,792,000
Modifications to Preferred Plan					
Scheduled Intl. Service	9,600/8,500	Remote Site	East Ramp	New Spine Rd	8,555,000
Alahao St.-Old Stable Rd. Connection	9,600/8,500	Remote Site	East Ramp	New Spine Rd.	7,986,000

Source: *Socio-Economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements Draft Report*, prepared for E.K. Noda & Associates, by Community Resources, Inc., November 1994.

Wilbur Smith Associates; April 1995

T-33/4/95

TRAFFIC GENERATION AT KAHULUI AIRPORT

The estimated numbers of "design day" vehicle trips to or from Kahului Airport in Year 2010 are summarized in Table 2. The "design day" is an average day on the busiest month of the year, or about 5 percent more trips than for the year-round average day.

The Preferred Plan would generate an estimated 27,300 vehicle trips on the 2010 design day, with most of these trips to/from activities in the West Ramp (air passenger terminal) area. About 7 percent of these vehicle trips would occur during the morning and afternoon commute peak hours.

The No Action Alternative would generate 27,830 design day vehicle trips at Kahului Airport, or 1.9 percent more than the Preferred Plan. The No Action Alternative retains helicopter operations at the Airport, which would more than offset the lower number of air passenger-related trips without the runway extension. However, the helicopter-related traffic would be relocated to another area of the island with the Preferred Plan, and would not represent a reduction in island-wide trips.

Design day trip generation with the six alternative "build" plans would range from 2.4 percent lower to 5.9 higher than the Preferred Plan. These differences reflect the combined effects of differences in air passenger activity (West Ramp) and the facilities retained within the East Ramp area of the Airport.

AIRPORT AREA TRAFFIC CONDITIONS

Design day traffic conditions were analyzed for the estimated commute peak hour volumes at the key intersections near Kahului Airport.

Conditions With Preferred Plan

The roadway system proposed with the Preferred Plan, coupled with the roadway projects included in the *Island-Wide Long-Range Highway Plan*, would accommodate the forecast 2010 traffic increases at most of the key intersections in the Airport area. Locations where traffic problems would be likely to occur include the following:

1. On the Spine Road and Hansen Road approaches at their common intersection with Hana Highway, where STOP sign controls would result in long delays to traffic on these approaches.

2. At the planned Dairy Road intersection with the Airport Access Road, where forecast peak hour volumes would exceed capacity by 7 to 11 percent.

3. Within the Airport Access Road interchange, where the left-turn from northbound Airport Access Road onto the on-ramp to westbound Hana Highway would experience long delays due to opposing southbound traffic flow.

4. Also at the Airport Access Road interchange, where the estimated traffic volumes would result in congestion and delays at the merge locations of the eastbound on-ramp with the Hana Highway through lanes.

5. At the intersection of Puunene Avenue with Kuihelani Highway/Airport Access Road, where the estimated peak volumes exceed capacity by 7 to 21 percent or more, with or without the Preferred Plan. This problem would occur with or without the Preferred Plan modifications.

Proposed Mitigation for Preferred Plan

To mitigate conditions at these anticipated problem locations, the following roadway modifications are proposed:

1. Install traffic signal controls at the Spine Road/Hansen Road intersection with Hana Highway.

2. At the Dairy Road-Airport Access Road intersection, add a second (double) left-turn lane on northbound Airport Access Road and add a second (double) right-turn lane on Dairy Road.

3. Install a traffic signal on Airport Access Road at the on-ramp to westbound Hana Highway.

4. Construct an eastbound auxiliary lane along Hana Highway to provide additional distance for on-ramp traffic to merge into through lanes.

5. Add an additional northbound and an additional southbound through lane to Airport Access Road/Kuihelani Highway from Dairy Road to a short distance south of Puunene Avenue. Add a second left-turn lane to the eastbound approach of Puunene Avenue.

No Action Alternative

The No Action Alternative would result in generally worse traffic conditions in the Airport area than with the Preferred Plan, since the No Action Alternative would result in similar levels of traffic increases without many of the roadway improvements of the Preferred Plan. Comparisons of conditions at the key intersections include:

- Even with the planned widening of Dairy Road to five lanes, its continued use as the main access route to the Airport West Ramp area would result in estimated traffic volumes in excess of capacity at the Hana Highway and Haleakala Highway intersections.

- The Dairy Road intersection with Puunene Avenue would experience congested conditions similar to those of the Preferred Plan.

- Traffic on the Pulehu Road approach to Hana Highway would experience long traffic delays.

- Morning traffic volumes at the Haleakala Highway intersections (Pukalani Junction) with Hana Highway would exceed intersection capacity.

Installation of a traffic signal could be necessary at the Pulehu Road intersection, while further roadway widening could be required at the other intersections.

Other Alternatives (#s 1 through 6)

Alternatives #1 through 6 would result in similar traffic conditions and mitigation needs as the Preferred Plan. Most of the alternatives would require installation of a traffic signal along Hana Highway for the different locations of the access road to the East Ramp area, or at the heliport access road intersection with Haleakala Highway (Alternatives #4 and #5).

Preferred Plan with Scheduled International Service

The additional traffic would add to the congestion at the problem locations identified for the Preferred Plan, particularly to those locations along the Airport Access Road route. However, the increases should not be sufficient to introduce congested conditions at additional locations in the Airport area. The mitigation actions identified for the Preferred Plan should be sufficient to accommodate the traffic increases.

Preferred Plan with Alahao Street-Old Stable Road Connection

Alahao Street would be extended to Old Stable Road, and Old Stable Road would be upgraded to standard two-lane roadway, to permit use of this route by through traffic. The analyses of this potential connection indicate the following:

1. Under normal conditions, the Alahao Street route would require several minutes longer travel time through the area than via Hana Highway.

2. Estimated diversion of traffic to the Alahao Street route would result in traffic increases of 50 to 100 percent along this route.

3. The diversion of traffic to the Alahao Street route would reduce traffic along the parallel section of Hana Highway by 3 to 5 percent.

4. The estimated volumes along Amala Place-Alahao Street-Old Stable Road could be accommodated by a two-lane roadway.

5. The connection would affect traffic conditions at several key intersections:

    i. Conditions would worsen for traffic exiting Old Stable Road at Hana Highway. Traffic signal controls would likely be necessary.

    ii. Conditions would worsen for the Kaahumanu Avenue eastbound left-turn movement crossing of the westbound Hana Highway through traffic. Traffic signal controls would likely be necessary.

    iii. The reduction of traffic turning left from Hobron Street onto Hana Highway would reduce delays for this movement.

EFFECT ON PLANNED BICYCLE FACILITIES

The State DOT bicycle plans include future designations of the section of Hana Highway in the Airport area as a bicycle route, due to the availability of wide paved roadway shoulder areas for use by bicyclists. With the Preferred Plan, the development of the Airport interchange would provide six ramp entry or exit connections to Hana Highway. This would result in traffic crossing these shoulder lanes to enter or exit these ramps, thus increasing safety concerns and potential inconvenience to bicyclists.

Further assessment of the potential vehicle-bicycle conflicts should be undertaken during the design process, and appropriate mitigation actions taken.

OVERVIEW OF SIGNIFICANT IMPACTS

For the purposes of this study, Wilbur Smith Associates identified the following conditions as representing significant traffic impacts:

1. Adverse, if the project worsens conditions at a location to level-of-service (LOS) E or F, from a condition of LOS D or better without the project.

2. Adverse, if the project worsens conditions at a location to LOS F, from LOS E without the project.

3. Adverse, if the project increases the traffic to more than 95 percent of the estimated capacity of a signalized intersection, with the project contributing at least a 2 percent increase to ratio of the volume to the capacity.

4. Beneficial, if the project improvements or traffic changes result in changed conditions equal and opposite to the "adverse" impact criteria in Items 1 through 3.

The levels-of-service for the key intersections in the vicinity of Kahului Airport are summarized in Table 3 and 4 for the morning and afternoon commute peak hours, respectively. The levels-of-service are presented for all relevant intersections for the Existing, No Action, and Preferred Plan scenarios, and for the intersections most directly affected by the other alternative airport plans. The indicated service levels are without mitigation actions. An asterisk (*) denotes those intersections where mitigation actions are proposed as a result of Airport impacts. The following identify the impact locations and mitigation status.

Significant Adverse Impacts, Mitigated to Acceptable Levels

- Intersection of Airport Access Road and Dairy Road
    - Preferred Plan
    - All Alternative Build Plans

Table 3
(Page 2 of 2)
MORNING PEAK HOUR LEVELS-OF-SERVICE AT KEY INTERSECTIONS WITHOUT MITIGATION
Kahului Airport Improvements - Traffic Impact Study

Intersection		Existing (1994)	— Year 2010 Scenario —									
North-South Street	East-West Street		No Action	Preferred Plan	Alternative Plan #1	Alternative Plan #2	Alternative Plan #3	Alternative Plan #4	Alternative Plan #5	Alternative Plan #6	P.P. With Intl. Service	P.P. with OSR(1) Connector
Pulehu Rd	Hansen Rd.	B	A	A	–	–	–	–	–	–	A	–
Pulehu Rd (2)	Hana Hwy.	C	F	●	●	●	●	●	●	●	●	●
Hansen Rd (2)	Hana Hwy.	B	A	F*	F*	F*	F*	F*	F*	F*	F*	F*
Haleakala Hwy.	Hana Hwy. (Pukalani Jct.)	E	F	C	F*	D	–	D	D	D	D	C
Old Stable Rd	Hana Hwy	E	E	E	–	–	–	–	–	E	E	F*

* = Action proposed to mitigate impact.
– = Not analyzed; should be similar to conditions with Preferred Plan.
● = Not applicable, no intersection for this scenario

(1) = Preferred Plan with Old Stable Road Connector
(2) = Pulehu Road connection via Hana Highway abandoned and traffic routed via Hansen Road for 2010 scenarios, other than No Action

Levels of Service:
A, B, C = Good
D = Acceptable
E = Frequent delays.
F = Unacceptable long delays.

Wilbur Smith Associates; June 1995

Table 3
(Page 1 of 2)
MORNING PEAK HOUR LEVELS-OF-SERVICE AT KEY INTERSECTIONS WITHOUT MITIGATION
Kahului Airport Improvements - Traffic Impact Study

Intersection		Existing (1994)	— Year 2010 Scenario —									
North-South Street	East-West Street		No Action	Preferred Plan	Alternative Plan #1	Alternative Plan #2	Alternative Plan #3	Alternative Plan #4	Alternative Plan #5	Alternative Plan #6	P.P. With Intl. Service	P.P. with OSR(1) Connector
Hobron St.	Amala Pl.	A	A	A	–	–	–	–	–	–	A	A
Kaahumanu Ave.	Hana Hwy.	F	E	E	–	–	–	–	–	–	E	F*
Hobron St.	Kaahumanu Ave	A	A	A	–	–	–	–	–	–	A	A
Hobron St.	Hana Hwy.	F	F	F	–	–	–	–	–	–	F	E
Haleakala Hwy.	Hana Hwy. (West Jct.)	F	F	F	–	–	–	–	–	–	F	F
Dairy Rd./ Kaolani Pl.	Haleakala Hwy	D	C	B	–	–	–	–	–	–	B	–
Dairy Rd.	Hana Hwy.	D	E	B	C	–	–	–	–	–	C	B
Kuihelani Hwy./ Airport Access/Dairy Rd.	Puunene Ave.	D	E	E*	F*	–	F*	–	–	–	F*	–
Dairy Rd.	Airport Access Rd.	●	●	D*	D*	–	D*	–	–	–	E*	–
Airport Access Rd.	Hana Hwy. EB On-Ramp	●	●	C	–	–	–	C	–	–	C	–
Airport Access Rd.	Hana Hwy. WB On-Ramp	●	●	B	–	–	–	–	–	–	B	–

Table 4
(Page 2 of 2)
AFTERNOON PEAK HOUR LEVELS-OF-SERVICE AT KEY INTERSECTIONS WITHOUT MITIGATION
Kahului Airport Improvements - Traffic Impact Study

Intersection		Existing (1994)	— Year 2010 Scenario —									
North-South Street	East-West Street		No Action	Preferred Plan	Alternative Plan #1	Alternative Plan #2	Alternative Plan #3	Alternative Plan #4	Alternative Plan #5	Alternative Plan #6	P.P. With Intl. Service	P.P. with OSR(1) Connector
Pulehu Rd	Hansen Rd.	B	A	A	–	–	–	–	–	–	A	–
Pulehu Rd [2]	Hana Hwy.	E	F	●	●	●	●	●	●	●	●	●
Hansen Rd [2]	Hana Hwy	B	A	F*	F*	F*	F*	F*	F*	F*	F*	F*
Haleakala Hwy.	Hana Hwy. (Pukalani Jct.)	C	D	B	C	B	–	B	B	B	B	B
Old Stable Rd	Hana Hwy	E	E	E	–	–	–	–	–	E	E	F*

* = Action proposed to mitigate impact
– = Not analyzed; should be similar to conditions with Preferred Plan.
● = Not applicable, no intersection for this scenario

(1) = Preferred Plan with Old Stable Road Connector
(2) = Pulehu Road connection via Hana Highway abandoned and traffic routed via Hansen Road for 2010 scenarios, other than No Action

Levels of Service.
A, B, C = Good.
D = Acceptable
E = Frequent delays.
F = Unacceptable long delays

Wilbur Smith Associates; June 1995

Table 4
(Page 1 of 2)
AFTERNOON PEAK HOUR LEVELS-OF-SERVICE AT KEY INTERSECTIONS WITHOUT MITIGATION
Kahului Airport Improvements - Traffic Impact Study

Intersection		Existing (1994)	— Year 2010 Scenario —									
North-South Street	East-West Street		No Action	Preferred Plan	Alternative Plan #1	Alternative Plan #2	Alternative Plan #3	Alternative Plan #4	Alternative Plan #5	Alternative Plan #6	P.P. With Intl. Service	P.P. with OSR(1) Connector
Hobron St.	Amala Pl.	A	A	A	–	–	–	–	–	–	A	A
Kaahumanu Ave.	Hana Hwy.	F	E	E	–	–	–	–	–	–	E	E
Hobron St.	Kaahumanu Ave	B	B	B	–	–	–	–	–	–	B	A
Hobron St.	Hana Hwy.	F	F	F	–	–	–	–	–	–	F	F
Haleakala Hwy.	Hana Hwy. (West Jct.)	D	F	F	–	–	–	–	–	–	F	F
Dairy Rd. / Kaoleni Pl.	Haleakala Hwy	F	E	C	–	–	–	–	–	–	C	–
Dairy Rd.	Hana Hwy.	F	F	C	C	–	–	–	–	–	C	C
Kuihelani Hwy / Airport Access/Dairy Rd.	Puunene Ave.	E	F	F*	F*	–	F*	–	–	–	F*	–
Dairy Rd.	Airport Access Rd.	●	●	D*	D*	–	E*	–	–	–	E*	–
Airport Access Rd.	Hana Hwy. EB On-Ramp	●	●	E	–	–	–	E	–	–	E	–
Airport Access Rd.	Hana Hwy WB On-Ramp	●	●	F*	F*	–	–	–	–	–	F*	–

- Airport Access Road Northbound Left-turn onto Westbound On-Ramp to Hana Highway
  - Preferred Plan
  - All Alternative Build Plans
- Intersection of Hana Highway with Hansen/Spine Road
  - Preferred Plan
  - All Alternative Build Plans
- Intersection of Hana and Halcakala Highways (Pukalani Junction)
  - Alternative Plan #1
- Intersection of Hana Highway and Old Stable Road
  - Preferred Plan with Old Stable Road-Alahao Street Connection
- Intersection of Hana Highway and Kaahumanu Avenue
  - Preferred Plan with Old Stable Road-Alahao Street Connection
- Airport Interchange Eastbound On-Ramp at Hana Highway
  - Preferred Plan
  - All Alternative Build Plans

Significant Beneficial Impact

- Intersection of Hana Highway and Dairy Road
  - Preferred Plan
  - All Alternative Build Plans
- Intersection of Dairy Road, Keolani Place, and Halcakala Highway
  - Preferred Plan
  - All Alternative Build Plans
- Hobron Street Left-turn onto Hana Highway
  - Preferred Plan with Old Stable Road-Alahao Street Connection

Significant Adverse Impact, Unresolved Issue

- Westbound Hana Highway Traffic at Entrance to Off-ramp to Airport Access Road. Alternative mitigation actions identified, with evaluation and selection during interchange design process.
- Future Hana Highway bicycle route crossing of entrance and exit ramps at Airport Access Road interchange. Alternative mitigation actions identified, with evaluation and selection during interchange design process.
  - Preferred Plan
  - All Alternative Build Plans.

Insignificant Impact, Mitigated to Acceptable Levels

- Intersection of Kuihelani Highway, Airport Access Road, and Puunene Avenue
  - Preferred Plan
  - All Alternative Build Plans[4]

[4] Alternatives #1 through #6, Preferred Plan with International Service, and Preferred Plan with Old Stable Road-Alahao Street connections.

1. INTRODUCTION

The State of Hawaii Department of Transportation (State DOT) plans to construct a number of modifications at Kahului Airport in order to improve operations at the facility. These modifications have been identified through the Kahului Airport Master Plan Study,[1] which identified and evaluated a series of alternative improvements for the Airport. Collectively, the recommended modifications are referred to herein as the "Preferred Plan" or the "Project", and are intended to serve as the Master Plan of airport improvements through Year 2010.

The purpose of this report is to assess the traffic-related impacts of the Preferred Plan of Airport improvements, and to identify where mitigation actions are appropriate to address the potential impacts. The report also includes an assessment of alternatives to the Preferred Plan, including a No Action alternative.

PROJECT DESCRIPTION

Kahului Airport is located at the eastern edge of the Wailuku-Kahului area on the north shore of the island of Maui (Figure 1-1). The Airport currently has a 7,000-foot long primary runway and a 4,990-foot long secondary runway. The West Ramp area, located west of the primary runway, includes the air passenger terminal facilities, air cargo facilities, and most of the support services for the air carrier operations. The East Ramp area includes the general aviation and helicopter facilities, as well as the airport control tower. Access to the West Ramp is primarily via Keolani Place, while access to the East Ramp is primarily via Haleakala Highway.

The Preferred Plan includes a number of modifications to upgrade and/or expand the present facilities at Kahului Airport. Those that most directly affect ground travel demands and traffic conditions are the following:

1. Modifications that could affect traffic demands:

   - Relocation of the helicopter facilities away from Kahului Airport.

   - Extension of the primary runway and construction of a parallel runway that could facilitate takeoffs for direct overseas flights to additional destinations.

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(1) *Kahului Airport Master Plan*, prepared for State of Hawaii Department of Transportation Airports Division, by Belt Collins & Associates and Aries Consultants, Ltd., June 1993.

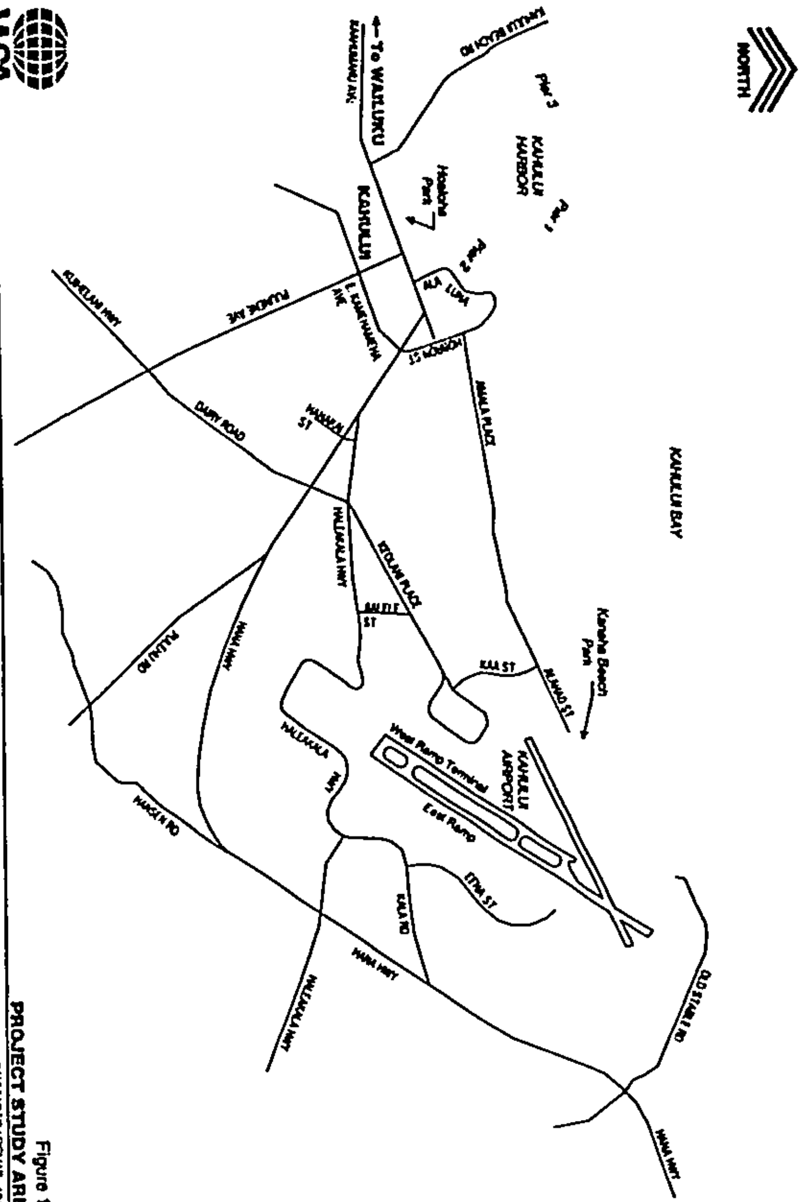

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Figure 1-1
PROJECT STUDY AREA

2. Modifications that would affect the roadway network:

- Construction of a new Airport Access Road with an interchange at Hana Highway to allow airport traffic to bypass Keolani Place/Dairy Road when entering or exiting the Airport West Ramp passenger terminal area.
- Abandonment of Haleakala Highway between Hana Highway (Pukalani junction) and Aalele Street to accommodate the extension of the present main runway.
- Construction of a new Spine Road parallel to the east side of the existing primary runway that would serve the general aviation, air cargo, and airport operations facilities of the East Ramp area.
- Abandonment of the present segments of Hansen and Pulehu Roads between their junction and Hana Highway, and replacement with a single roadway intersecting Hana Highway opposite the Spine Road.
- Abandonment of Kala Road north of Hana Highway.

The Preferred Plan also includes relocation of a segment of Hana Highway eastward to permit construction of a parallel runway. However, the relocated facility would be similar to the existing roadway, with primarily short-term, construction-related impacts to traffic conditions.

STUDY PURPOSE AND SCOPE

This assessment of the ground transportation-related impacts of modifications to Kahului Airport is prepared for input to the Environmental Impact Statement (EIS) for the project. The study encompasses an assessment of:

- Existing conditions.
- Future conditions without the Project (No Action Alternative), also used as a baseline from which to measure Project impacts.
- Future conditions with the Project (Preferred Plan).
- Future conditions with a series of six alternative sets of modifications at the Airport.
- Future conditions with two variations to the Preferred Plan:
  - Operation of regularly scheduled international service at Kahului Airport; and
  - Connection of Alahao Street to Old Stable Road to allow use by through traffic.

The analysis of future conditions is for Year 2010, which represents the time when all of the planned modifications are expected to be completed. The future analyses include the cumulative effect of traffic growth from other sources within this time frame.

The analyses focus on those roadway segments and intersections that would be most directly affected by the Airport modifications. These include the key intersections between the Kahului Harbor and West Spreckelsville areas for the Existing, No Action, Preferred Plan, and International Service scenarios. For other more localized alternative scenarios, the analyses focus on the intersections specifically affected by the modification.

The roadway analyses are for the morning and afternoon commute peak hours on an average day in August. The basis for this analysis period is further discussed in Chapter 2.

In addition to traffic impacts, the study also addresses the affects on public transportation and bicycle travel.

REPORT CONTENT AND ORGANIZATION

This report summarizes the ground traffic volumes and roadway traffic conditions projected for Year 2010 with the Preferred Plan of modifications at Kahului Airport, and with alternatives to the Preferred Plan, including the No Action Alternative. Following this introductory section (Chapter 1), the report is organized into the following chapters.

Chapter 2: Existing Conditions

This chapter presents an overview of the existing roadway system, traffic characteristics and travel conditions in the vicinity of the Airport. The existing conditions are provided to allow a comparison with future usage and conditions. The chapter encompasses:

- Description of the methodology for analyzing traffic conditions for both existing and future scenarios.
- Description of present key roadways, public transportation, and bicycle facilities.
- Description of present ground travel characteristics at the Airport, and relationship of Airport and ground travel volumes.
- Description of traffic volumes and conditions on roadways in the Airport vicinity.

Chapter 3: No Action Alternative

Year 2010 conditions without the airport improvements are presented as a baseline from which to compare the effects of the Preferred Plan. The chapter addresses:

- The methodology used to develop the 2010 forecasts of both airport and non-airport traffic.
- The level of both airport-related and non-airport-related traffic increases forecast to occur even without the Airport modifications.

- The roadway modifications expected to occur both as a result of the island-wide highway improvement plans and from new developments in the Airport vicinity.

- The resultant roadway traffic conditions near the Airport.

Chapter 4: Preferred Plan

Chapter 4 describes Year 2010 traffic conditions with the proposed modifications to the Airport roadway access and airfield facilities. Included in this chapter are the following:

- Description of the proposed on-site and off-site roadway modifications.

- Discussion of the methodology used to forecast changes in ground traffic volumes and of the resultant increases and decreases on area roadways.

- Description of the traffic conditions with the proposed roadway system, and identification of potential adverse project impacts.

- Discussion of actions to mitigate project impacts.

Chapter 5: Alternative Airport Modification Plans

This chapter discusses the potential effects on ground traffic conditions of six alternative sets of airport improvements, as identified in the *Kahului Airport Master Plan*.[2] Chapter 5 includes:

- The estimated ground traffic generated by each of the alternatives.

- An assessment of traffic conditions at those intersections most directly affected by each alternative, as compared to the Preferred Plan.

Chapter 6: Effects of Other Actions

This chapter presents the Year 2010 traffic forecasts, analyses, and findings with each of three variations to the Preferred Plan of airport modifications. The three variations are:

1. Introduction of regularly scheduled direct international flight service to/from Kahului Airport.

2. Connection and upgrading of Alahao Street-Old Stable Road to permit use by through traffic.

3. Construction of the Airport Access Road with an at-grade intersection at Hana Highway, instead of a grade-separated interchange.

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(2) Ibid.

2. EXISTING CONDITIONS

Kahului Airport is located at the eastern end of the Kahului-Wailuku urbanized area. The area surrounding the Airport contains a mixture of land uses which include industrial, commercial, residential, agricultural, and recreational uses, as well as natural features such as beaches and wetlands.

The coastal area between Kahului Airport and the Pacific Ocean includes the Kanaha Pond wetlands, Kanaha Beach Park, and the Spreckelsville residential area. Commercial and industrial areas are located west and northwest of the airport area, including the State's harbor facilities. The area south of Kahului Airport is in agricultural uses.

The network of roadways in the vicinity of the airport serves both local Kahului and regional traffic, with the Hana Highway and Dairy Road functioning as key links in the regional roadway system. An extensive inventory of roadways and traffic information was collected in 1990 for the Airport area. The data was used during the 1991-1992 traffic studies[1] for the Airport as the basis for evaluating existing traffic conditions and for forecasting future traffic demands.

Given the time since the prior Kahului Airport traffic study, a new data collection effort was undertaken by this study to update and supplement the 1990 information. The new data collection effort was used to establish 1994 as the base year for existing conditions concerning roadway capacities, traffic volumes, and traffic characteristics.

This chapter describes the existing ground transportation conditions in the Airport area for 1994, which includes roadway facilities, traffic volumes, traffic operating conditions, and traffic characteristics. In several instances, 1993 data is used and is so noted.

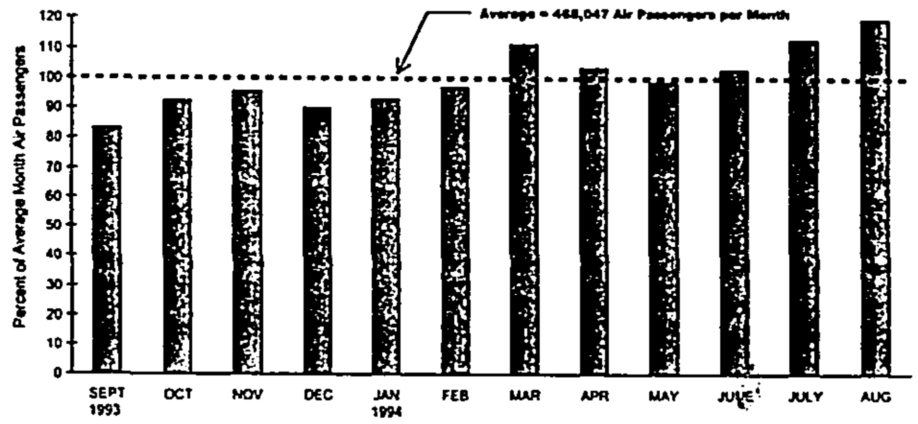
METHODOLOGY AND ASSUMPTIONS

The collection and analyses of ground transportation facilities and usage was structured to provide an overview of current conditions in the Airport area, and to establish a baseline with which to assess future changes in travel conditions in the future.

Basis of Analysis

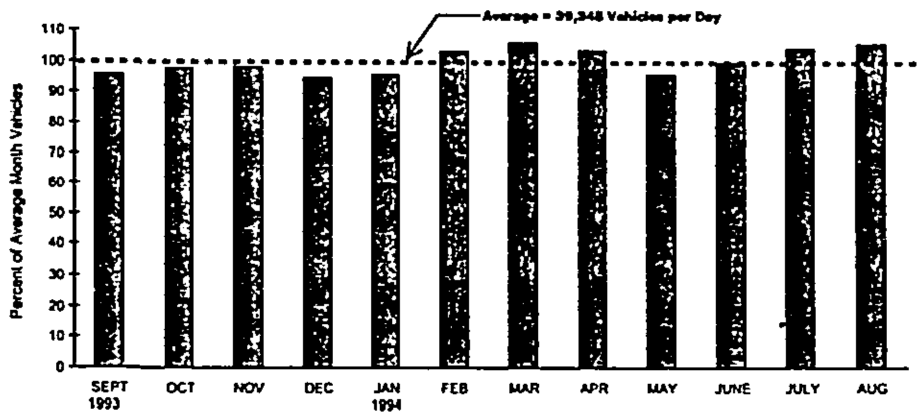
Travel demands for an average day in the highest activity month of the year is typically used by transportation planners as the basis for analyzing airport access conditions and needs. Kahului Airport air passenger counts for 1993-94 (Figure 2-1) indicate that August was the peak month, with other high activity months including March, July, and April.

[1] *Traffic Impact Assessment Report of Kahului Airport*, prepared for the State of Hawaii Department of Transportation Airports Division by Pacific Planning & Engineering, Inc., June 1992.



MONTHLY AIR PASSENGERS AT KAHULUI AIRPORT

SOURCE: State Department of Transportation, Airport Division, September 1993 - August 1994.



AVERAGE WEEKDAY TRAFFIC VOLUMES
ON HONOAPIILANI HIGHWAY AT KAANAPALI ROAD

SOURCE: State Department of Transportation Count Station CC-3, September 1993 - August 1994.

Figure 2-1
COMPARISON OF SEASONAL VARIATIONS IN AIR PASSENGERS AND HIGHWAY TRAFFIC

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There are no year-round roadway traffic counts available for the Kahului Airport area; the only year-round count is made at the State Department of Transportation (State DOT) research station (CC-3) located on Honoapiilani Highway just south of Kaanapali Road. Average monthly counts of weekday traffic at the Kaanapali area station indicate the highest average volumes in the September 1993 to August 1994 period occurred during February to April, with August having the highest volume of the summer months (Figure 2-1). Thus, seasonal variations in local resident vehicle travel, and perhaps the composition of visitors, may have more effect on traffic volumes than the number of visitors present on Maui.

For the purpose of the existing conditions, as well as future forecasts, most traffic volumes have been adjusted to represent the peak volume levels occurring in the August peak month for Airport travel. Where traffic data for other months is used, it is so noted.

The analysis of ground traffic conditions is presented for the morning and afternoon commute peak hours, rather than the early afternoon period when Airport-related traffic typically peaks. As discussed in the section *Peak Hours for Traffic Analysis*, the commute peak hours represent the highest traffic volumes on most major roads in the Airport vicinity. Given the comparative relationships of Airport and total traffic volumes, additional Airport-related traffic would most likely have the greatest effect upon traffic conditions during these heavily-travelled commute hours than in lower-volume mid-day period when Airport-related traffic is highest.

Methodology for Data Collection

Roadway and traffic control information were obtained through field reconnaissance by Wilbur Smith Associates (WSA) engineers during May 1994. The roadway inventory included those items needed to estimate roadway capacities, such as the number and width of lanes, shoulder conditions, types of traffic controls, and traffic signal phasing and timing.

Recent twenty-four hour machine counts of weekday traffic was obtained from State DOT count stations in the Kahului area. The most recent counts were made during June 1993. In addition, the machine counts were obtained for the State DOT station on Keolani Place for 1987 through 1991. Monthly traffic summaries were also obtained for State DOT station CC-3, located on Honoapiilani Highway south of Kaanapali Road, and which provides the only year-round traffic count information on Maui.

Existing commute peak hour traffic volumes at key intersections were developed from manual intersection turning movement counts made by WSA and by The Traffic Management Consultant (TTMC).[2] The WSA counts were made at the intersections of:

- Hana Highway with Dairy Road;
- Hana Highway with Haleakala Highway (east or Pukalani junction);
- Hana Highway with Old Stable Road;
- Puiehu Road with Hansen Road;
- Amala Place with Kaa Street and with Hobron Street; and

(2) Sources: *Traffic Impact Analysis Report (TIAR) for the Proposed Triangle Square Phase II*, and *TIAR for the Proposed Kahului Industrial Park Phase I*, prepared for A&B Properties by The Traffic Management Consultant, March 1994.

- Amala Place with Kaa Street and with Hobron Street; and
- Hobron Street with Kaahumanu Avenue.

The WSA counts were primarily made on May 18 to 19, 1994. Turning movement counts made previously by TTMC were used for the intersections of Dairy Road/Kuihelani Highway with Puunene Avenue, and Haleakala Highway with Dairy Road and with Hana Highway (west junction).

The traffic turning movements were counted and recorded every 15 minutes during the weekday morning and afternoon peak commute traffic periods. The turning movement count data was analyzed to determine the morning and afternoon peak one-hour periods, which were used to evaluate intersection conditions.

The various traffic counts were adjusted to reflect an average weekday in August 1994 (the peak air passenger month). The traffic volumes discussed herein and used for the analysis of existing traffic conditions thus represent airport *design day* conditions, the average weekday in the busiest month (August).

Methodology for Analyzing Traffic Conditions

The Transportation Research Board (TRB), a division of the National Science Foundation, has developed standardized methods for use in evaluating the effectiveness and quality of service for roadways and streets. Different methodologies are available for analyzing traffic signal-controlled intersections and unsignalized intersections, both of which were used in evaluating present and future conditions for this study.

The TRB evaluation methods use a concept known as level-of-service (LOS). This concept describes facility operations on a letter basis from A to F, which signify excellent to unacceptable conditions, respectively. The methods are generally based on a comparison of traffic volumes on a facility to the facility's theoretical capacity. Capacity is estimated based on the facility's physical characteristics (e.g. number of lanes), traffic conditions (e.g. types of vehicles), and type of traffic controls. The methodologies are described in the *1985 Highway Capacity Manual* (1985 HCM).[3]

Traffic Signal-Controlled Intersections - Traffic conditions at traffic signal-controlled intersections were evaluated using the *Operations Analysis* methodology described in the 1985 HCM. Using this method, the level-of-service is based on the average delay time per vehicle passing through the intersection. The delay time, calculated in seconds, is the result of the phasing and timing of the traffic signal as well as the intersection's physical layout and the composition of the traffic. Average delay time and level-of-service are determined for the entire intersection, for each roadway approach, and for each traffic movement or lane group. A description of the characteristics and criteria associated with LOS A through LOS F is provided in Figure 2-2.

The methodology also calculates the ratio of actual or estimated peak hour traffic volumes to the theoretical capacity of the intersection. This indicates the proportion of available capacity being used by traffic volumes and where there is unused capacity available for future traffic increases. This volume-to-capacity ratio (V/C) reflects the physical characteristics of the intersection and the traffic

(3) Highway Capacity Manual, Special Report 209, Transportation Research Board, 1985.

The **OPERATIONS LEVEL METHODOLOGY**, which is described in the Transportation Research Board's Highway Capacity Manual, defines Level of Service (LOS) for signalized intersections in terms of delay. Technically, delay is the amount of time an average vehicle must wait at an intersection before being able to pass through the intersection. For signalized intersections, the relationship between LOS and delay is based on the average stopped delay per vehicle for a fifteen minute period.

LEVEL OF SERVICE 'A' - Delay 0.0 to 5.0 seconds
Describes operations with very low delay, i.e., less than 5 seconds per vehicle. This occurs when signal progression is extremely favorable. Most vehicles arrive during the green phase and are not required to stop at all.
Corresponding V/C ratios usually range from 0.00 to 0.60.

LEVEL OF SERVICE 'B' - Delay 5.1 to 15.0 seconds
Describes operations with delay in the range of 5 to 15 seconds per vehicle generally characterized by good signal progression and/or short cycle lengths. More vehicles are required to stop than for LOS 'A' causing higher levels of average delay.
Corresponding V/C ratios usually range from 0.61 to 0.70.

LEVEL OF SERVICE 'C' - Delay 15.1 to 25.0 seconds
Describes operations with delay in the range of 15 to 25 seconds per vehicle. Occasionally, vehicles may be required to wait more than one red signal phase. The number of vehicles stopping at this level is significant although many still pass through the intersection without stopping.
Corresponding V/C ratios usually range from 0.71 to 0.80.

LEVEL OF SERVICE 'D' - Delay 25.1 to 40.0 seconds
Describes operations with delay in the range of 25 of 40 seconds per vehicle. At LOS 'D', the influence of congestion becomes more noticeable. Many vehicles stop, and the proportion of vehicles not stopping declines. The number of vehicles failing to clear the signal during the first green phase is noticeable.
Corresponding V/C ratios usually range from 0.81 to 0.90.

LEVEL OF SERVICE 'E' - Delay 40.1 to 60.0 seconds
Describes operations with delay in the range of 40 to 60 seconds per vehicle. These high delay values generally indicate poor signal progression, long cycle lengths and high V/C ratios. Vehicles frequently fail to clear the intersection during the first green phase.
Corresponding V/C ratios usually range from 0.91 to 1.00.

LEVEL OF SERVICE 'F' - Delay 60.1 seconds plus
Describes operations with delay in excess of 60 seconds per vehicle. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection.
Corresponding V/C ratios of over 1.00 are usually associated.

SOURCE: Transportation Research Board, "Operations Level Methodology-Signalized Intersections", Highway Capacity Manual Special Report 209, 1985

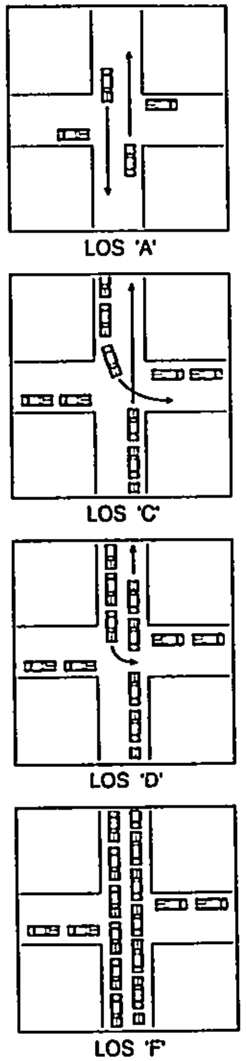

Figure 2-2
LEVEL OF SERVICE DIAGRAM

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characteristics, and is somewhat independent of the level-of-service, which also is affected by the efficiency of the traffic signal phasing/timing.

Unsignalized Intersections - At intersections with STOP sign controls, the level-of-service was calculated using the 1985 HCM procedures for intersections with two-way STOP sign control (STOP or YIELD signs on minor streets). As with signal-controlled intersections, six levels-of-service, A through F, are used to describe traffic conditions.

For three-leg ('T') and four-leg intersections with STOP or YIELD controls on the minor street approaches, the standard procedure provides a comparative measure of delay for those movements which must yield to conflicting movements at the intersection. The movements which must yield include:

- Left-turn out of the side street;
- Right-turn out of the side street; and
- Left-turn into the side street.

Through vehicles on the major streets are not required to yield to other movements at T- and two-way controlled intersections. The general indicator of intersection delay is determined by calculating the one-hour capacity for each key movement, based on conflicting traffic volumes, and then comparing the number of vehicles making that maneuver to the calculated capacity. The unused or "reserve" capacity for the movement is then used to identify a level-of-service for that movement. Unlike analysis of signal-controlled intersections, an overall intersection level-of-service is not calculated but rather a level-of-service is calculated for each lane group.

The level-of-service criteria for unsignalized intersections with minor street STOP controls are defined in Table 2-1A.

Table 2-1A
LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS
Kahului Airport Improvements
Traffic Impact Study

LOS	Reserve Capacity (pcph)	Expected Delay
A	400 or More	Little or no delays
B	300 - 399	Short traffic delays
C	200 - 299	Average traffic delays
D	100 - 199	Long traffic delays
E	-0- - 99	Very long traffic delays
F	Negative Value	Exceeds capacity with extreme traffic delays

LOS = Level-of-Service
pcph = passenger cars per hour
Source: *1985 Highway Capacity Manual*, Chapter 10

Freeway Ramps - The junction of an interchange ramp with a freeway, or other roadway, is generally designed to permit high-speed merging or diverging to take place with a minimum of disruption to the adjacent roadway traffic flow. Traffic conditions at the ramp junctions with Hana Highway were evaluated using the methodology described in the 1985 HCM, which identifies the level of service based on the combined traffic flow of the ramp and the adjacent freeway lane at the merge or diverge point. The level-of-service criteria for the ramp-Hana Highway terminal, and for the freeway (Hana Highway) traffic are summarized in Table 2-1B. LOS F represents unstable operations, with potential for average speeds to drop below 42 mph and possible formation of vehicle queues on an on-ramp, or on the freeway (Hana Highway) in advance of an off-ramp.

Table 2-1B

LEVEL-OF-SERVICE CRITERIA FOR FLOW RATES
AT RAMP-FREEWAY TERMINALS

LOS	Merge Flow Rate(1) (pcph)	Diverge Flow Rate(2) (pcph)	Freeway Flow Rate(3) (pcph)
A	≤ 600	≤ 650	—
B	≤1,000	≤1,050	≤2,000
C	≤1,450	≤1,500	≤2,800
D	≤1,750	≤1,800	≤3,400
E	≤2,000	≤2,000	≤4,000
F	LOS F widely variable since unstable operation.		

LOS = Level-of-Service.
pcph = Passenger cars per hour.
(1) = On-ramp volume plus volume in adjacent lane at merge.
(2) = Volume in outside lane immediately upstream of off-ramp.
(3) = Total directional flow upstream of off-ramp or downstream of on-ramp.
Source: *1985 Highway Capacity Manual*, Chapter 5.

AREA ROADWAY SYSTEM

The major elements of the roadway systems in the vicinity of Kahului Airport serve a mix of regional and local travel. The key roadways relevant to this study are depicted in Figure 2-3.

Key Streets and Highways

At present, Keolani Place is the primary access route into the main airport passenger terminal area (West Ramp), with many of the airport-related uses (car rentals, airport maintenance, air cargo) also reached via this street. The East Ramp area of the airport (general aviation, helicopter facilities, control tower) is accessed primarily via Haleakala Highway, which also provides a connection between the main airport terminal area and the East Ramp area. An overview of these and other key area roadways is provided in the following paragraphs.

Hana Highway - This State highway is the principal east-west facility through the study area. The highway connects the East Maui and Upcountry areas to Kahului-Wailuku, as well as providing a connection from the East and Upcountry Maui areas to the Kihei and West Maui areas. Between Kaahumanu Avenue and Haleakala Highway (Pukalani junction), Hana Highway has two through lanes in each direction with a landscaped median divider. East of Haleakala Highway, Hana Highway narrows to a two-lane roadway. The posted speed limit is 45 miles per hour (mph) west of Dairy Road and 55 mph east of Dairy Road.

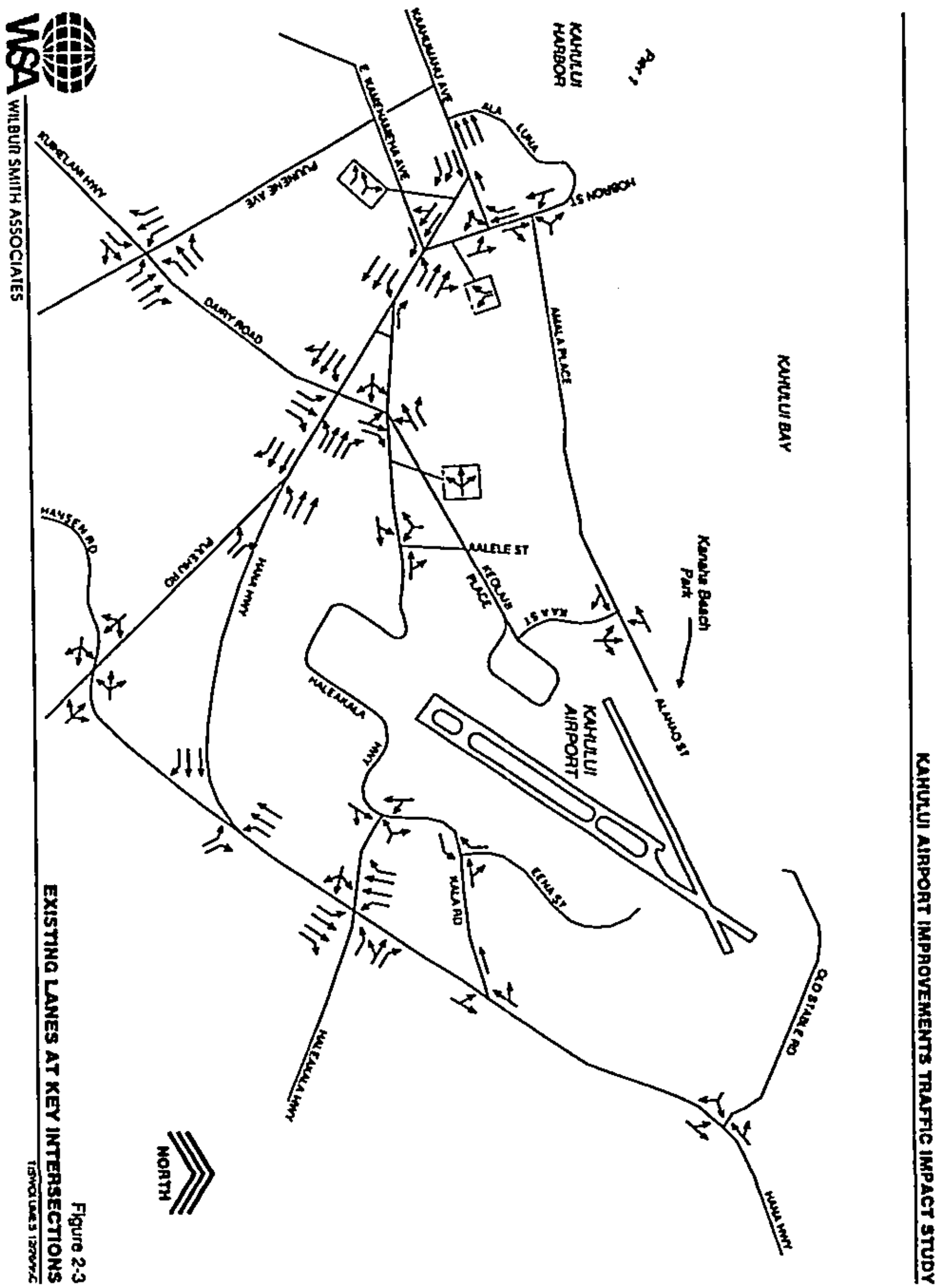

Figure 2-3
EXISTING LANES AT KEY INTERSECTIONS

Haleakala Highway - This State highway links the Upcountry areas of Maui to Hana Highway and to Kahului Airport. North of Hana Highway, Haleakala Highway is a two-lane road with a posted speed limit of 30 mph. South of Hana Highway, it is a three-lane road with the section closest to the intersection providing two northbound lanes and one southbound lane, with a changeover about one-quarter mile from the intersection to two southbound (uphill) lanes and one northbound lane. South of Hana Highway, the speed limit increases to 55 mph.

Keolani Place - This street provides four lanes between Haleakala Highway and the Airport Terminal loop roadway, with a speed limit of 30 mph.

Dairy Road - Dairy Road is a two-lane roadway with a 30 mph speed limit between Haleakala Highway and Puunene Avenue. South of Puuenene Avenue, it becomes Kuihelani Highway, a two-lane roadway with 55 mph speed limit that connects the Wailuku-Kahului area to the south and west Maui coastal areas.

Amala Place/Alahao Street - This two-lane street provides access to the Kanaha Beach Park, as well as the industrial activities and wastewater treatment plant located closer to the harbor end. This street also provides a secondary route into the Airport Terminal and car rental areas via Kaa Street and Koeheke Place. The speed limit is 30 mph.

Hobron Street - Hobron Street is a short two-lane roadway connecting Hana Highway and Kaahumanu Avenue to Amala Place and to Kahului Harbor. A number of harbor-related uses are also located along the street, with resultant large volumes of truck traffic. Access to the Hobron Street area is awkward, with left-turns into the area permitted via the Hana Highway-Kaahumanu Avenue intersection and left-turns out of the area restricted to the Hobron Street intersection with Hana Highway. Right-turns in/out are permitted at both intersections. The speed limit is 20 mph.

Old Stable Road - This privately-owned, unimproved two-way roadway provides access to the West Spreckelsville residential area and to the adjacent beach area. The roadway pavement is approximately 15 feet wide. Old Stable Road is also known as Old Spreckelsville Road.

Puunene Avenue - This State roadway extends from the Kahului harbor area south to the Puunene community. In Puunene, it connects to Mokulele Highway, to provide access between the Kihei-Wailea area and the Kahului area. The roadway provides one lane in each direction for most of its length.

Pulehu Road - This two-lane minor roadway parallels Haleakala Highway between the airport area and the Kula area. It primarily serves the agricultural areas west of Haleakala Highway. Posted speed limit is 45 mph near the Airport.

Hansen Road - Hansen Road connects Puunene to Hana Highway at the south boundary of the Airport. The two-lane roadway is primarily used by traffic between the East Maui/Maui Upcountry areas and the Kihei area.

Key Area Intersections

Most of the intersections in the vicinity of Kahului Airport are presently controlled by STOP signs. Three intersections are currently controlled by traffic signals. These are:

1. **Dairy Road at Hana Highway** - The signal operations include separate left-turn phases and overlapping through/left-turn phases for Hana Highway traffic, primarily to accommodate the large volume of traffic turning left from westbound Hana Highway. Dairy Road traffic operates on a single phase.

2. **Dairy Road at Puunene Avenue** - Both the Puunene Avenue and Dairy Road/Kuihelani Highway approaches are provided separate, protected left-turn phases.

3. **Hana Highway at Haleakala Highway** - Hana Highway traffic is provided with protected left-turn phases, as well as overlapping left-turn/through phases. Each approach on Haleakala Highway is provided with a separate signal phases.

A traffic signal is planned for installation at the intersection of Haleakala Highway with Keolani Place/Dairy Road. This intersection currently provides free flow for the westbound approach of Halekala Highway, with the other three approaches controlled by STOP signs.

The lane configurations for key study area intersections are depicted in Figure 2-3.

PUBLIC TRANSPORTATION

Maui Economic Opportunity, Inc. (MEO) provides the public transit service in the Wailuku-Kahului area. The MEO provides free transit service, with patronage primarily by low income or senior citizen residents who do not have access to or are unable to operate an automobile. It primarily serves non-work trips.

The MEO operates a Wailuku-Kahului Public Shuttle fixed-route service, as well as providing prearranged service upon request. Four bus trips per day, Monday through Saturday, are scheduled along the Shuttle route, with service frequency of about two hours between buses. The Shuttle stop closest to the Airport is the Kmart on Dairy Road at Hana Highway. MEO does provide prearranged trips to the Airport. These Airport trips are primarily to drop-off or pick-up senior citizens making group tours.

A broad range of private operators provide public transportation services to and from Kahului Airport. Most of these operations focus on service between the Airport and the major visitor lodging concentrations in the Lahaina/Kaanapali/Kapalua area and in the Kihei/Wailea area. These privately-operated services include:

- The special Airporter and Speedshuttle services to/from the Airport;
- A number of charter/tour bus operators that schedule buses to pick-up/drop-off tour groups, either to/from hotels, or for day tours; and

- Several limousine and taxi operators.

In addition, rental car agencies provide shuttle bus service between the Terminal and their pick-up/drop-off facilities.

BICYCLE FACILITIES

The bicycle lanes along the segment of East Kamehameha Street between Hana Highway and Puunene Street are the only existing bicycle facilities listed for the Airport area in the State DOT bicycle master plan.[4] The State's master plan includes a number of future bikeways for the area, which include:

- Designation of Hana Highway as a bike route;
- Designation of Haleahala Highway, south of Hana Highway, as a bike route;
- Designation of Keolani Place, Dairy Road, and Kuihelani Highway as a bike route; and
- Development of a continuous separate bike path facility along the ocean side of Amala Place, Alahao Street, and Old Stable Road, including a connection across the Airport between Alahao Street and Old Stable Road.

The "bike route" designation indicates a roadway with a widened curb lane or a paved shoulder available for bicycle use.

The Northshore Greenway bicycle plan,[5] prepared for Maui County, addresses the bicycle facility along the Amala Place, Alahao Street, and Old Stable Road. The Northshore Greenway plan differs from the State DOT plan in that it proposes the construction of a 4- to 6-foot-wide bike lane along each side of Amala Place, Alahao Street and Old Stable Road, rather than building a parallel bike path. The Northshore Greenway plan envisions the use of the existing Airport perimeter roadway, not open to public motor vehicular traffic, as a bike path connecting the Alahao Street and Old Stable Road segments.

AIRPORT TRAVEL CHARACTERISTICS

Ground traffic volumes and characteristics are determined by a combination of factors, which include:

(4) *Bike Plan Hawaii*, prepared for the State Department of Transportation, Highway Division, by R.M. Towill Corporation, April 1994.

(5) *Northshore Greenway Bicycle Component Master Plan*, Draft, prepared for County of Maui by Michael T. Munekiyo Consulting, Inc., May 1994.

- The distribution of aircraft operations throughout the day (and week);
- The type (passenger capacities) of aircraft;
- Passenger ground travel characteristics; and
- Employee travel patterns.

The following sections discuss these factors, based on available Kahului Airport information, and the resultant ground traffic characteristics. No air passenger or employee travel survey data was available for use in this study.

Aircraft Operations

In 1993, Kahului Airport accommodated approximately 172,000 aircraft operations, both take-offs and landings of air carrier, air taxi, helicopter, and other general aviation as well as military flights. Although air carriers account for only about 30 percent of air operations, these flights are responsible for the majority of ground traffic, both due to the large number of passengers on each flight and the numbers of ground employees and services needed to support the air carrier operations. The air carrier and air taxi operations accommodated approximately 5.4 million air passengers in 1993.

Air Carrier and Air Taxi Aircraft Characteristics - The small jet aircraft (B737 and DC9) used by the interisland airlines represent the majority of both the air carrier operations and the available seat capacity at Kahului Airport. For 1993, as summarized in Table 2-2, these aircraft accounted for 74.2 percent of air carrier operations and 73.5 percent of air passengers. Operations averaged about 130 flights per day.

The wide body jet aircraft (DC10 and L1011), whether on direct overseas flights or a continuation flight through Honolulu, contributed 9.3 percent of 1993 operations, or about 16 flights per day. With their much larger capacity, these aircraft served about 23.8 percent of the air passengers in 1993.

Weekly and Daily Patterns - The number of air carrier operations vary very little between the days of the week. Weekday activity is highest on Mondays, with 144 operations, and lowest on Thursdays and Friday, each with 135 operations, based on Kahului Airport records for May 1994. Tuesdays and Wednesdays each averaged 141 operations. Saturday and Sunday operation levels are similar to the highest weekday (Monday).

Air carrier operations do vary substantially between the various periods of the day, as does the available passenger capacity of these flights. Table 2-3 summarizes the hourly number of air carrier operations at Kahului Airport between 6:00 AM and 10:00 PM, as recorded in May 1994.

The hourly air carrier operations are highest during the early to mid-afternoon period, with 10 to 12 operations per hour. However, due to the "shuttle" nature of the interisland carriers, the hourly operations are only slightly lower for the other hours of the business day, with eight or more operations occurring each hour from 8:00 AM through 6:00 PM.

The estimated seat capacity exhibits a slightly more pronounced peak, relative to hourly operations. This occurs during those hours in which a wide-body aircraft arrives or leaves, in combination with a high number of interisland carrier flights. The wide-body aircraft flights tend to occur in the mid-

Table 2-2

1993 AIR CARRIER OPERATIONS AT KAHULUI AIRPORT
Kahului Airport Improvements - Traffic Impact Study

Aircraft Type	Average Seats per Aircraft	Estimated Average Passengers	Total Operations		Air Passengers	
			Number	% of Total	Number	% of Total
Wide Body Jet						
▸ DC10	293	220	3,978	6.1%		
▸ L1011	302	226	1,630	2.6%		
▸ B757	226	205	200	0.3%		
▸ DC8	176	134	42	0.1%		
		Subtotal	6,050	9.3%	1,276200	23.8%
Small Jet						
▸ B737	128	79	29,884	45.9%		
▸ DC9	139	86	18,370	28.3%		
		Subtotal	48,254	74.2%	3,936,600	73.5%
Propeller-Driven Air Taxi						
▸ DHC6	18	12	9,844	15.1%		
▸ DHC7	48	31	894	1.4%		
		Subtotal	10,738	16.5%	145,200	2.7%
		TOTAL	65,042	100.0%	5,358,000	100.0%

Source: Edward K. Noda and Associates, Inc., and Wilbur Smith Associates.

Wilbur Smith Associates; March 1995

T-01/474

Table 2-3

AIR CARRIER OPERATIONS BY HOUR OF THE DAY
Kahului Airport Improvements - Traffic Impact Study

Hour of Day	Aircraft Operations		Passenger Capacity	
	Number[1]	% of Total	Number [2]	% of Total
5 - 6 AM	2	1.4%	280	1.3%
6 - 7	6	4.2	700	3.3
7 - 8	7	4.9	980	4.6
8 - 9	10	7.0	1,460	6.8
9 -10	9	6.3	1,130	5.3
10 -11	11	7.7	1,830	8.5
11 -12	9	6.3	1,170	5.4
12 - 1 PM	8	5.6	1,340	6.3
1 - 2	12	8.4	1,620	7.6
2 - 3	10	7.0	1,920	9.0
3 - 4	12	8.4	1,280	6.0
4 - 5	9	6.3	1,600	7.5
5 - 6	10	7.0	1,520	7.1
6 - 7	7	4.9	1,450	6.8
7 - 8	8	5.6	1,710	8.0
8 - 9	8	5.6	1,000	4.6
9 -10	5	3.4	410	1.9
Total	143	100.0%	21,400	100.0%

Source:

(1) Aircraft operations records for May 1-19, 1994
(2) Edward K Noda and Associates, Inc.

Wilbur Smith Associates; April 1994

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morning to mid-afternoon period, and in the early evening. Typically there are no more than one wide-body aircraft operation in any one hour period due to the low number of such flights. The distribution of these flights during the day results in a peak of nine percent of capacity occurring in the highest one hour period (2:00 to 3:00 PM).

Daily Patterns in Airport Ground Traffic

The majority of Airport ground traffic is destined to the West Ramp air passenger terminal and the airport-related activities located along Keolani Place. Most of this traffic uses Keolani Place for travel to/from the West Ramp area, although a very small number of vehicles use the Amala Place-Kaa Street route into the area. The much smaller volume of traffic to/from the East Ramp primarily uses Haleakala Highway.

Airport Terminal Traffic - The hourly variations in traffic volumes along Keolani Place is depicted in Figure 2-4, from the early morning until early evening. The State DOT count, made in June 1993, was located just south of the Airport terminal roadway loop. The traffic on this segment is primarily Airport-related trips, with a very small volume of through traffic to the Kanaha Beach Park. The beach-related traffic represents about 5 percent or less of the traffic through the terminal area roadways.

The highest one-hour volume of traffic on Keolani Place occurred from 2:00 to 3:00 PM, with a two-way total of 1,371 vehicles. This peak hour primarily reflects the large number of vehicles picking up and dropping off air passengers for the afternoon flights. It amounts to 9.27 percent of the 24-hour traffic on Keolani Place.

Traffic volumes during the normal morning and afternoon commute peak hours are much lower along Keolani Place, each amounting to about 70 percent of the early afternoon "Airport" peak hour. These two commute peak hours mark the beginning and ending of a high plateau of hourly volumes throughout the daytime hours. Although a large number of workers are employed at the Airport, they encompass a large variety of employers and shift hours which likely results in the absence of a pronounced commute traffic peak hour along Keolani Place.

Peak Hours for Traffic Analyses - For this study, the analyses of roadway traffic conditions is based on traffic volumes during the morning and afternoon commute peak hours. Although the highest Airport traffic volumes occur in the early afternoon, the non-Airport travel during the "Airport" peak hour is substantially less than in the commute peak hours and results in lower total traffic volumes on most roadways within the study area.

Table 2-4 provides a comparison of Airport and commute peak hour traffic volumes, with the Hana Highway intersection with Dairy Road used as the example of a major regional roadway near the Airport. The assessment indicates the comparatively low level of midday traffic volumes on regional roadways relative to commute peak hours, and the degree to which the higher midday Airport traffic volumes are more than offset by the regional commute volumes, even at an intersection near the Airport. Kahului Airport contributes between 9 and 16 percent of the total traffic volume passing through the Hana Highway-Dairy Road intersection during these peak hours.

Table 2-4

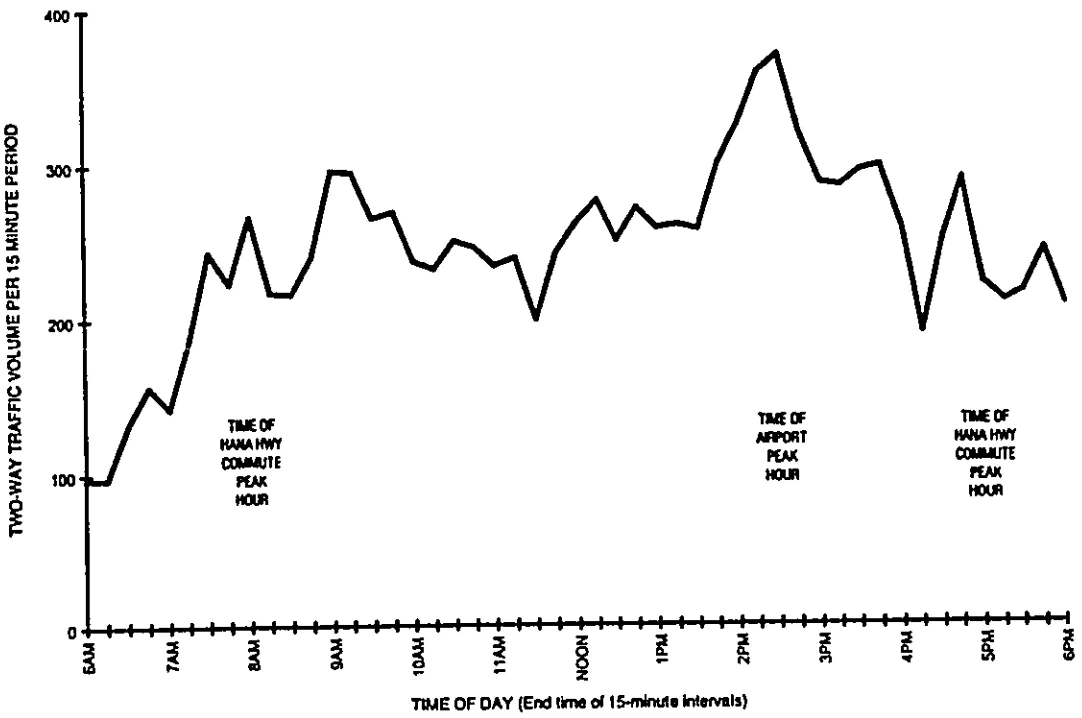
COMPARISON OF ROADWAY TRAFFIC VOLUMES DURING AIRPORT AND COMMUTE PEAK HOURS
Kahului Airport Improvements - Traffic Impact Study

Location	Morning Commute Peak Hour 7:30-8:30 AM	Airport Midday Peak Hour 2:00-3:00 PM	Afternoon Commute Peak Hour 4:30-5:30 PM
Keolani Place Near Airport			
▸ Two-Way Traffic Volume	949	1,371	971
▸ Percent of Airport Peak Hour	69.2%	100%	70.8%
Hana Highway East of Dairy Road			
▸ Two-Way Traffic Volume	3,156	2,435	3,108
▸ Percent of Airport Peak Hour	129.6%	100%	127.6%
Total Vehicles at Intersection of Dairy Road and Hana Highway			
▸ Vehicles Entering Intersection	3,978	3,607	4,418
▸ Percent of Airport Peak Hour	110.3%	100%	122.2%

Source: State DOT Traffic Counts, June 1993.

Wilbur Smith Associates; June 1995

T-03/474



SOURCE: State DOT Counts on Keolani Place at Kalialinui Bridge, June 2, 1993

Figure 2-4
TRAFFIC BY HOUR OF DAY - KEOLANI PLACE NEAR AIRPORT TERMINAL

Therefore, the worst traffic conditions should occur for almost all roadways during the commute peak hour. The analyses of Airport traffic impacts thus focus on the incremental impacts of Airport traffic on these commute peak hour conditions.

Design Day Vehicle Trip Generation

Vehicle trip generation associated with the Airport Terminal activities were estimated using the 1993 State DOT traffic counts along Keolani Place and 1993 records of air passengers. For the purpose of this analyses, all traffic on Keolani Place at the Airport Terminal loop roadway is assumed to be an airport-related trip.

Based on the 1993 data, the following factors are presented to depict current conditions:

- In August 1993,[6] the number of air passengers at Kahului Airport averaged 16,853 per day, or about 14.8 percent more than the average 14,680 daily air passengers throughout the year.
- Based on the June 2, 1993 vehicle counts and air passenger information, there was an average of 1.0356 vehicles per passengers entering or exiting the Airport terminal area. This trip rate includes all vehicles—employees, deliveries, maintenance, and other vehicles—and not just those vehicles carrying air passengers.
- The characteristics of vehicle traffic to/from the terminal area during each of the peak hour periods are as follows:

	Peak Hour		
	Morning Commute 7:00-8:30 AM	Airport Midday 2:00-3:00 PM	Afternoon Commute 4:30-5:30 PM
Percent of Daily Vehicle Trips	6.42%	9.27%	7.10%
Directional Splits			
▸ To Airport	54%	42%	40%
▸ From Airport	46%	58%	60%

(6) Average day in August is used as the "Design Day" for the basis of the traffic forecasts and analysis of traffic conditions in this study.

Ground Transportation Modes

A vehicle classification and occupancy count was made of traffic entering and exiting the Airport terminal area loop roadway via Keolani Place during the early afternoon period on September 14, 1994. The composition of traffic during the midday peak hour, which occurred from 1:15 to 2:15 PM on that date, is summarized in Table 2-5.

Small passenger and service vehicles—cars, pick-up trucks, minivans, and vans—comprised about 85 percent of the total traffic. The count was unable to distinguish air passenger trips from other trips. The remaining vehicles were evenly distributed among the other vehicle types. Taxis and tour vans each represented over 3 percent of the peak hour vehicles.

Features relative to the numbers of passengers in each vehicle are as follows:

1. **Taxis**
   - Some 63 percent carried passengers while 37 percent arrived or departed without passengers.
   - Of those with passengers, the average occupancy was 2.4 passengers (excluding driver) per taxi.
2. **Charter/Tour Vans**
   - One-half arrived or departed without passengers.
   - Of those with passengers, the average occupancy was 3.1 passengers (excluding driver).
3. **Buses**
   - About 38 percent of buses arrived or departed without passengers.
   - Those buses with passengers averaged 20.9 riders plus the driver.
4. **Limousines**
   - All had tinted windows, so no occupancy count was possible.
5. **Passenger Cars**
   - No occupancy count was made since unable to identify vehicle carrying air passengers.

Combined, the taxis, vans and buses served an estimated 450 air passengers during the peak hour, or about 25 to 30 percent of the estimated number arriving or departing the Airport during this time.

COMMUTE PEAK HOUR TRAFFIC VOLUMES

The manual traffic counts taken at key study area intersections during early to mid-1994 were adjusted to reflect traffic levels on an average weekday in August 1994. As discussed in *Basis of Analysis* in this chapter, the average day in the highest volume month of the year is typically used as the design condition for airport studies. August has the highest volume of air passengers at Kahului Airport and, based on State DOT year-round count station near Kaanapali, is one of the two highest months for Maui highway traffic. The August average day traffic volumes are approximately five percent higher than traffic volumes for the average day of the year.

The traffic volumes on area roadways during the morning and afternoon commute peak hours are depicted in Figures 2-5 and 2-6, respectively. Due to locational differences, the start of the morning commute peak hour varies between 6:30 and 7:30 AM, while the beginning of the afternoon commute peak hour generally ranges from 4:00 to 5:00 PM.

The highest traffic volumes in the study area occur along the segments of Haleakala Highway and Hana Highway connecting the Maui Upcountry area to Kahului. Along this route, traffic flows are substantially higher in the westbound direction during the morning peak hour and eastbound during the afternoon.

The traffic volumes along this route are highest for the segment of Hana Highway between the east junction of Haleakala Highway and Dairy Road. High volumes of vehicle turns occur at the intersections at each end of this segment. In the morning peak hour, the left-turn movement from Haleakala Highway onto westbound Hana Highway approximates 1,900 vehicles, while the left-turn movement from Hana Highway to southbound Dairy Road approximates 700 vehicles. Slightly lower volumes of right-turn vehicles occur for the return movements (eastbound) at these two intersections in the afternoon peak hour.

TRAFFIC CONDITIONS AT KEY INTERSECTIONS

The analysis of the three traffic signal-controlled intersections indicates that the August design day volumes result in undesirable conditions (LOS E or F) at each intersection during either the morning or afternoon peak hour (see Table 2-6). The worst conditions occur at the intersection of Hana Highway and Dairy Road during the afternoon peak hour. The long vehicle delays (LOS F) at this intersection result from the competing demands for signal green time by the high volume of eastbound through traffic on Hana Highway, coupled with a large volume of left-turn vehicles from westbound Hana Highway and large volumes of traffic in both directions along Dairy Road. The estimated August design day volumes exceed the theoretical capacity of the intersections by 6 percent (V/C of 1.06), which indicates that typical annual average day volumes approximate the calculated capacity of the intersection.

At the intersection of Hana Highway with Haleakala Highway (Pukalani junction), the morning peak hour volumes approximate 95 percent of the calculated capacity, with conditions at LOS E. These conditions result from the large volume of northbound traffic on Haleakala Highway and westbound traffic along Hana Highway.

Table 2-5

VEHICLE CLASSIFICATION OF AIRPORT TRAFFIC
MIDDAY PEAK HOUR FOR AIRPORT TERMINAL TRAFFIC
Kahului Airport Improvements - Traffic Impact Study

Type of Vehicle	To Airport		From Airport		Total	
	Number	Percent	Number	Percent	Number	Percent
Passenger Cars(1)	514	84.7%	551	86.2%	1,065	85%
Delivery Trucks(2)	15	2.5	14	2.2	29	2.3
Official Vehicles(3)	17	2.8	16	2.5	33	2.7
Airport Shuttle Buses(4)	5	0.8	4	0.6	9	0.7
Charter/Tour Buses	8	1.3	7	1.1	15	1.2
Charter/Tour Vans	18	3.0	21	3.3	39	3.1
Taxis	24	3.9	21	3.3	45	3.6
Limousines	6	1.0	5	0.8	11	0.9
Total	607	100.0%	639	100.0%	1,246	100.0%

Source: Vehicle count on Keolani Place at Aalele Street recorded September 14, 1994 between 1:15 and 2:15 PM
(1) Includes rental cars, pick-up trucks and vans.
(2) Large delivery trucks and panel trucks.
(3) Airport maintenance and security vehicles.
(4) Airporter and Speedshuttle.

Wilbur Smith Associates; April 1995

T-04/474b

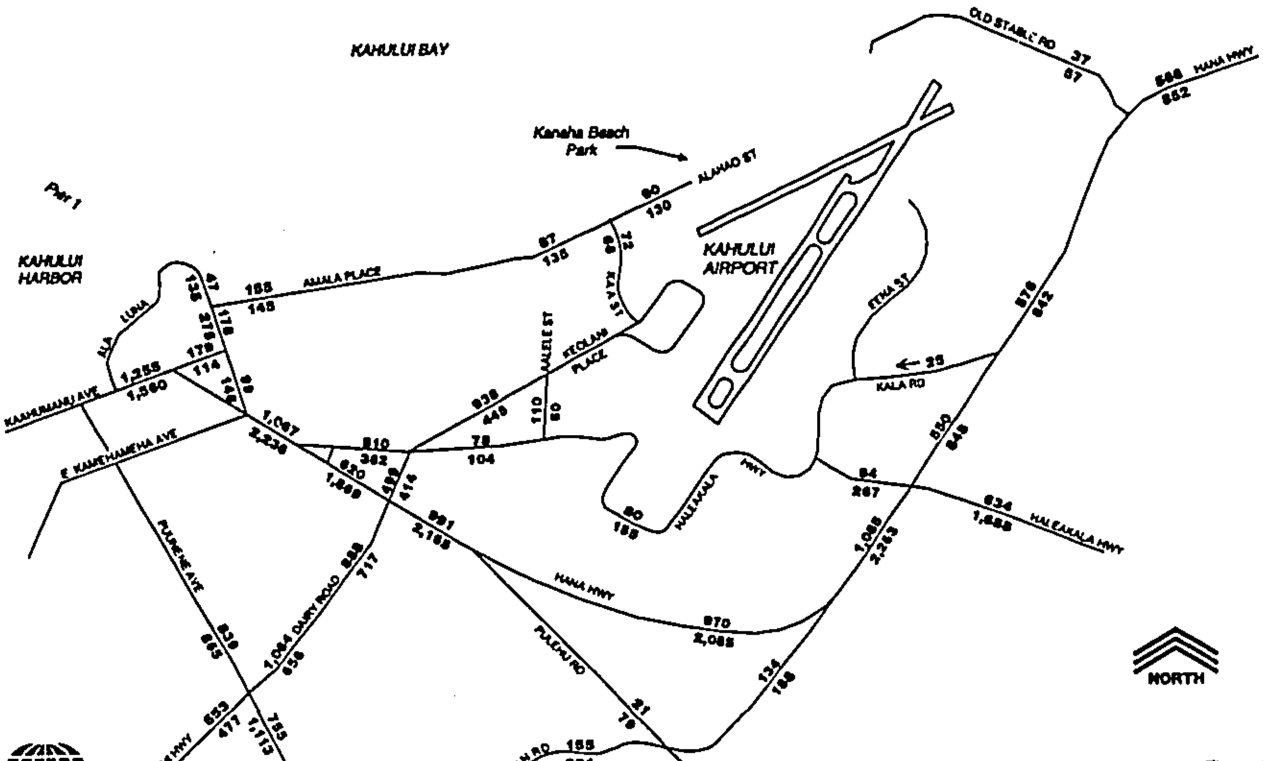


Figure 2-6
1994 DESIGN DAY AFTERNOON PEAK HOUR TRAFFIC

WSA WILBUR SMITH ASSOCIATES

KAHULUI AIRPORT IMPROVEMENTS TRAFFIC IMPACT STUDY

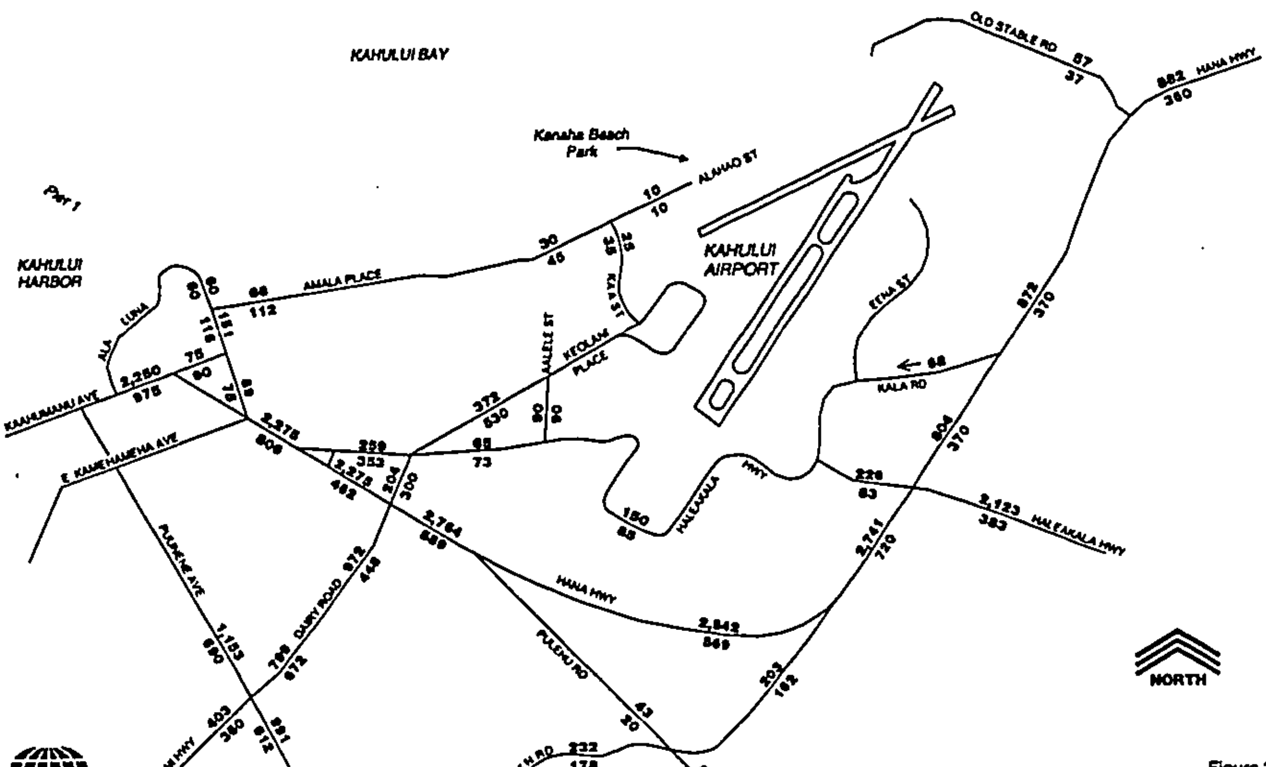


Figure 2-5
1994 DESIGN DAY MORNING PEAK HOUR TRAFFIC

WSA WILBUR SMITH ASSOCIATES

Peak hour traffic volumes at the Dairy Road-Puunene Avenue intersection utilize 78 and 86 percent of the calculated capacity during the morning and afternoon peak hours, respectively. Slightly longer vehicle delays (LOS E) occur during the afternoon peak hour due to higher left-turn volumes and a longer signal cycle length.

LOS F conditions (very long delays) are indicated for several STOP sign-controlled intersections along Hana Highway. At the Hobron Street and Hansen Road intersections, the LOS F condition is for traffic turning left from the side street onto Hana Highway. Each of these turns is difficult during peak traffic hours, but the LOS F may overstate the difficulty since a median refuge area is available to allow the vehicles to first cross to the median and then wait there for a gap in the other traffic direction to complete the turn, rather than the much longer wait needed for a gap to occur at the same time in both travel directions.

At the Kaahumanu Avenue and the Haleakala Highway intersections, the LOS F conditions are for eastbound left-turns crossing the high volume of westbound through traffic during the morning peak hour. The large negative reserve capacity (-229) at the Haleakala Highway overstates the difficulty of that left-turn movement since the analysis methodology does not account for gaps in westbound traffic flow created by the nearby traffic signal at Dairy Road. Field observations indicate queuing and delays do occur.

Table 2-6

LEVELS OF SERVICE AT KEY INTERSECTIONS - EXISTING CONDITIONS (YEAR 1994)
AUGUST DESIGN DAY
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Traffic Control Device	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
1	Hobron St.	Amala Pl.	STOP Sign	—	619	A	—	412	A
2	Kaahumanu Ave.	Hana Hwy.	STOP Sign	—	-5	F	—	59	E
3	Hobron St.	Kaahumanu Ave.	STOP Sign	—	532	A	—	390	B
4	Hobron St.	Hana Hwy.	STOP Sign	—	-13	F	—	-40	F
5	Haleakala Hwy.	Hana Hwy.	STOP Sign	—	-229	F	—	135	D
6	Dairy Rd. - Keolani Pl.	Haleakala Hwy.	STOP Sign	—	154	D	—	-177	F
7	Dairy Rd.	Hana Hwy.	Signal	0.78	—	D	1.06	—	F
8	Dairy Rd. - Kuihelani Hwy.	Puunene Ave.	Signal	0.78	—	D	0.86	—	E
9	Pulehu Rd.	Hana Hwy.	STOP Sign	—	211	C	—	11	E
10	Pulehu Rd.	Hansen Rd.	STOP Sign	—	370	B	—	389	B
11	Hansen Rd.	Hana Hwy.	STOP Sign	—	105	D	—	-17	F
12	Haleakala Hwy.	Hana Hwy.	Signal	0.95	—	E	0.85	—	C
13	Old Stable Rd.	Hana Hwy.	STOP Sign	—	98	E	—	40	

V/C = Ratio of traffic volumes to estimated capacity at signalized intersections.
RC = Reserve, or unused, capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.

Wilbur Smith Associates; June 1995

T-05/510b

3. YEAR 2010 CONDITIONS WITHOUT AIRPORT IMPROVEMENTS
NO ACTION ALTERNATIVE

The present facilities at Kahului Airport are expected to permit continued growth in air passenger activity through the Year 2010. As discussed in the *Socio-Economic Impact Assessment*,[1] the existing Airport facilities could accommodate most or all of the forecast air passenger increases through this time period, with the current Airport facilities imposing little or no constraints in attaining these forecast volumes.

This chapter summarizes the analyses of traffic conditions in 2010 without the proposed Airport improvements. This assessment is primarily intended to serve as a baseline against which the traffic impacts of the Preferred Plan and alternative plans can be measured. The analysis also indicates where traffic problems may occur that would affect access to the Airport.

The estimates of regional travel growth for this "No Action" scenario reflect the forecasts of population and economic growth on Maui as envisioned in the *Maui Long-Range Highway Planning Study*.[2] The study identified Year 2010 travel demands on the island of Maui and recommended a plan of roadway improvements to meet these travel requirements through Year 2010. The present State and County roadway improvement plans are based on that study. The State DOT and Maui County are currently updating the study forecasts and roadway plans for a horizon year of 2020. However, the study findings and recommended plan were not available at the time of this study.

ASSUMPTIONS AND METHODOLOGY

The traffic forecasts for this "No Project" scenario were developed from those for Alternative A (No Action) in the 1992 Traffic Impact Assessment Report (TIAR) for Kahului Airport.[3] The 1992 study had derived its forecasts from the Maui Long-Range Highway Planning Study. The forecast year for these two previous studies is 2010.

For the purpose of this analyses, Year 2010 traffic forecasts of the earlier studies were modified to reflect two changes:

1. The traffic volumes to/from Kahului Airport were revised to reflect the current air passenger forecasts for the "No Action" Alternative.

(1) *Socio-Economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements, Draft Report*, prepared by Community Resources, Inc., November 1994.

(2) *Maui Long-Range Highway Planning Study, Island-Wide Plan Final Report*, prepared for State of Hawaii DOT, County of Maui, Department of Public Works, and County of Maui, Department of Planning, by Austin Tsutsumi & Associates, Inc., May 1991.

(3) *Traffic Impact Assessment Report of Kahului Airport*, prepared for State of Hawaii DOT Airports Division, by Pacific Planning & Engineering, Inc., June 1992.

2. The substantial amount of development activity now occurring adjacent to Dairy Road near the Airport was not fully reflected in the 1992 study. These developments include Kmart (existing), Triangle Square (under construction), Costco, and the Kahului Industrial Park (Phase I).

The following sections provide an overview of the assumptions and methodology used in the development traffic forecasts for the No Action Alternative in this study.

Island-Wide Long-Range Highway Plan for Maui

The Long-Range Highway Plan Study, jointly undertaken by the State DOT and the County of Maui Planning Department and Public Works Department, was completed in 1991. The study was used to identify an island-wide plan of highway improvements to serve Maui travel growth through Year 2010.

Existing conditions for the island-wide study was for the Year 1987. The study then used projections of land uses and socio-economic data through 2010 to develop traffic forecasts for the island-wide highway network. The socio-economic data included population, employment, and visitor growth. The 2010 traffic forecasts were then used to evaluate alternative highway improvements, and to select and prioritize recommended improvements.

The 1992 Traffic Impact Analyses study for Kahului Airport based its forecasts of regional traffic volumes on the Island-Wide Long-Range Highway Plan Study.

Socio-Economic Data - The Maui socio-economic data used for the 1987 base year and 2010 forecast year of the Island-Wide Study are summarized in Table 3-1. The overall level of growth reflected for the island of Maui between 1987 and 2010 is as follows:

Population = + 84%
Employment = + 97%
Transient Accommodations = +111%

The forecasts indicate that population would grow in all areas, except Puunene. The Lahaina and Kihei/Makena areas would increase their net share of the population, while other areas would remain about the same or decrease in share. Employment would remain concentrated in the Lahaina, Wailuku/Kahului, and Kihei/Makena areas, with each having about 30 percent of Maui employment in 2010. Transient accommodations in the Kihei/Makena area would approach the levels of the Lahaina area.

The island-wide study projected the average daily visitor population to grow from 32,195 visitors in 1987, to 67,450 in 2010. This 110 percent increase in visitor population approximates the increase in transit accommodations.

Travel Increases - The Island-Wide Highway Plan Study forecast a 119 percent increase in the number of weekday vehicle trips between 1987 and 2010. The largest increases were projected for the Kihei/Makena area and for the Lahaina area, as summarized in Table 3-2. The weekday traffic

Table 3-1

SOCIO-ECONOMIC DATA USED IN 2010 TRAVEL FORECASTS
Island-Wide Long-Range Highway Planning Study

Parameter/Area	1987		2010		Net Increase
	Number	Percent	Number	Percent	
Residents					
▸ Wailuku/Kahului	29,217	36.0%	54,141	36.3%	24,924
▸ Lahaina	11,252	17.4	24,771	23.3	13,519
▸ Kihei/Makena	14,110	13.9	34,652	18.6	20,542
▸ Makawao/Haleakala	17,339	21.4	22,566	15.1	5,227
▸ Hana/Pala	8,490	10.5	12,336	8.3	3,846
▸ Puunene	622	0.8	622	0.4	-0-
Total	81,030	100.0%	149,088	100.0%	68,058
Employment					
▸ Wailuku/Kahului	18,970	46.5	23,902	29.8	4,932
▸ Lahaina	5,278	29.4	25,889	30.4	20,611
▸ Kihei/Makena	12,009	13.9	24,399	32.2	12,390
▸ Makawao/Haleakala	2,091	5.1	2,227	2.8	136
▸ Hana/Pala	2,010	4.9	2,982	3.7	972
▸ Puunene	460	1.1	874	1.1	414
Total	40,818	100.0%	80,273	100.0%	39,455
Transient Accommodation					
▸ Wailuku/Kahului	365	2.7	365	1.3	-0-
▸ Lahaina	8,978	64.0	15,852	53.5	6,874
▸ Kihei/Makena	4,676	33.3	13,381	45.2	8,705
▸ Makawao/Haleakala	1	0.0	1	0.0	-0-
▸ Hana/Pala	-0-	0.0	-0-	0.0	-0-
▸ Puunene	-0-	0.0	-0-	0.0	-0-
Total	14,040	100.0%	29,818	100.0%	15,679

Source: *Maui Long-Range Highway Planning Study, Island-Wide Plan Final Report*, prepared for State DOT, County of Maui Department of Public Works, and County of Maui Department of Planning by Austin Tsutsumi & Associates, Inc., May 1991.

Wilbur Smith Associates; March 1995

T-08474

Table 3-2

VEHICLE TRIP GENERATION FORECASTS
ISLAND-WIDE LONG-RANGE HIGHWAY PLANNING STUDY
Kahului Airport Improvements - Traffic Impact Study

Community Planning Areas	Average Weekday Vehicle Trip Ends		Percent Increase
	1987	2010	
Wailuku-Kahului	99,104	150,451	52%
Kihei-Makena	44,404	188,234	324%
Lahaina	85,037	204,917	141%
Hana	4,255	8,034	89%
Makawao-Pukulani-Kula	32,820	43,305	32%
Paia-Haiku	14,753	19,584	33%
Total	280,373	614,525	119%

Source: *Maui Long-Range Highway Planning Study, Island-Wide Plan Final Report*, prepared for State DOT, County of Maui Department of Public Works, and County of Maui Department of Planning by Austin Tsutsumi & Associates, Inc., May 1991.

Wilbur Smith Associates; March 1995

T-07474

forecasts were assigned to the network of major roadways and then used to identify deficiencies and recommended improvements.

Adjustments to Island-Wide Long-Range Highway Plan Forecasts - For the 1992 Kahului Airport TIAR, Pacific Planning & Engineering, Inc. (PPE) used the weekday forecasts from the Island-Wide Long-Range Highway Plan Study as the basis for their Year 2010 forecasts. The Island-Wide Study forecast volumes were used to develop the estimates of regional traffic in the study area for Kahului Airport. The procedure was as follows:

1. The forecasted regional traffic volumes were based on the Island-Wide Study, which provided Year 2010 daily traffic volumes at selected intersections.
2. The peak hour volumes were estimated from the daily volumes by use of factors representing the percent of daily traffic occurring during the peak hour and the directional split of traffic during each peak hour.
3. The regional traffic were assigned onto the roadway network in the Airport study area based on current travel patterns and the land use forecast data from the Island-Wide Study.

Development in the Airport Vicinity

Since the previous Island-Wide and Kahului Airport TIAR studies, four major commercial developments have located or planned to locate along the existing Dairy Road access route to Kahului Airport. Each of these four developments will be a substantial contributor to traffic increases in the Airport area by 2010. These four development are:

1. Kmart, recently completed, located at the northeast corner of the intersection of Dairy Road and Hana Highway.
2. Phase II of Triangle Square, a factory outlet retail center of about 79,000 sq. ft. of floor area, now under construction in the triangular area bounded by Dairy Road, Hana Highway, and Haleakala Highway.
3. A Costco Warehouse Club of about 136,000 sq. ft. of floor area, located at the southeast corner of Dairy Road and Haleakala Highway.
4. The Kahului Industrial Park, covering about 73 acres along the east side of Dairy Road between Hana Highway and Puunene Avenue.

These four developments are commensurate with the level of future employment and population forecast for the Wailuku-Kahului area. However, it is unlikely that the Kahului area forecasts obtained from the Island-Wide Study fully reflect the traffic from this concentrated level of development adjacent to the Airport access routes. Therefore, the traffic for these four developments was superimposed on the traffic assignments obtained from the previous Kahului Airport TIAR.

The assumptions and procedures used to incorporate the traffic for each development into the Year 2010 forecasts was as follows:

1. The number of vehicle trips generated by each development in 2010 was assumed to be the same as the trip generation estimated at buildout of each project in the traffic impact studies previously prepared for these projects.[4]
2. The number and distribution of vehicle trips generated by the Costco project during the morning peak hour was estimated by WSA.
3. The vehicle trips were assigned to the local roadway network as indicated in the respective TIARs.

The four developments are estimated to add 1,291 and 2,868 vehicle trips to area traffic volumes during the morning and afternoon peak hours, respectively (Table 3-3).

Roadway Improvements

A number of roadway improvement projects are planned for the central Maui area that would affect traffic circulation and roadway capacities within the vicinity of Kahului Airport. Most are among those regional roadway improvements recommended in the Island-Wide Long-Range Highway Plan Study, either to increase capacity along existing major roadways or to provide new roadway connections to divert traffic from congested corridors. Also, a limited number of local improvements are planned to mitigate traffic impacts of the planned new developments along Dairy Road. For the purpose of this impact study, the Year 2010 No Project scenario assumes the following:

- All of the Island-Wide Long-Range Highway Plan roadway improvements are implemented by 2010, except for the Kuihelani Highway Extension to the Kahului Airport (Airport Access Road). The Airport Access Road is one element of the Kahului Airport Preferred Plan, and thus has been deleted for the Airport "No Project" scenario.
- All of the planned mitigation actions for the local developments along Dairy Road are implemented by 2010.

A listing of the planned roadway projects is included under "Modifications Included in the No Action Scenario."

[4] *Addendum, Traffic Impact Analysis Report for Maui Sam's Club*, (now the planned Costco facility), prepared February 1994.

Traffic Impact Analysis Report for the Proposed Triangle Square Phase II, prepared for A&B Properties, Inc., by The Traffic Management Consultant, March 1994.

Traffic Impact Analysis Report for the Proposed Kahului Industrial Park Phase I, prepared for A&B Properties by The Traffic Management Consultant, March 1994.

Airport-Related Vehicle Trip Generation and Distribution

Vehicle Trip Generation - Ground traffic at Kahului Airport is primarily a factor of the level of air passenger activity at the West Ramp passenger terminal. Increases in the volume of air passengers result in increased numbers of rental car, private car, taxi, and charter vehicle trips to serve these passengers, but also result in increased employee traffic as well as trips by various types of service vehicles (baggage, food service, concessionaires, maintenance, etc.). Therefore, estimates of the future traffic volumes for the West Ramp terminal area of the airport are based on the forecasts of future air passenger volumes.

The methodology used to develop the West Ramp traffic forecasts is as follows:

1. The estimated number of design day air passengers is used as the basis of the projection, with the design day representing an average day in the peak month for air passengers (August).

2. The trip rates identified from the most recent State DOT ground counts at Kahului Airport are used to estimate ground traffic. These trip factors, outlined on Page 2-11, include:

   - An average of 1.0356 vehicle trips into or out of the airport is generated per air passenger, encompassing passenger trips, employee trips, and all other trips to/from the airport.

   - Of the daily trips, 6.42 percent occur in the morning commute peak hour with 54 percent entering and 46 percent exiting the terminal area.

   - Of the daily trips, 7.10 percent occur in the afternoon commute peak hour with 40 percent entering and 60 percent exiting the terminal area.

   - Although not used in the analysis of roadway impacts, the proportion of trips in the airport peak hour (early afternoon) is 9.27 percent, of which 42 percent enter and 58 percent exit the airport.

Ground traffic to/from the East Ramp area was estimated using trip generation rates for general aviation, helicopter, and air cargo operations. Standard trip rates for warehouse distribution centers were used to represent air cargo operations. The trip rates and sources are summarized in Table 3-4.

Trip Distribution - Distribution of airport trips to the various areas of Maui was based on the forecast future distribution of population and visitor accommodations. Population was used as the basis of distribution of resident and business trips, while visitor accommodations was used for distribution of visitor trips. Information from the Hawaii Visitors Bureau indicates 70 percent of persons flying in Hawaii are visitors, while the remaining 30 percent are assumed to be residents or

Table 3-3

ESTIMATED VEHICLE TRIP GENERATION OF PLANNED DEVELOPMENTS ALONG DAIRY ROAD
Kahului Airport Improvements - Traffic Impact Study

Development	Morning Peak Hour			Afternoon Peak Hour		
	Enter	Exit	Total	Enter	Exit	Total
K-Mart(1)	38	18	56	225	205	430
Costco(1)	37	31	68	425	425	850
Triangle Square(2)	89	53	142	56	62	118
Kahului Industrial Park Phase I(2)	815	210	1,025	657	813	1,470
Total	979	312	1,291	1,363	1,505	2,868

Source: Wilbur Smith Associates
(1) Includes all trips, including pass-by trips.
(2) New trips only, excludes pass-by trips.

Wilbur Smith Associates; April 1995

business travellers. The resultant distribution of airport trips, as prepared for the preceding 1992 Traffic Impact Assessment Report for Kahului Airport,[1] is presented in Table 3-5.

ROADWAY MODIFICATIONS INCLUDED IN THE NO ACTION SCENARIO

The No Action Scenario includes those roadway projects planned as mitigation for new developments near the Airport, as well as the projects recommended by the Island-Wide Long-Range Highway Plan. The one exception is the new Airport Access Road (Kuihelani Highway Extension), since it is a major element of the proposed Kahului Airport improvements.

The roadway modifications recommended by the Island-Wide Long-Range Highway Plan, that either provide additional roadway capacity or directly affect traffic volumes in the vicinity of the Airport, include the following:

- Haleakala Highway is planned for widening to four lanes between Hana Highway and Haliimaile Road.
- Kuihelani Highway is planned for widening to four lanes between Puunene Avenue and the proposed Maui Lani Parkway.
- A Puunene bypass road is planned between Kuihelani Highway, at the intersection with the planned Maui Lani Parkway, and Mokulele Highway south of Puunene.
- Mokulele Highway is planned for widening to four lanes south of the proposed Puunene bypass road.
- A new highway is planned between Kula and Wailea, which would divert traffic that would otherwise use Hana Highway to travel between these areas.
- A new highway is planned between Pukalani and Kihei, which would divert traffic that otherwise would use Hana Highway for travel between the Upcountry area and the Kihei and Lahaina areas.

The roadway modifications proposed in conjunction with the new developments in the Dairy Road area include the following:

- Dairy Road is to be widened to five lanes between Hana Highway and Haleakala Highway, with two lanes in each direction plus a center left-turn lane.
- The Haleakala Highway/Dairy Road/Keolani Place intersection is to be reconstructed to provide an exclusive left-turn lane on each approach, and a traffic signal installed.

[1] op cit.

Table 3-4

VEHICLE TRIP GENERATION RATES FOR AIRPORT USES
Kahului Airport Improvements - Traffic Impact Study

Land Use	Unit	Morning Peak Hour		Afternoon Peak Hour		Daily
		Enter	Exit	Enter	Exit	
West Ramp Terminal Area[1]	Air Passenger	0.0350	0.0306	0.0294	0.0441	1.0356
General Aviation[2]	Based Aircraft	0.38	0.29	0.48	0.52	6.6
Heliport[3]	Based Aircraft	1.84	1.22	2.30	2.29	30.6
Air Cargo[3]	Acres	7.11	2.77	3.06	5.69	56.1

Sources:

(1) Wilbur Smith Associates, based on Kahului Airport data.
(2) *Maui General Aviation Study, Airport Site Selection Report*, prepared for State DOT airports division by Edward K. Noda and Associates, Inc., December 1994.
(3) *Trip Generation*, Institute of Transportation Engineers, 1991.

Wilbur Smith Associates: April 1994

Table 3-5

DISTRIBUTION OF AIRPORT TRIPS
Kahului Airport Improvements - Traffic Impact Study

Area	Morning Peak Hour	Afternoon Peak Hour
Wailuku/Kahului	24.8%	11.2%
Hana/Haleakala	3.5%	1.5%
Kihei/Makena	28.2%	37.8%
Lahaina	34.4%	45.6%
Puunene	0.7%	0.3%
Makawao	8.4%	3.6%
Total	100.0%	100.0%

Source: *Traffic Impact Assessment Report for Kahului Airport*, prepared for State DOT Airports Division by Pacific Planning & Engineering, Inc., 1992.

Wilbur Smith Associates; March 1995

T-10474

- The westbound approach of Hana Highway at Dairy Road is to be widened to provide two left-turn lanes.
- Eastbound Hana Highway at the Dairy Road intersection is to be widened to provide an additional through/right-turn lane at the intersection, with the additional lane ending a short distance beyond the intersection.
- The section of Dairy Road between Hana Highway and Puunene Avenue is to be widened to five lanes, with two lanes in each direction plus a center left-turn lane. At the Puunene Avenue intersection, southbound Dairy Road would be further widened to include a second (double) left-turn lane.
- Puunene Avenue is to be widened to provide a second southeast bound through lane at the Dairy Road-Kuihelani Highway intersection.

AIRPORT VEHICLE TRIP GENERATION

Ground traffic forecasts for the "No Action" alternative are based on the following activity levels at Kahului Airport in Year 2010:

7,726,000 Annual Air Passengers
59 Based General Aviation Aircraft
46 Based Helicopters

The air passenger forecast represents a substantial decline from the level used in the 1992 ground traffic analysis. The 1992 study was based on a projected 9.059 MAAP (million annual air passengers) for the unconstrained "No Action" alternative, or about 17 percent more than the projection used in this study, while the constrained forecast for the 1992 "No Action" alternative was 8.153 MAAP or 5.5 percent more than the present forecast of 2010 activity.

The present "No Action" alternative results in an estimated 25,810 daily vehicle trips to or from the Airport West Ramp area on the August design day and 2,020 daily vehicle trips to or from the Airport East Ramp. The estimated vehicle trip generation for the peak hours on the August design day is summarized in Table 3-6.

The projected peak hour volumes to/from Kahului Airport are about 12 percent higher for the afternoon commute period than for the morning period. The projected volumes during the midday peak hour for Airport trips exceeds those for either commute peak hour.

The projected 2010 peak hour volumes for the unconstrained "No Action" alternative from the 1992 traffic study are also presented in Table 3-6 for comparison. The present study forecasts are about 200 and 50 vehicle trips below those of the 1992 traffic study for the morning and afternoon peak hours, respectively.

COMMUTE PEAK HOUR TRAFFIC VOLUMES

The peak hour traffic volumes for 2010 were estimated by the following process:

1. The "No Action" alternative traffic assignments from the 1992 traffic study were used as the basis for the development of the present revised "No Action" forecasts.

2. The 1992 traffic study assignments were adjusted to reflect the present lower forecasts of Airport activity in 2010.

3. The estimated trips to/from the Kmart, Costco, Triangle Square and Kahului Industrial Park Phase I developments were added to the 2010 assignment.

The resultant estimated traffic volumes in the morning and afternoon commute peak hours for the 2010 August design day are depicted in Figures 3-1 and 3-2, respectively. The volumes are presented for the commute peak hours, rather than the midday Airport peak hour, since the commute peak hours represent the highest total traffic volumes where incremental impacts to traffic conditions and roadway needs would most likely occur as a result of additional airport traffic. The forecasts represent an average day in August, or about 5 percent higher volumes than for an average weekday.

The highest traffic volumes in the airport area would occur along Hana Highway. However, the 2010 volumes along most segments of the Hana Highway near the Airport are forecast to show little or no increase relative to the existing traffic volumes. In the morning peak hour, peak direction (westbound) traffic volumes along Hana Highway are estimated to remain similar to current volumes, while eastbound volumes are anticipated to be slightly below current volumes. In the afternoon peak hour, the peak direction (eastbound) volumes are forecast to be about 20 percent higher than current volumes, while westbound traffic volumes are estimated to remain similar to current volumes. These small increases or decreases are attributable to the planned future construction of a new roadway(s) from the Maui Upcountry area to the Kihei-Makena area, which would divert a portion of existing traffic from the use of Hana and Haleakala Highways for travel between these areas.

Similarly, little traffic growth, or small decreases in traffic, is forecast for Haleakala Highway due to the diversion of trips to an Upcountry-Kihei area connector roadway.

Substantial traffic increases are projected for Dairy Road. For the "No Action" Alternative, this roadway would continue to function as the main entry to the West Ramp area of the Airport. The roadway would also provide the principal access to the new non-airport developments planned in the airport area.

TRAFFIC CONDITIONS AT KEY INTERSECTIONS

Congested conditions are projected to occur in the vicinity of Kahului Airport in 2010, even with the planned roadway improvements (less the Airport Access Road). The peak hour conditions at the key intersections are listed in Table 3-7.

Table 3-6

KAHULUI AIRPORT VEHICLE TRIP GENERATION - "NO ACTION" ALTERNATIVE
Kahului Airport Improvements - Traffic Impact Study

Study & Source	Peak Hour						Daily
	Morning Commute		Midday Airport		Afternoon Commute		
	Enter	Exit	Enter	Exit	Enter	Exit	
Present Study							
West Ramp Terminal	895	782	1,005	1,368	733	1,100	25,810
East Ramp							
• Heliport	65	56	•	•	106	105	1,410
• General Aviation, Other	50	30	•	•	40	54	610
Subtotal East Ramp	135	86	•	•	146	159	2,020
TOTAL	1,030	848	•	•	879	1,259	27,830
1992 Study(1)							
West Ramp Terminal	1,107	738	•	•	900	1,100	•
Heliport	78	90	•	•	40	52	•
TOTAL	1,185	828	•	•	940	1,152	•

(1) *Traffic Impact Assessment Report for Kahului Airport*, prepared for State DOT Airports Division by Pacific Planning & Engineering, Inc., 1992.
• Information not available.

Wilbur Smith Associates; June 1995

T-11/474b

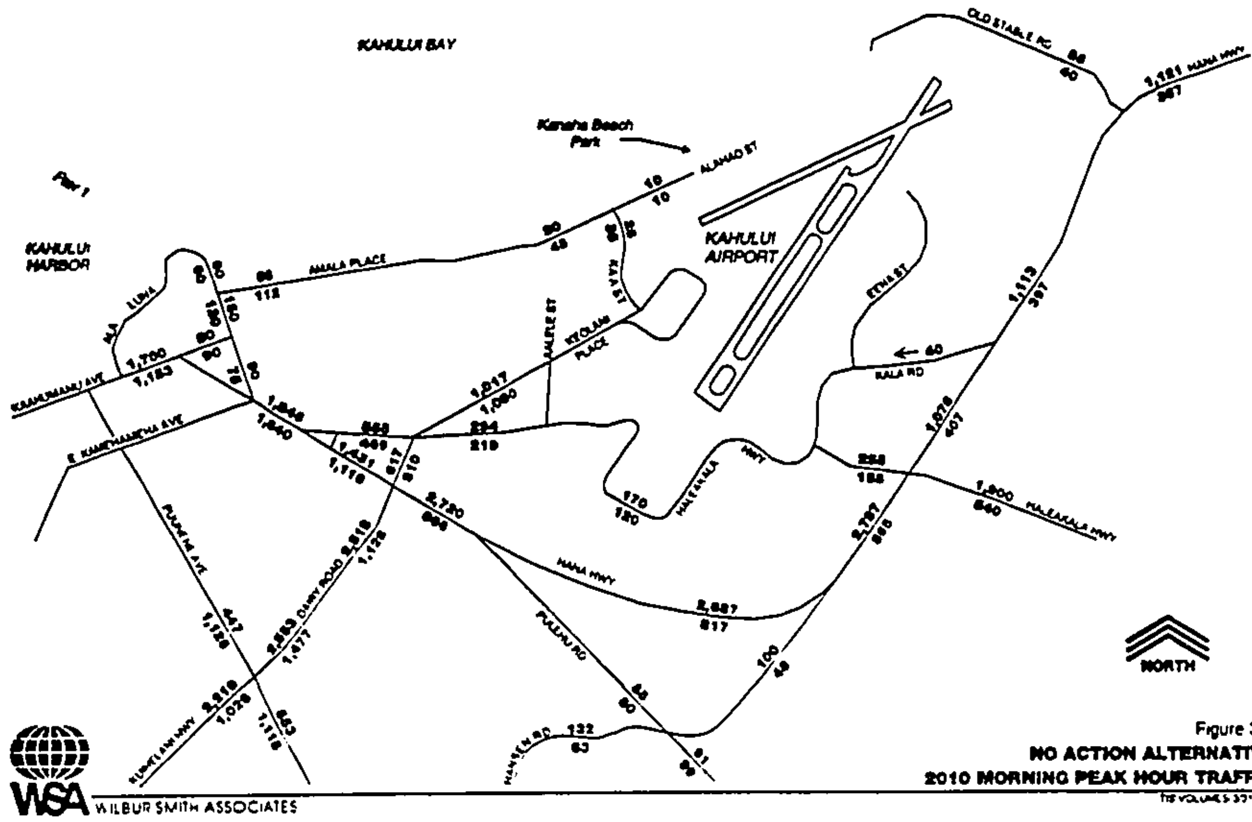


Figure 3-1
NO ACTION ALTERNATIVE
2010 MORNING PEAK HOUR TRAFFIC

KAHULUI AIRPORT IMPROVEMENTS TRAFFIC IMPACT STUDY

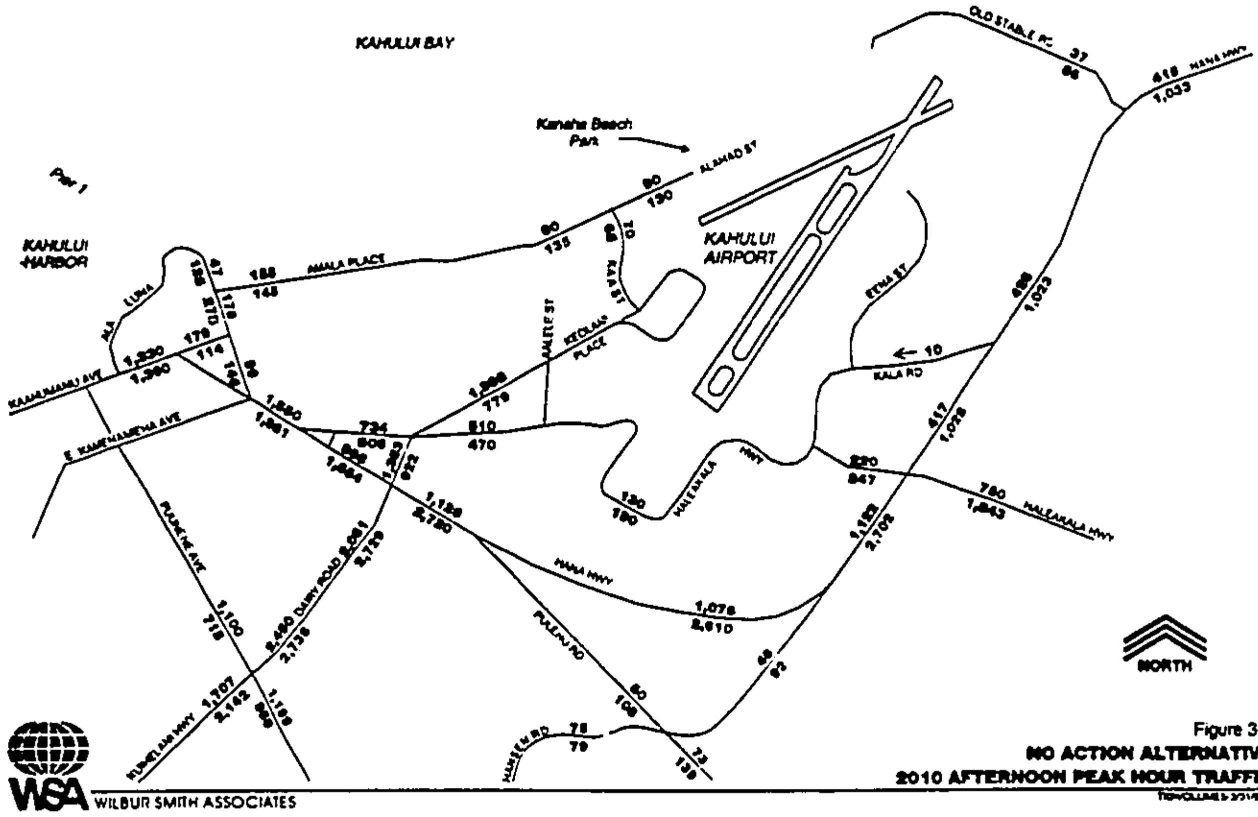


Figure 3-2
NO ACTION ALTERNATIVE
2010 AFTERNOON PEAK HOUR TRAFFIC

Table 3-7

LEVEL OF SERVICE AT KEY INTERSECTIONS
YEAR 2010 NO ACTION ALTERNATIVE WITHOUT AIRPORT MODIFICATIONS
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	N-S Street	E-W Street		V/C	RC	LOS	V/C	RC	LOS
1	Hobron St.	Amala Pl.	1994 2010 NA		619 619	A A		412 412	A A
2	Kaahumanu Ave.	Hana Hwy.	1994 2010 NA		-5 29	F E		59 78	E E
3	Hobron St.	Kaahumanu Ave.	1994 2010 NA		532 532	A A		390 390	B B
4	Hobron St.	Hana Hwy.	1994 2010 NA		-13 -3	F F		-40 -18	F F
5	Haleakala Hwy.	Hana Hwy. West Jct.	1994 2010 NA		-229 -408	F F		135 -251	D F
6	Dairy-Keolani Pl.	Haleakala Hwy.	1994 2010 NA	 0.72	154	D C	 1.03	-177	F E
7	Dairy Rd.	Hana Hwy.	1994 2010 NA	0.78 1.01		D E	1.06 1.27		F F
8	Dairy-Kuihelani	Puunene Ave.	1994 2010 NA	0.78 1.03		D E	0.86 1.23		E F
9	Pulehu Rd.	Hana Hwy.	1994 2010 NA		211 -31	C F		11 -23	E F
10	Pulehu Rd.	Hansen Rd.	1994 2010 NA		370 491	B A		389 509	B A
11	Hansen Rd.	Hana Hwy.	1994 2010 NA		105 221	D C		-17 22	F E
12	Haleakala Hwy.	Hana Hwy. Pukalani Jct.	1994 2010 NA	0.95 1.03		E F	0.65 0.86		C D
13	Old Stable Rd.	Hana Hwy.	1994 2010 NA		98 46	E E		40 38	E E

1994 = Existing Conditions (Year 1994).
2010 NA = No Action Alternative (Year 2010).
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.

Wilbur Smith Associates; June 1995

T-12/510b

At each of the four traffic signal-controlled intersections, the projected traffic increases would exceed planned roadway capacity and would result in undesirable LOS E or F conditions during at least one of the two commute peak hours.

- At the Pukalani (east) junction of Hana and Haleakala Highways, the increase in westbound through traffic would contribute to LOS F conditions in the morning peak hour.
- At the intersection of Dairy Road and Hana Highway, the projected volumes would equal or exceed the capacity of the widened intersection during both peak hours. The Airport and adjacent developments would contribute to increases in through traffic along Dairy Road, as well as add to the turning movements from both roadways.
- At the intersection of Dairy Road, Kuihelani Highway, and Puunene Avenue, traffic would exceed capacity during both peak hours with the increased Airport traffic and new Dairy Road development traffic a primary contributor to these conditions.
- At the intersection of Dairy Road, Keolani Place, and Haleakala Highway, the afternoon peak hour traffic would slightly exceed the capacity of the planned improvements at this intersection.

Traffic conditions are projected to worsen at many of the STOP sign-controlled intersections. The largest change would occur for the left-turn traffic from eastbound Hana Highway to Haleakala Highway (western junction) where the increased Airport and development traffic would result in LOS F conditions during both peak hours.

WSA

4. YEAR 2010 CONDITIONS WITH THE PREFERRED PLAN OF AIRPORT MODIFICATIONS

The Preferred Plan for modifications at Kahului Airport includes changes to the roadway network within and adjacent to the Airport, and changes to airport facilities that could affect activity levels at the Airport. The Preferred Plan modifications could potentially affect:

- The level of traffic demands at the Airport;
- Ground travel conditions to/from the Airport; and
- Travel conditions for regional through traffic and local traffic passing near the Airport.

The Preferred Plan of airport modifications, also collectively referred to herein as the "Project," could be completed by Year 2010.

PROJECT DESCRIPTION

The Preferred Plan includes a number of modifications to upgrade and/or expand facilities at Kahului Airport. Those that most directly affect ground travel demands and traffic conditions are the following:

1. Modifications that could affect traffic demands:
   - Relocation of the helicopter facilities away from Kahului Airport.
   - Runway extension and parallel runway that could facilitate more direct overseas flights.
2. Modifications that would affect roadway network:
   - Construction of a new Airport Access Road with an interchange at Hana Highway, to allow airport traffic to bypass Keolani Place/Dairy Road when entering or exiting the Airport.
   - Abandonment of Haleakala Highway between Hana Highway (Pukulani junction) and Aalele Street to accommodate the extension of the present runway.
   - Construction of a new Spine Road parallel to the east side of the existing runway that would serve the general aviation, air cargo, and airport operations facilities.
   - Abandonment of the present segments of Hansen and Pulehu Roads between their junction and Hana Highway, and replacement with a single roadway intersecting Hana Highway opposite the Spine Road.
   - Abandonment of Kala Road north of Hana Highway.

The Preferred Plan also includes relocation of a segment of Hana Highway eastward to permit construction of a parallel runway. However, the relocated facility would be similar to the existing roadway, with primarily short-term, construction-related impacts to traffic conditions.

METHODOLOGY AND ASSUMPTIONS

The future travel volumes with the Preferred Plan were estimated using a trip generation, trip distribution, and traffic assignment procedure similar to that used for the No Action Alternative. The general methodology used to estimate traffic volumes for the Preferred Plan was as follows:

1. The No Action trip generation and traffic assignments were used as the baseline from which to develop the Preferred Plan forecasts.
2. Increases/decreases in trip generation were estimated for the Preferred Plan, relative to changes from the No Action Alternative.
3. The revised numbers of Airport trips were assigned to the roadway system.
4. Airport and non-Airport traffic were reassigned to the area roadway network modified to include the Airport-related changes.

The following sections provide an overview of the assumptions and methodology used to develop the Preferred Plan forecasts and analysis.

Comparability With No Action Assumptions

The Preferred Plan forecasts reflect the same assumptions and methodology as presented for the No Action Alternative. These include the following:

Non-Airport Traffic - The Preferred Plan forecasts assume the same level of non-airport traffic as the No Action Alternative:

- Area traffic forecasts reflect the population, employment, and visitor accommodations used for 2010 by the Maui Islandwide Long-Range Highway Plan Study; and
- Airport area traffic volumes include the addition of trips to the Kmart, Costco, Triangle Square, and Kahului Industrial Park developments along Dairy Road.

Airport Traffic - Airport trips for the Preferred Plan were forecast using the same factors as used for the No Action Alternative:

- Trip generation rates (Table 3-4); and
- Distribution of trip origin/destination (Table 3-5).

Roadway Modifications - The Preferred Plan includes those roadway modifications proposed by:

- Regional roadway improvements included in the Islandwide Long-Range Highway Plan (Page 3-6); and
- Roadway improvements proposed as mitigation by the new developments along Dairy Road (Page 3-6).

Forecast Air Passengers

With the Preferred Plan, the Kahului Airport West Ramp terminal is estimated to serve 7,988,000 air passengers in Year 2010. This estimate is 3.4 percent higher than the 7,726,000 air passengers estimated for the No Action Alternative. This differential, as estimated by Community Resources, Inc.,[1] is attributed to the increased convenience of direct flights to several mainland market areas that would result from the expanded runways.

An estimated 25,770 air passengers would use the Kahului Airport terminal for the design day conditions (average day in August), or 850 more than estimated for the No Action Alternative.

Significance Criteria

Projects generally result in travel changes that may affect various components and segments of the transportation system. The importance of the effects is dependent in part on the size and characteristics of the increases, and in part on the capacities, usage levels, and conditions of the transportation system. For purposes of this study, the measures and criteria outlined in the following paragraphs are used to assess whether the project has significant effects on the area transportation system, and whether these project impacts warrant investigation of mitigative actions. These criteria have been identified by Wilbur Smith Associates for this study through the review of guidelines used by other cities and counties since Maui County and the State of Hawaii do not identify detailed criteria for use in identifying significant impacts of a project.

Traffic Signal-Controlled Intersections - The major intersections, which usually are controlled by traffic signals, largely determine traffic conditions along urban streets. The method of assessing conditions at signalized intersections, through use of the level-of-service (LOS) and the volume-to-capacity (V/C) ratio, is discussed in the Chapter 2 section on methodology.

Transportation engineers generally consider LOS D as acceptable for traffic conditions during peak traffic hours. This service level provides a balance of service quality (delays) versus the efficient use of transportation resources. For this study, the project impacts are considered significant at a signalized intersection where:

- Adverse, if the project traffic increase worsens the conditions to LOS E or F, from a condition of LOS D or better without the project;

[1] Op. cit.

- Adverse, if the project worsens the conditions to LOS F, from LOS E without the project;
- Adverse, if the project traffic increases the volume-to-capacity to greater than V/C 0.95, with the project responsible for an incremental increase of V/C 0.02 or more; and
- Beneficial, if the project improvements or traffic changes result in changed conditions equal and opposite to the "adverse" impact criteria.

Unsignalized Intersections - The length of delays to traffic stopped on the side streets usually determines the service level at STOP sign-controlled intersections. The methodology for assessing the delays is discussed in Chapter 2. For this study, the project impacts are considered significant at an unsignalized intersection when:

- Adverse, if the traffic increases for the project worsen conditions to LOS E or F, from LOS D or better without the project;
- Adverse, if the project traffic worsens conditions to LOS F, from LOS E without the project; and
- Beneficial, if the project improvements or traffic changes result in changed conditions equal and opposite to the "adverse" impact criteria.

Interchange Ramps - Traffic conditions for interchange ramps reflect both the delays to traffic using the ramp and any disruption to traffic flow in the major roadway through traffic lanes due to merging or weaving movements by vehicles entering or exiting the ramps. The criteria are the same as identified for unsignalized intersections.

DESCRIPTION OF AIRPORT ROADWAY MODIFICATIONS

The roadway modifications included as elements of the Preferred Plan are intended to improve access to Kahului Airport, as well as to benefit non-airport traffic in the adjacent areas. A description of each key modification is provided in the following paragraphs.

New Airport Access Road and Interchange

The new Airport Access Road would extend northeastward from Dairy Road, from a location about 700 feet north of its intersection with Puunene Avenue, across Hana Highway to intersect the West Ramp Terminal loop road. Key features of the new roadway are:

- The new Airport Access Road would be a four-lane highway with a median divider strip, and with full control of access.

- At the south end of the new road segment, the Airport Access Road/Kuihelani Highway would be the through route, with Dairy Road ending at a T-intersection with the new road.

- The Dairy Road approach would have separate left- and right-turn lanes at the intersection, and a northbound left-turn lane would be provided on the Airport Access Road. For purposes of this assessment, the intersection is assumed to have traffic signal controls.

- A grade-separated crossing and partial cloverleaf interchange would be provided at Hana Highway. The interchange would provide for all through and turning movements.

- The Airport Access Road would connect directly into the southern end of the West Ramp Terminal loop roadway.

- No at-grade street intersections are planned between Dairy Road and the Terminal loop roadway.

The configuration of the Hana Highway interchange is depicted in Figure 4-1. Key features of the interchange include:

- Direct ramps would be provided for each of the four right-turn movements at the junction of the two roads.

- Loop ramps would be provided for the high-volume Hana-to-Lahaina movement, and for the Wailuku-to-Airport movement.

- The Airport-to-Hana and Lahaina-to-Wailuku movements would be accommodated by at-grade left-turns onto the direct ramps in the southeast and northwest quadrants, respectively. Left-turn storage lanes would be provided on the Airport Access Road for these two movements, with no traffic signal controls assumed at either location.

Abandonment of the Airport Section of Haleakala Highway

The portion of Haleakala Highway between the Pukulani junction with Hana Highway and the new Airport Access Road would be permanently closed to public traffic to permit the runway extension and to avoid an at-grade crossing of the Airport Access Road.

- At the Pukalani junction, the southeastern portion of Haleakala Highway would end as a T-intersection with Hana Highway.

- At the west end, Aalele Street would be realigned to connect to Haleakala Highway west of the Airport Access Road. An airport service road would extend from Haleakala Highway beneath the Airport Access Road to provide access to the airside areas.

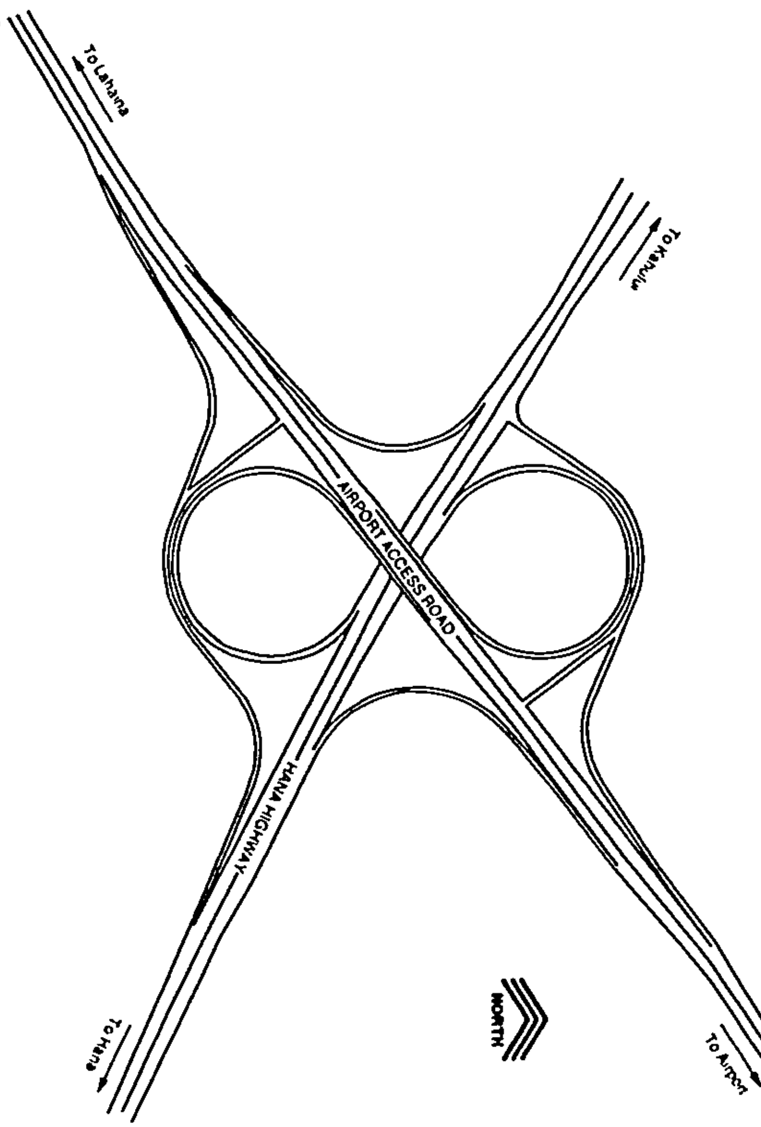


Figure 4-1
AIRPORT ACCESS ROAD/HANA HIGHWAY INTERCHANGE LAYOUT

WSA WILBUR SMITH ASSOCIATES

- The segment of Kala Road between Hana Highway and Haleakala Highway would also be abandoned.

These road closures would require traffic now using these segments to use Hana Highway.

New Airport Spine Road

A new public roadway would be constructed east of and parallel to the existing runway to provide access to the general aviation, air cargo, and airport operations facilities in this area. Roadway features include:

- The new roadway would provide one lane in each direction. At the Hana Highway intersection, separate right-turn lanes would be provided for turning vehicles.
- On Hana Highway, an eastbound left-turn and westbound right-turn lane would be provided for turns into the Spine Road.
- The Spine Road approach to Hana Highway would be STOP sign controlled.

Modifications to Hansen and Pulehu Roads

The construction of the Airport Access Road interchange would necessitate the eastward relocation of the Pulehu Road connection to Hana Highway. With the future construction of a new Spine Road intersection with Hana Highway, the Preferred Plan seeks to minimize disruption to Hana Highway traffic by consolidating the Pulehu, Hansen, and Spine Road connections into a single intersection at the Spine Road junction.

- The existing segments of Hansen and Pulehu Roads between their junction and Hana Highway would be abandoned.
- Hansen Road would be extended from Pulehu Road to intersect Hana Highway opposite Spine Road, with the extension having one travel lane in each direction.
- Pulehu Road would form a T-intersection with Hansen Road, with the Pulehu Road approach controlled by a STOP sign. Separate left- and right-turn lanes would be provided on both roadways.
- The Hansen Road approach to Hana Highway would be STOP sign-controlled and would include a separate right-turn lane. An eastbound right-turn lane and westbound left-turn lane would be provided on Hana Highway.

AIRPORT TRIP GENERATION

Ground traffic forecasts for the Preferred Plan are based on the increase in air passenger activity above the level projected for the No Action Alternative, and on the relocation of helicopter facilities away from Kahului Airport. The Preferred Plan traffic estimates for 2010 are based on:

7,988,000 Annual Air Passengers
59 Based General Aviation Aircraft

The Preferred Plan results in an estimated 26,690 daily vehicle trips to or from the Airport West Ramp area on the August 2010 design day, and 610 daily vehicle trips to the East Ramp area. The estimated daily and peak hour trips are summarized in Table 4-1 for the August design day.

The Preferred Plan would result in a slightly larger trip generation for the West Ramp area, approximately 3.4 percent higher, as compared to the No Action Alternative. However, the relocation of the helicopter facilities results in substantially lower traffic generation for the East Ramp area, as well as a 2 percent lower trip generation for the combined East and West Ramp activities.

PEAK HOUR TRAFFIC VOLUMES

The projected 2010 design day traffic volumes on roadways in the vicinity of Kahului Airport are depicted in Figures 4-2 and 4-3 for the morning and afternoon commute hours, respectively. The traffic assignment reflects both the proposed roadway modification for the Airport, and the changes in Airport activity levels.

The new Airport Access Road is estimated to divert over one-half of the traffic volumes from Keolani Place. On the segments entering/exiting the West Ramp terminal area, the Airport Access Road would accommodate approximately 50 percent higher volumes than Keolani Place in the morning peak hour (1,334 versus 889 vehicles), and almost double in the afternoon peak hour (1,786 versus 918 vehicles). The Airport Access Road would serve most of the terminal area traffic, while Keolani Place would primarily serve traffic to the adjacent land uses and a portion of the terminal area traffic to/from the Wailuku-Kahului area.

An overview of the changes in 2010 peak hour traffic patterns with the Preferred Plan, as compared to the No Action Alternative, is presented in Table 4-2.

The largest changes to peak hour traffic volumes would occur along Dairy Road. Diversion of most West Ramp Terminal airport traffic to the new Airport Access Road would reduce traffic volumes on the segment north of Hana Highway, in the Kmart/Triangle Square blocks, by about 50 percent as compared to the No Action Alternative. A similar reduction would occur along Keolani Place. A larger reduction would occur on the segment south of Hana Highway (about 70-75 percent) since the Airport Access Road would also divert from this segment the traffic between East Maui and the South and West Maui areas.

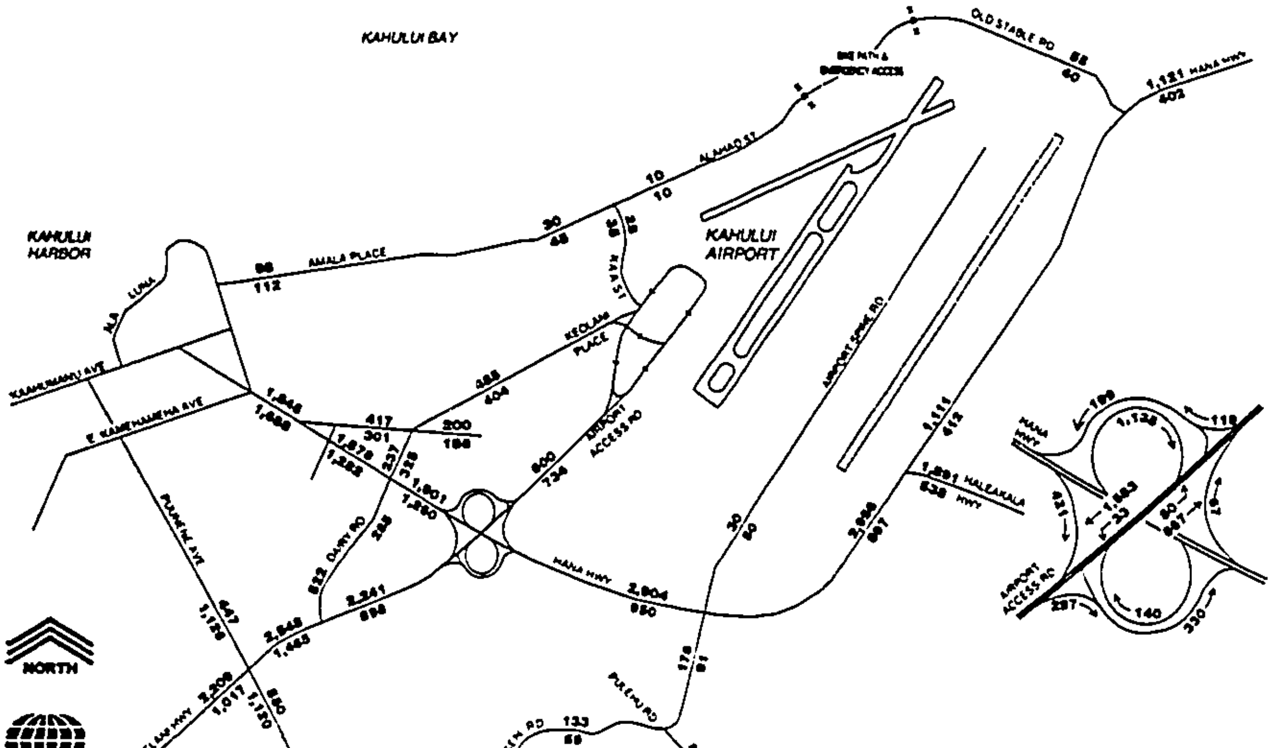


Figure 4-2
PREFERRED PLAN 2010 MORNING PEAK HOUR TRAFFIC

Table 4-1

KAHULUI AIRPORT VEHICLE TRIP GENERATION
PREFERRED PLAN
Kahului Airport Improvements - Traffic Impact Study

Activity	Morning Commute Peak Hour		Midday Airport Peak Hour		Afternoon Commute Peak Hour		Daily
	Enter	Exit	Enter	Exit	Enter	Exit	
Preferred Plan							
▸ West Ramp Terminal	925	788	1,039	1,435	758	1,137	26,690
▸ East Ramp, General Aviation, Other	50	30	*	*	40	54	810
Total	967	818	*	*	798	1,191	27,300
Difference Compared to No Action Plan							
▸ West Ramp Terminal	30	26	34	47	25	37	880
▸ East Ramp, General Aviation, Other	-85	-56	*	*	-106	-105	-1,410
Combined	-55	-30	*	*	-81	-68	-530

* = Not available.

Wilbur Smith Associates; March 1995

Table 4-2
(Page 1 of 2)

ESTIMATED PEAK HOUR TRAFFIC INCREASES/DECREASES WITH THE PREFERRED PLAN AS COMPARED TO THE NO ACTION ALTERNATIVE
Kahului Airport Improvements - Traffic Impact Study

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		No Action Traffic Volumes	Volume Change With Project	Percent Change	No Action Traffic Volumes	Volume Change With Project	Percent Change
Hana Highway at:							
• East of Haleakala Hwy. (Pukalani Junction)	Eastbound Westbound	407 1,076	5 35	1.2% 3.3%	1,023 426	7 -1	0.7% -0.2%
• East of New Airport Access Rd.	Eastbound Westbound	866 2,720	84 184	9.7% 6.8%	2,720 1,126	270 51	9.9% 4.5%
• East of Dairy Rd.	Eastbound Westbound	866 2,720	394 -819	45.5% -30.1%	2,720 1,126	-689 24	-25.3% 2.1%
• West of Haleakala Hwy. (West Junction)	Eastbound Westbound	1,640 1,846	48 -1	2.9% -0.1%	1,961 1,550	-9 -54	-0.5% -3.5%
Kaolani Pl. North of Haleakala Hwy.	Northbound Southbound	1,080 1,017	-676 -532	-62.6% -52.3%	779 1,396	-415 -844	-53.3% -60.4%
Dairy Road at:							
• North of Hana Hwy.	Northbound Southbound	810 617	-485 -380	-59.9% -61.6%	922 1,353	-436 -705	-47.3% -52.1%
• South of Hana Hwy.	Northbound Southbound	1,128 2,518	-843 -1,965	-74.7% -78.0%	2,729 2,061	-1,973 -1,571	-72.3% -76.2%

T-14/474D

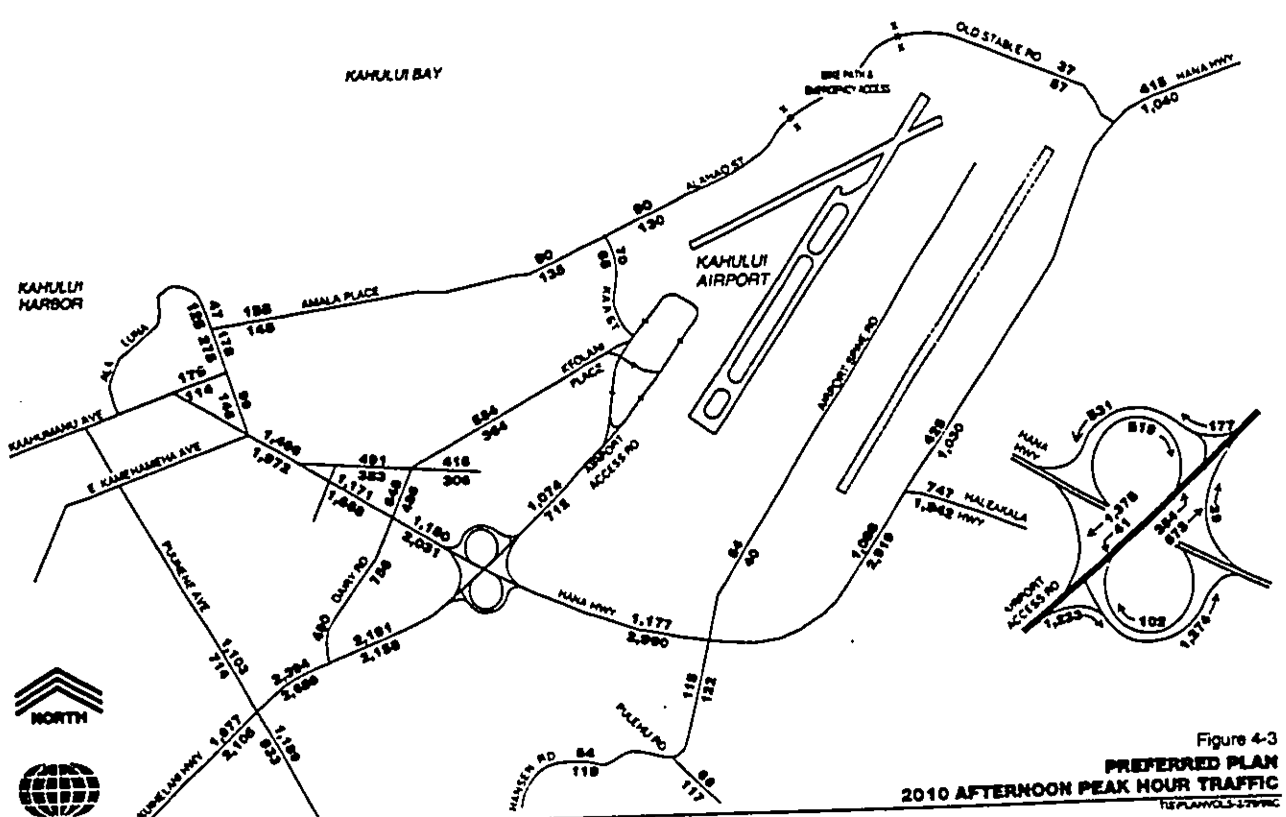


Figure 4-3
PREFERRED PLAN
2010 AFTERNOON PEAK HOUR TRAFFIC

Table 4-2
(Page 2 of 2)

ESTIMATED PEAK HOUR TRAFFIC INCREASES/DECREASES WITH THE PREFERRED PLAN AS COMPARED TO THE NO ACTION ALTERNATIVE
Kahului Airport Improvements - Traffic Impact Study

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		No Action Traffic Volumes	Volume Change With Project	Percent Change	No Action Traffic Volumes	Volume Change With Project	Percent Change
Haleakala Highway at:							
▸ South of Pukalani Jct.	Northbound Southbound	1,900 540	-9 -2	-0.5%	750	-3	-0.4%
▸ West of Dairy Rd.	Eastbound Southbound	469 555	-166 -136	-35.6% -24.9%	506 734	-123 -243	-24.3% -33.1%
Dairy Rd./Kuihelani Hwy. North of Puunene Ave.	Northbound Southbound	1,477 2,553	-12 -5	-0.8% -0.2%	2,736 2,450	-47 -56	-1.7% -2.3%

Wilbur Smith Associates: June 1995

The effects of the Preferred Plan would vary along the different segments of Hana Highway:

- Beyond the Pukalani and West Junctions with Haleakala Highway, the Preferred Plan volumes would show small increases or decreases from the No Action Alternatives. These nominal changes would result from the offsetting effects of the small increases in air passenger trips and the elimination of helicopter-related trips.

- Between Pukalani Junction and the Airport Access Road, traffic volumes would increase by 5 to 10 percent. The increase would result from the closure of Haleakala Highway between Pukalani Junction and Aalele Street, and the diversion of this traffic to Hana Highway.

- Between the Airport Access Road and Dairy Road, a variety of changes would occur due to the following:
  - Almost all of the traffic between East Maui and West Maui would be diverted to the new Airport Access Road, thus reducing volumes; and
  - Much of the Wailuku-Kahului traffic to the Airport would likely use the new Airport Access Road, thus increasing volumes on this segment.

  The net result would be a 25-30 percent reduction in peak direction traffic and increases to the off-peak direction traffic.

Decreases of 25 to 35 percent would also occur along Haleakala Highway near Dairy Road. This would occur due to less usage by airport traffic, and to the closure of the segment through the Airport.

Most other roadways would experience small decreases to no change in traffic volumes.

PEAK HOUR TRAFFIC CONDITIONS

Traffic conditions were analyzed at key locations with the Preferred Plan traffic forecasts and roadway modifications.

Conditions at Key Intersections

Conditions during the commute peak hours are summarized at the key intersections in Table 4-3. The conditions reflect the Year 2010 design day (average August day).

The Preferred Plan would result in improved conditions, as compared to the No Action Alternative, at each of the four intersections:

- **Dairy Road Intersections with Haleakala Highway and with Hana Highway** - The Preferred Plan would result in an improvement of intersection conditions to LOS B and C in the morning and afternoon peak hours, respectively, with traffic volumes of between 43 and 88 percent of available capacity. These substantial improvements, to very acceptable conditions, would result from diversion of traffic to the new Airport Access Road.

Table 4-3
(Page 2 of 2)
LEVELS-OF-SERVICE AT KEY INTERSECTIONS
PREFERRED PLAN YEAR 2010 DESIGN DAY
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
10	Pulehu Rd.	Hansen Rd.	1994		370	B		369	B
			2010 NA		451	A		509	A
			2010 PP		590	A		630	A
12	Haleakala Hwy.	Hana Hwy (Pulalani Jct.)	1994	0.95		E	0.65		C
			2010 NA	1.04		F	0.86		D
			2010 PP	0.90		C	0.59		B
13	Old Stable Rd.	Hana Hwy.	1994		96	E		40	E
			2010 NA		46	E		38	E
			2010 PP		44	E		37	E
14	Hansen - Spine Rd.	Hana Hwy.	2010 PP		-44	F		-28	F
15	Airport Access Rd.	Dairy Rd.	2010 PP	1.07		D	1.11		D
16	Airport Access Rd.	Hana Hwy. EB On-Ramp	2010 PP		279	C		80	E
17	Airport Access Rd	Hana Hwy. WB On-Ramp	2010 PP		306	B		-161	F

1994 = Existing Conditions (Year 1994)
2010 NA = No Action Alternative (Year 2010)
2010 PP = Preferred Plan (Year 2010)
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.

Wilbur Smith Associates; June 1995

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Table 4-3
(Page 1 of 2)
LEVELS-OF-SERVICE AT KEY INTERSECTIONS
PREFERRED PLAN YEAR 2010 DESIGN DAY
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
1	Hobron St.	Amala Pl.	1994		619	A		412	A
			2010 NA		619	A		412	A
			2010 PP		619	A		412	A
2	Kaahumanu Ave.	Hana Hwy.	1994		-5	F		59	E
			2010 NA		29	E		78	E
			2010 PP		31	E		96	E
3	Hobron St.	Kaahumanu Ave.	1994		532	A		390	B
			2010 NA		532	A		390	B
			2010 PP		[illegible]	A		[illegible]	B
4	Hobron St.	Hana Hwy.	1994		-13	F		-40	F
			2010 NA		-3	F		-18	F
			2010 PP		-3	F		-7	F
5	Haleakala Hwy.	Hana Hwy. (West Jct.)	1994		-229	F		135	D
			2010 NA		-406	F		-251	F
			2010 PP		-304	F		-180	F
6	Dairy Rd.-Kaolani Pl.	Haleakala Hwy.	1994		154	D		-177	F
			2010 NA	0.72		C	1.03		E
			2010 PP	0.43		B	0.56		C
7	Dairy Rd.	Hana Hwy.	1994	0.78		D	1.08		F
			2010 NA	1.01		E	1.27		F
			2010 PP	0.76		B	0.66		C
8	Dairy Rd.-Kuihelani Hwy.	Puunene Ave.	1994	0.78		D	0.86		E
			2010 NA	1.06		E	1.23		F
	Airport Access Rd.	Puunene Ave.	2010 PP	1.07		E	1.21		F

T-15/ 3b

- **Airport Access Road (present Dairy Road intersection with Puunene Avenue and Kuihelani Highway** - The Preferred Plan would result in a nominal improvement in the volume-to-capacity ratio, but intersection conditions would remain at congested levels.

- **Hana Highway Intersection with Haleakala Highway (Pukalani Junction)** - The Preferred Plan would result in a substantial improvement in traffic conditions for both peak hour periods, with capacity use dropping to 90 percent (from 103 percent) in the morning peak hour. This improvement would primarily result from the closure of the north leg of Haleakala Highway at the intersection, which would reduce traffic conflicts and allow more efficient operation of the traffic signal controls.

- **The New Airport Access Intersection with Dairy Road** - With traffic signal controls, the projected traffic volumes would exceed the planned capacity of the intersection during both peak periods. The traffic would exceed capacity by 7 and 11 percent during the morning and afternoon peak hours, respectively.

For the existing STOP sign-controlled intersections, the Preferred Plan would have the largest effect on the left-turn from Hana Highway onto Haleakala Highway at Triangle Square. The Preferred Plan would reduce the left-turn volume and thereby reduce the delays, although the left-turn conditions are projected to remain at LOS F during both peak hours. Installation of traffic signal controls may be needed both with or without the Preferred Plan.

The Preferred Plan would introduce four new key intersections with STOP or YIELD controls:

- The new T-intersection of Pulehu Road with Hansen Road would operate at LOS A.

- The new consolidated four-way intersection of Hansen and Spine Roads with Hana Highway would operate at LOS F during both peak hours.

- On Airport Access Road, within the Hana Highway interchange, the northbound left-turn onto the westbound on-ramp and the southbound left-turn onto the eastbound on-ramp would both be required to yield to on-coming through traffic:
  - The left-turn onto the westbound on-ramp would operate at LOS F during the afternoon peak hour and likely require traffic signal controls; and
  - The left-turn onto the eastbound afternoon peak hour would require future monitoring for possible congestion.

Conditions at the Airport Interchange Ramps

Traffic conditions were evaluated for the ramps of the planned partial cloverleaf interchange at the junction of the Airport Access Road with Hana Highway. The analyses were made for the individual ramp entry and exit points to the through lanes along Hana Highway, and for the conditions along the ramps.

Traffic conditions at the ramp merge and diverge points with Hana Highway are summarized in Table 4-4. During the morning peak hour, each ramp terminus would operate at LOS C or better except for the two westbound off-ramps. The entry to the westbound loop off-ramp (Hana-to-Lahaina movement) and the adjacent Hana Highway traffic would operate at LOS E due to the large traffic volume (1,135 vehicles) projected to use the ramp. The nearby upstream (east side) entry to the westbound off-ramp to the Airport would operate at LOS D. Even though the Airport off-ramp would accommodate a small volume of traffic (67 vehicles), conditions at the ramp entry area would be adversely affected by the large volume of traffic preparing to exit the nearby entry to the loop off-ramp.

For the afternoon peak hour, all of the ramps merge-diverge locations would operate at LOS C or better except for the eastbound on-ramp terminus area. At the eastbound ramp, the large volume of ramp traffic, coupled with the large volume of through traffic along Hana Highway, would result in LOS E conditions for Hana Highway traffic and LOS F conditions for traffic exiting the ramp.

PUBLIC TRANSPORTATION

The Preferred Plan would primarily affect public transportation through the reduction of future congestion on the roadways serving entry to and exit from Kahului Airport. This would apply to the various private operators, as well as to any public transit operations if such service should be extended to the Airport in the future.

BICYCLE FACILITIES

The direct effects on the planned bicycle routes in the vicinity of Kahului Airport would be as follows:

- The Preferred Plan should have no substantial effect upon the future development of the Northshore Greenway bicycle route.

- Along Hana Highway:
  - The Airport Access Road interchange would have eastbound and westbound ramp connections to Hana Highway with vehicles crossing the shoulder bicycle lane to enter or exit the ramps. Bicyclists along Hana Highway would have to cross these ramp entry/exit points with the attendant safety concerns. Bicycle travel along Hana Highway would be very difficult across the entrance to the westbound off-ramp and across the exit from the eastbound on-ramp due to the high volumes of vehicles forecast to use these ramps.

  - The Preferred Plan would consolidate the separate Pulehu and Hansen Road intersections into a single intersection and conflict point for bicyclists.

- The diversion of traffic volumes from Dairy Road and Keolani Place should reduce vehicle conflicts along these segments of planned bicycle routes.

ISLAND-WIDE TRAFFIC CONSIDERATIONS

The present island-wide plan of highway improvements for Maui was developed to serve the forecast traffic increases and roadway needs through Year 2010. The traffic forecasts were projected using the number of housing units, commercial uses, employment, and other socio-economic information, as projected for Year 2010. The socio-economic data, traffic forecasts, and resultant highway improvement program are documented in the *Maui Long-Range Highway Planning Study Final Report*.[1]

The traffic analyses for the Kahului Airport improvements also uses the *Island-Wide Highway Planning Study* to identify background (non-Airport) traffic increases as well as future roadway improvements in the vicinity of the Airport. These are described in Chapter 3. In addition, the island-wide Highway Plan also includes projects for other areas of the island, such as:

- Lahaina Bypass
- Honoapiilani Highway widening
- North Kihei Road widening
- Piilani Highway extension.

As part of the impact studies for the Kahului Airport modifications, Community Resources, Inc. also prepared forecasts of Year 2010 population and employment levels for each of the various improvement alternatives at Kahului Airport.[2] Table 4-5 provides a comparison of key socio-economic factors between these two studies: as used by the Highway Plan Study to identify island-wide roadway improvements, and as estimated by Community Resources, Inc. for conditions with the No Action Alternative and the Preferred Plan. A comparison of the socio-economic forecasts indicates:

- The island-wide estimates of population, housing units, and employment are substantially lower for both the No Action and Preferred Plan Kahului Airport alternatives than the 2010 forecasts used to develop the island-wide roadway improvements.
- The estimated population and employment for the Preferred Plan are about 3 to 4 percent higher than with the No Action Alternative.

(1) Op.Cit.

(2) *Socio-economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements, Draft Report*, prepared for E.K. Noda & Associates, Inc. by Community Resources, Inc., November 17, 1994.

Table 4-4

LEVEL-OF-SERVICE AT RAMP TERMINI WITH HANA HIGHWAY
AIRPORT ACCESS ROAD INTERCHANGE
PREFERRED PLAN 2010 DESIGN DAY
Kahului Airport Improvements - Traffic Impact Study

Ramp	Morning Peak Hour		Afternoon Peak Hour	
	Hana Highway Lanes Traffic	Ramp Merge/ Diverge Traffic	Hana Highway Lanes Traffic	Ramp Merge/ Diverge Traffic
Eastbound Hana Highway				
• Lahaina Off-Ramp	C	B	C	B
• Airport Loop Off-Ramp	C	B	C	C
• Eastbound On-Ramp	C	B	E	F
Westbound Hana Highway				
• Airport Off-Ramp	D	D	C	A
• Lahaina Loop Off-Ramp	E	E	C	B
• Westbound On-Ramp	C	B	C	B

Wilbur Smith Associates; April 1995

T-32/474D

- The estimated number of visitor units and the average daily visitor census are about one percent higher for the Preferred Plan than the estimates used as the basis of the island-wide Highway Plan. The Preferred Plan forecast are about 4 percent higher than the No Action Alternative.

The Highway Plan Study estimates that these projected land uses and socio-economic factors would generate an island-wide total of about 614,500 vehicle trips on a typical weekday in Year 2010. WSA estimates that the socio-economic projections for the No Action Alternative and the Preferred Plan would result in approximately 549,900 and 567,400 daily vehicle trips, respectively.

The estimated daily trips for both the No Action Alternative and Preferred Plan are lower than the Highway Plan forecasts. Therefore, assuming that the growth is distributed throughout Maui in a similar manner for all these scenarios, the highway improvements included in the Highway Plan Study should also be appropriate to serve the needs of either the No Action Alternative or the Preferred Plan.

The Preferred Plan is estimated to generate about 3 percent more daily trips, island-wide than the No Action Alternative. If the traffic increases are distributed in a similar pattern around the island, the 3 percent differential may result in some increased delays on any roadway section nearing capacity. However, a 3 percent difference is unlikely to generate the need for fewer or additional improvements in the major travel corridors.

The State DOT and Maui County are now conducting a study to update the long-range, island-wide Highway Plan to serve travel needs through Year 2020. Due to current expectations for lower rates of future growth, the population and employment forecasts for 2020 are similar to those used in the previous Highway Plan Study for Year 2010. This may result in a similar level of highway improvements to those now planned for Year 2010, but implemented over a longer time period. The State DOT and Maui County should monitor traffic increase on Maui roadways to reconfirm both the timing and adequacy of these planned roadway improvements.

MITIGATION ACTIONS

The Preferred Plan would result in several of the new road intersections accommodating traffic volumes in excess of the planned capacity and/or resulting in an unacceptable service level. These locations and the potential mitigation actions are discussed in the following paragraphs. The intersection conditions with the mitigation actions are summarized in Table 4-6.

Hana Highway Intersection With Hansen/Spine Road

The proposed STOP sign controls would result in LOS F conditions for left-turns from the Hansen and Spine Roads approaches.

- Traffic signal controls could be installed at this intersection to provide protected movement for traffic exiting the cross streets. For the design day volumes, the intersection would operate at LOS B (afternoon) or C (morning), and with peak hour volumes near the intersection capacity.

Table 4-5

COMPARISON OF ISLAND-WIDE MAUI HIGHWAY PLAN FORECAST BASIS TO AIRPORT FORECASTS
Kahului Airport Improvements - Traffic Impact Study

Item	Basis of Maui 2010 Island-Wide Highway Plan(1)	2010 Airport Scenarios(2)	
		No Action Alternative	Preferred Plan
Resident Population	149,068	129,880	133,720
Housing Units	54,210	47,020	48,420
Employment	50,271	69,090	71,120
Visitor Units	30,070	—	—
Visitor Units (occupied)	24,080	23,400	24,320
Average Visitor Census	67,450	65,510	68,100
Estimated Island-Wide Daily Vehicle Trips	614,500	549,900(3)	567,400(3)

(1) = *Maui Long-Range Highway Planning Study, Island-Wide Plan Final Report*, prepared for State DOT, County of Maui Department of Public Works, and County of Maui Department of Planning, by Austin Tsutsumi & Associates, Inc., May 1991.
(2) = *Socio-economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements, Draft Report*, prepared for E.K. Noda & Associates, Inc., by Community Resources, Inc., November 17, 1994.
(3) = Wilbur Smith Associates, May 1995

Wilbur Smith Associates; May 1995

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Airport Access Road Intersection with Dairy Road

With the proposed numbers of lanes, the forecast traffic volumes would exceed capacity of this intersection during both the morning and afternoon peak hours.

- Provision of a second northbound left-turn lane on the Airport Access Road would improve the intersection to a volume-to-capacity ratio of V/C 1.00 in both peak hours.
- Provision of a second right-turn lane on Dairy Road, in addition to the second northbound left-turn lane, would result in volumes at 84 percent of capacity.

Northbound Left-Turn from Airport Access Road onto Westbound On-Ramp to Hana Highway (Airport Interchange)

The large volume of left-turn vehicles from northbound Airport Access Road would result in LOS F conditions for the left-turn traffic during the afternoon peak hour.

- Installation of traffic signal controls on Airport Access Road would provide a protected left-turn movement, with overall intersection conditions at LOS A.

Airport Access Road Intersection with Kuihelani Highway and Puunene Avenue

Although the Preferred Plan would not worsen conditions at the intersection of the Airport Access Road, Kuihelani Highway and Puunene Avenue, this intersection would accommodate volumes in excess of planned capacity during both peak hours. The undesirable conditions would occur with either the No Action Alternative or the Preferred Plan. Conditions at this intersection could be improved by:

- Add a third northbound through lane on Kuihelani Highway, with the lane beginning just south of Puunene Avenue and extending north along the new Airport Access Road to the new Dairy Road intersection.
- Add a third southbound through lane to the Airport Access Road from the Dairy Road intersection through the Puunene Avenue intersection, with the lane ending and traffic merging into the remaining two through lanes a short distance south of Puunene Avenue. The lane could begin as a "free" right-turn lane from Dairy Road, with the right-turn traffic having to stop only for crossing pedestrians.
- Add a second left-turn lane to the eastbound approach of Puunene Avenue, for left-turns northbound towards Hana Highway.

These modifications would reduce the volume-to-capacity ratio to V/C 0.78 and 0.89 during the morning and afternoon peak hours, respectively.

Table 4-6

LEVELS OF SERVICE AT KEY INTERSECTIONS
PREFERRED PLAN ALTERNATIVE (YEAR 2010 DESIGN DAY) WITH MITIGATION
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
8	Airport Access Rd - Kuihelani Hwy.	Puunene Ave	2010 PP 2010 PPM	1.07 0.78		E D	1.21 0.89		F D
14	Hansen-Spine Rd.	Hana Hwy.	2010 PP 2010 PPM	 0.95	-40	F C	 0.95	-28	F B
15	Airport Access Rd.	Dairy Rd.	2010 PM 2010 PPM(1) 2010 PPM(2)	1.07 1.00 0.84		D D B	1.11 1.00 0.84		D D B
17	Airport Access Rd.	Hana Hwy. WB On-Ramp	2010 PP 2010 PPM	 0.20	398	B A	 0.55	-161	F A

2010 PP = Preferred Plan (Year 2010).
2010 PPM = Preferred Plan (Year 2010) with Mitigation.
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.
(1) = With second northbound left-turn lane.
(2) = With second northbound left-turn lane plus second right-turn lane on Dairy Road.

Wilbur Smith Associates; June 1995

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Airport Interchange Eastbound On-Ramp to Hana Highway

The large volume of traffic using the eastbound on-ramp from the Airport Access Road to Hana Highway during the afternoon peak hour would result in LOS F conditions at the merge point with Hana Highway.

- The merge conditions could be improved by construction of an auxiliary lane along eastbound Hana Highway to provide more distance for merging of the ramp traffic into the through traffic.

Airport Interchange Westbound Off-Ramp from Hana Highway

The large volume of traffic exiting from westbound Hana Highway onto the loop-ramp to Airport Access Road (Hana-to-Lahaina movement) would result in LOS E conditions for the diverge point and adjacent through lanes during the morning peak hour. Potential mitigation actions include:

1. Provide an auxiliary lane along westbound Hana Highway to provide more distance for the divergence of ramp traffic from the through lanes.

2. Provide more distance between the exit points for the two westbound off-ramps.

Each of these alternatives should be further considered during the design process.

Hana Highway Bicycle Route at Airport Access Road Interchange Ramps

The proposed interchange would result in traffic crossing the Hana Highway shoulder bicycle lanes at six ramp entry or exit points, with two of these crossings accommodating very high volumes of traffic. These bicycle-vehicle conflicts would pose safety concerns and potential delay to cyclists. Alternative approaches to the bicycle route crossing vehicle traffic at the ramp entry-exit points, that would improve bicyclist safety, include the following:

1. Delete the section of Hana Highway between Dairy Road and Haleakala Highway from planned use as a designated bicycle route. Bicyclists along Hana Highway would be directed to use the Northshore Greenway bicycle facility for travel through this section, with access and direction provided in the harbor area, the Old Stable Road, and the Dairy Road area.

   This would require development of a bicycle connection through the Airport and along Old Stable Road at the same time as the construction of the Airport Access Road.

   This approach would result in additional travel for many of the bicycle trips needing to travel to locations between Dairy Road and Old Stable Road.

   This approach does not reduce safety concerns or reduce delays for those bicyclists who choose to travel via Hana Highway rather than the coastal bicycle route.

2. Establish a bicycle crossing for each ramp at a right angle to each ramp and at a location along the ramp that provides good visibility for both the motorist and the bicyclist. Establish a low vehicle speed limit on the ramp. Provide a marked bicycle lane between Hana Highway and the crossing.

   This maximizes safety for an at-grade crossing, but does not eliminate the conflict.

3. Construct a grade-separated crossing of the six ramps.

   This approach would require several million dollars in construction funds, with the amount dependent upon the design concept.

   If the crossing is not convenient or secure for the bicyclist, some may continue to use the shoulder area to cross the ramp entry/exit locations.

4. Construct a grade-separated crossing of the two highest volume ramps (Hana-to-Lahaina and Lahaina-to-Hana) and establish at-grade crossings of the other ramps.

The planned bicycle route into the Airport West Ramp area is via Dairy Road. With the proposed interchange, a bicycle route could be designated along the paved shoulder of the westbound Hana-to-Airport off-ramp and the eastbound Airport/Lahaina-to-Hana on-ramp, as well as the portion of the Airport Access Road north of Hana Highway. The bicycle routes along these ramp shoulder areas could be used by bicyclists travelling between the East Maui/Upcountry Maui area and the Airport West Ramp and adjacent beach areas. Bicyclists using this route could avoid crossing the ramp entry-exit points along Hana Highway.

Each of these approaches should be considered during the design process before final selection of the approach for accommodating bicycle use through this corridor.

5. YEAR 2010 CONDITIONS WITH ALTERNATIVE AIRPORT IMPROVEMENT PLANS

Six alternative concept plans were also formulated and considered during the development process[1] for the Preferred Plan of Improvements for Kahului Airport. Each of these six alternative plans include elements that would likely result in a change in the number of vehicle trips to/from Kahului Airport, or changes to airport access. The assessment of the traffic impacts for these alternative plans has focussed on those plan elements that would likely result in substantial changes from the traffic impacts identified for the Preferred Plan (Chapter 4).

DESCRIPTION OF THE ALTERNATIVES

The six alternative plans differ from the Preferred Plan in several aspects that could affect the number of ground trips attracted to Kahului Airport or the traffic circulation patterns near the Airport. The key differences are:

1) The runway lengths, which could affect air passenger levels;
2) The potential changes to locations of helicopter and general aviation activities; and
3) Changes in the location of access to the East Ramp activities.

These differences between the Preferred Plan and the alternative plans are summarized in Table 5-1. The estimated number of annual air passengers reflect the different runway lengths, which would affect direct overseas flights and the convenience of travel from some overseas destinations, as discussed in the *Socio-economic Impact Assessment of the Kahului Airport Improvements*.[2] The 'fferences include the following:

- **Runway Length/Annual Air Passengers**
  - Alternatives #3 and #5 include runway lengths and air passenger forecasts similar to the Preferred Plan.
  - Alternatives #1, #2 and #6 include shorter runway lengths, and air passenger forecasts closer to those of the No Action alternative.
  - Alternative #4 includes a slightly longer runway and higher air passenger forecasts than the Preferred Plan.
- **Location of Helicopter Facility**
  - Alternatives #2 and #6 would relocate the facility, and its ground traffic, away from Kahului Airport.
  - Alternatives #1 and #3 would retain the facility near its present location.

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[1] *Kahului Airport Master Plan*, prepared for State of Hawaii Department of Transportation Airports Division, by Belt Collins & Associates and Aries Consultants, Ltd., June 1993.

[2] *Socio-Economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements, Draft Report*, prepared for F.K. Noda & Associates, Inc., by Community Resources, Inc., November 17, 1994.

Table 5-1

SUMMARY DESCRIPTION OF ALTERNATIVES FOR YEAR 2010 TRAFFIC ANALYSIS
Kahului Airport Improvements - Traffic Impact Study

Analysis Scenarios	Runway Length (feet) Main/Parallel	Helicopter Location	General Aviation Location	Access Road to East Ramp	Annual Number of Air Passengers(1)
No Action	7,000/None	East Ramp	East Ramp	Haleakala Hwy.	7,726,000
Preferred Plan	9,600/8,500	Remote Site	East Ramp	New Spine Rd.	7,988,000
Alternative Plans					
#1	7,000/None	East Ramp	Remote Site	Haleakala Hwy.	7,726,000
#2	8,500/3,500	Remote Site	East Ramp	Kala Rd. Area	7,792,000
#3	9,500/8500	East Ramp	East Ramp	New Spine Rd.	7,988,000
#4	10,500/10,500	South of Hana Hwy.	East Ramp	New Spine Rd.	8,053,000
#5	9,500/8,500	South of Hana Hwy.	East Ramp	New Spine Rd.	7,988,000
#6	8,500/7,000	Remote Site	East Ramp	Old Stable Rd.	7,792,000

(1) Source. *Socio-Economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements, Draft Report*, prepared for E.K. Noda & Associates, Inc. by Community Resources, Inc., November 17, 1994.

Wilbur Smith Associates; April 1995

- Alternatives #4 and #5 would relocate the facility, and its ground traffic, to a site at the southeast corner of the Hana Highway/Haleakala Highway intersection, with access via Haleakala Highway.

- **Location of General Aviation**
  - Alternative #1 would relocate the facility, and its ground traffic, away from Kahului Airport.
  - The other alternatives would retain general aviation in the East Ramp area.

- **East Ramp Access Road**
  - Alternatives #3, #4, and #5 would provide the same access, via a new Spine Road, as the Preferred Plan.
  - Alternative #1 would continue access via the Pukalani Junction intersection of Hana Highway and Haleakala Highway.
  - Alternative #2 would relocate access to near the Kala Road intersection with Hana Highway.
  - Alternative #6 would relocate access to use the Old Stable Road connection to Hana Highway.

- **West Spreckelsville Access**
  - Alternative #4 runway extension would require abandonment of the Old Stable Road connection to Hana Highway. Access to West Spreckelsville would be provided via extension of Alahao Street across the Airport.

All alternatives would include several roadway modifications identified for the Preferred Plan:

- All would include the new Airport Access Road and Interchange;
- All would include the closure of Haleakala Highway through the Airport; and
- All would include the closure of Pulehu Road between Hana Highway and Hansen Road.

METHODOLOGY AND ASSUMPTIONS

e assessment of traffic impacts for the alternative plans are based on the same methodologies and assumptions described for the No Action Alternative and Preferred Plan.

COMPARISON OF VEHICLE TRIP GENERATION

The estimated numbers of vehicle trips generated by the Kahului Airport activities for each alternative plan is summarized in Table 5-2. The estimates include the Year 2010 design day, and the morning and afternoon commute peak hours. Estimated trip generation for the Preferred Plan is provided as a basis of comparison. The principal findings are:

- The differences in estimated air passenger volumes, due to the various runway configurations, would have little effect on the traffic volumes to/from the West Ramp terminal area.

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Table 5-2
(Page 1 of 2)
ESTIMATED VEHICLE TRIP GENERATION FOR ALTERNATIVE PLANS
Kahului Airport Improvements - Traffic Impact Study

Scenario/Location	Design Day		Morning Peak Hour				Afternoon Peak Hour			
	Vehicle Trips	Percent Change	Trips In	Trips Out	Total Trips	Percent Change	Trips In	Trips Out	Total Trips	Percent Change
Preferred Plan										
▸ West Ramp	26,690		925	788	1,713		750	1,137	1,886	
▸ East Ramp	610		50	30	80		40	54	94	
Total	27,300	—	975	818	1,793	—	790	1,191	1,980	—
Alternative #1										
▸ West Ramp	25,810		895	762	1,657		733	1,100	1,833	
▸ East Ramp	1,630		113	68	181		118	128	246	
Total	27,400	+0.5%	1,008	830	1,838	+2.5%	851	1,228	2,079	+4.5%
Alternative #2										
▸ West Ramp	26,030		902	769	1,671		730	1,108	1,848	
▸ East Ramp	610		50	30	80		40	54	93	
Total	26,640	-2.4%	952	799	1,751	-2.3%	770	1,162	1,942	-2.4%
Alternative #3										
▸ West Ramp	26,690		925	788	1,713		750	1,137	1,886	
▸ East Ramp	2,020		135	86	221		146	158	305	
Total	28,920	+5.9%	1,060	880	1,940	+8.0%	910	1,306	2,216	+11.4%

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KAHULUI AIRPORT IMPROVEMENTS - TRAFFIC IMPACT STUDY

WSA WILBUR SMITH ASSOCIATES

Table 5-2
(Page 2 of 2)
ESTIMATED VEHICLE TRIP GENERATION FOR ALTERNATIVE PLANS
Kahului Airport Improvements - Traffic Impact Study

Scenario/Location	Design Day		Morning Peak Hour				Afternoon Peak Hour			
	Vehicle Trips	Percent Change	Trips In	Trips Out	Total Trips	Percent Change	Trips In	Trips Out	Total Trips	Percent Change
Alternative #4										
• West Ramp	26,900		833	794	1,727		764	1,146	1,910	
• East Ramp[1]	2,020		135	86	221		146	158	305	
Total	28,920	+5.9%	1,068	880	1,948	+6.8%	910	1,305	2,215	+11.4%
Alternative #5										
• West Ramp	26,690		925	798	1,713		758	1,137	1,895	
• East Ramp[1]	2,030		135	86	221		146	159	305	
Total	28,719	+6.2%	1,060	874	1,934	+7.9%	904	1,296	2,200	+10.8%
Alternative #6										
• West Ramp	28,030		902	769	1,671		739	1,109	1,848	
• East Ramp	610		50	30	80		40	54	94	
Total	28,640	-2.4%	952	799	1,751	-2.3%	779	1,163	1,942	-2.4%

(1) Helicopter field is located south of Hana Highway, but vehicle trips are included in East Ramp totals.

Wilbur Smith Associates; April 1995

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- For design day traffic, the West Ramp daily volumes would vary between 880 fewer trips to 210 more trips as compared to the Preferred Plan. This represents a difference of -3.3 to +0.8 percent in the number of vehicle trips to/from the Terminal area.
- On the design day, the morning peak hour traffic for the alternatives would range between 56 fewer to 14 more vehicle trips then the Preferred Plan.
- On the design day, the afternoon commute peak hour traffic for the alternatives would range between 62 fewer to 15 more vehicle trips than the Preferred Plan.

- Alternatives #3, #4 and #5 would result in the largest increases in total traffic to/from Kahului Airport, with estimated increases of about 5 to 6 percent in design day traffic, and 8 to 11 percent in peak hour trips. The larger increases for each of these alternatives would result from the continuation of the helicopter operations at East Ramp (Alternative #3) or adjacent to East Ramp (Alternatives #4 and #5).

- Alternatives #2 and #6 would result in about 2.4 percent fewer trips than the Preferred Plan, due to smaller air passenger volumes and the relocation of the helicopter operations away from the Airport.

- Alternative #1 would result in a smaller net increase in vehicle trips due to the lowest air passenger volumes, but with continued helicopter operations.

These estimated numbers of airport trips indicate the following relative to the assessment of traffic impacts:

1. The alternatives would have only minor effects on traffic volumes to/from the West Ramp area.

2. The major differences in traffic volumes and roadway conditions would mostly occur as a result of the changed Airport operations and roadway connections in the East Ramp area, with the largest effects occurring along the adjacent roadways and intersections.

ALTERNATIVE #1 TRAFFIC CONDITIONS

From the perspective of traffic impacts, Alternative #1 largely represents a combination of the travel demands comparable to the No Action Alternative, with addition of the Airport Access Road. This alternative plan also continues access to the East Ramp area via Pukalani Junction. General aviation is relocated away from Kahului Airport, but helicopter operations are retained at the East Ramp area.

Peak Hour Traffic Volumes

Alternative Plan #1 would result in several changes to traffic volumes on area roadways, as compared to the Preferred Plan:

1. Alternative #1 would increase the traffic on the segment of Hana Highway between Hansen Road and the Pukulani Junction with Haleakala Highway due to the use of Pukulani Junction as the only access to the East Ramp, and due to the increased East Ramp traffic (the addition of helicopter operations generate much higher traffic volumes then the general aviation included in the Preferred Plan).

2. The location of helicopter operations at East Ramp would also increase traffic on Hana Highway between the Airport Access Road and Hansen Road, as well as along Hansen Road.

3. Small proportional increases and decreases would occur along other roadways in the Airport area as a result of the net effect of fewer trips to the West Ramp terminal area (due to fewer air passengers) and the increased trips to East Ramp (due to the inclusion of helicopter operations).

The estimated net increases/decreases in peak hour traffic on Airport area roadways, as compared to the Preferred Plan, are summarized in Table 5-3.

With the exception of the 10 to 18 percent increases on the aforementionned segment of Hana Highway between Hansen Road and Pukulani Junction, and on the Hansen Road south of Hana Highway, the changes generally amount to between a 3 percent decrease and a 3 percent increase from the peak hour volumes with the Preferred Plan.

Peak Hour Traffic Conditions

Traffic conditions at the intersections most directly affected by Alternative Plan #2 are compared in Table 5-4 to forecast conditions with the Preferred Plan. The key comparisons are as follows:

- The retention of Haleakala Highway on the north side of Hana Highway for access to East Ramp would result in projected traffic in excess of available capacity at the Pukulani Junction Intersection during the morning peak hour. As a minimum, provision of an additional southbound lane as a separate left-turn lane would be needed to mitigate conditions at this intersection.

- The reduction in West Ramp traffic would improve conditions for the northbound left-turn from Airport Access Road to the westbound on-ramp to Hana Highway. However, traffic signal controls would still be appropriate at this location to address the afternoon LOS F conditions.

- At the intersection of the Airport Access Road with Puunene Avenue, the addition of traffic to/from the helicopter facility would increase the volume-to-capacity ratio to 1.10 (from V/C 1.07) for the morning peak hour. The mitigation measures identified for the Preferred Plan would be sufficient to address Alternative #1 traffic.

The Alternative #1 traffic would generally result in no change or little change of conditions at the ...er intersections.

Table 5-3
(Page 1 of 2)

ESTIMATED DIFFERENCE IN PEAK HOUR TRAFFIC
ALTERNATIVE #1 COMPARED TO PREFERRED PLAN

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		Preferred Plan Traffic	Traffic Change[1]	Percent Change[1]	Preferred Plan Traffic	Traffic Change[1]	Percent Change[1]
Hana Highway at:							
• East of Haleakala Hwy. (Pukalani Jct.)	Eastbound Westbound	412 1,111	0 1	0.0% 0.1%	1,030 425	1 0	0.1% 0.0%
• East of Hansen Rd.	Eastbound Westbound	897 2,956	93 51	10.4% 1.7%	2,919 1,086	107 139	3.7% 12.8%
• East of New Airport Access Rd.	Eastbound Westbound	950 2,904	41 20	4.3% 0.7%	2,990 1,177	80 48	2.7% 4.1%
• East of Dairy Rd.	Eastbound Westbound	1,901 1,260	12 5	0.6% 0.4%	2,031 1,150	7 6	0.3% 0.5%
Airport Access Road at:							
• North of Hana Hwy.	Northbound Southbound	734 600	-22 -26	-3.0% -4.3%	712 1,074	-22 -32	-3.1% -3.0%
• South of Hana Hwy	Northbound Southbound	898 2,241	13 -5	1.4% -0.2%	2,158 2,191	24 13	1.1% 0.6%
Kaolani Place	Northbound Southbound	454 485	-4 -4	-0.9% -0.8%	364 554	-3 -5	-0.8% -0.9%
Dairy Road North of Hana Hwy.	Northbound Southbound	325 237	-2 -2	-0.6% -0.8%	486 648	-2 -3	-0.4% -0.5%
Haleakala Hwy. South of Pukalani Jct.	Northbound Southbound	1,891 536	3 -1	0.2% -0.2%	747 1,942	2 2	0.3% 0.1%

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Table 5-4

LEVELS-OF-SERVICE AT KEY INTERSECTIONS
ALTERNATIVE PLAN #1
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
7	Dairy Rd.	Hana Hwy.	PP AP1	0.76 0.77		B C	0.86 0.87		C C
8	Airport Access Rd	Puunene Ave	PP AP1	1.07 1.10		E F	1.21 1.21		F F
11	Hansen Rd.	Hana Hwy.	PP AP1		-44 -46	F F		-28 -31	F F
12	Haleakala Hwy. (Pukalani Junction)	Hana Hwy.	PP AP1	0.90 1.06		C F	0.59 0.74		B C
15	Airport Access Rd.	Dairy Rd.	PP AP1	1.07 1.07		D D	1.11 1.11		D D
17	Airport Access Rd	Hana Hwy WB On-Ramp	PP AP1		396 522	B D		-161 -74	F F

PP = Preferred Plan.
AP1 = Alternative Plan #1.
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.

Wilbur Smith Associates; June 1995

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Table 5-3
(Page 2 of 2)

ESTIMATED DIFFERENCE IN PEAK HOUR TRAFFIC
ALTERNATIVE #1 COMPARED TO PREFERRED PLAN

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		Preferred Plan Traffic	Traffic Change(1)	Percent Change(1)	Preferred Plan Traffic	Traffic Change(1)	Percent Change(1)
Kuihelani Hwy. South of Puunene Ave.	Northbound Southbound	1,017 2,209	13 2	1.3% 0.1%	2,105 1,677	17 24	0.8% 1.4%
Puunene Ave. South of Kuihelani Hwy.	Northbound Southbound	550 1,120	-2 -9	-0.4% -0.8%	1,189 933	-2 -7	-0.2% -0.8%
Hansen Rd. South of Hana Hwy.	Northbound Southbound	91 176	12 11	13.2% 6.3%	122 118	22 21	18.0% 17.8%

(1) Increase or decrease (-) in Year 2010 traffic with Alternative #1, as compared to the Preferred Plan.

Wilbur Smith Associates; May 1995

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ALTERNATIVE #2 TRAFFIC CONDITIONS

The Alternative #2 plan includes limited runway expansion and estimated air passenger levels about 1 percent higher than the No Action Alternative and 2.5 percent below the Preferred Plan. The helicopter facility is relocated away from Kahului Airport. Access to the East Ramp general aviation area would be relocated to the vicinity of Kala Road.

Peak Hour Traffic Volumes

The small reduction (2.5 percent) in West Ramp Terminal traffic would result in small decreases in peak hour traffic volumes for most major roadways near Kahului Airport, as compared to the Preferred Plan. The small traffic reduction of less than 0.5 percent, as compared to the Preferred Plan forecasts, listed in Table 5-5 for the segments of Hana Highway east of Old Stable Road and west of the Airport Access road would be representative of these changes.

Alternative #2 would result in higher traffic volumes along the segment of Hana Highway between Kala Road (access to East Ramp) and the Hansen Road area. This would be due to the addition of traffic between East Ramp and the Wailuku-Kahului and South and West Maui areas which, under the Preferred Plan, would access Hana Highway at the Spine Road-Hansen Road intersection.

Peak Hour Traffic Conditions

Traffic conditions at intersections most directly affected by Alternative #2 are listed in Table 5-6.

- Use of the Kala Road Intersection with Hana Highway for access to East Ramp would result in acceptable service levels during the peak traffic hours. This is based on an upgrading of Kala Road to a standard two-lane cross-section and provision of left-turn storage lanes at the intersection with Hana Highway.
- The addition of East Ramp traffic volumes along the Hana Highway through the Haleakala Highway intersection would result in slightly worse conditions than with the Preferred Plan.
- Elimination of the Spine Road, and its traffic conflicts with Hansen Road traffic at the shared intersection in the Preferred Plan, would result in a nominal improvement of conditions for Hansen Road traffic exiting onto Hana Highway.

Table 5-6

**ESTIMATED DIFFERENCE IN PEAK HOUR TRAFFIC
ALTERNATIVE #2 COMPARED TO PREFERRED PLAN**
Kahului Airport Improvements - Traffic Impact Study

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		Preferred Plan Traffic	Traffic Change(1)	Percent Change(1)	Preferred Plan Traffic	Traffic Change(1)	Percent Change(1)
Hana Highway at:							
• West of Old Stable Rd.	Eastbound Westbound	412 1,111	-1 -1	-0.2% -0.1%	1,030 425	-1 -0-	-0.1% 0.0%
• East of Haleakala Hwy. (Pukalani Jct.)	Eastbound Westbound	412 1,111	44 24	10.7% 2.2%	1,030 425	37 52	3.6% 12.2%
• East of Hansen Rd.	Eastbound Westbound	897 2,956	37 16	4.1% 0.5%	2,919 1,086	33 48	1.1% 4.4%
• East of Airport Access Rd.	Eastbound Westbound	950 2,904	-4 -3	-0.4% -0.1%	2,990 1,177	-2 -1	-0.1% -0.1%
Hansen Road at South of Hana Hwy	Northbound Southbound	91 176	-0- -0-	0.0% 0.0%	116 122	-0- -0-	0.0% 0.0%
Haleakala Hwy. South of Hana Hwy.	Northbound Southbound	1,891 536	-3 -2	-0.2% -0.4%	747 1,942	-1 -1	-0.1% -0.1%

(1) Increase or decrease (-) in Year 2010 traffic with Alternative #2, as compared to the Preferred Plan.

Wilbur Smith Associates; June 1995

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Table 5-6

LEVELS-OF-SERVICE AT KEY INTERSECTIONS
ALTERNATIVE PLAN #2
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
11	Hansen Rd.	Hana Hwy.	PP AP2		-46 -45	F F		-28 -28	F F
12	Haleakala Hwy.	Hana Hwy.	PP AP2	0.90 0.95		C D	0.59 0.60		B B
19	Kala Rd.	Hana Hwy.	AP2		128	D		410	A

PP = Preferred Plan
AP2 = Alternative Plan #2
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service

Wilbur Smith Associates; April 1995

ALTERNATIVE #3 TRAFFIC CONDITIONS

The Alternative #3 plan is similar to the Preferred Plan, except this alternative would retain the helicopter facility in the East Ramp area.

Peak Hour Traffic Volumes

Peak hour traffic volumes for Alternative Plan #3 would be similar to those for the Preferred Plan except for those roadway segments most directly affected by traffic to/from the East Ramp helicopter facilities. The largest volume increases would be on the segment of Hana Highway between Spine Road and Airport Access Road, with combined two-directional increase of 83 and 120 vehicles during the morning and afternoon peak hours, respectively (see Table 5-7). Other roadways receiving the larger volume increases would be the Hansen Road, Airport Access Road, and Kuihelani Highway. Each of these roadways provides connecting routes to the Kihei and West Maui visitor areas, as well as to resident areas. The largest proportional increase in traffic would occur along Hansen Road, where the 41 morning and 80 afternoon peak hour trips would add a 9 to 33 percent increase to the projected Year 2010 traffic with the Preferred Plan.

Peak Hour Traffic Conditions

The key intersections most directly affected by the additional traffic to/from the helicopter facility would include Hana Highway intersection with the Spine and realigned Hansen Roads, and the Airport Access Road intersections with Dairy Road and with Puunene Avenue/Kuihelani Highway. The traffic increases would result in a worsening of traffic problems anticipated for each of these intersections with the Preferred Plan (see Table 5-8).

The additional traffic would increase the need for the mitigative actions identified at these locations with the Preferred Plan.

ALTERNATIVE #4 TRAFFIC CONDITIONS

This alternative differs from the Preferred Plan through two key elements that would affect traffic conditions in the Airport area:

- The helicopter facility is relocated to a new site opposite Hana Highway from East Ramp. However, the new site at the southeast corner of the Haleakala Highway intersection would use Hana and Haleakala Highways for access. The new heliport access road would be connected to Haleakala Highway south of the Hana Highway intersection.

- The runway extension would require closure of Old Stable Road. West Spreckelsville traffic and beach traffic would use Alahao Street.

Table 6-6

LEVELS-OF-SERVICE AT KEY INTERSECTIONS
ALTERNATIVE PLAN #3
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
8	Airport Access Rd. Kuihelani Hwy.	Puunene Ave.	PP AP3	1.07 1.11		E F	1.21 1.22		F F
14	Hansen - Spine Rd.	Hana Hwy.	PP AP3		-44 -72	F F		-28 -58	F F
15	Airport Access Rd.	Dairy Rd.	PP AP3	1.07 1.08		D D	1.11 1.12		D E

PP = Preferred Plan
AP3 = Alternative Plan #3
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.

Wilbur Smith Associates; April 1995

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KAHULUI AIRPORT IMPROVEMENTS - TRAFFIC IMPACT STUDY

Table 6-7

ESTIMATED DIFFERENCE IN PEAK HOUR TRAFFIC
ALTERNATIVE #3 COMPARED TO PREFERRED PLAN
Kahului Airport Improvements - Traffic Impact Study

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		Preferred Plan Traffic	Traffic Change(1)	Percent Change(1)	Preferred Plan Traffic	Traffic Change(1)	Percent Change(1)
Hana Highway at:							
East of Hansen Rd.	Eastbound Westbound	897 2,958	7 10	0.7% 0.3%	2,919 1,088	5 6	0.2% 0.5%
East of Airport Access Rd.	Eastbound Westbound	950 2,904	50 33	5.3% 1.1%	2,990 1,177	60 60	2.0% 5.1%
East of Dairy Rd.	Eastbound Westbound	1,901 1,260	21 14	1.1% 1.1%	2,031 1,150	12 12	0.6% 1.0%
Airport Access Rd. South of Hana Hwy.	Northbound Southbound	898 2,211	29 19	3.2% 0.8%	2,158 2,191	48 48	2.2% 2.2%
Kuihelani Hwy. South of Puunene Ave.	Northbound Southbound	1,017 2,209	29 19	2.9% 0.9%	2,105 1,677	48 48	2.3% 2.9%
Hansen Rd. South of Hana Hwy.	Northbound Southbound	91 176	25 16	27.5% 9.1%	122 118	40 40	32.8% 33.9%

(1) Increase or decrease (-) in Year 2010 traffic with Alternative #3, as compared to the Preferred Plan.

Wilbur Smith Associates; April 1995

Table 5-9
ESTIMATED DIFFERENCE IN PEAK HOUR TRAFFIC
ALTERNATIVE #4 COMPARED TO PREFERRED PLAN

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		Preferred Plan Traffic	Traffic Change(1)	Percent Change(1)	Preferred Plan Traffic	Traffic Change(1)	Percent Change(1)
Hana Highway at:							
• East of Haleakala Hwy. (Pukalani Jct.)	Eastbound Westbound	412 1,111	-8 -13	-1.9% -1.2%	1,030 425	12 -8	1.2% -1.9%
• East of Airport Access Rd.	Eastbound Westbound	950 2,904	45 47	4.7% 1.6%	2,990 1,177	74 54	2.5% 4.6%
• East of Dairy Rd.	Eastbound Westbound	1,901 1,260	2 5	0.1% 0.4%	2,031 1,150	-1 -7	-0.1% -0.6%
Alahao St. East of Kaa St.	Eastbound Westbound	10 10	57 37	570.0% 370.0%	130 90	37 57	28.5% 63.3%
Amala Place East of Hobron St.	Eastbound Westbound	112 68	16 12	14.3% 17.6%	145 155	13 16	9.0% 10.3%
Kaa St. South of Alahao St.	Northbound Southbound	25 35	41 25	164.0% 71.4%	70 65	24 41	34.3% 63.1%
Airport Access Road							
• North of Hana Hwy.	Northbound Southbound	734 600	43 26	5.9% 4.3%	712 1,074	29 43	4.1% 4.0%
• South of Hana Hwy.	Northbound Southbound	896 2,241	19 12	2.1% 0.5%	2,158 2,191	43 38	2.0% 1.7%
Haleakala Highway South of Hana Hwy	Northbound Southbound	1,891 536	51 78	2.7% 14.5%	747 1,942	101 102	13.5% 5.3%

(1) Increase or decrease (-) in Year 2010 traffic with Alternative #4, as compared to the Preferred Plan

Wilbur Smith Associates; May 1995

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Peak Hour Traffic Volumes

Those roadway segments most directly affected by the new helicopter location and the closure of Old Stable Road, with the estimated changes from the Preferred Plan traffic forecasts, are listed in Table 5-9. Traffic along most of these segments would increase, with some of the larger increases occurring on roadways that would otherwise accommodate substantially less traffic.

- Alahao Street, with an extension through to West Spreckelsville as a public road, would have to accommodate the resident and most beach traffic now using Old Stable Road.
- West Spreckelsville area traffic to/from most of the Kahului/Wailuku area would use Amala Place and Hobron Street.
- Most traffic between the West Spreckelsville/beach area and the East, Upcountry, South, and West Maui areas would likely use Kaa Street and the Airport Access Road, including the Terminal Area loop roadway.
- Haleakala Highway traffic would increase as a result of traffic to/from the heliport, with most of the increase occurring between Hana Highway and the heliport access driveway.
- The segments of Hana Highway between Old Stable Road and Kaahumanu Avenue would show varying levels of increases and decreases. These variations would result from the net effects of:
  - Addition of trips to/from the helicopter facility;
  - Addition of trips between West Spreckelsville and East and Upcounty Maui areas, which would use the Airport Access Road;
  - Reduction of trips on Old Stable Road to Hansen and Airport Access Road segments due to rerouting of trips between the West Spreckelsville area and the South and West Maui areas; and
  - Reduction of trips on the Old Stable Road to Kaahumanu Avenue section due to rerouting of trips between West Spreckelsville and Kahului/Wailuku areas.

Peak Hour Traffic Conditions

Traffic conditions at the key intersections most directly affected by the Alternative #4 elements are listed in Table 5-10.

- At the Pukalani Junction intersection of Hana and Haleakala Highways, the addition of traffic to /from the nearby heliport would increase morning peak hour volumes to near-capacity conditions, and increase vehicle delays.
- The net increase of heliport traffic and West Spreckelsville traffic along Hana Highway would slightly worsen conditions at the intersection with Hansen and Spine Roads, and increase the need for traffic signal control of this intersection.

Table 5-10

LEVELS-OF-SERVICE AT KEY INTERSECTIONS
ALTERNATIVE PLAN #4
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
12	Haleakala Hwy.	Hana Hwy. (Pukalani Jct.)	PP AP4	0.90 0.97		C D	0.59 0.63		B B
14	Hansen Rd. - Spine Rd.	Hana Hwy.	PP AP4		-48 -52	F F		-28 -38	F F
16	Airport Access Rd.	Hana Hwy. Eastbound On-Ramp	PP AP4		279 241	C C		60 36	E E
18	Heliport Access Rd.	Haleakala Hwy.	AP4		21	E		39	E

PP = Preferred Plan
AP4 = Alternative Plan #4
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.

Wilbur Smith Associates; April 1995

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- The addition of West Spreckelsville traffic to the left-turn movement from southbound Airport Access Road onto the eastbound on-ramp to Hana Highway would increase delays during the afternoon peak hour. The increased traffic and delays would increase the potential need for traffic signal controls at this location.

- Conditions for traffic entering/exiting the heliport onto Haleakala Highway (LOS E in both peak hours) may require installation of traffic signal controls.

ALTERNATIVE #5 TRAFFIC CONDITIONS

Alternative #5 is similar to the Preferred Plan, plus the addition of the heliport facility at the southeast corner of the Hana Highway-Haleakala Highway intersection across from East Ramp.

Peak Hour Traffic Volumes

Changes from the Preferred Plan traffic volumes would primarily occur on the roadway sections located nearest to the heliport facility. These roadway segments and the respective increases above the Preferred Plan forecasts are summarized in Table 5-11.

The largest numerical increases in traffic would occur on Haleakala Highway between the heliport access road and Hana Highway. During the afternoon peak hour, the increases on this segment would total approximately 100 vehicles in each direction.

Hansen Road would experience the largest proportional increases to peak hour traffic flows, as compared to Preferred Plan forecasts. The increases would approximate 33 percent in the afternoon peak hour. This roadway would be used by employee and patron traffic between the helicopter facility and the Kihei area.

Hana Highway would experience an increase of 126 and 199 vehicles, total in both directions, between Haleakala Highway and Hansen Road, with a proportional increase of about 8 to 9 percent in the off-peak direction and 2 to 3 percent in the peak traffic direction. A slightly lower increase would occur between Hansen Road and the Airport Access Road. Beyond these sections, the increases would approximate 2 percent or less.

Peak Hour Traffic Conditions

Traffic conditions at the intersections most directly affected by Alternative #5 are listed in Table 5-12.

The heliport facility traffic would worsen conditions at the adjacent intersection of Hana Highway and Haleakala Highway, particularly for the morning peak hour when estimated volumes approach the intersection capacity.

The increased traffic volumes at the intersection of Hana Highway and the Hansen Road/Spine road would worsen delays for the cross streets, and increase the need for traffic signal controls.

Table 5-12

LEVELS-OF-SERVICE AT KEY INTERSECTIONS
ALTERNATIVE PLAN #5
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
12	Haleakala Hwy.	Hana Hwy. (Pukalani Jct.)	PP AP5	0.90 0.97		C D	0.57 0.62		B B
14	Hansen Rd. - Spine Rd.	Hana Hwy.	PP AP5		-44 -52	F F		-28 -38	F F
16	Heliport Access Rd.	Haleakala Hwy.	AP5		21	E		30	E

PP = Preferred Plan
AP5 = Alternative Plan #5
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.

Wilbur Smith Associates; April 1995

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Table 5-11

ESTIMATED DIFFERENCE IN PEAK HOUR TRAFFIC
ALTERNATIVE #5 COMPARED TO PREFERRED PLAN
Kahului Airport Improvements - Traffic Impact Study

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		Preferred Plan Traffic	Traffic Change[1]	Percent Change[1]	Preferred Plan Traffic	Traffic Change[1]	Percent Change[1]
Hana Highway at:							
• East of Haleakala Hwy. (Pukalani Jct.)	Eastbound Westbound	412 1,111	2 3	0.5% 0.3%	1,030 425	2 2	0.2% 0.5%
• East of Hansen Rd.	Eastbound Westbound	897 2,956	75 51	8.4% 1.7%	2,919 1,088	100 99	3.4% 9.1%
• East of Airport Access Rd.	Eastbound Westbound	950 2,904	51 33	5.4% 1.1%	2,990 1,177	60 60	2.0% 5.1%
Haleakala Hwy. South of Hana Hwy.	Northbound Southbound	1,891 538	51 78	2.7% 14.5%	747 1,942	101 102	13.5% 5.3%
Hansen Rd. South of Hana Hwy.	Northbound Southbound	91 176	24 18	26.4% 10.2%	122 118	40 39	32.8% 33.1%

(1) Increase or decrease (-) in Year 2010 traffic with Alternative #5, as compared to the Preferred Plan.

Wilbur Smith Associates; April 1995

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As with Alternative #4, the heliport driveway conditions (LOS E) would approach levels meriting consideration of traffic signal controls.

ALTERNATIVE #6 TRAFFIC CONDITIONS

The primary difference between Alternative #6 and the Preferred Plan is the relocation of East Ramp Access to Old Stable Road. Alternative #6 would also accommodate approximately 2 percent less traffic to the West Ramp area.

Peak Hour Traffic Increases

As summarized in Table 5-13, the use of Old Stable Road for East Ramp access would result in a substantial increase in peak hour traffic volumes on the segment between Hana Highway and the airport driveway into the general aviation area. The general aviation traffic would approximately double peak hour traffic volumes on the segment of Old Stable Road nearest to Hana Highway.

The relocation of East Ramp access to Old Stable Road would also increase volumes along the segment of Hana Highway between Old Stable Road and the Preferred Plan location of the Spine Road-Hansen Road intersection. The increases would approximate 11-12 percent in the off-peak traffic direction between Old Stable Road and Haleakala Highway, and 2-4 percent in the peak traffic direction.

No traffic increases, and small decreases due to fewer West Ramp trips, would be expected beyond the area between Old Stable Road and the Spine Road location.

Peak Hour Traffic Conditions

Traffic conditions at the intersections directly affected by the relocation of East Ramp access to Old Stable Road are summarized in Table 5-14.

With STOP sign controls, the Old Stable Road approach to Hana Highway would operate at LOS E during both peak hour periods. Installation of traffic signal controls could be needed at the intersection.

T-23/41RC

Table 5-13

**ESTIMATED DIFFERENCE IN PEAK HOUR TRAFFIC
ALTERNATIVE #6 COMPARED TO PREFERRED PLAN
Kahului Airport Improvements - Traffic Impact Study**

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		Preferred Plan Traffic	Traffic Change(1)	Percent Change(1)	Preferred Plan Traffic	Traffic Change(1)	Percent Change(1)
Hana Highway at:							
• East of Old Stable Rd.	Eastbound Westbound	402 1,121	-0- -0-	0.0% 0.0%	1,040 415	-0- -0-	0.0% 0.0%
• East of Haleakala Hwy.	Eastbound Westbound	412 1,111	45 25	10.9% 2.2%	1,030 425	38 52	3.7% 12.2%
• West of Hansen Rd.	Eastbound Westbound	950 2,904	37 22	3.9% 0.8%	2,900 1,177	30 41	1.0% 3.5%
Old Stable Road North of Hana Hwy	Northbound Southbound	57 37	30 50	52.6% 135.1%	37 57	39 54	105.4% 94.7%

(1) Increase or decrease (-) in Year 2010 traffic with Alternative #6, as compared to the Preferred Plan.

Wilbur Smith Associates: April 1995

Table 5-14

LEVELS-OF-SERVICE AT KEY INTERSECTIONS
ALTERNATIVE PLAN #6
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
11	Hansen Rd.	Hana Hwy.	PP(1) AP6		-44 -45	F F		-28 -25	F F
12	Haleakala Hwy.	Hana Hwy. (Pukalani Jct.)	PP AP6	0.90 0.95		C D	0.59 0.60		B B
13	Old Stable Rd.	Hana Hwy.	PP AP6		44 22	E E		37 18	E E

V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.
(1) = Preferred Plan conditions for Spine Road intersection with Hana Highway.
PP = Preferred Plan.
AP6 = Alternative Plan #6.

Wilbur Smith Associates; April 1995

6. ASSESSMENT OF THE EFFECTS OF OTHER ACTIONS ON YEAR 2010 CONDITIONS

Year 2010 traffic conditions were evaluated for three variations to the Preferred Plan of Improvements for Kahului Airport. These three variations are:

1. Introduction of regularly scheduled international flights to/from Kahului Airport.
2. Construction of a roadway extension connecting Alahao Street to Old Stable Road, and the upgrading of Old Stable Road to accommodate through traffic.
3. Construction of the new Airport Access Road with an at-grade intersection at Hana Highway, instead of the planned interchange.

REGULARLY SCHEDULED INTERNATIONAL SERVICE

...ffic forecasts for the Preferred Plan (Chapter 4) are based on a continuation of the present facilities for and levels of international flights to/from Kahului Airport. Approximately 200 international flight arrivals or departures are now accommodated at Kahului Airport each year. Most of these are flights to/from Canada, where passengers are precleared through customs and immigration in Canada. The remaining international flights, mostly charter flights, are accommodated on an irregular basis with use of immigration and customs personnel flown in from Honolulu to handle each individual international arrival or departure flight.

If customs and immigration facilities and regularly scheduled international service to/from Kahului Airport were introduced in the future, the convenience of such flights could increase air passenger activity and employment at the Airport. The potential effects on traffic conditions are summarized in the following sections.

Methodology and Assumptions

The future travel volumes with international service were estimated using a procedure and assumptions similar to those used for the Preferred Plan. The general methodology used to estimate the future travel volumes was as follows:

1. The Preferred Plan traffic forecasts and roadway network were used as the baseline from which to develop the forecasts of future travel volumes with international services.
2. The estimated number of additional international air passengers was used to estimate the additional design day and peak hour vehicle trips, and the additional trips then assigned to the area roadway network.

3. The additional vehicle trips were added to the Preferred Plan forecasts on each roadway, with the combined total used to analyze roadway conditions.

The procedure for estimating peak hour trips was modified to reflect the arrival/departure schedule of international flights.

Increase in Air Passengers - The increased number of international air passengers was obtained from the socio-economic assessment prepared for the Kahului Airport Improvements.[1] The socio-economic study estimated that the provision of regularly scheduled international service could increase the number of annual air passengers to 8,555,000 in 2010, or 7.1 percent more than the 7,988,000 annual air passengers projected for the Preferred Plan. The August design day activity would increase to 27,600 air passengers, or 1,830 more than the estimate for the Preferred Plan without regularly scheduled international service.

The socio-economic assessment indicates that most of these additional air passengers would be visitors to/from Japan.

Trip Generation Rates - The existing trip generation rates were used to estimate the numbers of Airport vehicle trips associated with the increase in international visitors. These rates reflect trips made by the air passengers, as well as by the increased numbers of workers at the Airport, and increased service vehicle trips (deliveries, concessionaires, maintenance, etc.) associated with the increased activity levels at the Airport. These rates likely overstate the increases associated with the mostly Japanese visitors since the rates largely reflect local resident trips and trips by Mainland visitors, which tend to be more frequent users of automobiles (private and rental cars) and less frequent users of public transportation modes than Japanese visitors, although the differences may narrow somewhat by 2010.

Asian flights are generally concentrated during the morning to early afternoon period. Based on patterns at the Honolulu International Airport, flight arrivals from Japan typically occur during the 7:00 to 11:00 AM period, with most flights departing during the 9:00 AM to 3:00 PM period. Since the peak hour trip rates are based on a distribution of flights throughout the day and early evening, a special adjustment was made to the estimated number of vehicle trips during the morning peak hour. The morning peak hour adjustment was developed as follows:

- The estimated number of international air passengers would require about six flight arrivals and six flight departures on a typical day.
- Since at least one to two hours are required to clear customs and immigration checks, no significant amount of ground traffic would be expected to occur during the morning peak hour as a result of the arriving flights; these traffic increases would likely occur in the mid-morning to early afternoon period.

[1] *Socio-economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements, Draft Report*, prepared for E.K. Noda & Associates, Inc., by Community Resources, Inc., November 17, 1994.

Table 6-1

KAHULUI AIRPORT VEHICLE TRIP GENERATION
PREFERRED PLAN WITH INTERNATIONAL SERVICE
2010 DESIGN DAY
Kahului Airport Improvements - Traffic Impact Study

Activity	Morning Commute Peak Hour		Afternoon Commute Peak Hour		Daily
	Enter	Exit	Enter	Exit	
West Ramp					
▸ Preferred Plan Trips	925	788	758	1,137	26,690
▸ Additional International Passenger-Related Volumes	66	68	54	80	1,830
▸ Vehicle Trips for Initial Morning Departure Flight	60	12	—	—	—
Subtotal	1,051	868	812	1,217	28,520
East Ramp	50	30	40	54	610
Total	1,101	898	852	1,271	29,130
Increase Above Preferred Plan	13.2%	9.8%	6.8%	6.7%	6.7%

Wilbur Smith Associates; April 1995

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- Based on Honolulu International Airport patterns, the initial arriving flight could be "turned around" and prepared for departure as early as the 9:00 to 10:00 AM period.

- Since international visitors are advised to arrive at the Airport two hours before flight time, the passengers on the first departing flight could be arriving at the Airport during the morning peak hour.

- Therefore, the trip generation in the morning peak hour was increased to reflect the passengers on the first flight travelling to the Airport during the morning peak hour. The number of vehicle trips was estimated to reflect the following assumptions:
  - The departing flight would carry 250 passengers;
  - The average party size for Japanese visitors would be 4.14 persons, based on a survey at Honolulu International Airport;[1] and
  - There would be one vehicle trip to the Airport per party of 4.14 persons during the morning peak hour. Twenty percent of these vehicles would depart the Airport after discharging passengers, while 80 percent would remain at the Airport, either taxis or vans awaiting to pick up passengers from arriving flights, or rental cars returned by the passengers.

Trip Distribution - The distribution of the additional trips to the various areas of Maui was made using the same assumptions as for the Preferred Plan.

Airport Trip Generation

The estimated ground traffic to/from Kahului Airport is based on the following:

7,988,000 Annual Air Passengers (Preferred Plan)
567,000 Additional Annual Air Passengers with Scheduled International Flights
59 Based General Aviation Aircraft

Also, the morning peak hour traffic volumes were increased to reflect air passengers arriving at Kahului Airport for the initial international flight departure of the day.

With the estimated increase in air passengers, the design day vehicle trips are estimated at 29,130 vehicles, or 6.7 percent more than the Preferred Plan without schedule international service. As summarized in Table 6-1, morning peak hour traffic would total 1,999 vehicles, or 12.6 percent more then the Preferred Plan. The afternoon volume of 2,123 vehicles would be an increase of 6.7 percent above the Preferred Plan.

Peak Hour Traffic Volumes

The estimated morning and afternoon peak hour traffic volumes with scheduled international service to/from Kahului Airport are depicted in Figures 6-1 and 6-2, respectively.

(1) *Oahu Visitors Travel Survey, Honolulu Rapid Transit Program Task 3.2*, prepared for City and County of Honolulu Department of Transportation Services, by Barton-Aschman Associates, Inc., January 1992.

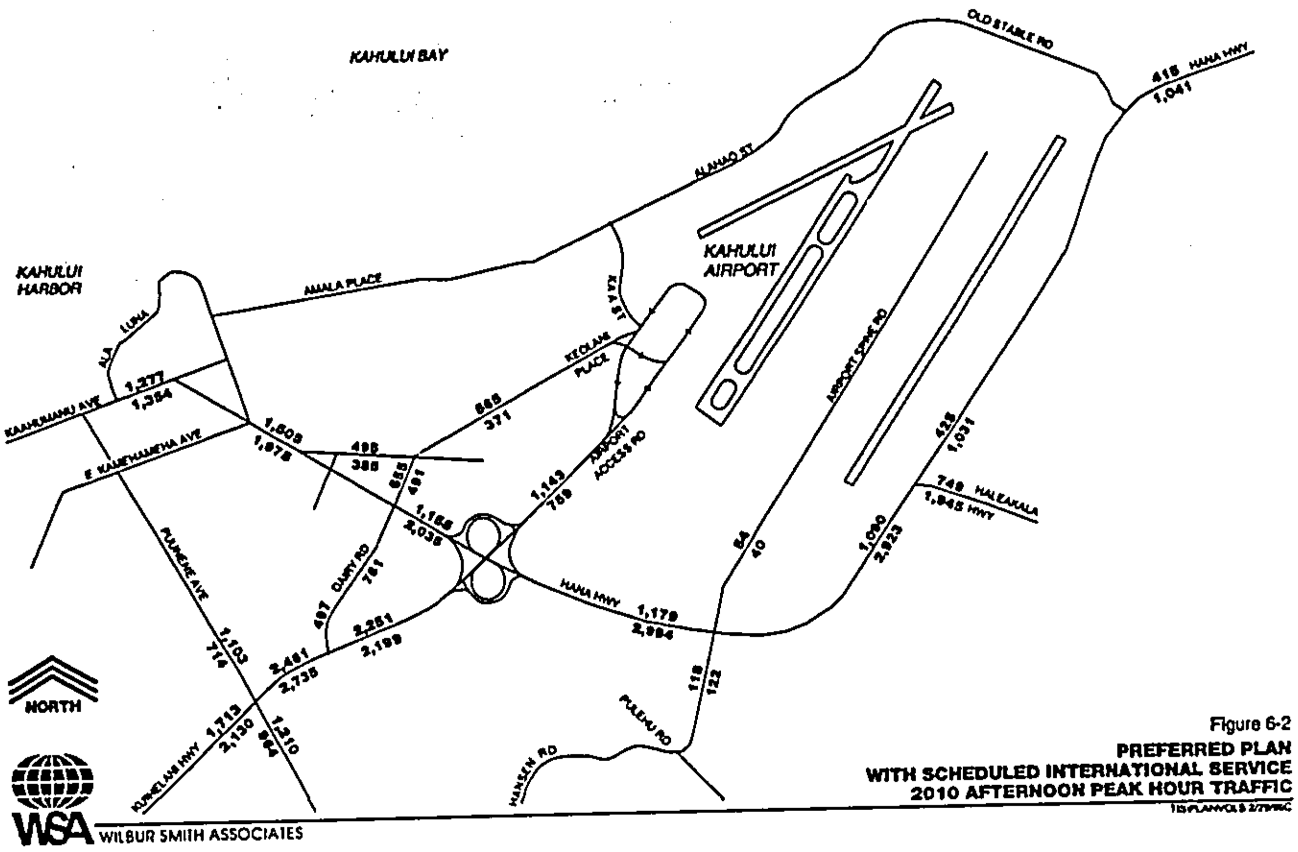

Figure 6-2
PREFERRED PLAN
WITH SCHEDULED INTERNATIONAL SERVICE
2010 AFTERNOON PEAK HOUR TRAFFIC

KAHULUI AIRPORT IMPROVEMENTS TRAFFIC IMPACT STUDY

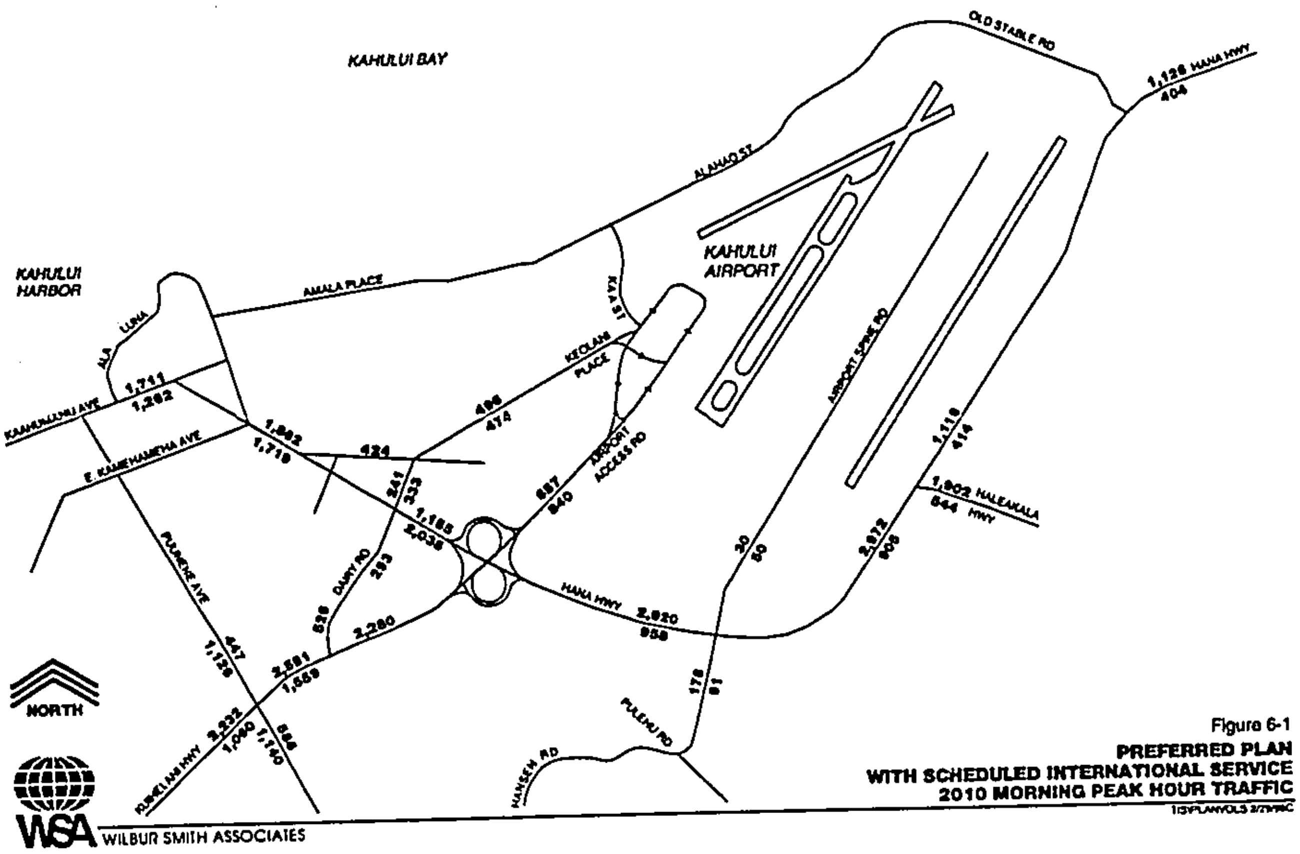

Figure 6-1
PREFERRED PLAN
WITH SCHEDULED INTERNATIONAL SERVICE
2010 MORNING PEAK HOUR TRAFFIC

Table 6-2
(Page 1 of 2)

ESTIMATED DIFFERENCES IN PEAK HOUR TRAFFIC WITH INTERNATIONAL SERVICE
Kahului Airport Improvements - Traffic Impact Study

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		No Int'l Service(1)	Increase With Int'l Service(2)	Percent Change(3)	No Int'l Service(1)	Increase With Int'l Service(2)	Percent Change(3)
Hana Highway:							
▸ East of Haleakala Hwy. (Pukalani Jct.)	Eastbound Westbound	412 1,111	2 5	0.5% 0.5%	1,030 425	1 -0-	0.1% 0.0%
▸ East of Airport Access Rd.	Eastbound Westbound	950 2,904	8 18	0.8% 0.6%	2,990 1,177	2 6	0.2% 0.3%
▸ West of Haleakala Hwy. (West Jct.)	Eastbound Westbound	1,688 1,645	31 17	1.8% 0.9%	1,972 1,448	6 9	0.3% 0.6%
Keolani Place	Northbound Southbound	454 485	20 9	4.4% 1.9%	364 554	7 11	1.9% 2.0%
Dairy Road at:							
▸ North of Hana Hwy.	Northbound Southbound	325 237	8 4	2.5% 1.7%	486 648	5 7	1.0% 1.1%
▸ South of Hana Hwy.	Northbound Southbound	285 522	8 4	2.8% 0.8%	756 490	5 7	0.7% 1.4%
Airport Access Road:							
▸ North of Hana Hwy.	Northbound Southbound	734 600	106 57	14.4% 9.5%	712 1,074	47 69	6.6% 6.3%
▸ South of Hana Hwy.	Northbound Southbound	896 2,241	77 39	8.6% 1.7%	2,158 2,191	41 60	1.9 2.7

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With the introduction of international service, the largest increase in traffic volumes would occur along the routes between the Airport and the major visitor accommodation areas in the Kihei and West Maui areas. As shown in Table 6-2, the Airport Access Road traffic in the morning peak hour would increase by an estimated 106 northbound and 57 southbound vehicles over the Preferred Plan forecasts without international service. This would amount to an increase of 14.4 and 9.5 percent, respectively. The largest numerical and percentage increases would continue along the Airport Access Road to the junction with the Kuihelani Highway and Puunene Avenue routes to/from the Kihei and West Maui areas. With the split of the visitor traffic at this intersection, the numerical and proportional increases would be much lower. The northbound increase on the two roadways would approximate 4 to 6 percent, while the southbound trips would add 1 to 2 percent to the forecast volumes.

The other larger increases would be expected on Hana Highway into the Kahului area, and on Keolani Place. Beyond these roadways, the international-related traffic would be more dispersed and the morning increases would generally amount to less than 10 vehicles and/or less than a one percent increase.

In the afternoon peak hour, the traffic volume and percentage increases on each roadway would be approximately half those in the morning peak hour. Also, the predominate travel direction for the international-related traffic would be reversed from that of the morning peak hour.

Peak Hour Traffic Conditions

The peak hour traffic conditions at the key intersections are listed in Table 6-3 for the Preferred Plan (without scheduled international service) and with the addition of international service. The intersection conditions do not reflect the mitigation measures discussed in Chapter 4.

The added traffic volumes would generally result in small increases to the proportion of intersection capacity being utilized by forecast volumes. At those intersections indicated as deficient with the Preferred Plan, the international service-related traffic increases would contribute to a worsening of delays. The traffic increases would have the largest impacts at the following locations:

- The traffic increases during the morning peak hour at the Airport Access Road/Kuihelani Highway/Puunene Avenue intersection would worsen traffic delays to LOS F (from LOS E), with the traffic volumes exceeding capacity by 13 percent, versus a 7 percent deficiency without the international service.
- The traffic increases at the Airport Access Road intersection with Dairy Road would worsen traffic delays to LOS E, from LOS D.

The mitigation actions proposed for the Preferred Plan would be sufficient to also accommodate the traffic increases with international service.

Table 6-3
(Page 1 of 2)
LEVELS OF SERVICE AT KEY INTERSECTIONS FOR YEAR 2010 DESIGN DAY
PREFERRED PLAN WITH SCHEDULED INTERNATIONAL SERVICE
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
1	Hobron St.	Amala Pl.	2010 PP 2010 IS		619 619	A A		412 412	A A
2	Kaahumanu Ave.	Hana Hwy.	2010 PP 2010 IS		31 27	E E		96 95	E E
3	Hobron St.	Kaahumanu Ave.	2010 PP 2010 IS		532 532	A A		390 390	B B
4	Hobron St.	Hana Hwy.	2010 PP 2010 IS		-3 -5	F F		-7 -9	F F
5	Haleakala Hwy. (West Jct.)	Hana Hwy.	2010 PP 2010 IS		-304 -319	F F		-180 -185	F F
6	Dairy Rd.-Keolani Pl.	Haleakala Hwy.	2010 PP 2010 IS	0.43 0.57		B B	0.56 0.66		C C
7	Dairy Rd.	Hana Hwy.	2010 PP 2010 IS	0.76 0.77		B C	0.66 0.69		C C
8	Dairy Rd.-Kuihelani Hwy. Airport Access Rd.	Puunene Ave.	2010 PP 2010 IS	1.07 1.13		F F	1.21 1.23		F F
10	Pulehu Rd.	Hansen Rd.	2010 PP 2010 IS		590 590	A A		630 630	A A

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Table 6-2
(Page 2 of 2)

ESTIMATED DIFFERENCES IN PEAK HOUR TRAFFIC WITH INTERNATIONAL SERVICE
Kahului Airport Improvements - Traffic Impact Study

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		No Int'l Service[1]	Increase With Int'l Service[2]	Percent Change[2]	No Int'l Service[1]	Increase With Int'l Service[2]	Percent Change[2]
Haleakala Hwy. South of Hana Hwy.	Northbound Southbound	1,691 536	11 6	0.6% 1.1%	747 1,942	2 3	0.3% 0.2%
Kuihelani Hwy. South of Puunene Ave.	Northbound Southbound	1,017 2,209	43 23	4.2% 1.0%	2,105 1,677	25 36	1.2% 2.1%
Puunene Ave. East of Kuihelani Hwy.	Northbound Southbound	550 1,120	36 20	6.5% 1.8%	1,169 933	21 31	1.8% 3.3%

(1) Year 2010 traffic volumes for Preferred Plan without International facilities and flight service.
(2) Increase in Year 2010 traffic with international facilities and flight service, as compared to Preferred Plan without International facilities.

Wilbur Smith Associates; June 1995

T-25/474b

WSA WILBUR SMITH ASSOCIATES

Table 6-3
(Page 2 of 2)
LEVELS OF SERVICE AT KEY INTERSECTIONS FOR YEAR 2010 DESIGN DAY
PREFERRED PLAN WITH SCHEDULED INTERNATIONAL SERVICE
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
12	Haleakala Hwy. (Pukalani Jct.)	Hana Hwy.	2010 PP 2010 IS	0.90 0.95		C D	0.57 0.59		B B
13	Old Stable Rd.	Hana Hwy.	2010 PP 2010 IS		44 44	E E		37 37	E E
14	Hansen - Spine Rd.	Hana Hwy.	2010 PP 2010 IS		-48 -49	F F		-28 -28	F F
15	Airport Access Rd.	Dairy Rd.	2010 PP 2010 IS	1.07 1.09		D E	1.11 1.13		D E
16	Airport Access Rd.	Hana Hwy. EB On-Ramp	2010 PP 2010 IS		279 237	C C		60 75	E E
17	Airport Access Rd	Hana Hwy. WB On-Ramp	2010 PP 2010 IS		398 382	B B		-161 -186	F F

2010 PP = Preferred Plan without international facilities (Year 2010).
2010 IS = International Service Alternative (Year 2010).
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.

Wilbur Smith Associates; June 1995

T-26/474b

ISLAND-WIDE TRAFFIC CONSIDERATIONS

Community Resources, Inc.[3] estimated that international service at Kahului Airport would result in about a 4 percent increase in the daily visitor census and a similar increase in occupied visitor units in 2010, as compared to the Preferred Plan. The additional economic activity is estimated to increase employment and population by 6 percent above the forecasts with the Preferred Plan.

As summarized in Table 6-4, the average visitor census and occupied visitor units are estimated to increase to levels about 5 percent higher than those used as the basis for the island-wide Highway Plan Study. Even with this incremental increase in economic activity, the estimated population (141,810) and employment (75,420) would remain below the levels used as the basis for the present highway improvement plans on Maui.

The socio-economic projections, with the international service, results in an estimated island-wide total of 600,200 vehicle trips on a typical weekday in 2010. The estimated vehicle travel for the international scenario is less than that used as the basis for the Maui Island-Wide Highway Improvement Plan. Therefore, the improvements included in that plan should be sufficient to accommodate the ground travel increases that would result from international service.

The international scenario represents about 6 percent more vehicle trips than the Preferred Plan, and 9 percent more than the No Action Alternative. The higher number of vehicle trips could increase delays on those highway segments where traffic volumes are approaching roadway capacity in Year 2010, relative to the No Action and Preferred Plan scenarios.

ALAHAO STREET - OLD STABLE ROAD AS A THROUGH ROADWAY

An assessment was made of usage levels and traffic conditions with the connection of Alahao Street to Old Stable Road, and the reconstruction of Old Stable Road to a standard two-lane roadway. This would permit use of Old Stable Road/Alahao Street/Amala Place/Hobron Street as a through route paralleling Hana Highway.

Methodology and Assumptions

The roadway connection and upgrade could potentially attract/serve several user groups:

1. Trips between West Spreckelsville and Kahului-Wailuku areas;
2. Trips between the Harbor area and East Maui;
3. Trips between the greater Kahului-Wailuku area and East Maui;
4. Trips between Kahului Airport and East Maui, via Kaa Street; and
5. Induced new "sight-seeing" trips along coastline by both residents and visitors.

(3) Op.Cit.

This assessment addresses the potential use by the first four groups since no methodology was available within the scope of this study to estimate new "sight-seeing" traffic. However, it is unlikely that a large number of such trips would occur during the weekday commute peak hours used as the analysis periods.

Roadway Improvements - The assessment is based on the upgrading of Old Stable Road to two-lane roadway similar to that along Amala Place. The roadway segments would be posted with a 25 or 30 mph speed limit. No modifications would be made at the Hobron Street end, and existing STOP sign controls would remain along the route.

Travel Demands - The analysis is based on the Year 2010 travel demands with the Preferred Plan. The travel demands for each of the "user groups" was estimated from the information available from the *Maui Island-Wide Long Range Highway Plan Study*.[6]

Traffic Diversion to New Route - The diversion of traffic to the new through route was based on use of a logit-type model to relate proportional shares to each route based on a comparison of travel times between the current route and the new Alahao Street - Old Stable Road route.[7] The travel times along each route were estimated using the speed limits for each roadway section, plus estimated delay times at traffic signals and STOP sign controls.

Travel Times and Traffic Diversion to Old Stable Road

The comparative travel times via Hana Highway and via Old Stable Road/Alahao Street were estimated as an average for both eastbound and westbound travel. The average travel times and the resultant split in traffic between the two routes was estimated as follows:

For Travel Between East Spreckelsville and	Travel Time Between Areas in Minutes		Percent of Trips Between Areas Estimated to Use Each Route	
	Via Hana Hwy.	Via Old Stable Rd.	Via Hana Hwy.	Via Old Stable Rd.
Kahului Airport Terminal	5.9	7.3	80%	20%
Kahului Harbor	5.8	7.4	83%	17%
Kaahumanu/Puunene Ave. Intersection	5.6	8.4	94%	6%

All of trips between West Spreckelsville and the Kahului-Wailuku area were assumed to use the Alahao Street route.

[6] *Maui Long-Range Highway Planning Study Island-Wide Plan Final Report*, prepared for Hawaii State DOT and the County of Maui Departments of Public Works and Planning, by Austin, Tsutsumi & Associates, Inc., May 1991.

[7] *Urban Transportation Planning*.

Table 6-4

COMPARISON OF ISLAND-WIDE MAUI HIGHWAY PLAN FORECAST BASIS TO AIRPORT FORECASTS WITH INTERNATIONAL SERVICE
Kahului Airport Improvements - Traffic Impact Study

Item	Basis of Maui 2010 Island-Wide Highway Plan[1]	2010 Airport Scenarios[2]		
		No Action Alternative	Preferred Plan	Preferred Plan With International Service
Resident Population	149,068	129,880	133,720	141,810
Housing Units	54,210	47,020	48,420	51,340
Employment	80,271	69,060	71,120	75,420
Visitor Units	30,070	—	—	—
Visitor Units (occupied)	24,060	23,400	24,320	25,380
Average Visitor Census	67,450	65,510	68,100	71,050
Estimated Island-Wide Daily Vehicle Trips	614,500	549,900[3]	587,400[3]	600,200[3]

(1) = *Maui Long-Range Highway Planning Study, Island-Wide Plan Final Report*, prepared for State DOT, County if Maui Department of Public Works, and County of Maui Department of Planning, by Austin Tsutsumi & Associates, Inc., May 1991.
(2) = *Socio-economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements, Draft Report*, prepared for E.K. Noda & Associates, Inc., by Community Resources, Inc., November 17, 1994.
(3) = Wilbur Smith Associates, May 1995

Wilbur Smith Associates; May 1995

T-40/47ab

Application of the above splits between the two routes resulted in an estimated diversion of about 135 and 139 vehicle trips to the Alahao Street-Old Stable Road route in the morning and afternoon peak hours, respectively.

Peak Hour Traffic Volumes

The estimated morning and afternoon peak hour traffic volumes are depicted in Figures 6-3 and 6-4, respectively, along the Old Stable Road-Alahao Street and Hana Highway alternative routes, and the connecting streets that would be most directly affected by changes in the travel patterns with the roadway connection. The change in traffic volumes and the proportional change, as compared to the Preferred Plan without the street connection, are presented in Table 6-5 for those roadways most directly affected by the use of Alahao Street-Old Stable Road as a through route. Note, that those estimated trips do not include "sightseeing" trips, nor new trips that might be made only with the added convenience of the connection.

The connection is estimated to attract approximately 120 to 135 trips in the morning peak hour and 130 to 140 trips in the afternoon commute hour that would otherwise use Hana Highway. This would reduce Hana Highway volumes by about 3 to 6 percent below the Preferred Plan forecasts.

Peak hour volumes traffic along Old Stable Road-Alahao Street-Amala Place would increase by a similar volumes. The increased volumes would typically represent a 50 to 100 percent increase to peak hour volumes along the existing sections of these streets. The estimated changes in 2010 daily traffic volumes would be:

	Without Connection	With Connection	Increase
Old Stable Road	1,300	2,500	92.3%
Amala Place	3,000	4,700	56.7%

Peak Hour Traffic Conditions

The estimated roadway volumes along Old Stable Road-Amala Place would be well within the capacity of a two-lane roadway. The projected traffic volumes would be comparable to current traffic along Hansen Road.

Analysis of conditions at key intersections along the two alternative routes affected by the connection are presented in Table 6-6. Conditions with the Preferred Plan, without the roadway connection, is provided for comparison. The primary changes are at the following intersections:

- **Old Stable Road - Hana Highway** - The increase in traffic turning left from Old Stable Road would worsen conditions to LOS F for both peak hour periods. A traffic signal would be needed at this intersection.

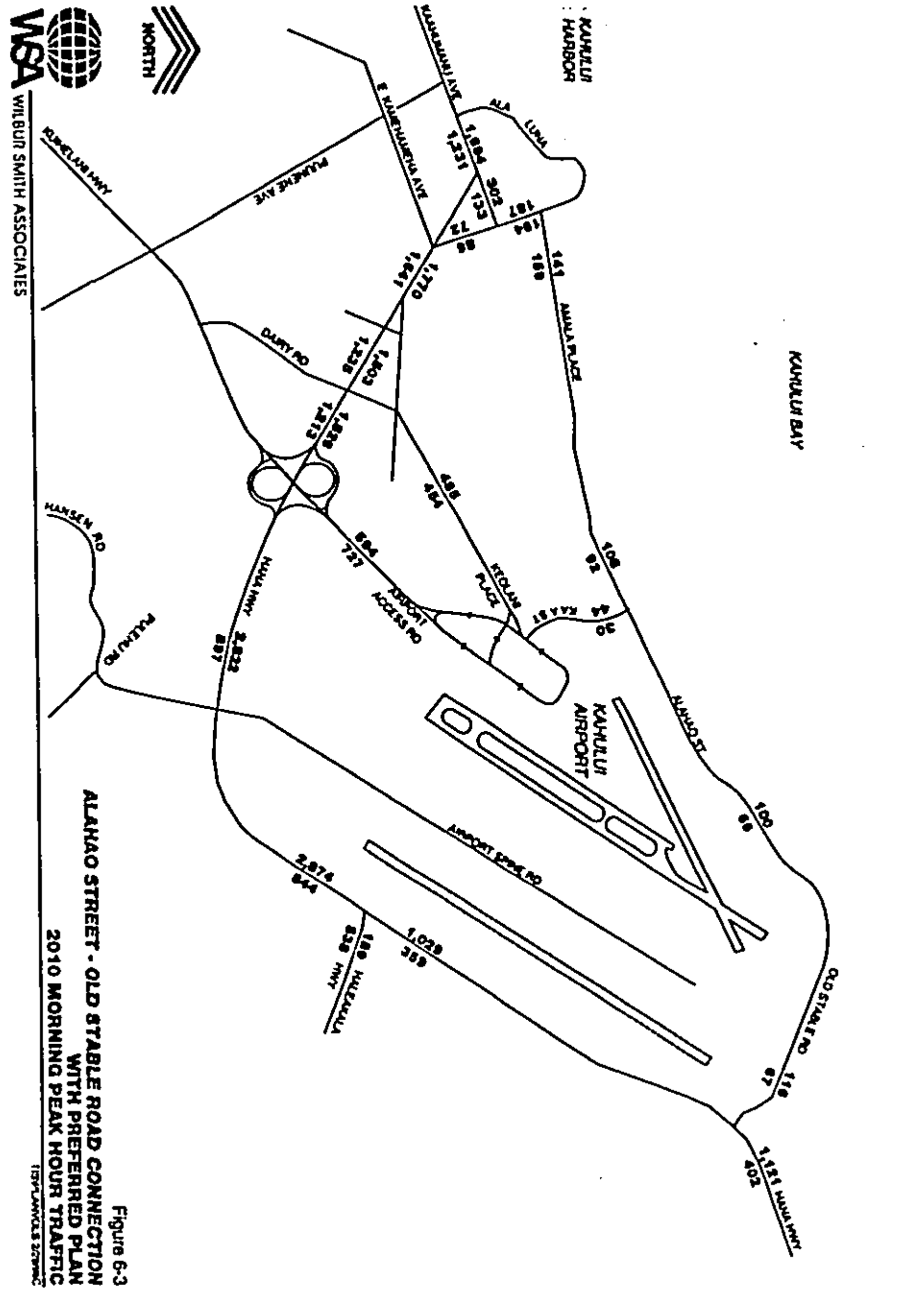

Figure 6-3
ALAHAO STREET - OLD STABLE ROAD CONNECTION
WITH PREFERRED PLAN
2010 MORNING PEAK HOUR TRAFFIC

Table 6-6

ESTIMATED CHANGES IN PEAK HOUR TRAFFIC
PREFERRED PLAN WITH ALAHAO STREET/OLD STABLE ROAD CONNECTION
Kahului Airport Improvements - Traffic Impact Study

Roadway/Location	Direction	Morning Peak Hour			Afternoon Peak Hour		
		Without Connection(1)	Change With Connection(2)	Percent Change	Without Connection(1)	Change With Connection(2)	Percent Change
Hana Highway at:							
• East of Airport Access Rd.	Eastbound Westbound	950 2,904	-53 -82	-5.6% -2.8%	2,990 1,177	-84 -55	-2.8% -4.7%
• West of Haleakala Hwy. (West Jct.)	Eastbound Westbound	1,668 1,845	-47 -75	-2.8% -4.1%	1,972 1,496	-80 -52	-4.1% -3.5%
Old Stable Road North of Hana Hwy.	Eastbound Westbound	40 55	30 59	75.0% 72.7%	57 37	61 32	107.0% 86.5%
Alahao St.	Eastbound Westbound	10 10	53 62	530.0% 620.0%	130 90	84 55	64.6% 61.1%
Amala Place	Eastbound Westbound	112 68	47 75	42.0% 110.3%	145 155	80 52	55.2% 33.5%
Kaa St.	Northbound Southbound	25 35	6 7	24.0% 20.0%	70 65	4 3	5.7% 4.6%
Kaahumanu Ave. West of Hobron St.	Eastbound Westbound	87 73	46 72	52.9% 98.6%	114 179	77 49	67.5% 27.4%

(1) *Year 2010 traffic for Preferred Plan without Alahao Street/Old Stable Road connection.*
(2) Year 2010 traffic for Preferred Plan with Alahao Street/Old Stable Road connection.

Wilbur Smith Associates, June 1995

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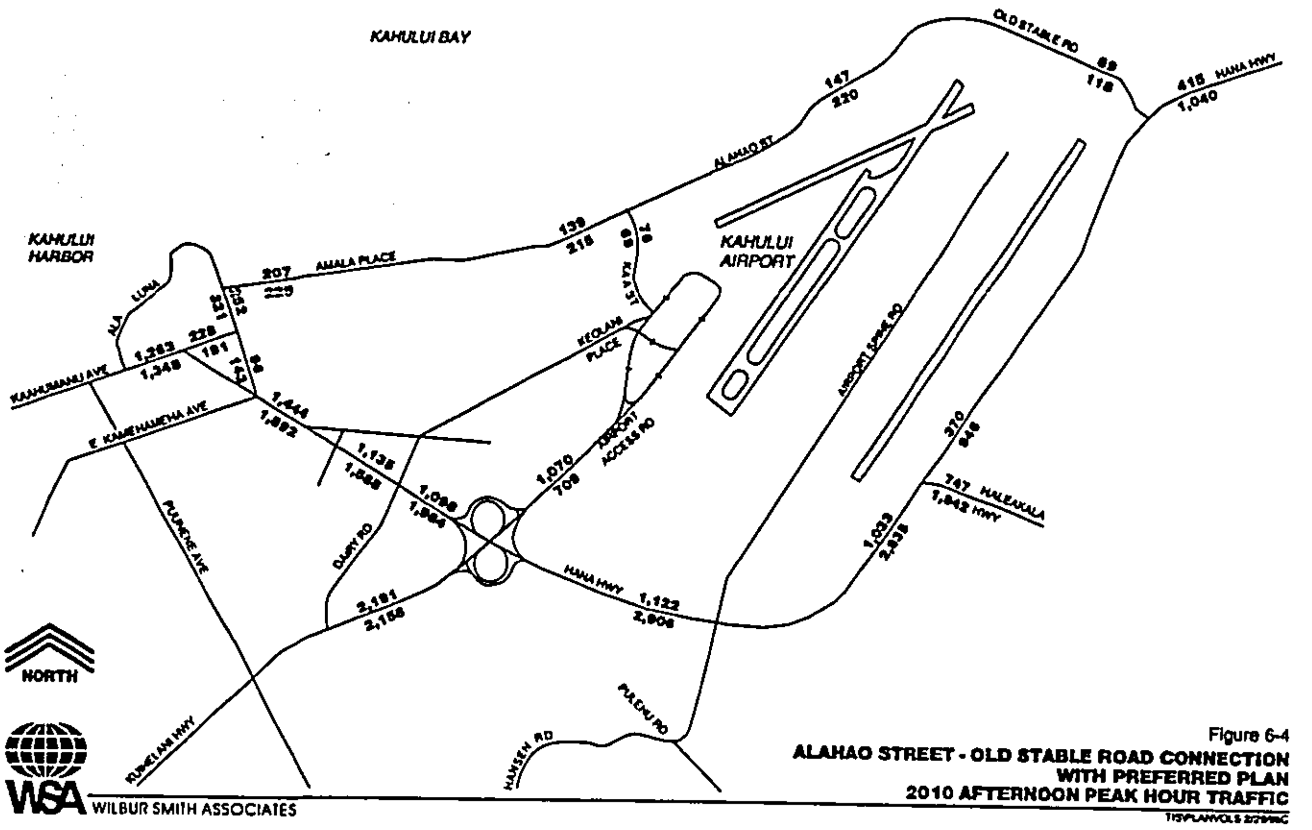

Figure 6-4
ALAHAO STREET - OLD STABLE ROAD CONNECTION WITH PREFERRED PLAN 2010 AFTERNOON PEAK HOUR TRAFFIC

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Table 6-6
(Page 2 of 2)

LEVELS OF SERVICE AT KEY INTERSECTIONS FOR YEAR 2010 DESIGN DAY
PREFERRED PLAN WITH ALAHAO STREET-OLD STABLE ROAD CONNECTION
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
14	Hansen - Spine Rd.	Hana Hwy.	2010 PP 2010 AO		-48 -52	F F		-20 -34	F F

2010 PP = Preferred Plan (Year 2010)
2010 AO = Alahao St.-Old Stable Road Connection Alternative (Year 2010)
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.

Wilbur Smith Associates; June 1995

WSA WILBUR SMITH ASSOCIATES
KAHULUI AIRPORT IMPROVEMENTS - TRAFFIC IMPACT STUDY

Table 6-6
(Page 1 of 2)

LEVELS OF SERVICE AT KEY INTERSECTIONS FOR YEAR 2010 DESIGN DAY
PREFERRED PLAN WITH ALAHAO STREET-OLD STABLE ROAD CONNECTION
Kahului Airport Improvements - Traffic Impact Study

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
1	Hobron St.	Amala Pl.	2010 PP 2010 AO		619 565	A A		412 366	A A
2	Kaahumanu Ave.	Hana Hwy.	2010 PP 2010 AO		31 -8	E F		96 26	E E
3	Hobron St.	Kaahumanu Ave.	2010 PP 2010 AO		532 566	A A		390 543	B A
4	Hobron St.	Hana Hwy.	2010 PP 2010 AO		-3 15	F E		-7 -2	F F
5	Haleakala Hwy. (West Jct.)	Hana Hwy.	2010 PP 2010 AO		-304 -267	F F		-180 -161	F F
7	Dairy Rd.	Hana Hwy.	2010 PP 2010 AO	0.78 0.74		B B	0.66 0.65		C C
12	Haleakala Hwy. (Pukalani Jct.)	Hana Hwy.	2010 PP 2010 AO	0.90 0.86		C C	0.57 0.54		B B
13	Old Stable Rd.	Hana Hwy.	2010 PP 2010 AO		44 -18	E F		37 -60	E F

- **Kaahumanu Avenue - Hana Highway** - The increase in traffic turning left from eastbound Kaahumanu Avenue across the westbound Hana Highway traffic to reach Hobron Street, would lengthen delays, with the morning peak hour worsening to LOS F. Traffic signal controls would likely be needed for this intersection.

- **Hobron Street - Hana Highway** - The reduction in left-turn vehicles from Hobron Street would shorten delays, with the condition improving from LOS F to LOS E in the morning peak hour.

The traffic decreases along Hana Highway would result in small incremental reductions in the proportion of intersection capacity used, but not to the extent of improving the service level.

Bicycle Facilities

The increases in traffic along Amala Place - Old Stable Road route would also increase potential conflicts between bicyclists and automobile traffic. The use of the roadways as a through route would also change the characteristics of automobile travel along these roads. The roadway connection would increase the desirability of providing separate bicycle lanes or a bike paths along the Old Stable Road - Amala Place corridor.

Mitigation Actions

The actions needed to mitigate the effects of this roadway connection would be:

- Install traffic signal controls at Hana Highway intersection with Old Stable Road; and
- Install traffic signal controls at Hana Highway with Kaahumanu Avenue.

AT-GRADE INTERSECTION FOR AIRPORT ACCESS ROAD AT HANA HIGHWAY

The Preferred Plan includes the construction of a grade-separated interchange at the junction of the new Airport Access Road and Hana Highway. An analysis was made of traffic conditions at this junction if the new Airport Access Road were to be constructed with a convention at-grade intersection at Hana Highway.

Assumptions for the Analysis

The analysis was made using the same HCM Operations Analysis methodology as used for traffic signal-controlled intersections for other scenarios and locations included in this traffic study. (See Chapter 2 for discussion of methodology.) The analysis was based on the following assumptions:

1. The Preferred Plan peak hour traffic volumes were used for the analysis, with no change in travel routes or volumes due to the at-grade intersection.

2. Hana Highway was assumed to have:
   i. Two through lanes in each direction;
   ii. Separate right-turn lanes on each approach;
   iii. Two left-turn lanes for turns from westbound Hana Highway and one left-turn lane for east Hana Highway.

3. Airport Access Road was assumed to have:
   i. Two through lanes in each direction;
   ii. Separate right-turn lanes on each approach;
   iii. Single left-turn lane for each approach.

The assessment also included an analysis of the intersection with Hana Highway widened to three through lanes in each direction.

Analysis Results

During the morning peak hour, the projected Year 2010 traffic volumes would approximate 98 percent of the capacity of the intersection, with either four or six-lanes on Hana Highway (see Table 6-7). The number of Hana Highway through lanes would have little effect since the critical conflicting traffic volumes that determine the overall conditions at the intersection, would be the large volume of left-turn vehicles from westbound Hana Highway (from East Maui towards Lahaina) and the through and left-turn movements on the Airport Access Road. These critical movements would each operate at capacity while the Hana Highway traffic would operate at 90 percent or less of capacity.

The intersection would provide an acceptable LOS D as an overall condition for all traffic movements, based on optimal signal timing. This acceptable level represents an average for all vehicles. However, the individual critical traffic movements would operate at LOS F with long delays, while the Hana Highway through traffic would operate at LOS C.

During the afternoon peak hour, with a more even distribution of traffic among the roadway approaches and turning movements than for the morning volumes, the projected volumes would greatly exceed the capacity of the intersection. The widening of Hana Highway to three through lanes in each direction would provide capacity equivalent to the projected afternoon volumes.

Table 6-7

2010 TRAFFIC CONDITIONS WITH AT-GRADE INTERSECTION AIRPORT ACCESS ROAD AT HANA HIGHWAY
Kahului Airport Improvements - Traffic Impact Study

Time Period/Number of Lanes	V/C	AD	LOS
Morning Peak Hour			
▸ Four-Lane Hana Highway	0.98	30.6	D
▸ Six-Lane Hana Highway	0.98	28.1	D
Afternoon Peak Hour			
▸ Four-Lane Hana Highway	1.25	•	F
▸ Six-Lane Hana Highway	1.00	42.2	E

V/C = Volume-to-Capacity Ratio.
AD = Average delay per vehicle in seconds.
LOS = Level-of-Service.
• = Average vehicle delay cannot be calculated when volumes exceed capacity by more than 20 percent.

Wilbur Smith Associates; June 1995

APPENDIX N

AVIATION STUDIES

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AVIATION STUDIES RELATED TO THE PROPOSED KAHULUI AIRPORT MASTER PLAN IMPROVEMENTS

Prepared for:

Edward K. Noda and Associates, Inc.

Prepared by:

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MAY 5, 1995

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Section I

ANALYSIS OF ALTERNATIVE RUNWAY LENGTHS

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INTRODUCTION

I-1
INTRODUCTION

Section I provides an overview of runway alternatives previously presented in the June 1993, Kahului Airport Master Plan Update. The October 6, 1992, Complaint to Enforce Court Order stated that the 1992 Final EIS did not evaluate "all known alternative actions such as runways of different lengths."

PURPOSE AND SCOPE

Previous studies recommended that Runway 2-20 be extended from its present length of 7,000 feet to 9,600 feet. This document provides analyses of the proposed and alternative runway lengths. The analyses include the following:

- Review and evaluate the runway length analysis presented in the 1992 Final EIS.
- Evaluate runway length measurements for alternative airport roles including non-stop service to the West Coast; service to the Midwest; and, International service (e.g. Japan). The objective is to provide technical evaluation of the proposed 9,600 foot runway by considering:
  - Aircraft payload and range characteristics
  - Passenger and cargo operations
  - Passenger and cargo payload penalties
  - Present and future aircraft fleet mix
- Study the effects of new families of aircraft (e.g. B767ER, B777 and MD11) on runway length requirements. Performance characteristics (payload and range, runway length requirements), passenger and cargo penalties, and certification of new and future aircraft for flights from Hawaii to other destinations are to be included in the analyses.
- Consider the effects of "declared distances" (i.e., treating an airplane's performance distances independently) on runway length requirements.

METHODOLOGIES

Runway length analyses were performed by using runway takeoff length and flight plan data developed for this study by Jeppesen Sanderson, Inc, and aircraft performance data contained in manuals published by the aircraft manufacturers, specifically those of the Boeing Company and McDonnell-Douglas. Runway take-off length requirements were calculated for various combinations of payload and range. Particular attention was directed towards the cargo carrying abilities of the various aircraft models in addition to the passenger capacities in view of the need to accommodate agricultural and other cargo needs of Maui.

Runway landing lengths were based on wet pavement conditions and upon various landing weights.

Since it has been noted that high airport temperature has an adverse effect on the payloads allowable on the present 7,000 foot length, runway length analyses were prepared using standard day (59°F) plus 36°F or standard day plus either 25°F, 27°F, 31°F, or 33°F as presented by McDonnell-Douglas and Boeing, respectively in their airplane characteristics manuals for the various engines offered.

CONTENTS AND ORGANIZATION

This section is organized into five subsections. Following this Introduction are the following subsections:

- I-2 Background
- I-3 Airport Properties
- I-4 Air Trade Demand
- I-5 Runway Length Analysis

I-2

BACKGROUND

I-2
BACKGROUND

IMPORTANCE OF AIR TRANSPORTATION

Information contained in this subsection was extracted from The Role of Air Transportation in Maui's Economic Future, published by the Maui Economic Development Board, Inc. (MEDB) in July 1992.

Although Maui's economy is dominated by tourism, MEDB believes the future well-being of the Island relies on the diversification of the economy by developing "high-tech" businesses on Maui. The success of this venture is dependent upon acquiring domestic and international investments. The availability of direct flights to Maui will be a major factor to be considered by businesses in their decision to make investments and locate operations on Maui.

Over 98 percent of the visitors to Maui travel by air and Maui residents receive practically all of their fresh produce and milk products on the same aircraft that carry these visitors. The agricultural industry ships out a substantial amount of fresh pineapple, flowers and onions by air cargo.

Maui Industries - Agriculture

Maui's agriculture is dominated by sugar and pineapple. "Diversified agriculture" (which includes crops other than sugar or pineapple) is most known for the world famous Maui onions and flowers although other crops such as macadamia nuts, seed corn and fruits and vegetables are also significant.

Sugar is not transported from Maui by air. However, approximately 6,000 tons of fresh pineapple are shipped by air annually. Fresh pineapple is a perishable crop and must rely entirely on air transportation to reach markets in a fresh condition.

The following air transportation issues have been identified as concerns of the pineapple industry:

- Fresh pineapple production is directly limited by a lack of sufficient air cargo capacity off of the Island.

- The major factor affecting the predictability of air cargo capacity is the length of the runway at Kahului Airport.
- Uncertainty of air cargo service results in pineapple containers weighing 2,500 to 3,000 pounds being "bumped" off aircraft because of weight restrictions.
- Routing pineapple through Honolulu generally results in greater spoilage.
- Airlines may switch to smaller aircraft with less cargo capacity. (e.g. B757)

Most of Maui's "diversified agricultural" crops exported from Maui, aside from sugar, are shipped by air. The most common diversified agricultural products shipped by air are flowers and onions. The following air transportation issues have been expressed by the grower associations involved with these crops (as reported in The Role of Air Transportation in Maui's Economic Future):

- Diversified agriculture products often get "bumped" for pineapple.
- Air cargo service is particularly limited during holidays.
- Current air cargo service costs eliminate profits and competitiveness.
- Current special rates for air cargo service may not continue.
- Growers fear importation of pests.

In summary, the agricultural industry is limited in its ability to grow and expand due to the lack of sufficient, predictable air cargo transportation. Sufficient and predictable air cargo transportation is directly related to the short runway length and pavement strength limitations, because significant weight restrictions are imposed on aircraft taking-off and priority is given to passengers and their baggage. Weights and capacities are further restricted by temperature, wind conditions and runway pavement strength.

Maui Industries - Tourism

Tourism is the largest component of the Maui economy. It has been estimated that 54 percent of Maui's gross County product can be attributed to tourism. In 1992, tourism expenditures in Maui were $2.2 billion.

California dominates the number of U.S. visitors to Maui – providing almost a third of all U.S. visitors. The West Coast region (California, Alaska, Washington, Oregon, Arizona and Nevada) produce the most Maui visitors. Table I.2-1 summarizes the distribution of U.S. visitors to Maui in 1993. Approximately 31 percent of Maui's visitors in 1993 were from outside the U.S. Table 1.2-2 shows the distribution of international visitors.

TABLE I.2-1
DISTRIBUTION OF 1993 U.S. VISITORS TO MAUI [a]

U.S. Region [b]	Percent of U.S. Visitors
West Coast	49
Rockies	6
Plains/Midwest	24
East and South	21
Total	100

[a] Source: Hawaii Visitors Bureau, 1994.

[b] The states which are in each region are shown in Appendix B (Table 6) of Appendix D, Socio-economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements.

TABLE I.2-2
DISTRIBUTION OF 1993 VISITORS TO MAUI BY COUNTRY OF ORIGIN [a]

Country	Percent of International Visitors
United States	69
Japan	14
Canada	6
Australia	1
Germany	2
United Kingdom	1
Taiwan	1
South Korea	1
All Other	4
Total	100

[a] Source: Hawaii Visitors Bureau, 1994.

Air transportation is critical to tourism's goal of reasonable hotel occupancy rates and consistently high levels of sales for retailers, tourist attractions and car rental companies. The

following air transportation issues have been identified by visitor industry representatives as particular concerns (The Role of Air Transportation in Maui's Economic Future):

- Maui is potentially losing about $366 million a year in visitor expenditures and over $7 million in transient accommodation taxes because of a lack of direct flights from the U.S. and the inability to process international visitors (due to lack of customs services).
- The same number of visitors with fewer aircraft arrivals can be achieved with more direct access and larger aircraft.
- Maui competes in a world market for tourism, not just with Oahu and the other neighbor islands.
- Visitors are increasingly concerned about time and convenience.
- Visitors prefer non-stop flights.
- Maui's visitor market is too dependent on California.

It should be noted that the last three points are not consistent with the findings of Appendix D of this EIS, Socio-economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements.

1993 MASTER PLAN SUMMARY

In June 1993, the Kahului Airport Master Plan was published by the State of Hawaii. The objective of the study was: to update guidelines for future airport development which will satisfy forecast aviation demands in a financially sound manner, while addressing the community's environmental and socioeconomic issues and concerns.

Alternative runway length analyses were performed for air carrier Runway 2-20 in the Facilities Requirement section of the master plan. Runway lengths of 8,500 feet, 9,500 feet and 10,500 feet were discussed in terms of the types of aircraft operations that could be performed. Set out below is a brief narrative given in the master plan for each alternative runway length:

- Runway 8,500 Feet Long. This length would allow unrestricted operations between Kahului and the U.S. West Coast by all aircraft likely to be used. It would also permit restricted payloads on non-stop to Denver. This length would not be feasible for non-stop service to Japan during all months of the year.

- Runway 9,500 Feet Long. The runway length would permit unrestricted non-stop flights between Kahului and the Mid-West. It would also permit economic non-stop operations to Japan.

- Runway 10,500 Feet Long. This runway length would permit unrestricted non-stop flights between Kahului and the East Coast and to other Pacific Rim Countries.

The master plan concluded that a length of 9,600 feet would satisfy the objective of the State of Hawaii, Department of Transportation to provide non-stop service to Mid-West cities from Kahului Airport. The extension of Runway 5-23 was not recommended in the master plan. The master plan also concluded that Runway 2-20 should be strengthened to accommodate dual tandem wheel gear aircraft (e.g., DC-10, L-1011) with a gross weight up to 600,000 pounds and double dual tandem wheel aircraft (e.g., B747) up to 900,000 pounds.

1992 FEIS SUMMARY

The Final Environmental Impact Statement, Kahului Airport Master Plan Update, published by the State of Hawaii in July, 1992 (FEIS) is a companion to the Kahului Airport Master Plan and focused on the airport improvements believed to be essential during the first five years of the development program. Specifically, the following five actions will require FAA approval during the next five years:

- Extend existing Runway 2-20 to a total length of 9,600 feet.
- Strengthen existing Runway 2-20.
- Construct a new Airport Access Road.
- Provide essential technical airport improvements (i.e. navigational aids and related infrastructure).
- Acquire land necessary to accomplish these actions only.

No construction will be initiated on these five recommended actions until a formal proposal is made to the FAA, there is compliance with NEPA and related federal requirements, and FAA approval is obtained.

The alternatives to the proposed action contained in the 1992 FEIS included only the No-Action Alternative and the Proposed Action. The October 6, 1992, Complaint to Enforce Court Order stated that the 1992 FEIS did not evaluate "all known alternative actions such as runways of different lengths." It is the purpose of this document to supplement the data contained in the 1992 FEIS and 1993 Airport Master Plan by providing a complete runway length analysis.

I-3

AIRPORT PROPERTIES

I-3
AIRPORT PROPERTIES

EXISTING AIRFIELD CONFIGURATION

Kahului Airport's land area of 1,447 acres is located on the northeastern side of the Town of ahului. Buildings and landside facilities are located east and west of the long air carrier runway oriented northeast-southwest. A second shorter runway intersects the long runway in an open-vee configuration and is also oriented northeast-southwest.

A brief description of each runway is presented in the following subsections.

Runway 2-20

The runway is 150 feet wide and 7,000 feet long and serves as the air carrier runway. It is paved with asphalt concrete and it has 35 foot wide asphalt concrete shoulders. The pavement strength is 130,000 pounds for single-wheel gears and 170,000 pounds for dual-wheel aircraft. here is a Category I ILS on Runway 2 and is supported by HIRL, MALSR and precision pavement marking.

The pavement has shown signs of distress and this has resulted in weight restrictions placed on heavy aircraft. DC10-10 and DC-10-30 aircraft are limited to gross take-off weights of 405,000 pounds and 430,000 pounds, respectively. Wide-body aircraft landings on Runway 2 must exit at the northerly threshold to Taxiway A for their return to the passenger terminal apron.

The runway has obstructions in both approaches. Runway 2 approach slope is 48:1 occasioned by a ground penetration of the transitional surface and a six foot stack penetration of the 50:1 approach surface. The Runway 20 approach surface is penetrated by trees resulting in an approach slope of 15:1. The Master Plan recommended that this runway be extended 2,600 feet to the south to provide a length of 9,600 feet.

Runway 5-23

This runway is 150 feet wide and 4,990 feet long and serves commuter and general aviation aircraft. It is paved with asphalt concrete and it also has 35 feet wide asphalt concrete shoulders. The pavement strength is 130,000 pounds for single-wheel aircraft, 170,000 pounds

for dual-wheel gears and 270,000 pounds for dual tandem gears. The pavement has not shown any signs of distress.

The runway is a non-precision instrument runway with 34:1 approach slopes. There are no obstructions in either direction. The lighting equipment is medium intensity edge lights with a VASI 4 on Runway 5. The Master Plan recommended that this runway remain at its present length of 4,990 feet.

AIRPORT ELEVATION

According to the data contained in the Master Plan Airport Layout Plan, the current airport elevation is 54 feet above mean sea level (MSL), and a planned elevation is 80 feet MSL when Runway 2-20 is extended to 9,600 feet.

METEOROLOGICAL CHARACTERISTICS

The principal meteorological characteristic pertinent to runway length analysis is the temperature ranges at the airport and in particular the average maximum temperature during the hottest month. According to data contained in the Airport Layout Plan, this temperature is 84°F.

I-4

AIR TRADE DEMAND

I-4
AIR TRADE DEMAND

INTRODUCTION

The Update Hawaii Aviation Demand Forecasts, dated August 1994, forms the bases of data contained in this section of the document. The forecasts include annual values of enplaned and deplaned cargo and mail, aircraft operations and based aircraft. The aircraft operations are further defined for the air carrier and commuter services by aircraft mix.

The forecasts are presented in five year increments starting in the year 2000 and continuing with projections for the years 2005, 2010, 2015 and 2020.

PASSENGER DISTRIBUTIONS

Although the passenger forecast presented the number of enplaned and deplaned passengers for each forecast period (which when translated into aircraft operations becomes of interest in an airside capacity analysis) a more important forecast element related to runway length analysis is the origin of future passengers.

From time to time various agencies have conducted passenger surveys that produced information concerning passenger origin locations, length of stay, expenditures during visit and which neighbor island was visited. Passenger characteristics data provides knowledge about the air service role of Kahului Airport now and in the future.

Using the distribution of visitors shown in Tables I.2-1 and I.2-2, a more detailed distribution for the top 20 U.S. states and by foreign countries was prepared together with the mileage between Maui and the visitor origins.

Table I.4-1 summarizes the results of the adjusted domestic and international visitor distributions. As can be seen from Table I.4-1 approximately 90 percent of total visitors arrive from origin locations not exceeding 5,000 statute miles from Maui. The 5,000 statute mile non-stop distance should satisfy the objectives of the State of Hawaii Department of Transportation as well as those of the Maui Economic Development Board, Inc. and the agricultural and tourism industries.

TABLE I.4-1
VISITOR DISTRIBUTION BY MILEAGE
FROM MAUI

Distance (Statute Miles)	Typical Cities	Percent Visitors	Cumulative Percent Visitors
2300 - 3000	Los Angeles, San Francisco	34	34
3000 - 4000	Dallas-Ft. Worth, Denver	10	44
4000 - 5000	Chicago, Atlanta, New York, Tokyo	46	90
5000 - 6000	Sydney, Hong Kong	4	94
6000 - 7000	Singapore	1	95
7000 - 9000	London, Frankfurt	5	100

Source: Hawaii Visitors Bureau.

AIRCRAFT MIX

Aircraft Fleet Mixes of Airlines Serving Maui

Research was conducted to understand the composition of aircraft fleets operated by the airlines serving Maui. The research also included aircraft on order but not yet delivered. The aircraft fleets set out below were reported by "Air Transport World" as of June 30, 1994.

- American Airlines Aircraft:

Model	Operational	On Order
B727-200 Adv	114	--
B757-200	75	16
B767-200	8	--
B767-200ER	22	--
B767-300ER	34	7
A300-605R	35	1
DC10-10	30	--
DC10-10ER	3	--
DC10-30	5	--
Fokker 100	62	13
MD-11	19	
MD-82	234	--
MD-83	26	--
Totals	667	37

- Delta Airlines Aircraft:

Model	Operational	On Order
B727-200 Adv	138	--
B737-200	58	--
B737-300	15	30
B757-200	84	6
B767-200	15	--
B767-300	26	2
B767-300ER	14	5
A310-200	5	--
S310-300	9	--
L1011-1	32	--
L1011-200	1	--
L1011-250	6	--
L1011-500	17	--
MD-11	10	5
MD-88	120	--
MD-90-30	--	31
Totals	550	79

- United Airlines Aircraft:

Model	Operational	On Order
B727-200 Adv	75	--
B737-200 Adv	69	--
B737-300	101	--
B737-400	--	--
B737-500	57	--
B747-100	18	--
B747-200B	9	--
B747-400	22	--
B747-SP	9	--
B757-200	88	--
B767-200	19	--
B767-300ER	23	--
B777-A	--	30
B777-B	--	4
A320-200	5	45
DC10-10	41	--
DC10-30	8	--
Totals	544	79

- Aloha Airlines Aircraft:

Model	Operational	On Order
B727-200	12	--
B737-300	2	--
B737-400	2	2
Totals	16	2

- Hawaiian Airlines Aircraft:

Model	Operational	On Order
DC9-50	13	--
DC10-10	7	--
Totals	20	--

Aircraft operated by the commuter airlines were not researched since these aircraft have no effect on the need for a runway extension.

A review of the composite aircraft fleet of all airlines indicated that the four most prominent aircraft types that were either operational or on order in 1994 are the following together with their percent of the total fleet:

B727-200 Adv	18.76%
B757-200	13.67
MD82, 88	21.03
B737-300	6.64
Total	60.10%

However, none of the four most prominent aircraft are currently operating between Kahului Airport and the U.S. mainland or are capable of operating 5,000 statute miles non-stop. Therefore, they were not considered in the runway length analysis.

Aircraft Mix Serving Kahului Airport

Commercial air carrier aircraft which served Kahului Airport in 1994 were the following:

Model	Percent of Air Carrier Operations at Kahului Airport
DC10-10	6.2
DC10-30	2.3
L1011-100	2.6
L1011-250	0.9
B767	0.9
B737	52.8
DC9-50	34.3
	100.0

Aircraft Capable of a 5,000 Statute Mile Non-Stop Flight

The current aircraft capable of a 5,000 statute mile non-stop flight include the following models together with their percent of the total fleet in 1994:

B747-400	1.22%
B767-200ER	1.22
B767-300ER	3.93
B777-200 *	1.85
DC10-30 **	0.72
MD11	1.60
Total	10.54%

* Not yet certified by FAA
** Out of Production Aircraft

The above six aircraft models represent 10.5 percent of the combined fleet of the airlines serving Maui. Two aircraft, the DC10-10 and L1011-100, while not capable of a 5,000 statute mile flight with a full passenger load, are currently used in non-stop or one-stop passenger service between Kahului Airport and the U.S. mainland.

PASSENGER DEMAND

Kahului Airport will continue throughout the forecast period, as the principal airport on the Island of Maui. The following forecasts of activity at Kahului Airport were taken from Draft Update Hawaii Aviation Demand Forecasts, prepared by the State of Hawaii, June 1994

(Revised). The total number of passengers (enplaned and deplaned) is estimated to increase from 5.36 million in 1993 to 7.99 million by 2010, an annual growth rate of 2.4 percent and an overall increase of 49 percent.

Interisland passengers will continue to account for the majority of passengers in the future, increasing from 3.90 million in 1992 to 5.44 million by 2010.

AIR CARGO DEMAND

Total annual volume of air cargo is forecast to increase from 40,100 tons in 1993 to 58,000 tons by 2010, an overall increase of 45 percent.

AIRCRAFT OPERATIONS

Total aircraft operations are forecast to increase from 187,300 in 1993 to 253,700 operations by 2010, an overall increase of 35 percent.

Air carrier aircraft operations are forecast to increase from 54,300 in 1993 to 80,700 in 2010. Commuter/air taxi operations are forecast to increase from 89,600 in 1993 to 112,300 operations by 2010. Helicopter tour operations are increasing and are forecast to account for about 80 percent of the commuter/air taxi operations by 2010.

General aviation operations are forecast to increase from 37,100 in 1993 to 49,000 operations by 2010. Military aircraft operations are expected to increase from 6,300 in 1993 to 11,700 in 2010.

I-5

RUNWAY LENGTH ANALYSIS

I-5
RUNWAY LENGTH ANALYSIS

INTRODUCTION

This section presents the analysis for determining the take-off and landing runway lengths required by various aircraft models that either exist or on order by the airlines serving Maui. It was noted in Subsection I-4 that 90 percent of Maui visitors come from origin cities within 5,000 miles from Maui. Subsection I-2 identified constraints experienced by Maui's agricultural industry in terms of the uncertainty of air cargo services because of weight restrictions.

The runway length analysis focusses attention on satisfying the passenger and cargo transportation needs of the top two Maui industries -- tourism and agriculture.

DEFINITIONS AND ASSUMPTIONS

Factors which have a bearing on runway length can be grouped into three general categories:

- Performance requirements imposed by the government on aircraft manufacturers and operators.
- The environment at the airport.
- Those items which establish the operating takeoff and landing gross weights for each aircraft type.

Since performance requirements imposed by the government are inherent in the aircraft takeoff and landing performance curves, attention was directed to the other two factors.

Airport Environment

Certain conditions at an airport will influence runway length. The more important conditions are temperature, surface wind, runway gradient, airport elevation and the condition of the runway surface. The effect of these conditions on runway length can only be approximated. However, it is important to understand their impacts.

Temperature. The higher the temperature, the longer the runway requirement because high mperatures reflect lower air densities resulting in lower output of thrust. The standard temperature at sea level is 59°F. For estimating purposes, the approximate variations of runway

length with temperature which apply to turbine-powered aircraft between 59°F and 90°F, varies from about 0.42 to 0.65 percent per degree Fahrenheit above 59°F. Therefore at 85°F, the runway length would be increased by an average of between 11 and 18 percent over the length required at 59°F.

Surface Wind. The greater the headwind, the shorter the runway length requirement and the greater the tailwind, the longer the runway length. A 5 knot headwind reduces the takeoff length by about 3 percent, whereas a 5 knot tailwind increases this length by about 7 percent.

Runway Gradient. An uphill gradient requires more takeoff runway length than a level or downhill gradient, the specific amount depending on the airport elevation and temperature. Aircraft manufacturers performance curves for takeoff lengths assume a zero runway gradient.

Airport Elevation. All other things being equal, the higher the altitude of the airport, the longer the runway required. This increase is not linear but varies with weight and temperature. For planning purposes, an increase in length from sea level of 7 percent per 1,000 feet of altitude will satisfy most airport sites. The Kahului Airport elevation is 54 feet above mean sea level (MSL). The airport elevation is not a significant factor at this airport regarding runway length.

Condition of Runway Surface. Standing water on the runway results in a very poor coefficient of braking friction and promotes hydroplaning of the tires. In addition to poor braking, there is also a loss of steering capability. Runway landing lengths for wet pavement conditions are increased 15 percent over dry pavement landing lengths.

Components of Aircraft Weight

It is important to understand the basic components which make up the weight of an aircraft during takeoff and landing, since weight is one of the major factors which govern the runway length. A number of different weights which are referenced in aircraft performance manuals and which will be used in analyses to follow are set out below:

- Operating Empty Weight (OEW) - This is the basic weight of the airplane including the crew and all gear required for flight, but excluding fuel and payload.

- Zero Fuel Weight (ZFW) - The weight above which all additional weight must be fuel.

- Payload - The total revenue producing load including passengers and baggage, mail, express and cargo.

- Maximum Structural Payload - The maximum load which the aircraft is certified to carry whether this load be passengers, cargo or a combination of both. This load is the difference between zero-fuel weight (ZFW) and operating empty weight (OEW). The maximum payload actually carried is generally less than the maximum structural payload because of volume restrictions.

- Maximum Structural Takeoff Weight - The maximum weight authorized at brake release for takeoff. It excludes taxi and run up fuel and it includes the OEW, trip and reserve fuel and payload.

- Maximum Structural Landing Weight - The structural capability of the aircraft in landing. On landing, the weight of an aircraft is the sum of the OEW, payload and fuel reserve and cannot exceed the maximum structural landing weight.

The average distribution of weight components for passenger turbine-powered aircraft expressed as an percent of takeoff weight is as follows for long range aircraft:

Operating Weight Empty	44%
Payload	10%
Trip Fuel	41%
Fuel Reserve	5%
Takeoff Weight	100%

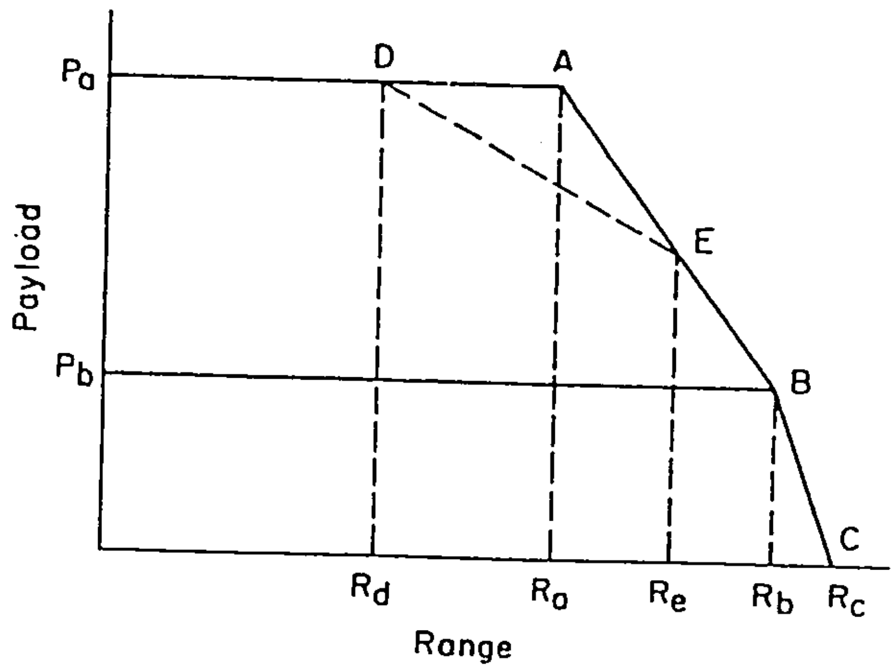
Payload and Range

A number of factors influence the range (distance) of an aircraft. Among the most important is payload. Normally, as range is increased, payload is decreased, with a weight tradeoff occurring between fuel to fly to destination and the payload which can be carried.

Aircraft manufacturers publish payload versus range diagrams in aircraft characteristics manuals for each aircraft model. These diagrams are very useful for determining the most probable weight characteristics of aircraft flying particular stage lengths between airports.

Figure I.5-1 is a general representative of the relationship between payload and range. Point "A"', the range at maximum payload, designates the farthest distance "Ra" that an aircraft can fly with a maximum structural payload.

FIGURE I.5-1
GENERAL RELATIONSHIP BETWEEN PAYLOAD AND RANGE



To fly a distance of "Ra" and carry a payload of "Pa", the aircraft has to take off at its maximum structural takeoff weight; however, its fuel tanks are not completely filled. Point "B", the range at maximum fuel, represents the farthest distance "Rb" that an aircraft can fly if its fuel tanks are completely filled at the start of the trip. The corresponding payload that can be carried is "Pb". To travel the distance "Rb", the aircraft must take off at its maximum structural takeoff weight.

To extend the distance traveled from "Ra" to "Rb", the payload has to be reduced in favor of adding more fuel. Point "C" represents the maximum distance that an aircraft can fly without any payload. Sometimes this is referred to as the ferry range and it is used, if necessary, to deliver aircraft. To travel this distance "Rc", the maximum amount of fuel is necessary, but since there is no payload, the takeoff weight is less than maximum.

In some cases, the maximum structural landing weight may determine how long an aircraft can fly with a maximum structural payload. In this case, line "DE" represents the tradeoff between payload and range which must occur, since the payload is limited by the maximum structural landing weight. The shape of the payload versus the range curve would follow line "DEBC" instead of "ABC".

The actual payload, particularly in passenger aircraft, is normally less than the maximum structural payload even when the aircraft is completely full. This is due to the limitation of space when passengers are carried. For computing payload, passengers and their baggage are normally considered as 205 lb. units.

Runway length analyses were prepared using several different but related approaches. The first approach considered the performance limitation on current non-stop flights to the mainland west coast. The second approach determined takeoff and landing runway lengths for long range flights of 5,000 miles for each of the six aircraft identified in Subsection I-4. The third approach identified the operational performance of the same six aircraft on the alternative runway lengths contained in the Kahului Airport Master Plan Update report; namely, 7,000 feet, 8,500 feet, 9,500/9,600 feet, and 10,500 feet. The fourth approach identified the passenger-and cargo-carrying restrictions for operations to a number of cities under alternative runway lengths. At the end of this section the "declared distance" concept is examined.

PERFORMANCE LIMITATIONS ON CURRENT NON-STOP FLIGHTS TO THE WEST COAST

As of November 1994, the only aircraft used for non-stop flights from Kahului Airport to the mainland west coast is the McDonnell-Douglas DC10-10. Departures of the DC10-10 from Kahului Airport are often restricted in the number of passengers and/or amount of cargo that can be carried because of the length of runway available, wind conditions, temperature and other factors. This subsection describes these aircraft performance limitations. Performance limitations for the L1011-100 are also described in this subsection because that aircraft is used in flights from Kahului to the mainland west coast that stop in Honolulu.

~~The payload penalty data developed here are based on minimum requirements established by the Federal Aviation Administration (FAA) and other planning standards. It must be noted that each airline has its own procedures and standards, which are often more stringent than the minimum requirements used here. More stringent standards could result in greater payload penalties. Two large U.S. airlines with flights between the mainland and Kahului and/or Honolulu were surveyed to compare their standards with those used in the analyses here. The following differences were found:~~

- ~~the use of greater fuel reserves by one airline, which for a typical scenario produced a limitation of 50 percent of maximum passengers and baggage compared with 60 percent under the calculations presented here.~~

- ~~the use of greater average weights for passengers and baggage (211 to 215 pounds compared with 205 pounds for the calculations here).~~

~~Therefore airlines operating from Kahului Airport could experience greater payload penalties than shown here. The performance limitation information contained here should be used to identify the lower limit of potential limitations.~~

Maximum Takeoff Weight

The primary factors affecting the maximum takeoff weight for large aircraft departures at Kahului Airport are temperature, runway direction, wind velocity, and obstructions. In Tables I.5-1 and I.5-2 the affects of each of these factors on the maximum aircraft takeoff weight is shown. Takeoff weights are based on actual runway gradient and clearance of obstacles according to Federal Aviation Regulations Part 121 requirements. It should be noted that the lowest recorded temperature at Kahului was 48°F and the average is 71.5°F (State Data Book, 1993-1994).

TABLE I.5-1
AIRCRAFT TAKEOFF WEIGHT FOR DC10-10 DEPARTURES AT KAHULUI AIRPORT FOR EXISTING RUNWAY 2-20 AND ALTERNATIVE WIND AND TEMPERATURE CONDITIONS [a]

Temperature (Degrees Fahrenheit)	Aircraft Takeoff Weight for Alternate Wind Conditions (Thousands of Pounds)			
	5 Knot Tailwind	Zero Wind	5 Knot Headwind	10 Knot Headwind
Runway 02 with No Tall Ships				
40	394.5	408.2 [b]	413.6 [b]	418.9 [b]
50	392.4	406.0 [b]	411.2 [b]	416.4 [b]
60	391.0	404.4	409.4 [b]	414.4 [b]
70	389.4	402.5	408.3 [b]	413.4 [b]
80	386.7	400.2	406.0 [b]	411.8 [b]
90	379.2	392.7	398.4	404.2
100	363.8	375.5	380.8	386.2
Runway 02 with Tall Ship [c]				
40	352.2	367.1	372.3	377.6
50	350.9	365.6	370.7	375.8
60	349.7	364.4	369.5	374.6
70	348.6	363.2	368.3	373.4
80	347.5	362.0	367.2	372.3
90	342.3	356.5	361.6	366.8
100	325.0	338.5	342.8	347.0
Runway 20				
40	375.6	391.2	397.6	404.1
50	372.9	388.4	395.1	401.7
60	370.7	386.2	392.8	399.4
70	368.4	383.8	390.6	397.3
80	365.9	381.2	388.2	395.1
90	359.1	374.1	381.1	388.1
100	344.0	358.4	364.6	370.9

[a] Source: P&D Aviation, based on operations data developed by Jeppesen Sanderson, Inc. Takeoff weights are based on actual runway gradient and clearance of obstacles according to Federal Aviation Regulations Part 121 requirements. DC10-10 engine type: CF6-6D.

[b] Exceeds structural limit of runway pavement, 405,000 pounds. Runway characteristics are:

	Length (feet)	Gradient (%)
Runway 02	7,000	-0.59
Runway 20	7,000	+0.59

[c] Maximum height of ship is 138 feet above elevation of Runway 20 threshold.

TABLE I.5-2
AIRCRAFT TAKEOFF WEIGHT FOR L1011-100 DEPARTURES AT KAHULUI AIRPORT FOR EXISTING RUNWAY 2-20 AND ALTERNATIVE WIND AND TEMPERATURE CONDITIONS [a]

Temperature (Degrees Fahrenheit)	Aircraft Takeoff Weight for Alternate Wind Conditions (Thousands of Pounds)			
	5 Knot Tailwind	Zero Wind	5 Knot Headwind	10 Knot Headwind
Runway 02 with No Tall Ships				
40	[b]	394.5	398.1	401.7
50	[b]	391.2	394.8	398.4
60	[b]	387.9	391.5	395.1
70	[b]	384.7	388.3	391.9
80	[b]	381.4	385.0	388.6
90	[b]	371.4	375.0	378.6
100	[b]	358.5	362.1	365.7
Runway 02 with Tall Ship [c]				
40	[b]	372.8	375.7	378.6
50	[b]	370.8	373.7	376.6
60	[b]	368.8	371.7	374.6
70	[b]	366.8	369.7	372.6
80	[b]	365.0	367.9	370.8
90	[b]	355.9	358.8	361.7
100	[b]	341.6	344.5	347.4
Runway 20				
40	[b]	379.6	383.2	386.7
50	[b]	376.6	380.2	383.7
60	[b]	373.5	377.1	380.6
70	[b]	370.4	374.0	377.5
80	[b]	367.3	370.9	374.4
90	[b]	358.1	361.7	365.2
100	[b]	345.6	349.2	352.7

[a] Source: P&D Aviation, based on operations data developed by Jeppesen Sanderson, Inc. Takeoff weights are based on actual runway gradient and clearance of obstacles according to Federal Aviation Regulations Part 121 requirements. L1011-100 engine type: RB211-22B. Runway characteristics are:

	Length (feet)	Gradient (%)
Runway 02	7,000	-0.59
Runway 20	7,000	+0.59

[b] Data not available.

[c] Maximum height of ship is 138 feet above elevation of Runway 20 threshold.

FAA Form 8260-5, Standard Instrument Approach Procedure, for Kahului Airport identifies a ship north of the airport as a potential obstruction. A maximum ship height of 150 feet above sea level is specified in the Form 8260-5. An object such as this at the end of a runway can affect the maximum takeoff weight of a departing aircraft due to Part 121 requirements. Therefore, the takeoff weights for Runway 02 were determined for conditions with and without a tall (150-foot) ship. The affect on takeoff weight was also tested for temperatures ranging from 40°F to 100°F and winds at the airport ranging from a 5 knot tailwind to a 10 knot headwind.

For departures on Runway 02 with no tall ships north of the airport, the structural limit of the runway pavement (405,000 pounds) can be reached with DC10-10 departures under some wind and temperature conditions. These conditions are generally cool temperatures (40°F to 50°F) and/or headwinds exceeding 5 knots with temperatures up to 80°F. Performance on Runway 20 is not as good as Runway 02 (with no tall ships) due to the uphill gradient of Runway 20. The structural limit of the runway can not be reached with L1011-100 departures under the conditions shown.

Maximum Payload Allowable

In Tables I.5-3 and I.5-4 the aircraft takeoff weights shown in Tables I.5-1 and I.5-2 are converted to maximum allowable payload for various enroute wind and destination weather conditions. The maximum payload that an aircraft can carry is principally determined by the allowable takeoff weight, winds enroute and weather conditions at the destination airport (which often affect the fuel requirement for alternate destinations). The data in Tables I.5-3 and I.5-4 were developed from individual flight plans prepared for the weather conditions and takeoff weights shown. Poor weather conditions throughout the Los Angeles basin require sufficient fuel to continue to Las Vegas as the alternate destination. Enroute winds are shown in Tables I.5-3 and I.5-4 for the average conditions during the best month (January) and worst month (July). As seen in Tables I.5-3 and I.5-4, aircraft takeoff weight has the greatest affect on allowable payload. However, low tailwinds and poor west coast weather can decrease allowable payloads significantly.

Percent of Maximum Payload

DC10-10. The payloads shown in Table I.5-3 are expressed in terms of percent of maximum payloads in Table I.5-5. The DC10-10 payload percents are based on the current United Airlines DC10-10 seating capacity of 287 and an average of 205 pounds per passenger (including baggage), a maximum passenger and baggage payload of 58,835 pounds. The maximum cargo capacity on passenger flights is 35,994 pounds.

TABLE I.5-3
MAXIMUM PAYLOADS FOR NON-STOP DC10-10 DEPARTURES FROM KAHULUI AIRPORT TO THE MAINLAND WEST COAST (LOS ANGELES) ON EXISTING RUNWAY 2-20 [a]

Aircraft Takeoff Weight (Thousands of Pounds)	Maximum Allowable Payload (Pounds)			
	Good West Coast Weather (Ontario, CA Alternate Destination)		Poor West Coast Weather (Las Vegas Alternate Destination)	
	42 Knot Tailwinds Enroute [b]	22 Knot Tailwinds Enroute [c]	42 Knot Tailwinds Enroute [b]	22 Knot Tailwinds Enroute [c]
350	30,639	28,263	26,377	23,979
360	38,608	36,037	34,232	31,640
370	46,548	44,276	42,061	39,762
380	54,683	52,195	50,082	47,568
390	62,436	59,985	57,724	55,247
400	70,459	68,007	65,634	63,154
405 [d]	74,582	71,953	69,699	67,044

[a] Source: Operations data developed by Jeppesen Sanderson, Inc. Individual flight plans were prepared for each weather condition and takeoff weight consideration.
[b] Average wind conditions enroute during best month (January).
[c] Average wind conditions enroute during worst month (July).
[d] Existing structural limit of runway pavement.

As Table I.5-5 illustrates, full passenger loads are possible with an aircraft takeoff weight of 390,000 pounds or more on existing Runway 2-20 with good west coast weather and 400,000 pounds or more with poor west coast weather. Table I.5-1 indicates the temperature and wind conditions which would allow DC10-10 aircraft takeoff weights of this amount. For example, DC10-10 aircraft takeoff weights of 400,000 pounds or more under calm wind conditions cannot be obtained on Runway 20 and are possible on Runway 02 (with no tall ships), only if temperatures are 80°F or below.

At the maximum takeoff weight, 405,000 pounds, only 44 percent of available cargo capacity can be used under the conditions shown in Table I.5-5.

L1011-100. An analysis similar to the DC10-10 analysis is shown in Table I.5-6 for the L1011-100. The payload percents for the L1011-100 are based on the current Delta Airlines L1011-100 seating capacity of 302 and an average of 205 pounds per passenger (including

TABLE I.5-4
MAXIMUM PAYLOADS FOR NON-STOP L1011-100 DEPARTURES FROM KAHULUI AIRPORT TO THE MAINLAND WEST COAST (LOS ANGELES) ON EXISTING RUNWAY 2-20 [a]

Aircraft Takeoff Weight (Thousands of Pounds)	Maximum Allowable Payload (Pounds)			
	Good West Coast Weather (Ontario, CA Alternate Destination)		Poor West Coast Weather (Las Vegas Alternate Destination)	
	42 Knot Tailwinds Enroute [b]	22 Knot Tailwinds Enroute [c]	42 Knot Tailwinds Enroute [b]	22 Knot Tailwinds Enroute [c]
350	19,794	17,248	14,438	11,848
360	27,968	25,215	22,549	19,755
370	36,071	33,284	30,586	27,759
380	44,154	41,480	38,596	35,882
390	51,994	49,073	46,363	43,403
400	59,855	57,112	54,144	51,361
405 [d]	64,000	61,003	58,245	55,212

[a] Source: Operations data developed by Jeppesen Sanderson, Inc. Individual flight plans were prepared for each weather condition and takeoff weight consideration.

[b] Average wind conditions enroute during best month (January).

[c] Average wind conditions enroute during worst month (July).

[d] Existing structural limit of runway pavement.

TABLE I.5-5
PAYLOAD RESTRICTIONS FOR NON-STOP DC10-10 DEPARTURES FROM KAHULUI AIRPORT TO THE MAINLAND WEST COAST (LOS ANGELES) ON EXISTING RUNWAY 2-20 [a]

Aircraft Takeoff Weight (Thousands of Pounds)	Good West Coast Weather (Ontario, CA Alternate Destination)		Poor West Coast Weather (Las Vegas Alternate Destination)	
	42 Knot Tailwinds Enroute [b]	22 Knot Tailwinds Enroute [c]	42 Knot Tailwinds Enroute [b]	22 Knot Tailwinds Enroute [c]
	Percent of Maximum Payload of Passengers and Baggage [d]			
350	52	48	45	41
360	66	61	58	54
370	79	75	71	68
380	93	89	85	81
390	100	100	98	94
400	100	100	100	100
405 [e]	100	100	100	100
	Percent of Cargo Capacity in Addition to 100 Percent of Passengers and Baggage on Passenger Flights [f]			
390	10	3	0	0
400	32	25	19	12
405 [e]	44	36	30	23

[a] Source: P&D Aviation, based on operations data developed by Jeppesen Sanderson, Inc. Individual flight plans were prepared for each weather condition and takeoff weight consideration.

[b] Average wind conditions enroute during best month (January).

[c] Average wind conditions enroute during worst month (July).

[d] Based on United Airlines DC10-10 seating capacity of 287 (28 first class, 259 coach) and an average of 205 pounds per passenger (including baggage), a maximum passenger and baggage payload of 58,835 pounds.

[e] Existing structural limit of runway pavement.

[f] Based on a cargo capacity on passenger flights of 35,994 pounds.

TABLE I.5-6
PAYLOAD RESTRICTIONS FOR NON-STOP L1011-100 DEPARTURES FROM KAHULUI AIRPORT TO THE MAINLAND WEST COAST (LOS ANGELES) ON EXISTING RUNWAY 2-20 [a]

Aircraft Takeoff Weight (Thousands of Pounds)	Good West Coast Weather (Ontario, CA Alternate Destination)		Poor West Coast Weather (Las Vegas Alternate Destination)	
	42 Knot Tailwinds Enroute [b]	22 Knot Tailwinds Enroute [c]	42 Knot Tailwinds Enroute [b]	22 Knot Tailwinds Enroute [c]
Percent of Maximum Payload of Passengers and Baggage [d]				
350	32	28	23	19
360	45	41	36	32
370	58	54	49	45
380	71	67	62	58
390	84	79	75	70
400	97	92	87	83
405 [e]	100	99	94	89
Percent of Cargo Capacity in Addition to 100 Percent of Passengers and Baggage on Passenger Flights [f]				
390	0	0	0	0
400	0	0	0	0
405 [e]	14	0	0	0

[a] Source: P&D Aviation, based on operations data developed by Jeppesen Sanderson, Inc. Individual flight plans were prepared for each weather condition and takeoff weight consideration.

[b] Average wind conditions enroute during best month (January).

[c] Average wind conditions enroute during worst month (July).

[d] Based on Delta Airlines L1011-100 seating capacity of 302 (32 first class, 270 coach) and an average of 205 pounds per passenger (including baggage), a maximum passenger and baggage payload of 61,910 pounds.

[e] Existing structural limit of runway pavement.

[f] Based on a cargo capacity on passenger flights of 14,960 pounds.

baggage), a maximum passenger and baggage payload of 61,910 pounds. The maximum cargo capacity on passenger flights is 14,960 pounds.

As Table I.5-6 shows, the passenger-carrying performance of the L1011-100 is not as good as the DC10-10 with a 7,000-foot runway. Full passenger loads to the west coast are only possible at a takeoff weight of 405,000 pounds, good west coast weather and favorable winds enroute. At the maximum takeoff weight, only 14 percent of available maximum cargo capacity can be used under favorable enroute and destination weather conditions.

This analysis of the payload restrictions for nonstop DC10-10 and L1011-100 departures from Kahului Airport to the mainland west coast shows that the limited runway length, together with other factors, places significant restrictions on these flights. The flight distance from Kahului Airport to Los Angeles International Airport (2,525 statute miles) is only slightly farther than to San Francisco International Airport (2,375 statute miles). Therefore, the analysis shown here for Los Angeles would generally apply to San Francisco also.

RUNWAY LENGTH REQUIREMENTS FOR LONG-RANGE (5,000 STATUTE MILES) OPERATIONS

This subsection describes an analysis undertaken to compare runway length requirements for six aircraft types which are capable of long-range (5,000 statute mile) non-stop service from Kahului Airport. The airport environmental data was generalized for this analysis, unlike the approach taken in the preceding subsection. Because the purpose of this approach was to identify general differences in performance among aircraft types for long-range operations, the following parameters were used for this analysis:

Mean Temperature - Hottest Month	84°F
Airport Elevation	Sea Level
Runway Gradient	Zero
Wind	Zero

The pertinent operational characteristics of the designated aircraft are set out in Table I.5-7. The payloads consist of full passengers and baggage at 205 pounds per unit. The runway lengths needed to satisfy the operational characteristics contained in Table I.5-7 are set out in Table I.5-8.

TABLE I.5-7
LONG RANGE AIRCRAFT OPERATIONAL CHARACTERISTICS

Model	Operating Empty Weight (lbs)	Passenger Payload (lbs) [a]	Brake Release Weight (lbs)	Typical Landing Weight (lbs) [b]
B747-400	396,500	82,000	740,000	516,600
B767-200ER [c]	181,500	44,300	345,000	256,500
B767-300ER	195,000	53,500	380,000	288,000
B777-200	304,500	76,900	550,000	409,500
DC10-30	266,200	55,350	550,000	362,700
MD11	285,130	66,215	573,000	387,000

[a] Passenger payload equals maximum number of passengers times 205 pounds. Maximum passenger loads are shown in Table I.5-8.

[b] Estimated at 90 percent of maximum structural landing weight.

[c] ER = Extended range.

TABLE I.5-8
RUNWAY TAKEOFF AND LANDING LENGTHS FOR LONG RANGE OPERATIONS WITH FULL PASSENGER PAYLOAD

Model	Passengers	Take-off Length (ft) [a]	Landing Length (ft) [b]
B747-400	400	8,000	6,500
B767-200ER	216	6,700	5,300
B767-300ER	261	8,600	5,400
B777-200	375	8,000	6,100
DC10-30	270	10,500	5,500
MD11	323	9,100	7,000

[a] Corrected for 84°F.
[b] Landings on wet pavements.

As can be seen from Table I.5-8, the landing lengths on wet pavements are not the critical lengths. In all instances, the take-off lengths for a 5,000 statute mile non-stop flight are the controlling lengths. The newer generation of Boeing aircraft (747-400, 767-200ER, 300ER and B777-200) require the shortest runway while the McDonnell-Douglas aircraft (DC10-30 and MD11) need the longest runway for a long-range flight.

It should be noted that the take-off runway lengths included in Table I.5-8 are not for maximum take-off weights of the aircraft because cargo is not included. Since the uncertainty of air cargo capacity is a concern of Maui's agricultural industry, the runway length analyses must also

include payloads that consist of both passengers and cargo. Adding cargo to the full load of passengers will result in longer takeoff runway lengths for the same 5,000 statute mile flight. Table I.5-9 shows the weight of cargo that could be added to each aircraft to reach the maximum payload.

The next issue that was examined is the amount of payload that could be carried by those aircraft on a 5,000 statute mile nonstop flight. An operational analysis of the six aircraft carrying maximum payload on a 5,000 statute mile trip resulted in the following takeoff runway lengths and reductions in payload weights from the weights shown in Table I.5-9.

- B747-400 — Runway takeoff length 9,500 feet; Payload restriction - none
- B767-200ER — Runway takeoff length - 9,000 feet; Payload restriction - none
- B767-300ER — Runway takeoff length - 10,700 feet; Payload restriction - 8,000 lbs of cargo
- B777-200 — Runway takeoff length - 9,600 feet; Payload restriction - 15,000 lbs of cargo
- DC10-30 — Runway takeoff length - 10,000 feet; Payload restriction - 31,430 lbs of cargo
- MD11 — Runway takeoff length - 9,100 feet; Payload restriction - 14,870 lbs of cargo

It is concluded from the above analysis that the six aircraft can carry, in addition to full passengers and baggage, the cargo weights shown in Table I.5-10. As can be seen from the previous two tabulations, the DC10-30 aircraft carries the least weight of cargo, and moreover requires the second longest runway to carry any cargo in addition to passengers. The best performing aircraft under this loading scenario is the B747-400 which has no cargo payload penalty and requires a runway length of only 9,500 feet.

TABLE I.5-9
MAXIMUM PASSENGER AND CARGO PAYLOADS

Model	Passengers/ Payload (lbs)	Cargo Payload (lbs)	Maximum Payload (lbs)
B747-400	400/82,000	56,490	138,490
B767-200ER	216/44,300	34,200	78,500
B767-300ER	261/53,500	39,460	92,960
B777-200	375/76,900	43,600	120,500
DC10-30	255/52,275	49,535	101,810
MD11	323/66,215	48,655	114,870

TABLE I.5-10
TOP OFF CARGO WEIGHTS FOR LONG RANGE OPERATION

Model	Cargo Payload (lbs)
B747-400	56,486
B767-200ER	34,200
B767-300ER	31,457
B777-200	28,600
DC10-30	18,104
MD11	33,785

OPERATIONAL PERFORMANCE FOR ALTERNATIVE RUNWAY LENGTHS

As noted in Subsection I-2, the Kahului Airport Master Plan Update report considered three alternative runway extension proposals in addition to the existing 7,000 foot length. The report concluded that a 2,600 foot extension would satisfy the objectives of the Department of Transportation to provide non-stop service to mid-west cities and farther airport hubs both domestic and international.

The objective of this analysis is to determine the maximum operational capability of each of the six aircraft types on the alternative runway lengths. The first operational test was whether or not each aircraft can carry a full passenger payload on a 5,000 statute mile non-stop flight. If this was not possible for a given aircraft, then a determination was made on the longest non-stop flight with full passenger payload. The final part of the analysis determined the longest non-stop distance with full passengers and the weight of cargo shown in Table I.5-10. This analysis is based on a zero runway gradient, zero winds, no pavement restrictions, and a temperature of 84°F.

Existing Runway Length 7,000 Feet

Set out below are the aircraft operational achievements for each aircraft on a 7,000 foot long runway, the existing runway length, but without the aircraft weight limitations of the existing pavement.

B747-400. Analysis shows that this aircraft cannot perform a 5,000 statute mile non-stop flight with full passengers and baggage. A weight penalty of 115 passengers resulting in a 71 percent load factor would be experienced on this shortest of all alternative runway lengths. Analysis further shows that this aircraft could perform a 4,300 statute mile non-stop flight with a full passenger payload. In order to carry a full passenger and cargo payload (Table I.5-10 cargo weight), the aircraft could perform a 2,900 statute mile non-stop flight. The tabulation below summarizes the operational analyses for a B747-400 aircraft operating on a 7,000 foot runway:

Non-Stop Flight (Statute Miles)	Payload
5,000	71% Passengers + Baggage
4,300	100% Passengers + Baggage
2,900	100% Passenger, Baggage and Cargo

B767-200ER. Analysis shows that this aircraft cannot perform a 5,000 statute mile non-stop flight with full passengers and baggage. A weight penalty of 38 passengers resulting in a 82 percent load factor would be experienced on this short runway.

Analysis further shows that this aircraft could perform a 4,600 statute mile non-stop flight with a full passenger payload. In order to carry a full passenger and cargo payload (Table I.5-10, cargo weight), the aircraft could perform a 2,800 statute mile non-stop flight. The tabulation below summarizes the operational analysis for a B767-200ER aircraft operating on a 7,000 foot runway:

Non-Stop Flight (Statute Miles)	Payload
5,000	82% Passengers + Baggage
4,600	100% Passengers + Baggage
2,800	100% Passenger, Baggage and Cargo

B767-300ER. Analysis shows that this aircraft cannot perform a 5,000 statute mile non-stop flight with full passengers and baggage. A weight penalty of 76 passengers resulting in a 71 percent load factor would be experienced on this short runway. Analysis further shows that this aircraft could perform a 4,300 statute mile non-stop flight with a full passenger payload. In order to carry a full passenger and cargo payload (Table I.5-10, cargo weight), the aircraft could perform a 2,100 statute mile non-stop flight. The following tabulation summarizes the operational analysis for a B767-300ER aircraft operating on a 7,000 foot runway.

Non-Stop Flight (Statute Miles)	Payload
5,000	71% Passengers + Baggage
4,300	100% Passengers + Baggage
2,100	100% Passenger, Baggage and Cargo

B777-200. Analysis shows that this aircraft cannot perform a 5,000 statute mile non-stop flight with full passengers and baggage. A weight penalty of 114 passengers resulting in a 70 percent load factor would be experienced on this short runway.

Analysis also shows that this aircraft could perform a 4,000 statute mile non-stop flight with a full passenger payload. In order to carry a full passenger and cargo payload (Table I.5-10, cargo weight), the aircraft could perform a 2,400 statute mile non-stop flight. The following tabulation summarizes the operational analysis for a B777-200 aircraft operating on a 7,000 foot runway:

Non-Stop Flight (Statute Miles)	Payload
5,000	70% Passengers + Baggage
4,000	100% Passengers + Baggage
2,400	100% Passenger, Baggage and Cargo

DC10-30. Analysis shows that this aircraft cannot carry any payload on a 5,000 statute mile non-stop flight when operating from a 7,000 foot runway. The takeoff gross weight is limited to 460,000 pounds. The operating empty weight is 266,191 pounds and when subtracted from the gross takeoff weight, leaves 193,809 pounds available for fuel and payload. Estimated fuel weight for a 5,000 statute mile non-stop flight is 200,500 pounds, therefore no payload could be carried and moreover, the aircraft could not fly 5,000 miles even if it were empty (no payload). The maximum empty range would be 4,833 statute miles.

A payload of full passengers and baggage weighs 55,350 pounds. Adding the OEW, brings the payload plus OEW to 321,541 pounds. Subtracting this from the gross takeoff weight of 460,000 pounds, leaves 138,459 pounds available for fuel. This available fuel weight equates to a non-stop distance of 3,453 statute miles.

When the passenger payload is increased by the cargo weight shown in Table I.5-10, the payload is increased to 70,009 pounds and the available fuel weight is reduced to 123,800 pounds. This will permit a non-stop flight of 3,087 statute miles. The following tabulation summarizes the operational analyses for a DC10-30 operating from a 7,000 foot runway.

Non-Stop Flight (Statute Miles)	Payload
5,000	Beyond the Range - No payload
3,453	100% Passengers + Baggage
3,087	100% Passenger, Baggage and Cargo

MD11. Analysis shows that this aircraft cannot perform a 5,000 statute mile non-stop flight with full passengers and baggage when operating from a 7,000 foot runway. A weight penalty of 104 passengers resulting in a 68 percent load factor would be experienced operating on this short runway. Analysis also shows that this aircraft could perform a 4,390 statute mile non-stop flight with a full passenger and baggage payload. In order to carry both passengers and the cargo weight shown in Table I.5-10, the aircraft could perform a 3,430 statute mile non-stop flight. The tabulation below summarizes the operational analysis for a MD11 aircraft operating on a 7,000 foot runway:

Non-Stop Flight (Statute Miles)	Payload
5,000	68% Passengers + Baggage
4,390	100% Passengers + Baggage
3,430	100% Passenger, Baggage and Cargo

Operational Analyses Summary for a 7,000 Foot Runway. Table I.5-11 summarizes the non-stop flight distances for each of the six aircraft for various payload scenarios.

TABLE I.5-11
NON-STOP FLIGHT DISTANCES FOR PAYLOAD COMBINATIONS
7,000 FOOT RUNWAY

Aircraft Model	Full Passenger and Baggage (Statute Miles)	Full Passengers, Baggage and Cargo (Statute Miles)
B747-400	4,300	2,900
B767-200ER	4,600	2,800
B767-300ER	4,300	2,100
B777-200	4,000	2,400
DC10-30	3,453	3,087
MD11	4,390	3,430

Runway Length 8,500 Feet

This subsection contains the same operational analyses for each of the six aircraft operating on an 8,500 foot runway.

B747-400. Analysis shows that this aircraft can perform a 5,000 statute mile non-stop flight with full passengers and baggage when operating on an 8,500 foot long runway, without a weight penalty. Analysis also shows that a payload of full passengers and the cargo weight shown in Table I.5-10 can be carried on a 4,300 statute mile non-stop flight. These distances are summarized in the following tabulation:

Non-Stop Flight (Statute Miles)	Payload
5,000	100% Passengers + Baggage
4,300	100% Passenger, Baggage and Cargo

B767-200ER. Analysis shows that this aircraft can perform a 5,000 statute mile non-stop flight with full passengers and baggage when operating on an 8,500 foot long runway, without a weight penalty. Analysis also shows that a payload of full passengers and the cargo weight shown in Table I.5-10 can be carried on a 3,500 statute mile non-stop flight. These distances are summarized in the following tabulation:

Non-Stop Flight (Statute Miles)	Payload
5,000	100% Passengers + Baggage
3,500	100% Passenger, Baggage and Cargo

B767-300ER. Analysis shows that this aircraft can perform a 5,000 statute mile non-stop flight with full passengers and baggage when operating on an 8,500 foot long runway, without a weight penalty. Analysis also shows that a payload of full passengers and the cargo weight shown in Table I.5-10 can be carried on a 4,300 statute mile non-stop flight. These distances are summarized in the following tabulation:

Non-Stop Flight (Statute Mile)	Payload
5,000	100% Passengers + Baggage
4,300	100% Passenger, Baggage and Cargo

777-200. Analysis shows that this aircraft can perform a 5,400 statute mile non-stop flight with full passengers and baggage when operating on an 8,500 foot runway without a weight penalty. Analyses also shows that a payload of passengers and the cargo weight shown in Table I.5-10 can be carried on a 4,300 mile non-stop flight. This operating distances are summarized in the following tabulation:

Non-Stop Flight (Statute Mile)	Payload
5,400	100% Passengers + Baggage
4,300	100% Passenger, Baggage and Cargo

DC10-30. Analysis shows that this aircraft cannot perform a 5,000 statute mile non-stop flight with full passengers and baggage. There would be a weight penalty of 36 passengers resulting in an 87 percent load factor. A payload of full passengers and baggage could be carried on a 4,814 statute mile non-stop flight. Analysis shows that a payload of full passengers, baggage and cargo weight shown in Table I.5-10, could be carried on a 4,449 statute mile non-stop flight. This operational analyses is summarized in the following tabulation:

Non-Stop Flight (Statute Mile)	Payload
5,000 4,814 4,449	87% Passengers + Baggage 100% Passengers + Baggage 100% Passenger, Baggage and Cargo

MD11. Analysis shows that this aircraft can perform a 5,000 statute mile non-stop flight with full passengers and baggage. A payload of passengers, baggage and cargo weight contained in Table I.5-10 can be carried on a 4,429 statute mile non-stop flight. These distances are summarized in the following tabulation:

Non-Stop Flight (Statute Mile)	Payload
5,000 4,429	100% Passengers + Baggage 100% Passenger, Baggage and Cargo

Operational Analyses Summary for an 8,500 Foot Runway. Table I.5-12 summarizes the non-stop flight distances for each of the six aircraft for various payload scenarios.

TABLE I.5-12
NON-STOP FLIGHT DISTANCES FOR PAYLOAD COMBINATIONS
8,500 FOOT RUNWAY

Aircraft Model	Full Passenger and Baggage (Statute Mile)	Full Passengers, Baggage and Cargo (Statute Mile)
B747-400	5,000	4,300
B767-200ER	5,000	3,500
B767-300ER	5,000	4,300
B777-200	5,400	4,300
DC10-30	4,814	4,449
MD11	5,000	4,429

Runway Length 9,500/9,600 Feet

This subsection contains the same operational analyses for each of the six aircraft operating on a 9,500/9,600 foot runway.

B747-400. Analysis shows that this aircraft operating from a 9,500/9,600 foot runway can carry a full passenger baggage payload on a 6,300 statute mile non-stop flight. Moreover, a payload of full passengers, baggage and cargo weight as set out in Table I.5-10 can be carried on a 5,000 statute mile non-stop flight:

Non-Stop Flight (Statute Mile)	Payload
6,300 5,000	100% Passengers + Baggage 100% Passenger, Baggage and Cargo

B767-200ER. Analysis shows that this aircraft can perform a 5,300 statute mile non-stop flight with full passengers and baggage payload. A payload of full passengers, baggage and cargo weight as shown in Table I.5-10 can be carried on a 3,800 statute mile non-stop flight:

Non-Stop Flight (Statute Mile)	Payload
5,300 3,800	100% Passengers + Baggage 100% Passenger, Baggage and Cargo

B767-300ER. Analysis shows that this aircraft can perform a 5,800 statute mile non-stop flight with full passenger and baggage payload. By adding the cargo weight shown in Table I.5-10 to the payload, the non-stop range is reduced to 4,800 statute miles:

Non-Stop Flight (Statute Mile)	Payload
5,800 4,800	100% Passengers + Baggage 100% Passenger, Baggage and Cargo

B777-200. Analysis shows that this aircraft with a payload of full passenger and baggage can perform a 6,000 statute mile non-stop flight. A payload with a cargo weight shown in Table I.5-10 added to the payload, reduces the non-stop range to 5,000 statute miles:

Non-Stop Flight (Statute Mile)	Payload
6,000 5,000	100% Passengers + Baggage 100% Passenger, Baggage and Cargo

DC10-30. Analysis shows this aircraft can perform a 5,300 statute mile non-stop flight with a payload of full passengers and baggage. Adding a cargo weight from Table I.5-10 to the payload reduces the non-stop range to 4,960 statute miles:

Non-Stop Flight (Statute Mile)	Payload
5,300	100% Passengers + Baggage
4,960	100% Passenger, Baggage and Cargo

MD11. Analysis shows this aircraft can perform a 6,390 statute mile non-stop flight with full passengers and baggage. Adding the weight of cargo from Table I.5-10 to the payload reduces the range to 5,430 statute miles:

Non-Stop Flight (Statute Mile)	Payload
6,390	100% Passengers + Baggage
5,430	100% Passenger, Baggage and Cargo

Operational Analysis Summary for a 9,500/9,600 Foot Runway. Table I.5-13 summarizes the non-stop flight distance, for each of the six aircraft for various payload scenarios.

TABLE I.5-13
NON-STOP FLIGHT DISTANCES FOR PAYLOAD COMBINATIONS
ON A 9,500/9,600 FOOT RUNWAY

Aircraft Model	Full Passenger and Baggage	Full Passengers, Baggage and Cargo
B747-400	6,300	5,000
B767-200ER	5,300	3,800
B767-300ER	5,800	4,800
B777-200	6,000	5,000
DC10-30	5,300	4,960
MD11	6,390	5,430

Runway Length 10,500 Feet

This subsection contains the same operational analyses for each of the six aircraft operating on a 10,500 foot runway.

B747-400. Analysis shows this aircraft can perform a 6,900 statute mile non-stop flight with full passengers and baggage payload. Adding cargo weight from Table I.5-10 to the payload, reduces the range to 5,600 statute miles:

Non-Stop Flight (Statute Mile)	Payload
6,900	100% Passengers + Baggage
5,600	100% Passenger, Baggage and Cargo

B767-200ER. Analysis shows this aircraft can perform a 5,300 statute mile non-stop flight with a payload of full passengers and baggage. Adding cargo weight from Table I.5-10 to the payload reduces the range to 3,800 statute miles:

Non-Stop Flight (Statute Mile)	Payload
5,300	100% Passengers + Baggage
3,800	100% Passenger, Baggage and Cargo

B767-300ER. Analysis shows this aircraft has a non-stop range of 6,000 statute miles with a payload of full passengers and baggage and a non-stop range of 5,000 statute miles when the payload is increased by the cargo weight from Table I.5-10:

Non-Stop Flight (Statute Mile)	Payload
6,000	100% Passengers + Baggage
5,000	100% Passenger, Baggage and Cargo

B777-200. Analysis shows this aircraft has a non-stop range of 6,100 statute miles with a payload of full passengers and baggage and a non-stop range of 5,000 statute miles when the payload is increased by the cargo weight from Table I.5-10:

Non-Stop Flight (Statute Mile)	Payload
6,100	100% Passengers + Baggage
5,000	100% Passenger, Baggage and Cargo

DC10-30. Analysis shows this aircraft has a non-stop range of 5,946 statute miles with a payload of full passengers and baggage. The range is reduced to 5,580 statute miles when cargo weight from Table I.5-10 is added to the payload:

Non-Stop Flight (Statute Mile)	Payload
5,946	100% Passengers + Baggage
5,580	100% Passenger, Baggage and Cargo

MD11. Analysis shows this aircraft has a non-stop range of 7,390 statute miles with full passengers and baggage payload. The range is reduced to 6,420 statute miles when cargo weight from Table I.5-10 is added to the payload:

Non-Stop Flight (Statute Mile)	Payload
7,390	100% Passengers + Baggage
6,420	100% Passenger, Baggage and Cargo

Operational Analyses Summary for a 10,500 Foot Runway. Table I.5-14 summarizes the non-stop flight distances for each of the six aircraft for various payload scenarios.

TABLE I.5-14
NON-STOP FLIGHT DISTANCES FOR PAYLOAD COMBINATIONS
10,500 FOOT RUNWAY

Aircraft Model	Full Passenger and Baggage (Statute Mile)	Full Passengers, Baggage and Cargo (Statute Mile)
B747-400	6,900	5,600
B767-200ER	5,300	3,800
B767-300ER	6,000	5,000
B777-200	6,100	5,000
DC10-30	5,946	5,580
MD11	7,390	6,420

Table I.5-15 is a summary of the operational performance of the six aircraft for two payload scenarios on runway lengths of 7,000, 8,500, 9,500/9,600 and 10,500.

TABLE I.5-15
SUMMARY OF NON-STOP DISTANCES AND PAYLOADS FOR RUNWAY LENGTHS OF 7,000 FEET, 8,500 FEET 9,500/9,600 FEET AND 10,500 FEET

	Maximum Non-Stop Flight Distance (Statute Miles)	
Aircraft Models	Full Passengers and Baggage	Full Passengers, Baggage and Cargo
	7,000 Foot Runway	
B747-400	4,300	2,900
B767-200ER	4,600	2,800
B767-300ER	4,300	2,100
B777-200	4,000	2,400
DC10-30	3,453	3,087
MD11	4,390	3,430
	8,500 Foot Runway	
B747-400	5,000	4,300
B767-200ER	5,000	3,500
B767-300ER	5,000	4,300
B777-200	5,400	4,300
DC10-30	4,814	4,449
MD11	5,000	4,429
	9,500/9,600 Foot Runway	
B747-400	6,300	5,000
B767-200ER	5,300	3,800
B767-300ER	5,800	4,800
B777-200	6,000	5,000
DC10-30	5,300	4,960
MD11	6,390	5,430
	10,500 Foot Runway	
B747-400	6,900	5,600
B767-200ER	5,300	3,800
B767-300ER	6,000	5,000
B777-200	6,100	5,000
DC10-30	5,946	5,580
MD11	7,390	6,420

PAYLOAD RESTRICTIONS FOR SERVICE TO SELECTED CITIES

In this analysis payload restrictions were determined for nonstop service from Kahului Airport to selected cities for runway lengths of 7,000 feet, 8,500 feet, 9,500/9,600 feet and 10,500 feet. For this analyses, the 9,600 foot runway length was chosen to be consistent with the recommendations contained in the 1993 Kahului Airport Master Plan. However, the results of the 9,600 foot runway analysis would generally apply for a 9,500 foot runway. The cities chosen for study include the cities most likely to be candidates for nonstop service to Kahului Airport at sometime in the future: Los Angeles, Dallas-Ft. Worth, Chicago, New York and Tokyo. The nonstop air miles to each city for a typical flight are as follows:

City	Statute Miles [a]	Nautical Miles
Los Angeles	2,525	2,192
Dallas-Ft. Worth	3,780	3,284
Chicago	4,270	3,703
Atlanta	4,502	3,908
New York	5,000	4,339
Tokyo	4,020	3,466

[a] Source: Official Airline Guides, Official Airlines Guide.

The maximum percentage of passengers and cargo that could be carried on passenger flights was determined for seven aircraft types: DC10-10, DC10-30, L1011-100, B747-200, B747-400, B767-200ER and B767-300ER. The results are shown in Tables I.5-16 through I.5-22 for each aircraft type, respectively. Data for these tables were developed on the basis of flight plans prepared by Jeppesen Sanderson, Inc. and aircraft performance manuals. All data in Tables I.5-16 through I.5-22 are based on an airport temperature of 84°F and zero surface winds. Furthermore, it was assumed that there would be no runway pavement structural limitation.

This analysis verifies that the current runway length severely restricts the passenger and cargo carrying capabilities of the DC10-10, DC10-30 and L1011-100 to the west coast as well as to the more distant destinations shown. With a 9,600 foot runway and the conditions shown, the DC10-10 and L1011-100 are unrestricted in passenger service to the west coast but the DC10-10 has cargo carrying limitations. The DC10-10 and L1011-100 do not perform as well as the other aircraft studied, even with a runway length of 9,600 feet or more. The DC10-30 can accommodate 100 percent of passengers with a 9,600 foot runway, for the conditions and destinations shown. However, the DC10-30, with a 9,600 foot runway, would be unable to carry 100 percent of its cargo capacity beyond the west coast.

TABLE I.5-16
PERCENT OF MAXIMUM PAYLOAD FOR DC10-10 DEPARTURES FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 1 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet) 7,000	8,500	9,600	10,500
Aircraft Takeoff Weight (Thousands of Pounds)				
Runway 02 (No Ships)	397.9	423.3	430.0 [b]	430.0 [b]
Runway 20	378.6	397.3	426.4	430.0 [b]
Maximum Allowable Payload (Pounds)				
Runway 02				
Los Angeles	66,350	86,669	91,500	91,500
Dallas/Fort Worth	36,218	55,123	59,932	59,932
Chicago	25,172	43,877	48,586	48,586
New York	10,872	27,887	31,790	31,790
Tokyo	21,654	38,747	43,776	43,776
Runway 20				
Los Angeles	51,235	65,886	88,961	91,500
Dallas/Fort Worth	22,772	35,789	57,239	59,932
Chicago	12,727	24,799	45,951	48,586
New York	[c]	10,465	29,243	31,790
Tokyo	7,801	21,244	41,145	43,776
Percent of Maximum Passengers and Baggage [d]				
Runway 02				
Los Angeles	100	100	100	100
Dallas/Fort Worth	62	94	100	100
Chicago	43	75	83	83
New York	18	47	54	54
Tokyo	37	66	74	74
Runway 20				
Los Angeles	87	100	100	100
Dallas/Fort Worth	39	61	97	100
Chicago	22	42	78	83
New York	[c]	18	50	54
Tokyo	13	36	70	74
Percent of Cargo Capacity in Addition to 100 Percent of Passengers and Baggage on Passenger Flights [d]				
Runway 02				
Los Angeles	21	77	91	91
Dallas/Fort Worth	0	0	3	3
Chicago	0	0	0	0
New York	0	0	0	0
Tokyo	0	0	0	0

TABLE I.5-16
PERCENT OF MAXIMUM PAYLOAD FOR DC10-10 DEPARTURES
FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 2 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Runway 20				
Los Angeles	0	20	84	91
Dallas/Fort Worth	0	0	0	3
Chicago	0	0	0	0
New York	[c]	0	0	0
Tokyo	0	0	0	0

[a] Source: P&D Aviation, based on flight plan data developed by Jeppesen Sanderson, Inc.

[b] Maximum aircraft structural takeoff weight.

[c] Unable to fly this distance with takeoff weight indicated.

[d] Based on the following conditions:

- Zero surface winds.
- Airport temperature of 84°F (mean maximum temperature of hottest month).
- 26-30 knot tailwinds enroute to the U.S. mainland; 23-25 knot headwinds enroute to Tokyo.
- Good destination weather conditions.
- No runway pavement structural limit.
- No tall ships north of airport.
- DC10-10 engine type: CF6-6D. Maximum takeoff weight at 84°F: 430,000 pounds.
- Maximum passenger and baggage payload: 58,835 pounds (287 passengers).
- Cargo capacity on passenger flights: 35,994 pounds.
- Maximum payload: 94,829 pounds.
- Flap setting: optimum.

TABLE I.5-17
PERCENT OF MAXIMUM PAYLOAD FOR DC10-30 DEPARTURES
FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 1 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Aircraft Takeoff Weight (Thousands of Pounds)				
Runway 02 (No Ships)	447.4	494.2	521.9	541.8
Runway 20	431.5	470.9	507.5	526.9
Maximum Allowable Payload (Pounds)				
Runway 02				
Los Angeles	79,649	101,810	101,810	101,810
Dallas/Fort Worth	47,073	81,481	101,350	101,810
Chicago	34,609	68,800	88,030	100,705
New York	18,435	49,823	68,315	81,289
Tokyo	31,044	64,091	83,716	97,971
Runway 20				
Los Angeles	67,279	99,053	101,810	101,810
Dallas/Fort Worth	35,421	64,693	90,999	101,810
Chicago	24,256	52,478	78,072	91,315
New York	7,661	33,775	58,749	71,453
Tokyo	19,610	47,638	71,897	87,348
Percent of Maximum Passengers and Baggage [b]				
Runway 02				
Los Angeles	100	100	100	100
Dallas/Fort Worth	77	100	100	100
Chicago	57	100	100	100
New York	30	82	100	100
Tokyo	51	100	100	100
Runway 20				
Los Angeles	100	100	100	100
Dallas/Fort Worth	58	100	100	100
Chicago	40	86	100	100
New York	13	55	96	100
Tokyo	32	78	100	100
Percent of Cargo Capacity in Addition to 100 Percent of Passengers and Baggage on Passenger Flights [b]				
Runway 02				
Los Angeles	46	100	100	100
Dallas/Fort Worth	0	50	99	100
Chicago	0	19	66	97
New York	0	0	18	50
Tokyo	0	7	56	91

TABLE I.5-17
PERCENT OF MAXIMUM PAYLOAD FOR DC10-30 DEPARTURES FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 2 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Runway 20				
Los Angeles	15	93	100	100
Dallas/Fort Worth	0	9	73	100
Chicago	0	0	42	74
New York	0	0	0	25
Tokyo	0	0	27	64

[a] Source: P&D Aviation, based on flight plan data developed by Jeppesen Sanderson, Inc.

[b] Based on the following conditions:

- Zero surface winds.
- Airport temperature of 84°F (mean maximum temperature of hottest month).
- 26-30 knot tailwinds enroute to the U.S. mainland; 23-25 knot headwinds enroute to Tokyo.
- Good destination weather conditions.
- No runway pavement structural limit.
- No tall ships north of airport.
- DC10-30 engine type: CF6-50C. Maximum takeoff weight at 84°F: 553,100 pounds.
- Maximum passenger and baggage payload: 61,090 pounds (298 passengers).
- Cargo capacity on passenger flights: 40,720 pounds.
- Maximum payload: 101,810 pounds.
- Flap setting: 12.

TABLE I.5-18
PERCENT OF MAXIMUM PAYLOAD FOR L1011-100 DEPARTURES FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 1 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Aircraft Takeoff Weight (Thousands of Pounds)				
Runway 02 (No Ships)	379.1	415.0	439.1	455.2
Runway 20	365.6	393.9	423.4	441.8
Maximum Allowable Payload (Pounds)				
Runway 02				
Los Angeles	42,000	70,000	76,870	76,870
Dallas/Fort Worth	12,000	39,000	56,000	67,000
Chicago	[b]	27,000	44,000	54,000
New York	[b]	9,000	25,000	36,000
Tokyo	7,000	35,000	51,000	62,000
Runway 20				
Los Angeles	32,000	53,000	76,870	76,870
Dallas/Fort Worth	2,000	24,000	45,000	58,000
Chicago	[b]	12,000	32,000	45,000
New York	[b]	[b]	15,000	27,000
Tokyo	[b]	18,000	40,000	53,000
Percent of Maximum Passengers and Baggage [c]				
Runway 02				
Los Angeles	68	100	100	100
Dallas/Fort Worth	19	63	90	100
Chicago	[b]	44	71	87
New York	[b]	15	40	58
Tokyo	11	57	82	100
Runway 20				
Los Angeles	52	86	100	100
Dallas/Fort Worth	3	39	73	94
Chicago	[b]	19	52	73
New York	[b]	[b]	24	44
Tokyo	[b]	29	65	86
Percent of Cargo Capacity in Addition to 100 Percent of Passengers and Baggage on Passenger Flights [c]				
Runway 02				
Los Angeles	0	54	100	100
Dallas/Fort Worth	0	0	0	34
Chicago	0	0	0	0
New York	0	0	0	0
Tokyo	0	0	0	1

TABLE I.5-18
PERCENT OF MAXIMUM PAYLOAD FOR L1011-100 DEPARTURES
FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 2 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Runway 20				
Los Angeles	0	0	100	100
Dallas/Fort Worth	0	0	0	0
Chicago	0	0	0	0
New York	0	0	0	0
Tokyo	0	0	0	0

[a] Source: P&D Aviation, based on data developed by Jeppesen Sanderson, Inc., and aircraft performance charts in: Lockheed-California Company, L1011 Airplane Characteristics, Airport Planning, August 1978.

[b] Unable to fly this distance with takeoff weight indicated.

[c] Based on the following conditions:

- Zero surface winds.
- Airport temperature of 84°F (mean maximum temperature of hottest month).
- No runway pavement structural limit.
- No tall ships north of airport.
- L1011-100 engine type: RB211-22B. Maximum takeoff weight at 84°F: 465,400 pounds.
- Maximum passenger and baggage payload: 61,910 pounds (302 passengers).
- Cargo capacity on passenger flights: 14,960 pounds.
- Maximum payload: 76,870 pounds.
- Flap setting: 10.

TABLE I.5-19
PERCENT OF MAXIMUM PAYLOAD FOR B747-200 DEPARTURES
FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 1 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Aircraft Takeoff Weight (Thousands of Pounds)				
Runway 02 (No Ships)	662.9	724.4	762.4	790.3
Runway 20	645.3	694.9	742.7	769.0
Maximum Allowable Payload (Pounds)				
Runway 02				
Los Angeles	133,000	145,000	145,000	145,000
Dallas/Fort Worth	86,000	130,000	145,000	145,000
Chicago	67,000	110,000	138,000	145,000
New York	41,000	81,000	107,000	128,000
Tokyo	77,000	122,000	145,000	145,000
Runway 20				
Los Angeles	119,000	145,000	145,000	145,000
Dallas/Fort Worth	73,000	110,000	145,000	145,000
Chicago	55,000	90,000	126,000	143,000
New York	29,000	63,000	95,000	113,000
Tokyo	64,000	100,000	137,000	145,000
Percent of Maximum Passengers and Baggage [b]				
Runway 02				
Los Angeles	100	100	100	100
Dallas/Fort Worth	100	100	100	100
Chicago	82	100	100	100
New York	50	99	100	100
Tokyo	94	100	100	100
Runway 20				
Los Angeles	100	100	100	100
Dallas/Fort Worth	89	100	100	100
Chicago	67	100	100	100
New York	35	77	100	100
Tokyo	78	100	100	100
Percent of Cargo Capacity in Addition to 100 Percent of Passengers and Baggage on Passenger Flights [b]				
Runway 02				
Los Angeles	81	100	100	100
Dallas/Fort Worth	6	76	100	100
Chicago	0	44	89	100
New York	0	0	40	73
Tokyo	0	63	100	100

TABLE I.5-19
PERCENT OF MAXIMUM PAYLOAD FOR B747-200 DEPARTURES FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 2 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Runway 20				
Los Angeles	59	100	100	100
Dallas/Fort Worth	0	44	100	100
Chicago	0	13	70	97
New York	0	0	21	49
Tokyo	0	29	87	100

[a] Source: P&D Aviation, based on data developed by Jeppesen Sanderson, Inc., and aircraft performance charts in: Boeing Commercial Airplane Group, 747 Airplane Characteristics for Airport Planning, May 1984.

[b] Based on the following conditions:

- Zero surface winds.
- Airport temperature of 84°F (mean maximum temperature of hottest month).
- No runway pavement structural limit.
- No tall ships north of airport.
- B747-200 engine type: JT9D - 7J. Maximum takeoff weight at 84°F: 810,000 pounds.
- Maximum passenger and baggage payload: 82,000 pounds (400 passengers).
- Cargo capacity on passenger flights: 63,000 pounds.
- Maximum payload: 145,000 pounds.
- Flap setting: 20.

TABLE I.5-20
PERCENT OF MAXIMUM PAYLOAD FOR B747-400 DEPARTURES FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 1 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Aircraft Takeoff Weight (Thousands of Pounds)				
Runway 02 (No Ships)	710.3	777.6	822.1	859.4
Runway 20	692.2	751.3	800.7	834.7
Maximum Allowable Payload (Pounds)				
Runway 02				
Los Angeles	138,490	138,490	138,490	138,490
Dallas/Fort Worth	131,000	138,490	138,490	138,490
Chicago	114,000	138,490	138,490	138,490
New York	90,000	138,490	138,490	138,490
Tokyo	125,000	138,490	138,490	138,490
Runway 20				
Los Angeles	138,490	138,490	138,490	138,490
Dallas/Fort Worth	120,000	138,490	138,490	138,490
Chicago	103,000	138,490	138,490	138,490
New York	80,000	121,000	138,490	138,490
Tokyo	113,000	138,490	138,490	138,490
Percent of Maximum Passengers and Baggage [b]				
Runway 02				
Los Angeles	100	100	100	100
Dallas/Fort Worth	100	100	100	100
Chicago	100	100	100	100
New York	100	100	100	100
Tokyo	100	100	100	100
Runway 20				
Los Angeles	100	100	100	100
Dallas/Fort Worth	100	100	100	100
Chicago	100	100	100	100
New York	98	100	100	100
Tokyo	100	100	100	100
Percent of Cargo Capacity in Addition to 100 Percent of Passengers and Baggage on Passenger Flights [b]				
Runway 02				
Los Angeles	100	100	100	100
Dallas/Fort Worth	87	100	100	100
Chicago	57	100	100	100
New York	14	100	100	100
Tokyo	76	100	100	100

TABLE I.5-20
PERCENT OF MAXIMUM PAYLOAD FOR B747-400 DEPARTURES FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 2 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Runway 20				
Los Angeles	100	100	100	100
Dallas/Fort Worth	67	100	100	100
Chicago	37	100	100	100
New York	0	69	100	100
Tokyo	55	100	100	100

[a] Source: P&D Aviation, based on data developed by Jeppesen Sanderson, Inc., and aircraft performance charts in: Boeing Commercial Airplane Group, 747-400 Airplane Characteristics for Airport Planning, October 1994.

[b] Based on the following conditions:

- Zero surface winds.
- Airport temperature of 84°F (mean maximum temperature of hottest month).
- No runway pavement structural limit.
- No tall ships north of airport.
- B747-400 engine type: CF6-80C2B1F. Maximum takeoff weight at 84°F: 870,000 pounds.
- Maximum passenger and baggage payload: 82,000 pounds (400 passengers).
- Cargo capacity on passenger flights: 56,490 pounds.
- Maximum payload: 138,490 pounds.
- Flap setting: 20.

TABLE I.5-21
PERCENT OF MAXIMUM PAYLOAD FOR B767-200ER DEPARTURES FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 1 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Aircraft Takeoff Weight (Thousands of Pounds)				
Runway 02 (No Ships)	344.4	375.7	380.0 [b]	380.0 [b]
Runway 20	331.8	355.4	380.0 [b]	380.0 [b]
Maximum Allowable Payload (Pounds)				
Runway 02				
Los Angeles	78,500	78,500	78,500	78,500
Dallas/Fort Worth	74,000	78,500	78,500	78,500
Chicago	66,000	78,500	78,500	78,500
New York	55,000	78,500	78,500	78,500
Tokyo	70,000	78,500	78,500	78,500
Runway 20				
Los Angeles	78,500	78,500	78,500	78,500
Dallas/Fort Worth	65,000	78,500	78,500	78,500
Chicago	58,000	74,000	78,500	78,500
New York	47,000	62,000	78,500	78,500
Tokyo	61,000	78,500	78,500	78,500
Percent of Maximum Passengers and Baggage [b]				
Runway 02				
Los Angeles	100	100	100	100
Dallas/Fort Worth	100	100	100	100
Chicago	100	100	100	100
New York	100	100	100	100
Tokyo	100	100	100	100
Runway 20				
Los Angeles	100	100	100	100
Dallas/Fort Worth	100	100	100	100
Chicago	100	100	100	100
New York	100	100	100	100
Tokyo	100	100	100	100
Percent of Cargo Capacity in Addition to 100 Percent of Passengers and Baggage on Passenger Flights [c]				
Runway 02				
Los Angeles	100	100	100	100
Dallas/Fort Worth	87	100	100	100
Chicago	63	100	100	100
New York	31	100	100	100
Tokyo	75	100	100	100

TABLE I.5-21
PERCENT OF MAXIMUM PAYLOAD FOR B767-200ER DEPARTURES FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 2 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Runway 20				
Los Angeles	100	100	100	100
Dallas/Fort Worth	61	100	100	100
Chicago	40	87	100	100
New York	8	52	100	100
Tokyo	49	100	100	100

[a] Source: P&D Aviation, based on data developed by Jeppesen Sanderson, Inc., and aircraft performance charts in: Boeing Commercial Airplane Group, B767 Airplane Characteristics for Airport Planning, February 1989.

[b] Maximum aircraft structural takeoff weight.

[c] Based on the following conditions:

- Zero surface winds.
- Airport temperature of 84°F (mean maximum temperature of hottest month).
- No runway pavement structural limit.
- No tall ships north of airport.
- B767-200ER engine type: PW4060. Maximum takeoff weight at 84°F: 380,000 pounds.
- Maximum passenger and baggage payload: 44,280 pounds (216 passengers).
- Cargo capacity on passenger flights: 34,220 pounds.
- Maximum payload: 78,500 pounds.
- Flap setting: 5.

TABLE I.5-22
PERCENT OF MAXIMUM PAYLOAD FOR B767-300ER DEPARTURES FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 1 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Aircraft Takeoff Weight (Thousands of Pounds)				
Runway 02 (No Ships)	348.8	380.7	397.5	400.0 [b]
Runway 20	332.9	355.8	390.7	400.0 [b]
Maximum Allowable Payload (Pounds)				
Runway 02				
Los Angeles	84,000	92,960	92,960	92,960
Dallas/Fort Worth	64,000	89,000	92,960	92,960
Chicago	56,000	80,000	92,960	92,960
New York	44,000	67,000	80,000	81,000
Tokyo	60,000	84,000	92,960	92,960
Runway 20				
Los Angeles	71,000	90,000	92,960	92,960
Dallas/Fort Worth	52,000	69,000	92,960	92,960
Chicago	45,000	61,000	87,000	92,960
New York	33,000	50,000	75,000	81,000
Tokyo	48,000	65,000	92,000	92,960
Percent of Maximum Passengers and Baggage [c]				
Runway 02				
Los Angeles	100	100	100	100
Dallas/Fort Worth	100	100	100	100
Chicago	100	100	100	100
New York	82	100	100	100
Tokyo	100	100	100	100
Runway 20				
Los Angeles	100	100	100	100
Dallas/Fort Worth	97	100	100	100
Chicago	84	100	100	100
New York	62	93	100	100
Tokyo	90	100	100	100
Percent of Cargo Capacity in Addition to 100 Percent of Passengers and Baggage on Passenger Flights [c]				
Runway 02				
Los Angeles	77	100	100	100
Dallas/Fort Worth	27	90	100	100
Chicago	6	67	100	100
New York	0	34	67	70
Tokyo	16	77	100	100

TABLE I.5-22
PERCENT OF MAXIMUM PAYLOAD FOR B767-300ER DEPARTURES
FROM KAHULUI AIRPORT TO VARIOUS CITIES, BY RUNWAY LENGTH [a]

Page 2 of 2

Takeoff Runway and Destination City (and Statute Miles)	Runway Length (Feet)			
	7,000	8,500	9,600	10,500
Runway 20				
Los Angeles	44	92	100	100
Dallas/Fort Worth	0	39	100	100
Chicago	0	19	85	100
New York	0	0	54	70
Tokyo	0	29	97	100

[a] Source: P&D Aviation, based on data developed by Jeppesen Sanderson, Inc., and aircraft performance charts in: Boeing Commercial Airplane Group, B767 Airplane Characteristics for Airport Planning, February 1989.

[b] Maximum aircraft structural takeoff weight.

[c] Based on the following conditions:

- Zero surface winds.
- Airport temperature of 84°F (mean maximum temperature of hottest month).
- No runway pavement structural limit.
- No tall ships north of airport.
- B767-300ER engine type: PW4060. Maximum takeoff weight at 84°F: 400,000 pounds.
- Maximum passenger and baggage payload: 53,505 pounds (261 passengers).
- Cargo capacity on passenger flights: 39,455 pounds.
- Maximum payload: 92,960 pounds.
- Flap setting: 5.

Both the B747-400 and B767-200ER, with a 9,600 foot runway, could carry 100 percent of the passengers and cargo to the five cities studied. The B747-200 and B767-300ER could carry 100 percent of the passengers to each of these cities, with a 9,600 foot runway. However, less than a full load of cargo could be carried to the more distant cities studied.

This analysis of payload restrictions to various cities which could potentially be served by nonstop flights from Kahului Airport verifies the findings of the 1993 Kahului Airport Master Plan with regard to runway length. That is, a 9,600 foot runway would allow unrestricted service to the mainland midwest (for example Dallas-Ft. Worth or Chicago) by most aircraft which typically would be used for those flights. Although data were not available for this detailed analysis for the B777-200 or MD11, the general analysis in the preceding subsection shows that these two aircraft would perform as well as the B747-400 and would therefore be capable of accommodating 100 percent of passengers and cargo on nonstop flights to the midwest, with a 9,600 foot runway.

DECLARED DISTANCES

The "declared distance" approach to specifying available runway length is an alternate approach available to an airport operator when the standard runway safety area (RSA), runway object free area (ROFA), or runway protection zone (RPZ) can not be provided due to constraints at the end of the runway. Under the declared distance approach, each of an airplane's performance distances are measured independently. It has been suggested that applying the declared distance concept to the extension of Runway 2-20 at Kahului Airport might provide the same effective runway length with less new pavement construction. This subsection addresses the potential application of declared distances at Kahului Airport.

Declared distances are the distances the airport owner declares available and suitable for satisfying an airplane's takeoff run, takeoff distance, accelerate-stop distance, and landing distance requirements. These terms are defined as follows.

- **Takeoff run available (TORA).** The runway length declared available and suitable for the ground run of an airplane taking off.

- **Takeoff distance available (TODA).** The TORA plus the length of any remaining runway and/or clearway beyond the far end of TORA.

- **Accelerate-stop distance available (ASDA).** The runway plus stopway length declared available and suitable for the acceleration and deceleration of an airplane aborting a takeoff.

- **Landing distance available (LDA).** The runway length declared available and suitable for a landing airplane.

.eferred to in the above definitions are the following:

- **Clearway.** A defined rectangular area beyond the end of a runway cleared and suitable for use in lieu of runway to satisfy takeoff distance requirements. The clearway must be at least 500 feet wide and no more than 1,000 feet long. The clearway plane slopes upward with a slope not greater than 1.25 percent. No objects (except for threshold lights less than 26 inches high) may protrude higher than the clearway plane.

- **Stopway.** A defined rectangular surface beyond the end of a runway prepared or suitable for use in lieu of runway to support an airplane without causing structural damage to the airplane, during an aborted takeoff. A stopway must be at least as wide as the runway. Because of their limited use and high construction cost, as opposed to providing full strength runway pavement, the use of a stopway is less cost effective.

  It is important to note that in order to gain credit for a stopway, runway safety areas and object free areas must extend the standard distances specified for a runway beyond the far end of a stopway. For example, if a 1,000 foot safety area is required beyond a runway, this length of safety area must extend beyond the stopway. If a 1,000 foot stopway is provided, then the safety area actually extends 2,000 feet beyond the runway end.

The FAA must approve the application of declared distances. The FAA recommends incorporating declared distances into airport design only in cases where it is impractical to provide runway safety areas, object free areas, and runway protection zones in accordance with FAA airport design standards (FAA AC 150/5300-13 Change 3, 9/1/93). This is not the case at Kahului Airport. At Kahului Airport adequate space exists at each end of Runway 2-20, with a 2,600 foot extension, for RSAs, ROFAs and RPZs which meet all FAA standards. Because there are no limitations which would prevent meeting the FAA standards, Kahului Airport does not meet FAA criteria for use of the declared distance approach.

Furthermore, application of the declared distance concept would not reduce the amount of runway construction at Kahului Airport needed to achieve a 9,600-foot takeoff distance.

- The takeoff run available (TORA) is the distance to accelerate from brake release to lift-off, plus safety factors. The TORA cannot exceed the length of the runway. For a field length takeoff requirement of 9,600 feet, the TORA must be at least 9,600 feet. A stopway or

  clearway at the end of a runway cannot be used as TORA. Therefore, a 9,600-foot runway is needed, regardless of the use of declared distances.

- A stopway could increase the accelerate-stop distance available (ASDA) but would not increase the TORA.

- A clearway could increase the takeoff distance available (TODA) but would not increase the TODA. The usable TODA length is controlled by obstacles in the departure area vis-a-vis aircraft performance.

Aside from the fact that the use of stopways or clearways would not preclude the need for 9,600 feet of runway (TODA), most U.S. airlines (including American, Delta and United) do not consider clearways and stopways in their runway calculations except in rare occasions.

Because of the reasons stated above, the declared distance concept would not reduce the runway pavement requirement, nor would it meet FAA criteria for implementation at Kahului Airport. Therefore, it is recommended that use of declared distances at the airport not be pursued further.

Section II

IMPACT OF REACTIVATING PUUNENE AIRPORT OR OPENING NEW GENERAL AVIATION AIRPORT/HELIPORT

SECTION II

IMPACT OF REACTIVATING PUUNENE AIRPORT OR OPENING NEW GENERAL AVIATION AIRPORT/HELIPORT

On March 11, 1991, the Circuit Court of the Second Circuit, State of Hawaii, stipulated that the State of Hawaii "shall investigate, in the EIS and otherwise, the feasibility of reactivating the Puunene Airport on a permanent basis for general aviation, as a reliever airport and for night cargo operation... [and shall] also consider reactivation of Puunene Airport on a temporary basis for night aircraft use during the period of time required to implement the [Kahului Airport] runway strengthening project."

e former Puunene Airport is located five miles south of Kahului adjacent to Mokulele Highway (State Highway 35) connecting Kahului and Kihei. The former airport served as Maui's commercial airport before World War II, when it became a U.S. Naval Air Station. The airport has been closed for many years and now is used for a variety of activities, including a drag strip, a crop dusting base (used for one single-engine aircraft), and a helicopter practice area.

The requirement to study additional options for Kahului Airport presented the opportunity for the State to assess the long-term general aviation needs for Maui and consider a broad range of options for meeting those needs. Consequently, the State initiated an island-wide general aviation study. The Maui General Aviation Study addresses requirements for general aviation facilities on Maui over the next 20 years and considers a number of alternatives to accommodate these requirements.

The overall goal of the Maui General Aviation Study is to develop a comprehensive general aviation airport system plan that meets the long-term needs of general aviation users and provides relief of air traffic congestion and operating delays at Kahului Airport. Specifically, the General Aviation study has the following objectives:

- Provide adequate facilities for the long-term (20-year) needs of general aviation, including private flying, training, corporate aviation and helicopter operators.
- Relieve Kahului Airport of airspace and airfield congestion and associated delays, and possibly postpone the need for increased airfield capacity at Kahului Airport.

- Study the potential for relocating fixed-wing general aviation activity, helicopter operations and air cargo operations from Kahului Airport to the former Puunene Airport or other suitable site.
- Achieve and maintain compatibility between general aviation activity and (a) the environment and (b) affected communities and community plans.

Furthermore, relocating certain elements of aviation from Kahului Airport, such as helicopters and small general aviation aircraft, which have different flight characteristics from commercial jet aircraft has the potential of enhancing the safety of operations by segregating these different classes of aircraft.

The following categories of demand were considered candidates for possible relocation to another airport:

- **Helicopters.** Most helicopter activity at Kahului Airport is for sight-seeing tours. However, helicopters also use the airport for medical transport, search and rescue, business and industrial (heavy lift operations) uses, government uses and flight training.
- **General Aviation Piston Aircraft.** Single engine and twin engine general aviation piston aircraft are used for a variety of activities including flight training, charter, aircraft rental, sight-seeing, personal and business uses.
- **Turbine Powered General Aviation Aircraft.** A variety of turboprop and turbojet aircraft are used in corporate activity. Corporate aircraft typically consist of turboprop and business jets under 30,000 pounds gross weight.
- **Inter-Island Air Cargo Service.** Inter-island air cargo operators fly commercial jets such as Boeing B737 freighters as well as smaller turboprop and piston aircraft such as Cessna cargo models.

DESCRIPTION OF RELOCATION ALTERNATIVES

Four categories of airports or sites were considered for the transfer of activity from Kahului Airport: existing airports (Kapulua-West Maui Airport and Hana Airport), locations where airports existed in the past, sites proposed for new airports in previous studies, and new site locations.

Five types of new airport facilities were considered for relocating activity from Kahului Airport. The five categories differ substantially in size and the types of activity which they would accommodate. The airport types are a limited-service heliport, a full service heliport, a utility airport, a utility airport/heliport and a transport airport/heliport. Each category of airport would accommodate one or more of the types of service which were identified earlier which potential could be relocated from Kahului Airport to another site.

After careful consideration of existing airports, former airport locations, previously proposed sites, and new sites, several site alternatives emerged as a potential reliever for Kahului Airport. These airport site alternatives are described below.

- **Relocation Alternative 1: No New Airport.** Relocation Alternative 1 consists of operating the existing system of airports on Maui. No new sites would be developed and existing airports would be expanded to accommodate the necessary growth.

- **Relocation Alternative 1A: Relocation of Kahului Helicopter Facilities to the East.** This alternative consists of relocating the existing helicopter facilities at Kahului to the east on property to be acquired, but which would be contiguous with airport property and become a part of Kahului Airport.

- **Relocation Alternative 1B: New Limited-Service Heliport at Unspecified Site.** Under this alternative a new limited service heliport facility would be constructed on the west side of Maui to serve tourists in the Lahaina-Kaanapali area. The limited service heliport wold be used for passenger pick-up and drop-off and would not accommodate aircraft maintenance or storage facilities.

- **Relocation Alternative 2: New Heliport at South End of Former Puunene Airport.** Under Alternative 2, a new heliport would be constructed along the southeast border of state-owned property at the former Puunene Airport site (Figures I.8-5 and I.8-6). Four takeoff and landing areas would be located in a linear alignment with the extended centerline of Runway 2-20 at Kahului Airport. The southerly takeoff and landing area would be located 5.8 miles from the proposed (extended runway) landing threshold for Runway 2-20 at Kahului Airport. The heliport would be separated from the extended centerline of Runway 2-20 by 3.0 miles. Access to the site would be from Mokulele Highway (State Highway 35).

- **Relocation Alternative 3: New Heliport Located on the East Side of the Former Puunene Airport.** In Alternative 3, a new heliport would be built on the east side of the former Puunene Airport site. This site would be 5.0 miles south of the proposed

future landing threshold to Runway 2-20 at Kahului Airport. The heliport would be 2.4 miles from the extended centerline of Runway 2-20 at Kahului Airport.

- **Relocation Alternative 4: Utility Airport/Heliport at Former Puunene Airport.** Relocation Alternative 4 is a new utility airport with full-service heliport which would be constructed at the former Puunene Airport site. The airport would have a 3,800 foot runway located at the center of the former airport site to obtain the maximum separation from the Kahului Airport flight tracks yet not impact unfavorably on the developed areas at Kihei. Some lands outside the state-owned properties would need to be purchased, primarily for the runway protection zones. The south runway threshold of the new runway would be located 5.2 miles from the proposed extended south threshold of Runway 2-20 at Kahului Airport. The new runway would be parallel to Runway 2-20 with a centerline separation of 2.1 miles.

- **Relocation Alternative 4A: New Utility Airport at Former Puunene Airport Site.** This relocation alternative is similar to Alternative 4 accept that no helicopter facilities would be provided. Under this alternative, all helicopter activity would remain at Kahului Airport.

- **Relocation Alternative 5: New Utility Airport/Heliport North of Kihei.** Under this relocation alternative a new utility airport and full service heliport would be built three miles northeast of the Kihei area at approximately the 600 foot elevation. A new 3,800 foot runway would be located between Keahuaiwi and Kolaloa Gulches and would intersect Waiakoa Road. The south threshold of the Relocation Alternative 5 runway and the extended Runway 2-20 at Kahului Airport would be separated by 3.9 miles. The runway centerlines would be laterally separated by 5.2 miles.

- **Alternative 6: New Utility Airport/Heliport East of Kahului.** Relocation Alternative 6 is a new utility airport and full-service heliport located east of the Kahului-Wailuku area immediately south of the Haleakala Highway. A new 3,800-foot runway would be separated laterally 3.3 miles from the Runway 2-20 centerline at Kahului Airport. The south threshold of the Relocation Alternative 6 runway would be located approximately 1,200 feet north of the extended south threshold of Runway 2-20 at Kahului Airport.

- **Relocation Alternative 7: New Heliport and Utility Airport at Former Puunene Airport.** In this alternative, a new full-service heliport and utility airport would be developed at separate locations on the former Puunene Airport site. The heliport would be located on the east side of Mokulele Highway on State-owned property at the north end of the site. The utility airport, with a 3,900-foot runway, would be located at the southern end of the site, mostly on State property. Land would need to be purchased for portions of the runway protection zones.

- **Alternative 8: New Transport Airport and Full-Service Heliport at Former Puunene Airport.** Under this alternative, a new transport category airport and full-service heliport would be built on the former Puunene Airport site. The southwest end of the runway would be in the same location as the runway under Relocation Alternative 4. The transport runway would be 6,600 feet long. Alternative 8 would require the use of more state-owned property and would necessitate greater acquisition of private property than Relocation Alternative 4.

Aircraft operations forecasts were developed for each new airport/heliport alternative (Table II-1) on the bases of the projections for cargo, helicopter, and fixed-wing general aviation activity at Kahului Airport. For Relocation Alternatives 2 through 8, the addition of operations at the new site is estimated to result in the reduction of an equal number of operations at Kahului Airport. Therefore, the total number of aircraft operations estimated for the new site alternative and Kahului Airport in 2010 under Relocation Alternatives 2 through 8 equals the number of aircraft operations projected for Kahului Airport in the year 2010 with no new airports 53,700 operations). No additional activity would be generated at the new site beyond what has been projected in the 1994 State forecast for Kahului Airport alone.

The following operations are estimated to be shifted from Kahului Airport to the new site under each alternative:

- Alternative 1B. New Limited Service Heliport -- a portion of tour helicopter operations.

- Alternative 2. New Heliport-Puunene South -- all helicopter operations.

- Alternative 3. New Heliport-Puunene East -- all helicopter operations.

Alternative 4. New Utility Airport/Heliport-Puunene -- all helicopter operations and all fixed-wing piston general aviation operations.

TABLE II-1
FORECASTS OF AIRCRAFT OPERATIONS AT NEW AIRPORT/ HELIPORT FOR RELOCATION ALTERNATIVES, 2010 [a]

Relocation Alternative	Aircraft Operations at New Airport/Heliport in Year 2010 (Thousands)						
	Total	Cargo		Helicopter		Fixed-Wing General Aviation	
		Air Carrier	Commuter	Tour	Other	Piston	Turbine
1B. New Limited Service Heliport	69.2	0	0	69.2	0	0	0
2. New Heliport-Puunene South	95.1	0	0	89.8	5.3	0	0
3. New Heliport-Puunene East	95.1	0	0	89.8	5.3	0	0
4. New Utility Airport/ Heliport-Puunene	134.0	0	0	89.8	5.3	38.9	0
4A. New Utility Airport -Puunene	38.9	0	0	0	0	38.9	0
5. New Utility Airport/ Heliport-North of Kihei	134.0	0	0	89.8	5.3	38.9	0
6. New Utility Airport/ Heliport-East of Kahului	134.0	0	0	89.8	5.3	38.9	0
7. New Utility Airport and New Heliport-Puunene							
Airport	38.9	0	0	0	0	38.9	0
Heliport	95.1	0	0	89.8	5.3	0	0
8. New Transport Airport/ Heliport-Puunene	140.5	4.4	1.0	89.8	5.3	38.9	1.1

[a] Source: P&D Aviation.

- Alternative 4A. New Utility Airport- Puunene -- all fixed-wing piston general aviation operations.
- Alternative 5. New Utility Airport/Heliport - North of Kihei -- all helicopter operations and all fixed-wing piston general aviation operations.
- Alternative 6. New Utility Airport/Heliport - East of Kahului -- all helicopter operations and all fixed-wing piston general aviation operations.
- Alternative 7. New Utility Airport and New Heliport -- Puunene
  - Airport -- all fixed-wing piston general aviation operations.
  - Heliport -- all helicopter operations.
- Alternative 8. New Transport Airport/ Heliport - Puunene -- All helicopter operations, all interisland air cargo operations, all fixed-wing piston general aviation operations, all turboprop fixed-wing general aviation operations, and all interisland turbojet general aviation operations (estimated to be 4 percent of total turbojet general aviation operations).

Relocation Alternative 1B, a new limited service heliport, is the only alternative in which the total operations at Kahului Airport and the new site would be greater than at Kahului Airport alone. Under this alternative, a limited service heliport would be developed on the west side Maui to serve the visitors in that area. The new heliport would be used for boarding and deplaning of tour helicopter customers but would not be used to base aircraft overnight. Ferry flights would be necessary to bring helicopters to the new facility in the morning and return them to Kahului Airport in the evening.

Helicopter tour operators estimate that 60 to 75 percent of their customers originate from the westside of the island. It is estimated for purposes of this analysis that 60 percent of the tour helicopter customers would board at a new limited service heliport on the west side if one were available, assuming some tour operators used only Kahului Airport and some westside customers would have other reasons for preferring to board at Kahului Airport.

Based on these conditions, tour helicopter operations at a new limited service heliport would total 69,200 in the year 2010. In addition, there would be 50,200 tour helicopter operations at Kahului Airport under Alternative 1B.

IMPACT ANALYSIS

The shifting of aircraft flight activity from Kahului Airport to an alternate airport and/or heliport site would potentially result in a variety of impacts, most of which would be net positive impacts due to the relocation of flight activities from an urban area to an area which is less intensely developed. Potential impacts are described below.

Reduction in Aircraft Operations and Related Activity at Kahului Airport

Table II-2 lists the projections of operations by type in the year 2010 that would be handled at Kahului Airport as a result of the relocation of some activity to a new site. Aircraft operations which would be shifted from Kahului Airport to the new site include the following categories, for one or more of the relocation alternatives: air carrier (cargo operations), commuter/air taxi (helicopter tour operations and cargo operations) and general aviation (fixed-wing piston aircraft, fixed-wing turbine power aircraft and helicopters). No military operations are projected to be shifted from Kahului Airport under the relocation alternatives. The number of operations shifted from Kahului Airport in the year 2010 would vary from 55 percent for Relocation Alternative 8, a new transport airport/heliport at Puunene, to 15 percent for Relocation Alternative 4A, a new utility airport at Puunene.

Postponement of Improvements Needed to Increase Airfield Capacity

Relocation of Kahului Airport operations to another site, particularly fixed-wing aircraft operations, would have the beneficial impact of postponing the need to provide improvements to Kahului Airport for the purpose of increasing airfield capacity and reducing aircraft operating delays. The primary improvement in the airport development program for increasing airfield capacity is the construction of third runway, scheduled for Phase III development. Annual airfield capacity (annual service volume) is estimated to be 187,000 operations for the mix of aircraft forecast for the year 2010, with the current airfield facilities. A new parallel runway would increase the annual service volume of the airport between 250,000 and 410,000 operations, depending upon how the parallel runways are used.

Under the relocation alternatives with a new utility airport and full service heliport, Kahului Airport would have 119,700 annual operations in the year 2010, which is only 64 percent of the projected capacity of the existing airfield configuration. It is likely that, with some operations shifted to a new airport/heliport site, the need for a third runway at Kahului Airport could be postponed well beyond 2010, based on current projections of airport demand.

TABLE II-2
FORECASTS OF AIRCRAFT OPERATIONS AT KAHULUI AIRPORT FOR RELOCATION ALTERNATIVES, 2010 [a]

Relocation Alternative	Aircraft Operations at Kahului Airport in Year 2010 (Thousands)				
	Total	Air Carrier	Commuter/ Air Taxi	General Aviation	Military
1. No New Airport [b]	253.7	80.7	112.3	49.0	11.7
1A. Relocation of Kahului Helicopter Facilities East	253.7	80.7	112.3	49.0	11.7
1B. New Limited Service Heliport	192.6	80.7	51.2	49.0	11.7
2. New Heliport-Puunene South	158.6	80.7	22.5	43.7	11.7
3. New Heliport-Puunene East	158.6	80.7	22.5	43.7	11.7
4. New Utility Airport/ Heliport-Puunene	119.7	80.7	22.5	4.8	11.7
4A. New Utility Airport-Puunene	214.8	80.7	112.3	10.1	11.7
5. New Utility Airport/ Heliport-North of Kihei	119.7	80.7	22.5	4.8	11.7
6. New Utility Airport/ Heliport-East of Kahului	119.7	80.7	22.5	4.8	11.7
7. New Utility Airport and New Heliport-Puunene	119.7	80.7	22.5	4.8	11.7
8. New Transport Airport/ Heliport-Puunene	113.2	76.3	21.5	3.7	11.7

[a] Source: P&D Aviation, except as noted.

[b] Source: Aries Consultants, Ltd., Update Hawaii Aviation Demand Forecasts, June 1994, "Low Passenger Forecasts."

Relief of Airspace Congestion

The various alternatives proposed would have varying effects on activity levels at Kahului Airport. In addition to reductions in total operations at Kahului Airport, the various alternatives would result in changes to the fleet mix utilizing the airport. Separation of smaller general aviation aircraft from air carrier operations would also serve to enhance capacity at Kahului Airport and create a safer environment in that smaller, slower aircraft types would be shifted to another facility. This would also serve to lessen delay at Kahului to various degrees. Military traffic at Kahului Airport would remain unchanged under all the alternatives. Figures utilized in evaluating 2010 traffic levels for the various alternatives are contained in Table II-2.

- Alternatives 1 and 1A: These alternatives have little, if any effect on total operations at Kahului Airport through the year 2010.

- Alternative 1B: Establishment of a limited service heliport(s) would reduce total operations at Kahului by approximately 24 percent and commuter/air taxi operations by approximately 54 percent when compared to the no project alternative. Air carrier operations and fixed-wing general aviation activities would remain at levels forecast for the no project alternative.

- Alternatives 2 and 3: A new heliport in the Puunene area would result in an approximate 37 percent reduction in total operations at Kahului and an approximate 80 percent reduction in commuter/air taxi operations. Forecasts indicate that a reduction of approximately 11 percent in general aviation activity would be achieved through the implementation of these alternatives. Air carrier operations would remain at levels forecast for the no project alternative.

- Alternatives 4, 5, 6 and 7: A new utility airport/heliport, regardless of location, would result in an approximate 52 percent reduction in total operations at Kahului Airport. While forecasted air carrier operations would remain the same as the no project alternative, commuter/air taxi activity would be reduced by approximately 80 percent and general aviation activity would be reduced by approximately 90 percent.

- Alternative 4A: A new utility airport at Puunene would result in a reduction of approximately 15 percent in total operations at Kahului Airport. Most of this would be in general aviation activity which would experience a reduction of approximately 79 percent. Air carrier operations would remain at levels forecast for the no project alternative.

- Alternative 8: A new combined transport airport and heliport would result in the most significant reduction in total operations at Kahului. Total forecast operations would be reduced by approximately 55 percent from those forecast for the no project alternative. Air carrier operations would be reduced by approximately 5 percent, commuter/air taxi operations would be reduced by approximately 81 percent and general aviation activity would be reduced by approximately 92 percent.

Airspace Constraints

Due to the relatively narrow nature of the isthmus area, approach corridors to the central Maui area are somewhat constrained. Historically, FAA personnel have expressed concern regarding the possible establishment of a fixed-wing general aviation facility in the south isthmus area. This is due to the nature of the visual approaches utilized by air carrier aircraft, primarily arrivals from the mainland, that involve descending downwind legs and turns to the final approach being flown over the south isthmus area at approximately 2,000 to 3,000 feet above ground level (AGL). FAA personnel have also expressed concern regarding the proximity of the proposed Puunene site to the extended runway centerline at Kahului.

FAA concern regarding the proximity of air carrier traffic to fixed wing general aviation operations relates specifically to Alternatives 4, 4A, 5, 7, and 8. Of lesser concern are helicopter operations in the south isthmus area. This lesser concern is due, in large part, to the high maneuverability of helicopters. As such, Alternatives 1A, 2 and 3 pose less of a concern than those alternatives involving fixed-wing activity in the south isthmus area.

While no specific FAA reaction has yet been received regarding Alternative 6, it appears that any concern regarding vertical separation would be significantly lessened. This alternative places fixed wing activity towards the north end of the isthmus where air carrier aircraft on the downwind leg of the visual approach are at higher altitudes, approximately 5,000 to 6,000 feet AGL.

Potential Enhancement In Aviation Safety

As a result of the shifting of aircraft operations from Kahului Airport to another site, the aircraft operational safety environmental could be enhanced. The potential enhancement in aviation safety would be the result of two factors. First, the mix of aircraft operating at Kahului Airport would contain aircraft more similar in physical and operating characteristics. The relocation alternatives would shift smaller general aviation aircraft and/or helicopters from Kahului Airport away from the operating environment of the large commercial transport jets.

Second, aircraft operations would be shifted away from Kahului Airport to an airport site in an area that does not have the intensity of urban development that is adjacent to Kahului Airport. Therefore, an off-airport accident at a new site would have less potential for injury or property damage on the ground than at Kahului Airport.

Other Potential Impacts

The shifting of aircraft operations from Kahului Airport to a new site would have other impacts such as those related to aircraft noise and vehicle traffic. Aircraft noise around Kahului Airport would be lessened by varying degrees, depending upon the relocation alternative chosen. However, there would be added aircraft noise at the new site, and depending upon the new site alternative, the resulting effect could be lesser or greater aircraft noise impact overall.

Likewise, the potential impacts of vehicle traffic could be lessened or increased overall. A shifting in aircraft operations to a new site would result in a corresponding shift of vehicle movements from Kahului Airport to the new site. Depending upon the location of the new site, overall traffic impacts or vehicle miles traveled could increase or decrease.

In general the overall affects of these other impacts, when Kahului Airport and a new airport site are considered together are not expected to be significant. Impacts would be shifted from one site to another, but the combined impact is not expected to be significantly different than with the operation of Kahului Airport alone.

Section III

REVIEW OF FORECASTS AND DEVELOPMENT OF FORECAST REFINEMENTS

SECTION III
REVIEW OF FORECASTS AND DEVELOPMENT OF FORECAST REFINEMENTS

INTRODUCTION

This section describes the results of the effect of a runway extension at Kahului Airport on the projected number of passengers and aircraft operations. This discussion addresses issues concerning the possible inducement of demand at the airport which could result from extension of Runway 2-20. This section also addresses concerns identified in the March 11, 1991 Stipulation concerning the impact on Kahului Airport demand which would result from the development of a new reliever airport. Also discussed herein is the effect of potential new international flight operations on Kahului Airport activity, which was discussed in the October 2, 1992 Complaint.

The effects on Kahului Airport passengers and aircraft operations that would result from the following circumstances are discussed in the sections that follow:

- Possible effect of runway extension on airport passenger demand.
- Estimated effect of proposed project runway extension on aircraft operations.
- Estimated effects of alternative runway lengths on aircraft operations.
- Estimated effect of international flight activity on airport demand.
- Estimated effect of relocation (new reliever airport) alternatives on airport demand.

EFFECT OF RUNWAY EXTENSION ON AIR PASSENGER DEMAND

Case Studies of Other Airports With Major Runway Extensions

Generally, the extension of a runway, by itself, will not increase demand at an airport, even though the runway extension adds significantly to the runway's length and allows aircraft to serve the airport from greater distances. Among other things, an increase in demand would require a measurable increase in the level of service between the airport and cities from which the demand would originate. If those cities already have an acceptable level of service provided

by one-stop flights and single-connection flights, demand is not likely to be significantly effected by the addition of limited nonstop service. Furthermore, regardless of the runway length, nonstop service would be provided by an airline only in the event that the airline anticipates the new route would meet its profit objectives and be compatible with its overall route structure.

A case study approach was used to test the impact of a major runway extension on passenger demand. Four airports in the United States have recently completed runway projects which significantly increased the length of its longest runway: San Jose International Airport (8,900 feet to 10,200 feet), Colorado Springs Airport (11,021 feet to 13,500 feet), Dallas-Ft. Worth International Airport (11,388 feet to 13,400 feet) and Nashville International Airport (8,529 feet to 11,029 feet). At each of these airports, the total number of passengers (enplaned and deplaned) before and after the runway projects were compared (Table III-1). None of the airports experienced a substantial increase in the number of passenger served. Two of the airports experienced a decline in passengers after the projects were completed. The other two airports had modest passenger increases which were consistent with passenger growth at the airports prior to the runway projects.

Impact of Proposed Project Extension on Kahului Airport Passenger Demand

The case studies described above support the premise that a major runway extension will not necessarily provide an inducement of passenger demand. Nevertheless, it is necessary to consider the specific circumstances at Kahului Airport that relate to this issue.

Potential for a Additional Nonstop Mainland Flights and Increased Service Level. Potentially, an increase in demand could occur within certain market segments if the air passenger service level to those cities were substantially increased and demand in those market segments was not adequately being served. To address this issue, the potential increase in nonstop service which could result from a runway extension was estimated. Then, the service level provided by the potential new flights was compared with existing service.

In Table III-2 the number of visitors to Maui by origin are estimated for 1993, 2000 and 2010. This table identifies the top twenty U.S. states and top foreign markets for visitors to Hawaii. In 1993 there were an estimated 2,210,000 visitors to Maui. The number of visitors is expected to increase to 2,540,000 by 2000 and 3,220,000 by 2010. Approximately 80 to 82 percent of air passengers to Maui are visitors. The remaining passengers consist of local residents.

These visitor estimates were used to identify markets which would have the potential for nonstop service to Kahului if the runway were extended (Table III-3). An extension of Runway 2-20 to

TABLE III-1
EFFECT OF INCREASE IN PRIMARY RUNWAY LENGTH ON PASSENGER DEMAND: CASE STUDIES [a]

Increase In Primary Runway Length	Year	Total Passengers (Enplaned and Deplaned in Thousands)
San Jose International Airport, California		
In 1992, the extension of the primary runway from 8,900 feet to 10,200 feet was completed.	1991 1992 1993 1994	7,045 7,085 7,006 8,100 [b]
Colorado Springs Airport, Colorado		
In 1992, a new 13,500 foot runway was completed. Previously, the airport's longest runway was 11,021 feet.	1991 1992 1993 1994	1,252 1,429 1,519 1,600 [b]
Dallas/Fort Worth International Airport, Texas		
In October 1993, a runway extension was completed which lengthened a primary runway from 11,388 feet to 13,400 feet.	1991 1992 1993 1994	48,198 51,981 49,655 51,000 [b]
Nashville International Airport, Tennessee		
Runway extensions to the airport's longest runway were completed in 1991 (700-foot extension) and May 1993 (1,800-foot extension) for a total extension of 2,500 feet. The runway is now 11,029 feet long.	1990 1991 1992 1993 1994	7,438 8,846 10,302 8,883 8,100 [b]

[a] Source: Airport management of referenced airports.

[b] Estimated by P&D Aviation, based on data for most of 1994.

TABLE III-2
ESTIMATED VISITORS TO MAUI BY ORIGIN, 1993 TO 2010 [a]

Item	Percent of Total Visitors	Annual Visitors (Thousands) Estimated 1993 [b]	Projected 2000	Projected 2010
Total Visitors to Maui				
Total Enplaned Passengers	-	2,680	3,150	4,000
Total Visitors	-	2,210	2,540 [c]	3,220 [c]
Visitors Percent of Air Passengers	-	82.50	80.1	80.5
Domestic Visitors to Maui				
TOP 20 U.S. STATES				
California	25.4	562	645	818
Washington	5.0	111	127	161
Illinois	3.3	72	84	106
Texas	3.2	70	81	103
New York	2.8	62	71	90
Oregon	2.1	46	53	68
Ohio	1.8	40	46	58
Michigan	1.8	40	46	58
New Jersey	1.7	37	43	55
Florida	1.7	37	43	55
Pennsylvania	1.6	36	41	52
Colorado	1.6	36	41	52
Arizona	1.3	29	33	42
Minnesota	1.3	29	33	42
Massachusetts	1.1	25	28	35
Georgia	1.1	25	28	35
Missouri	1.0	21	25	32
Virginia	1.0	21	25	32
Wisconsin	1.0	22	25	32
Indiana	0.9	19	23	29
Subtotal Top 20 States	60.6	1,340	1,539	1,951
Other States	8.6	190	219	277
Total Domestic Visitors	69.2	1,530	1,758	2,228

TABLE III-2
ESTIMATED VISITORS TO MAUI BY ORIGIN,
1993 TO 2010 [a]

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Item	Percent of Total Visitors	Annual Visitors (Thousands) Estimated 1993 [b]	Projected 2000	Projected 2010
International Visitors to Maui				
Asia				
Japan	14.4	318	366	464
Other Asia	3.0	66	76	96
Subtotal Asia	17.4	384	442	560
Oceana	1.7	38	43	55
Canada	6.1	135	155	196
Europe	4.9	108	124	158
Other International	0.7	15	18	23
Subtotal International	30.8	680	782	992
Total Visitors	100.0	2,210	2,540	3,220

[a] Source: P&D Aviation analysis, except where noted.
[b] Source of visitor data: Hawaii Visitors Bureau, 1994.
[c] Projections are by P&D Aviation, based on the following average annual percentage increases, which were used by Aries Consultants, Ltd., to project visitors to the State of Hawaii in Update Hawaii Aviation Demand Forecasts, June 1994:

1993 to 2000	2.0%
2000 to 2010	2.4%
2010 to 2020	2.0%

9,500 or 9,600 feet would permit nonstop service to Chicago, Dallas-Ft. Worth and Japan. An extension of Runway 2-20 to 10,500 feet, in addition, would permit nonstop service to New York/New Jersey. It is estimated that demand would be sufficient to allow economic non-stop service from Chicago and Dallas-Ft. Worth by the year 2000 and from Japan by 2010. Forecasts by the State of Hawaii (Draft Update Hawaii Aviation Demand Forecasts, June 20, 1994, with revisions) in Scenario Two project that international flights to Kahului would begin in 2010.

Demand for domestic nonstop service was estimated by assigning a portion of the visitor demand from certain states to a candidate city (as described in Table III-3). The percentage of demand assigned to each state allows for passengers who would prefer routings through other cities or on airlines other than the airline providing the potential new service, the availability of flights at more convenient times, and the desire to visit Oahu in addition to Maui (thereby desiring service to Honolulu).

As Table III-3 shows, the potential for nonstop service to these new markets, for a 9,500 or 9,600 foot extension is two domestic flights daily in 2000 and three daily in 2010. Furthermore, the addition of nonstop service in these markets would not result in a dramatic increase in service level. For example, the Chicago market currently has two one-stop direct flights and six flights with connecting one-stop or direct two-stop service.

There would be a potential for three nonstop flights to Japan in the year 2010. The development of this estimate is described later in this section. Although there are no one-stop direct flights to Japan, there are nine connecting flights daily with a single connection.

As the above evidence shows, the passenger demand at Kahului Airport would not be expected to increase significantly as a direct result of a runway extension because of the limited number of new nonstop flights and the limited service level benefits which would result from the nonstop flights.

Limited Inconvenience of Honolulu Connections. Excellent connecting service for Kahului flights is provided by the large number of interisland flights from Honolulu. Virtually any flight to Honolulu has a very short connecting time to Maui. The availability of connecting service and the short travel time from Honolulu minimize the potential gains which could result from nonstop service to Kahului. Additionally, many visitors to Maui also visit Oahu and prefer that their itinerary routes them through Honolulu.

TABLE III-3
POTENTIAL INCREASE IN NONSTOP FLIGHTS WITH RUNWAY EXTENSION, 2010 [a]

City and Distance from Kahului (Nautical Miles)	Potential Number of Daily Enplaned Passengers		Potential Average Daily Nonstop Flights Due to Longer Runway [b]		Existing Daily Flights to Kahului Airport [c]	
	2000	2010	2000	2010	One-Stop Direct Flights	Connecting Flights [d] and 2-Stop Direct Flights
Preferred Project and Alternatives 3, 5 and 7: Extension of Runway 2-20 to 9,500 or 9,600 Feet						
Domestic [e]						
Chicago (3,644)	250	310	1.5	2	2	6
Dallas/Fort Worth (3,234)	150	190	0.5	1	1	3
Denver (2,857)	70	90	0	0	0	2
International						
Japan (Tokyo & Osaka) (3,430)	0 [f]	700	0 [f]	3	0	9
Alternative 4: Extension of Runway 2-20 to 10,500 Feet						
Domestic [e]						
Atlanta (3,846)	80	100	0	0	2	1
Chicago (3,644)	250	310	1.5	2	2	6
Dallas/Fort Worth (3,234)	150	190	0.5	1	1	3
Denver (2,857)	70	90	0	0	0	2
New York/New Jersey (4,264)	200	260	1	1.5	0	2
International						
Japan (Tokyo & Osaka) (3,430)	0 [f]	700	0 [f]	3	0	9

[a] Source: P&D Aviation.
[b] Typical aircraft used in these flights would be B767, MD11 and B747.
[c] Source: Official Airline Guide, April 1994 (International) and October 1994 (Domestic). Flights operating at least 5 days per week.
[d] One connection, with no intermediate stops.
[e] Estimated on the basis of the percentage of demand from the following states:
Chicago: Illinois (65%); Ohio, Michigan, Wisconsin and Indiana (25%)
Dallas/Fort Worth: Texas (65%)
Denver: Colorado (65%)
Atlanta: Georgia (65%); Florida (25%)
New York/Newark: New York and New Jersey (65%)
[f] The State of Hawaii forecasts that international flights will not operate at Kalului Airport before 2010. (Scenario Two, Draft Update Hawaii Aviation Demand Forecasts, June 20, 1994, revised).

Conclusions. On the basis of the above studies and considerations, it is concluded that passenger demand at Kahului Airport would not be significantly effected by an increase in runway length. The major benefits of a runway extension would be the ability of airlines to increase cargo and passenger loads (as described in Section I of this appendix) and an added margin of safety for aircraft operations using the runway (as described in Section IV of this appendix). In addition, some benefits of increased air service would result.

ESTIMATED EFFECT OF THE PROPOSED PROJECT RUNWAY EXTENSION ON AIRCRAFT OPERATIONS

Although the runway extension which is a part of the proposed project would not directly impact the number of passengers at Kahului Airport, the runway extension would effect the number and type of aircraft operations. Specifically, an extension would increase the number of nonstop flights, allow flights having a greater stage length (nonstop distance), alter the mix of operations by type of aircraft, and effect the total number of aircraft operations. The sections below describe these effects.

Increase in Nonstop Flights

The extension of Runway 2-20 to 9,500/9,600 feet would increase the number of overseas nonstop flights, as described above. Nonstop overseas flights would increase by two average daily departures in the year 2000 and six average daily departures in 2010 (Table III-3).

Aircraft Operations Mix and Flight Stage Lengths

The increase in new nonstop service would alter the mix of aircraft operations as well as the flight stage lengths. Another factor effecting the operations mix and stage lengths is the greater number of flights to the U.S. mainland west coast. With the runway extension, nonstop flights from the mainland west coast to Kahului would become more attractive to the airlines because such flights would not be restricted by takeoff weight limits (as described in Section I of this appendix). Currently, under some temperature and runway use conditions, such flights must depart Kahului with less than the maximum load of passengers, baggage and air cargo. A greater number of west coast mainland flights are expected to fly nonstop to Kahului as a result of the removal of the economic and operational penalties which airlines must sometimes incur with nonstop service to the mainland.

Table III-4 contains estimates of the number of aircraft operations by stage length and aircraft size for air carrier service under the proposed project. Commuter/air taxi operations are not

TABLE III-4
ESTIMATED AIRCRAFT STAGE LENGTHS AND OPERATIONS MIX
FOR PREFERRED PROJECT AND RUNWAY ALTERNATIVES 3, 5 AND 7:
EXTENSION OF RUNWAY 2-20 TO 9,500 OR 9,600 FEET,
1993 TO 2010 [a]

[a] Source: Developed by P&D Aviation. Total number of aircraft operations by aircraft type for 2000 and 2010 were taken from: State of Hawaii, Update Hawaii Aviation Demand Forecasts, June 1994 (revised 8/15/94). Aircraft operations by aircraft type for 1993 were supplied by Hawaii Department of Transportation.

[b] Typical aircraft types include:

Small 2-Engine	B737, MD80, DC9
Medium 2-Engine	B757, B767
Medium 4-Engine	DC8, B707
Large 2-Engine	B777
Large 3-Engine	DC10, L1011, MD11
Large 4-Engine	B747, A340

[c] Includes all-cargo operations.

TABLE III-4
ESTIMATED AIRCRAFT STAGE LENGTHS AND OPERATIONS MIX
FOR PREFERRED PROJECT AND RUNWAY ALTERNATIVES 3, 5 AND 7:
EXTENSION OF RUNWAY 2-20 TO 9,500 OR 9,600 FEET,
1993 TO 2010 [a]

Nonstop Aircraft Stage Length (Nautical Miles) and Aircraft Type [b]	Annual Air Carrier Aircraft Operations [c]					
	1993		2000		2010	
	Number	%	Number	%	Number	%
Air Carrier - Domestic Service						
0-500 (Interisland)						
Small 2-Engine	48,254	88.9	57,400	85.8	68,100	84.4
Medium 2-Engine	0	0	500	0.7	1,400	1.7
Medium 4-Engine	42	0.1	0	0	0	0
Large 2-Engine/4-Engine	0	0	200	0.3	80	0.1
Large 3-Engine	3,608	6.6	3,300	4.9	2,600	3.2
1,500-2,500 (West Coast)						
Medium 2-Engine	200	0.4	500	0.7	1,400	1.7
Medium 4-Engine	0	0	200	0	0	0
Large 2-Engine/4-Engine	0	0	3,300	0.3	80	0.1
Large 3-Engine	2,200	4.1		4.9	2,600	3.2
2,500-3,500 (Dallas/Ft. Worth)						
Large 3-Engine	0	0	400	0.6	700	0.9
3,500-4,500 (Chicago, New York)						
Large 2-Engine	0	0	0	0	340	0.4
Large 3-Engine	0	0	1,100	1.6	1,200	1.5
Subtotal Air Carrier-Domestic	54,304	100.0	66,900	100.0	78,500	97.3
Air Carrier-International Service						
2,500-3,500 (Japan)					2,200	
Large 3-Engine/4-Engine	0	0	0	0		2.7
Subtotal Air Carrier-International	0	0	0	0	2,200	2.7
Total Air Carrier	54,304	100.0	66,900	100.0	80,700	100.0

expected to be affected by a runway extension. The proposed project operations for the years 2000 and 2010 are compared with 1993 in Table III-4 and compared with the No Action Alternative in Table III-5. Compared with the No Action alternative, the preferred project is expected to result in a greater number of large three-engine aircraft (DC10, L1011, MD11) operations and large two-engine/four-engine aircraft (Boeing 777 or Boeing 747) operations. Moreover, the preferred project will result in more nonstop flights to the U.S. mainland west coast than the No Action Alternative and nonstop flights to the central U.S. mainland and Japan, which would not exist under the No Action Alternative.

Estimated Number of Aircraft Operations

The proposed project would result in a reduction of total aircraft operations, compared with the No Action Alternative, in 2000 and 2010 because of the shift towards larger aircraft serving the airport. The increased use of larger aircraft at the airport would be a result of more nonstop overseas flights and fewer interisland connecting flights. The runway extension under the proposed project would reduce the total number of air carrier operations from 71,100 to 66,900 in the year 2000 and from 89,600 to 80,700 in the year 2010 (Tables III-4 and III-5).

ESTIMATED EFFECTS OF ALTERNATIVE RUNWAY LENGTHS ON AIRCRAFT OPERATIONS

The effects of runway length alternatives to the proposed project are shown in Table III-5. In addition to the No Action and Runway Alternative 1 (no extension of Runway 2-20), Table III-5 shows the effects of Runway Alternatives 2 and 6 (extension of Runway 2-20 to 8,500 feet) and Runway Alternative 4 (extension of Runway 2-20 to 10,500 feet).

Runway Alternatives 2 and 6

Under Runway Alternatives 2 and 6, Runway 2-20 would be extended to 8,500 feet. It is assumed that under these alternatives nonstop air carrier service would continue to be limited to the U.S. mainland west coast. Compared with the No Action Alternative and Alternative 1 (no runway extension), it is anticipated that there would be an increase in nonstop flights to the west coast due to the lack of weight restrictions on aircraft taking off during high temperature conditions. It is estimated that the medium 2-engine and large aircraft jet operations would be divided equally between nonstop mainland flights and flights to Honolulu. Compared with the No Action Alternative and Alternative 1, Alternatives 2 and 6 would result in more flights by large 2-engine/4-engine and 3-engine aircraft and fewer flights by small 2-engine aircraft. The total number of air carrier flights under Alternatives 2 and 6 would be reduced from 71,100 to

TABLE III-5
ESTIMATED AIRCRAFT STAGE LENGTHS AND OPERATIONS MIX
FOR RUNWAY ALTERNATIVES 1, 2, 4, 6 AND NO ACTION, 1993 TO 2010 [a]

Nonstop Aircraft Stage Length (Nautical Miles) and Aircraft Type [b]	Annual Air Carrier Aircraft Operations [c]					
	1993		2000		2010	
	Number	%	Number	%	Number	%
No Action Alternative and Runway Alternative 1: No Extension of Runway 2-20						
Air Carrier - Domestic Service						
0-500 (Interisland)						
Small 2-Engine	48,254	88.9	63,100	88.7	80,200	89.5
Medium 2-Engine	0	0	500	0.7	1,400	1.6
Medium 4-Engine	42	0.1	0	0	0	0
Large 2-Engine	0	0	200	0.3	1,200	1.3
Large 3-Engine	3,608	6.6	4,700	6.6	3,600	4.0
1,500-2,500 (West Coast)						
Medium 2-Engine	200	0.4	500	0.7	1,400	1.6
Large 2-Engine	0	0	0	0	0	0
Large 3-Engine	2,200	4.1	2,000	2.8	1,900	2.1
Total Air Carrier	54,304	100.0	71,100	100.0	89,600	100.0
Runway Alternatives 2 and 6: Extension of Runway 2-20 to 8,500 Feet						
Air Carrier - Domestic Service						
0-500 (Interisland)						
Small 2-Engine	48,254	88.9	61,100	88.3	80,500	90.8
Medium 2-Engine	0	0	500	0.7	1,400	1.6
Medium 4-Engine	42	0.1	0	0	0	0
Large 2-Engine	0	0	200	0.3	80	1.0
Large 3-Engine	3,608	6.6	3,300	4.8	2,600	2.9
1,500-2,500 (West Coast)						
Medium 2-Engine	200	0.4	500	0.7	1,400	1.6
Large 2-Engine	0	0	200	0.3	80	0.1
Large 3-Engine	2,200	4.1	3,300	4.8	2,600	2.9
Total Air Carrier	54,304	100.0	69,200	100.0	88,700	100.0
Total Air Carrier	54,304	100.0	69,200	100.0	88,700	100.0

TABLE III-5
ESTIMATED AIRCRAFT STAGE LENGTHS AND OPERATIONS MIX
FOR RUNWAY ALTERNATIVES 1, 2, 4, 6 AND NO ACTION, 1993 TO 2010 [a]

[a] Source: Developed by P&D Aviation. Total number of aircraft operations for 1993 was taken from: State of Hawaii, Update Hawaii Aviation Demand Forecasts, June 1994.

[b] Typical aircraft types include:

Small 2-Engine	B737, MD80, DC9
Medium 2-Engine	B757, B767
Medium 4-Engine	DC8, B707
Large 2-Engine	B777
Large 3-Engine	DC10, L1011, MD11
Large 4-Engine	B747, A340

[c] Includes all-cargo operations.

Aviation Studies Related to the Proposed Kahului Airport Master Plan Improvements

TABLE III-5
ESTIMATED AIRCRAFT STAGE LENGTHS AND OPERATIONS MIX
FOR RUNWAY ALTERNATIVES 1, 2, 4, 6 AND NO ACTION, 1993 TO 2010 [a]

Nonstop Aircraft Stage Length (Nautical Miles) and Aircraft Type [b]	Annual Air Carrier Aircraft Operations [c]					
	1993		2000		2010	
	Number	%	Number	%	Number	%
Runway Alternative 4: Extension of Runway 2-20 to 10,500 Feet						
Air Carrier - Domestic Service						
0-500 (Interisland)						
Small 2-Engine	48,254	88.9	55,500	84.5	65,100	82.5
Medium 2-Engine	0	0	500	0.8	1,400	1.8
Medium 4-Engine	42	0.1	0	0	0	0
Large 2-Engine	0	0	200	0.3	80	0.1
Large 3-Engine	3,608	6.6	3,300	5.0	2,600	3.3
1,500-2,500 (West Coast)						
Medium 2-Engine	200	0.4	500	0.8	1,400	1.8
Large 2-Engine	0	0	200	0.3	80	0.1
Large 3-Engine	2,200	4.1	3,300	5.0	2,600	3.3
2,500-3,500 (Dallas/Ft Worth)						
Large 3-Engine	0	0	400	0.6	700	0.9
3,500-4,500 (Chicago, New York)						
Large 2-Engine	0	0	0	0	700	0.9
Large 3-Engine	0	0	1,800	2.7	1,800	2.3
Subtotal Air Carrier-Domestic	54,304	100.0	65,700	100.0	76,700	97.2
Air Carrier-International Service						
2,500-3,500 (Japan)						
Large 2-Engine/4-Engine	0	0	0	0	2,200	2.8
Subtotal Air Carrier-International	0	0	0	0	2,200	2.8
Total Air Carrier	54,304	100.0	65,700	100.0	78,900	100.0

69,200 in the year 2000 and from 89,600 to 88,700 in the year 2010 from the No Action Alternative and Alternative 1.

Runway Alternative 4

In Runway Alternative 4, Runway 2-20 would be extended to 10,500 feet, allowing unrestricted departures from Kahului Airport to essentially any destination within the range of passenger aircraft. Based on the demand analyses contained earlier in this section, the only other nonstop market that would be served in addition to those served by a 9,600 foot runway would be New York/New Jersey. This is estimated to result in an increase in operations by large 2-engine/4-engine and 3-engine aircraft in the 3,500 to 4,500 nautical mile range and a decrease in small 2-engine aircraft operations in the 0 to 500 nautical mile range, compared with the preferred project alternative. In other respects, the resulting operational mix would be similar to the preferred project alternative. Compared with the No Action Alternative and Alternative 1, Alternative 4 would result in a reduction of total air carrier operations from 71,100 to 65,700 in the year 2000 and from 89,600 to 78,900 in the year 2010.

ESTIMATED EFFECT OF INTERNATIONAL FLIGHT ACTIVITY ON AIRPORT DEMAND

Passengers

Forecasts developed by the State of Hawaii (Update Hawaii Aviation Demand Forecasts, June 1994, revised) were developed for two scenarios, Scenario One with no international passenger operations at Kahului Airport and Scenario Two with international operations at Kahului Airport beginning in the year 2010. The Scenario Two Low Passenger Forecast prepared for the State of Hawaii estimates that there will be 511,000 international passengers flying directly to/from Kahului Airport in the year 2010 (255,500 international enplaned passengers). According to this scenario, international passengers would be 6.4 percent of the total Kahului Airport passengers in 2010.

Table III-6 contains the methodology used to prepare an independent estimate of international demand for air passengers and flights. The results from the independent analysis prepared for this EIS are consistent with the State of Hawaii international passenger forecast.

The Hawaii Visitors Bureau estimates there were 318,000 visitors from Japan to Maui County in 1993, 14.4 percent of total visitors. Assuming that the visitors from Japan remain at this percentage of total visitors, Maui County visitors from Japan are estimated to be 463,000 in

TABLE III-6
ESTIMATED INTERNATIONAL PASSENGER ACTIVITY AT KAHULUI AIRPORT, YEAR 2010 [a]

Activity	1993 [b]	Year 2010 Activity	
		All Flights	Non-Stop Flights
Total Visitors to Maui	2,210,000	3,220,000	-
Visitors from Japan to Maui County	318,000	463,000	-
Percent on Non-stop Flights	-	-	50%
Visitors from Japan on Non-Stop Flights	-	-	231,500
Visitors from Other Asian Countries to Maui County	66,000	96,000	-
Percent Departing on Non-stop Flights from Japan	-	-	25%
Visitors from Other Asian Countries Departing on Non-Stop Flights from Japan	-	-	24,000
Total Visitors Departing Japan on Non-Stop Flights (Enplaned Passengers)			
Annually	-	-	255,500
Daily	-	-	700
Average Daily Departures from Japan to Maui	-	-	3.0

[a] Source: P&D Aviation analysis, except where noted.

[b] Sources: Hawaii Visitors Bureau, 1993 survey information.

2010. Visitors from other Asian countries to Maui County are estimated to total 66,000 in 1993, growing to 96,000 in the year 2010.

It is estimated that 50 percent of the visitors from Japan and 25 percent of the visitors from other Asian countries would travel to Kahului Airport on nonstop flights in the year 2010. Based on these conditions, there would be 255,000 annual visitors arriving on nonstop flights from Japan, or 700 daily enplaned passengers. Based on a mix of B747-400 and B767-300ER aircraft, the nonstop passenger demand from Japan would be accommodated by an average of three daily departures, assuming an average load factor of approximately 73 percent.

According to the State of Hawaii forecasts, there would be the same number of total passengers to Kahului Airport with or without nonstop international service. As shown in Table III-3 there are currently an average of 9 daily flights from Tokyo and Osaka to Kahului Airport that are single-connection flights. Thus, visitors desiring to travel directly from Tokyo and Osaka Japan already have a variety of flights from which to choose, that have reasonable connecting times.

Aircraft Operations

The effect on aircraft operations of the introduction of international service to Kahului Airport in 2010 is illustrated in Tables III-4 and III-5. The Japan flights would result in approximately 2,200 annual operations by large aircraft operating in the 2,500 to 3,500 nautical miles stage length. Nonstop flights to Japan are estimated to occur under the preferred project and Alternatives 3, 4, 5 and 7. The three daily international flights to Japan would shift some operations from small 2-engine aircraft (interisland service) to large aircraft. Each international flight would replace approximately 2.6 interisland flights, resulting in a net reduction of approximately 3,500 annual operations for the three daily flights.

ESTIMATED EFFECT OF RELOCATION ALTERNATIVES ON AIRPORT DEMAND

Relocation alternatives to the preferred project are summarized below and the estimated effects of these alternatives on demand at Kahului Airport are described.

The following categories of demand were considered candidates for possible relocation to another airport:

- **Helicopters.** Most helicopter activity at Kahului Airport is for sight-seeing tours. However, helicopters also use the airport for medical transport, search and rescue, business and industrial (heavy lift operations) uses, government uses and flight training.

- **General Aviation Piston Aircraft.** Single engine and twin engine general aviation piston aircraft are used for a variety of activities including flight training, charter, aircraft rental, sight-seeing, personal and business uses.

- **Turbine Powered General Aviation Aircraft.** A variety of turboprop and turbojet aircraft are used in corporate activity. Corporate aircraft typically consist of turboprop and business jets under 30,000 pounds gross weight.

- **Inter-Island Air Cargo Service.** Inter-island air cargo operators fly commercial jets such as Boeing B737 freighters as well as smaller turboprop and piston aircraft such as Cessna cargo models.

After careful consideration of existing airports, former airport locations, previously proposed sites, and new sites, several site alternatives emerged as a potential reliever for Kahului Airport. These airport site alternatives are described below.

- **Relocation Alternative 1: No New Airport.** Relocation Alternative 1 consists of operating the existing system of airports on Maui. No new sites would be developed and existing airports would be expanded to accommodate the necessary growth.

- **Relocation Alternative 1A: Relocation of Kahului Helicopter Facilities to the East.** This alternative consists of relocating the existing helicopter facilities at Kahului to the east on property to be acquired, but which would be contiguous with airport property and become a part of Kahului Airport.

- **Relocation Alternative 1B: New Limited-Service Heliport at Unspecified Site.** Under this alternative a new limited service heliport facility would be constructed on the west side of Maui to serve tourists in the Lahaina-Kaanapali area. The limited service heliport wold be used for passenger pick-up and drop-off and would not accommodate aircraft maintenance or storage facilities.

- **Relocation Alternative 2: New Heliport at South End of Former Puunene Airport.** Under Alternative 2, a new heliport would be constructed along the southeast border of state-owned property at the former Puunene Airport site.

- **Relocation Alternative 3: New Heliport Located on the East Side of the Former Puunene Airport.** In Alternative 3, a new heliport would be built on the east side of the former Puunene Airport site.

- **Relocation Alternative 4: Utility Airport/Heliport at Former Puunene Airport.** Relocation Alternative 4 is a new utility airport with full-service heliport which would be constructed at the former Puunene Airport site. The airport would have a 3,800 foot runway located at the center of the former airport site to obtain the maximum separation from the Kahului Airport flight tracks yet not impact unfavorably on the developed areas at Kihei.

- **Relocation Alternative 4A: New Utility Airport at Former Puunene Airport Site.** This relocation alternative is similar to Alternative 4 accept that no helicopter facilities would be provided. Under this alternative, all helicopter activity would remain at Kahului Airport.

- **Relocation Alternative 5: New Utility Airport/Heliport North of Kihei.** Under this relocation alternative a new utility airport and full service heliport would be built three miles northeast of the Kihei area at approximately the 600 foot elevation. A new 3,800 foot runway would be located between Keahuaiwi and Kolaloa Gulches and would intersect Waiakoa Road.

- **Alternative 6: New Utility Airport/Heliport East of Kahului.** Relocation Alternative 6 is a new utility airport and full-service heliport located east of the Kahului-Wailuku area immediately south of the Haleakala Highway. A new 3,800-foot runway would be provided.

- **Relocation Alternative 7: New Heliport and Utility Airport at Former Puunene Airport.** In this alternative, a new full-service heliport and utility airport would be developed at separate locations on the former Puunene Airport site. The heliport would be located on the east side of Mokulele Highway on State-owned property at the north end of the site. The utility airport, with a 3,900-foot runway, would be located at the southern end of the site, mostly on State property.

- **Alternative 8: New Transport Airport and Full-Service Heliport at Former Puunene Airport.** Under this alternative, a new transport category airport and full-service heliport would be built on the former Puunene Airport site. The southwest end of the runway would be in the same location as the runway under Relocation Alternative 4. The transport runway would be 6,600 feet long.

The following operations are estimated to be shifted from Kahului Airport to the new site under each alternative:

- Alternative 1B. New Limited Service Heliport -- a portion of tour helicopter operations.

- Alternative 2. New Heliport-Puunene South -- all helicopter operations.

- Alternative 3. New Heliport-Puunene East -- all helicopter operations.

- Alternative 4. New Utility Airport/Heliport-Puunene -- all helicopter operations and all fixed-wing piston general aviation operations.

- Alternative 4A. New Utility Airport-Puunene -- all fixed-wing piston general aviation operations.

- Alternative 5. New Utility Airport/Heliport-North of Kihei -- all helicopter operations and all fixed-wing piston general aviation operations.

- Alternative 6. New Utility Airport/Heliport-East of Kahului -- all helicopter operations and all fixed-wing piston general aviation operations.

- Alternative 7. New Utility Airport and New Heliport-Puunene

  - Airport -- all fixed-wing piston general aviation operations.
  - Heliport -- all helicopter operations.

- Alternative 8. New Transport Airport/ Heliport - Puunene -- All helicopter operations, all interisland air cargo operations, all fixed-wing piston general aviation operations, all turboprop fixed-wing general aviation operations, and all interisland turbojet general aviation operations (estimated to be 4 percent of total turbojet general aviation operations).

Relocation Alternative 1B, a new limited service heliport, is the only alternative in which the total operations at Kahului Airport and the new site would be greater than at Kahului Airport alone. Under this alternative, a limited service heliport would be developed on the west side of Maui to serve the visitors in that area. The new heliport would be used for boarding and deplaning of tour helicopter customers but would not be used to base aircraft overnight. Ferry flights would be necessary to bring helicopters to the new facility in the morning and return them to Kahului Airport in the evening.

Tour Helicopter Passengers

In 1993 there were an estimated 160,000 helicopter tour passengers enplaned at Kahului Airport. If heliport facilities for tour operations are not built in another location on Maui, the number of helicopter tour passenger enplaned at Kahului is expected to grow to 200,000 in the year 2000 and 250,000 in 2010. With a new limited-service heliport many of the operations would be shifted to the new site. Tour helicopter operations at Kahului would continue to serve passengers in the Kihei-Wailea area and provide for ferry flights between Kahului Airport and a new limited-service west side heliport facility. Under the limited-service alternative, Kahului Airport would serve 80,000 helicopter tour passengers in 2000 and 100,000 in 2010. With a new full-service heliport or full-service heliport/airport combination, all helicopter tour passengers would be accommodated at the new site. Forecasts of helicopter tour passengers at Kahului Airport for new airport alternatives is shown in Table III-7.

Air Cargo

A new transport airport under Relocation Alternative 8 would accommodate all interisland air cargo which is carried on all-cargo flights. In 1993, 40,100 tons of air cargo and mail were handled at Kahului Airport (Table III-8). Under Relocation Alternative 8, cargo handled at Kahului Airport would be reduced to 28,000 tons in the year 2000 and 34,000 tons in 2010, compared with 47,000 tons in 2000 and 58,000 tons in 2010 projected for Kahului Airport without a new site capable of accommodating air cargo. Air cargo and mail not carried on all-cargo flights would be carried in the cargo holds of passenger flights.

General Aviation Based Aircraft

All relocation alternatives except a new limited-service heliport would accommodate based aircraft and/or helicopters. Without a reliever airport, the number of aircraft based at Kahului Airport is expected to increase from 86 in 1993 to 93 in 2000 and 105 in 2010 (Table III-9). Under the relocation alternatives with a new utility airport/heliport or new transport airport/heliport, all aircraft based at Kahului Airport would be transferred to the new site.

TABLE III-7
FORECAST OF HELICOPTER TOUR PASSENGERS AT KAHULUI AIRPORT FOR NEW AIRPORT ALTERNATIVES, 1993 TO 2010 [a]

Year	Helicopter Tour Passengers Enplaned at Kahului Airport
No New Airport or New Utility Airport	
1993	160,000
2000	200,000
2010	250,000
New Limited-Service Heliport	
2000	80,000
2010	100,000
New Full-Service Heliport, Utility Airport/ Heliport or Transport Airport/Heliport	
2000	0
2010	0

[a] Source: P&D Aviation analysis.

TABLE III-8
FORECAST OF CARGO AT KAHULUI AIRPORT FOR NEW AIRPORT ALTERNATIVES, 1993 TO 2010 [a]

Year	Air Cargo and Mail at Kahului Airport (Thousands of Tons)
No New Airport, New Heliport, or New Utility Airport/Heliport [a]	
1993	40.1
2000	47.0
2010	58.0
New Transport Airport/Heliport [b]	
2000	28.0
2010	34.0

[a] Source: Aries Consultants, Ltd., Update Hawaii Aviation Demand Forecasts, June 1994.

[b] Source: P&D Aviation Analysis, based on the following amounts of cargo (in thousands of tons) being shifted to a new transport airport/heliport:

Year	Air Carrier Cargo	Commuter/Air Taxi Cargo
2000	18.7	0.3
2010	23.5	0.5

TABLE III-9
FORECAST OF BASED AIRCRAFT KAHULUI AIRPORT FOR NEW AIRPORT ALTERNATIVES, 1993 TO 2010 [a]

Year	Based Aircraft at Kahului Airport		
	Total	Fixed-Wing Piston	Helicopter
No New Airport, New Limited-Service Heliport			
1993	86	50	36
2000	93	55	38
2010	105	59	46
New Full-Service Heliport			
2000	55	55	0
2010	59	59	0
New Utility Airport			
2000	38	0	38
2010	46	0	46
New Utility Airport/Heliport			
2000	0	0	0
2010	0	0	0
New Transport Airport/Heliport			
2000	0	0	0
2010	0	0	0

[a] Source: P&D Aviation Analysis.

Aircraft Operations

As shown in Table III-10, the relocation alternatives would have varying effects on the number of operations at Kahului Airport. Relocation alternatives would potentially impact all categories of aircraft operations at the airport except military operations. Without a reliever airport site, total aircraft operations at Kahului Airport are projected to increase from 187,300 in 1993 to 219,900 in 2000 and 253,700 in 2010. A new utility airport would have the least impact on aircraft operations at Kahului, reducing the 2010 operations to 214,800. The greatest impact on operations would be a new transport airport/heliport, which would reduce the 2010 operations at Kahului Airport to 113,200, which is only 45 percent of operations projected for Kahului Airport without a reliever site.

TABLE III-10
FORECAST OF AIRCRAFT OPERATIONS AT KAHULUI AIRPORT FOR NEW AIRPORT ALTERNATIVES, 1993 TO 2010 [a]

Year	Aircraft Operations at Kahului Airport (Thousands)				
	Total	Air Carrier	Commuter/ Air Taxi	General Aviation	Military
No New Airport [b]					
1993	187.3	54.3	89.6	37.1	6.3
2000	219.9	66.9	90.0	41.0	12.0
2010	253.7	80.7	112.3	49.0	11.7
New Limited-Service Heliport					
2000	161.7	66.9	41.8	41.0	12.0
2010	192.6	80.7	51.2	49.0	11.7
New Full-Service Airport					
2000	134.6	66.9	19.2	36.5	12.0
2010	158.6	80.7	22.5	43.7	11.7
New Utility Airport					
2000	176.7	66.9	90.0	7.8	12.0
2010	214.8	80.7	112.3	10.1	11.7
New Utility Airport/Heliport					
2000	101.4	66.9	19.2	3.3	12.0
2010	119.7	80.7	22.5	4.8	11.7
New Transport Airport/Heliport					
2000	96.1	63.4	18.2	2.5	12.0
2010	113.2	76.3	21.5	3.7	11.7

[a] Source: P&D Aviation Analysis, except as noted.

[b] Source: Aries Consultants, Ltd., Update Hawaii Aviation Demand Forecasts, June 1994.

Section IV

AVIATION SAFETY

SECTION IV
AVIATION SAFETY

This section focuses on the existing conditions at Kahului Airport related to aviation safety standards, the safety record of the airport and impacts of the proposed development on the safety of aircraft flight operations. Aviation safety issues include:

- Adherence to aviation laws and regulations pertaining to safety of flight operations.
- Adherence to FAA criteria and standards related to airfield geometrics, airport safety zones and obstructions.
- Air space congestion.
- Adequacy of runway length and margin of safety provided.
- The aircraft accident record at the airport and the potential for future accidents.

The evaluation of the airport's accident record will include a review of the accident history at the airport, accident rates experienced at the airport, a comparison of accident rates with nationwide rates and trends, and the potential for future accidents at the airport.

EXISTING CONDITIONS

Laws and Regulations Related to Aviation Safety at Airports

Agencies responsible for aviation safety concerns related to Kahului Airport are listed below along with their primary areas of responsibility associated with aviation safety:

- Federal Aviation Administration (air traffic control, aircraft operating and flight rules, airport planning and design, certification and operation of airports, airport security, airport obstructions and aircraft certification).
- National Transportation Safety Board (accident reporting and accident investigation).
- State of Hawaii (airport planning, design and construction; airport permitting; airport operations and adherence to FAA safety standards; and land uses near airports).

Laws and regulations pertaining to aviation safety at airports are contained in the code of Federal Aviation Regulations (federal laws) and the State of Hawaii Aeronautics Code (State laws). Federal regulations which pertain to the safety of aircraft operations at airports are contained in the following Federal Aviation Regulations:

- Part 77, Objects Affecting Navigable Air Space
- Part 91, General Operating and Flight Rules
- Part 107, Airport Security
- Part 139, Certification and Operations: Land airports serving CAB-Certificated Scheduled Air Carriers operating large aircraft
- Part 150, Airport Noise Compatibility Planning

Airport operations are believed to be in complete conformance with the regulations and laws included in the Federal Aviation Regulations identified above as they pertain to aviation safety. Federal Aviation Regulations, Part 77 includes guidance criteria for the height of objects located near airports. Heights of some existing natural and man-made objects exceed Part 77 guidance limitations and are discussed in the next subsection.

The State of Hawaii Aeronautics Code (Title 15, Transportation and Utilities, Chapter 261, Aeronautics) contains state laws relating to the safety of airport operations. State regulations relevant to aviation safety are:

- Section 261-7, Operation and Use Privileges
- Section 261-12, Rules, Standards
- Section 261-13.5, Promotion of Safety and Efficient use of Facilities Where Congestion Occurs
- Section 261-16, Licensing of Airports

Kahului Airport operations are believed to adhere to all state laws and regulations relating to aviation safety.

FAA Planning and Design Guidelines

The following Federal Aviation Administration Advisory Circulars contain criteria and standards relating to the safe design and operation of airports:

- AC150/5020-1, Noise Control and Compatibility Planning for Airports
- AC150/5060-5, Airport Capacity and Delay
- AC150/5070-6A, Airport Master Plans
- AC150/5300-13, Airport Design

FAA Advisory Circular 150/5300-13, Airport Design, contains FAA standards for airfield geometrics, runway and taxiway separations, Runway Safety Areas and Runway Protection Zones.

The layout of the Kahului Airport facility is generally consistent with the FAA standards and guidelines contained in the Advisory Circulars referenced above. The notable exceptions relating to aviation safety are described below.

Runway Safety Areas. A Runway Safety Area is a rectangular area centered about the runway that is cleared, drained, graded and usually turfed. Under normal conditions, this area should be capable of accommodating occasional aircraft that may veer off the runway, as well as firefighting equipment. For Kahului Airport, the FAA standards specify a Runway Safety Area for each airport that is 500 feet wide centered on the runway centerline and extending 1,000 feet beyond each runway end.

Presently, the Runway Safety Area for Runway 2-20 is 400 feet wide and extends 1,000 feet beyond each runway end. A storm drainage swale along the western side of portions of the runway limits the width of the safety area on the sides of the runway. Additionally, a small storm drainage channel traverses the north end of the runway approximately 400 feet from the runway end. This does not meet Runway Safety Area standards which provide that aircraft must be able to roll safely through the Runway Safety Area without substantial damage.

The Runway Safety Area for Runway 5-23 is 370 feet wide and extends 1,000 feet beyond both ends of the runway. This Runway Safety Area is narrower than provided for by FAA standards.

Although both Runway Safety Areas conformed to FAA criteria which were in effect at the time of construction of the runway, and therefore are approved by the FAA, the National Transportation Safety Board and FAA strongly encourage airports to provide the recommended Runway Safety Areas wherever possible.

Runway Protection Zones. The Runway Protection Zone (RPZ) is an area at the end of the runway used to enhance the protection of people and property on the ground. The Runway Protection Zone begins 200 feet from the end of the runway and has a size which varies with the designated use of the runway. The Runway Protection Zone should be kept clear of incompatible objects and activities. No new structures should be permitted nor the congregation of people allowed within the Runway Protection Zone. Some uses such as golf courses and agricultural operations are permitted within the RPZ.

Control of the RPZ by the airport owner is essential. It is desirable, therefore, that the airport owner acquire adequate property interests, preferably in fee title, in the RPZ to ensure compliance with the FAA standards.

The existing Runway Protection Zones have the following dimensions:

Runway	Type of Runway	Length in Feet	Inner Width In Feet	Outer Width In Feet
2	Precision	2,500	1,000	1,750
20	Precision	2,500	1,000	1,750
5	Nonprecision	1,700	500	1,010
23	Nonprecision	1,700	500	1,010

The RPZs for Runway 20, Runway 5 and Runway 23 are larger than required by FAA standards for the current instrumentation of the runway and the RPZ for Runway 2 meets FAA standards. The larger RPZs are preserved to provide for future instrument landing systems for these runway ends. Except for a small portion of the east side of the Runway 23 RPZ, all of the RPZs lie entirely within airport property. The RPZ currently required for Runway 23 would be located entirely on airport property.

FAR Part 77 Penetrations. Federal Aviation Regulations (FAR), Part 77 (FAA, FAR Part 77, Objects Affecting Navigable Air Space, January 1975) specifies a series of imaginary surfaces surrounding an airport. Any penetration of the terrain or man-made object above these surfaces is considered an obstruction by the FAA. All such obstructions are reviewed by the FAA to determine if they constitute a hazard to air navigation. If an obstruction is allowed, it must often be appropriately marked and/or lighted. In all cases, however, penetrations to the imaginary surfaces are not advised and new development should stay beneath these surfaces if physically and economically feasible. FAR Part 77 surfaces that apply to Kahului Airport consist of:

- Primary Surface. Surface longitudinally centered on the runway. The runway Primary Surface extends 200 feet beyond the threshold of the runway. The width of the runway Primary Surface is 1,000 feet for Runway 2-20 and 500 feet for Runway 5-23.

- Approach Surface. Surfaces longitudinally centered on the extended runway centerline and extending outward and upward at the following slopes:

Runways 2 & 20	50:1 for first 10,000 feet
	40:1 for next 40,000 feet
Runways 5 & 23	34:1 for 10,000 feet

- Transitional Surfaces. Surfaces extending outward and upward at right angles to the edge of the Primary Surface and Approach Surfaces at a slope of 7:1.

- Horizontal Surface. A horizontal plane 150 feet above the established airport elevation of 54 feet above mean sea level (defined as the highest point on any runway) at a distance of approximately 10,000 feet from the runway end or runway centerline.

- Conical Surface. A surface extending outward and upward from the periphery of the Horizontal Surface at a slope of 20:1 for a horizontal distance of 4,000 feet.

The Kahului Airport Master Plan prepared for the State of Hawaii, Department of Transportation, Airports Division, by Belt Collins & Associates and Aries Consultants, Ltd., 1993, identified FAA Part 77 obstructions to Runway 2 and Runway 20.

The Runway 2 imaginary approach surface is penetrated by two groups of objects. The first penetration is by Kealoloa Ridge of the West Maui Mountains, which penetrates a portion of the 7:1 transitional surface between 8 and 10 miles south of the runway threshold. The second penetration is by the tallest (252 feet above mean sea level) of the five stacks at the Puunene Sugar Mill. This stack is located approximately 9,800 feet south of the Runway 2 threshold and extends approximately 6 feet into the approach surface.

Some trees penetrated the approach surface to Runway 20, but they were 475 feet off the Runway centerline. The trees penetrating the approach surface to Runway 20 might have been trimmed subsequently to the publication of the Kahului Airport Master Plan in June 1993.

The penetrations described above are recognized by the FAA and do not adversely affect the safe operations of aircraft into and out of the airport.

Air Traffic Congestion

Although the amount of air traffic congestion at an airport cannot be shown to directly affect aviation safety, the potential for aircraft accidents could increase if the number of annual operations significantly exceeds annual capacity or if the mix of traffic at the airport contains large percentages of diverse aircraft types.

Annual Airfield Capacity and Demand. Annual airfield capacity is measured by the "Annual Service Volume". The Annual Service Volume is an estimate of the number of aircraft operations that can be accommodated at a given facility over the course of a year with an average annual aircraft delay on the order of 1 to 4 minutes. If the number of annual operations exceeds the annual service volume, moderate or severe congestion may occur. Based on current runway use patterns and aircraft mixes, the annual service volume of the existing airfield is about 193,000 operations. In 1993, there were approximately 114,000 fixed-wing aircraft operations on the airport's runways, which is about 59 percent of the airport's Annual Service Volume. An annual service volume of approximately 187,000 operations was estimated in the 1993 Kahului Airport Master Plan for the mix of aircraft forecast for the year 2010 (which includes a higher percentage of large and heavy (Class C and D aircraft) and current airfield facilities.

Aircraft Mix. Because the helicopter landing and takeoff helipads generally are at least 700 feet from the centerline of Runway 2-20, they are largely independent of fixed-wing aircraft operations at the present time. Therefore, the annual service volume has been calculated for fixed-wing aircraft operations only.

However, due to the large increase in helicopter operations in the last several years, concern has been expressed regarding the impact of increasing numbers of helicopter operations on the safety of flight operations. The helicopter operations at Kahului conform to all FAA safety requirements and at this time there is no identifiable degradation of airport safety as a result of the relatively large mix of helicopter operations.

Runway Length and Margin of Safety

.he runway margin of safety is defined in this appendix as the additional runway length available beyond the length required for a particular aircraft configuration and airport condition. The margin of safety is not an FAA requirement. Instead it is a concept developed here to describe the degree of safety provided by additional runway length which would be available, for example, in the case of an aborted takeoff or a landing accident.

The margin of safety for the existing Runway 2-20 at Kahului Airport is shown in Table IV-1 for eight aircraft types representative of aircraft which are currently or could potentially be in overseas service at Kahului Airport. The runway margin of safety is shown for nonstop service to the mainland west coast and ranges from zero to 1,600 feet for flights with maximum passengers and baggage (no cargo) and zero to 800 feet for flights with full passenger, baggage and cargo loads.

The runway length requirements in Table IV-1 are computed for a temperature of 84° fahrenheit, zero winds and zero runway gradient. Greater runway lengths would be required for hotter days and departures on Runway 20, which has a positive gradient of 0.59 percent (as described and quantified in Section I of this appendix). Consequently, the runway margin of safety would be reduced under those conditions.

Airport Accident History

To obtain an assessment of the general aircraft operational safety environment at Kahului Airport, the history of previous accidents at the airport were reviewed and compared with nationwide rates and trends. The majority of the accident information included herein was obtained from National Transportation Safety Board (NTSB) Accident Briefs, Annual Reviews, and news releases.

According to NTSB Regulations, Title 49, Part 830, an

> "aircraft accident means an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage.

TABLE IV-1
MARGINS OF SAFETY FOR EXISTING 7,000-FOOT RUNWAY LENGTH AT KAHULUI AIRPORT [a]

	Takeoff Runway Length Required for Non-Stop Service to the Mainland West Coast (Feet)		Existing Runway Margin of Safety (Feet) [b]	
Aircraft Type	Full Load of Passenger and Baggage	Full Load of Passengers, Baggage and Cargo	Full Load of Passengers and Baggage	Full Load of Passengers, Baggage and Cargo
B747-400	5,900	6,300	1,100	700
B767-200 ER	5,400	6,700	1,600	300
B767-300 ER	5,800	8,500	1,200	0 [c]
B777-200	5,800	5,800	1,200	200
DC10-10	7,000	10,000	0	0 [c]
DC10-30	6,000	8,500	1,000	0 [c]
MD11	5,800	6,200	1,200	800
L1011-100	7,200	8,100	0 [c]	0 [c]

[a] Source: P&D Aviation analysis, based on aircraft characteristics manuals and nonstop flight to Los Angeles or San Francisco, for 84°F, zero runway gradient, zero winds and the following payload capacities:

	Passengers and Baggage (Pounds)	Passengers, Baggage and Cargo (Pounds)
▪ B747-400	82,000	138,490
▪ B767-200 ER	44,280	78,500
▪ B767-300 ER	53,505	92,966
▪ B777-200	76,900	120,500
▪ DC10-10	58,835	94,829
▪ DC10-30	61,090	101,810
▪ MD11	66,215	114,870
▪ L1011-100	61,910	76,870

[b] The margin of safety is defined in this appendix as additional runway length available beyond that required for the aircraft type and specific conditions. There is no FAA requirement for a margin of safety.

[c] The existing 7,000-foot runway is not long enough to accommodate the departure at full load, under the conditions indicated in footnote [a].

> Serious injury means any injury which: (1) Requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) causes severe hemorrhages, nerve, muscle, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.
>
> Substantial damage means damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Engine failure or damage limited to an engine if only one engine fails or is damaged, bent fairings or cowling, dented skin, small punctured holes in the skin or fabric, ground damage to rotor or propeller blades and damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wingtips are not considered substantial damage for the purpose of this part.
>
> Fatal injury means any injury which results in death within 30 days of the accident. Incident means an occurrence other than an accident associated with the operation of an aircraft, which affects or could affect the safety of operations."

Accident History at Kahului Airport. Aircraft accidents which have occurred at Kahului Airport from 1964 to 1993 are summarized in Table IV-2. The 17 listings shown on this table involve air carrier, air taxi and general aviation operations. The Aloha Airlines accident on April 28, 1988 is included in Table IV-2 because the aircraft landed at Kahului Airport after the accident occurred. However, this accident was not associated with Kahului Airport with respect to location of occurrence and consequently the accident analyses described in this document do not include this accident. All other accidents included in Table IV-2 were related to aircraft at Kahului Airport or approaching or departing the airport. The accident that occurred on July 23, 1983 involved two aircraft, each of which are listed in Table IV-2. The accident analyses described in this document will, therefore, refer to only 15 aircraft accidents occurring between 1964 and 1993.

TABLE IV-2
AIRCRAFT ACCIDENTS AT KAHULUI AIRPORT, 1964 TO 1993

No.	Date	Time	Location	Type of Operation	Aircraft Type	Injuries: In Airplane F	In Airplane S	In Airplane M/N	On Ground F	On Ground S	On Ground M/N	Phase of Operation	Accident Type	Primary Accident Cause	Aircraft Damage
1	11/12/65	14:15	Off Airport (inaccessible area - over 5 miles from airport)	Air Taxi-Cargo	Beechcraft C45H	2	0	0	0	0	0	Landing: Missed Approach	Collision with ground	Pilot - Position disoriented	Destroyed
2	11/6/68	12:06	On Airport	Air Taxi - Passenger	Cessna 402	0	0	8	0	0	0	Landing: Roll	Gear collapsed	Airframe - Landing gear failure	Substantial
3	12/27/70	11:30	On Airport	Personal	Piper J-3	0	0	1	0	0	0	Taxi: From Landing	Ground loop/swerve; Nose over/down	Pilot - Poor judgment	Substantial
4	8/14/76	9:56	Off Airport (ground/water - over 5 miles from airport)	Air Taxi - Cargo	Cessna 207	0	0	1	0	0	0	In Flight: Descending Landing: Roll	Fire in flight; Collision with ground	Powerplant - Smoke in cockpit	Substantial
5	3/1/78	13:00	On Airport	Training	Cessna 182P	0	0	1	0	0	0	Taxi: To takeoff	Nose over/down	Pilot - Poor judgment	Substantial
6	6/14/80	9:10	Off Airport (struck houses - 1 to 2 miles from airport)	Personal	Cessna 172N	3	0	0	0	0	0	Landing: Final Approach	Stall	Pilot - Failure to maintain flying speed	Destroyed
7	10/18/81	[c]	Off Airport - (over 5 miles from airport)	Personal	Hiller UH12E	0	0	[c]	0	0	0	Landing	Collision with ground	Powerplant - Failure	Substantial
8	6/29/83	1:55	Off Airport (sugar cane field 4 miles from airport)	Air Carrier - Cargo	Douglas DC-4	0	0	3	0	0	0	Landing: Final Approach	Collision with ground	Powerplant - Failure	Substantial
9	7/23/83	[c]	On Airport	Air Taxi - Passenger	Beech C-45G	0	0	20	0	0	0	Holding: To takeoff	Collision with taxiing aircraft	Pilot of other aircraft - Taxied into standing aircraft	Substantial
10	7/23/83	[c]	On Airport	Air Taxi - Passenger	Beech E-18S	0	0	20	0	0	0	Taxi: To takeoff	Collision with standing aircraft	Pilot - Taxied into standing aircraft	Substantial
11	1/16/85	[c]	On Airport (auto rotation to rocky clear area)	Aerial Photo	Hughes 369D	0	0	4	0	0	0	Landing: Approach	Collision with ground	Fuel exhaustion	Substantial
12	7/22/85	[c]	On Airport	Personal	Cessna 310D	0	0	1	0	0	0	Landing: Final approach	Collision with ground	Fuel exhaustion	Substantial
13	4/23/86	[c]	On Airport	Business	Hughes 269	0	0	3	0	0	0	Landing: Approach	Collision with ground	Pilot - Improper compensation for wind	Substantial
14	4/29/87	[c]	On Airport	Air Taxi - Nonpassenger	Cessna 402A	0	1	0	0	0	0	Landing: Final approach	Collision with ground	Fuel exhaustion	Destroyed
15	4/28/88	[c]	[d]	Air Carrier - Passenger	Boeing 737-200	1	9	[c]	0	0	0	Cruise	Explosive decomposition	Airframe - Structural failure	Substantial
16	5/3/90	[c]	On Airport	Air Taxi - Nonpassenger	Hughes 369C	0	0	1	0	0	0	Air Taxi	Collision with tug vehicle	Pilot - Misjudgment	Substantial
17	11/15/90	[c]	On Airport	Air Taxi - Passenger	Aerospatiale 350B	0	0	7	0	0	0	Air Taxi: To takeoff	Collision with ground	Pilot - Improper activation of controls	Substantial

[a] Sources: National Transportation Safety Board Accident Briefs, 1964 to 1993; Federal Aviation Administration Accident/Incident Data System, 1974 to 1993.

[b] F = Fatal; S = Serious Injury; M/N = Minor or No Injury.

[c] Data not available.

[d] This accident was not associated with Kahului Airport with respect to location of occurrence. It is included in this table because the aircraft landed at the airport after the accident occured. Subsequent analyses of accidents described in this document do not include this accident.

TABLE IV-3
AIRCRAFT ACCIDENTS AT KAHULUI AIRPORT BY TYPE OF OPERATION, 1964 TO 1993 [a]

Year	Total Accidents	Air Carrier		Commuter/Air Taxi			General Aviation
		Passenger	Cargo	Passenger	Cargo	Other	(Personal/Business)
1964	0	0	0	0	0	0	0
1965	1	0	0	0	1	0	0
1966	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0
1968	1	0	0	1	0	0	0
1969	0	0	0	0	0	0	0
1970	1	0	0	0	0	0	1
1971	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0
1976	1	0	0	0	1	0	0
1977	0	0	0	0	0	0	0
1978	1	0	0	0	0	0	1
1979	0	0	0	0	0	0	0
1980	1	0	0	0	0	0	1
1981	1	0	0	0	0	0	1
1982	0	0	0	0	0	0	0
1983	2	0	1	1	0	0	0
1984	0	0	0	0	0	0	0
1985	2	0	0	0	0	0	2
1986	1	0	0	0	0	0	1
1987	1	0	0	0	0	1	0
1988	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0
1990	2	0	0	1	0	1	0
1991	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0
Total	15	0	1	3	2	2	7

[a] Sources: National Transportation Safety Board Accident Briefs, 1964 to 1993; Federal Aviation Administration Accident/Incident Data System, 1974 to 1993.

TABLE IV-4
AIRCRAFT ACCIDENTS AT KAHULUI AIRPORT BY LOCATION AND PHASE OF OPERATION, 1964 TO 1993 [a]

Year	Total Accidents	On Airport Accidents			Off-Airport Accidents					
					Landing			Departure		
		Landing	Departure	Taxi/ Stationary	0-1 Mile	1-5 Miles	Over 5 Miles	0-1 Mile	1-5 Miles	Over 5 Miles
1964	0	0	0	0	0	0	0	0	0	0
1965	1	0	0	0	0	0	1	0	0	0
1966	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0
1968	1	1	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0
1970	1	0	0	1	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0
1976	1	0	0	0	0	0	1	0	0	0
1977	0	0	0	0	0	0	0	0	0	0
1978	1	0	0	1	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0
1980	1	0	0	0	0	1	0	0	0	0
1981	1	0	0	0	0	0	1	0	0	0
1982	0	0	0	0	0	0	0	0	0	0
1983	2	0	0	1	0	1	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0
1985	2	2	0	0	0	0	0	0	0	0
1986	1	1	0	0	0	0	0	0	0	0
1987	1	1	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0
1990	2	0	0	2	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0
Total	15	5	0	5	0	2	3	0	0	0

[a] Sources: National Transportation Safety Board Accident Briefs, 1964 to 1993; Federal Aviation Administration Accident/Incident Data System, 1974 to 1993.

In Table IV-3 aircraft accidents at Kahului Airport are categorized by type of operation. The 15 accidents consist of 1 air carrier, 7 commuter/air taxi and 7 general aviation accidents. Three of the eight airline (air carrier and commuter/air taxi) accidents involved cargo operations.

In Table IV-4 aircraft accidents at Kahului Airport are listed by location and phase of operation. Ten of the fifteen accidents occurred on airport property, all of which were in the landing phase of operation. The off-airport accidents also were all related to aircraft landing. Two of the five off-airport accidents occurred within one to five miles of the airport. The remaining three off-port accidents occurred over five miles from the airport.

Aircraft accidents at Kahului Airport are classified according to aircraft damage and injuries in Table IV-5. Twelve of the fifteen accidents resulted in substantial aircraft damage. The aircraft were destroyed in the remaining three accidents. There were no accidents in which persons on the ground were injured; all injuries resulting from the accidents were to occupants of the aircraft. A total of five fatalities resulted from the fifteen aircraft accidents occurring from 1964 to 1993.

...rcraft accident causes are identified in Table IV-6. The principal cause of aircraft accidents at Kahului Airport was pilot error or misjudgment. Other causes were airframe failure, power plant failure and fuel exhaustion.

Comparison with National Accident Rates. Based on historical data, accident rates per 100,000 operations were developed for Kahului Airport (Table IV-7). Separate rates were developed for air carrier, commuter/air taxi and general aviation activity. The single air carrier accident between 1974 and 1993 results in an average rate of 0.10 air carrier accidents per 100,000 operations (or 1 accident per 1 million operations). The commuter/air taxi accident rate from 1974 to 1983 was 0.74 accidents per 100,000 operations. This rate fell to 0.49 accidents per 100,000 operations for the period from 1984 to 1993. General aviation accident rates were the highest of the three categories, 1.12 accidents per 100,000 operations from 1974 to 1983 and 0.78 accidents per 100,000 operations from 1984 to 1993. The accident rates shown in Table IV-7 were developed from the accident history shown in Table IV-2 and the history of aircraft operations at Kahului Airport, shown in Table IV-8.

Aircraft accident rates for all categories of operations are significantly lower at Kahului Airport than the national averages (Table IV-7). The annual nationwide accident rates reported by the NTSB for each category of operation are shown in Table IV-9. The unadjusted U.S. accident rate is an average of the accident rates for the periods indicated. The U.S. accident rate was adjusted to eliminate enroute accidents, which are not associated with an airport. The adjusted

TABLE IV-5
AIRCRAFT ACCIDENT DAMAGES AND INJURIES AT KAHULUI AIRPORT, 1964 TO 1993 [a]

Year	Total Accidents	Aircraft Damage		Injuries to Occupants of Aircraft [b]		
		Substantial	Destroyed	F	S	M/N
1964	0	0	0	0	0	0
1965	1	0	1	2	0	0
1966	0	0	0	0	0	0
1967	0	0	0	0	0	0
1968	1	1	0	0	0	8
1969	0	0	0	0	0	0
1970	1	1	0	0	0	1
1971	0	0	0	0	0	0
1972	0	0	0	0	0	0
1973	0	0	0	0	0	0
1974	0	0	0	0	0	0
1975	0	0	0	0	0	0
1976	1	1	0	0	0	1
1977	0	0	0	0	0	0
1978	1	1	0	0	0	1
1979	0	0	0	0	0	0
1980	1	0	1	3	0	0
1981	1	1	0	0	0	[c]
1982	0	0	0	0	0	0
1983	2	2	0	0	0	40
1984	0	0	0	0	0	0
1985	2	2	0	0	0	5
1986	1	1	0	0	0	3
1987	1	0	1	0	1	0
1988	0	0	0	0	0	0
1989	0	0	0	0	0	0
1990	2	2	0	0	0	8
1991	0	0	0	0	0	0
1992	0	0	0	0	0	0
1993	0	0	0	0	0	0
Total	15	12	3	5	1	67 [d]

[a] Sources: National Transportation Safety Board Accident Briefs, 1964 to 1993; Federal Aviation Administration Accident/Incident Data System, 1974 to 1993.

[b] F = Fatal; S = Serious Injury; M/N = Minor or No Injury.

[c] Data not available.

[d] Excludes persons with minor or no injuries in the 1981 accident.

TABLE IV-6
AIRCRAFT ACCIDENTS AT KAHULUI AIRPORT BY PRIMARY CAUSE, 1964 TO 1993 [a]

Year	Total Accidents	Primary Cause: Pilot Error/ Misjudgment	Primary Cause: Airframe Failure	Primary Cause: Powerplant Failure	Primary Cause: Fuel Exhaustion
1964	0	0	0	0	0
1965	1	1	0	0	0
1966	0	0	0	0	0
1967	0	0	0	0	0
1968	1	0	1	0	0
1969	0	0	0	0	0
1970	1	1	0	0	0
1971	0	0	0	0	0
1972	0	0	0	0	0
1973	0	0	0	0	0
1974	0	0	0	0	0
1975	0	0	0	0	0
1976	1	0	0	1	0
1977	0	0	0	0	0
1978	1	1	0	0	0
1979	0	0	0	0	0
1980	1	1	0	0	0
1981	1	0	0	1	0
1982	0	0	0	0	0
1983	2	1	0	1	0
1984	0	0	0	0	0
1985	2	0	0	0	2
1986	1	1	0	0	0
1987	1	0	0	0	1
1988	0	0	0	0	0
1989	0	0	0	0	0
1990	2	2	0	0	0
1991	0	0	0	0	0
1992	0	0	0	0	0
1993	0	0	0	0	0
Total	15	8	1	3	3

[a] Sources: National Transportation Safety Board Accident Briefs, 1964 to 1993; Federal Aviation Administration Accident/Incident Data System, 1974 to 1993.

TABLE IV-7
AIR CARRIER AND COMMUTER AIR TAXI ACCIDENT RATES AT KAHULUI AIRPORT, 1964 TO 1993

Year	Aircraft Operations at Kahului Airport [a] (Thousands)	Accidents at Kahului Airport [b]	Average accident Rate per 100,000 Operations: Kahului Airport	United States: Unadjusted	United States: Adjusted [c]
Air Carrier					
1974 to 1993	1,050.6	1	0.10	0.21	0.17
Commuter/Air Taxi					
1974 to 1983	268.8	2	0.74	1.41 [d]	1.18
1984 to 1993	612.3	3	0.49	0.99	0.83
General Aviation					
1974 to 1983	268.2	3	1.12	2.54 [e]	2.11
1984 to 1993	385.7	3	0.78	0.99	0.82

[a] Source: State of Hawaii, Department of Transportation, Airports Division, Airport Activity Statistics, Calendar Year 1992.

[b] F = Fatal; S = Serious Injury; M/N = Minor or No Injury.

[c] Sources: National Transportation Safety Board, Annual Review of Aircraft Accident Data, U.S. Air Carrier Operations, Calendar Year 1991 and Annual Review of Aircraft Accident Date, U.S. General Aviation, Calendar Year 1992. Adjusted to exclude accidents in the cruise phase of operation because they are not associated with airports. The approximate percentage of accidents in the cruise phase is:

- Air Carrier 20%
- Commuter Air Taxi 16%
- General Aviation 17%

[d] Excludes date for 1974-1976.

[e] Excludes data for 1981.

TABLE IV-8
AIRCRAFT OPERATIONS BY TYPE AT KAHULUI AIRPORT, 1970 TO 1993 [a]

Year	Air Carrier	Air Taxi	General Aviation	Military	Total
1970	38,680	[b]	23,508	15,263	77,451
1971	32,781	3,919 [b]	22,964	17,104	76,768
1972	33,957	11,007	16,773	13,745	75,482
1973	35,103	12,703	12,219	14,418	74,443
1974	33,010	14,063	15,898	11,912	74,883
1975	35,135	18,120	14,488	9,319	77,062
1976	37,568	23,036	19,098	10,753	90,455
1977	40,365	26,231	25,117	8,942	100,655
1978	43,052	37,441	37,119	7,679	125,291
1979	41,400	35,503	44,096	6,478	127,477
1980	40,708	28,866	34,701	7,298	111,573
1981	42,348	28,641	24,984	6,787	102,760
1982	49,494	28,350	24,538	10,046	112,428
1983	57,425	28,588	28,172	10,103	124,288
1984	67,230	37,128	26,333	11,620	142,311
1985	71,745	43,777	30,558	11,151	157,231
1986	78,820	56,361	30,338	9,041	174,560
1987	76,368	54,845	26,534	8,173	165,920
1988	61,990	60,385	43,792	6,886	173,053
1989	56,981	63,444	49,823	7,555	177,803
1990	56,532	75,923	44,209	6,022	182,686
1991	51,668	74,410	49,717	5,062	180,857
1992	57,159	68,832	47,281	5,480	178,752
1993	51,648	79,744	34,606	6,308	172,265

a] Source: State of Hawaii, Department of Transportation, Airports Division, Airport Activity Statistics, Calendar Year 1992.

[b] Air Taxi operations were combined with General Aviation operations until July 1971 when they were separated.

TABLE IV-9
AIRCRAFT ACCIDENTS RATES FOR UNITED STATES, AIR CARRIERS, COMMUTER/AIR TAXI CARRIERS AND GENERAL AVIATION, 1974 TO 1993 [a]

	Total Accidents in the U.S. per 100,000 Operations			Fatal Accidents in the U.S. per 100,000 Operations		
Year	Air Carriers	Commuter/Air Taxi Carriers [b]	General Aviation [c]	Air Carriers	Commuter/Air Taxi Carriers [b]	General Aviation [c]
1974	0.44	[d]	3.13	0.06	[d]	0.51
1975	0.32	[d]	2.93	0.02	[d]	0.47
1976	0.23	[d]	2.73	0.02	[d]	0.45
1977	0.23	1.50	2.67	0.05	0.30	0.44
1978	0.22	1.74	2.53	0.05	0.45	0.45
1979	0.27	1.36	2.07	0.05	0.29	0.35
1980	0.17	1.47	2.04	0.01	0.37	0.36
1981	0.24	1.54	[d]	0.04	0.40	[d]
1982	0.18	1.18	2.42	0.04	0.27	0.44
1983	0.22	1.10	2.38	0.04	0.25	0.43
1984	0.14	1.20	2.30	0.01	0.21	0.42
1985	0.17	1.34	2.15	0.06	0.33	0.39
1986	0.16	0.93	2.12	0.01	0.22	0.39
1987	0.23	0.98	2.05	0.03	0.30	0.37
1988	0.18	0.91	1.93	0.01	0.23	0.37
1989	0.18	0.98	1.77	0.07	0.23	0.34
1990	0.15	0.97	1.72	0.04	0.25	0.34
1991	0.16	1.00	1.77	0.03	0.32	0.35
1992	0.11	0.87	1.94	0.03	0.27	0.42
1993	0.14	0.73	1.95	0.01	0.19	0.37

[a] Sources: National Transportation Safety Board, "News Release," January 1, 1994, January 12, 1987, and January 9, 1981.

[b] Data for non-scheduled air-taxi service estimated from data on accident rates per 100,000 aircraft hours.

[c] Estimated from data on accident rates per 100,000 aircraft hours.

[d] Data not available.

accident rate represents an average airport accident rate and can be compared with individual airports to determine if the airport's accident rate is above or below the national average. For large jets, enroute accidents are mostly a result of injuries due to clear air turbulence. The percentage of enroute accidents, which are excluded from the adjusted rates are:

- Air Carrier 20%
- Commuter/Air Taxi 16%
- General Aviation 17%

Over the past two decades, the accident rates at Kahului Airport have been substantially below the adjusted national rates, as shown in Table IV-7.

Aircraft Accident Trends. As Table IV-7 illustrates, average aircraft accident rates at Kahului Airport for commuter/air taxi and general aviation operations have fallen significantly in the last 10 years compared with the previous 10 year period. The air carrier aircraft accident trend at Kahului Airport cannot be developed due to the limited data. The overall downward trend in the aircraft accident rates is also seen in the United States statistics (Tables IV-7 and IV-9). The decline of accident rates nationwide is shown graphically in Figure IV-1 for U.S. air carriers, Figure IV-2 for U.S. commuter/air taxi operators and Figure IV-3 for general aviation users. As the three figures illustrate, the decline in fatal accident rates over the last 20 years has been less pronounced than the decline in the total accident rates.

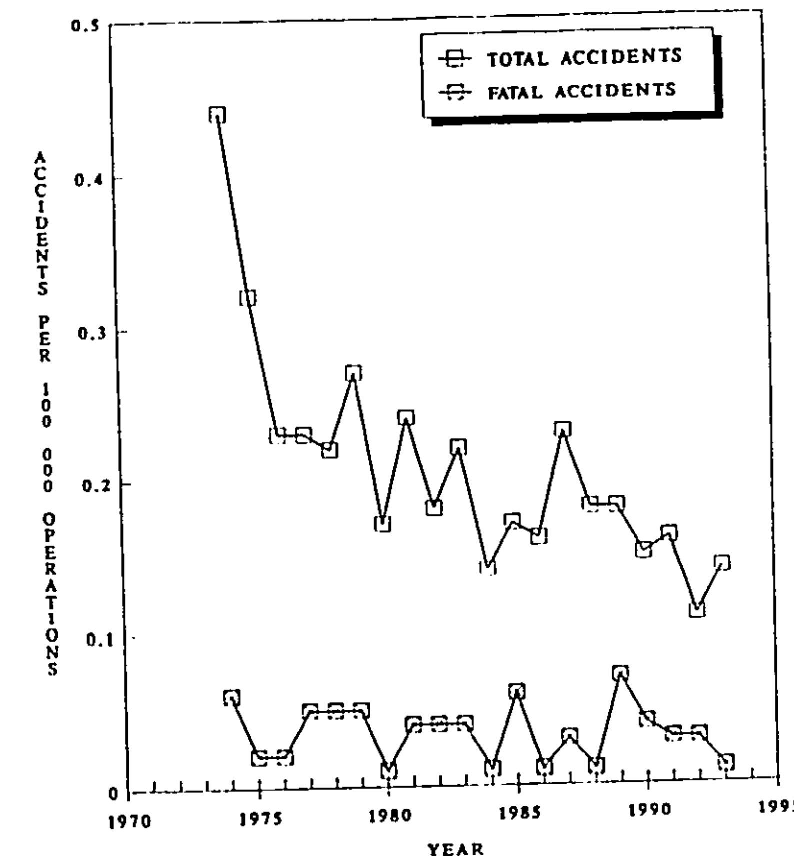
IMPACT ANALYSES

The proposed development and other development alternatives would have positive long-term impacts on the safety of aircraft flight operations at Kahului Airport. These impacts are described below.

Adherence to FAA Airport Design Standards

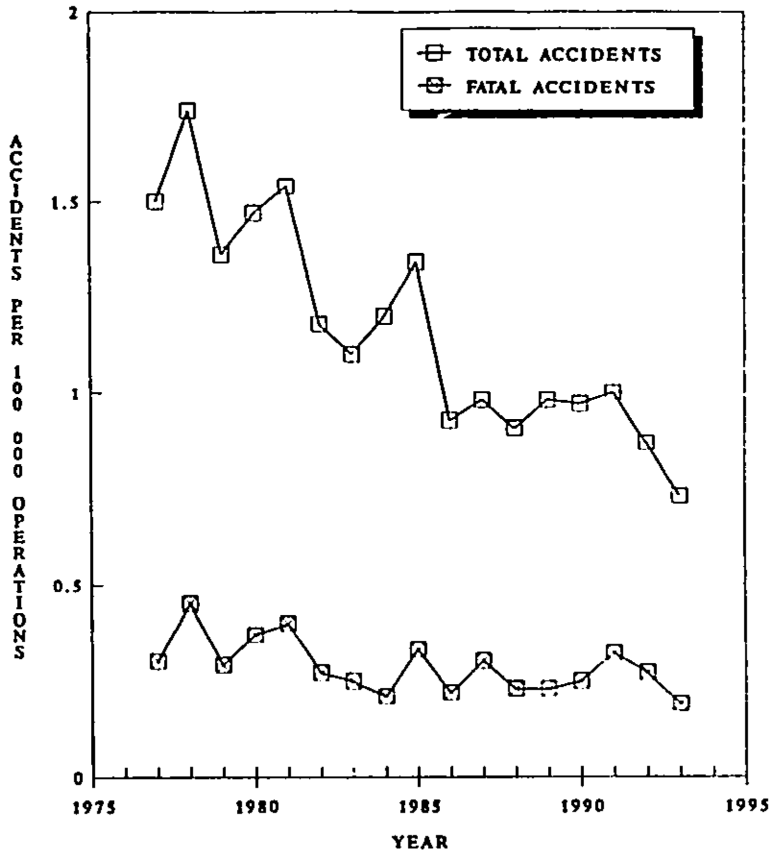
As a result of the proposed development project, several of the important standards relating to airport layout and operation will be improved upon or brought into conformance with FAA design guidelines. This will result in the overall enhancement of the aircraft operational safety environment at Kahului Airport. The affects of these changes could be a lessening of injuries or aircraft damage as a result of an aircraft accident at the airport.

FIGURE IV-1
AIRCRAFT ACCIDENT RATES FOR U.S. AIR CARRIERS, 1974-1993



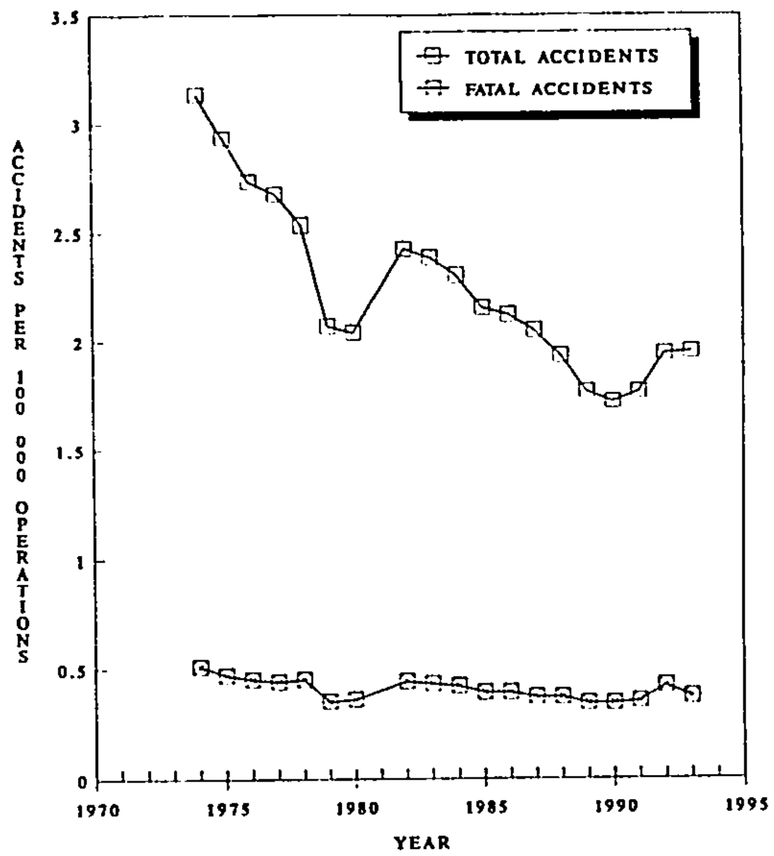
Source: National Transportation Safety Board

FIGURE IV-2
AIRCRAFT ACCIDENT RATES FOR U.S.
COMMUTER / AIR TAXI CARRIERS, 1977-1993



Source: National Transportation Safety Board

FIGURE IV-3
AIRCRAFT ACCIDENT RATES FOR U.S.
GENERAL AVIATION, 1974-1993



The standards which would be brought into conformance are the following:

- The provisions for a 1,000 foot long by 500 foot wide Runway Safety Area beyond both ends of Runway 2-20.

- The provision for a 1,000 foot long by 500 foot wide Runway Safety Area at each end of Runway 5-23. Acquisition of property in the Runway 5-23 Runway Protection Zone which is currently off airport property.

- The trees penetrating the approach surface to Runway 20 should be periodically trimmed or removed, as recommended in the 1993 Kahului Airport Master Plan.

The recommended project provides for a 400-foot displaced landing threshold for Runway 2 (i.e., the landing threshold would be located 9,200 feet south of the existing Runway 20 threshold) due to the Puunene Sugar Mill stack. The FAA has determined that a 400-foot displaced landing threshold would be required if the runway is extended to the south to a total length of 9,600 feet.

All new construction contained in the proposed action, as described in the 1993 Kahului Airport Master Plan, would conform to all FAA standards related to aircraft operational safety. All development alternatives would also be constructed to FAA safety-related standards. As indicated in the 1993 Kahului Airport Master Plan, the Runway Protection Zone at the north end of the future parallel runway would contain portions of two buildings, one at the northern edge of the RPZ and another at the western edge of the RPZ. Both of these structures are currently off airport property but are within the property area that would be acquired for the new runway. To fully compiled with FAA RPZ criteria, these two structures should be removed or relocated outside the RPZ.

A portion of the airport's horizontal and conical surfaces are penetrated by terrain southeast of the airport. These penetrations, as well as the penetrations to the approach surfaces described above, have been considered by the FAA in the approach and departure procedures established for the airport.

The safety improvements described above would be incorporated in all alternatives to the proposed action except for the No Action Alternative. All of the development alternatives would benefit from these airport safety improvements.

Improvements to Air Traffic Congestion

The following improvements to air traffic congestion at the airport would result from the proposed project:

- In the year 2010, the projected number of fixed-wing operations (approximately 160,000) would be 86 percent of capacity, assuming there is no change in the airfield configuration. This level of operations relative to airfield capacity would not adversely impact the safety of aircraft operations. Furthermore, a 2,600 foot extension of Runway 2-20 to the south would allow the airfield, much of the time, to be operated as two non-intersecting runways, rather than two intersecting runways. This would increase the effective capacity of the airfield and reduce airspace congestion and delays. A new parallel runway would increase airfield capacity (annual service volume) to between 250,000 and 410,000 operations, depending on how the parallel runways are used, according to the 1993 Kahului Airport Master Plan.

- Increased separation of Runway 2 landings and helicopter operations would result from the extension of Runway 2-20 to the south. The south landing threshold would be relocated 2,200 feet to the south, placing approaching aircraft farther from helicopter operations. This could result in a safety enhancement due to the increased separation of fixed-wing aircraft approaches and helicopter operations.

- It is recommended that in the near-term the present tour helicopter operating area be temporarily moved approximately 1,000 feet to the east to a vacant area on the south side of the helicopter area vehicle parking lot. This move will enhance the safety of aircraft operations at the airport by increasing further the separation of fixed-wing and rotary-wing aircraft operations.

- Helicopter operations are projected to remain a substantial percentage of total airport operations (an estimated 37 percent of airport operations in the year 2010). An alternative to the proposed action is to establish a new site for general aviation and/or helicopter activity. A new general aviation airport and/or heliport would enhance the overall safety of aircraft operations by separating aircraft types which have significantly different operating characteristics. The projected operations mix for each alternative to the proposed action is described in Section III of this appendix.

Increased Runway Margin of Safety

One effect of the increase in runway length would be to increase the runway margin of safety for all flights which currently operate from the airport. The increased safety margin would potentially reduce the risk of landing accidents by allowing a greater landing length and reduce the risks of aborted takeoff accidents by providing a greater accelerate-stop distance.

Impact on Aircraft Accident Rates

The airfield safety improvements included in the proposed project will have a beneficial impact on the safety of aircraft operations at the airport. These safety improvements include the enlargement of the Runway Safety Areas at the ends of Runway 2-20 and 5-23 to conform to FAA standards and the removal of obstacles (trimming or removal of trees) at the end of Runway 20. These safety improvements would have a tendency to lower the risk of accidents and lower the potential for injuries or aircraft damage if an accident would occur. In all the alternatives to the proposed action, except for the No Action Alternative, the safety improvements described above would be made and have a similar favorable impact on the potential for aircraft accidents at the airport.

As described earlier in this section, accident rates at Kahului Airport and nationwide have been falling over the past 20 years. This trend is in part due to:

- Technological improvements in airport navigational aids and air traffic control equipment operated by the FAA, such as instrument landing systems and radar systems.
- Technological improvements in aircraft navigation and safety equipment, such as wind shear detection equipment and collision avoidance equipment.
- Laws requiring wider use of safety equipment, such as transponders on aircraft.
- Improved training and maintenance procedures and maintenance equipment.

Considering the factors described above, future accident rates at the airport are not expected to increase in the future as a result of the proposed action or any of the alternative development programs identified in this report.

SIGNIFICANCE ANALYSIS

The adverse impacts of a project alternative would be considered to be significant if the project would increase the rate of aircraft accidents at the airport or if the new project development would not conform with FAA standards and criteria in a material way that would degrade the safety of aircraft operations on the airport. The risk of aviation accidents cannot be eliminated because safe aircraft operation is dependent on human judgement, mechanical equipment and weather conditions, which to varying degrees can contribute to aircraft accidents.

FAA standards which directly relate to safety of aircraft operations provide for:

- Dimensions of Runway Safety Areas and Runway Protection Zones.
- Recommended separations between parallel runways and between runways and parallel taxiways.
- Recommended separations between runways and helipads.
- Obstruction standards.

MITIGATION MEASURES

The impacts of the proposed project and alternatives related to safety of aircraft operations are not significantly adverse under the definition of threshold of significance. Therefore, no mitigation measures related to aviation safety are necessary.

LEVEL OF SIGNIFICANCE AFTER MITIGATION

No mitigation measures are necessary related to safety of aircraft operations for the proposed action or any of the development alternatives.

Section V

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Section VI

GLOSSARY

SECTION VI
GLOSSARY

Maximum Ramp Weight	Maximum weight authorized for ground maneuver by applicable government regulations, including taxi and runup fuel. Also designated in some manuals as maximum design taxi weight.
Maximum Landing Weight	Maximum weight authorized at touchdown by applicable government regulations.
Maximum Takeoff Weight	Maximum weight authorized at takeoff brake release by the applicable government regulations and excludes taxi and runup fuel.
Operating Weight Empty	Weight of structure, power plant, furnishings, systems, unusable fuel and other unusable propulsion agents, and other items of equipment that are considered an integral part of a particular airplane configuration. Also included are certain standard items, personnel, equipment and supplies necessary for full operation, excluding fuel and payload. Described as "Operating Empty Weight" in some manuals.
Maximum Zero Fuel Weight	Maximum airplane weight less usable fuel, engine injection fluid and other consumable propulsion agents. It may include usable fuel in specified tanks when carried in lieu of payload. The addition of usable and consumable items to the Zero Fuel Weight must be in accordance with the applicable government regulations so that airplane structure and air worthiness requirements are not exceeded.
Maximum Structural Payload	Consists of the maximum design payload weight of passengers, passenger baggage and/or cargo.
Maximum Seating Capacity	The maximum number of passengers specifically certified or anticipated for certification.
Maximum Cargo Volume	The maximum space available for cargo.
Usable Fuel Capacity	The volume of fuel carried for a particular operation, less drainable unusable fuel and trapped fuel remaining after a fuel run out test has been accomplished.

APPENDIX O

NOISE COMPATIBILITY PROGRAM REPORT

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KAHULUI AIRPORT — FAR PART 150
NOISE COMPATIBILITY PROGRAM

Kahului, Hawaii

VOLUME II
NOISE COMPATIBILITY PROGRAM REPORT

Governor Benjamin J. Cayetano

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION

SEPTEMBER 1995
BELT COLLINS HAWAII
Y. EBISU & ASSOCIATES

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INTRODUCTION AND SUMMARY

CHAPTER 1
INTRODUCTION AND SUMMARY

1.1 PROJECT BACKGROUND

This Noise Compatibility Program was prepared by Belt Collins Hawaii and its subconsultant, Y. Ebisu & Associates, for the airport's operator, The Airports Division of the State of Hawaii Department of Transportation. Preparation of the report was funded, in part, through a grant to the Department from the Federal Aviation Administration, U.S. Department of Transportation. The noise exposure maps and supporting documentation were prepared in accordance with the provisions of Federal Aviation Regulations (FAR) Part 150 (1985).

This report is the second of two volumes prepared for Kahului Airport's noise compatibility program. The first, *Volume I: Noise Exposure Map Report, Kahului Airport, Kahului, Maui*, was published in 1989 (Belt Collins & Associates, *et al.*, December 1989). That report describes Kahului Airport and its environs and the methodology used to prepare a "Base Year (1987) Noise Exposure Map" and "Five-Year (1992) No Mitigation" Noise Exposure Map for the airport. The noise exposure maps documented in the report were accepted by the Federal Aviation Administration (FAA) on July 31, 1991 (see *Federal Register* August 12, 1991 and Appendix A).

This volume contains the FAR Part 150 Noise Compatibility Program for the airport. Because of the time that has elapsed since the original noise exposure maps were prepared, the report includes new Base Year (1993) and Five-Year (1998) No Mitigation Noise Exposure Maps, as well as a map depicting 1998 Noise levels if the proposed plan is implemented. These maps, if accepted by the FAA, revise the previously approved noise exposure maps.

The maps and supporting text use "Ldn" when referring to day-night average sound level. A recent FAA policy change calls for the term "DNL" to be used instead of "Ldn" when referring to the average day-night sound level, and future noise reports and noise exposure maps for Kahului Airport will use that terminology. However, to ensure consistency between the report body and the historical correspondence and meeting handouts included in the appendixes (all of which used "Ldn"), the term "Ldn" has been retained for the report.

1.2 PURPOSE OF THE NOISE COMPATIBILITY PROGRAM

By the mid-1980s, an estimated 2 percent of the United States' population resided in areas exposed to relatively high levels of aircraft noise. Moreover, the number of persons exposed to excessive aircraft noise was rising, and public opposition to aircraft noise was growing even faster. In several instances, residents of areas around public use airports initiated legal action

to close them or to restrict their operations in order to reduce or eliminate bothersome aircraft noise.

The FAA has taken a number of steps to address the problem. These include the establishment of limits on noise emissions by new aircraft, mandatory retirement of noisier aircraft or retrofitting them with quieter engines, and creation of an environmental review process for airport development projects. These steps produced positive results, but they did not entirely resolve the problem of excessive aircraft noise. Consequently, state and local governments, supported in some instances by the courts, have continued their efforts to restrict operations at some airports.

Concerned that such uncoordinated actions by local jurisdictions might damage the nation's air transportation system, the Congress adopted the Aviation Safety and Noise Abatement Act of 1979. Part 150 of the Federal Aviation Regulations (FAR Part 150, Airport Noise Compatibility Planning), implements portions of that act and is intended as a planning tool to help improve land use compatibility around airports. More specifically, it establishes a single system for the measurement of airport (and background) noise; a standardized procedure for determining the exposure of individuals to noise; and a formal airport noise compatibility planning process. The process:

- provides for "Noise Exposure Maps" and "Noise Compatibility Programs" to be developed by airport operators in cooperation with other interested parties and submitted to the FAA for review and approval;
- establishes standard noise units, methods, and analytical techniques to be used in assessing airport noise;
- identifies the land uses that are generally compatible with various noise levels around airports; and
- defines the procedures and criteria that are to be used by the FAA in judging whether or not the Part 150 programs submitted to it are acceptable.

The FAR Part 150 Airport Noise Compatibility Program includes land use planning and implementation elements deemed necessary to achieve the objectives of the Airport Safety and Noise Act. According to FAA Advisory Circular (AC) 150/5020-1:

> *The Act does not in any way interfere with the established prerogatives of State and local governments concerning land use and related noise compatibility actions. Accordingly, approvals and disapprovals of programs submitted under Part 150 do not constitute a Federal determination that the use of land covered by the program is acceptable or unacceptable under Federal, State, or Local law. The responsibility*

for determining the acceptable and permissible land uses remains with local authorities.

Participation in the FAR Part 150 program is voluntary, but it carries with it several benefits.

- The methodology incorporated in the planning process is based on scientific studies that identify land uses normally compatible with various levels of airport noise.
- The program gives airport operators access to technical guidance from the FAA and to Federal financial assistance (under the Airport Improvement Program) for the preparation of the plan.
- The program contains a strong public participation component that promotes extensive consultation and interaction between airport operators, airport neighbors, local land use control agencies, and the FAA; this promotes broad-based public confidence in the plan and support for its implementation over the long-term.
- Local governments may be eligible for Federal financial assistance for projects carried out in accordance with Part 150 Plans accepted by the FAA.
- Section 107 of the Airport Safety and Noise Abatement Act makes available certain sanctions that protect airport operators with approved noise compatibility programs against suits by neighboring landowners.

1.3 KAHULUI AIRPORT NOISE COMPATIBILITY PROGRAM

This report describes the recommended FAR Part 150 Noise Compatibility Program for Kahului Airport. More specifically, it:

(1) presents inventory data concerning the airport, aircraft operations, and land uses in the surrounding community;

(2) provides Noise Exposure Maps (NEM), including Base Year (1993) and Five-Year (1998) No Mitigation Noise Exposure Maps and supporting technical documentation needed to comply with (1) Section 103 of the Aviation Safety and Noise Abatement Act of 1979 and (2) Sub-Part B of Appendix A of FAR Part 150 (Noise Exposure Map Development);

(3) presents recommended aircraft noise versus land use compatibility criteria specific to the type of construction typically found in Hawaii;

(4) discusses and analyzes alternatives considered as a means of increasing noise compatibility around the airport;

(5) describes the recommended noise compatibility program, including program measures to reduce or eliminate present and future non-compatible land uses, and each measure's relative contribution to the overall effectiveness of the program;

(6) describes the public participation, agency, and user consultation;

(7) describes the actual or anticipated effect of the program on reducing noise exposure to individuals, reducing non-compatible land uses, and preventing new non-compatible land uses;

(8) provides a summary of public comments and the airport's response and disposition of these comments, and materials supporting the feasibility and consistency of the Program with Part 150's goals;

(9) provides a program schedule and materials demonstrating the feasibility and consistency of the program with Part 150's goals; and

(10) provides provisions to revise the program, if made necessary by the revision of the noise exposure map.

1.4 PUBLIC AND AGENCY PARTICIPATION

The Airports Division of the State Department of Transportation keeps its neighbors aware of development plans for airports through a program of public news releases, public informational meetings and hearings, and periodic meetings with legislators and local government officials. Staff members are available on request to meet with those concerned with airport-related issues. A staff member at each airport is responsible for receiving and responding to complaints concerning aircraft noise, and a 24-hour toll-free telephone number is available for public contact with the Airports Division office in Honolulu, Oahu. Where preliminary investigations have indicated it would be appropriate, more formal investigations have been initiated to determine the cause of, and potential solutions to, aircraft noise problems.

A Technical Advisory Committee was established by the State Department of Transportation during preparation of the 1989 *Kahului Airport Noise Exposure Map Report*. The Committee consisted of representatives of Federal, State, and County agencies, user groups including air carriers, business interests, and local residents (see Appendix B for a membership list). It was designated as the official forum for providing and discussing public, agency, and airport user input as required by Section 150.23 of FAR Part 150. Committee meetings were used to help identify noise-related problems, to report on the status of the study, and to seek opinions concerning priorities and the implications of a variety of potential noise reduction measures.

Besides meeting periodically with the Technical Advisory Committee, the Department and its consultants also conducted a series of public informational meetings. These meetings took place on the same days as the Technical Advisory Committee meetings and were open to the public. Public notices announcing the times, dates, and locations of the meetings were published in two newspapers published in Honolulu and distributed statewide, the *Honolulu Advertiser* and the *Sunday Advertiser* and *Star Bulletin*; the notices also appeared in the *Maui News*, which is published in Wailuku and distributed to readers throughout Maui. Press releases announcing the meetings were sent to every radio station in the State of Hawaii.

At each meeting, the State and its consultants described the work that had been carried out and described their findings. Questions and comments were accepted from all those attending, and the information obtained in this fashion was taken into consideration during the next step in the planning process. Where appropriate, the Department and/or its consultants followed up the meetings with individual contacts. Copies of all written comments are on file with the Western Pacific Region of the FAA.

While the draft program recommendations were being prepared, the relationships between the Airports Division and some residents of nearby areas, particularly East Spreckelsville, became more contentious. This eventually culminated in a lawsuit being filed against the Airports Division. The lawsuit was not over the Part 150 Noise Compatibility Program. However, when it became clear that it would not be possible to continue open consultation and cooperation, the Airports Division suspended work on the Noise Compatibility Program.

Work on the Part 150 Noise Compatibility Program was re-initiated in the summer of 1994. Public participation and appropriate consultations with airport users and affected or interested governmental agencies have been an important element in the Part 150 process. Combined public information/Technical Advisory Committee meetings were held that included presentations and open discussions. Parties consulted during the Part 150 process included, but were not limited to, representatives of the Federal Aviation Administration, homeowners in the vicinity of the airport, the airport operator, the Maui County Planning Department, interisland air carriers, and the Airline Pilots Association.

The consultant preparing the Part 150 Program and staff of the Airports Division of the State Department of Transportation met regularly with interested parties during the Part 150 process. These meetings allowed the consultant to describe the current status of their efforts and findings; they also allowed the public to provide substantive input to the process. Public meetings were held in both the afternoon and evening on August 30, 1994, and December 14, 1994. Copies of the materials presented at the meetings are included in Appendix C.

1.5 ORGANIZATION OF THE REPORT

Background information concerning the FAR Part 150 Program, the purpose of this report, and the steps that are being taken to insure broad community involvement in the airport planning process are described above. The remainder of the report is organized as follows:

- Chapter 2 contains an overview of the airport and its environs. It covers many factors that affect the airport and its relationship to the surrounding community.
- Chapter 3 describes the existing airspace, air traffic control procedures, existing noise abatement procedures, and history of noise complaints.
- Chapter 4 includes the noise and land use compatibility standards and guidelines, such as the FAA standards and the Hawaii State Department of Transportation guidelines.
- Chapter 5 describes the data and procedures used to estimate existing (1993 Base Year) aircraft noise levels in the airport environs, presents the 1993 Noise Exposure Map, and describes existing land use compatibility.
- Chapter 6 presents the 1998 aircraft noise levels that can be expected without mitigation and discusses potential land use compatibility.
- Chapter 7 describes and evaluates the wide variety of noise mitigation measures considered for Kahului Airport and discusses the reasons why certain measures were rejected.
- Chapter 8 describes the recommended Noise Compatibility Program for the Airport.
- Chapter 9 includes references used in developing this report.

Appendices A through H provide reference materials and correspondences associated with the formulation of the program.

CHAPTER 2
OVERVIEW OF AIRPORT AND ENVIRONS

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OVERVIEW OF AIRPORT AND ENVIRONS

2.1 BACKGROUND

Kahului Airport occupies approximately 1,500 acres of land on the north side of Maui's central plain between the West Maui Mountains and Haleakala Volcano (Figures 2-1 and 2-2). Kahului town lies just to the west of the Airport. Approximately 236 acres within the Airport are set aside for the Kanaha Pond Wildlife Refuge. Kahului Airport's central location places it within an hour's drive of more than 90 percent of the island's population.

The U.S. Navy acquired the present Kahului Airport site following the outbreak of World War II and developed it into the Naval Air Station Kahului, or NASKA. The military's need for this facility disappeared with the end of the war, and in 1947 the U.S. Government turned NASKA over to the Territorial Government. The new location proved superior to the old Pu'u-nēnē Airport site a few miles to the south, and in 1951 civil operations were transferred from Pu'u-nēnē to Kahului Airport, where they have remained. In 1957, title to the Airport was transferred to the Territory of Hawaii.

Maui's two other airports, the Hana Airport and the West Maui Airport, are also operated by the Airports Division of the State Department of Transportation.

Maui has experienced relatively rapid population growth over the past quarter-century. Between 1960 and 1990, for example, the population of Maui County increased from 42,855 to 91,361, an average annual increase of 2.8 percent per year, compounded. This is noticeably faster than the 2 percent per year growth rate experienced by the State as a whole. Long-range forecasts prepared by the Hawaii State Department of Business and Economic Development (November 1988b:4) suggest that the population of the Neighbor Islands will continue to grow at a faster rate than that of the state as a whole.

The district-level population estimates for Maui shown in Table 2-1 indicate that the Wailuku District (in which Kahului Airport is located) is by far the most populous district on the island. As of July 1, 1990, for example, its resident population was estimated as 45,685, or nearly half the island's resident population of 91,361.

Wailuku-Kahului, of which Kahului now forms the largest part, is the seat of Maui's County government and the most populous town on the island. Most State government departments also have offices there. The twin towns are the island's only metropolitan area and function as the County's industrial, commercial, and distribution center. Kahului Harbor is Maui's only major port. The rapid growth of tourism on the island has made the island's economy, which depended for many years on the agricultural sector (particularly sugar), more service-oriented. Today, fewer than 10 percent of its jobs remain in agriculture.

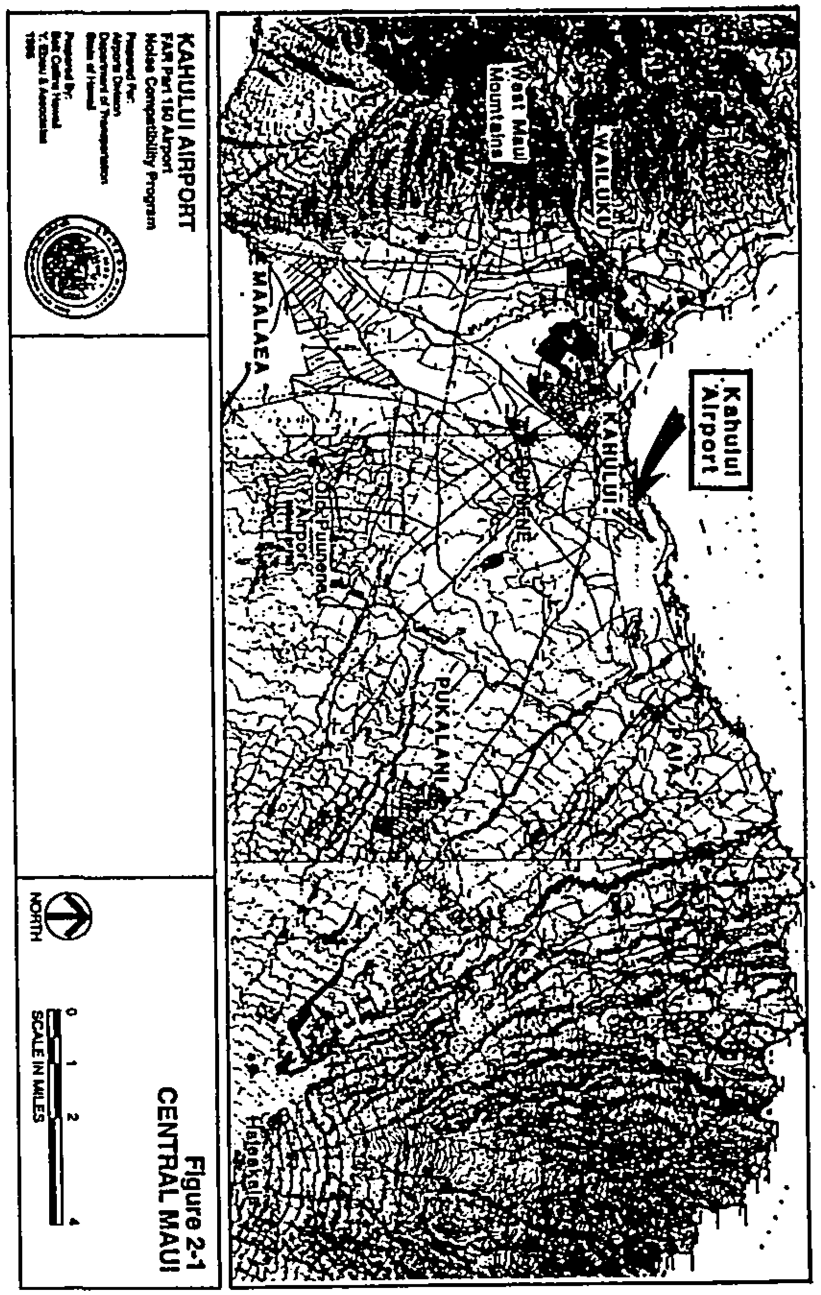
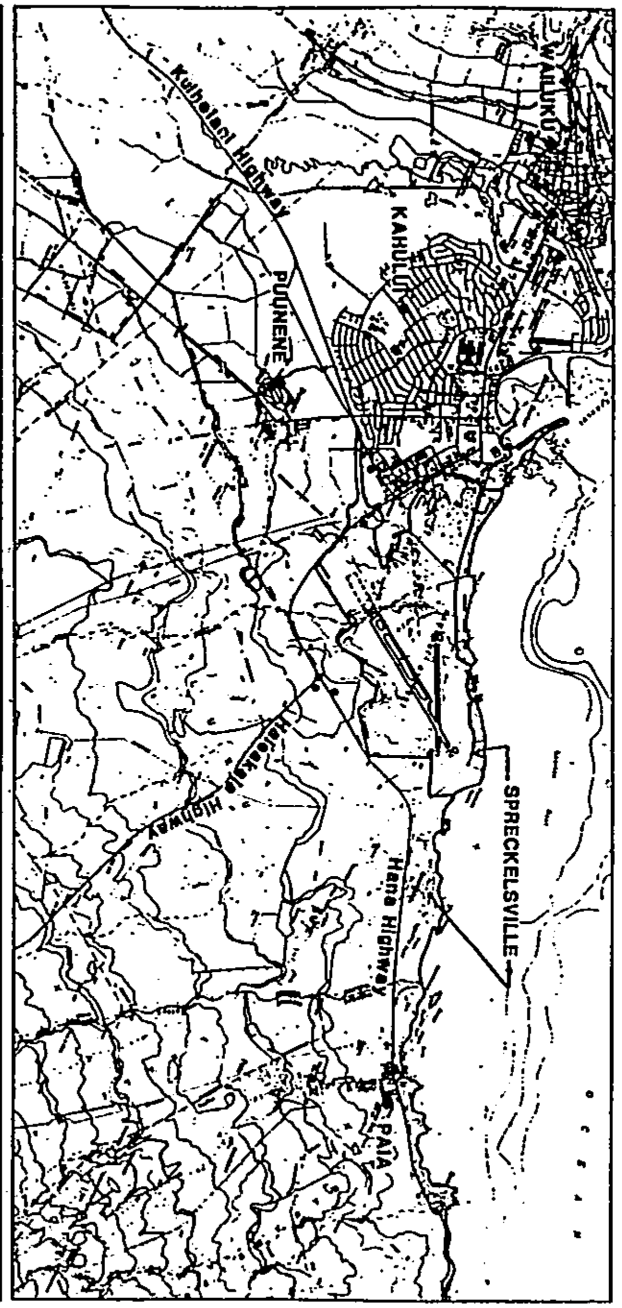


Figure 2-1
CENTRAL MAUI



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FAR Part 150 Airport
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Airports Division
Department of Transportation
State of Hawaii
Prepared By:
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Figure 2-2
KAHULUI AIRPORT
AND ENVIRONS

Table 2-1 Resident Population of Maui Island by District: 1970-90.

RESIDENT POPULATION BY YEAR				PERCENT CHANGE			
				1970-80 AVERAGE		1980-90 AVERAGE	
DISTRICT	1970	1980	1990	TOTAL	AVERAGE ANNUAL	TOTAL	AVERAGE ANNUAL
Hana	969	1,423	1,895	47.0	3.9	33.2	2.9
Makawao	9,979	19,005	29,207	90.4	6.6	53.7	4.4
Wailuku	22,219	32,111	45,685	44.5	3.6	42.3	3.6
Lahaina	5,524	10,284	14,574	86.2	6.4	41.7	3.5
TOTAL	48,996	64,636	91,361	31.9	2.8	11.5	2.8

Source: Department of Business and Economic Development (March 1993). *The State of Hawaii Data Book*. Author: Honolulu, p.21.

The state's economy as a whole, and the volume of air travel in particular, are strongly influenced by the visitor industry. The number of visitors coming to the state rose an average of 5.5 percent per year between 1972 and 1992 (Table 2-2). The growth has been uneven, however. During the 1970s, it averaged 8.5 percent per year, with the vast majority of the visitors coming from the U.S. Mainland. The growth rate during the past decade has been slower, averaging only 4.4 percent per year. During this period, the eastbound component of the travel market became much more important. The growth in visitor arrivals to Maui has been even more robust than that of the state as a whole over the entire twenty-year period, but it has languished during the past five years. Westbound arrivals to the island have actually decreased somewhat over this period, and the number of eastbound travelers to the state visiting Maui has increased only moderately.

2.1.1 Ownership and General Characteristics

Kahului Airport is located on the northeastern side of the town of Kahului, Maui (see Figures 2-1 and 2-2). The Airport encompasses approximately 1,447 acres of land and is owned and operated by the State of Hawaii as part of the statewide airport system. Kahului Airport's main passenger terminal, commuter airline terminal, airport rescue and firefighting facility,

Table 2-2 Visitor Arrival Statistics for the State and Neighbor Island Counties 1970-1992

	State of Hawaii				Westbound		
Year	Overnight and Longer Visitors	Westbound Visitors	Eastbound Visitors	Overnight Neighbor Island Visitors	Hawaii County	Kauai County	Maui County
1970	1,746,970	1,326,135	420,835	637,518	445,401	410,075	447,985
1971	1,818,944	1,430,325	388,619	758,515	522,166	472,663	554,799
1972	2,244,377	1,782,737	461,640	975,557	637,562	565,386	710,050
1973	2,630,952	2,067,861	563,091	1,095,239	694,170	590,475	766,791
1974	2,786,489	2,184,620	601,869	1,210,603	742,839	601,703	852,204
1975	2,829,105	2,207,417	621,688	1,310,459	769,779	632,821	931,863
1976	3,220,151	2,551,601	688,550	1,510,531	816,514	699,275	1,110,726
1977	3,433,667	2,763,312	670,355	1,681,981	839,008	740,501	1,257,142
1978	3,670,309	3,030,999	639,310	1,885,901	908,983	837,712	1,403,054
1979	3,960,531	3,139,455	821,076	1,972,737	860,940	825,366	1,419,773
1980	3,934,504	3,046,132	888,372	1,903,632	761,103	781,409	1,378,189
1981	3,934,623	2,974,791	959,832	1,873,879	672,683	757,811	1,389,892
1982	4,242,925	3,278,525	964,400	2,015,190	678,170	733,295	1,550,080
1983	4,368,105	3,396,115	971,990	2,119,440	714,030	692,130	1,645,720
1984	4,855,580	3,721,380	1,134,200	2,396,170	760,940	814,590	1,854,690
1985	4,884,110	3,708,610	1,175,500	2,400,620	697,380	832,580	1,831,110
1986	5,607,000	4,256,890	1,350,590	2,760,200	786,930	1,014,650	1,801,870
1987	5,799,830	4,204,010	1,631,320	2,730,620	782,550	1,032,840	1,908,780
1988	6,142,420	4,264,730	1,877,690	2,765,670	782,360	1,043,710	1,884,050
1989	6,641,820	4,705,320	1,936,500	3,110,050	946,540	1,138,230	2,113,100
1990	6,971,180	4,719,730	2,251,450	3,061,050	982,900	1,118,930	1,995,160
1991	6,873,890	4,584,460	2,289,430	3,047,440	975,610	1,085,290	1,925,460
1992	6,513,880	3,980,120	2,533,760	3,406,210	909,490	714,880	1,859,680

Source: Hawaii Visitors Bureau, Research Department. Annual statistics

hold cargo warehouse, ground transportation baseyard, and airport baseyard are located between the two active runways on the western side of the airfield. The FAA air traffic control tower, general aviation facilities, helicopter facilities, and itinerant aircraft holding areas are located on the eastern side of the airport. The relationship of these facilities to one another and to immediately adjacent off-airport land uses is shown in Figures 2-2 and 2-3.

Kahului Airport has two active runways. At 7,000 feet, Runway 2-20 is the longest; it is equipped for instrument operations and is used by virtually all of the turbojet aircraft that operate out of the airport. The shorter runway, 5-23, is 4,990 feet long and is not equipped for instrument operations. An apron to the west of Runway 2-20 serves the passenger terminal complex, while the apron on the eastern side of that runway is used by general aviation, general cargo, air scenic tours, helicopters, and itinerant aircraft. An extensive system of taxiways connects the runways and aprons; for the most part these taxiways are designed to accommodate Design Group IV aircraft (DC-10 and smaller). Because of the relatively limited runway length, larger jet aircraft departing Kahului Airport direct for overseas destinations cannot carry full payloads.

The runway protection zone (RPZ) information for each of the existing runways is as follows:

			APPROACH END WIDTH (in feet)		
RUNWAY	TYPE OF RZ	LENGTH (in feet)	INNER	OUTER	SLOPE
2	Precision Instrument	2,500	1,000	1,750	50:1
20	Precision Instrument	1,700	1,000	1,750	50:1
5	Non-Precision Instrument	1,700	500	1,010	34:1
23	Non-Precision Instrument	1,700	500	1,010	34:1

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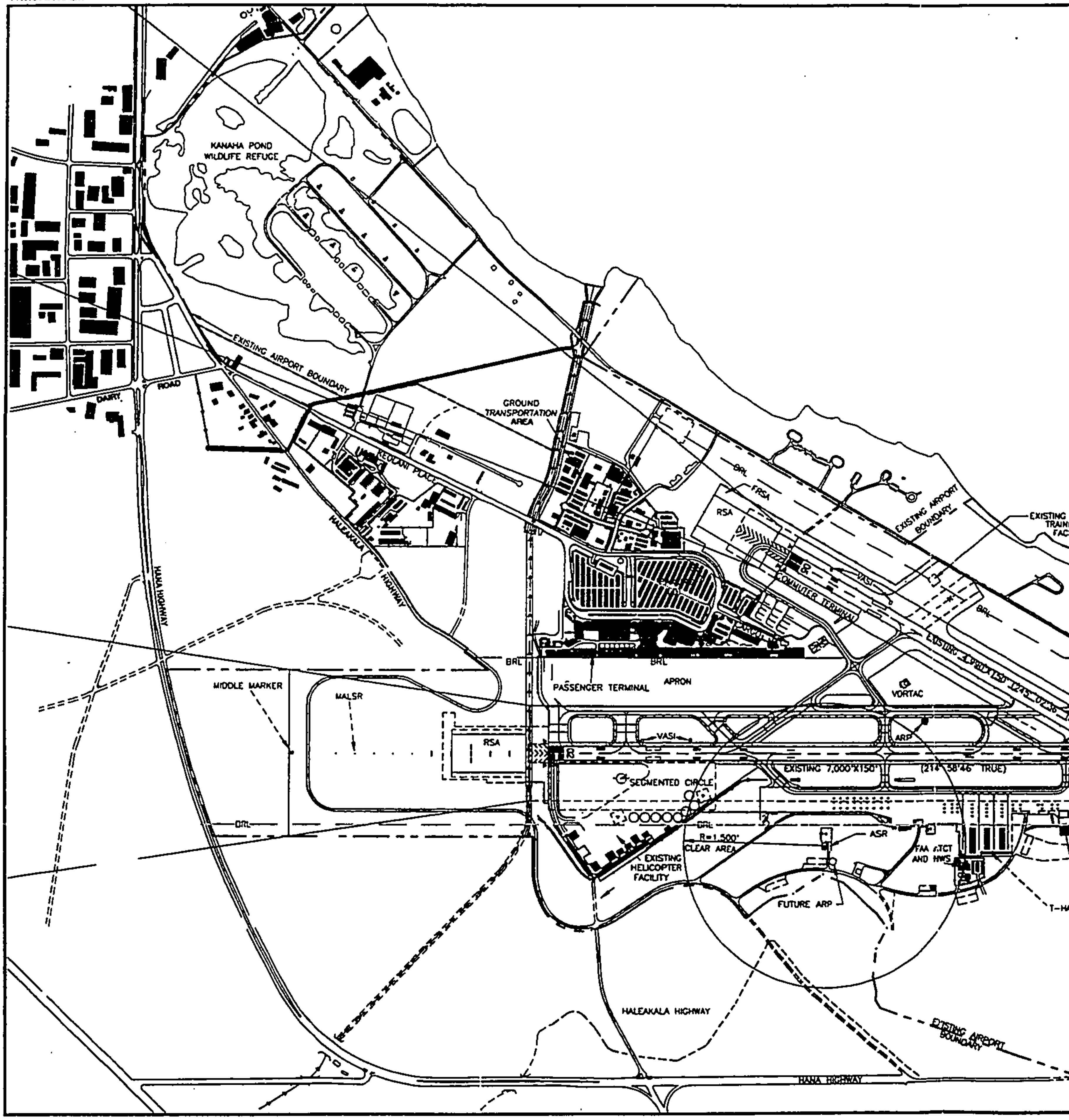

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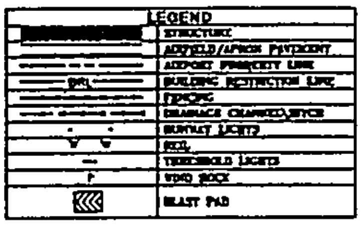


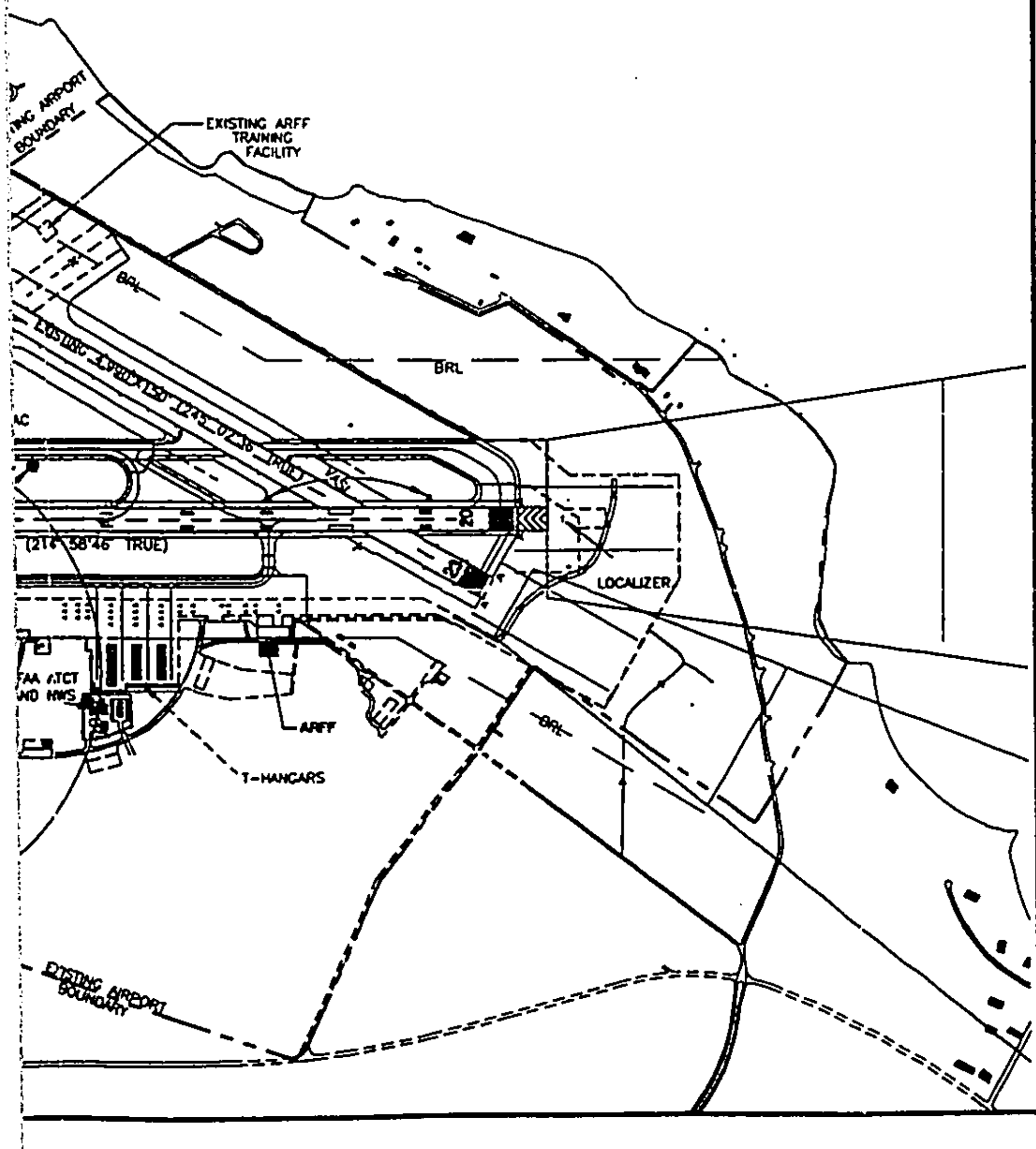


Figure 2-3
EXISTING AIRPORT FACILITIES

Airfield lighting and navigational aids at Kahului Airport include taxiway edge lights, taxiway guidance signs, runway edge lights, and runway threshold lights. Runways 2, 20, and 5 each have a Visual Approach Slope Indicator-4 (VASI-4) approach lighting system. Runway 2 has a Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights. A new airport control tower is located on the eastern side of Runway 2-20 near its intersection with Runway 5-23.

2.1.2 Role in the State Aviation System

Kahului Airport is one of 16 airports owned and/or operated by the Airports Division of the State of Hawaii Department of Transportation on the major islands in the Hawaiian chain. The National Plan of Integrated Airport Systems (NPIAS) currently classifies Kahului Airport as a "Commercial Service-Primary Airport." Airports in this category typically serve long-haul air carrier routes of more than 1,500 miles. The Airport also serves interisland short-haul air carrier routes of less than 500 miles. Kahului Airport's service area includes the entire island of Maui. It is the only airport on the island that can accommodate turbojet aircraft and handles the great majority of passengers and air cargo moving to and from the island.

The number of aircraft operations and passenger volumes at Kahului Airport have more than tripled over the past 20 years. In 1992, Kahului Airport recorded nearly 180,000 aircraft operations, over five million passengers, and more than 40,000 tons of cargo. It is currently the second busiest airport in the State.

There are two other airports on Maui. Both are owned and operated by the Airports Division of the State Department of Transportation:

- The Hana Airport is a small, general aviation facility with Commuter/Air Taxi operations that serves the eastern end of the island. Hana Airport's small size and distance from Maui's population centers makes it unsuitable for most of the kinds of operations handled at Kahului Airport.

- The Kapalua Airport is located on the slopes above West Maui's resort areas; it is used principally by commuter/air taxi operators. While the Kapalua Airport is better situated than the Hana Airport with respect to potential users, its short runway (3,000 feet) and limits that the County of Maui placed on its use (number of operations, type of aircraft, time of day that it is open, etc.) as a condition of its original construction approval mean that it is not a viable alternate to Kahului Airport for the great majority of operations.

Consequently, it is expected that Kahului Airport will continue to accommodate the bulk of interisland passengers, all overseas flights, and most of general aviation operations for the foreseeable future.

2.2 EXISTING AND FUTURE LAND USE CONTROLS

2.2.1 State Land Use Law

The State Land Use Commission regulates land use throughout Hawaii under the provisions of Chapter 205, Hawaii Revised Statutes. There are four different land use districts—Urban, Agricultural, Conservation, and Rural—and the Commission has established broad categories of uses permissible in each district. The individual Counties govern land use within the Urban District and, subject to certain limitations, within the Rural and Agricultural Districts as well. The State Department of Land and Natural Resources is responsible for controlling land use within the Conservation District.

The great majority of the land within the official boundaries of Kahului Airport is within the Urban District (Figure 2-4). Airports are permissible uses within the Urban District. Three parts of the airport are not within the State Urban District:

- The 1,750-foot wide strip of vacant airport land between the southern end of Runway 2-20 and Hana Highway is in the Agricultural District. Since the airport uses it only as a vacant buffer zone, it is a permissible use.

- The Kanaha Pond Waterfowl Refuge on the western side of the airport is in the State Conservation District. No airport uses are situated in this area.

- Portions of the eastern side of the Airport containing the FAA Control Tower, the Airport Rescue and Fire-Fighting Facility, the general aviation T-hangars, and minor support facilities are in the Agricultural District. A petition to change the designation of this area to Urban is pending before the State Land Use Commission.

Figure 2-4 also shows the State Land Use District designation of areas surrounding the airport. In general, the land to the east and south is in the Agricultural District, while areas to the west and north are in the Urban District.

2.2.2 Maui County General Plan

The Maui County General Plan establishes broad policies for the long-range development of the County and identifies the general social, environmental, economic, and design objectives that are to be pursued. The General Plan consists of two parts: the first is a set of objectives expressing the common wishes and aspirations of County residents; the second identifies the policies that must be implemented in order to attain each specific objective.

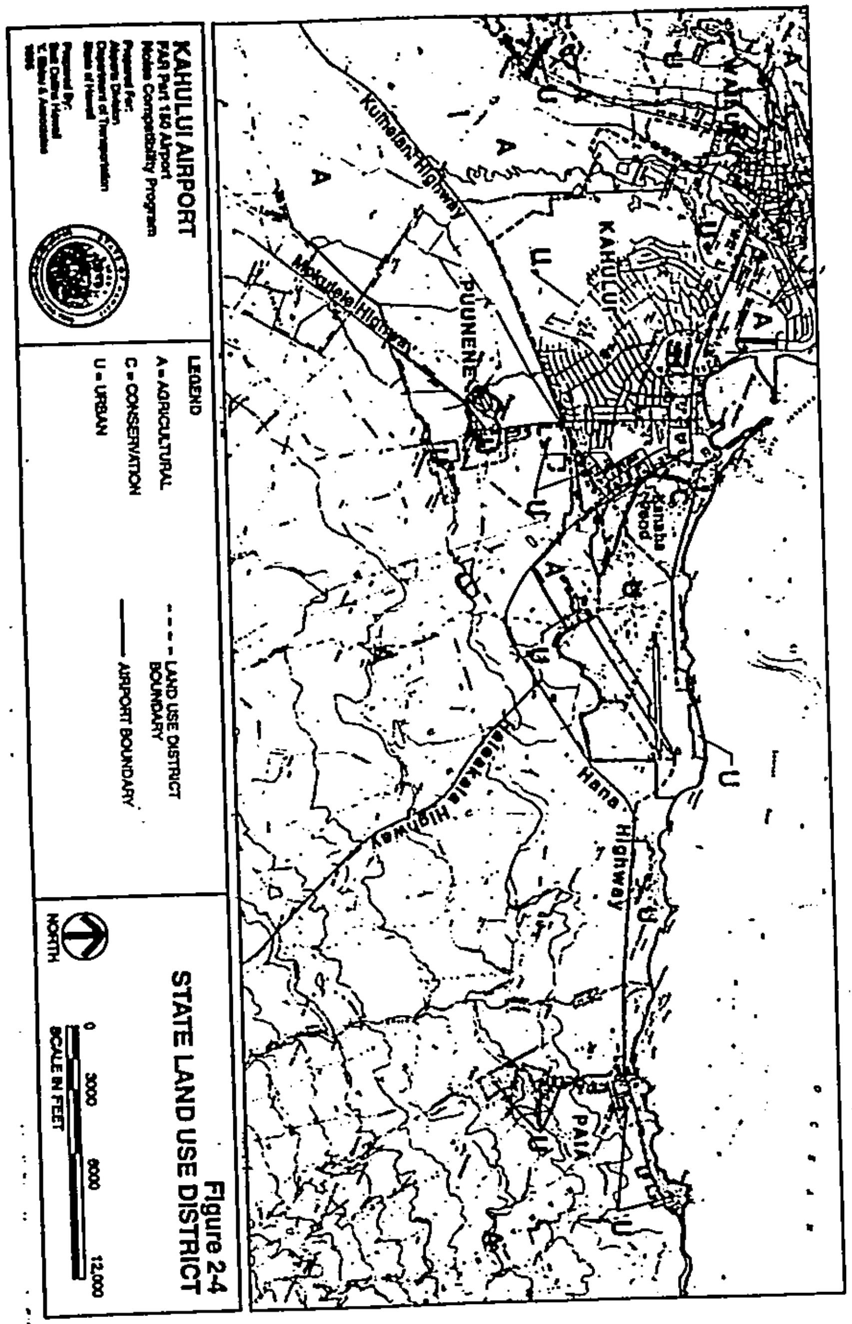


Figure 2-4
STATE LAND USE DISTRICT

The General Plan policies emphasize the County's desire that Kahului Airport be operated in a way that minimizes adverse noise and other environmental impacts while meeting the transportation needs of the island's residents. They imply County cooperation in controlling incompatible land uses around Kahului Airport.

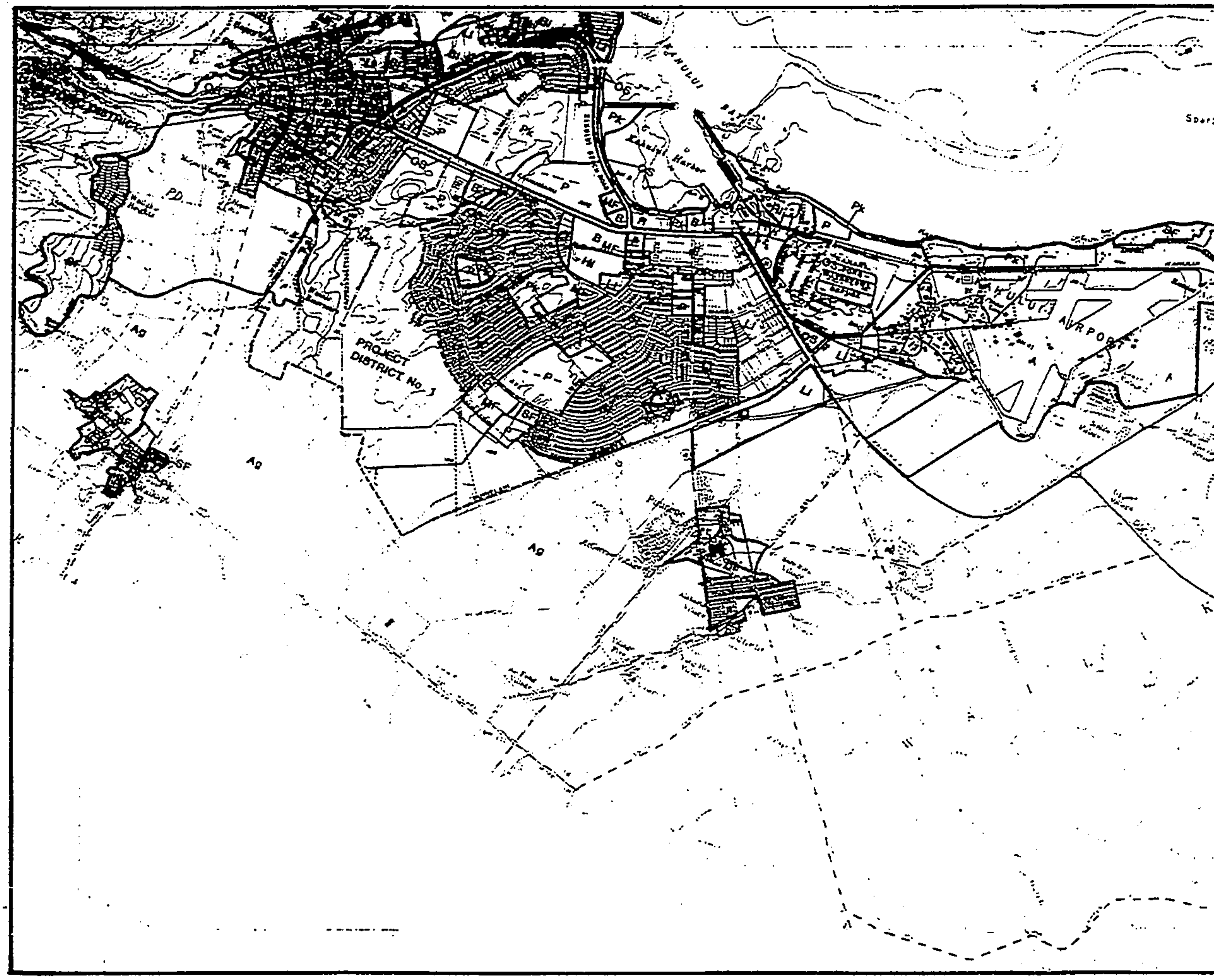
2.2.3 Wailuku-Kahului Community Plan

The Maui General Plan mandated the preparation of community development plans that establish programs for implementing the policies contained in the General Plan. One of these, the *Wailuku-Kahului Community Development Plan*, encompasses the civic and business centers of Wailuku and Kahului, Kahului Harbor and Airport, the surrounding agricultural lands of central Maui, and the eastern half of the West Maui Mountains. The Community Plan land use map is reproduced in Figure 2-5.

The following *Wailuku-Kahului Community Development Plan* recommendations are relevant to an evaluation of the noise compatibility of Kahului Airport:

- Provide industrial growth opportunities through the expansion of existing industrial centers associated with the airport and harbor and in Wailuku and Kahului.
- Direct residential growth to areas providing contiguous outward expansion of existing residential areas, where public services can expand in an efficient and economical manner.
- Modify the State Agricultural District boundaries to allow for contiguous outward expansion of Kahului, Wailuku, Waiehu, and Waikapu residential areas.
- Guide development in the direction of the land use plan shown in Figure 2-5. This includes keeping the airport and the agricultural lands to the south and east in their current location.
- Provide sufficient land areas for new residential growth that will relax constraints on the housing market.
  - *Seek alternative residential growth areas within the planning region, with high priority given to the Wailuku area.*

Together, these recommendations point to the expansion of noise sensitive development to the West of Kuihelani Highway, and in the foothills of the West Maui Mountains.



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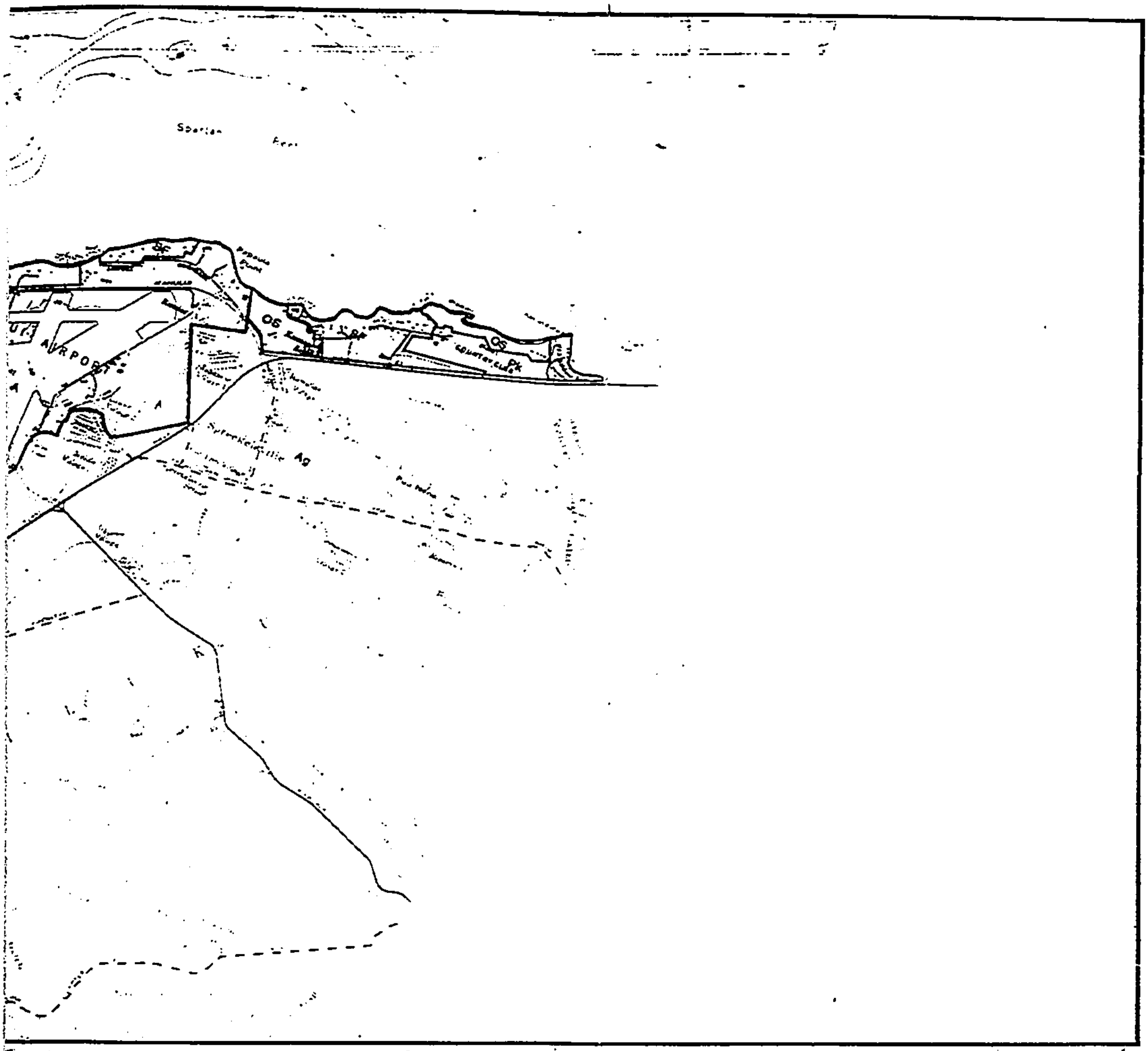
LEGEND

Ag	Agriculture	BR	Business/Multi-Family	P	Public/Quasi-Public
R	Rural	BI	Business/Industrial	Pk	Park
SF	Single Family Residential	LI	Light Industrial	OS	Open Space
MF	Multi-Family Residential	HI	Heavy Industrial	PD	Project District
B	Business/Commercial	H	Hotel	A	Airport



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k

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ort

Figure 2-5
WAILUKU-KAHULUI COMMUNITY PLAN

NORTH

0 2000 4000 8000

SCALE IN FEET

2.2.4 County Zoning

The *Maui County General Plan* and the *Wailuku-Kahului Community Development Plan* are implemented through the County's zoning ordinance. The zoning designations generally follow the *Wailuku-Kahului Community Plan* discussed above.

2.3 EXISTING LAND OWNERSHIP AND USE

All of the land within the Airport except the U.S. Post Office site is owned by the State of Hawaii. Most of it is administered by the State Department of Transportation (DOT); the exception is the Kanaha Pond Wildlife Refuge on the western side of the airport. The Refuge is administered and managed by the State Department of Land and Natural Resources.

The majority of the land surrounding the Airport is privately owned. The largest single landowner is Alexander and Baldwin (A&B). Its subsidiary, the Hawaiian Commercial and Sugar Company (HC&S), owns and cultivates the sugarcane fields to the south and east of the airport. A&B has recently developed the new commercial area near the intersection of the existing airport access road and Hana Highway.

Existing land use in the vicinity of Kahului Airport is shown in Figure 2-6. Several aspects of it are of particular note:

- The land immediately south and east of the airport is mostly in agricultural use; the only exception is the built-up area around the Pu'u-nēnē Mill. That area once contained many plantation homes, but HC&S has relocated all but six families that rented these dwellings and has razed most of the dilapidated wooden structures. Pu'u-nēnē is now planned for heavy industrial uses that are compatible with relatively high noise levels.
- Moderately dense residential development is located southwest of Kuihelani Highway/Dairy Road under the infrequently used left-hand curved approach to Runway 2. This development extends inland past Maui High School.
- Kanaha Pond and the light industrial uses on the airport's western side separate the Airport from industrial and commercial uses around Kahului Harbor.
- Most of the shoreline northwest of the airport is in the Kanaha Beach Park or other public uses. However, single-family homes in West Spreckelsville occupy a narrow strip of privately owned land between the airport boundary and the ocean.
- The single-family homes in East Spreckelsville are separated from the airport property by a band of open space.

2.4 NOISE-SENSITIVE USES

As shown in Figure 2-6, one large (the southeastern part of Kahului) and two small (East and West Spreckelsville) residential areas are located close to the Airport. A few schools and public-use structures are also nearby. These include Maui High School and Kahului School between Hina and Lono Avenues in Kahului, the County's Kaunoa Senior Citizens' Center at the intersection of Hana Highway and Laulea Place, and the complex of community facilities located on the eastern side of Pu'u-nēnē (e.g., the Holy Family Ecumenical Shelter and Civil Air Patrol Meeting Room between Pu'u-nēnē Road and Spanish Road south of Pu'u-nēnē).

2.5 BACKGROUND AMBIENT NOISE

Existing background ambient noise levels (exclusive of aircraft noise) in the communities surrounding Kahului Airport are estimated to range from 45 to 65 Ldn. Noise levels greater than 65 Ldn exist along the rights-of-way of the major roadways which service Kahului, but these higher noise levels are generally confined to the roadway corridors. Locations in Kahului, Wailuku, Pu'u-nēnē, and Paia affected by traffic noise have background ambient levels ranging from 55 to 65 Ldn. Residential areas away from major roadways affected by local traffic typically have background ambient noise levels between 45 and 55 Ldn. The surf produces noise levels of approximately 60 to 65 Ldn along the shorelines of Kahului Bay. In general, background ambient noise levels in the Kahului Airport environs are not high enough to mask aircraft noise events.

2.6 FUTURE DEVELOPMENT

2.6.1 Off-Airport

Tourism has been the driving force in Maui's economy over the past decade. Most of the visitor facilities have been built in Kihei and West Maui, and they have not directly affected land use in Wailuku-Kahului. However, with its geographically central position, good airport, protected harbor, and established industrial base, Wailuku-Kahului has remained the island's major support community.

The following areas in the vicinity of Kahului Airport are most likely to be developed within the next five years, the time horizon of this Noise Compatibility Study:

- Single-family homes in "Project District No. 1" along the southern side of Kahului.
- Industrial in-fill development southwest of the airport.

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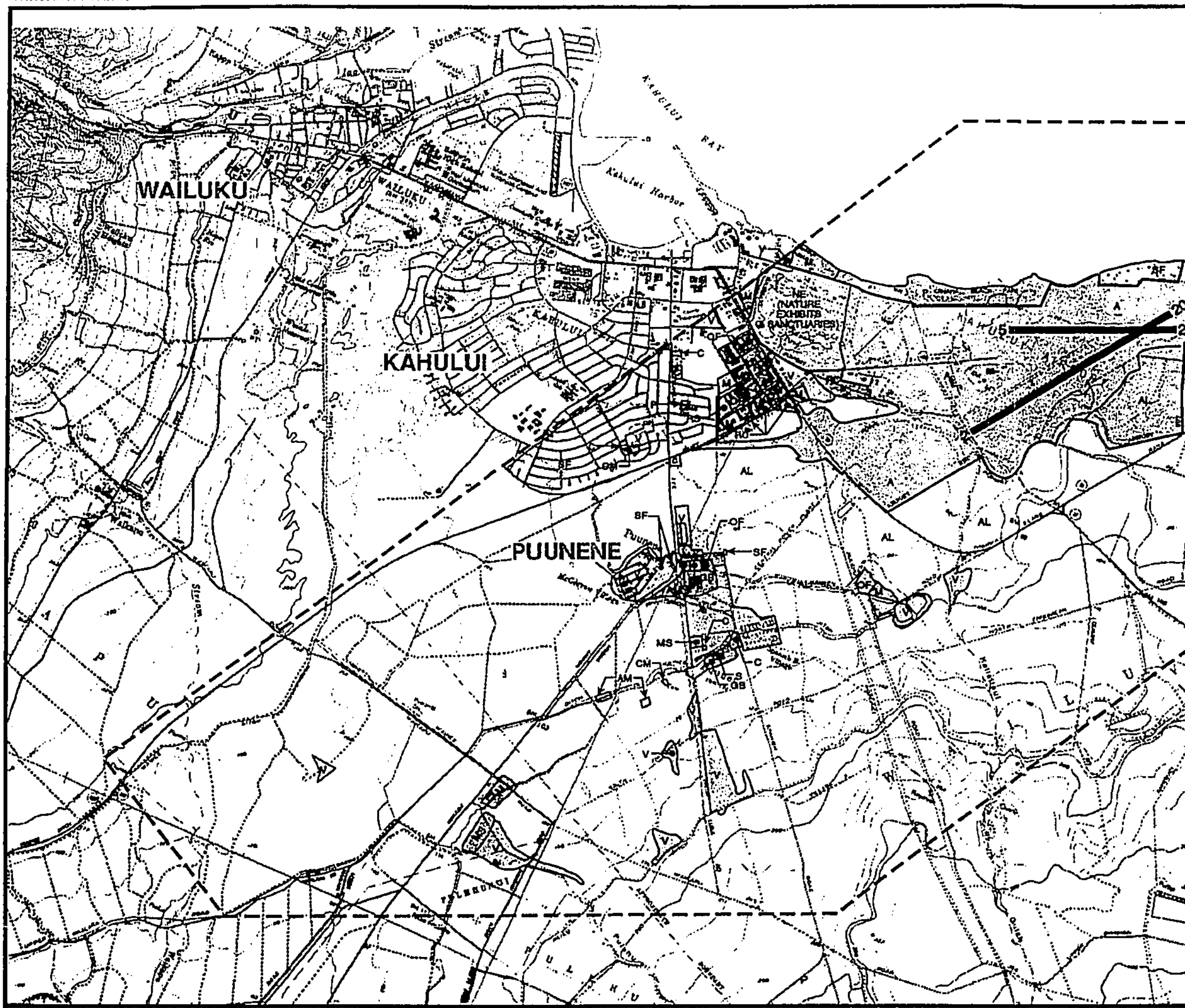

KAHULUI AIRPORT
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State of Hawaii

Prepared By:
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LAND USE CLASSIFICATION

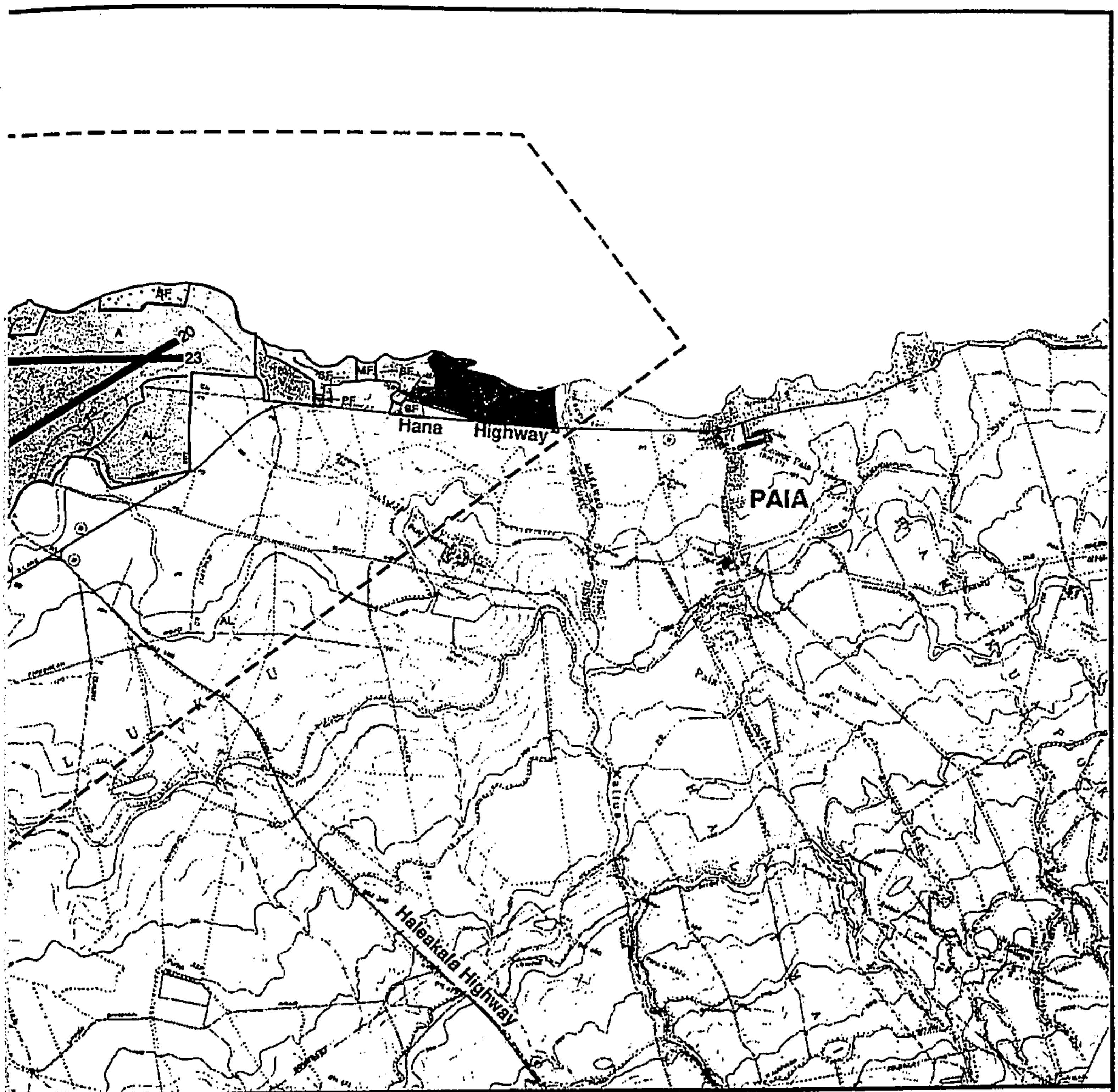
COMMERCIAL AND GOVERNMENT USE
- RC RETAIL COMMERCIAL
- OF BUSINESS/PROFESSIONAL OFFICES
- AC AIRPORT BUSINESSES (car rental agencies, tours, lei stands)
- RS RETAIL STORAGE (warehouses)
- CS COMMERCIAL SERVICES
- GB GOVERNMENT BUILDING

RESIDENTIAL
- SF SINGLE FAMILY
- MF MULTIPLE FAMILY

PUBLIC USE
- S SCHOOL
- H HOSPITALS (clinics, health care facilities, nursing homes)
- PF PUBLIC FACILITIES (day care, libraries, community centers)
- C CHURCH

MANUFACTURING, PRODUCTION & STORAGE
- M LIGHT/HEAVY MANUFACTURING
- AM AGRICULTURAL MANUFACTURING
- MS MANUFACTURING WAREHOUSES

AL AGRICULTURAL LAND



e facilities,

libraries,

DUCTION & STORAGE
NG
IRING
ISES
ND

RECREATIONAL
OR OUTDOOR RECREATION
NE NATURE EXHIBITS & SANCTUARIES
G&W GOLF COURSES, GARDENS, WATER RECREATION

OPEN SPACE
CM CEMETERY
P PARK
V VACANT OR UNDEVELOPED LAND

STUDY AREA BOUNDARY
AIRPORT PROPERTY

Figure 2-6
1993 EXISTING LAND USE MAP

NORTH

0 2000 4000 8000
SCALE IN FEET

- Additional single-family homes in an existing East Spreckelsville subdivision near the Maui Country Club.

Only the last of these is a potentially serious problem from a noise-compatibility standpoint.

2.6.2 On-Airport

A number of major improvements have been made to Kahului Airport over the past five years. These include a major addition to the main passenger terminal, construction of an extended runway safety area at the southern end of Runway 2-20, reconfiguration and expansion of the airport entrance road and main parking area, relocation of the Aircraft Rescue and Firefighting Facility (ARFF). The Airports Division has proposed extending Runway 2-20 by 2,600 feet to the south to a total length of 9,600 feet to accommodate unrestricted Mainland departures. An environmental impact statement is currently being prepared for the proposed runway extension, the construction of a new airport access road, and related facilities. It is anticipated that the proposed runway extension would be completed by 1998, the forecast year for this study.

CHAPTER 3
EXISTING AIR TRAFFIC PATTERNS AND NOISE ABATEMENT PROCEDURES

CHAPTER 3
EXISTING AIR TRAFFIC PATTERNS AND NOISE ABATEMENT PROCEDURES

3.1 AIRWAYS AND GENERAL AIR TRAFFIC PATTERNS

Moderate to strong trade winds prevail at Kahului Airport the great majority of the time. During trade wind[1] conditions, larger aircraft, including virtually all interisland and overseas jet aircraft, take off and land toward the north-northeast on Runway 2. Lightly loaded interisland jet aircraft are capable of using Runway 5 under some wind and load conditions, but, because of the short length of this runway (4,990 feet), this occurs infrequently. Commuter/Air Taxi and general aviation aircraft generally take off on Runway 5 under trade wind conditions, but they occasionally use Runway 2 as well. During Kona (southerly) winds, the flow is reversed, with larger aircraft using Runway 20 and smaller aircraft using Runway 23.

The flight corridor northwest of Kahului Airport parallels the 320-degree radial from the Kahului Airport (OGG) VORTAC. Except for a short stretch between the airport and the shoreline, this corridor lies over the ocean. The flight corridor to the northeast of the airport lies between the 30 and 84 degree radials from the OGG VORTAC; although generally over ocean areas, it does cross land in the vicinity of noise-sensitive (residential) development near Pā'ia.

The flight corridor south of Kahului Airport lies between the 186 and 204 degree radials from the OGG VORTAC. The southern flight corridor is landlocked, and crosses over noise sensitive (primarily residential) areas in Mā'alaea and Kīhei along the southern shore of the isthmus. The Pu'unēnē sugar mill and related support community are also directly beneath the southern approach to the airport. At one time this included several camps with homes for sugar workers, but most of these have been razed, ending noise-sensitive residential uses there.

[1]The term "trade winds" refers to the northeasterly winds that prevail at Kahului throughout the year. The term "Kona winds" refers to winds from the south that periodically replace the trade winds for periods ranging from a few hours to several days

3.2 ARRIVAL/DEPARTURE ROUTES AND FLIGHT TRACKS[2]

3.2.1 Arrival/Departure Routes

FAA en route strips containing the aircraft flight plans and reporting points were reviewed to determine the primary and secondary routes into and out of Kahului Airport. These strips are generated at the FAA Traffic Control Center in Diamond Head Crater, O'ahu, which controls all operations into and out of Hawaiian airspace.

The routings that are of greatest importance to Kahului Airport are summarized below. The names refer to navigational beacons and flyway intersections depicted on the FAA's sectional aeronautical chart of the Hawaiian Islands (see Figure 3-1). The discussion distinguishes between the arrival and departure routes followed during the three different wind regimes (trade wind, Kona (southerly), and turbulent trade wind) that determine the FAA's assignment of regional routes. As discussed later, the trade wind flow regime is by far the most prevalent, and the turbulent trade wind flow regime the least frequently used.

3.2.1.1 Trade Wind Arrival Routes

The major arrival routes followed during trade wind conditions are:

- **HNL-LNY-CAMPS1-OGG:** This route is used by all large aircraft flying from Honolulu International Airport to Kahului Airport when the normal trade wind flow regime is in effect. It takes eastbound aircraft south of O'ahu and Moloka'i and over Lāna'i. They turn north-northeast at CAMPS intersection and cross Maui's southern shoreline near Mā'alaea Harbor. They continue onward from there to a landing on Runway 2 at Kahului Airport.

- **ITO-MAKEN-CAMPS1-OGG:** This route is followed by all interisland jets and other large aircraft arriving from Hilo when the trade wind flow regime is in effect. It takes them from Hilo along the northern coast of the Big Island, south of the eastern end of Maui to MAKEN intersection, a point near Mākena Beach. From there, they proceed inbound from over the CAMPS intersection to cross Maui's southern shoreline near Mā'alaea Harbor. They continue onward from there to a landing on Runway 2 at Kahului Airport. The aircraft may take a more easterly route over the Central Valley when visual approaches are in effect.

[2]The term "route" refers to the corridor followed by approaching and departing aircraft (e.g., Honolulu International Airport to Kahului Airport via Lāna'i and the Maui isthmus). The term "flight track" refers to the exact path that is followed within that route. The route of a particular aircraft is a function of wind conditions (trade wind or Kona), the aircraft's origin or destination, and the type of aircraft. The specific flight track that is used within the route varies as a function of other air traffic, pilot preference, the amount of turbulence, and other factors.

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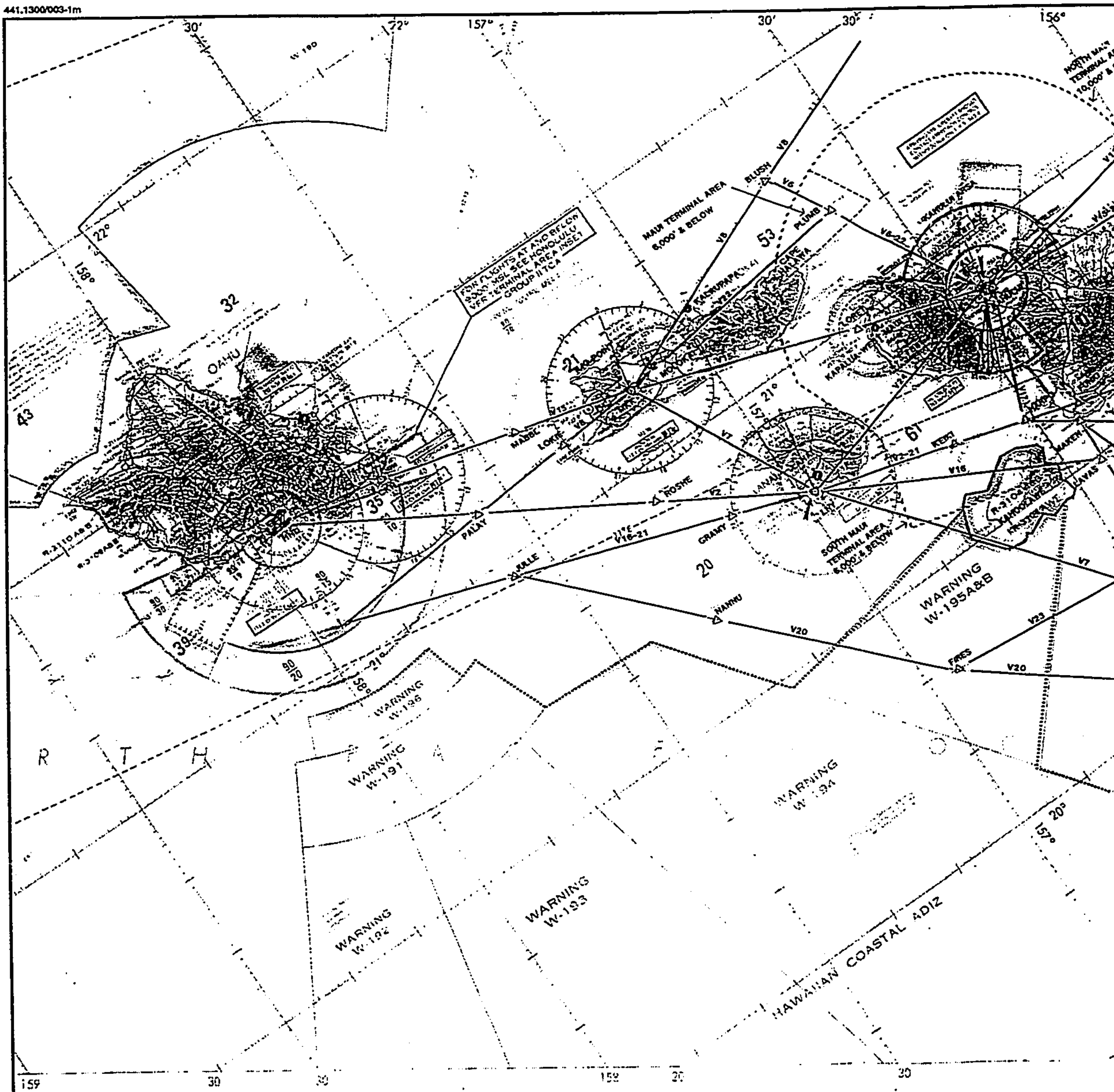
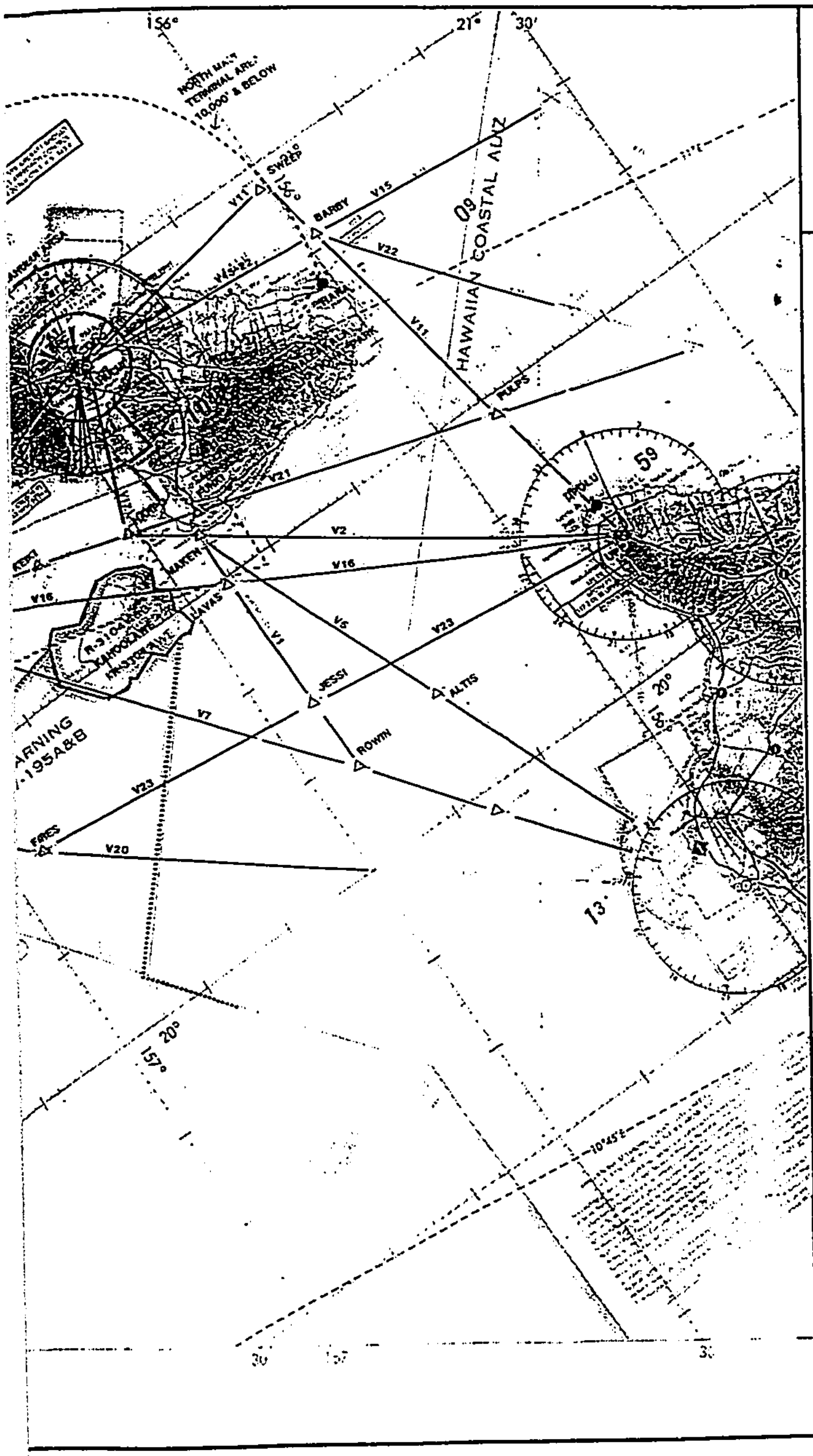


Source: *Hawaiian Island Sectional Aeronautical Chart*, May 1992.



KAHULUI AIRPORT

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Department of Transportation
State of Hawaii

Prepared By:
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LEGEND

- AIRWAYS
- VORTAC
- INTERSECTION
- RESTRICTED AREA OR ALERT AREA
- WARNING AREA
- PRECISION APPROACH
- NON PRECISION APPROACH
- MAUI TOWER APPROACH/DEPARTURE CONTROL DELEGATED AIRSPACE
- 41/20 ARSA EFFECTIVE ALTITUDES
- X 10,020' SPOT ELEVATION IN FEET ABOVE MEAN SEA LEVEL

MAUI COUNTY AIRSPACE AND NAVIGATIONAL FACILITIES

0 5 10 15
SCALE IN

NORTH

Figure 3-1
SECTIONAL AERONAUTICAL CHART

- **KOA-MAKEN-OGG:**This route is used by all aircraft flying from Kona to Kahului under trade wind conditions. It takes them on a direct line from Keahole Airport to the MAKEN intersection. From there they are cleared to CAMPS intersection and on to Kahului Airport. They may take a route over the eastern side of the Central Valley when visual approaches are in effect.

- **Mainland-OGG:** Aircraft arriving at Kahului direct from North America approach Maui from the east, cross the island's northern shoreline near Pā'ia, and make a right turn inland of the Pu'unēnē sugar mill before landing on Runway 2. If the aircraft are unable to execute a visual approach into Kahului Airport, they are vectored off the southern shoreline for an instrument approach from the south, crossing the shoreline inbound near Mā'alaea Harbor.

- **MKK-V2-OGG:**This route takes aircraft arriving from the west along the northern side of the island. It is followed when the FAA, responding to pilots' reports of severe turbulence on the normal trade wind approach (HNL-LNY-CAMPS1-OGG), changes the flow.

3.2.1.2 Trade Wind Departures

- **OGG-V6-BLUSH-V8-MKK-HNL:** Small aircraft bound for Moloka'i or Honolulu depart northwest-bound to the vicinity of Cape Halawa on Moloka'i. There, they turn westbound and continue to Moloka'i or O'ahu.

- **OGG-LNY-JULLE4-HNL:** This is the primary departure route for most jet and other large aircraft departing Kahului Airport during trade wind conditions for points to the west. It carries them west along the northern side of the West Maui Mountains. Honolulu-bound aircraft turn southeast toward Lāna'i and then west to the JULLE intersection, south of O'ahu.

- **OGG-OPANA1-BARBY-V22-BONUS-V21-PUMIC-ITO:** This route is followed by all aircraft flying from Kahului to Hilo International Airport. It takes them off the northern coast of East Maui, across the 'Alenuihāhā Channel, off the north shore of the island of Hawai'i to Hilo.

- **OGG-OPANA1-BARBY-V22-VECKIS-KOA:** This route is the same as the route to Hilo as far as the 'Alenuihāhā Channel. There it turns south-southeast to a landing at Keahole Airport.

- **OGG-BEACH1-LNY:**This route is used by most aircraft destined for Lanai. After taking off from Runway 5 or 2, aircraft fly southward over the Maui isthmus, cross the shoreline of Mā'alaea Bay, and proceed on to Lāna'i.

- **OGG-BEACH1-HARPO-KOA/ITO:** This route is used by small aircraft destined for the Big Island. It crosses the Central Valley to a point offshore over Mā'alaea Bay. From there, aircraft join the normal routes to the Big Island.

- **OGG-North America:** Mainland-bound aircraft takeoff on Runway 2 and continue northeast across the Pacific to their destination.

3.2.1.3 Kona Wind Arrivals

The major arrival routes followed during Kona wind conditions are:

- **HNL-BLUSH-OGG:** This route is used by all large aircraft flying from Honolulu International Airport to Kahului Airport when the Kona wind flow regime is in effect. It takes eastbound aircraft south of O'ahu and north of Moloka'i. They turn south-southeast and remain offshore on the final approach until crossing the shoreline just north of the airport for a landing on Runway 20.

- **ITO-BARBY-OGG:**This route is followed by all aircraft arriving from Hilo when the Kona wind flow regime is in effect. It takes them along the northern coast of the Big Island to BARBY intersection, a point near Hana. They remain offshore from there on the instrument approach until crossing the shoreline just north of the Airport and landing on Runway 20.

- **KOA-BARBY-OGG:** This route is used by all aircraft flying from Kona to Kahului under Kona wind conditions. It takes them north from Kona of the eastern end of Maui to BARBY intersection. They continue from there along the same route as arrivals from Hilo to a landing on Runway 20.

- **Mainland-OGG:** Aircraft arriving at Kahului direct from North America approach Maui from the north and east and remain offshore until crossing the shoreline for a landing on Runway 20.

3.2.1.4 Kona Wind Departures

The major departure routes followed during Kona wind conditions are:

- **OGG-BEACH1-LNY-HNL:** Most aircraft departing Kahului from Runway 20 under Kona wind conditions turn left between 10 and 15 degrees immediately after takeoff and cross the isthmus on a heading of approximately 190 degrees. They cross the shoreline in the middle of Mā'alaea Bay and turn right toward Oahu.

- **OGG-BEACH1-HARPO-V21-PUMIC-ITO:** Initially, this route is the same as OGG-BEACH1-LNY. However, after departing on Runway 20, aircraft turn southeast-bound toward the Big Island in the middle of Mā'alaea Bay. They continue from there along the southern side of Haleakala on to Hilo.
- **OGG-BEACH1-HARPO-V5-KOA:** This route is the same as Hilo departures.
- **OGG-Mainland:** Mainland departures under Kona wind conditions turn left after takeoff. They cross the shoreline near Pā'ia and proceed onward to the Mainland.

3.2.1.5 Turbulent Trade Wind Arrivals and Departures

When the trade winds are particularly strong, they produce heavy turbulence over Lana'i and the southern side of Maui. These can severely buffet aircraft using the normal trade wind approach into Kahului Airport. During such conditions, many pilots prefer a routing around the northern side of Maui. Most of the aircraft arriving from the west when the turbulent trade wind regime is in effect follow an MKK-V22-OGG routing. They turn south once they pass the West Maui Mountains, overflying Wailuku before making a 140-degree left turn and landing on Runway 2. Departure routes under turbulent trade wind conditions are the same as for normal trade wind conditions. For a variety of reasons the FAA places the turbulent trade wind flow regime in effect relatively infrequently, typically for 3 to 8 hours on each of 5-6 days per year.

3.2.2 Arrival/Departure Route Usage

Flight strips obtained from the FAA's Diamond Head Control Center for the period beginning in early July and ending in mid-November, 1994 were used in conjunction with published air carrier flight schedules to determine the relative frequency with which different approach and departure routes were used by each type of aircraft. These frequencies were used in deriving the runway and flight track usage percentages incorporated in the "average day" forecasts presented in Chapter 5. Key patterns revealed by the data include the following:

- During trade wind conditions, all interisland and overseas air carrier departures were from Runway 2. More than 90 percent of the interisland jet aircraft turned left (west) after takeoff and proceeded westward over the ocean; the remaining interisland jets turned right and proceeded off the

northern coast of East Maui and on to Hilo or Kona on the Island of Hawai'i.

- Many Mainland-bound air-carrier aircraft made intermediate stops in Honolulu, with the exact percentage varying significantly between air carriers and aircraft types. During trade wind conditions, both Honolulu-bound and Mainland-bound aircraft stayed to the North of the island. During Kona winds, Honolulu-bound aircraft flew south over the isthmus before turning west for Honolulu; Mainland-bound aircraft made a left turn after takeoff and departed over Pā'ia.
- All interisland air carrier jet departures during Kona conditions were from Runway 20. The great majority of Honolulu- and Kona-bound aircraft followed a BEACH1 departure route across the center of the island; a few remained on the runway heading.
- Commuter/Air Taxi aircraft and light cargo aircraft used on interisland routes from O'ahu and Moloka'i generally approach and depart the airport along the northern shore of West Maui. Those arriving from and departing to Lāna'i cross the center of the island.
- Training operations at the airport are conducted from both Runway 2-20 and 5-23. Essentially all of the military operations and a small part of the general aviation aircraft use Runway 2-20.

3.2.3 Aircraft Flight Tracks

The precise ground tracks of aircraft arriving, departing, and training at Kahului Airport were determined using a variety of data sources and techniques. During the preparation of the 1989 *Noise Exposure Map Report: Kahului Airport, Kahului Hawaii*, the radar display in the Kahului Control Tower was used to record the tracks of arriving and departing aircraft during a three day period in January, 1988. These traces were then used to update radar traces obtained in July, 1983. The flight paths were grouped by aircraft type, type of operation (arrival, departure, training), and by traffic pattern to create generalized flight tracks. The frequency of flight corridor usage by various types of aircraft was tabulated from radar data collected at the time the tracings were made. The radar tracings were supplemented and validated by field observations of aircraft flybys made during the noise measurement phase of the investigation.

For this report, the radar tracings obtained during the 1989 study were supplemented by analyzing data from the FAA's radar data files for the following dates: July 6, 1994; July 11, 1994; October 3, 1994; October 4, 1994, and October 5, 1994. The first two days represent a period when all operations were in a trade wind flow regime (i.e., arrivals from the south and departures to the north). The October dates represent a period of mixed trade wind and Kona operations. No new radar data were available from periods in which the turbulent trade wind flow regime was in effect; consequently, the "Wailuku" approach track (TR18) identified in the 1989 report was used for these aircraft. The results of the 1994 flight track analysis generally confirmed the earlier findings, but indicated somewhat greater dispersion along some of the routes than had been documented earlier. Several additional flight tracks were added to better represent this in the Integrated Noise Model.

The approach, departure, training, and helicopter flight tracks used as input to the Integrated Noise Model are shown in Figures 3-2, 3-3, 3-4, and 3-5, respectively. Table 3-1 contains a brief narrative description of the tracks and of the aircraft types utilizing each of them.

3.3 EXISTING NOISE ABATEMENT PROCEDURES AND HISTORY

3.3.1 Existing Noise Abatement Procedures

Existing noise abatement procedures for Kahului Airport are published in the Area Notices section of the most recent (August 18, 1994) edition of the FAA's Pacific Chart Supplement. The Supplement notes that aircraft noise complaints from the Spreckelsville Beach area adjacent to the Airport have become a matter of serious concern, describes the noise abatement runways and flight patterns that have been developed to improve the situation, and urges all pilots to follow these procedures to the maximum extent possible consistent with operational safety. These procedures constitute an *informal* noise abatement runway use program.

The informal program designates Runway 2-20 as the noise abatement departure runway for large (over 12,500 pounds gross weight) propeller- and jet-powered aircraft. Upon departure from Runway 2, the noise abatement procedure is to climb straight until 1 mile clear of the shoreline before initiating a turn. The noise abatement departure procedure from Runway 5, which is used primarily by light, propeller aircraft, is to turn as soon as possible after takeoff. Southbound aircraft are asked to turn right; east and westbound aircraft are asked to turn left and to remain at least one mile clear of the shoreline. This latter Runway 5 departure procedure can result in light aircraft overflying existing Spreckelsville homes on Old Stable Road, and these overflights have caused some complaints.

Under the trade wind conditions that prevail at the Airport the great majority of the time, virtually all large aircraft arriving at the airport from elsewhere in the state approach the airport across the central valley, overflying the Pu'unēnē sugar mill and landing on Runway 2. Large aircraft arriving from North America approach the island from the northwest, overfly the shoreline near Pā'ia, and make a right-hand turn to line up with Runway 2 south of the

Pu'unēnē sugar mill. At one time the Pu'unēnē mill was surrounded by a substantial number of plantation homes, but all but six of these have been demolished over the past twenty years. There have been no noise complaints from the vicinity of Pu'unēnē. Runway 5 is rarely used by arriving large aircraft. When it is, the noise abatement approach to Runway 5 is the "harbor approach," which generally avoids overflights of the noise-sensitive areas of Kahului.

Large propeller and jet aircraft landing at Kahului Airport under Kona conditions (southerly winds) are normally instructed to use Runway 20. This results in over-water approaches for all large aircraft except those arriving from Lāna'i, of which there is usually only one each day. There have been few complaints about these operations. Light propeller aircraft generally land on Runway 23 during Kona conditions. The approach to this runway from the east carries aircraft over East Spreckelsville. As a result, some noise complaints have been received from residents of this area during Kona wind conditions.

3.3.2 History of Noise Complaints and Relevant Legal Action

As noted above, most of the aircraft noise complaints received that are directly related to operations at Kahului Airport are from residents of East and West Spreckelsville. The principal source of the complaints is interisland jet operations on Runway 2-20, notably departures from Runway 2, and particularly nighttime operations by jet cargo aircraft (which did not begin until the mid-1980s). Relatively few complaints have been received from residents of Wailuku and Kahului since the FAA changed the primary eastbound flow pattern into the airport from one that came along the north shore of the island and mauka of Wailuku (the "Wailuku" approach) to the current pattern that routes them over Lanai and across the central valley.

In February 1989, a group of Spreckelsville residents filed a lawsuit against the State in State Circuit Court. The suit alleged that the noise constituted a trespassory private nuisance that deprived them of (*i*) the use and enjoyment of their property and (*ii*) the uninterrupted sleep at night necessary to fulfill their daytime responsibilities. It also alleged that the State had "*. . . operated and managed Kahului Airport without any abatement program which protects neighboring landowners from the noise and fuel fumes generated by airplanes taking off from the Kahului Airport.*" It sought relief in the form of actions by the State to "*. . . restrict access to Kahului Airport and to abate a continuing private nuisance or trespass.*"

On September 3, 1991, the State DOT and the plaintiffs signed a Stipulation for Stay of Proceedings that suspended the suit pending the preparation of specific analyses of ways to reduce aircraft noise annoyance in the vicinity of the Airport. The intent was that the study would identify means of reducing aircraft noise that were both legally and financially viable and that these would form the basis for an out-of-court settlement of the suit. To an extent, the Stipulation assumes that certain provisions of the Federal *Airport Noise and Capacity Expansion Act of 1990* would be implemented in Hawaii through subsequent amendments to FAR Part 91

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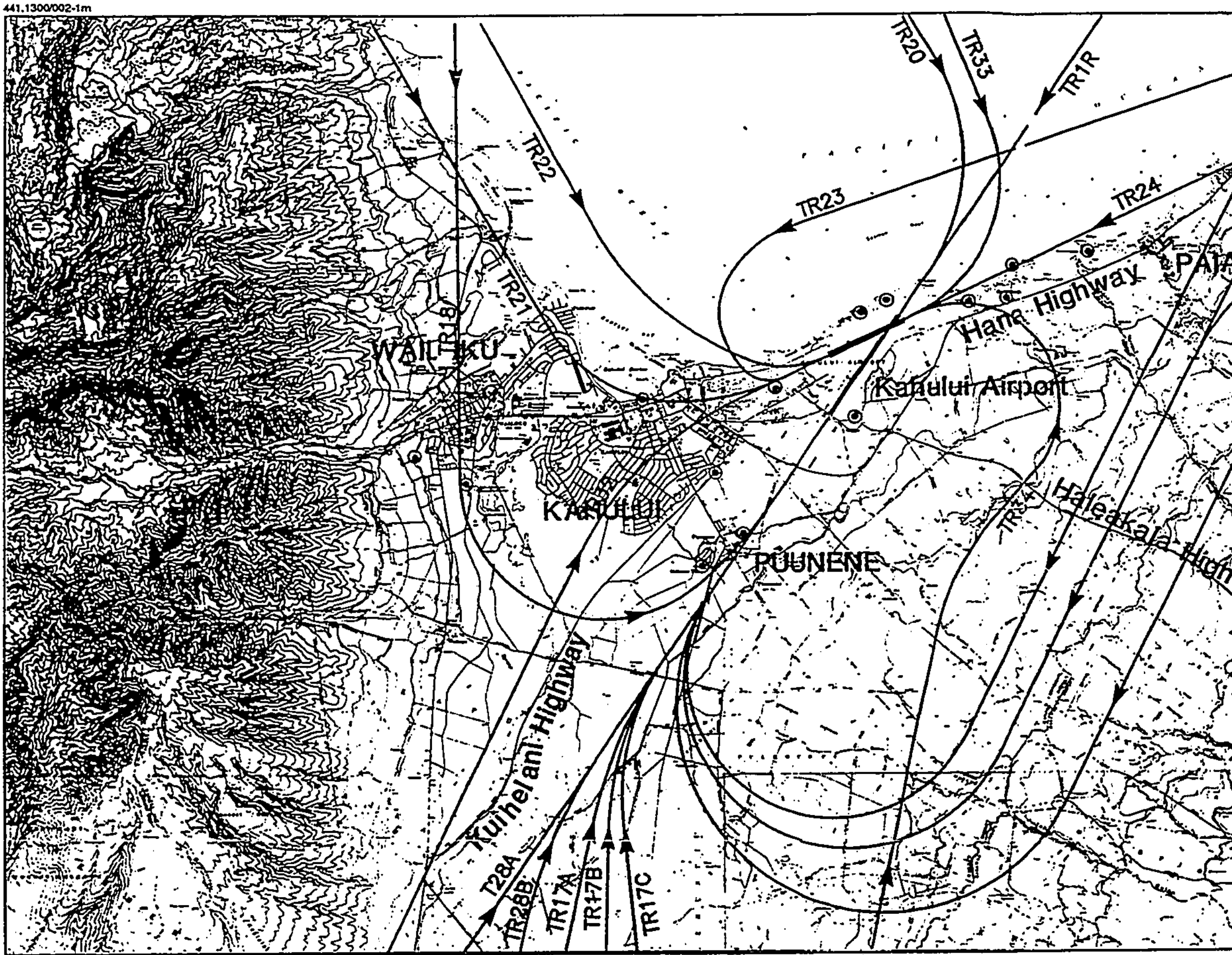

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LEGEND

◉ Noise Sample Locations

Note: See table for brief description of track.

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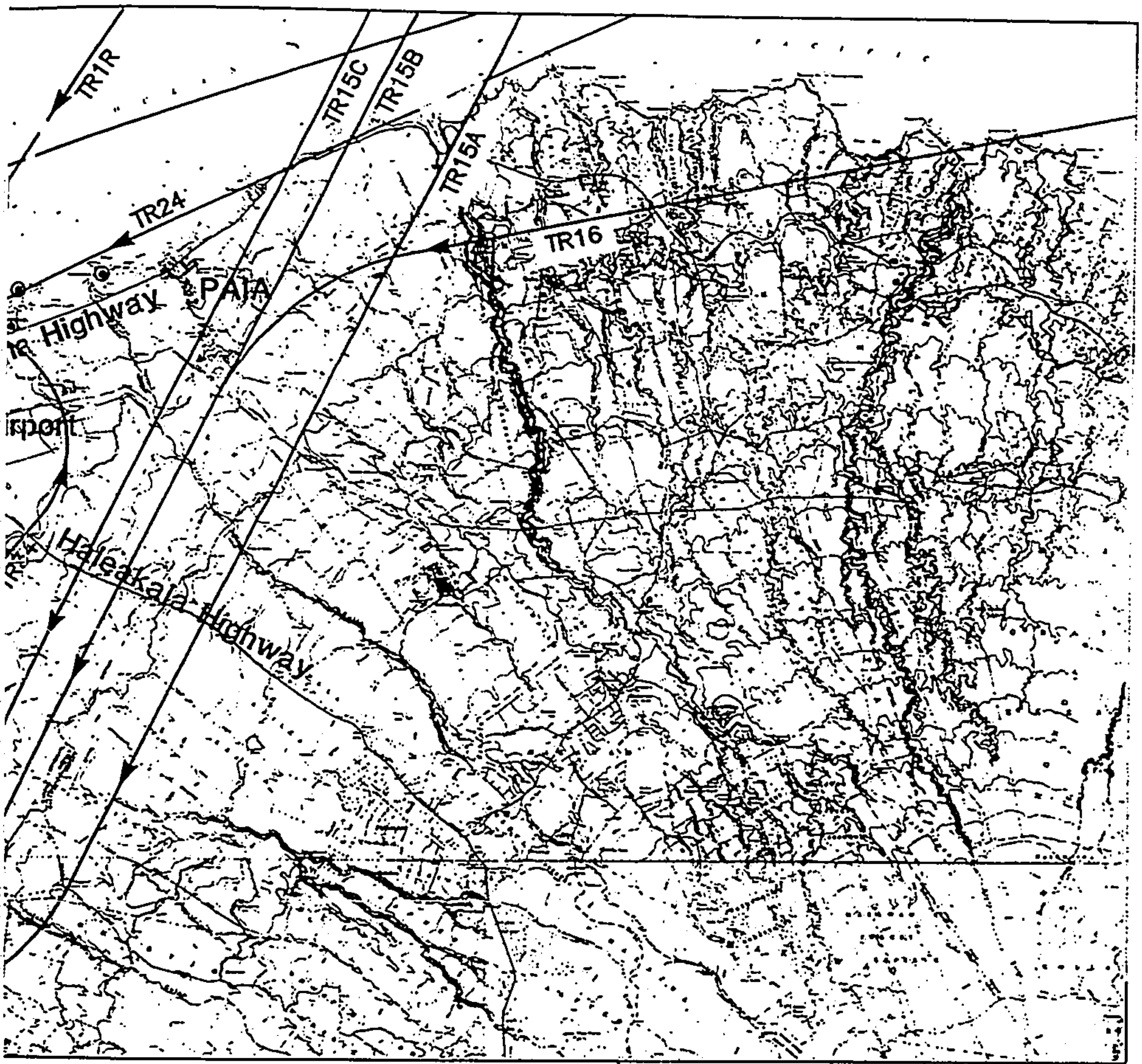

Figure 3-2
ARRIVAL FLIGHT TRACKS

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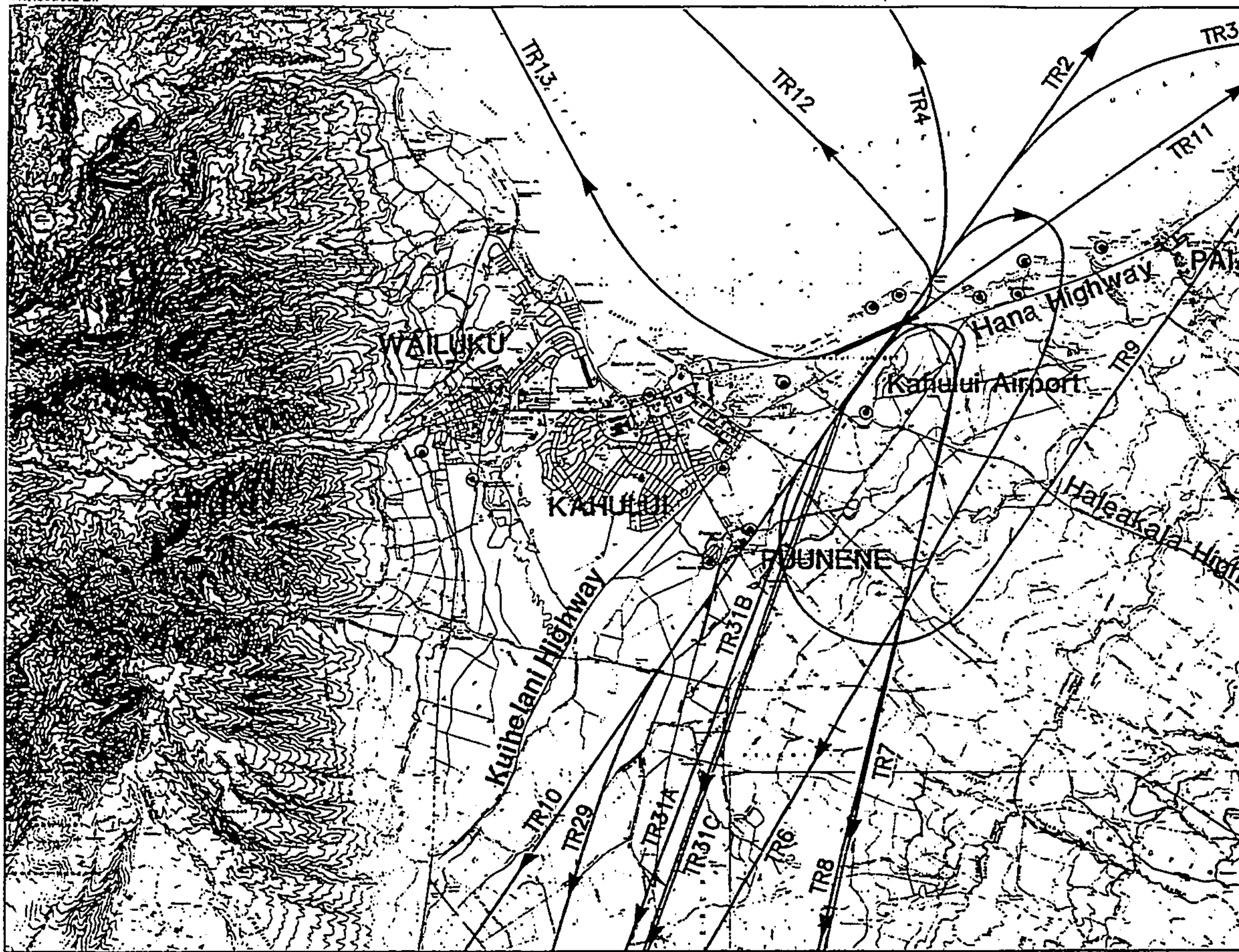

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LEGEND

◉ Noise Sample Locations

Note: See table for brief description of track.

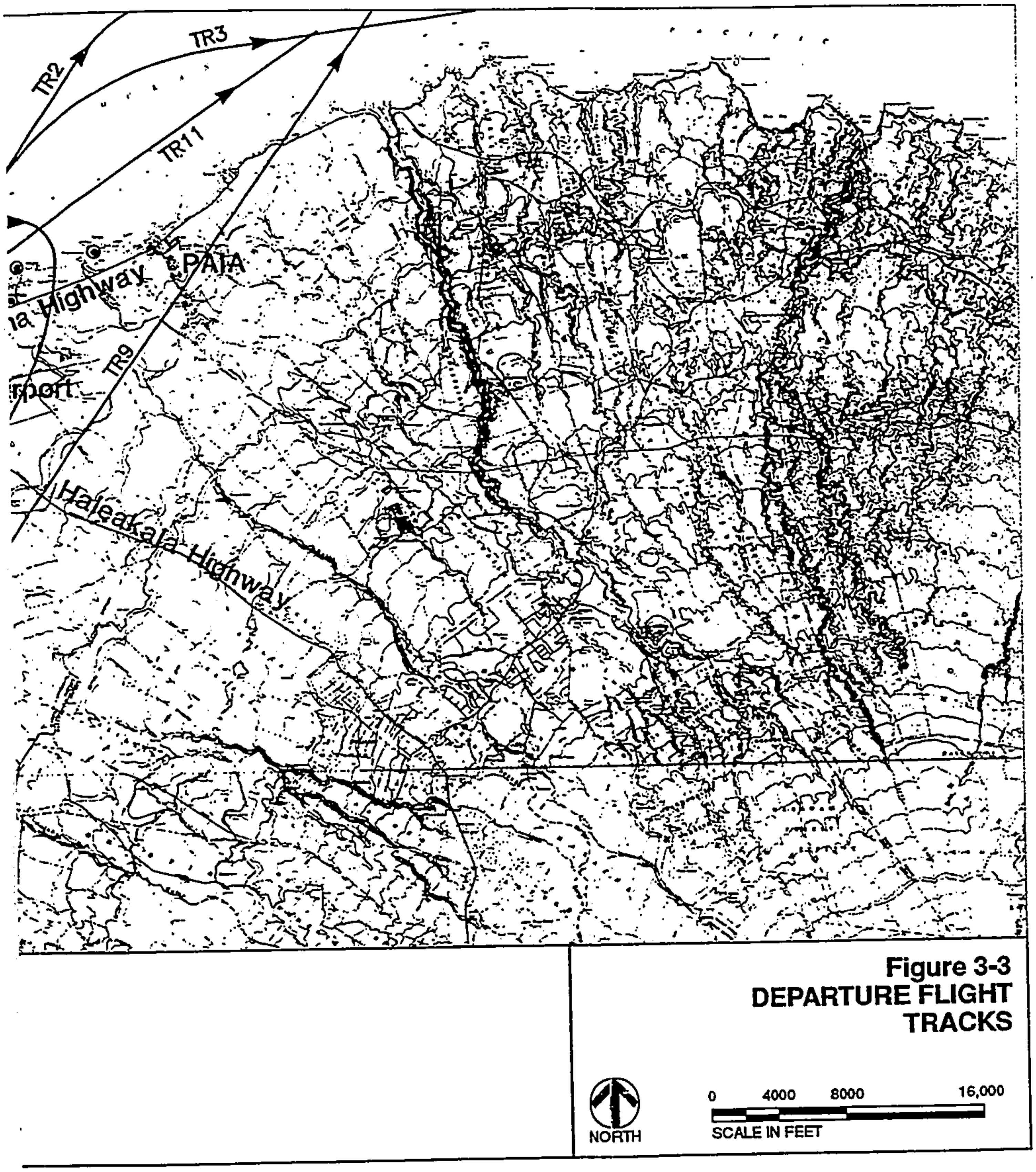

Figure 3-3
DEPARTURE FLIGHT TRACKS

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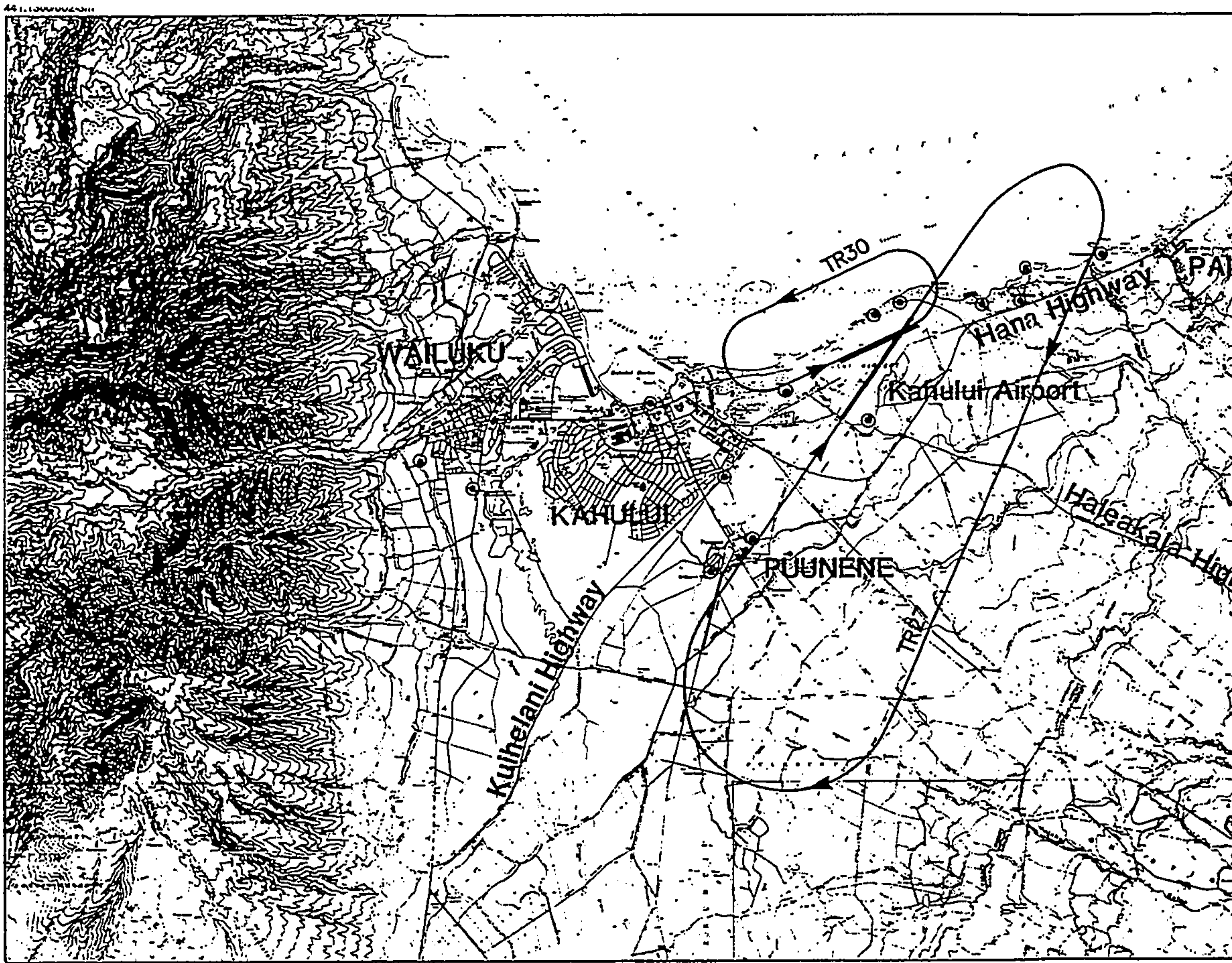

KAHULUI AIRPORT
FAR Part 150 Airport
Noise Compatibility Program

Prepared For:
Airports Division
Department of Transportation
State of Hawaii

Prepared By:
Belt Collins Hawaii
Y. Ebisu & Associates
1995

LEGEND

◉ Noise Sample Locations

Note: See table for brief description of track.

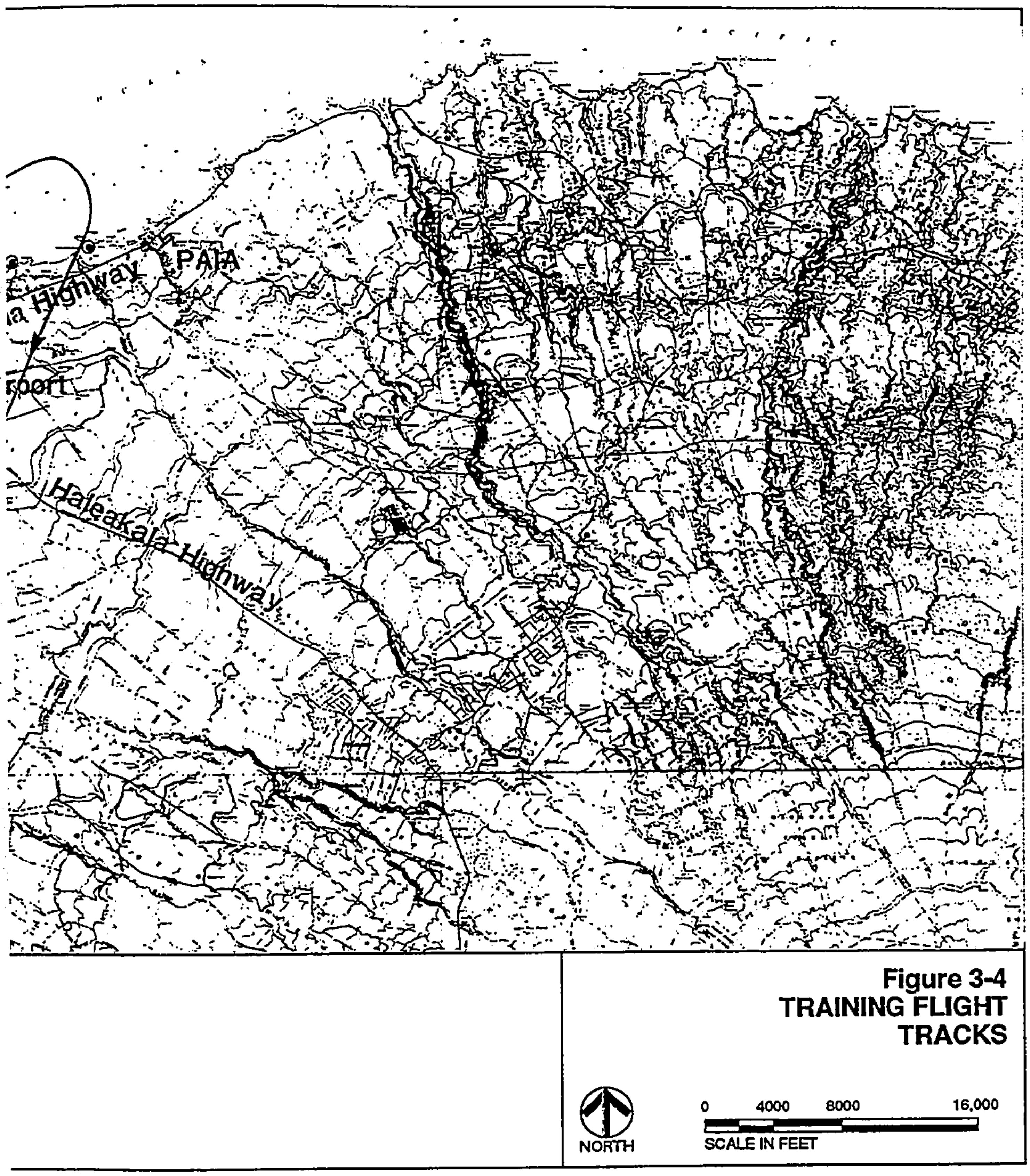

Figure 3-4
TRAINING FLIGHT TRACKS

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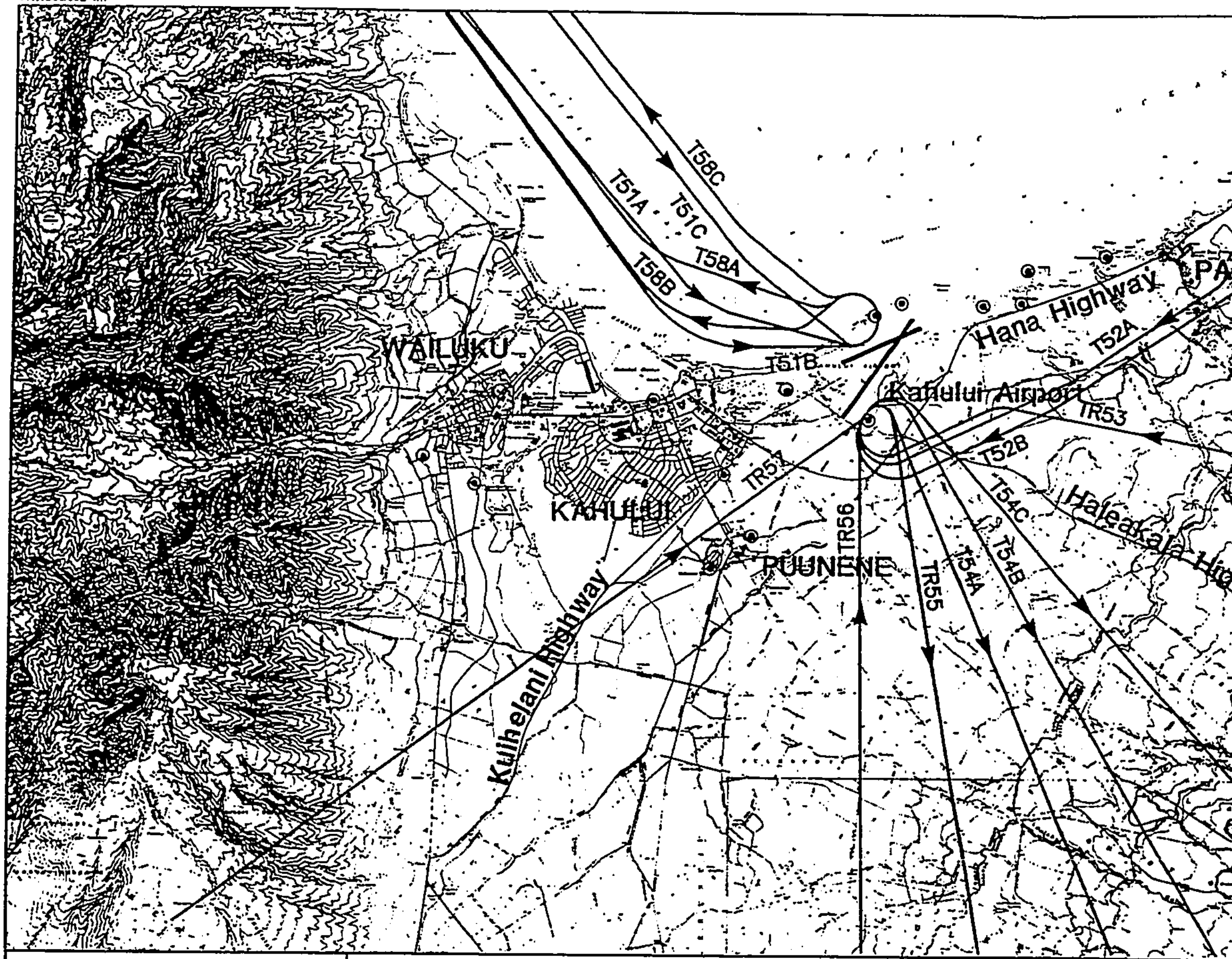
441.1300/002-4m



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Prepared By:
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Y. Ebisu & Associates
1995

LEGEND

◉ Noise Sample Locations

Note: See table for brief description of track.

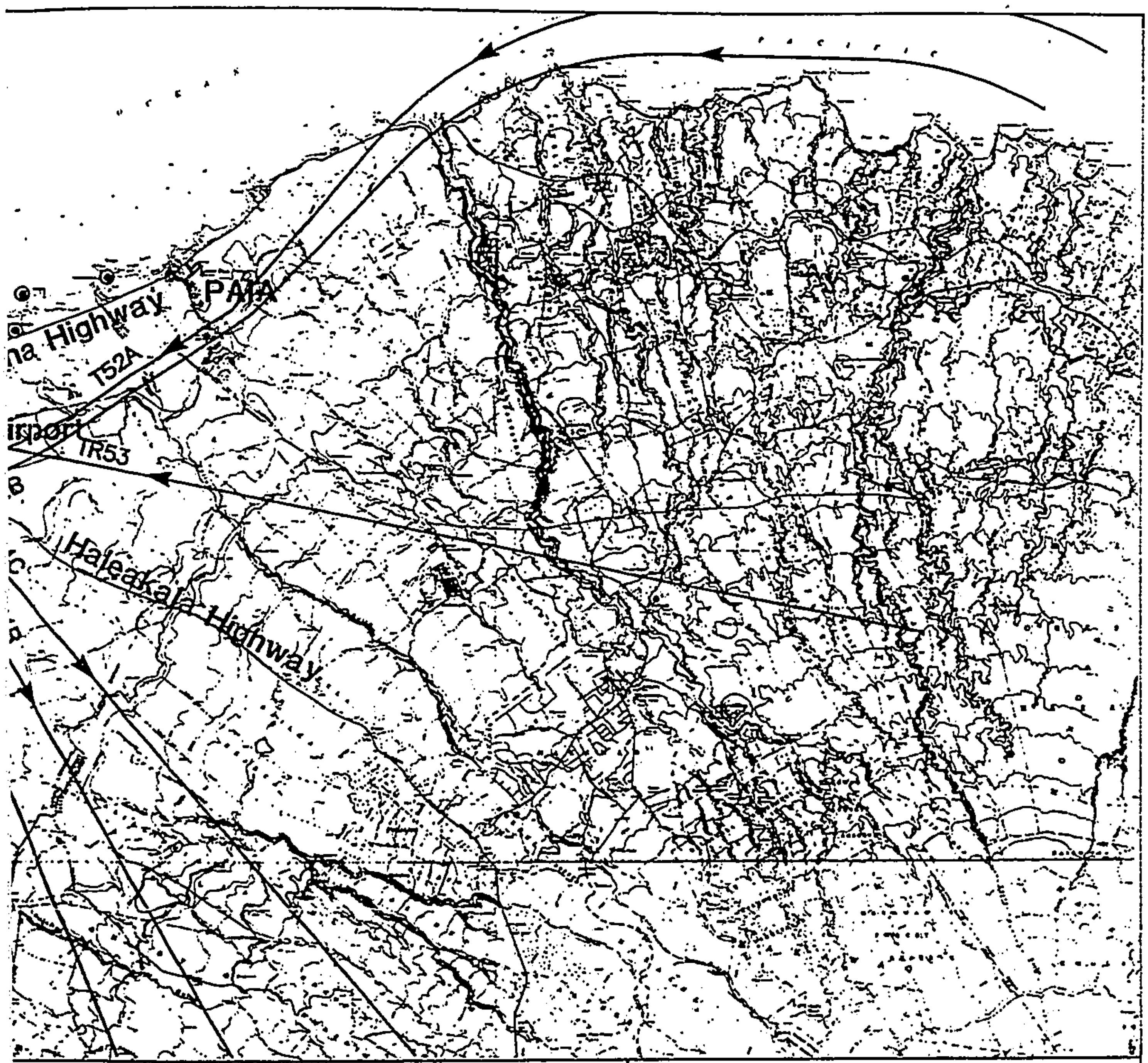

Figure 3-5
HELICOPTER FLIGHT TRACKS

NORTH

0 4000 8000 16,000
SCALE IN FEET

Table [illegible] Description of Flight Tracks Used to Generate Base Year Noise Exposure Map for Kahului Airport

TRACK NAME	TRACK DESCRIPTION
DEPARTURES:	
TR2	RWY 02 Itinerant interisland, overseas and military departures to the east
TR3	RWY 02 Itinerant departures to east
TR4	RWY 02 Itinerant departures to northwest, all aircraft
TR6	RWY 02 Itinerant general aviation aircraft departures to south
TR7	RWY 02 Itinerant general aviation aircraft departures to south
TR8	RWY 05 Itinerant general aviation aircraft departures to south
TR9	RWY 20 Itinerant eastbound overseas and military departures
TR10	RWY 20 Itinerant departures to west
TR11	RWY 05 Itinerant general aviation aircraft departures to east
TR12	RWY 05 Itinerant general aviation aircraft departures to northwest
TR13	RWY 23 Itinerant general aviation aircraft departures to northwest
TR29	RWY 20 Itinerant departures
TR31 A, B, C	RWY 20 Itinerant overseas, interisland, and military departures to west and east
TR54 A, B, C	Air Taxi helicopter departures to southeast from southeast apron
TR55	Air Taxi helicopter departures to south from southeast apron
TR58 A, B, C	Air Taxi helicopter departures to northwest from north apron
ARRIVALS:	
TR1R	RWY 20 Itinerant arrivals from north, south, and east, all aircraft
TR15 A, B, C	RWY 02 Itinerant overseas and interisland arrivals from northwest and north
TR16	RWY 02 Itinerant interisland and military arrivals from east
TR17 A, B, C	RWY 02 Itinerant interisland and military arrivals from Kona and Hilo
TR18	RWY 02 Itinerant interisland curved approach track from northwest
TR20	RWY 20 Itinerant arrivals from northwest, all aircraft
TR21	RWY 05 Itinerant interisland jet arrivals
TR22	RWY 05 Itinerant general aviation arrivals
TR23	RWY 05 Itinerant general aviation aircraft arrivals from east
TR24	RWY 23 Itinerant general aviation aircraft arrivals from east
TR28 A, B	RWY 02 ILS arrivals from southwest
TR32	RWY 05 Itinerant general aviation arrivals from the southwest
TR33	RWY 23 Itinerant general aviation arrivals from northwest
TR34	RWY 23 Itinerant general aviation arrivals from the south
TR51 A, B, C	Air Taxi helicopter arrivals from northwest
TR52 A, B	Air Taxi helicopter arrivals from southeast
TR53	Air Taxi helicopter arrivals from southeast
TR56	Air Taxi helicopter arrivals from south
TR57	Air Taxi helicopter arrivals from west
TRAINING:	
TR27	RWY 02-20 track for civil and military general aviation aircraft
TR30	RWY 05-23 track for civil and military general aviation aircraft

and the promulgation of FAR Part 161, but it preceded these two final rules (which became effective on September 21, 1991) and the December 1991 amendment to the Act. The major provisions of the stipulation are:

(1) The State would mandate the phased replacement of Stage 2 aircraft by quieter Stage 3 aircraft so long as the cost-benefit analysis required by Federal regulations justified this action.

(2) The State would consider restrictions on nighttime operations of Stage 2 aircraft prior to 2000.

(3) Potential restrictions on Stage 2 aircraft would be accompanied by a cost-benefit analysis prepared by an impartial third party. This analysis would take into consideration aircraft restrictions contained in FAA Advisory Circular 150/5020-1, *Noise Control and Compatibility Planning for Airports.*

(4) The cost-benefit analysis would evaluate a range of possible aircraft restrictions and would devise, evaluate, and (if warranted) select cost-beneficial restrictions on nighttime operations that reduce nighttime aircraft noise to the Stage 3 level.

(5) The cost-benefit analysis would take into consideration likely changes in the level of operations, the type of aircraft, alternatives to nighttime movement of cargo by jet aircraft, and other relevant issues.

(6) The cost-benefit analysis would consider single-event, as well as cumulative, noise levels and other relevant issues.

(7) The State would make a copy of the cost-benefit analysis available to the plaintiffs, accept comments, and make any restrictions that might result from it available for public comment at least six months before their effective date.

(8) The State would begin promulgating a rule implementing cost-beneficial operational restrictions on nighttime operations that would reduce nighttime noise to the level that would occur if Stage 3 aircraft were used.

The Stipulation further provided that the proceedings before the court would be stayed until the State Department of Transportation decides either (*i*) not to initiate rule-making procedures or (*ii*) to initiate rule-making procedures that do not include aircraft restrictions that would reduce nighttime noise to the level that would occur with Stage 3 aircraft. Finally, it stated that the plaintiffs could proceed immediately at their own expense to soundproof their homes sufficiently to reduce the peak SENEL interior aircraft noise resulting from a Stage 2 aircraft operating on Runway 2-20 to the peak SENEL level that would be experienced from a Stage 3 aircraft if the home were not insulated.

The resulting report, entitled *Cost/Benefit Analysis to Alternative Noise Restrictions Kahului Airport*, was published in March 1992. It concluded that restricting nighttime turbojet operations to Stage 3 aircraft was the most cost-beneficial means of achieving the desired goal. More specifically, it found:

> *On the basis of this review, it would appear that the use of Stage 3 aircraft for nighttime air cargo operations would address the issue of noise from these operations without placing undue burden on the airlines or local businesses. In the Stipulation, it states that, if soundproofing were considered, the treatment of structures would need to be sufficient to reduce the indoor noise levels from Stage 2 aircraft to those of Stage 3 aircraft. The replacement of nighttime Stage 2 aircraft with Stage 3 aircraft would achieve this same goal, without any modifications to the structures. The only effect on airlines would be to assign the Stage 3 quick change aircraft already on order to cargo routes serving Kahului, and the potential conversion of future Stage 3 aircraft to the quick change configuration. There would be no effect on local businesses, as they would receive shipments according to current schedules.*

Pursuant to this finding, the State proposed an amendment to Chapter 19-28, *Aircraft Noise Control*, Hawaii Administrative Rules. If approved, the proposed amendment would add a new section to the chapter that would read:

> *No Airplane shall take off or land at Kahului Airport between the hours of 10 p.m. and 6 a.m. as of December 31, 1995 unless it is a stage 3 airplane.*

Because of the possibility that there were procedural inconsistencies in the way the original notice of the proposed amendment was published, a revised notice was published. A public hearing to consider the proposal was held in December 1994, with the public comment period closing on December 31, 1994. Testimony was given at the hearings and in subsequent submittals by both supporters and opponents of the proposed amendment.

The FAA has reviewed the *Cost/Benefit Analysis Related to Alternative Noise Restrictions Kahului Airport*. Following its review, it strongly encouraged the State, in its capacity as airport proprietor, to consider the use of voluntary agreements with the airlines to achieve its noise abatement objectives rather than the mandatory restrictions it had proposed, thereby insuring consistency with the procedural requirements of the Airport Noise and Capacity Act of 1990 (ANCA) as implemented by 14 CFR Part 161. In addition, the FAA expressed concern about the underlying assumption that the State of Hawaii has the authority to implement a local phaseout of Stage 2 aircraft. Finally, the FAA has informed the State that if it wishes to continue its efforts to impose formal restrictions on the use of Stage 2 aircraft at Kahului it must update the cost-benefit analysis and provide a new public notice and opportunity for public comment.

CHAPTER 4
NOISE AND LAND USE COMPATIBILITY STANDARDS

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NOISE AND LAND USE COMPATIBILITY STANDARDS

4.1 NOISE DESCRIPTORS

The noise descriptor currently used by the FAA to relate aircraft noise levels to land use compatibility, and to assess environmental noise in general, is the "Day-Night Average Sound Level" (Ldn). Appendix D contains a glossary describing this and other acoustical descriptors, symbols, and terminology.

The Ldn descriptor is a 24-hour average of instantaneous A-weighted sound levels as read on a standard sound level meter; these readings are normally referred to as "dBA." The maximum A-weighted sound level occurring while an aircraft is flying past a listener (i.e., the maximum sound level from a "single event") is referred to as the "Lmax value." The mathematical product (or integral) of the instantaneous sound level times the duration of the event is known as the "Sound Exposure Level," or Lse. It is analogous to the energy of the time-varying sound levels associated with a single event.

When computing the Ldn, sound levels that occur during the night (defined as the hours between 10:00 PM and 7:00 AM) are increased by 10 decibels (dB) before computing the 24-hour average. Because of the averaging used, Ldn values in urbanized areas typically range between 50 and 75 Ldn. Ldn exposure levels of 55 or less are typical of quiet rural or suburban areas. Ldn exposure levels of 55 to 65 are typical of urbanized areas with medium to high levels of activity and street traffic. Ldn exposure levels above 65 are representative of densely developed urban areas and areas fronting high volume roadways. In comparison, intermittent noise events may have maximum Sound Level Meter readings (Lmax) ranging between 75 and 105 dBA.

4.2 FAA STANDARDS

Table 4-1 presents current FAA standards and acceptability criteria for various land uses exposed to differing levels of environmental noise as measured by the Ldn descriptor (Table 1, FAR 150.101). For the purposes of determining noise acceptability for funding assistance from federal agencies (FHA/HUD and VA), an exterior noise level of 65 Ldn or lower is considered acceptable for all dwelling units (houses and apartments). This standard is applied nationally (U.S. Department of Housing & Urban Development, July 12, 1979).

Table 4-1. FAR Part 150 Recommendations for Land Use Compatibility in Yearly Day-Night Average Sound Levels (Ldn)

TYPE OF LAND USE	Yearly Day-Night Average Sound Level: ≤ 65	65-70	70-75	75-80	80-85	Over 85
RESIDENTIAL:						
Residential (except mobile homes & transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
PUBLIC USE:						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
COMMERCIAL USE:						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale & Retail: (bldg. mater.,hardware, & farm equip.)	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade - general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
MANUFACTURING AND PRODUCTION:						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL USE:						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

Note: Numbers in parentheses refer to the following notes.

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

(2) Measures to achieve NLR 25 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(3) Measures to achieve NLR of 30 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(4) Measures to achieve NLR 35 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(5) Land use compatible provided special sound reinforcement systems are installed.

(6) Residential buildings require a NLR of 25.

(7) Residential buildings require a NLR of 30.

(8) Residential buildings not permitted.

<u>Abbreviations:</u>

Y(Yes) = Land Use and related structures compatible w/o restrictions.

N(No) = Land Use and related structures are not compatible and should be prohibited.

NLR = Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35 = Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structures.

<u>Regulatory Note.</u> The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

Source: FAR Part 150, Appendix A, Table 1. "Land Use Compatibility With Yearly Day-Night Average Sound Levels."

4.3 OTHER NOISE COMPATIBILITY GUIDELINES AND STANDARDS

Because of Hawaii's open architecture, the predominant use of naturally ventilated dwellings (which implies open windows), and the relatively low (nominally 9 dB) outdoor-to-indoor sound attenuation afforded by such structures, an exterior noise level of 65 Ldn does not eliminate all risks of adverse noise impacts in the Hawaiian environment. For these reasons, and as recommended by the U.S. Environmental Protection Agency (March 1974), a lower level of 55 Ldn is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise. The land use compatibility guidelines suggested in ANSI S12.40-1990 (Acoustical Society of America, 1990) incorporate the lower outdoor-to-indoor Noise Level Reduction characteristics of naturally ventilated structures and provide additional weight to extensive outdoor land uses (Figure 4-1.)

Federal agencies, such as FHA/HUD and VA, recognize that exterior noise levels between 55 Ldn and 65 Ldn can have an adverse impact on communities. However, after considering the cost and feasibility of applying the lower level of 55 Ldn, they have selected 65 Ldn as a more appropriate federal regulatory standard.

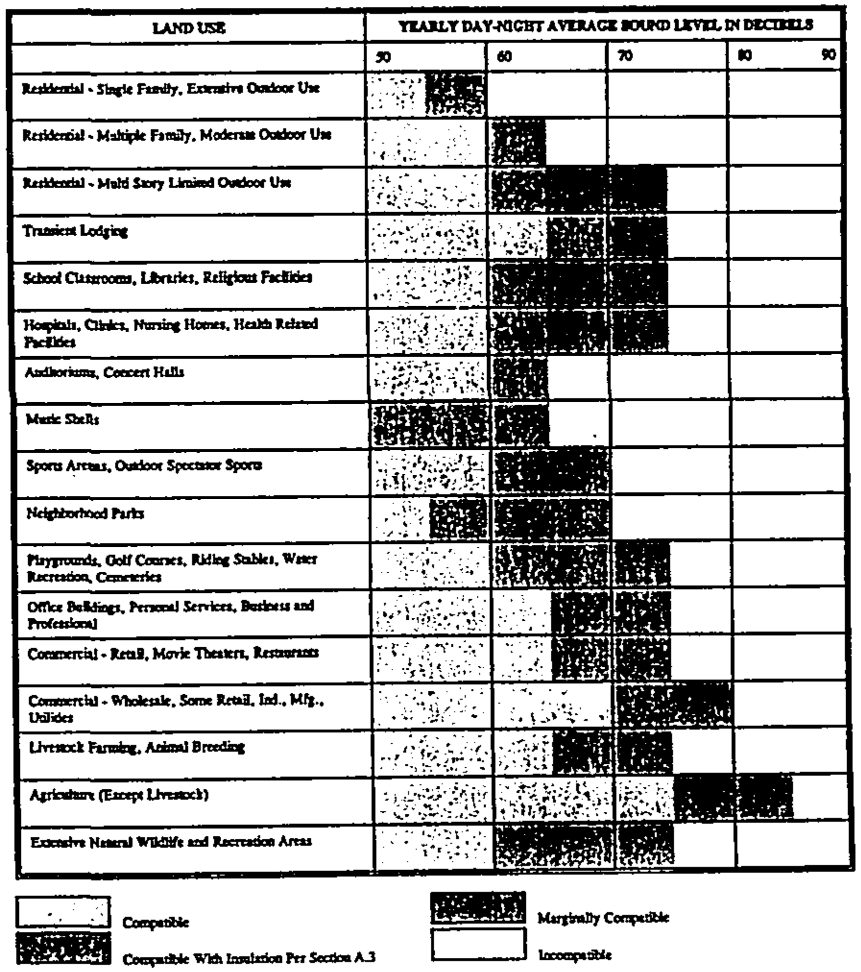
The Hawaii State Department of Health has also established noise regulations; these are contained in Title 11, Chapters 42 and 43, Administrative Rules of the State Department of Health. Chapter 42 governs noise emissions from vehicles (cars, trucks, buses, etc.), while Chapter 43 is aimed at noise from on-site activities. *Neither Chapter is applicable to noise from aircraft or to activities on the Island of Maui.* Chapter 43 limits noise from mechanical equipment on O'ahu to approximately 55 Ldn where they are adjacent to residentially zoned property and to approximately 60 Ldn where they are adjacent to parcels zoned for apartment or hotel use.

Maui County does *not* regulate aircraft noise. In fact, the City & County of Honolulu is the only County in the State that has any general noise regulations. The Honolulu Land Use Ordinance noise standard, which is applicable to all properties where dwellings are permitted, is roughly equivalent to 57 Ldn. Like the State standards *these limits are not applicable to aircraft in flight or to the Island of Maui.*

4.4 AIRPORTS DIVISION POLICY AND RECOMMENDED LAND USE COMPATIBILITY GUIDELINES

After reviewing all available noise compatibility standards, the Airports Division of the Hawaii State Department of Transportation, has concluded that an aircraft noise limit of 60 Ldn should be used as a planning level for noise-sensitive land uses which normally involve naturally ventilated structures (Table 4-2). Applicable uses are dwellings, and public-use structures such as schools, libraries, churches, clinics, and public meeting rooms. This position represents a compromise between the near-zero risk level of 55 Ldn and the significant risk level of 65 Ldn for naturally ventilated structures. [Note that the Airport Division's noise compatibility criteria for other uses are about

Figure 4-1
American National Standards Institute Guidelines for Land Use Compatibility with Yearly Day-Night Average Sound Level at Sites for Buildings as Commonly Constructed



Source: ANSI S12.40-1990.

Table 4-? [illegible] for Local Land Use Compatibility Expressed in Yearly Day-Night Average Sound Levels (Ldn)

TYPE OF LAND USE	Yearly Day-Night Average Sound Level < 60	60-65	65-70	70-75	75-80	80-85
RESIDENTIAL:						
Low density residential, resorts, & hotels (w/ outdoor facl.)	Y(a)	N(b)	N	N	N	N
Low density apartment w/ moderate outdoor use	Y	N(b)	N	N	N	N
High density apartment with limited outdoor use	Y	N(b)	N(b)	N	N	N
Transient lodgings (w/ limited outdoor use)	Y	N(b)	N(b)	N	N	N
PUBLIC USE:						
Schools, day care centers, libraries, and churches	Y	N(c)	N(c)	N(c)	N	N
Hospitals, nursing homes, clinics, and health facilities	Y	Y(d)	Y(d)	Y(d)	N	N
Indoor auditoriums and concert halls	Y(c)	Y(c)	N	N	N	N
Government services and office bldgs. serving the public	Y	Y	Y(d)	Y(d)	N	N
Transportation and parking	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
COMMERCIAL AND GOVERNMENT USE:						
Offices—government, business, and professional	Y	Y	Y(d)	Y(d)	N	N
Wholesale & Retail: bldg. mater., hardware, & heavy equip.	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
Airport businesses—car rental, ticketing, lei stands, etc.	Y	Y	Y(d)	Y(d)	N	N
Retail trade, restaurants, shp. centers, financial institutn. etc.	Y	Y	Y(d)	Y(d)	N	N
Power plants, sewage treatment plants, & base yards	Y	Y	Y(d)	Y(d)	Y(d)	N
Studios w/o outdoor sets, broadcasting & Production facil.	Y(c)	Y(c)	N	N	N	N
MANUFACTURING, PRODUCTION AND STORAGE:						
Manufacturing, general	Y	Y	Y(d)	Y(d)	Y(d)	N
Photographic and optical	Y	Y	Y(d)	Y(d)	N	N
Agriculture (except livestock) and forestry	Y	Y(e)	Y(e)	Y(e)	Y(e)	Y(e)
Livestock farming and breeding	Y	Y(e)	Y(e)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL USE:						
Outdoor sports arenas and spectator sports	Y	Y(f)	Y(f)	N	N	N
Outdoor music shells, amphitheaters	Y(f)	N	N	N	N	N
Nature exhibits and zoos, neighborhood parks	Y	Y	Y	N	N	N
Amusements, beach parks, active playgrounds, etc.	Y	Y	Y	Y	N	N
Public golf courses, riding stables, cemeteries, gardens, etc.	Y	Y	N	N	N	N
Professional/resort sports facil., media event facil., etc.	Y(f)	N	N	N	N	N
Extensive natural wildlife and recreation areas	Y(f)	N	N	N	N	N

Note: Letters in parentheses refer to following notes.

(a) A noise level of 60 Ldn does not eliminate all risks of adverse noise impacts from aircraft noise. However, the 60 Ldn planning level has been selected by the State Airports Division as an appropriate compromise between the minimal risk level of 55 Ldn and the significant risk level of 65 Ldn.

(b) Where the community determines that these uses should be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 Ldn or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure plus air conditioning may be required to provide additional outdoor to indoor NLR, but will not eliminate outdoor noise problems.

(c) Because the Ldn noise descriptor system represents a 24-hour average of individual aircraft noise events, each of which can be unique in respect to amplitude, duration, and tonal content, the NLR requirements should be evaluated for the specific land use, interior acoustical requirements, and properties of the aircraft noise events. NLR requirements should not be based solely upon the exterior Ldn exposure level.

(d) Measures to achieve required NLR must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(e) Residential buildings require NLR. Residential buildings should not be located where exterior noise is greater than 65 Ldn.

(f) Impact of amplitude, duration, frequency, and tonal content of aircraft noise events should be evaluated.

Abbreviations:
Y(Yes) = Land Use and related structures compatible without restrictions.
N(No) = Land Use and related structures are not compatible and should be prohibited.

Source: Airports Division, Department of Transportation, State of Hawaii

five Ldn units lower than the FAR Part 150 standards (see Table 4-1).] It should be noted that the California Land Use Commission applies a criterion similar to that recommended by the Airports Division, suggesting that local jurisdictions use the 60 Ldn contour to establish the Airport's environs.

In conjunction with this determination, the State DOT asked the FAA whether noise mitigation measures in areas subject to noise levels of between 60 and 65 Ldn would be eligible for Federal funding under the Part 150 Noise Compatibility Program. After reviewing the request (including coordination with the Regional Airports Division Office in Los Angeles), the FAA's Honolulu District Office (letter from Mr. David J. Welhouse and Mr. Henry A. Sumida dated December 24, 1986) responded that:

> *"Based upon our review [and specific assumptions cited from FAA noise and land use planning circulars], we have determined that the 60 Ldn noise contour may be included in the five FAR Part 150 studies [including Kahului Airport]. However, a more specific case-by-case review of recommended noise mitigation measures will be required prior to any Federal funding for these proposed measures, especially within the 60 to 65 Ldn contours. These reviews will be accomplished at the time funding is requested for particular mitigation measures.*
>
> *"Our determination considered the technical data contained in the 1981 Honolulu Airport Environs Study, the "open environment" life style of Hawaii, and reduced sound attenuation values of housing structures, as well as the understanding that measures to reduce noise at a site are preferred to those which only protect interior space."*

CHAPTER 5
BASE YEAR (1993) NOISE EXPOSURE

CHAPTER 5
BASE YEAR (1993) NOISE EXPOSURE

5.1 INTEGRATED NOISE MODEL

The regulations governing the preparation of FAR Part 150 Airport Noise Compatibility Program (14 CFR 150, February 6, 1985) require that noise exposure maps be prepared using a noise description method approved by the FAA, usually the Federal Aviation Administration's "Integrated Noise Model" (INM) or an approved equivalent. The INM is a computer model used to show the areas of different noise exposure using continuous noise contours or footprints plotted on maps of the area around the airport. The model's output is based on the inputs of the number, time, type and tracks of flights, and noise characteristics of the aircraft. The use of a model with wide public availability is intended to provide interested parties the opportunity to substantiate the results of the noise modeling.

The FAA requires that the noise be described in the Ldn metric, which is a day-night average A-weighted sound level (Ldn). The Ldn is a cumulative noise exposure metric that averages noise over a 24-hour period. The Ldn metric multiplies the effect of nighttime flights between 10:00 PM and 7:00 AM. Noise Exposure Maps (NEM) produced using the model show continuous contours for the 55, 60, 65, 70, and 75 Ldn levels. They also show which land uses are incompatible with those levels of aircraft noise.

The FAA-approved noise exposure maps for Kahului Airport contained in *Volume 1: Noise Exposure Map Report, Kahului Airport, Kahului, Hawaii* (Belt Collins & Associates, December 1989) were prepared using Version 3.9 of the INM. Version 4.11 of the INM, which is the most recent version available from the FAA, was used for the analyses and maps contained in this report. Differences in the algorithms and other functions built into the model cause Version 4.11 to produce slightly different noise contours than those produced by Version 3.9; these differences are discussed in Appendix E of this report. The analysis presented in that Appendix shows that Version 4.11 of the INM can be used to accurately depict noise from aircraft operations at Kahului Airport.

5.1.1 Model Input

The INM requires the following user inputs:

- lengths and locations of the airport runways;
- airport elevation and average air temperature;

- desired Ldn contour values for output by the model;
- aircraft flight tracks for itinerant and local operations;
- the number of average daily operations on each track by aircraft type and by daytime (7:00 AM to 10:00 PM) and nighttime (10:00 PM to 7:00 AM) periods;
- aircraft takeoff weights and stage lengths;
- noise characteristics of the aircraft;
- engine power levels for landings and takeoffs; and
- the aircraft departure and landing profiles (altitudes versus distance from start-to-roll or stop points) along the ground tracks.

The following optional inputs to the model result in more accurate Noise Exposure Maps:

- aircraft source noise levels versus distance and engine thrust settings;
- schedules of aircraft engine thrust settings versus distance along the ground tracks; and
- additional operational and noise data bases for aircraft types not included in the standard model.

These inputs, including the optional items, were developed for this study using aircraft noise measurements, radar data, visual observations of aircraft over-flights, FAA tower strips, FAA en route strips, air carrier landing reports, and historical weather data. A complete listing of the input data is presented in Appendix F. The methods and assumptions used in their derivation are described in the remainder of this chapter.

Standard takeoff profiles included in the FAA INM Version 4.11 database were used as inputs to the INM for most aircraft. Aircraft approach profiles (as indicated by aircraft altitude display on tower radar) varied from 3 to 5 degrees. Based on an analysis of the radar data collected in 1994, a 4-degree slope was used in modeling both the existing (1993) and forecast (1998) approach noise for air carrier aircraft.

5.1.2 Model Output

Outputs generated by the FAA's INM include:

- a complete and formatted listing of the input assumptions;
- a listing of the noise contour map, which contains the x- and y-coordinate location of the noise contour point and its Ldn value; and
- the area, in square miles, contained within each noise contour.

Supplementary outputs from the model include:

- calculations of Ldn and aircraft sound exposure level at specified locations (or grid points);
- plots of aircraft ground tracks; and
- plots of runways and the Noise Exposure Map.

5.1.3 Model Limitations and Caveat

The FAA INM (like all noise models) includes some generalizations and simplifications. Specifically, it does not account for: (1) excess sound attenuation resulting from site-specific terrain and shielding effects; (2) sound amplification resulting from thermal ducting effects; or (3) the reduced excess sound attenuation resulting from elevated (high-rise) receptors. The Airport Safety and Noise Abatement (ASNA) Act of 1979 mandated that the Department of Transportation use a single number rating system for noise. In response to this mandate, the FAA adopted the Ldn descriptor system. The Ldn descriptor system is a single number representation of noise that occurs during a typical 24-hour day. The Federal Interagency Committee on Noise (FICON) has recently concluded that there are no new descriptors or metrics of sufficient standing to substitute for the present Ldn (DNL) cumulative noise metric. It remains the best available approach for analyzing overall health and welfare impacts for the vast majority of transportation noise analyses.

To insure that the INM accurately models aircraft noise conditions in the vicinity of Kahului Airport, existing noise levels were monitored at 30 nearby locations. The field data from these monitoring stations were then compared with noise estimates generated by the INM. In addition:

- weather and meteorological conditions at Kahului Airport and their impact on aircraft operations and nighttime sound ducting were evaluated;
- the INM outputs were further analyzed to validate the aircraft noise database and operational assumptions and to test the accuracy of the INM under conditions of ground-to-ground propagation and sound ducting; and
- the effect of the nighttime ducting phenomena on the accuracy of the INM's Ldn predictions were also checked.

The results of analyses aimed at validating the INM noise predictions for Kahului Airport are described in Appendix B. They indicate that the aircraft noise contours produced by the INM are reasonably accurate for the Base Year (1993) conditions at the Airport.

5.2 AVERAGE DAY OPERATIONS FOR 1993

Table 5-1 contains a detailed breakdown of average-day operations by aircraft type at Kahului Airport during the 1993 Base Year. The jet aircraft, and particularly the interisland air carrier jet aircraft (B-737 and DC-9), are the most important aircraft from a noise standpoint. This is due to their higher individual noise levels (in 1993, all DC-9s and the majority of B-737s were Stage 2 aircraft), the relatively large number of operations that they made, and the substantial number of operations by these aircraft that occur during the noise-sensitive nighttime period. While small propeller-driven aircraft accounted for as many operations as the air carriers' jets, their individual noise emissions are so much lower that their contribution to the overall noise level is insignificant. C-130 and P-3 propeller aircraft were the most frequent military aircraft users of the airport; however, because they are individually noisier, the military's C-135 and C-20 jet aircraft contributed as much to total noise levels. The data sources used to estimate 1993 operations for each of the major types of operations are described below.

5.2.1 Air Carrier and Commuter/Air Taxi Operations

Airport user landing reports provided by the Airports Division of the State Department of Transportation (DOTA) were used to quantify the annual totals of air carrier and commuter/air taxi aircraft departures and landings by aircraft type categories. This annual estimate was divided by 365 to convert it to average daily operations. The State landing reports, supplemented by data on aircraft fleet mix provided by the airlines,[1] flight strips from the FAA CERAP, and other sources, were used to establish the percentage mix of the various aircraft types. The hourly breakdown to determine the day and night operational split was developed from a variety of sources including: July 1994 Flight Information Display System, Kahului Air Control Tower radar data for July 6 and 11, 1994, DOTA Kahului-Honolulu flight information for July 4, 1993, 1993 Design Day data for Honolulu International Airport to/from Kahului Airport, flight strips from the FAA CERAP, and flight schedules for the air carriers serving the airport (Aloha Airlines, Aloha Island Air, American Airlines, Delta Airlines, Mahalo Airlines, Hawaiian Airlines, and United Airlines).

[1]Because they represent a relatively large proportion of total operations at the airport and involve some of the noisiest aircraft, the fleet mix for the interisland air carriers was particularly important. Hawaiian Airlines indicated that it expected that its fleet in both 1993 and 1998 would consist entirely of Stage 2 DC-9-50 aircraft. Aloha Airlines indicated that its 1993 daytime fleet was 75 percent Stage 2 (B-737-200) and 25 percent Stage 3 (B-737-300 and B-737-400); its nighttime passenger flights were 82 percent Stage 2 and 18 percent Stage 3; and its nighttime cargo flights were 60 percent Stage 2 and 40 percent Stage 3. Aloha's anticipated 1998 fleet mix is reported in Chapter 7.

TABLE 5-1
KAHULUI AIRPORT, PART 150 REPORT, 1993 AVERAGE DAY DEPARTURES

AIR CARRIER DAYTIME	TOTAL DAYTIME DEPART	TOTAL TRADE DEPART	TRADE (88%) RWY 2 TR4	RWY 2 TR2	RWY 2 TR3		TOTAL KONA DEPART	KONA (12%) RWY 20 TR10	RWY 20 TR9	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
DC-10-10	4.56	4.01	2.70	1.31			0.55	0.04	0.18	0.11	0.11	0.11
DC-10-30	0.89	0.78	0.53	0.26			0.11	0.01	0.03	0.02	0.02	0.02
L1011-100	2.02	1.78	1.33	0.44			0.24	0.02	0.06	0.05	0.05	0.05
L1011-250	0.48	0.42	0.32	0.11			0.06	0.00	0.01	0.01	0.01	0.01
B-757-200	0.09	0.08		0.08			0.01		0.01			
DC-8-61/62	0.06	0.05	0.02	0.02	0.02		0.01		0.01			
B-737-200Pax	19.95	17.56	14.69	2.86			2.39	0.24		0.71	0.73	0.71
B-737-200QC	6.63	5.83	4.88	0.95			0.80	0.08		0.24	0.24	0.24
Total INM 737-200	26.58	23.39	19.58	3.81			3.19	0.32		0.95	0.98	0.95
B-737-300Pax	0.00	0.00	0.00	0.00			0.00	0.00		0.00	0.00	0.00
B-737-300QC	4.43	3.90	3.26	0.64			0.53	0.05		0.16	0.16	0.16
Total INM 737-300	4.43	3.90	3.26	0.64			0.53	0.05		0.16	0.16	0.16
B-737-400	4.43	3.90	3.26	0.64			0.53	0.05		0.16	0.16	0.16
DC-9-50	23.67	20.83	18.79	2.04			2.84	0.28		0.84	0.87	0.84
TOTAL DAY:	67.21	59.14	49.79	9.33	0.02	0.00	8.07	0.77	0.31	2.30	2.37	2.30

AIR CARRIER NIGHTTIME	TOTAL NIGHTTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (80%) RWY 2 TR4	RWY 2 TR2			TOTAL KONA DEPARTS	KONA (20%) RWY 20 TR10	RWY 20 TR9	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
DC-10-10	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
DC-10-30	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
L1011-100	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
L1011-250	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
B-757-200	0.18	0.14		0.14			0.04		0.04			
DC-8-61/62	0.00	0.00					0.00		0.00			
B-737-200Pax	0.98	0.78	0.66	0.13			0.20	0.02		0.06	0.06	0.06
B-737-200QC	2.57	2.06	1.73	0.33			0.51	0.05		0.15	0.16	0.15
Total INM 737-200	3.55	2.84	2.39	0.455			0.71	0.07		0.21	0.22	0.21
B-737-300Pax	0.00	0.00	0.00	0.00			0.00	0.00		0.00	0.00	0.00
B-737-300QC	1.72	1.38	1.16	0.22			0.34	0.03		0.10	0.11	0.10
Total INM 737-300	1.72	1.38	1.16	0.22			0.34	0.03		0.10	0.11	0.10
B-737-400	0.22	0.18	0.15	0.03			0.04	0.00		0.01	0.01	0.01
DC-9-50	1.49	1.19	1.08	0.12			0.30	0.03		0.09	0.09	0.09
TOTAL NIGHT:	7.16	5.73	4.77	0.96	0.00	0.00	1.43	0.14	0.04	0.41	0.43	0.41

TABLE 5-1 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1993 AVERAGE DAY DEPARTURES

AIR TAXI/COMMUTER DAYTIME	TOTAL DAYTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (88%) RWY 2 TR3	RWY 2 TR4	RWY 2 TR5	RWY 2 TR6	RWY 2 TR7	RWY 4 TR8	RWY 5 TR11	RWY 5 TR12	TOTAL KONA DEPARTS	KONA (12%) RWY 20 TR9	RWY 20 TR10	RWY 20 TR29	RWY 23 TR13	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
DHC-7	1.22	1.07		0.03		0.03	1.02				0.15			0.07		0.02	0.02	0.02
DC3	0.57	0.50	0.15	0.36							0.07	0.03	0.01			0.00	0.01	0.01
DHC-6	10.08	8.87						2.42	1.61	4.83	1.21	0.22	0.10			0.29	0.29	0.29
Twin Propeller																		
Britten-Norman	2.54	2.24		0.28						1.96	0.30				0.30			
BeechE&H	1.23	1.08		0.14						0.95	0.15				0.15			
Cessna 402	3.75	3.30						0.33	0.17	2.81	0.45				0.45			
Cessna 414A	1.11	0.98		0.10						0.88	0.13				0.13			
Fokker F27	0.90	0.79		0.08						0.71	0.11				0.11			
Shorts 330	0.40	0.35		0.04						0.32	0.05				0.05			
PA-31-350	0.31	0.27		0.03						0.25	0.04				0.04			
P68C Partenavia	0.45	0.40		0.04						0.38	0.05				0.05			
Single Propeller																		
Cessna 152	0.17	0.15						0.01	0.01	0.13	0.02				0.02			
Cessna 208	1.02	0.90						0.09	0.04	0.76	0.12				0.12			
Waco YMF	2.30	2.02						0.20	0.10	1.72	0.28				0.28			
TOTAL DAY:	26.05	22.92	0.15	1.08	0.00	0.03	1.02	3.06	1.93	15.66	3.13	0.25	0.10	0.07	1.70	0.32	0.33	0.33

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DHC-7	0.00	0.00		0.00		0.00	0.00				0.00		0.00	0.00		0.00	0.00	0.00
DC3	0.00	0.00	0.00	0.00							0.00	0.000	0.00			0.00	0.00	0.00
DHC-6	3.40	2.72						0.74	0.50	1.48	0.68	0.12	0.06			0.17	0.17	0.17
Twin Propeller																		
Britten-Norman	0.88	0.70		0.09						0.62	0.18				0.18			
BeechE&H	0.42	0.34		0.04						0.29	0.08				0.08			
Cessna 402	1.29	1.03						0.10	0.05	0.88	0.26				0.26			
Cessna 414A	0.38	0.30		0.03						0.27	0.08				0.08			
Fokker F27	0.31	0.25		0.02						0.22	0.06				0.06			
Shorts 330	0.14	0.11		0.01						0.10	0.03				0.03			
PA-31-350	0.11	0.09		0.01						0.08	0.02				0.02			
P68C Partenavia	0.15	0.12		0.01						0.11	0.03				0.03			
Single Propeller																		
Cessna 152	0.03	0.02						0.00	0.00	0.02	0.01				0.01			
Cessna 208	0.17	0.14						0.01	0.01	0.12	0.03				0.03			
Waco YMF	0.38	0.30						0.03	0.02	0.28	0.08				0.08			
TOTAL NIGHT:	7.66	6.13	0.00	0.22	0.00	0.00	0.00	0.89	0.57	4.45	1.53	0.12	0.06	0.00	0.85	0.17	0.17	0.17

TABLE 8-1 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1993 AVERAGE DAY DEPARTURES

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AS350 AStar	47.38		2.37	4.74	2.37	7.11	14.21	7.11	9.48	
Bell206B	25.45		1.27	2.55	1.27	3.82	7.64	3.82	5.09	
Hughes 500	15.15		0.76	1.52	0.76	2.27	4.55	2.27	3.03	
MD-369D	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	
R22Beta	0.09		0.00	0.01	0.00	0.01	0.03	0.01	0.02	
H500D	5.50		0.28	0.55	0.28	0.83	1.65	0.83	1.10	
TOTAL DAY:	93.57		4.40	8.81	4.40	13.21	26.42	13.21	17.61	

[illegible] HELICOPTERS [illegible] NIGHTTIME [illegible]	TOTAL NIGHTTIME DEPARTS	[illegible]	[illegible] TR56X	[illegible]	[illegible]	[illegible]	RWY 3R TR54B	RWY 3R TR54C	RWY 3R TR55	[illegible]
AS350 AStar	0.48		0.02	0.05	0.02	0.07	0.14	0.07	0.10	
Bell206B	0.26		0.01	0.03	0.01	0.04	0.08	0.04	0.05	
Hughes 500	0.15		0.01	0.02	0.01	0.02	0.05	0.02	0.03	
MD-369D	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	
R22Beta	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	
H500D	0.09		0.00	0.01	0.00	0.01	0.03	0.01	0.02	
TOTAL NIGHT:	0.98		0.04	0.09	0.04	0.13	0.27	0.13	0.18	

GENERAL AVIATION [illegible] DAYTIME [illegible]	TOTAL DAYTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE [illegible] TR11	[illegible]	[illegible] TR12	RWY 6 TR12	[illegible]	TOTAL KONA DEPARTS	KONA (12%) RWY 23 TR13	[illegible]
Fix-Wing Piston										
Twin Propeller										
BEC58P	1.70	1.50				1.50		0.20	0.20	
Single Propeller										
GASEPV	3.17	2.79				2.79		0.38	0.38	
GASEPF	6.46	5.68				5.68		0.78	0.78	
Fix-Wing Turbine										
CNA441	2.27	2.00		0.20	0.10	1.70		0.27	0.27	
Jets:										
Challenger 601	0.16	0.14	0.01			0.13		0.02	0.02	
Gulfstream	0.48	0.42	0.03			0.39		0.06	0.06	
Falcon 900	0.11	0.10	0.01			0.09		0.01	0.01	
TOTAL DAY:	14.35	12.63	0.05	0.20	0.10	12.28		1.72	1.72	

GENERAL AVIATION [illegible] NIGHTTIME [illegible]	TOTAL NIGHTTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (80%) [illegible]	[illegible]	[illegible] TR11	RWY 6 TR12	[illegible]	TOTAL KONA DEPARTS	KONA (20%) RWY 23 TR13	[illegible]
Fix-Wing Piston										
Twin Propeller										
BEC58P	0.07	0.06				0.06		0.01	0.01	
Single Propeller										
GASEPV	0.14	0.11				0.11		0.02	0.02	
GASEPF	0.28	0.22				0.22		0.03	0.03	
Fix-Wing Turbine										
CNA441	0.10	0.08		0.01	0.00	0.07		0.01	0.01	
Jets:										
Challenger 601	0.01	0.01	0.00			0.01		0.00	0.00	
Gulfstream	0.02	0.02	0.00			0.01		0.00	0.00	
Falcon 900	0.00	0.00	0.00			0.00		0.00	0.00	
TOTAL NIGHT:	0.62	0.50	0.00	0.01	0.00	0.48		0.07	0.07	

TABLE 8-1 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1993 AVERAGE DAY DEPARTURES

TOUCH AND GO (DEPARTURES) DAYTIME	TOTAL TOUCH & GOS	[illegible]	RWY 2 TR30									
Single Propeller												
GASEPV	8.16		8.16									
GASEPF	16.61		16.61									
Twin Propeller												
BEC58P	4.37		4.37									
TOTAL DAY	29.14		29.14									

TOUCH AND GO (DEPARTURES) NIGHTTIME	TOTAL TOUCH & GOS	[illegible]	RWY 2 TR30									
Single Propeller												
GASEPV	0.35		0.35									
GASEPF	0.71		0.71									
Twin Propeller												
BEC58P	0.19		0.19									
TOTAL NIGHT	1.25		1.25									

MILITARY DAYTIME	TOTAL DAYTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (80%) RWY 2 TR3	RWY 2 TR4	RWY 2 TR2	RWY 2 TR27	TOTAL KONA DEPARTS	KONA (12%) RWY 20 TR9	RWY 20 TR10	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
C-130	1.38	1.21	0.19	0.45		0.56	0.17	0.08	0.01	0.02	0.03	0.02
P-3	1.95	1.72	0.28	0.64	0.80		0.23	0.12	0.01	0.03	0.04	0.03
C-135	0.67	0.59	0.09	0.23	0.27		0.08	0.04	0.00	0.01	0.01	0.01
C-12	0.03	0.03	0.00	0.01		0.01	0.00	0.00	0.00	0.00	0.00	0.00
C-20	0.03	0.03	0.01	0.01	0.01		0.00	0.00	0.00	0.00	0.00	0.00
C-26	0.27	0.24	0.04	0.09		0.11	0.03	0.02	0.00	0.00	0.00	0.00
HH-65	0.73	0.64	0.10	0.24		0.30	0.09	0.04	0.00	0.01	0.01	0.01
SH-60	0.27	0.24	0.04	0.09		0.11	0.03	0.01	0.00	0.00	0.00	0.00
UH-1V	0.40	0.35	0.06	0.13		0.16	0.05	0.02	0.00	0.01	0.01	0.01
CH-53	0.02	0.02	0.00	0.01		0.01	0.00	0.00	0.00	0.00	0.00	0.00
AH-1	0.33	0.29	0.05	0.11		0.14	0.04	0.02	0.00	0.01	0.01	0.01
UH-1	0.27	0.24	0.04	0.09		0.11	0.03	0.01	0.00	0.00	0.00	0.00
UH-60	0.66	0.58	0.09	0.22		0.27	0.08	0.04	0.00	0.01	0.01	0.01
OH-58	0.89	0.78	0.13	0.29		0.36	0.11	0.05	0.01	0.02	0.02	0.02
CH-47D	0.30	0.26	0.04	0.10		0.12	0.04	0.02	0.00	0.01	0.01	0.01
TOTAL INM CH47	3.87	3.41	0.54	1.28		1.58	0.46	0.21	0.02	0.07	0.07	0.07
TOTAL DAY:	8.20	7.22	1.15	2.71	1.08	2.28	0.98	0.47	0.05	0.15	0.15	0.15

MILITARY NIGHTTIME	TOTAL NIGHTTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (80%) RWY 2 TR3	RWY 2 TR4	RWY 2 TR2	RWY 2 TR27	TOTAL KONA DEPARTS	KONA (20%) RWY 20 TR9	RWY 20 TR10	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
C-130	0.02	0.02	0.00	0.01		0.01	0.00	0.00	0.00	0.00	0.00	0.00
P-3	0.03	0.02	0.00	0.01	0.01		0.01	0.00	0.00	0.00	0.00	0.00
C-135	0.01	0.01	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
C-12	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-20	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
C-26	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH-65	0.01	0.01	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
SH-60	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
UH-1V	0.01	0.01	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
CH-53	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
AH-1	0.01	0.01	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
UH-1	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
UH-60	0.01	0.01	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
OH-58	0.01	0.01	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
CH-47D	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00
TOTAL INM CH47	0.05	0.04	0.01	0.02	0.00		0.01	0.00	0.00	0.00	0.00	0.00
TOTAL NIGHT:	0.11	0.09	0.01	0.03	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00

TABLE 5-1 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1993 AVERAGE DAY ARRIVALS

[illegible]	TOTAL DAYTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (80%) RWY 2 TR15A	RWY 2 TR15B	RWY 2 TR15C	RWY 2 TR17A	RWY 2 TR17B	RWY 2 TR17C	RWY 2 TR20A	RWY 2 TR20B	RWY 5 TR21	RWY 2 TR18	RWY 2 TR19	TOTAL KONA LANDING	KONA (20%) RWY20 TR1R	RWY20 TR2D
DC-10-10	4.56	4.01	0.50	1.00	0.50				1.00	1.00				0.55	0.27	0.27
DC-10-30	0.89	0.78	0.10	0.20	0.10				0.20	0.20				0.11	0.05	0.05
L1011-100	2.02	1.78	0.39	0.78	0.39				0.11	0.11				0.24	0.21	0.03
L1011-250	0.48	0.42	0.09	0.18	0.09				0.03	0.03				0.06	0.05	0.01
B-757-200	0.09	0.08	0.02	0.04	0.02									0.01	0.01	
DC-8-61/62	0.06	0.06		0.01								0.04		0.00		
B-737-200Pax	19.95	17.56				0.69	1.37	0.69	7.35	7.35			0.11	2.39	0.39	2.00
B-737-200QC	6.63	5.83				0.23	0.46	0.23	2.44	2.44			0.04	0.80	0.13	0.67
Total INM 737-200	26.58	23.39				0.92	1.83	0.92	9.79	9.79			0.15	3.19	0.52	2.67
B-737-300Pax	0.00	0.00				0.00	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00
B-737-300QC	4.43	3.90				0.15	0.31	0.15	1.63	1.63			0.03	0.53	0.09	0.44
Total INM 737-300	4.43	3.90				0.15	0.31	0.15	1.63	1.63			0.03	0.53	0.09	0.44
B-737-400	4.43	3.90				0.15	0.31	0.15	1.63	1.63			0.03	0.53	0.09	0.44
DC-9-50	23.67	20.83				0.52	1.03	0.52	9.31	9.31			0.13	2.84	0.28	2.56
TOTAL DAY:	67.21	59.15	1.10	2.21	1.10	1.74	3.48	1.74	23.71	23.71		0.04	0.33	8.06	1.58	6.48

AIR CARRIER NIGHTTIME	TOTAL DAYTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (80%) RWY 2 TR15A	RWY 2 TR15B	RWY 2 TR15C	RWY 2 TR17A	RWY 2 TR17B	RWY 2 TR17C	RWY 2 TR20A	RWY 2 TR20B	RWY 5 TR21	RWY 2 TR18	RWY 2 TR19	TOTAL KONA LANDING	KONA (20%) RWY20 TR1R	RWY20 TR2D
DC-10-10	0.00	0.00												0.00	0.00	
DC-10-30	0.00	0.00												0.00	0.00	
L1011-100	0.00	0.00												0.00	0.00	
L1011-250	0.00	0.00												0.00	0.00	
B-757-200	0.18	0.14	0.04	0.07	0.03									0.04	0.04	
DC-8-61/62	0.00	0.00												0.00		
B-737-200Pax	0.98	0.78				0.03	0.06	0.03	0.33	0.33	0.00		0.00	0.20	0.03	0.16
B-737-200QC	2.57	2.06				0.08	0.16	0.08	0.83	0.83	0.05		0.01	0.51	0.08	0.43
Total INM 737-200	3.55	2.84				0.11	0.23	0.11	1.16	1.16	0.05		0.02	0.71	0.12	0.59
B-737-300Pax	0.00	0.00				0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
B-737-300QC	1.72	1.38				0.05	0.11	0.05	0.55	0.55	0.05		0.01	0.34	0.06	0.29
Total INM 737-300	1.72	1.38				0.05	0.11	0.05	0.55	0.55	0.05		0.01	0.34	0.06	0.29
B-737-400	0.22	0.18				0.01	0.01	0.01	0.07	0.07	0.00		0.00	0.04	0.01	0.04
DC-9-50	1.49	1.19				0.03	0.06	0.03	0.53	0.53			0.01	0.30	0.03	0.27
TOTAL NIGHT:	7.16	5.73	0.04	0.07	0.03	0.20	0.41	0.20	2.32	2.32	0.10		0.03	1.43	0.25	1.19

TABLE 5-1 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1993 AVERAGE DAY ARRIVALS

AIR TAXI/COMM DAYTIME	TOTAL DAYTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (88%) RWY 2 TR15A	RWY 2 TR15B	RWY 2 TR15C	RWY 2 TR17A	RWY 2 TR17B	RWY 2 TR17C	RWY 2 TR18	RWY 2 TR26A	RWY2 TR26B	RWY 6 TR22	RWY 8 TR23	RWY2 TR19	RWY5 TR22	TOTAL KONA LANDING	KONA (12%) RWY20 TR1R	RWY 20 TR20	RWY 23 TR24	RWY 2 TR33	RWY 23 TR34
DHC-7	1.22	1.07				0.08	0.17	0.08	0.24	0.14	0.14	0.23				0.15	0.08	0.07			
DC3	0.57	0.50				0.02	0.03	0.015		0.22	0.22					0.07	0.03	0.03			
DHC-6	10.08	8.87	0.02	0.04	0.02				0.24	0.06	0.06	4.59	1.53		2.30	1.21			0.22	0.68	0.33
Twin Propeller																					
Brittan-Norman	2.54	2.24										0.11	0.11	2.01		0.30			0.30		
BeechE&H	1.23	1.08										0.05	0.05	0.97		0.15			0.15		
Cessna 402	3.75	3.30								0.17	0.17	2.97				0.45			0.45		
Cessna 414A	1.11	0.98										0.44	0.05	0.49		0.13			0.13		
Fokker F27	0.90	0.79										0.38	0.04	0.40		0.11			0.11		
Shorts 330	0.40	0.35										0.16	0.02	0.18		0.05			0.05		
PA-31-350	0.31	0.27										0.12	0.01	0.14		0.04			0.04		
P68C Partenavia	0.45	0.40										0.18	0.02	0.20		0.05			0.05		
Single Propeller																					
Cessna 152	0.17	0.15								0.01	0.01	0.13				0.02			0.02		
Cessna 208	1.02	0.90								0.04	0.04	0.81				0.12			0.12		
Waco YMF	2.30	2.02								0.10	0.10	1.82				0.28			0.28		
TOTAL DAY:	28.05	22.92	0.02	0.04	0.02	0.10	0.20	0.10	0.48	0.74	0.74	11.97	1.84	4.38	2.30	3.13	0.11	0.10	1.92	0.68	0.33

AIR TAXI/COMM NIGHTTIME	TOTAL NIGHTTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (80%) RWY 2 TR15A	RWY 2 TR15B	RWY 2 TR15C	RWY 2 TR17A	RWY 2 TR17B	RWY 2 TR17C	RWY 2 TR18	RWY 2 TR26A	RWY 2 TR26B	RWY 6 TR22	RWY 8 TR 23	RWY2 TR19	RWY5 TR22	TOTAL KONA LANDING	KONA (20%) RWY20 TR1R	RWY 20 TR20	RWY 23 TR24	RWY 2 TR33	RWY 23 TR 34
DHC-7	0.00	0.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00				0.00		0.00			
DC3	0.00	0.00				0.00	0.00	0.00		0.00	0.00					0.00		0.00			
DHC-6	3.40	2.72	0.01	0.01	0.01				0.07	0.02	0.02	1.41	0.47		0.71	0.68			0.12	0.37	0.19
Twin Propeller																					
Brittan-Norman	0.88	0.70										0.04	0.04	0.63		0.18			0.18		
BeechE&H	0.42	0.34										0.02	0.02	0.30		0.08			0.08		
Cessna 402	1.29	1.03								0.05	0.05	0.93				0.26			0.26		
Cessna 414A	0.38	0.30										0.14	0.02	0.15		0.08			0.08		
Fokker F27	0.31	0.25										0.11	0.01	0.12		0.06			0.06		
Shorts 330	0.14	0.11										0.05	0.01	0.06		0.03			0.03		
PA-31-350	0.11	0.09										0.04	0.00	0.04		0.02			0.02		
P68C Partenavia	0.15	0.12										0.05	0.01	0.06		0.03			0.03		
Single Propeller																					
Cessna 152	0.03	0.02								0.00	0.00	0.02				0.01			0.01		
Cessna 208	0.17	0.14								0.01	0.01	0.12				0.03			0.03		
Waco YMF	0.38	0.30								0.02	0.02	0.27				0.08			0.08		
TOTAL NIGHT:	7.66	6.13	0.01	0.01	0.01	0.00	0.00	0.00	0.07	0.09	0.09	3.20	0.57	1.37	0.71	1.53	0.00	0.00	0.98	0.37	0.19

TABLE 8-1 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1993 AVERAGE DAY ARRIVALS

[illegible] DAYTIME	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
AS350 AStar	47.72		2.39	4.77	2.39	14.35	14.21	4.79	2.39	2.39	
Bell206B	25.63		1.28	2.56	1.28	7.72	7.64	2.58	1.28	1.28	
Hughes 500	15.30		0.77	1.53	0.77	4.61	4.61	1.54	0.77	0.77	
MD-369D	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
R22Beta	0.09		0.00	0.01	0.00	0.03	0.03	0.01	0.00	0.00	
H500D	5.48		0.27	0.55	0.27	1.64	1.64	0.55	0.27	0.27	
TOTAL DAY:	94.22		4.71	9.42	4.71	28.35	28.13	9.47	4.71	4.71	

[illegible] NIGHTTIME	[illegible]	[illegible]	RWY [illegible] TR51A	RWY [illegible] TR51B	RWY [illegible] TR51C	RWY [illegible] TR52A	RWY [illegible] TR52B				
AS350 AStar	0.14						0.14				
Bell206B	0.08						0.08				
Hughes 500	0.00										
MD-369D	0.00										
R22Beta	0.00										
H500D	0.00										
TOTAL NIGHT:	0.22		0.00	0.00	0.00	0.00	0.22				

[illegible] DAYTIME	[illegible] DAYTIME LANDINGS	TOTAL TRADE LANDINGS	RWY 2 [illegible]	RWY 2 [illegible]	RWY 2 [illegible]	RWY 5 [illegible]	RWY 5 [illegible]		TOTAL KONA LANDING	KONA RWY 23 TR24	
Fix-Wing Piston											
Twin Propeller											
BEC58P	1.70	1.50	1.35			0.07	0.07		0.20	0.20	
Single Propeller											
GASEPV	3.17	2.79	1.39			1.26	0.14		0.38	0.38	
GASEPF	6.45	5.68	2.84			2.56	0.28		0.78	0.77	
Fix-Wing Turbine											
CNA441	2.27	2.00		0.10	0.10	1.80			0.27	0.27	
Jets:											
Challenger 601	0.16	0.14	0.07			0.06	0.01		0.02	0.02	
Gulfstream	0.48	0.42	0.21			0.18	0.03		0.06	0.06	
Falcon 900	0.11	0.10	0.05			0.04	0.01		0.01	0.01	
TOTAL DAY:	14.35	12.63	5.91	0.10	0.10	5.97	0.54		1.72	1.72	

[illegible] NIGHTTIME	[illegible] NIGHTTIME LANDINGS	TOTAL TRADE LANDINGS	RWY 2 [illegible]	RWY 2 [illegible]	RWY 2 [illegible]	RWY 5 [illegible]	RWY 5 [illegible]		TOTAL KONA LANDING	KONA RWY 23 TR24	
Fix-Wing Piston											
Twin Propeller											
BEC58P	0.07	0.06	0.05			0.00	0.00		0.01	0.01	
Single Propeller											
GASEPV	0.14	0.11	0.06			0.05	0.01		0.03	0.03	
GASEPF	0.28	0.22	0.11			0.10	0.01		0.05	0.06	
Fix-Wing Turbine											
CNA441	0.10	0.08		0.00	0.00	0.07			0.02	0.02	
Jets:											
Challenger 601	0.01	0.01	0.00			0.00	0.00		0.00	0.00	
Gulfstream	0.02	0.02	0.01			0.01	0.00		0.00	0.00	
Falcon 900	0.00	0.00	0.00			0.00	0.00		0.00	0.00	
TOTAL NIGHT:	0.62	0.50	0.23	0.00	0.00	0.24	0.02		0.12	0.12	

TABLE 8-1 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1993 AVERAGE DAY ARRIVALS

TOUCH AND GO (ARRIVALS) DAYTIME	TOTAL TOUCH AND GOS	[illegible]	RWY [illegible] TR[illegible]									
Single Propeller												
GASEPV	8.16		8.16									
GASEPF	16.61		16.61									
Twin Propeller												
BEC58P	4.37		4.37									
TOTAL DAY	29.14		29.14									

TOUCH AND GO (ARRIVALS) NIGHTTIME	TOTAL TOUCH AND GOS		RWY [illegible] TR[illegible]									
Single Propeller												
GASEPV	0.35		0.35									
GASEPF	0.71		0.71									
Twin Propeller												
BEC58P	0.19		0.19									
TOTAL NIGHT	1.25		1.25									

MILITARY DAYTIME	TOTAL DAYTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE [illegible]: RWY 2 TR17A	RWY 2 TR17B	RWY 2 TR17C	RWY 2 TR7	RWY 2 TR8A	RWY 2 TR8B	RWY 2 TR[illegible]	TOTAL KONA LANDING	KONA [illegible]: RWY 20 TR[illegible]	RWY 20 TR[illegible]
C-130	1.38	1.21	0.02	0.04	0.02	0.56	0.29	0.29		0.17	0.09	0.08
P-3	1.95	1.72	0.03	0.05	0.03		0.40	0.40	0.80	0.23	0.12	0.11
C-135	0.67	0.59	0.01	0.02	0.01		0.14	0.14	0.27	0.08	0.04	0.04
C-12	0.03	0.03	0.00	0.00	0.00	0.01	0.01	0.01		0.00	0.00	0.00
C-20	0.03	0.03					0.01	0.01		0.00	0.00	0.00
C-26	0.27	0.24	0.00	0.01	0.00	0.11	0.06	0.06		0.03	0.02	0.02
HH-65	0.73	0.64	0.01	0.02	0.01	0.30	0.15	0.15		0.09	0.05	0.04
SH-60	0.27	0.24	0.00	0.01	0.00	0.11	0.06	0.06		0.03	0.02	0.01
UH-1V	0.40	0.35	0.01	0.01	0.01	0.16	0.08	0.08		0.05	0.03	0.02
CH-53	0.02	0.02	0.00	0.00	0.00	0.01	0.00	0.00		0.00	0.00	0.00
AH-1	0.33	0.29	0.00	0.01	0.00	0.14	0.07	0.07		0.04	0.02	0.02
UH-1	0.27	0.24	0.00	0.01	0.00	0.11	0.06	0.06		0.03	0.02	0.01
UH-60	0.68	0.58	0.01	0.02	0.01	0.27	0.14	0.14		0.08	0.04	0.04
OH-58	0.89	0.78	0.01	0.02	0.01	0.36	0.18	0.18		0.11	0.06	0.05
CH-47D	0.30	0.26	0.00	0.01	0.00	0.12	0.06	0.06		0.04	0.02	0.02
TOTAL INM CH47	3.87	3.41	0.05	0.11	0.05	1.59	0.80	0.80			0.25	0.21
TOTAL DAY:	8.20	7.22	0.12	0.23	0.12	2.27	1.70	1.70	1.07	0.98	0.52	0.46

MILITARY NIGHTTIME	TOTAL NIGHTTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE [illegible]: RWY 2 TR17A	RWY 2 TR17B	RWY 2 TR17C	RWY 2 TR7	RWY 2 TR8A	RWY 2 TR8B	RWY 2 TR[illegible]	TOTAL KONA LANDING	KONA [illegible]: RWY 20 TR[illegible]	RWY 20 TR[illegible]
C-130	0.02	0.02	0.00	0.00	0.00	0.01	0.00	0.00		0.00	0.00	0.00
P-3	0.03	0.02	0.00	0.00	0.00		0.01	0.01	0.01	0.01	0.00	0.00
C-135	0.01	0.01	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
C-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
C-20	0.00	0.00					0.00	0.00		0.00	0.00	0.00
C-26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
HH-65	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
SH-60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
UH-1V	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
CH-53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
AH-1	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
UH-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
UH-60	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
OH-58	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
CH-47D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
TOTAL INM CH 47	0.05	0.04	0.00	0.00	0.00	0.02	0.01	0.01				
TOTAL NIGHT:	0.11	0.09	0.00	0.00	0.00	0.03	0.02	0.02	0.01	0.02	0.01	0.01

5.2.2 Military and General Aviation Operations

Kahului Tower counts of itinerant and local military aircraft were used to quantify the number of military and general aviation aircraft operations on an annual basis. Data provided by U.S. Commander-In-Chief Pacific (USCINCPAC) (February 11, 1994) were used to establish the mix of military aircraft. These estimates of aircraft mix were validated by comparing them with randomly selected FAA enroute strips from July through mid-November 1994. The number of military aircraft operations, particularly by the nosier jet aircraft, was relatively low.

The total numbers of General Aviation aircraft by aircraft category (including helicopters) was extracted from the *Draft Maui General Aviation Study, Interim Report Number 3, Aviation Demand Study*, dated September 2, 1994. Because detailed 1993 information was unavailable, the hourly breakdown to determine the day and night operational split was based on data from the Kahului Tower counts from May 1 through 19, 1994 and on Maui Air Traffic Control Tower data from July 6 and 11, 1994. The hourly breakdown during this period is believed to be representative of the 1993 Base Year.

5.2.3 Runway Use Frequency

The frequency with which each of the runways is used is a function of the wind patterns, the length and orientation of the different runways, the runway length needs of the various types of aircraft that use the airport, and air traffic factors. The derivation of the runway use frequencies used in the modeling is summarized below.

Daytime and nighttime wind conditions at Kahului Airport were determined during preparation of the *Volume I: Noise Exposure Map Report, Kahului Airport* and analyzed to establish runway use frequencies for daytime and nighttime periods. The analysis was performed with the assistance of a professional meteorologist using hourly tabulations of daytime and nighttime wind data from the National Weather Service (August 1976 to September 1981). Tabulation of wind speeds and alignment with Runway 2-20 were performed separately for the daytime and nighttime periods in order to estimate the relative frequency of trade and Kona wind traffic patterns at Kahului Airport.

The results of the daytime and nighttime wind analysis indicate that runway use frequencies at Kahului Airport are as follows:

- During the daytime and evening (i.e., between 7:00 AM and 10:00 PM), the tradewind (north flow) and Kona (south flow) traffic pattern frequencies were approximately 88 percent and 12 percent, respectively. The daytime hours are characterized as having a high (65 percent) probability of occurrence of strong northeasterly tradewinds with a relatively low (4 percent) probability of occurrence of strong south winds.

- During the nighttime (10:00 PM to 7:00 AM), the trade and Kona traffic pattern frequencies were approximately 80 percent and 20 percent, respectively. The nighttime hours have a high (48 percent) probability of low (less than 6 knots) wind speeds from the north and south; there is a very low (1 percent) probability of strong south winds.

When trade winds prevail at the airport, aircraft use Runways 2 and 5; Runways 20 and 23 are used under Kona wind conditions. Within a given wind regime (trade wind or Kona), the choice of runways depends upon the type of aircraft (e.g., overseas or interisland jet air carrier aircraft), the aircraft's origin (for arrivals) or destination (for departures), the amount of other air traffic that is present, and other lesser factors. Runway assignments for each type of aircraft under each wind regime were estimated using data from schedules, interviews with air traffic controllers and pilots, and field observations. In general, the air carrier aircraft that are the primary source of aircraft noise at Kahului Airport use Runways 2 and 20.

5.3 BASE YEAR NOISE EXPOSURE (1993)

The 1993 Base Year Noise Exposure Map for Kahului Airport generated using INM Version 4.11 and the input data described previously is presented in Figure 5-1. It shows aircraft noise contours in the vicinity of the airport ranging from 55 Ldn to 75 Ldn. In addition, it identifies each incompatible land use in each area depicted on the map. In addition to the noise contours and incompatible land uses, the maps identify runway locations, the airport boundaries, and the location of noise-sensitive public buildings. An estimate of the number of people within the 55, 60, 65, 70, and 75 Ldn contours are included in this section. The location of the noise monitoring stations relative to the noise contours are shown as well. A detailed discussion of the results of the noise measurements and analyses undertaken to validate the analysis is contained in Appendix E.

Calculated 1993 average day-night noise levels at the monitoring sites around the airport are summarized in Table 5-2. They were obtained using the grid-output module of the INM. As discussed more fully below and in the description of the steps taken to insure the model's accuracy in Appendix E, the computed "Total Ldn" at each noise monitoring site was essentially equal to (and dominated by) the noise generated by airborne aircraft rather than by the rearward "start-to-roll" noise generated by aircraft starting their takeoff runs (see Table 5-7). This is significant because it means that ground-based measures designed to shield noise-sensitive uses from aircraft noise would not reduce noise exposure significantly.

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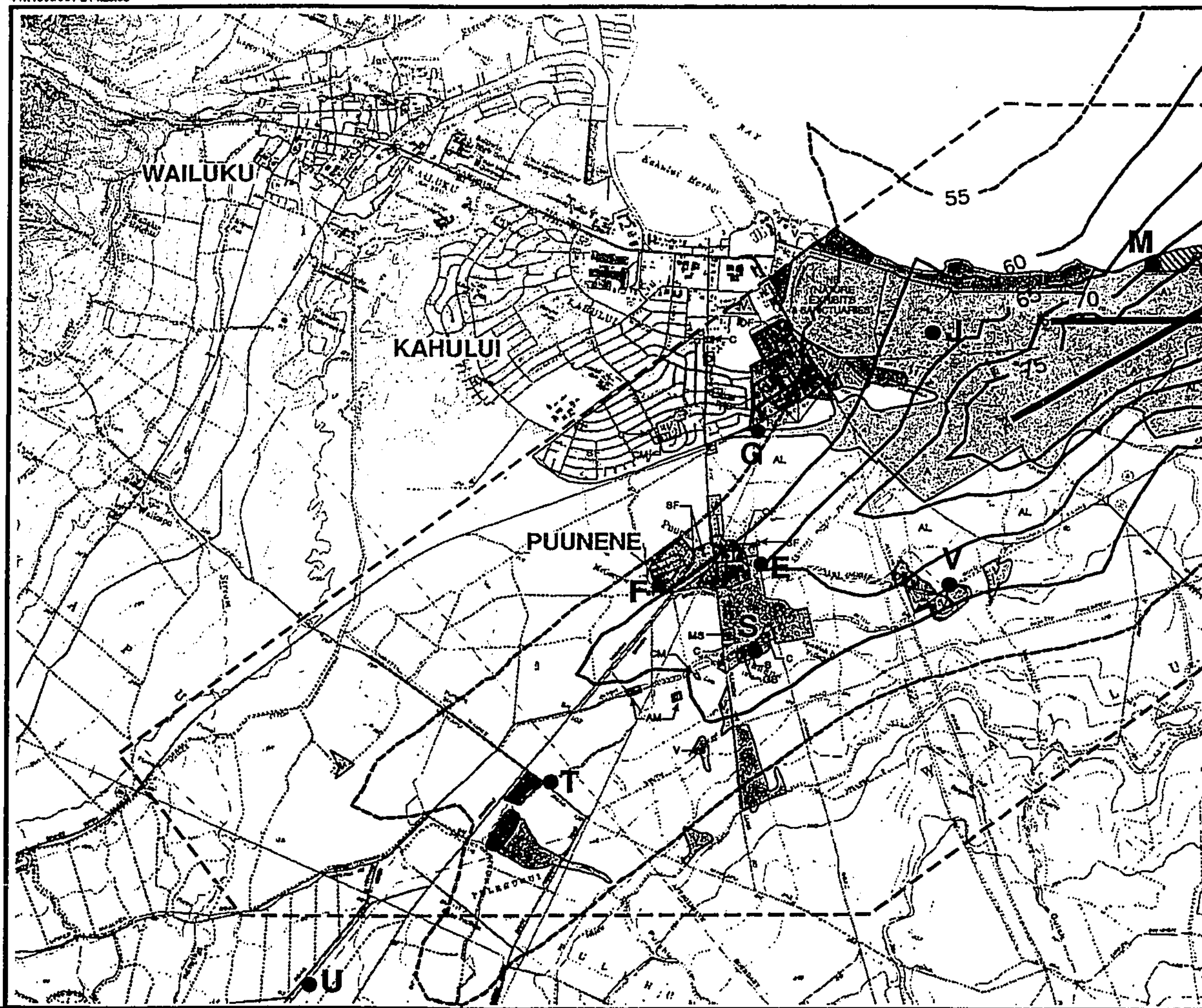


KAHULUI AIRPORT
FAR Part 150 Airport Noise Compatibility Program

Prepared For:
Airports Division
Department of Transportation
State of Hawaii

Prepared By:
Belt Collins Hawaii
Y. Ebisu & Associates
1995

LAND USE CLASSIFICATION

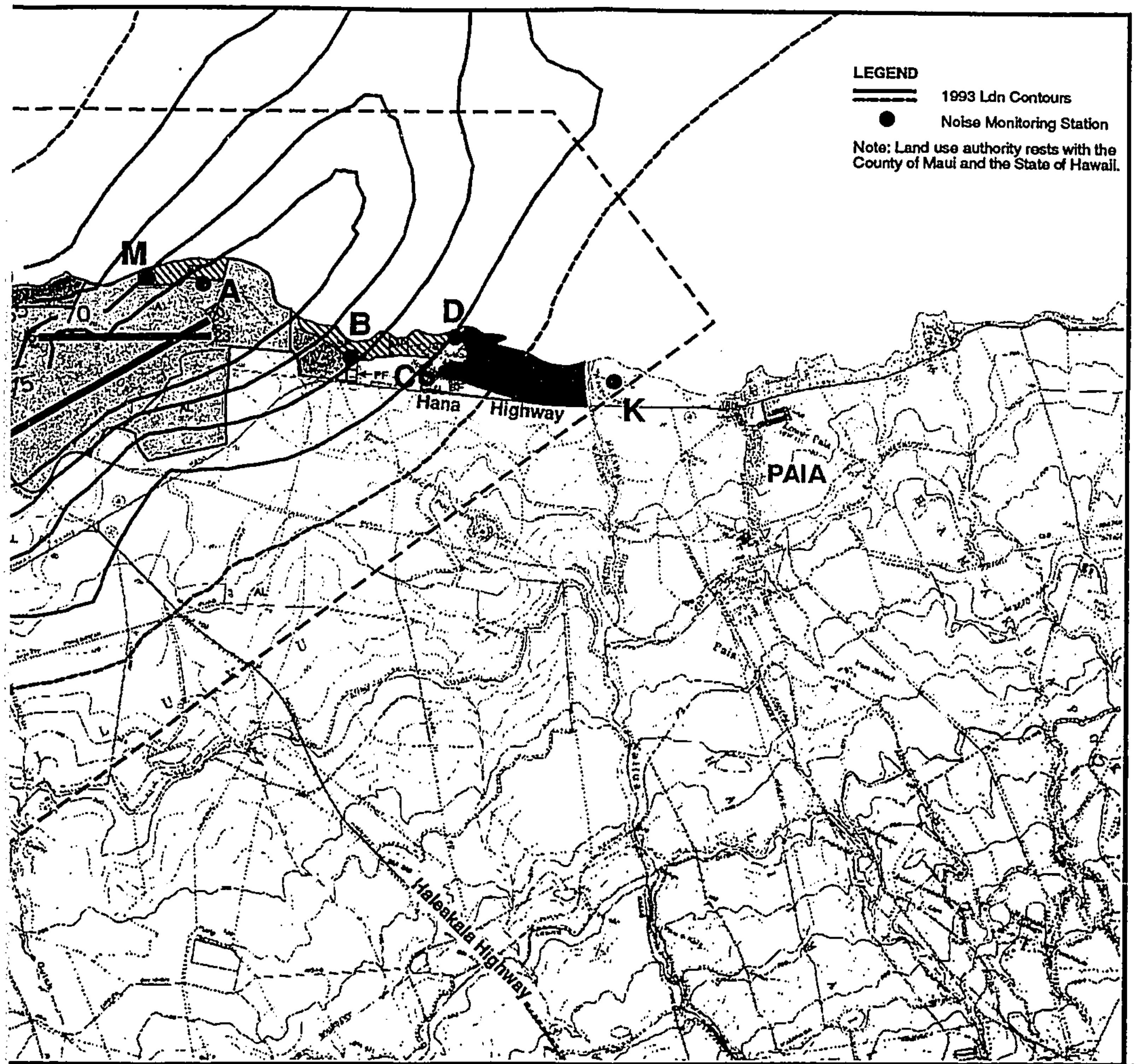
COMMERCIAL AND GOVERNMENT USE
RC RETAIL COMMERCIAL
OF BUSINESS/PROFESSIONAL OFFICES
AC AIRPORT BUSINESSES (car rental agencies, tours, lei stands)
RS RETAIL STORAGE (warehouses)
CS COMMERCIAL SERVICES
GB GOVERNMENT BUILDING

RESIDENTIAL
SF SINGLE FAMILY
MF MULTIPLE FAMILY

PUBLIC USE
S SCHOOL
H HOSPITALS (clinics, health care facilities, nursing homes)
PF PUBLIC FACILITIES (day care, libraries, community centers)
C CHURCH

MANUFACTURING, PRODUCTION & STORAGE
M LIGHT/HEAVY MANUFACTURING
AM AGRICULTURAL MANUFACTURING
MS MANUFACTURING WAREHOUSES

AL AGRICULTURAL LAND



care facilities,

re, libraries,

RODUCTION & STORAGE
URING
TURING
OUSES
LAND

RECREATIONAL
OR OUTDOOR RECREATION
NE NATURE EXHIBITS & SANCTUARIES
G&W GOLF COURSES, GARDENS, WATER RECREATION
OPEN SPACE
CM CEMETERY
P PARK
V VACANT OR UNDEVELOPED LAND
STUDY AREA BOUNDARY
AIRPORT PROPERTY
AREA OF INCOMPATIBLE LAND USE

Figure 5-1
BASE YEAR (1993) NOISE EXPOSURE MAP: KAHULUI AIRPORT

NORTH

0 2000 4000 8000
SCALE IN FEET

Table 5-2 [illegible] Monitoring Stations

Monitoring Station	[illegible] INM-Calculated 1993 Ldn Levels		
	Standard	Calibrated	Difference
A	78.1	78.2	0.1
B	65.9	66.1	0.2
C	59.3	59.4	0.1
D	59.8	60.0	0.2
E	65.1	66.5	1.4
F	58.6	60.2	1.6
G	54.5	54.8	0.3
J	62.6	62.9	0.3
K	50.5	50.7	0.2
M	70.6	70.8	0.2
S	61.8	62.4	0.6
T	56.4	57.2	0.8
U	52.0	52.5	0.5
V	62.0	62.1	0.1

Note: See Figure 5-1 for monitoring station locations. The "Calibrated" Model is discussed in Appendix E.

Source: Y. Ebisu & Associates

Under some circumstances the INM can produce inaccurate results. Consequently, a major effort was made to insure that its predictions for Kahului Airport corresponded to actual measurements. This calibration effort is summarized below. It is described in more detail in Appendix E.

A comparison of the noise monitoring data with model estimates suggests that the INM Version 4.11 may underestimate rearward start-to-roll noise of interisland jet aircraft at monitoring Site V by 3.8 to 6.7 dB during the early morning hours. The measured noise levels of the quieter (Stage 3) jet aircraft such as the DC-10, L-1011, and B-737(300) were 3.5 to 7.0 dB higher (noisier) than standard FAA INM Version 4.11 model predictions. Because these quieter jet aircraft tend to be overshadowed by the noise contributions from the noisier (Stage 2) B-737(200) and DC-9(50) aircraft, the 1993 Base Year and 1998 5-Year No Mitigation noise contour maps produced by the standard FAA INM Version 4.11 are not significantly different from those produced by the calibrated version. However, because the standard FAA INM Version 4.11 tends to underestimate the noise levels of the quieter aircraft, it may overstate the noise reduction benefits from aircraft fleet quieting. Therefore, all potential noise mitigation measures were evaluated using both the standard and calibrated versions of the FAA INM.

The total differences in the 1993 Base Year levels computed by the standard vs. calibrated models were less than 2 Ldn, and typically less than 1 Ldn. The total differences in the 5th-Year, No Mitigation, levels computed by the standard vs. calibrated models were no greater than 2.5 Ldn, and typically less than 1 Ldn. The primary reason for the good agreement between the models was the dominating influence of the departure noise of the noisier interisland jet aircraft, which are accurately represented by the standard version of the FAA INM.

In view of the differences between measured and predicted sound levels from rearward start-to-roll noise and the possible large increases in noise levels associated with thermal ducting, the Grid Output Module of the INM was used to calculate the Base Year Ldn values at fourteen noise monitoring sites. The relative Ldn contributions of aircraft noise associated with flyby events (air-to-ground propagation) were computed separately from those associated with start-to-roll events during takeoff (ground-to-ground propagation behind the departing aircraft). Separating the components in this way made it possible to evaluate the possible influence of inaccuracies associated with ground-to-ground propagation, and in particular, those associated with nighttime, rearward, start-to-roll events. The results of these calculations showed that the computed "Total Ldn" at most noise monitoring sites are essentially equal to (and dominated by) the Ldn associated with "All Air-to-Ground Events," or aircraft flyby events past the monitoring sites. In these cases, rearward "start-to-roll" noise as computed by the INM was at least 8 Ldn units less than the "air-to-ground" component.

Earlier comparisons of noise monitoring data with calibrated and standard FAA INM model outputs for ground-to-ground sound propagation during aircraft start-to-roll at takeoff has indicated that both the calibrated and standard versions of the model tend to underestimate the effects of aircraft start-to-roll noise for receptor (and particularly elevated receptor) locations to the rear of the departing aircraft. To determine what effect this built-in characteristic of the model was having on calculated 1993 and 1998 Ldn contours, worst case Ldn values were calculated using noise monitoring data and assuming thermal ducting during the nighttime Ldn penalty hours of 10:00 PM to 7:00 AM. A comparison of these adjusted results with the unadjusted noise model estimates indicates that the FAA INM model's assumptions regarding rearward departure noise do not have a significant effect on estimated noise levels in East and West Spreckelsville areas enclosed by the Base Year or 5th-Year 60 Ldn contours.

In summary, a comparison of the Base Year Ldn contours computed by the standard and calibrated versions of the Integrated Noise Model, Version 4.11, confirms that the model accurately predicts aircraft noise. The correspondence between the data and the model estimates is very good in the sideline areas. It is slightly poorer in the regions below the aircraft flight tracks, where the model tends to slightly underestimate Ldn levels.

The noise contours shown in Figure 5-1 were used to calculate the total area enclosed by each 5 Ldn band (e.g., the area exposed to noise levels between 65 Ldn and 70 Ldn). This information is summarized in Table 5-3. Table 5-4 compares the 1993 noise levels to the "Five-

Year 1992 No Mitigation" noise level forecasts contained in the accepted Noise Exposure Map Report. The comparison indicates that the actual 1993 noise contours are generally smaller than those that were forecast for 1992 in the accepted *Noise Exposure Map* report.

5.4 EXISTING LAND USE COMPATIBILITY

Table 5-5 tabulates incompatible land uses in the vicinity of the airport. It is based on the 1993 noise contours shown in Figure 5-1, existing land use information presented in Chapter 2 (Figure 2-6), estimates of the average number of persons per residence made on the basis of 1990 census data for Kahului, and the FAR Part 150 land use compatibility standards contained in Table 4-1. The incompatible land uses determined using the FAR Part 150 standards are associated principally with the residential uses in East and West Spreckelsville north of the airport. In addition, a few residential units and noise-sensitive community uses are situated in Pu'u-nēnē south of the airport.

Existing land use compatibility was also evaluated using the more stringent noise compatibility guidelines recommended by the State of Hawaii Department of Transportation (Table 4-2). The results of these calculations are summarized in Table 5-6. Because the State's compatibility criteria are approximately 5 Ldn units lower than those contained in FAR Part 150, the numbers of acres, dwelling units, and residents determined to be in the incompatible zone are higher when these criteria are used than when the FAR Part 150 compatibility standards are applied. Most of the difference consists of additional residences in the West and East Spreckelsville communities. However, several public facilities situated between the 60- and 65-Ldn contours are also affected. These include the Kaunoa Senior Citizens Center on Hana Highway; the Holy Family Ecumenical Shelter, an adult day care facility; the meeting rooms of the Civil Air Patrol Maui Composite Squadron; and Lanakila Church. According to the landowner, Alexander and Baldwin, the latter is scheduled to be relocated outside of this zone.

Table 5-3 Summary of Area Exposed to Noise Levels Above 55 Ldn: 1993 Base Year

Noise Level Bands	Area Between Contours			Cumulative Area Enclosed	
	Square Miles	Acres		Square Miles	Acres
		Total	[illegible]		
>75 Ldn	1.24	794	25.4%	1.24	794
70 to 75 Ldn	1.29	826	24.7%	2.53	1,619
65 to 70 Ldn	2.88	1,843	29.7%	5.41	3,462
60 to 65 Ldn	6.93	4,435	34.6%	12.34	7,898
55 to 60 Ldn	15.97	10,221	37.7%	28.31	18,118

Source: Y. Ebisu and Associates. Calculated by INM Version 4.11.

Table 5-4 Comparison of Forecast 1992 "No Mitigation" Noise Levels From Accepted Noise Exposure Map Report With Actual 1994 Noise Levels

Noise Level Bands	Area Between Contours (in square miles)		
	Forecast for 1992[1]	1993 Actual	Difference
>75 Ldn	1.10	1.24	0.14
70 to 75 Ldn	1.83	1.29	(0.54)
65 to 70 Ldn	4.16	2.88	(1.28)
60 to 65 Ldn	8.22	6.93	(1.29)
55 to 60 Ldn	18.36	15.97	(2.39)

1 From accepted *Noise Exposure Map Report, Kahului Airport, Kahului, Hawaii* (Belt Collins and Associates et al., December 1989, p. 6-1).

Table 5-5 Base Year (1993) Incompatible Land Uses[1] Determined Using FAR Part 150 Standards

LAND USE	Incompatible Land Uses in Acres by Average Day-Night Sound Level (Ldn)		
	65-70	70-75	>75
Single-Family Residential	9.01	7.82	12.15
Multi-Family Residential	0.0	0.0	0.0
Resort	0.0	0.0	0.0
Commercial[1]	n.a.	0.0	0.0
Industrial[1]	n.a.	0.0	0.0
Agricultural	n.a.	0.0	0.0

LAND USE	DWELLING UNITS AND RESIDENTS IN INCOMPATIBLE AREAS					
	No. of Incompatible Dwelling Units by Ldn Band			No. of Persons Residing in Incompatible Areas by Ldn Band[2]		
	65-70	70-75	>75	65-70	70-75	>75
Single-Family Residential	11	5	19	39	18	67
Multi-Family Residential	0	0	0	0	0	0

[1]Compatibility determination is from Table 1 in FAR Part 150, Section A150.101.

[2]Population estimates based on average of 3.5 persons per single-family residential unit and 2.75 persons per multi-family dwelling unit.

Source: Acreages and number of units calculated by Belt Collins Hawaii Ltd. based on Ldn contours developed by Y. Ebisu & Associates (see Figure 5-1).

Table 5-6 Base Year (1993) Incompatible Land Uses[1] Determined Using Recommended State Guidelines

LAND USE	Incompatible Land Uses in Acres by Average Day-Night Sound Level			
	60-65	65-70	70-75	>75
Single-Family Residential	18.48[3]	9.01	7.82	12.15
Multi-Family Residential	4.04	0	0	0
Public Facilities[1]	3.0	0	0	0
Commercial[1]	n.a.	n.a.	0	0
Industrial	n.a.	n.a.	0	0

LAND USE	DWELLING UNITS AND RESIDENTS IN INCOMPATIBLE AREAS							
	No. of Incompatible Units by Ldn Band				No. of Persons Residing in Incompatible Areas by Ldn Band[2]			
	60-65	65-70	70-75	>75	60-65	65-70	70-75	>75
Single-Family Residential[3]	36	11	5	19	126	39	18	67
Multi-Family Residential	18	0	0	0	50	0	0	0
Public Facilities	3	0	0	0	n.a.	n.a.	n.a.	n.a.
Churches	1	0	0	0	n.a.	n.a.	n.a.	n.a.

[1]Compatibility determination is from the Department of Transportation, State of Hawaii, recommendations for local land use compatibility.

[2]Population estimates based on average of 3.5 persons per single-family residential unit and 2.75 persons per multi-family dwelling unit.

[3]Unsubdivided land in Pu'u-nēnē assumed to be 1/4 acre per residence.

Source: Acreages and number of units calculated by Belt Collins Hawaii Ltd. based on Ldn contours developed by Y. Ebisu & Associates (see Figure 5-1).

Table 5-7. Base Year Noise Levels at Monitoring Sites

Monitoring Site	Ldn From Integrated Noise Model		
	Total	All Rear-Departure Events	All Air-to-Ground Events
A	78.1	70.1	77.4
B	65.9	50.6	65.8
C	59.3	44.7	59.1
D	59.8	42.6	59.7
E	65.1	43.2	65.1
F	58.6	39.9	58.5
G	54.5	48.1	53.4
J	62.6	60.3	58.7
K	50.5	36.1	50.3
M	70.6	58.9	70.3
S	61.8	41.6	61.8
T	56.4	34.4	56.4
U	52.0	27.9	52.0
V	62.0	54.3	61.2

Source: Y. Ebisu & Associates; see Appendix E, Table B-3, Standard INM Output.

CHAPTER 6
FUTURE (1998) NOISE EXPOSURE—NO MITIGATION

CHAPTER 6
FUTURE (1998) NOISE EXPOSURE—NO MITIGATION

6.1 INTRODUCTION

This chapter describes the anticipated 1998 noise exposure if no special noise abatement or mitigation measures are instituted. It begins with a discussion of anticipated changes in the number and type of aircraft operations, flight tracks, and airfield layout that will affect aircraft noise in the Airport's environs (Section 6.2). This is followed by a review of changes in land use that would affect noise exposure (Section 6.3). Section 6.4 contains the 1998 "No Mitigation" noise exposure map. Finally, Section 6.5 briefly discusses land use compatibility under that scenario, i.e., the extent to which the forecast changes in operations will affect the compatibility of land uses depicted on the map.

6.2 1998 OPERATIONS AND AIRPORT LAYOUT

6.2.1 1998 Annual Aircraft Operations Forecasts

Forecasts of annual aviation demand for all airports in the State of Hawaii were developed in 1990 for the *Hawaii Statewide Airport System Plan* (Wilson Okamoto & Associates, Inc. and Aries Consultants Ltd., December 1990). These forecasts were updated by Aries Consultants Ltd. in 1994 as part of the State's on-going transportation planning process; the revised air carrier forecasts pertaining to Kahului Airport are presented in Table 6-1. They reflect current forecasts of visitor arrivals, the cessation of regular air carrier service to Kapalua West Maui Airport, and other relevant factors. They assume that visitor travel will not be constrained by insufficient hotel rooms or other visitor infrastructure.

Several events that occurred after these updated forecasts were prepared necessitated that they be adjusted as part of this study when calculating the "average day" operations used as input for the INM. These adjustments are summarized below.

Hawaiian Airlines' *Every Half-Hour* Schedule. During the summer of 1994, Hawaiian Airlines instituted an "every half-hour" schedule on its Honolulu-Kahului route. Insofar as can be determined, this increase was not accompanied by an equivalent increase in interisland passenger volumes or an off-setting decrease in the number of passengers carried by Aloha Airlines, the other major interisland air carrier. The resulting increase in interisland air carrier aircraft operations was not foreseen when the forecasts were prepared.

Table 6-1 Forecast Annual Aircraft Operations At Kahului Airport: 1998

Type of Aircraft	1998 Annual Operations
4-Engine Wide-Body (e.g., B-747, A-340)	0
3-Engine Wide-Body (e.g., DC-10, L-1011, MD-11)	7,404
Large 2-Engine Wide-Body (e.g., B-777)	0
Medium 2-Engine Wide-Body (e.g., B-767, B-757)	1,038
4-Engine Narrow-Body (e.g., DC-8, B-707)	0
3-Engine Narrow-Body	0
2-Engine Narrow-Body (e.g., B-737, DC-9, MD-80)	54,930
Air Carrier Subtotal	63,372
Large Turboprop (e.g., DHC-6, DHC-8, ATR-42)	568
2-Engine Propeller (E.g., DHC-6, Dornier, C-402)	16,318
1-Engine Propeller (e.g., C-208, C-206)	1,396
Helicopters	67,694
GRAND TOTAL	149,348

Source: Aries Consultants Ltd., October 20, 1994.

To account for these changes for the purpose of this study, the number of DC-9 aircraft operations between Honolulu and Kahului assumed for 1998 was increased from the number originally forecast (57 daily operations) to the number that Hawaiian Airlines was actually flying in the fall of 1994 (78 daily operations). In order for this level of aircraft operations actually to be achieved, the interisland airlines must continue to be willing to operate at a lower average load factor than assumed in the SASP forecasts.

Mahalo Airlines Re-Entry Into The Kahului Market. Late in 1994 Mahalo Airlines re-entered the Kahului market flying ATR-42s. Its entry was not accompanied by a decrease in flights by the competing airlines. Based on information provided by a representative of Mahalo Airlines,[1] it was assumed that it would continue to operate those aircraft through 1998; Mahalo's latest flight schedule was used to estimate the number of operations. The number of

[1] Personal communication between Mr. Chris Durbin, Chief Pilot for Mahalo Airlines, and Mr. Perry White, Belt Collins Hawaii Ltd., January 1995.

operations by Aloha Airlines and Hawaiian Airlines was not reduced; this implies lower load factors than the interisland air carriers have traditionally been willing to sustain.

Aloha Airlines Use of DHC-8 for Kahului-Lanai Flights. In late 1994, Aloha Airlines announced that it would soon substitute DHC-8 aircraft for the DHC-6 aircraft it is now using for its flights between Lanai and Kahului Airports. Based on the information provided by an Aloha Airlines' representative,[3] it was assumed that the substitution would be on a one-for-one basis. Consequently, the number of DHC-8 flights between Lanai and Kahului was assumed to total six per day (three arrivals and three departures).

6.2.2 Runway And Flight Track Use Assumptions

6.2.2.1 Runways And Runway Use

The *Kahului Airport Master Plan* recommends that Runway 2-20 be extended from its existing length of 7,000 feet to a total length of approximately 9,600 feet. The increased length would be achieved by extending the existing pavement approximately 2,600 feet to the south. The runway threshold would be displaced 400 feet from the southern end of the runway to insure adequate clearance over stacks at the Puunene Sugar Mill. These changes would be in place by 1998. The *Kahului Airport Master Plan* recommends that Runway 5-23 remain at its current length, and it does not recommend any new runways before the end of this century. Finally, it calls for helicopter operations to remain in their present location through at least the year 2000.

Air traffic controllers at the FAA's Kahului Airport Control Tower, representatives of the three interisland airlines, a representative of the Airline Pilots Association, and others familiar with air traffic and air traffic control procedures at Kahului Airport, were consulted to determine what effect the planned runway extension would have on runway use patterns at the Airport. Based on the information they provided, it was concluded that use of Runway 5-23 and the various helicopter flight tracks are likely to remain unchanged. In the absence of contrary noise abatement program provisions, the extension is judged likely to affect the use of Runway 2-20 as follows:

- **Tradewind Conditions.** All overseas air carrier aircraft (which are most in need of a longer runway) would start their takeoff rolls from the end of the extended runway. All interisland air carrier jet aircraft would also start their takeoff rolls from the southern end of the extended runway. General aviation aircraft, as well Mahalo Air's ATR-42s, would continue to start their takeoff rolls from the existing runway end unless a formal noise abatement or runway operating policy forbids it.

[3]Personal communication from Mr. Jim King of Aloha Airlines to Mr. Perry White, Belt Collins Hawaii Ltd., December 15, 1994.

- **Kona Wind Conditions.** Under Kona wind conditions all takeoff rolls on Runway 20 would continue to start at the north end of the Runway, thereby allowing aircraft to take advantage of the full length of the extended runway.

6.2.2.2 Flight Track Usage

For the purpose of the INM modelling, it was assumed that flight track usage would continue as at present. Representatives of interisland air carrier pilots have indicated a desire to use Track 18 (the approach used by interisland jet aircraft approaching from the west under turbulent tradewind conditions) more frequently than is presently the case and are collecting data to support their position. It is possible that this data may lead the Federal Aviation Administration to increase the frequency with which the turbulent tradewind flow regime is used, thereby increasing the proportion of interisland air carrier aircraft arriving on Track 18 and decreasing the number of those aircraft arriving on Tracks 28a and 28b. However, it was felt that it would be premature to assume that a change would be instituted. Preliminary analyses indicate that it would not substantially alter Ldn levels in noise-sensitive areas if it were. The change would slightly increase the number of single-event noise events experienced by residents of homes in these areas, however.

6.2.3 1998 Average Day Operations

Table 6-2 contains a detailed breakdown of 1998 average-day operations at Kahului Airport. The total number of operations at the airport in 1998 is expected to be only modestly higher than in the 1993 base year. The most notable increase over the 1993-1998 time period is in interisland air carrier operations, which the 1998 No Mitigation forecast suggests would be about 30 percent higher than the 1993 level. As previously noted, much of that increase is accounted for by the sudden jump in DC-9 operations that occurred in the middle of 1994. Because the increased flight frequency occurred as a result of a marketing decision on the part of the airline rather than a demonstrated increase in the number of interisland passengers, it remains to be seen if this level will actually be achieved.

Air Taxi/Commuter operations were originally forecasted in the SASP to be down slightly overall from the 1993 totals, partly because of a switch to larger aircraft. However, since Mahalo Airlines (whose ATR-42s are officially classified as air taxi/commuter aircraft) has recently re-entered the Kahului market, the total number of operations for Air Taxi/Commuter was increased in 1998 for this study. The twin- and single-engine propeller aircraft totals are forecasted to be lower in 1998, while the helicopter operations are expected to increase slightly.

TABLE 6-2
KAHULUI AIRPORT, PART 150 REPORT, 1998 AVERAGE DAY DEPARTURES

AIR CARRIER DAYTIME	TOTAL DAYTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (88%) RWY 2 TR4	RWY 2 [illegible]	[illegible]	TOTAL KONA DEPART	KONA (12%) RWY 20 TR10	RWY 20 [illegible]	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
DC-10-10	4.98	4.38	0.00	4.38		0.60		0.60			
DC-10-30	0.97	0.85	0.00	0.85		0.12		0.12			
MD-11	1.00	0.88	0.00	0.88		0.12		0.12			
L1011-100	2.58	2.27	0.00	2.27		0.31		0.31			
L1011-250	0.61	0.54	0.00	0.54		0.07		0.07			
B-757-200	0.14	0.12	0.00	0.12		0.02		0.02			
B-767	1.00	0.88	0.00	0.88		0.12		0.12			
B-737-200Pax	11.22	9.87	8.26	1.61		1.35	0.13		0.40	0.41	0.40
B-737-200QC	4.48	3.94	3.30	0.64		0.54	0.05		0.16	0.16	0.16
Total INM 737-200	15.70	13.82	11.58	2.25		1.88	0.19		0.56	0.58	0.56
B-737-300Pax	15.70	13.82	11.56	2.25		1.88	0.19		0.56	0.58	0.56
B-737-300QC	8.96	7.88	6.60	1.29		1.08	0.11		0.32	0.33	0.32
Total INM 737-300	24.66	21.70	18.16	3.54		2.96	0.30		0.88	0.91	0.88
B-737-400	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00
DC-9-50	36.99	32.55	29.26	3.29		4.44	0.44		1.32	1.36	1.32
TOTAL DAY:	88.63	77.99	58.99	19.00		10.64	0.93	1.35	2.76	2.84	2.76

AIR CARRIER NIGHTTIME	TOTAL 1.5 NIGHTTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (80%) RWY 2 TR4	RWY 2 [illegible]	[illegible]	TOTAL KONA DEPARTS	KONA (20%) RWY 20 TR10	RWY 20 [illegible]	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
DC-10-10	0.00	0.00		0.00		0.00		0.00			
DC-10-30	0.00	0.00		0.00		0.00		0.00			
MD-11	0.00	0.00		0.00		0.00		0.00			
L1011-100	0.00	0.00		0.00		0.00		0.00			
L1011-250	0.00	0.00		0.00		0.00		0.00			
B-757-200	0.28	0.22	0.00	0.22		0.06		0.06			
B-767	0.00	0.00		0.00		0.00		0.00			
B-737-200Pax	0.81	0.65	0.54	0.11		0.16	0.02		0.05	0.05	0.05
B-737-200QC	1.43	1.14	0.96	0.18		0.29	0.03		0.08	0.09	0.08
Total INM 737-200	2.24	1.79	1.50	0.29		0.45	0.04		0.13	0.14	0.13
B-737-300Pax	1.14	0.91	0.76	0.15		0.23	0.02		0.07	0.07	0.07
B-737-300QC	2.86	2.29	1.92	0.36		0.57	0.06		0.17	0.18	0.17
Total INM 737-300	4.00	3.20	2.69	0.51		0.80	0.08		0.24	0.24	0.24
B-737-400	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00
DC-9-50	2.01	1.61	1.45	0.16		0.40	0.04		0.12	0.12	0.12
TOTAL NIGHT:	8.53	6.82	5.64	1.19		1.71	0.17	0.06	0.49	0.50	0.49

Note: RWY 2 reflects the 2,600-foot lengthening of Runway 2-20 for a total of 9,600 feet.

TABLE 6-2 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1998 AVERAGE DAY DEPARTURES

AIR TAXI/ COMMUTER DAYTIME:	TOTAL DAYTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (88%) RWY 2 TR3	RWY 2 TR4	RWY 8 TR8	RWY 8 TR11	RWY 5 TR12	TOTAL KONA DEPARTS	KONA (12%) RWY 20 TR6	RWY 20 TR10	RWY 20 TR29	RWY 23 TR13	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
ATR-42 (INM DHC8)	8.00	7.04		7.04				0.96					0.32	0.33	0.32
DHC-8	3.00	2.64			2.64			0.36			0.36				
Total INM DHC8	11.00	9.68		7.04	2.64			1.32	0.00		0.36	0.00	0.32	0.33	0.32
DHC-6	5.98	5.19			0.00	1.30	3.89	0.79	0.00	0.08			0.23	0.24	0.23
Twin Propeller															
Brittan-Norman	2.06	1.81		0.23			1.59	0.25				0.25			
BeechE&H	0.99	0.87		0.11			0.76	0.12				0.12			
Cessna 402	3.04	2.68			0.27	0.13	2.27	0.36				0.36			
Cessna 414A	0.90	0.79		0.08			0.71	0.11				0.11			
Fokker F27	0.73	0.64		0.06			0.58	0.09				0.09			
Shorts 330	0.32	0.28		0.03			0.25	0.04				0.04			
PA-31-350	0.25	0.22		0.02			0.20	0.03				0.03			
P68C Partenavia	0.36	0.32		0.03			0.29	0.04				0.04			
Single Propeller															
Cessna 152	0.08	0.07			0.01	0.00	0.06	0.01				0.01			
Cessna 208	0.48	0.42			0.04	0.02	0.36	0.06				0.06			
Waco YMF	1.08	0.95			0.10	0.05	0.81	0.13				0.13			
TOTAL DAY:	27.27	23.93	0.00	7.60	3.05	1.51	11.77	3.34	0.00	0.08	0.36	1.23	0.55	0.57	0.55

AIR TAXI/ COMMUTER NIGHTTIME:	TOTAL NIGHTTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (80%) RWY 2 TR3	RWY 2 TR4	RWY 8 TR8	RWY 8 TR11	RWY 5 TR12	TOTAL KONA DEPARTS	KONA (20%) RWY 20 TR6	RWY 20 TR10	RWY 20 TR29	RWY 23 TR13	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
ATR-42	0.00	0.00						0.00							
DHC-6	2.02	1.57				0.39	1.18	0.45		0.045			0.135	0.135	0.135
Twin Propeller															
Brittan-Norman	0.69	0.55		0.07			0.48	0.14				0.14			
BeechE&H	0.33	0.26		0.03			0.23	0.07				0.07			
Cessna 402	1.01	0.81			0.08	0.04	0.69	0.20				0.20			
Cessna 414A	0.30	0.24		0.02			0.22	0.06				0.06			
Fokker F27	0.24	0.19		0.02			0.17	0.05				0.05			
Shorts 330	0.11	0.09		0.01			0.08	0.02				0.02			
PA-31-350	0.08	0.06		0.01			0.06	0.02				0.02			
P68C Partenavia	0.12	0.10		0.01			0.09	0.02				0.02			
Single Propeller															
Cessna 152	0.01	0.01			0.00	0.00	0.01	0.00				0.00			
Cessna 208	0.08	0.06			0.01	0.00	0.05	0.02				0.02			
Waco YMF	0.18	0.14			0.01	0.01	0.12	0.04				0.04			
TOTAL NIGHT:	5.17	4.09	0.00	0.17	0.10	0.44	3.38	1.08	0.00	0.05	0.00	0.63	0.14	0.14	0.14

Note: RWY 2 reflects the 2,600-foot lengthening of Runway 2-20 for a total of 9,600 feet.

TABLE 6-2 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1998 AVERAGE DAY DEPARTURES

AIR TAXI/COMMUTER HELICOPTERS DAYTIME	TOTAL DAYTIME DEPARTS		RWY 03L TR58A	RWY 03L TR58B	RWY 03 TR58C	RWY 3R TR54A	RWY 3R TR54B	RWY 3R TR54C	RWY 3R TR55
AS350 AStar	49.39		2.47	4.94	2.47	7.41	14.82	7.41	9.88
Bell206B	26.53		1.33	2.65	1.33	3.98	7.96	3.98	5.31
Hughes 500	15.79		0.79	1.58	0.79	2.37	4.74	2.37	3.16
R22Beta	0.09		0.00	0.01	0.00	0.01	0.03	0.01	0.02
H500D	5.74		0.29	0.57	0.29	0.86	1.72	0.86	1.15
TOTAL DAY:	97.54		4.59	9.18	4.59	13.77	27.54	13.77	18.36

AIR TAXI/COMMUTER HELICOPTERS NIGHTTIME	TOTAL NIGHTTIME DEPARTS		RWY 03L TR58A	RWY 03L TR58B	RWY 03 TR58C	RWY 3R TR54A	RWY 3R TR54B	RWY 3R TR54C	RWY 3R TR55
AS350 AStar	0.50		0.03	0.05	0.03	0.08	0.15	0.08	0.10
Bell206B	0.27		0.01	0.03	0.01	0.04	0.08	0.04	0.05
Hughes 500	0.16		0.01	0.02	0.01	0.02	0.05	0.02	0.03
R22Beta	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
H500D	0.09		0.00	0.01	0.00	0.01	0.03	0.01	0.02
TOTAL NIGHT:	1.02		0.05	0.09	0.05	0.14	0.28	0.14	0.19

GENERAL AVIATION DAYTIME	TOTAL DAYTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE: RWY 2 TR4	RWY 5 TR8	RWY 5 TR11	RWY 5 TR12		TOTAL KONA DEPARTS	KONA: RWY 23 TR13
Fix-Wing Piston									
Twin Propeller									
BEC58P	1.80	1.58				1.58		0.22	0.22
Single Propeller									
GASEPV	3.37	2.97				2.97		0.40	0.40
GASEPF	6.88	6.04				6.04		0.82	0.82
Fix-Wing Turbine									
CNA441	2.41	2.12		0.21	0.11	1.80		0.29	0.29
Jets:									
Challenger 601	0.17	0.15	0.01			0.14		0.02	0.02
Gulfstream	0.51	0.45	0.03			0.41		0.06	0.06
Falcon 900	0.12	0.11	0.01			0.10		0.01	0.01
TOTAL DAY:	15.24	13.41	0.05	0.21	0.11	13.04		1.83	1.83

GENERAL AVIATION NIGHTTIME	TOTAL NIGHTTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE: RWY 2 TR4	RWY 5 TR8	RWY 5 TR11	RWY 5 TR12		TOTAL KONA DEPARTS	KONA: RWY 23 TR13
Fix-Wing Piston									
Twin Propeller									
BEC58P	0.08	0.06				0.06		0.01	0.01
Single Propeller									
GASEPV	0.14	0.11				0.11		0.02	0.02
GASEPF	0.29	0.23				0.23		0.03	0.03
Fix-Wing Turbine									
CNA441	0.10	0.08		0.01	0.00	0.07		0.01	0.01
Jets:									
Challenger 601	0.01	0.01	0.00			0.01		0.00	0.00
Gulfstream	0.02	0.02	0.00			0.01		0.00	0.00
Falcon 900	0.01	0.01	0.00			0.01		0.00	0.00
TOTAL NIGHT:	0.65	0.52	0.00	0.01	0.00	0.51		0.08	0.08

Note: RWY 2 reflects the 2,600-foot lengthening of Runway 2-20 for a total of 9,600 feet.

TABLE 6-2 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1998 AVERAGE DAY DEPARTURES

TOUCH & GO (DEPARTURES) DAYTIME	TOTAL TOUCH & GOS	[illegible]	[illegible]	[illegible]								
Single Propeller												
GASEPV	8.66			8.66								
GASEPF	17.63			17.63								
Twin Propeller												
BEC58P	4.64			4.64								
TOTAL DAY	30.93		0.00	30.93								

TOUCH & GO (DEPARTURES) NIGHTTIME	TOTAL TOUCH & GOS		RWY 5 TR27	RWY 5 TR30								
Single Propeller												
GASEPV	0.37			0.37								
GASEPF	0.75			0.75								
Twin Propeller												
BEC58P	0.20			0.20								
TOTAL NIGHT	1.32		0.00	1.32								

MILITARY DAYTIME	TOTAL DAYTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (88%): RWY 2 TR3	RWY 2 TR4	RWY 2 TR2	RWY 5 TR27	TOTAL KONA DEPARTS	KONA (12%): RWY 20 TR9	RWY 20 TR10	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
C-130	1.50	1.32	0.21	0.49		0.62	0.18	0.09	0.01	0.03	0.03	0.03
P-3	1.95	1.72	0.28	0.64	0.80		0.23	0.12	0.01	0.04	0.04	0.04
C-135	0.67	0.59	0.09	0.23	0.27		0.08	0.04	0.00	0.01	0.01	0.01
C-12	0.03	0.03	0.00	0.01		0.01	0.00	0.00	0.00	0.00	0.00	0.00
C-20	0.04	0.04	0.01	0.014	0.01		0.00	0.00	0.00	0.00	0.00	0.00
C-26	0.27	0.24	0.04	0.09		0.11	0.03	0.02	0.00	0.00	0.00	0.00
HH-65	0.88	0.77	0.12	0.29		0.36	0.11	0.05	0.01	0.02	0.02	0.02
SH-60	0.27	0.24	0.04	0.09		0.11	0.03	0.01	0.00	0.01	0.01	0.01
UH-1V	0.40	0.35	0.06	0.13		0.16	0.05	0.02	0.00	0.01	0.01	0.01
CH-53	0.02	0.02	0.00	0.01		0.01	0.00	0.00	0.00	0.00	0.00	0.00
AH-1	0.13	0.11	0.02	0.04		0.05	0.02	0.01	0.00	0.00	0.00	0.00
UH-1	0.15	0.13	0.02	0.05		0.06	0.02	0.01	0.00	0.00	0.00	0.00
UH-60	0.65	0.57	0.09	0.21		0.27	0.08	0.04	0.00	0.01	0.01	0.01
OH-58	0.89	0.78	0.13	0.29		0.36	0.11	0.05	0.01	0.02	0.02	0.02
CH-47D	0.30	0.26	0.04	0.10		0.12	0.04	0.02	0.00	0.01	0.01	0.01
TOTAL INM CH47	3.69	3.25	0.52	1.22		1.51	0.44	0.20		0.07	0.07	0.07
TOTAL DAY:	8.15	7.17	1.15	2.69	1.08	2.25	0.98	0.47	0.05	0.15	0.15	0.15

MILITARY NIGHTTIME	TOTAL NIGHTTIME DEPARTS	TOTAL TRADE DEPARTS	TRADE (88%): RWY 2 TR3	RWY 2 TR4	RWY 2 TR2	RWY 2 TR27	TOTAL KONA DEPARTS	KONA (12%): RWY 20 TR9	RWY 20 TR10	RWY 20 TR31A	RWY 20 TR31B	RWY 20 TR31C
C-130	0.02	0.02	0.00	0.01		0.01	0.00	0.00	0.00	0.00	0.00	0.00
P-3	0.03	0.02	0.00	0.01	0.01		0.01	0.00	0.00	0.00	0.00	0.00
C-135	0.01	0.01	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
C-12	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-20	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
C-26	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
HH-65	0.01	0.01	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
SH-60	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
UH-1V	0.01	0.01	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
CH-53	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
AH-1	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
UH-1	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
UH-60	0.01	0.01	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
OH-58	0.01	0.01	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
CH-47D	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL INM CH47	0.04	0.03	0.01	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL NIGHT:	0.10	0.08	0.01	0.03	0.01	0.02	0.02	0.01	0.00	0.00	0.00	0.00

Note: RWY 2 reflects the 2,600-foot lengthening of Runway 2-20 for a total of 9,600 feet.

TABLE 6-2 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1998 AVERAGE DAY ARRIVALS

AIR CARRIER DAYTIME	TOTAL DAYTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (88%) RWY 3 TR15A	RWY 3 TR15B	RWY 3 TR15C	RWY 3 TR17A	RWY 3 TR17B	RWY 3 TR17C	RWY 3 TR28A	RWY 3 TR28B	RWY 3 TR18	RWY 6 TR21	TOTAL KONA LANDING	KONA (12%) RWY20 TR1R	RWY 20 TR20
DC-10-10	4.98	4.38	0.55	1.10	0.55				1.10	1.10			0.60	0.30	0.30
DC-10-30	0.97	0.85	0.11	0.21	0.11				0.21	0.21			0.12	0.06	0.06
MD-11	1.00	0.88	0.11	0.22	0.11				0.22	0.22			0.12	0.06	0.06
L1011-100	2.58	2.27	0.50	0.99	0.50				0.14	0.14			0.31	0.27	0.04
L1011-250	0.61	0.54	0.12	0.23	0.12				0.03	0.03			0.07	0.06	0.01
B-757-200	0.14	0.12	0.03	0.06	0.03				0.00	0.00			0.02	0.02	
B-767	1.00	0.88	0.22	0.44	0.22				0.00	0.00			0.12	0.12	
B-737-200Pax	11.22	9.87				0.39	0.77	0.39	4.13	4.13	0.06		1.35	0.22	1.13
B-737-200QC	4.48	3.94				0.15	0.31	0.15	1.65	1.65	0.03		0.54	0.09	0.45
Total INM 737-200	15.70	13.82				0.54	1.08	0.54	5.78	5.78	0.09		1.88	0.31	1.58
B-737-300Pax	15.70	13.82				0.54	1.08	0.54	5.78	5.78	0.09		1.88	0.31	1.58
B-737-300QC	8.96	7.88				0.31	0.62	0.31	3.30	3.30	0.05		1.08	0.18	0.90
Total INM 737-300	24.66	21.70				0.85	1.70	0.85	9.08	9.08	0.14		2.96	0.48	2.48
B-737-400	0.00	0.00				0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
DC-9-50	37.01	32.57				0.81	1.62	0.81	14.58	14.58	0.20		4.44	0.44	4.00
TOTAL DAY:	88.65	78.01	1.63	3.26	1.63	2.20	4.40	2.20	31.13	31.13	0.43		10.64	2.12	8.52

AIR CARRIER NIGHTTIME	TOTAL NIGHTTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (80%) RWY 3 TR15A	RWY 3 TR15B	RWY 3 TR15C	RWY 3 TR17A	RWY 3 TR17B	RWY 3 TR17C	RWY 3 TR28A	RWY 3 TR28B	RWY 3 TR18	RWY 6 TR21	TOTAL KONA LANDING	KONA (20%) RWY20 TR1R	RWY 20 TR20
DC-10-10	0.00	0.00											0.00		
DC-10-30	0.00	0.00											0.00		
MD11	0.00	0.00													
L1011-100	0.00	0.00											0.00		
L1011-250	0.00	0.00											0.00		
B-757-200	0.28	0.22	0.06	0.11	0.06								0.06	0.06	
B-767	0.00	0.00											0.00		
B-737-200Pax	0.81	0.65				0.03	0.05	0.03	0.27	0.27	0.00	0.00	0.18	0.03	0.14
B-737-200QC	1.43	1.14				0.05	0.09	0.05	0.47	0.47	0.01	0.02	0.29	0.05	0.24
Total INM 737-200	2.24	1.79				0.07	0.14	0.07	0.74	0.74	0.01	0.02	0.45	0.07	0.37
B-737-300Pax	1.14	0.91				0.04	0.07	0.04	0.38	0.38	0.01	0.00	0.23	0.04	0.19
B-737-300QC	2.86	2.29				0.09	0.18	0.09	0.93	0.93	0.01	0.06	0.57	0.09	0.48
Total INM 737-300	4.00	3.20				0.13	0.25	0.13	1.31	1.31	0.02	0.06	0.80	0.13	0.67
B-737-400	0.00	0.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DC-9-50	1.99	1.59				0.04	0.08	0.04	0.71	0.71	0.01		0.40	0.04	0.36
TOTAL NIGHT:	8.51	6.81	0.06	0.11	0.06	0.24	0.48	0.24	2.75	2.75	0.04	0.08	1.70	0.30	1.40

Note: RWY 3 represents the 400-foot displaced landing threshold that would be used when Runway 2-20 is extended to 9,600 feet.

TABLE 6-2 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1998 AVERAGE DAY ARRIVALS

AIR CARRIER DAYTIME	TOTAL DAYTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (88%) RWY 3 TR15A	RWY 3 TR15B	RWY 3 TR15C	RWY 3 TR17A	RWY 3 TR17B	RWY 3 TR17C	RWY 3 TR28A	RWY 3 TR28B	RWY 3 TR18	RWY 6 TR21	TOTAL KONA LANDING	KONA (12%) RWY20 TR1R	RWY 20 TR20
DC-10-10	4.98	4.38	0.55	1.10	0.55				1.10	1.10			0.60	0.30	0.30
DC-10-30	0.97	0.85	0.11	0.21	0.11				0.21	0.21			0.12	0.06	0.06
MD-11	1.00	0.88	0.11	0.22	0.11				0.22	0.22			0.12	0.06	0.06
L1011-100	2.58	2.27	0.50	0.99	0.50				0.14	0.14			0.31	0.27	0.04
L1011-250	0.61	0.54	0.12	0.23	0.12				0.03	0.03			0.07	0.06	0.01
B-757-200	0.14	0.12	0.03	0.06	0.03				0.00	0.00			0.02	0.02	
B-767	1.00	0.88	0.22	0.44	0.22				0.00	0.00			0.12	0.12	
B-737-200Pax	11.22	9.87				0.39	0.77	0.39	4.13	4.13	0.06		1.35	0.22	1.13
B-737-200QC	4.48	3.94				0.15	0.31	0.15	1.65	1.65	0.03		0.54	0.09	0.45
Total INM 737-200	15.70	13.82				0.54	1.08	0.54	5.78	5.78	0.09		1.88	0.31	1.58
B-737-300Pax	15.70	13.82				0.54	1.08	0.54	5.78	5.78	0.09		1.88	0.31	1.58
B-737-300QC	8.96	7.88				0.31	0.62	0.31	3.30	3.30	0.05		1.08	0.18	0.90
Total INM 737-300	24.66	21.70				0.85	1.70	0.85	9.08	9.08	0.14		2.96	0.48	2.48
B-737-400	0.00	0.00				0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
DC-9-50	37.01	32.57				0.81	1.62	0.81	14.58	14.58	0.20		4.44	0.44	4.00
TOTAL DAY:	88.65	78.01	1.63	3.26	1.63	2.20	4.40	2.20	31.13	31.13	0.43		10.64	2.12	8.52

AIR CARRIER NIGHTTIME	TOTAL NIGHTTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (80%) RWY 3 TR15A	RWY 3 TR15B	RWY 3 TR15C	RWY 3 TR17A	RWY 3 TR17B	RWY 3 TR17C	RWY 3 TR28A	RWY 3 TR28B	RWY 3 TR18	RWY 6 TR21	TOTAL KONA LANDING	KONA (20%) RWY20 TR1R	RWY 20 TR20
DC-10-10	0.00	0.00											0.00		
DC-10-30	0.00	0.00											0.00		
MD11	0.00	0.00													
L1011-100	0.00	0.00											0.00		
L1011-250	0.00	0.00											0.00		
B-757-200	0.28	0.22	0.06	0.11	0.06								0.06	0.06	
B-767	0.00	0.00											0.00		
B-737-200Pax	0.81	0.65				0.03	0.05	0.03	0.27	0.27	0.00	0.00	0.18	0.03	0.14
B-737-200QC	1.43	1.14				0.05	0.09	0.05	0.47	0.47	0.01	0.02	0.29	0.05	0.24
Total INM 737-200	2.24	1.79				0.07	0.14	0.07	0.74	0.74	0.01	0.02	0.45	0.07	0.37
B-737-300Pax	1.14	0.91				0.04	0.07	0.04	0.38	0.38	0.01	0.00	0.23	0.04	0.19
B-737-300QC	2.86	2.29				0.09	0.18	0.09	0.93	0.93	0.01	0.06	0.57	0.09	0.48
Total INM 737-300	4.00	3.20				0.13	0.25	0.13	1.31	1.31	0.02	0.06	0.80	0.13	0.67
B-737-400	0.00	0.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DC-9-50	1.99	1.59				0.04	0.08	0.04	0.71	0.71	0.01		0.40	0.04	0.36
TOTAL NIGHT:	8.51	6.81	0.06	0.11	0.06	0.24	0.48	0.24	2.75	2.75	0.04	0.08	1.70	0.30	1.40

Note: RWY 3 represents the 400-foot displaced landing threshold that would be used when Runway 2-20 is extended to 9,600 feet.

TABLE 6-2 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1998 AVERAGE DAY ARRIVALS

HELICOPTERS DAYTIME	TOTAL DAYTIME LANDINGS	[illegible]	RWY 03L TR51A	RWY 03L TR51B	RWY 03L TR51C	RWY 03R TR52A	RWY 03R TR52B	RWY 03R TR53	RWY 03R TR56	RWY 03R TR57
AS350 AStar	49.74		2.50	4.99	2.50	14.97	14.82	4.99	2.50	2.50
Bell206B	26.72		1.34	2.68	1.34	8.04	8.02	2.68	1.34	1.34
Hughes 500	15.95		0.80	1.60	0.80	4.79	4.71	1.60	0.80	0.80
R22Beta	0.09		0.00	0.01	0.00	0.03	0.03	0.01	0.00	0.00
H500D	5.83		0.29	0.58	0.29	1.75	1.75	0.58	0.29	0.29
TOTAL DAY:	98.33		4.93	9.86	4.93	29.57	29.32	9.86	4.93	4.93

HELICOPTERS NIGHTTIME	TOTAL NIGHTTIME LANDINGS	[illegible]	RWY 03L TR51A	RWY 03L TR51B	RWY 03L TR51C	RWY 03R TR52A	RWY 03R TR52B	RWY 03R TR53	RWY 03R TR56	RWY 03R TR57
AS350 AStar	0.15						0.15			
Bell206B	0.08						0.08			
Hughes 500	0.00									
R22Beta	0.00									
H500D	0.00									
TOTAL NIGHT:	0.23		0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00

GENERAL AVIATION DAYTIME	TOTAL DAYTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (88%) RWY 3 TR18	RWY 3 TR28A	RWY 3 TR28B	RWY 5 TR22	RWY 5 TR23	TOTAL KONA LANDING	KONA (12%) RWY 20 TR20	RWY 23 TR24
Fix-Wing Piston										
Twin Propeller										
BEC58P	1.80	1.58	1.43			0.08	0.08	0.22		0.22
Single Propeller										
GASEPV	3.37	2.97	1.48			1.33	0.15	0.40	0.00	0.40
GASEPF	6.88	6.04	3.02			2.72	0.30	0.82	0.00	0.82
Fix-Wing Turbine										
CNA441	2.41	2.12		0.11	0.11	1.91		0.29		0.29
Jets:										
Challenger 601	0.17	0.15	0.07			0.06	0.01	0.02		0.02
Gulfstream	0.51	0.45	0.22			0.19	0.03	0.06		0.06
Falcon 900	0.12	0.11	0.05			0.05	0.01	0.01		0.01
TOTAL DAY:	15.24	13.41	6.28	0.11	0.11	6.34	0.58	1.83	0.01	1.82

GENERAL AVIATION NIGHTTIME	TOTAL NIGHTTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (80%) RWY 3 TR18	RWY 3 TR28A	RWY 3 TR28B	RWY 5 TR22	RWY 5 TR23	TOTAL KONA LANDING	KONA (20%) RWY 20 TR20	RWY 23 TR24
Fix-Wing Piston										
Twin Propeller										
BEC58P	0.08	0.06	0.06			0.00	0.00	0.02		0.02
Single Propeller										
GASEPV	0.14	0.11	0.06			0.05	0.01	0.03	0.00	0.03
GASEPF	0.29	0.23	0.12			0.10	0.01	0.06	0.00	0.06
Fix-Wing Turbine										
CNA441	0.10	0.08		0.00	0.00	0.07		0.02		0.02
Jets:										
Challenger 601	0.01	0.01	0.00			0.00	0.00	0.00		0.00
Gulfstream	0.02	0.02	0.01			0.01	0.00	0.00		0.00
Falcon 900	0.01	0.01	0.00			0.00	0.00	0.00		0.00
TOTAL NIGHT:	0.65	0.52	0.25	0.00	0.00	0.24	0.02	0.13	0.00	0.13

TABLE 6-2 (continued)
KAHULUI AIRPORT, PART 150 REPORT, 1998 AVERAGE DAY ARRIVALS

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]								
Single Propeller												
GASEPV	8.66			8.66								
GASEPF	17.63			17.63								
Twin Propeller												
BEC58P	4.64			4.64								
TOTAL DAY	30.93			30.93								

TOUCH & GO (ARRIVALS) NIGHTTIME	TOTAL TOUCH & GOS		RWY 3 TR27	RWY 5 TR30								
Single Propeller												
GASEPV	0.37			0.37								
GASEPF	0.75			0.75								
Twin Propeller												
BEC58P	0.20			0.20								
TOTAL NIGHT	1.32			1.32								

MILITARY DAYTIME:	TOTAL DAYTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (88%) RWY 3 TR17A	RWY 3 TR17B	RWY 3 TR17C	RWY 23 TR27	RWY 3 TR28A	RWY 3 TR28B	RWY 3 TR18	TOTAL KONA LANDING	KONA (12%) RWY 20 TR20	RWY 20 TR1R
C-130	1.50	1.32	0.02	0.04	0.02	0.61	0.31	0.31		0.18	0.10	0.08
P-3	1.95	1.72	0.03	0.05	0.03		0.40	0.40	0.80	0.23	0.12	0.11
C-135	0.67	0.59	0.01	0.02	0.01		0.14	0.14	0.27	0.08	0.04	0.04
C-12	0.03	0.03	0.00	0.00	0.00	0.01	0.01	0.01		0.00	0.00	0.00
C-20	0.04	0.04					0.02	0.02		0.00	0.00	0.00
C-26	0.27	0.24	0.00	0.01	0.00	0.11	0.06	0.06		0.03	0.02	0.02
HH-65	0.88	0.77	0.01	0.02	0.01	0.36	0.18	0.18		0.11	0.06	0.05
SH-60	0.27	0.24	0.00	0.01	0.00	0.11	0.06	0.06		0.03	0.02	0.01
UH-1V	0.40	0.35	0.01	0.01	0.01	0.16	0.08	0.08		0.05	0.03	0.02
CH-53	0.02	0.02	0.00	0.00	0.00	0.01	0.00	0.00		0.00	0.00	0.00
AH-1	0.13	0.11	0.00	0.00	0.00	0.05	0.03	0.03		0.02	0.01	0.01
UH-1	0.15	0.13	0.00	0.00	0.00	0.06	0.03	0.03		0.02	0.01	0.01
UH-60	0.65	0.57	0.01	0.02	0.01	0.27	0.13	0.13		0.08	0.04	0.04
OH-58	0.89	0.78	0.01	0.02	0.01	0.38	0.18	0.18		0.11	0.06	0.05
CH-47D	0.30	0.26	0.00	0.01	0.00	0.12	0.06	0.06		0.04	0.02	0.02
TOTAL INM CH47	3.69	3.25	0.05	0.10	0.05		0.77	0.77			0.24	0.20
TOTAL DAY:	8.15	7.17	0.11	0.23	0.11	2.25	1.69	1.69	1.07	0.98	0.52	0.46

MILITARY NIGHTTIME:	TOTAL NIGHTTIME LANDINGS	TOTAL TRADE LANDINGS	TRADE (80%) RWY 3 TR17A	RWY 3 TR17B	RWY 3 TR17C	RWY 23 TR27	RWY 3 TR28A	RWY 3 TR28B	RWY 3 TR18	TOTAL KONA LANDING	KONA (20%) RWY 20 TR20	RWY 20 TR1R
C-130	0.02	0.02	0.00	0.00	0.00	0.01	0.00	0.00		0.00	0.00	0.00
P-3	0.03	0.02	0.00	0.00	0.00		0.01	0.01	0.01	0.01	0.00	0.00
C-135	0.01	0.01	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
C-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
C-20	0.00	0.00					0.00	0.00		0.00	0.00	0.00
C-26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
HH-65	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
SH-60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
UH-1V	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
CH-53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
AH-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
UH-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
UH-60	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
OH-58	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
CH-47D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
TOTAL INM CH47	0.04	0.03	0.00	0.00	0.00	0.01	0.01	0.01		0.01	0.00	0.00
TOTAL NIGHT:	0.10	0.08	0.00	0.00	0.00	0.02	0.02	0.02	0.01	0.02	0.01	0.01

Note: RWY 3 represents the 400-foot displaced landing threshold that would be used when Runway 2-20 is extended to 9,600 feet.

6.3 ANTICIPATED CHANGES IN LAND USE

State and County land use plans, information on development proposals submitted to the County, existing land use data, and other information were used to forecast changes in land use near the Airport between 1993 and 1998. The most obvious trend is the continued expansion of light industrial and commercial uses in the area between Dairy Road and the proposed new airport access road. With one possible exception, no new noise-sensitive uses are anticipated.

The possible exception is a proposal to develop two-acre agricultural lots on land on the *makai* side of Hana Highway east of the Kaunoa Senior Citizens Center. This land is currently cultivated in sugar cane. Since State and County zoning ordinances and regulations allow single-family residences on agriculturally zoned lots so long as they qualify as farm dwellings, this would allow an increase in incompatible uses in this area. The proposed agricultural subdivision requires discretionary permits and approvals, however, and the presence of the noise exposure maps developed in 1989 has made public agencies aware of the potential conflicts. Consequently, this report assumes that residential uses will not expand into this area between now and 1998.

6.4 1998 "NO MITIGATION" NOISE EXPOSURE MAP

Figure 6-1 shows the Ldn noise levels anticipated in 1998 if no special noise mitigation or abatement measures are taken. It provides a base against which the effectiveness of measures developed as part of the noise compatibility program can be measured. Like the 1993 noise contours, these were developed using Version 4.11 of the INM.

The "1998 No Mitigation Scenario" noise contours shown in Figure 6-1 were used to calculate the total land area enclosed by each Ldn contour band. These are shown in Table 6-3.

Table 6-4 shows the changes in the sizes of the noise contours between the "1998 No Mitigation Scenario" and the 1993 Base Year shown in Chapter 5.

Predicted changes in Ldn at selected locations in the airport environs between 1993 and 1998 (for the "1998 No Mitigation Scenario") are shown in Table 6-5. They range from -1.4 to +2.7 Ldn. The greatest reduction in Ldn levels between the two years is at Monitoring Station J, which is on the Airport near the ground transportation area west of the airport access road.

The greatest increase in aircraft noise levels would occur south of the airport (Stations E, G, and V. This is primarily the result of jet air carrier aircraft taking off on Runway 2 changing their start-to-roll point from the existing runway end to the end of the extended runway. The higher noise level at Station M in West Spreckelsville is due to the fact that departing air carrier aircraft will be at a higher altitude than at present because of the 2,600-foot extension of Runway 2-20.

Table 6-3 Forecast 1998 "No Mitigation Scenario Noise Contour Size"

Noise Level Bands	Area Between Contours			Cumulative Area Enclosed	
	Square Miles	Acres	Approx % Over Water	Square Miles	Acres
>75 Ldn	1.37	877	11.7%	1.37	877
70 to 75 Ldn	1.21	774	18.6%	2.58	1,651
65 to 70 Ldn	2.81	1,798	28.2%	5.39	3,450
60 to 65 Ldn	7.36	4,710	34.9%	12.75	8,160
55 to 60 Ldn	16.59	10,618	37.0%	29.34	18,778

Source: Y. Ebisu & Associates. Calculated by INM Version 4.11

Table 6-4 Changes in Areas Within Each Ldn Band between 1993 Base Year and "1998 No Mitigation Scenario"

Noise Level Bands	Changed Area Between Contours		Changed Cumulative Area Enclosed	
	Square Miles	Acres	Square Miles	Acres
>75 Ldn	+.13	+83	+0.13	+83
70 to 75 Ldn	-.08	-52	+0.05	+32
65 to 70 Ldn	-.07	-45	-0.02	-12
60 to 65 Ldn	+.43	+275	+0.41	+262
55 to 60 Ldn	+.62	+397	+1.03	+660

Source: Based on difference between 1993 Base Year areas in Table 5-3 and 1998 "No Mitigation" areas in Table 6-3.

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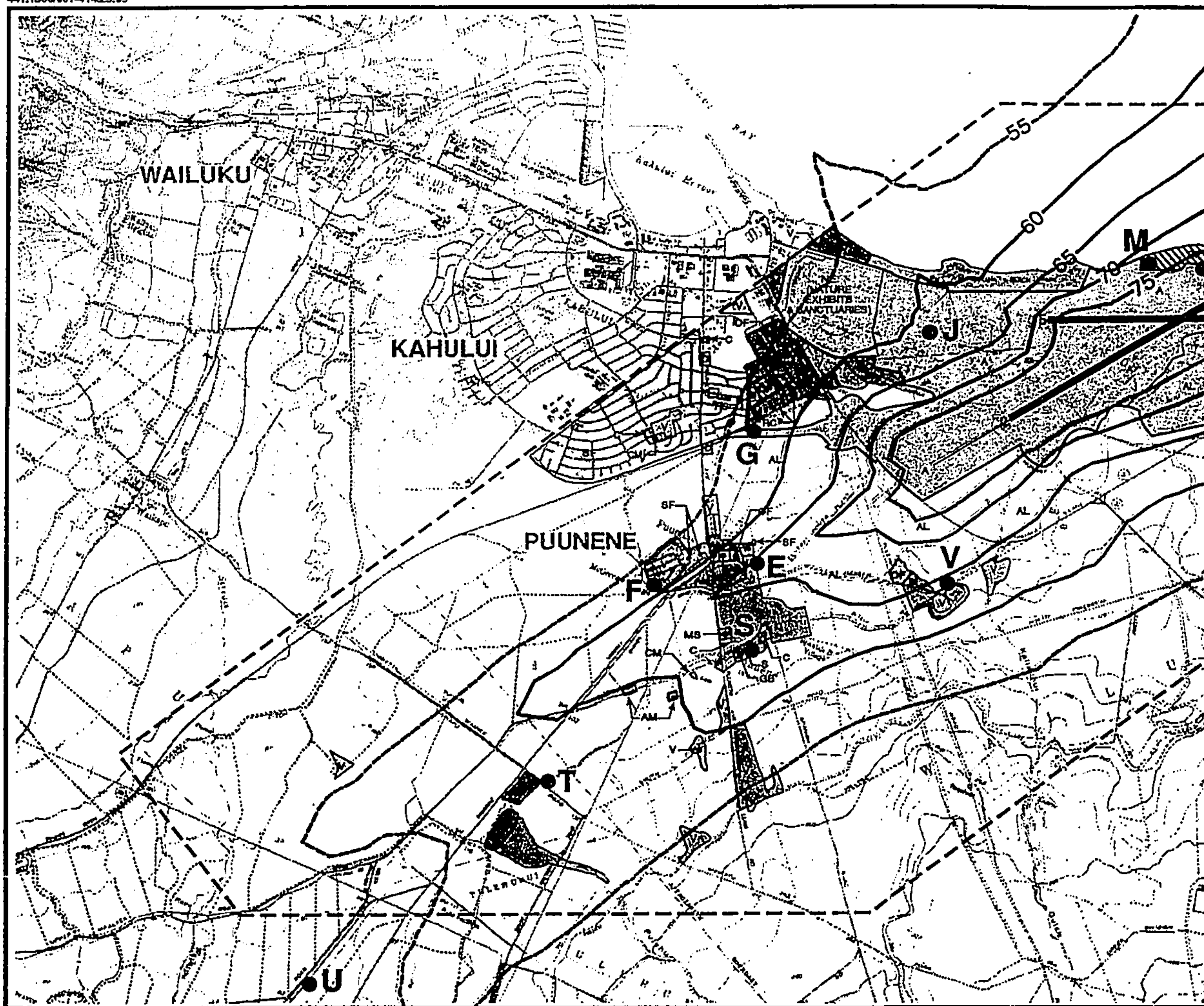


KAHULUI AIRPORT
FAR Part 150 Airport Noise Compatibility Program

Prepared For:
Airports Division
Department of Transportation
State of Hawaii

Prepared By:
Belt Collins Hawaii
Y. Ebisu & Associates
1995

LAND USE CLASSIFICATION

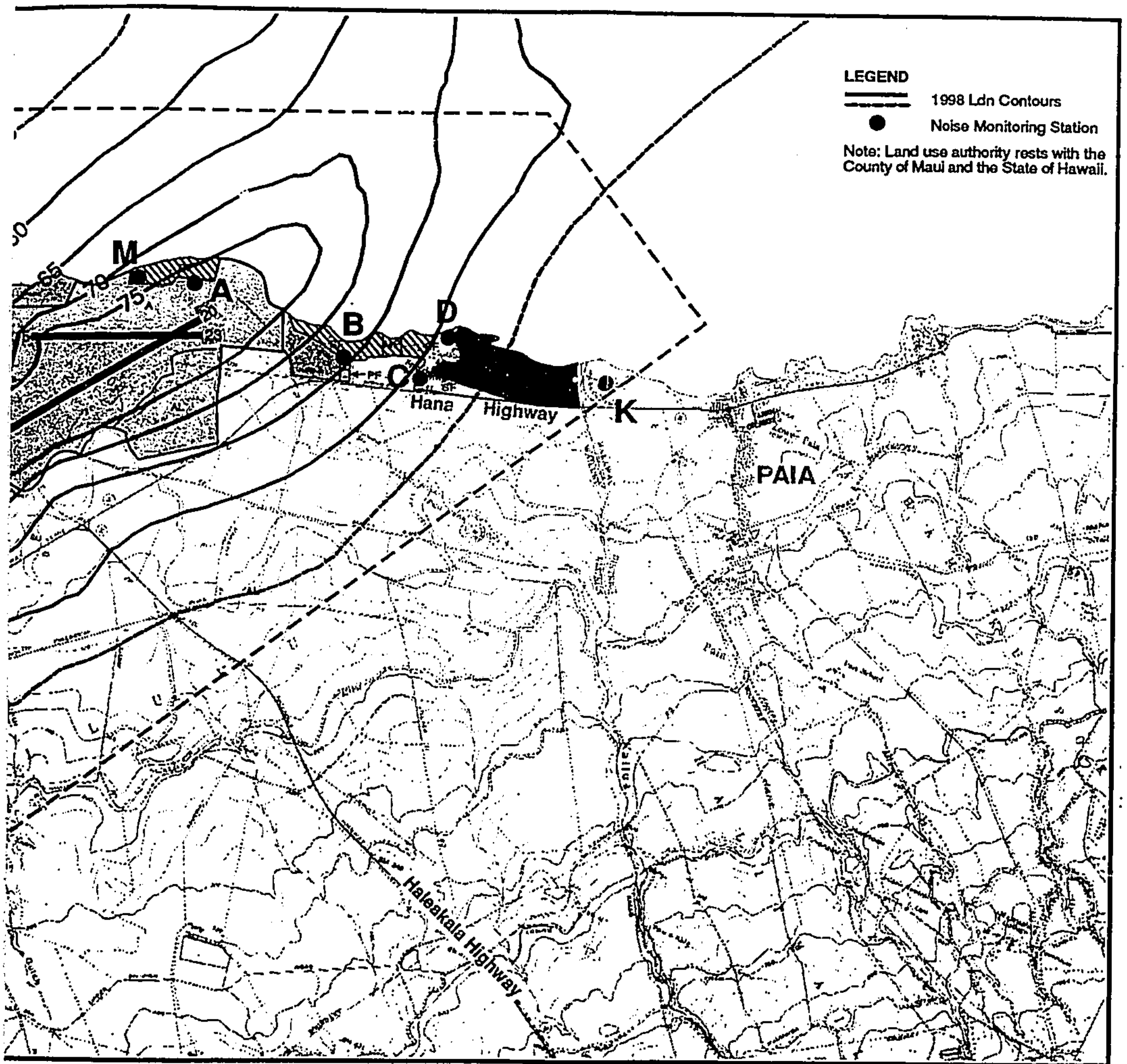
COMMERCIAL AND GOVERNMENT USE
RC RETAIL COMMERCIAL
OF BUSINESS/PROFESSIONAL OFFICES
AC AIRPORT BUSINESSES (car rental agencies, tours, lei stands)
RS RETAIL STORAGE (warehouses)
CS COMMERCIAL SERVICES
GB GOVERNMENT BUILDING

RESIDENTIAL
SF SINGLE FAMILY
MF MULTIPLE FAMILY

PUBLIC USE
S SCHOOL
H HOSPITALS (clinics, health care facilities, nursing homes)
PF PUBLIC FACILITIES (day care, libraries, community centers)
C CHURCH

MANUFACTURING, PRODUCTION & STORAGE
M LIGHT/HEAVY MANUFACTURING
AM AGRICULTURAL MANUFACTURING
MS MANUFACTURING WAREHOUSES

AL AGRICULTURAL LAND



are facilities,

e, libraries,

ODUCTION & STORAGE
RING
URING
USES
LAND

RECREATIONAL
OR OUTDOOR RECREATION
NE NATURE EXHIBITS & SANCTUARIES
G&W GOLF COURSES, GARDENS, WATER RECREATION
OPEN SPACE
CM CEMETERY
P PARK
V VACANT OR UNDEVELOPED LAND
STUDY AREA BOUNDARY
AIRPORT PROPERTY
AREA OF INCOMPATIBLE LAND USE

NORTH

0 2000 4000 8000
SCALE IN FEET

Figure 6-1
FIVE-YEAR (1998)
N0 MITIGATION
NOISE EXPOSURE MAP:
KAHULUI AIRPORT

[illegible] 1998 No Mitigation [illegible] Levels at Monitoring Stations in Kahului and Environs

Noise Monitoring Station	Day/Night Noise Level (Ldn) 1993 Base Year	Day/Night Noise Level (Ldn) 1998 No Mitigation	Change From 1993 to 1998
A	78.1	77.7	- 0.4
B	65.9	66.1	+0.2
C	59.3	59.3	0.0
D	59.8	59.2	- 0.6
E	65.1	66.6	+1.5
F	58.6	58.9	+ .3
G	54.5	57.2	+2.7
J	62.6	61.2	- 1.4
K	50.5	49.9	- .6
M	70.6	72.5	+1.9
S	61.8	61.8	0.0
T	56.4	56.4	0.0
U	52.0	52.2	+0.2
V	62.0	64.1	+2.1

Note: See Figure 6-1 for noise monitoring station locations. Calculated using INM Version 4.11.

Source: Y. Ebisu & Associates; see Appendix B, Table B-5

6.5 LAND USE COMPATIBILITY

6.5.1 Compatibility Determined Using Far Part 150 Standards

The "1998 No Mitigation Scenario" noise contours shown in Figure 6-1 were used together with the FAR Part 150 land use compatibility standards contained in Table 4-1 to calculate the land use compatibility forecasts shown in Table 6-6. The table also lists the number of dwelling units and resident population in the incompatible use area.

Most of the land around Kahului Airport where noise levels in 1998 would be higher than in the 1993 Base Year are, and would continue to be, in agricultural, commercial, or light industrial use. Its use for these purposes would continue to be compatible with the operation of the airport under the "1998 No Mitigation Scenario." Residences in East and West Spreckelsville, however, would continue to be exposed to incompatible aircraft noise levels. The greatest incompatibility would be in West Spreckelsville, where noise levels at some homes would exceed 75 Ldn, the level that a primary FAR Part 150 Program goal seeks to contain within the airport boundaries.

6.5.2 Land Use Compatibility Using State of Hawaii Department of Transportation Recommendations

As noted in Chapter 4, in conjunction with the various FAR Part 150 plans that it is preparing, the State of Hawaii Department of Transportation has determined that a single noise level of 60 Ldn should be uniformly applied in all land use compatibility determinations related to residential, apartment, resort, educational, public use, and other noise sensitive land uses throughout the State. Because of this, land use compatibility for the Kahului Airport "1998 No Mitigation Scenario" was also evaluated using these more stringent noise compatibility standards (Table 4-2). The results of these calculations are summarized in Table 6-6. The residences in East and West Spreckelsville remain the clearest incompatible uses when judged by the State criteria.

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Table 6-6 [illegible] Determined Using Official FAR Part 150 Standards

LAND USE	Incompatible Land Uses in Acres by Average Day-Night Sound Level		
	65-70	70-75	>75
Single-Family Residential	10.50	6.33	12.15
Multi-Family Residential	0.00	0.00	0.00
Resort	0.00	0.00	0.00
Commercial[1]	0.00	0.00	0.00
Industrial[1]	0.00	0.00	0.00

LAND USE	[illegible] DWELLING UNITS AND RESIDENTS IN INCOMPATIBLE AREAS					
	[illegible] Incompatible Dwelling Units by Ldn Band			No. of Persons Residing in Incompatible Areas by Ldn Band[2]		
	65-70	70-75	>75	65-70	70-75	>75
Single-Family Residential	11	5	19	39	18	67
Multi-Family Residential	0	0	0	0	0	0

[1] Compatibility determination is from Table 1 in FAR Part 150, Section A150.101.

[2] Population estimates based on average of 3.5 persons per single-family residential unit and 2.75 persons per multi-family dwelling unit.

Source: Acreages and number of units calculated by Belt, Collins & Associates based on Ldn contours developed by Y. Ebisu & Associates (see Figure 6-1).

Table 6-7 1998 "No Mitigation" Incompatible Land Uses Determined Using Recommended State Guidelines

LAND USE	Incompatible Land Uses in Acres by Average Day-Night Sound Level			
	60-65	65-70	70-75	>75
Single-Family Residential	15.22	10.50	6.33	12.15
Multi-Family Residential	4.04	0	0	0
Schools	0	0	0	0
Public Facilities[1]	2	0	0	0
Churches	1	0	0	0

LAND USE	DWELLING UNITS AND RESIDENTS IN INCOMPATIBLE AREAS							
	No. of Incompatible Dwelling Units by Ldn Band				No. of Persons Residing in Incompatible Areas by Ldn Band[2]			
	60-65	65-70	70-75	>75	60-65	65-70	70-75	>75
Single-Family Residential	28	11	5	19	98	39	18	67
Multi-Family Residential	18	0	0	0	50	0	0	0

[1] Compatibility determination is from the Department of Transportation, State of Hawaii, recommendations for local land use compatibility.

[2] Population estimates based on average of 3.5 persons per single-family residential unit and 2.75 persons per multi-family dwelling unit.

Source: Acreages and number of units calculated by Belt, Collins & Associates based on Ldn contours developed by Y. Ebisu & Associates (see Figure 6-1).

CHAPTER 7
NOISE ABATEMENT ALTERNATIVES CONSIDERED

CHAPTER 7
NOISE ABATEMENT ALTERNATIVES CONSIDERED

7.1 PROBLEM IDENTIFICATION AND GENERAL METHODOLOGY

The 1993 Noise Exposure Map shown in Figure 5-1 and data in Tables 5-2 and 5-3 show that incompatible land uses exist around Kahului Airport at the present time. The comparable 1998 "No Mitigation" Noise Exposure Map shown in Figure 6-1 and data in Tables 6-2 and 6-3 show that the incompatibilities will continue to exist in 1998 if no special noise abatement and/or noise mitigation measures are taken. This is true whether Federal FAR Part 150 guidelines or the planning guidelines adopted by the Airports Division of the State of Hawaii Department of Transportation are used as criteria. Most of the existing incompatibility occurs in West and East Spreckelsville, small residential subdivisions located immediately northwest and northeast of the airport, respectively, and this will remain true in the future. In addition to this area within the noise contours, the airport also receives noise complaints from residents located outside the area covered by the Noise Exposure Maps.

A range of alternative noise abatement and noise mitigation measures was evaluated to determine the extent to which they could reduce existing and future incompatible land uses around the Airport. The primary measures of effectiveness were their ability to: (1) reduce the area contained within the Airport's Ldn noise contours and (2) to reduce or eliminate incompatible land uses as judged by the land use compatibility criteria described in Chapter 4.

Program alternatives were initially screened with respect to their potential for improving the existing and future land use compatibility situation around Kahului Airport. Table 7-1 lists the categories of measures considered, the kinds of aircraft noise that each addresses, and the extent to which the initial screening indicated they might be useful at Kahului Airport. All alternatives suggested for investigation and/or implementation during the many discussions held concerning noise from Kahului Airport, all alternatives mandated by the FAR Part 150 regulations for inclusion in the analysis, and all alternatives considered promising in reducing land use incompatibilities were considered.

For purposes of discussion, the measures can be divided into four broad categories:

- **Operational/Procedural Changes.** This includes changes to flight procedures and restrictions on the use of the airport by type or class of aircraft to reduce noise exposure (see Section 7.2).

Table 7-1 Alternative Measures Considered During Screening

Alternative Methods of Achieving Land Use Compatibility[2]	Applicability of Possible Measures for Increasing Land Use Compatibility: Taxi Noise	Departure Noise	Approach Noise	Landing Noise	Training Flights	Maintenance	Ground Equipment	Extent to Which Measure Might Increase Land Use Compatibility at Kahului[3]
Fan Out Departure Tracks		■						Low
Change Aircraft Flap Management		■	■		■			Low
Limit Use of Reverse Thrust				■				Low
Restrict Ground Equipment Use							■	Low
Restrict Run-up Areas or Times						■	■	Low
Limit Ground Movement of Aircraft	■							Low
Change Takeoff/Landing Procedures		■	■					Low[1]
Prescribed Flight Tracks		■	■		■			Low[1]
Restrict Training Flights	■	■	■	■	■			Low
Reschedule Flights	■	■	■	■	■	■	■	Moderate
Noise-Related Landing Fees	■	■	■	■	■			Moderate
Preferential Runway Use	■	■	■	■	■			Low
Limit Aircraft Operations	■	■	■	■	■	■	■	Moderate
Limit Aircraft Types	■	■	■	■	■	■	■	Moderate
Impose Curfew on Operations	■	■	■	■	■			Moderate
Construct New Runway(s)			■	■				Low
Extend Existing Runway(s)		■		■				Low
Displace Runway Threshold			■					Low
Build High-Speed Exit Taxiway(s)	■			■				Low
Relocate Aircraft Parking/Terminal	■					■	■	Low
Construct Noise Barrier	■	■		■		■	■	Low
Construct New Engine Run-up Areas						■		Low
Relocate Airport	■	■	■	■	■	■	■	High
Acquire Land or Easement	■	■	■	■	■	■	■	High
Require Sound Insulation	■	■	■	■	■	■	■	High
Compatible Use Zoning	■	■	■	■	■	■	■	High

[1] Already in effect through informal Preferential Runway Use Program.
[2] See text for discussion of effectiveness of these measures.
[3] "Low" = <2 Ldn Reduction; "Moderate" = 2 to 5 Ldn Reduction and/or reduces overflights; "High" = >5 Ldn Reduction or eliminates land use incompatibility.

- **On-Airport Improvements.** This category includes construction measures that the Airport Operator can take within its property to reduce noise levels in the surrounding areas (see Section 7.3). Examples of such measures include the construction of noise barriers or berms, the construction of new runways or runway extensions, and the addition or reconfiguration of taxiways to reduce ground noise.

- **Off-Airport Construction or Acquisition of Land or Interest in Land (Section 7.4).** This category involves construction measures that would enhance the sound attenuation characteristics of existing structures and/or the acquisition of land and property and/or interests in land (e.g., air rights, easements, or development rights) for the purpose of removing (or preventing the establishment of) incompatible uses.

- **Planning Efforts Related to Future Landside Developments (Section 7.5).** This category includes steps the Airports Division and government agencies can take to avoid noise-related land use conflicts around the airport.

Constraints imposed by safety considerations and Federal Aviation Administration (FAA) policies regarding non-discrimination and airport access were considered in developing the program alternatives. The potential consequences of nighttime curfews, of forcing interisland air carriers to convert from use of noisier (Stage 2) to quieter (Stage 3) jet aircraft over a relative short period of time, and different competitive scenarios for interisland air carrier service were also taken into account. Measures directed toward reducing the number of aircraft overflights of noise-sensitive communities, as well as the single-event noise resulting from these overflights, were also evaluated. The effectiveness of applying sound attenuation treatment to affected homes and the feasibility of relocating affected residences were also studied. The recommended Noise Compatibility Program described in Chapter 8 was prepared after evaluating the advantages and disadvantages of the various alternatives.

7.2 NOISE ABATEMENT THROUGH OPERATIONAL CHANGES

The first broad category of noise abatement alternatives includes changing aircraft and/or airport operational procedures to reduce noise exposure. Measures in this category include such things as a preferential runway use system, special take-off and landing procedures, aircraft flight track modifications, restrictions by class of aircraft on the use of the airport, and curfews or prohibitions on operations. Operational alternatives can reduce noise in noise-sensitive areas by five different means:

- Changing the aircraft flight tracks to increase the lateral and/or vertical separation between the aircraft and the ground receptor.

- Restricting the use of the airport by type or class of aircraft, e.g., substituting quieter aircraft for noisier aircraft (either by retiring older/noisier aircraft and replacing them with newer/quieter aircraft or by quieting existing aircraft by retro-fitting them with "hush kits").

- Limiting (including reducing) the total number of aircraft operations (by aircraft type and/or time of day).

- Establishing a preferential runway use system that directs aircraft onto runways that have the least impact on the surrounding community.

- Closing the airport (i.e., imposing a curfew) for some hours each day (usually during the nighttime period).

The noise reduction benefits of the eleven most promising alternatives were calculated using Version 4.11 of the FAA's Integrated Noise Model and 1993 and 1998 operational data and forecasts. The results of these calculations and the noise reductions that they provide relative to the Base Year and 5-Year No Mitigation noise levels are shown in Table 7-2. The 1998 Ldn noise contours for each alternative are shown in Figures 7-1 through 7-11 at the end of this chapter.

The following paragraphs describe the noise reductions that are possible from each of the operational alternatives examined and discusses the extent to which each could be effectively employed in a Noise Compatibility Program for Kahului Airport. The extent to which each of the ten alternatives would change the area in each 5-Ldn band is shown in Table 7-3; their effect on the number of residences that would experience incompatible levels of aircraft noise is shown in Table 7-4. Table 7-5 compares the alternatives with respect to their implied equipment costs (which would be borne by operators) and noise mitigation costs (which would be borne by homeowners).

7.2.1 Alter or Fan Out Departure Paths

Departure noise is the cause of many complaints from persons residing around Kahului Airport. The great majority of these complaints are from residents of East and West Spreckelsville and relate to interisland jet departures from Runway 2-20.

An extension of the centerline of Runway 2-20 to the north passes over the open space between East and West Spreckelsville. As noted earlier in this document, the existing informal preferential runway use program in effect at the Airport calls for aircraft departing on Runway 2 to continue straight on their departure heading until they are at least a mile offshore as a means of minimizing noise impacts on these two communities. The FAA would be responsible for any changes to these procedures.

Table 7-2 Effect of Noise Abatement Options on 1998 Noise Levels

[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B-93	1993 Base Year	78.1	65.9	59.3	59.8	65.1	58.6	54.5	62.6	50.5	70.6	61.8	56.4	52.0	62.0
B-98	1998 "No Mitigation"	77.7	66.1	59.3	59.2	66.6	58.9	57.2	61.2	49.9	72.5	61.8	56.4	52.2	64.1
	Change from 1993 Base Year	-0.4	0.2	0.0	-0.6	1.5	0.3	2.7	-1.4	-0.6	1.9	0.0	0.0	0.2	2.1
T1	No Stage 2 (All Aloha Operations by B-737-300 and All Hawaiian Operations by MD-82)	68.0	56.9	50.6	52.4	63.9	55.9	48.8	54.9	45.5	63.2	55.3	51.2	46.2	55.3
	Change from 1998 "No Mitigation"	-9.7	-9.2	-8.7	-6.8	-2.7	-3.0	-8.4	-6.3	-4.4	-9.3	-6.5	-5.2	-6.0	-8.8
T2	No Stage 2 (All Aloha Operations by B-737-300 and All Hawaiian Operations by DC-9-50 with Hush Kits)	72.3	61.0	54.2	54.8	63.8	55.9	52.1	57.0	46.7	67.2	56.5	52.0	47.4	58.9
	Change from 1998 "No Mitigation"	-5.4	-5.1	-5.1	-4.4	-2.8	-3.0	-5.1	-4.2	-3.2	-5.3	-5.3	-4.4	-4.8	-5.2
T3	No Stage 2 Operations Between 10:00 PM and 7:00 AM (All Aloha Night Operations by B-737-300 and All Hawaiian Night Operations by DC-9-50 with Hush Kits)	76.2	64.8	57.9	57.9	65.5	57.7	55.5	59.7	48.8	71.0	59.6	54.5	50.2	62.3
	Change from 1998 "No Mitigation"	-1.5	-1.3	-1.4	-1.3	-1.1	-1.2	-1.7	-1.5	-1.1	-1.5	-2.2	-1.9	-2.0	-1.8
T4	No Stage 2 Operations Between 10:00 PM and 7:00 AM (Forecast B-737-300 Operations at Night; Convert All B-737-200 and DC-9-50 Nighttime Operations to Daytime Operations)	75.9	64.5	57.6	57.6	65.2	57.3	55.2	59.4	48.6	70.7	59.2	54.1	49.7	61.9
	Change from 1998 "No Mitigation"	-1.8	-1.6	-1.7	-1.6	-1.4	-1.6	-2.0	-1.8	-1.3	-1.8	-2.6	-2.3	-2.5	-2.2
T5	Impose Stage 2 Phaseout Schedule As On Mainland (Total Fleet is 75 Percent Stage 3)	75.5	64.0	57.2	57.4	65.8	57.8	55.2	59.5	48.5	70.4	60.3	54.9	50.4	62.1
	Change from 1998 "No Mitigation"	-2.2	-2.1	-2.1	-1.8	-0.8	-1.1	-2.0	-1.7	-1.4	-2.1	-1.5	-1.5	-1.8	-2.0

Table 7-2 Effect of Noise Abatement Options on 1998 Noise Levels (Continued)

Noise Abatement Option		Sta. A	Sta. B	Sta. C	Sta. D	Sta. E	Sta. F	Sta. G	Sta. J	Sta. K	Sta. M	Sta. S	Sta. T	Sta. U	Sta. V
T6	Use existing Runway 2 Threshold for Interisland Air Carrier and GA Tradewind Departures on Runway 2	78.6	66.4	59.8	60.3	66.6	58.8	54.9	62.6	50.7	71.0	61.8	56.4	52.2	62.5
	Change from 1998 "No Mitigation"	0.9	0.3	0.5	1.1	0.0	-0.1	-2.3	1.4	0.8	-1.5	0.0	0.0	0.0	-1.6
T7	Use Early Power Cutback at 800-foot Altitude for all DC-9-50 and B-737 Departures	76.3	64.6	58.4	59.0	67.1	59.2	56.9	60.7	49.8	70.4	63.6	56.7	52.1	63.4
	Change from 1998 "No Mitigation"	-1.4	-1.5	-0.9	-0.2	0.5	0.3	-0.3	-0.5	-0.1	-2.1	1.8	0.3	-0.1	-0.7
T8	All Aircraft Use Runway 2 During Light Kona Winds	77.6	66.6	59.6	59.6	66.5	58.3	56.2	60.3	50.1	72.8	57.4	53.3	48.1	62.3
	Change from 1998 "No Mitigation"	-0.1	0.5	0.3	0.4	-0.1	-0.6	-1.0	-0.9	0.2	0.3	-4.4	-3.1	-4.1	-1.8
T9	Place a 10:00 PM to 7:00 AM Curfew on Airport (Convert All Nighttime Operations to Daytime Operations)	75.8	64.3	57.4	57.2	64.5	56.6	55.1	58.8	48.0	70.6	59.0	53.7	49.4	61.9
	Change from 1998 "No Mitigation"	-1.9	-1.8	-1.9	-2.0	-2.1	-2.3	-2.1	-3.4	-1.9	-1.9	-2.8	-2.7	-2.8	-2.2
T10	Place a 10:00 PM to 7:00 AM Curfew on Airport (Convert Nighttime Operations Except Early Bird Arrivals (before 7:00 AM) to Daytime Operations	75.8	64.4	57.5	57.5	66.2	58.2	55.1	59.2	48.4	70.6	59.2	54.3	49.8	61.9
	Change from 1998 "No Mitigation"	-1.9	-1.7	-1.8	-1.7	-0.4	-0.7	-2.1	-3.4	-1.5	-1.9	-2.6	-2.1	-2.4	-2.2
T11	No Stage 2 Operations Between 10:00 PM and 6:00 AM. All Night Cargo by B-737-300-QC.	77.4	65.8	58.9	58.9	66.2	58.5	56.8	60.8	49.6	72.1	61.1	55.8	51.7	63.7
	Change from 1998 "No Mitigation"	-0.3	-0.3	-0.4	-0.3	-0.4	-0.4	-0.4	-0.4	-0.3	-0.4	-0.7	-0.6	-0.5	-0.4

[1] See Figures 7-1 through 7-11 for maps comparing noise contours for each option with Base Year 1993 and Five Year (1998) noise contours.
Source: Y Ebisu and Associates. Station locations are shown on Figure 8-1.

Table 7-3 [illegible] Base Year (1993), Future Year (1998) No Mitigation, and Noise Abatement Option Ldn Contours

[illegible]	[illegible] (Sq. miles) Enclosed by Contour				
	>75 Ldn	>70 Ldn	>65 Ldn	>60 Ldn	>55 Ldn
1993 Base Year	1.34	2.53	5.41	12.34	28.31
1998 (No Mitigation)	1.37	2.58	5.39	12.75	29.34
1998 (Option T1) No Stage 2 (All Aloha Operations by B-737-300 and All Hawaiian Operations by MD-82)	0.48	0.78	1.75	3.97	10.31
1998 (Option T2) No Stage 2 (All Aloha Operations by B-737-300 and All Hawaiian Operations by DC-9-50 with Hush Kits)	0.59	1.36	2.63	5.72	13.87
1998 (Option T3) No Stage 2 Operations Between 10:00 PM and 7:00 AM (All Aloha Night Operations by B-737-300 and All Hawaiian Night Operations by DC-9-50 with Hush Kits)	1.09	2.13	4.37	9.88	22.90
1988 (Option T4) No Stage 2 Operations Between 10:00 PM and 7:00 AM (Forecast B-737-300 Operations at Night; Convert All B-737-200 and DC-9-50 Nighttime Operations to Daytime Operations)	1.03	2.05	4.19	9.38	21.88
1998 (Option T5) Impose Stage 2 Phaseout Schedule As On Mainland (Total Fleet is 75 Percent Stage 3)	0.98	2.01	4.15	9.43	21.87
1998 (Option T6) Use existing Runway 2 Threshold for Interisland Jet and GA Tradewind Departures on Runway 2	1.41	2.74	5.77	13.26	29.95
1998 (Option T7) Use Early Power Cutback at 800-foot Altitude for all DC-9-50 and B-737 Departures	1.26	2.41	5.52	12.67	28.96
1998 (Option T8) All Aircraft Use Runway 2 During Light Kona Winds	1.37	2.56	5.29	12.62	28.51
1998 (Option T9) Place a 10:00 PM to 7:00 AM Curfew on Airport (Convert All Nighttime Operations to Daytime Operations)	1.00	2.00	4.07	8.96	20.71
1998 (Option T10) Place a 10:00 PM to 7:00 AM Curfew on Airport (Convert Nighttime Operations Except Early Bird Arrivals (before 7:00 AM) to Daytime Operations	1.01	2.04	4.16	9.38	21.63
1998 (Option T11) No Stage 2 Operations Between 10:00 PM and 6:00 AM. All Night Cargo by B-737-300-QC.	1.30	2.43	5.09	11.98	27.50

Note: Calculated using standard INM Version 4.11.

Source: Y. Ebisu and Associates.

Table 7-4 Comparison of Alternative Noise Abatement Measures

	Alternative	Number of Dwelling Units by Ldn Band			
		60-65 Ldn	65-75 Ldn	>75 Ldn	Total
B-93	1993 Base Year	54	16	19	89
B-98	1998 "No Mitigation"	46	16	19	81
T1	No Stage 2 (All Aloha Operations by B-737-300 and All Hawaiian Operations by MD-82)	2	17	0	19
	Change from 1998 "No Mitigation"	-44	1	-19	-62
T2	No Stage 2 (All Aloha Operations by B-737-300 and All Hawaiian Operations by DC-9-50 with Hush Kits)	11	24	0	35
	Change from 1998 "No Mitigation"	-35	8	-19	-46
T3	No Stage 2 Operations Between 10:00 PM and 7:00 AM (All Aloha Night Operations by B-737-300 and All Hawaiian Night Operations by DC-9-50 with Hush Kits)	39	19	12	70
	Change from 1998 "No Mitigation"	-7	3	-7	-11
T4	No Stage 2 Operations Between 10:00 PM and 7:00 AM (Forecast B-737-300 Operations at Night; Convert All B-737-200 and DC-9-50 Nighttime Operations to Daytime Operations)	38	19	12	69
	Change from 1998 "No Mitigation"	-8	3	-7	-12
T5	Impose Stage 2 Phaseout Schedule As On Mainland (Total Fleet Is 75 Percent Stage 3)	38	24	6	68
	Change from 1998 "No Mitigation"	-8	8	-13	-13
T6	Use existing Runway 2 Threshold for Interisland Jet and GA Tradewind Departures on Runway 2	49	18	19	86
	Change from 1998 "No Mitigation"	3	2	0	5
T7	Use Early Power Cutback at 800-foot Altitude for all DC-9-50 and B-737 Departures	46	19	12	77
	Change from 1998 "No Mitigation"	0	3	-7	-4
T8	All Aircraft Use Runway 2 During Light Kona Winds	46	17	22	85
	Change from 1998 "No Mitigation"	0	1	3	4
T9	Place a 10:00 PM to 7:00 AM Curfew on Airport (Convert All Nighttime Operations to Daytime Operations)	38	22	8	68
	Change from 1998 "No Mitigation"	-8	6	-11	-13
T10	Place a 10:00 PM to 7:00 AM Curfew on Airport (Convert Nighttime Operations Except Early Bird Arrivals (before 7:00 AM) to Daytime Operations	38	22	6	68
	Change from 1998 "No Mitigation"	-8	6	-11	-13
T11	No Stage 2 Operations Between 10:00 PM and 6:00 AM. All Night Cargo by B-737-300-QC.	42	19	16	77
	Change from 1998 "No Mitigation"	-4	3	-3	-4

Table 7-5 Costs of Achieving Land Use Compatibility Using Different Noise Abatement Alternatives

[illegible]	[illegible]	[illegible]								[illegible]									
		Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
B-96	"1996 "No Mitigation""	–	–	–	–	–	–	–	–	–	–	–	–	–	–	$6.7	$15.7	$6.7	$15.7
T1	No Stage 2 (All Aloha Operations by B-737-300 and All Hawaiian Operations by MD-82)	0	5	0	2	0	0	8	12	$0.0	$0.0	$0.0	$0.0	$240.0	$335.0	$1.1	$1.1	$241.1	$336.1
T2	No Stage 2 (All Aloha Operations by B-737-300 and All Hawaiian Operations by DC-9-50 with Hush Kits)	0	5	0	2	8	12	0	0	$0.0	$0.0	$0.0	$0.0	$16.0	$199.0	$2.3	$2.3	$18.3	$201.3
T3	No Stage 2 Operations Between 10:00 PM and 7:00 AM (All Aloha Night Operations by B-737-300 and All Hawaiian Night Operations by DC-9-50 with Hush Kits)	0	5	0	2	3	12	0	0	$0.0	$0.0	$0.0	$0.0	$6.0	$199.0	$5.7	$10.7	$11.7	$209.7
T4	No Stage 2 Operations Between 10:00 PM and 7:00 AM (Prevent B-737-300 Operations at Night; Convert All B-737-200 and DC-9-50 Nighttime Operations to Daytime Operations)	0	1	0	0	0	0	0	1	$0.0	$19.2	$0.0	$0.0	$0.0	$64.2	$5.4	$10.3	$5.4	$74.5
T5	Impose Stage 3 Phaseout Schedule As On Mainland (Total Fleet is 75 Percent Stage 3)	2	5	1	2	9	12	0	0	$0.0	$0.0	$0.0	$0.0	$88.0	$199.0	$4.2	$7.5	$92.2	$206.5
T6	Use existing Runway 2 Threshold for Interisland Jet and GA [illegible] Departures on Runway 2	0	0	0	0	0	0	0	0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$7.0	$16.0	$7.0	$16.0
T7	Use Early Power Cutback at 800-foot Altitude for all DC-9-50 and B-737 Departures	0	0	0	0	0	0	0	0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$5.5	$10.4	$5.5	$10.4
T8	All Aircraft Use Runway 2 During Light Kona Winds	0	0	0	0	0	0	0	0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$7.6	$18.4	$7.6	$18.4
T9	Place a 10:00 PM to 7:00 AM Curfew on Airport (Convert All Nighttime Operations to Daytime Operations)	1	1	0	0	0	0	0	0	$34.6	$57.7	$2.9	$9.2	$69.6	$124.7	$4.9	$9.0	$74.5	$133.7
T10	Place a 10:00 PM to 7:00 AM Curfew on Airport (Convert Nighttime Operations Except Early Bird Arrivals (before 7:00 AM) to Daytime Operations)	1	1	0	0	0	0	1	1	$34.6	$57.2	$2.0	$6.5	$99.6	$122.7	$4.6	$8.6	$104.2	$131.3
T11	No Stage 2 Operations Between 10:00 PM and 6:00 AM, All Night Cargo by B-737-300-QC.	0	0	0	2	0	0	0	0	0	0	0	0	0	$70.0	$6.4	$14.2	$6.4	$84.2

Table 7-5 Costs of Achieving Land Use Compatibility Using Different Noise Abatement Alternatives (Continued)

Notes:

1. The "low" estimates for B-737-300-pax aircraft for options T1-T4 assume that Aloha Airlines will concentrate the B-737-300 passenger aircraft it already plans to have in its fleet on Kahului routes. The "low" estimates for Options T9 and T10 assume that an additional aircraft would be acquired so that Aloha could operate additional passenger flights between 7:00am and 10:00pm, thereby accommodating passengers who could not fly between 6:00am and 7:00am.

2. The "high" estimates for B-737-300-pax aircraft for Options T1-T4 assume that Aloha Airlines would purchase new B-737-300 passenger aircraft rather then concentrating those it already plans to have in its fleet on Kahului routes, purchasing new aircraft instead. The "high" estimates for Option T5 assumes that Aloha would purchase sufficient aircraft to operate Stage 3 aircraft on all its interisland routes, not just on those to and from Kahului. The assumptions for Options T9 and T10 are the same as those for the "low" estimate.

3. The "low" and "high" estimates for B-737-QC aircraft incorporate the same assumptions as were used for B-737-300-pax aircraft.

4. The "low" estimates for the number of "hush kits" that would be needed for Hawaiian Airlines DC9-50 aircraft assume that only the minimum number of aircraft needed to serve Kahului would be retro-fitted. Where the need for additional aircraft is indicated, the "high" estimates assume that Hawaiian's entire fleet would be retro-fitted with hush-kits.

5. The "low" estimate for MD-82 aircraft assumes that only the minimum number of aircraft needed to serve Kahului would be purchased.

6. The "high" estimate for MD-82 aircraft for Option T1 assumes that Hawaiian will replace its entire Stage 2 fleet. The estimate for T4 assumes that one additional aircraft would be purchased for use between 7:00am and 10:00pm to make up for the capacity lost as a result of the curfew; this was assumed to prevent a revenue decrease that could occur if fewer seats were available. The additional aircraft was assumed to be a DC-9-50 (Stage 2 aircraft) rather than a Stage 3 MD-82. The additional aircraft needed for T9 was also assumed to be a DC-9-50.

7. The "low" and "high estimates for "reduced cargo" for Options T1 through T8 assume that the interisland airlines would be able to carry all of the cargo that shippers present to them. Consequently, there would be no reduction in cargo volume and no "cost" in this column. The "low" estimate for Options T9 and T10 assume the costs estimated in KPMG's March 1992 cost-benefit analysis report. The "high" is also based on that study's estimate of the value of air cargo that would be displaced but assumes that none of it can be shifted to the daytime, an assumption which results in a higher figure.

8. For the "reduced passenger" heading, both the "low" and "high" estimates for Options T1 through T8 and for Option T11 assume that the measures would not reduce the number of passengers carried. The "low" estimates for Options T9 and T10 assume that the passengers displaced from the 6:00am to 7:00am flights would travel later in the day (albeit at the cost of having to purchase additional aircraft), avoiding a loss in revenue. The "high" cost estimate for this heading assumes that the displaced passengers would not travel later in the day. (Because this latter assumption means that it would be unnecessary to purchase additional aircraft to carry passengers during the day, the total "high" cost for these options would actually be lower than the "low" cost.

9. The "low" estimates under the "total abatement cost" heading are the sum of the costs of obtaining the number of additional aircraft and/or hush-kits listed in the "low" columns and the "low" costs associated with reduced cargo volume and reduced passenger volume. The "high" costs under the "total noise abatement cost" heading are generally the sums of the figures in the corresponding "high" columns. However, because of some special interactions this is not always the case.

10. The "low" residential sound attenuation cost estimate assumes that sound-proofing would be used for all homes exposed to noise greater than 60 Ldn (i.e., compatibility would not be achieved by purchasing property and removing it from a noise sensitive residential use). The "high" estimate assumes that the State would purchase all the homes within the 75 Ldn contour, providing sound attenuation treatment only for homes between the 60 and 75 Ldn contours.

The homes in these communities are close to the northeast end of the runway, making it impossible for jet aircraft to avoid flying very close. Moreover, because homes are located both to the left and to the right of the extended runway centerline, shifting aircraft flight tracks slightly to the east or west would reduce aircraft noise levels in one community only at the expense of increasing them in the other. Consequently, this measure does not have the potential to increase land use compatibility.

Some complaints concerning overflights by general aviation and commuter aircraft departing Runway 5 and Runway 2 are received from Spreckelsville residents. The complaints about overflights from West Spreckelsville relate primarily to smaller aircraft that lift off after a short takeoff run and turn left immediately rather than making their left turn closer to the extended centerline of Runway 2-20. The informal runway use plan that is in effect at the Airport already calls for aircraft to avoid overflights of West Spreckelsville. This can best be accomplished by following the recommended procedures—not by fanning out the departure tracks. The complaints from East Spreckelsville relate primarily to straight-out departures from Runway 5. Again, they stem from pilots' failure to follow the recommended procedure of turning left off the northern end of Runway 2-20. Fanning out the departures would lead to more overflights of East Spreckelsville than the recommended procedure. Consequently, the more appropriate solution is to increase efforts to have pilots follow the existing voluntary noise abatement procedures.

7.2.2 Reduce Engine Power Settings On Departures (Option T7)

The intent of this alternative is to reduce aircraft departure noise in East and West Spreckelsville, the areas most affected by departure noise. Federal Aviation Administration Advisory Circular No. 91-53A describes a Close-In Community Noise Abatement Departure Profile (Close-In NADP) which was investigated (see Option T7) for possible inclusion in the FAR Part 150 Program. The procedure prescribes an early power cutback at 800 feet (above field level) following liftoff. For the noisier interisland jet aircraft, 800 feet altitude is reached at approximately 7,000 to 9,000 feet from the start-to-roll point. Thus, the power cutback and subsequent noise reductions would occur during the noisier portions of the flyby events past the Spreckelsville community. The maximum achievable reduction is estimated at approximately 1 to 1.5 Ldn for areas closest to the end of Runway 2-20. An average reduction of 1 to 2 dB for single events may be possible as well. The Airports Division, the airlines, and the FAA would be responsible for implementing this option.

Early power cutback (Option T7), the most promising noise abatement procedure in this category, would reduce the net number of residences exposed to incompatible levels of aircraft noise by only four (see Table 7-4 and Figure 7-7). Specifically, it would decrease the number of residences exposed to 75 Ldn and above by seven, while increasing the number of residences in the 65 to 75 Ldn contour by three. Its effect on the cost of providing noise attenuation treatment for homes that would continue to be exposed to noise above the 60 Ldn threshold is equally limited, reducing it by about a million dollars relative to the no mitigation alternative

if no properties are purchased (see Table 7-5). This alternative would not substantially reduce single-event noise levels.

Maintaining adequate thrust during takeoff is critically important for safety. Pilots of interisland jets contacted during the course of this study indicate that they already use less-than maximum power settings for takeoffs from Kahului Airport under most wind and load conditions. They also expressed strong safety concerns about any formal restrictions that might require them to use less-than-maximum power in the strong and turbulent wind conditions that can occur near the airport, pointing out that this could increase the likelihood of an accident in the case of engine failure or other unusual event. Pilots believe that the use of reduced power settings should be optional at the discretion of the pilot based on load, wind, runway length, and other factors.

While this procedure is not likely to produce large reductions in aircraft noise in Spreckelsville, further evaluation of this procedure is warranted to determine if it can be implemented without compromising aircraft safety. The planned runway extension may slightly increase pilots' comfort with, and tendency to use, less-than-maximum power settings when departing Kahului Airport assuming interisland aircraft begin their takeoff rolls from the new end of the extended runway. However, as discussed in a subsequent section, use of the new runway end would increase noise levels in residential areas of Kahului near Dairy Road. The recommended program provides for further investigation of this measure once the longer runway is available.

7.2.3 Change Aircraft Flap Management

Aircraft flap settings can be adjusted to vary an aircraft's climb and descent profiles during the high altitude portions of flight. This, in turn, can sometimes reduce aircraft noise levels on the ground. The FAA can recommend approach profiles, but pilots retain ultimate responsibility for the handling of their aircraft and would be responsible for determining the flap settings used under any given set of conditions. The areas that experience high aircraft noise levels as a result of aircraft operations at Kahului Airport are too close to the runways to benefit from changes in flap settings. Consequently, the recommended plan does not include changes in current flap management practices.

7.2.4 Limit Ground Activity

Noise from ground level activities (e.g., operation of ground maintenance equipment, engine run-up for maintenance purposes, etc.) causes noise complaints at some airports. By providing appropriate areas for such activities, the airport operator can determine the locations where they occur. However, these activities are not a significant source of problems or complaints at Kahului Airport. Consequently, the plan contains no measures related to these activities.

7.2.5 Preferential Runway Use System

As previously noted, an informal runway use program is currently in effect at Kahului Airport. It was instituted in response to noise complaints from area residents and has helped address some of their concerns. This program is the responsibility of the FAA.

A number of possible modifications and additions to the existing program were examined during the course of this study to determine the extent to which they could reduce average day-night noise levels. In addition, other measures, including some suggested by local residents, were evaluated to determine their potential for minimizing overflights and high single-event noise levels in noise sensitive communities surrounding the airport. The Grid Output Module of the FAA INM was used to calculate the effect several possible measures would have on the forecasted 1998 noise levels. Table 7-2 presents the results of these calculations and compares the forecast levels with 1993 Base Year and 1998 "No Mitigation" Ldn values. The extent to which these measures would increase land use compatibility and the costs of providing sound attenuation in residential units still exposed to incompatible levels of aircraft noise are discussed below and compared in Tables 7-4 and 7-5.

7.2.5.1 Use Runway 2 Instead of Runway 20 When Kona Winds Are Light (Option T8)

Some residents of Spreckelsville have asked that takeoffs be made from Runway 2 (i.e., towards the north) rather than Runway 20 whenever winds make this possible. North flow operations on Runway 2 expose Spreckelsville residents to in-flight noise from departing aircraft, to thrust-reversal noise from arriving aircraft, and to taxi noise from aircraft returning to the terminal following completion of their landing roll. South flow operations on Runway 20 expose the same residents to start-to-roll noise from departing aircraft, and to taxi noise and fuel fumes from aircraft moving into position and holding prior to takeoff. Consequently, the net benefit of such a change was unclear. In an effort to quantify the effect that such a change would have on noise exposure, the INM was used to calculate 1998 Ldn levels at the monitoring sites assuming some takeoffs from Runway 2 even when winds are from the south (Kona winds). Tradewind frequencies of 94.5 percent and 97.5 percent (instead of 88 and 80 percent) were used for the daytime and nighttime periods, respectively.[1]

The noise contours resulting from implementation of this measure are shown in Figure 7-8. As shown in Table 7-2, this measure would decrease Ldn noise levels in the vicinity of the old Pu'unēnē School (which is now used for offices rather than instruction) by 3 to 4 Ldn units. It would, however, increase noise levels by about 0.3 to 0.5 Ldn in Spreckelsville. Although this

[1] These frequencies were derived by assuming all wind departures and arrivals on Runway 2 for all periods when the tailwind would not exceed 6 knots. Because aircraft approach patterns are established when the aircraft are far from the airport, the percentage of operations that could actually be handled in this manner is probably somewhat lower, but the higher proportion was used to help understand the maximum benefit that might be gained by such a measure.

measure might lessen the fuel odor problem and taxi noise experienced by Spreckelsville residents under Kona wind conditions, it would worsen the dominant source (in-flight departure noise) of the aircraft noise contours over the Spreckelsville area. Table 7-4 shows that it would slightly increase the number of homes requiring noise attenuation. Table 7-5 indicates that it would not impose additional costs on aircraft operators or otherwise degrade the performance of the airport. Since this measure would be counterproductive with respect to achieving land use compatibility as measured by the Ldn descriptor, it is not included in the plan recommendations.

7.2.5.2 Close Runway 5-23 between 7:00 PM and 7:00 AM Unless Runway 2-20 Is Closed

This measure has been used in the past, when it was instituted on an informal basis by the Airport and the FAA Tower through a NOTAM. Upon review by the FAA's regional office it was suspended pending review and approval of the FAR Part 150 Noise Compatibility Program.

Because Runway 5-23 is generally used by only a few small aircraft between 7:00 PM and 7:00 AM, closing it during these hours would not have a significant effect on average day-night noise levels. However, it would eliminate the possibility of overflights during the hours when most Spreckelsville residents are home. A curfew on Runway 5 would not be necessary to reduce the number of overflights of Spreckelsville if noise abatement departure flight tracks like those prescribed in the previous informal runway use program are implemented. Since overflights of portions of East Spreckelsville are unavoidable during landings on Runway 23, there is some benefit to closing it during these hours. Consequently, it is part of the recommended program, with the caveat that the option of restoring evening and nighttime operations on the runway in the future should be maintained.

7.2.5.3 Prohibit Landings On Runway 23

This measure would have virtually no effect on Ldn levels and would decrease the airport's operating efficiency. Its only benefit is that it would eliminate low-level overflights of East Spreckelsville during Kona wind (south flow) conditions. By forcing general aviation aircraft to use Runway 20 during Kona wind conditions, it would mix low- and high-performance aircraft onto a single runway, increasing potential conflicts. It is not an effective means of improving land use compatibility near the Airport and would have an adverse effect on its safety and its operating efficiency. Moreover, the measure described in the previous section would provide almost the same benefits. Consequently, a prohibition on landings on this runway is not part of the recommended plan.

7.2.5.4 Use Existing Runway 2 Threshold for Interisland Air Carrier Departures (Option T6)

The pilots of interisland air carrier jet aircraft have indicated that under tradewind conditions they will normally begin their takeoff rolls from the southern end of Runway 2 after it is extended. This would provide them with 9,600 feet of runway rather than the existing 7,000 feet and is consistent with recent FAA policy to discourage intersection takeoffs. The existing runway length does not pose any load limitations on the interisland jets under most meteorological and load conditions, but the additional length will increase the margin of safety. Moreover, because there is less opportunity for accidents if all aircraft start their takeoff rolls from the end of the runway, the FAA is discouraging the regular use of intersection takeoffs.[2]

This noise abatement measure would encourage pilots of interisland air carrier jets to start their takeoff rolls from the existing runway end. As shown in Table 7-2 and in Figure 7-6, it would decrease aircraft noise levels south of the airport relative to the No Mitigation condition. The change would be very small close to the runway centerline, but it would be measurable (approximately 2 Ldn points) in the homes closest to Dairy Road. This measure would have the opposite effect on homes in Spreckelsville, where it would increase Ldn levels slightly (from roughly a half to a full Ldn point) relative to 1998 "No Mitigation" levels. As shown in Table 7-4, Option T-6 would actually increase the number of homes exposed to incompatible levels of aircraft noise. Table 7-5 shows that it would slightly increase the cost of sound attenuation needed to provide compatible levels of interior noise as well. Consequently, it is not a part of the recommended Noise Compatibility Program.

7.2.6 Modify Aircraft Flight Tracks

7.2.6.1 Instruct Aircraft to Follow Flight Paths Away from Noise-Sensitive Areas

For the most part, interisland jet aircraft already follow paths designed to minimize their noise impact on the community. The Noise Exposure Maps for Kahului Airport are dominated by the departure noise of Stage 2 interisland jet aircraft. Unavoidable overflights of Pu'unēnē occur during trade wind arrivals and Kona departures. Nearly all residences in Pu'unēnē have already been removed, and the six that remained in the base year are expected to be gone by 1998. Consequently, future land use incompatibilities associated with overflights of the Pu'unēnē area will be limited to those in the few public use structures to the east of the sugar mill. Shifting most air carrier Kona departures from Track 31 to track 10 would slightly decrease noise levels in the public use structures in Pu'u-nēnē. However, the improvement there would be small and

[2]This measure was discussed with the chief of the FAA Control Tower at the outset of the study. No objections to it were raised at that time. Consequently, it was included among the options evaluated. No further discussions have been held subsequent to recently announced FAA policy changes that discourage intersection takeoffs, particularly during nighttime hours.

would not avoid the necessity of sound-proofing them. Moreover, it would increase overflights of the Pu'u-nēnē Mill and its high stacks. Consequently such a change does not appear to be warranted.

The "Turbulent Tradewind" route into Kahului Airport (Track 18 shown on Figure 3-2) is used when pilots report extreme turbulence while flying their normal tradewind approach across the island's central valley. This route takes aircraft along the northern side of the island, where turbulence is generally less under these conditions. However, it carries them on a curved approach that passes near residential areas in Wailuku. While its use does lead to overflights of some residential areas, the fact that it is only used for periods of three to eight hours on a few days each year means that it does not have a significant effect when measured by the Ldn criteria. Interisland air carrier pilots have indicated an interest in increasing the frequency with which they use this approach route as a means of avoiding the turbulence that they encounter when using the more normal tradewind approach under these conditions. They are presently collecting data in support of their position. If the information provided by the pilots leads the FAA to alter its current policy, the frequency with which the approach is used could increase. The FAA should consider the effect this would have on noise levels in the residential areas near this route before altering its current policy.

At one time, Kona-bound interisland air carrier jets taking off on Runway 2 frequently circled back over the central valley. This generated noise complaints from some residents of "Up Country" areas such as Makawao, Pukalani, and Kula. The interisland air carrier jets no longer utilize this route, proceeding instead along the northern coast of the island before turning south towards Keahole Airport. This northern route is excellent from a noise standpoint, and no changes are recommended.

The Pā'ia area is overflown by aircraft arriving from the Mainland and landing on Runway 2. In the past, some residents of the area complained about noise from arriving Mainland flights. However, the complaints have largely ceased and the 1998 "No Mitigation" Noise Exposure Map (Figure 6-1) indicates that noise levels there will be below 55 Ldn.

7.2.6.2 Instruct Aircraft Departing On Runways 2 and 5 to Avoid Overflights of Spreckelsville

Some residents of West Spreckelsville have complained that light aircraft occasionally turn seaward too soon when departing from Runways 5 and 23, overflying their homes. In addition, East Spreckelsville residents have complained about noise and overflights from aircraft using straight out departures from Runway 5 and from aircraft executing quick right turns following lift-off from Runway 2. Because these overflights are associated primarily with light, propeller driven aircraft, they do not significantly affect the noise contours shown on the Noise Exposure Maps. The existing informal Runway Use Program for Kahului Airport attempts to address this overflight problem, but the text could be improved.

7.2.6.3 Maximize North Flow Routing of Arrivals Under Trade Wind Conditions

This change was implemented by the FAA in 1989 and will remain in effect for the foreseeable future. Except during conditions of high turbulence along the south central shore of Maui, overflights of Wailuku and Kahului by arriving interisland jet aircraft have been eliminated during approaches to Runway 2. This straight-in approach to Runway 2 should be identified as a noise abatement route in the Runway Use Program for Kahului Airport.

7.2.7 Limitations or Restrictions On Type Or Class Of Aircraft Based on Aircraft Noise Levels

7.2.7.1 Introduction

A variety of possible restrictions on aircraft activity based on the noisiness of the aircraft were formulated and evaluated. These included:

- denial of use of the airport to classes of aircraft which do not meet federal noise standards, i.e., imposition of the same Stage 2 aircraft phase-out requirement already applicable to airports on the Mainland (Option T5, see Section 7.2.7.2);
- complete elimination of Stage 2 aircraft (Options T1 and T2, see Section 7.2.7.3);
- capacity limitations based on the relative noisiness of different types or classes of aircraft (see Section 7.2.7.7);
- differential landing fees based on FAA certificated or estimated noise emission levels or on time of arrival (see Section 7.2.7.7); and
- partial or complete curfews, e.g., limitations on the use of Stage 2 aircraft based on the time of day (Options T3, T4, T9, T10, and T11, see Sections 7.2.7.4 and 7.2.7.5).

Background information concerning aircraft mix and scheduling that is important to the discussion is provided below. The specific economic and legal implications of the various alternatives are highlighted in the discussion of each alternative.

The Hawaii State Department of Transportation would be responsible for implementing restrictions in this category, and an important legal consideration that could affect all of the options is the extent to which the establishment of noise regulations applicable only to Kahului Airport which are more restrictive than those in effect at other airports within the Airports Division's statewide system may run afoul of non-discrimination provisions of the law. If the courts hold that all airports within the state airport system must be treated similarly, the imposition of operating restrictions at Kahului Airport could require the adoption of similar

rules applicable statewide. In this event, operators would be required to consider their entire fleet, not just those aircraft which are used at Kahului Airport. This would raise the cost of compliance and make sound attenuation through sound attenuation treatment of buildings relatively more attractive.

Since the two interisland air carriers that use turbojet aircraft (Aloha Airlines and Hawaiian Airlines) operate virtually all of the Stage 2 aircraft likely to operate at the Airport, the analysis focuses on the implications that the various alternatives would have on their operations. Two characteristics of their operations are particularly important: 1) the mix of Stage 2 and Stage 3 aircraft that they fly and 2) the extent to which they operate these aircraft during nighttime hours where the Ldn "10 dB noise penalty" is in effect.

Aircraft Mix. At present, approximately 75 percent of Aloha's interisland fleet consists of Stage 2 aircraft, the remainder (including two of the "Quick Change" passenger-cargo aircraft that it uses for its night cargo operations) consists of Stage 3 aircraft. Aloha Airlines estimates that its 1998 Stage 2/Stage 3 split will be as follows:

Aircraft Type	Stage	1993 Fleet Mix		1998 Fleet Mix	
		Number of A/C	Percent of Fleet	Number of A/C	Percent of Fleet
B-737-200 pax	2	9	56.3	5	27.8
B-737-200 QC[1]	2	3	18.7	2	11.1
Stage 2 Subtotal		12	75.0	7	38.9
B-737-300 pax	3	0	0.0	7	38.9
B-737-300 QC[1]	3	2	12.5	4	0.2
B-737-400 pax	3	2	12.5	0	0.0
Stage 3 Subtotal		4	25.0	11	61.1
GRAND TOTAL		16	100.0	18	100.0

Source: King (December 13, 1994)

[1]The "QC" stands for "Quick Change." It refers to the ability to quickly change their configuration from passenger mode (with rows of seats) to cargo mode (with tie-downs for standard air cargo pallets).

Hawaiian Airlines is presently operating an all-Stage 2 fleet of DC-9-50s (13 aircraft) and reports it plans to continue with these aircraft at least through 1998.

Nighttime Operations. Both interisland airlines complete their regular passenger flights at Kahului Airport before 10:00 PM.[4] Both have a few early morning passenger flights at the airport between 6:00 and 7:00 AM.[5] In addition to these passenger flights, Aloha Airlines operates night cargo flights using its B-737-QC aircraft. Aloha and Hawaiian have indicated that the stage-mix of aircraft used at Kahului Airport approximates that of the entire fleet for passenger flights and of the "QC" fleet for night cargo flights.[6] In other words, no special effort is made to see that Stage 3 aircraft are used more at any one airport within their systems than at another.

7.2.7.2 Impose Noise Restrictions Comparable To Those Applicable on the Mainland (Option T5)

Basis of the Alternative. The Airport Noise and Capacity Act's requirement for the phase-out of all Stage 2 aircraft operations by December 31, 1999, applies only in the contiguous 48 United States; Hawaii and Alaska are specifically exempted.[7] Therefore, aircraft that meet FAR Part 36, Stage 2 noise standards (including the current interisland B-737-200 and DC-9-50 jet aircraft which are the principal determinants of the existing and forecast noise contours around Kahului Airport) will be allowed to operate there indefinitely <u>unless</u> Congress amends the Act or the State adopts legislation or regulations which limit their use. The Act does contain a "non-addition" provision which limits the number of Stage 2 aircraft owned, leased, or operated in Hawaii from exceeding the number of such aircraft present on November 5, 1990. Both airlines comply with the non-addition limit. At the present time, there is no indication that Congress intends to amend the Airport Noise and Capacity Act to include Hawaii. Thus, imposition of such restrictions would have to be done at the State level.

The State has taken one step in that direction in proposing to amend Hawaii Administrative Rules, Chapter 19-28, to prohibit the use of Stage 2 aircraft at Kahului Airport between 10:00 PM and 6:00 AM. However, this proposal is being strenuously opposed by Aloha Airlines and Hawaiian Airlines, as well as by companies and individuals who use Aloha's night cargo service and believe they would be adversely affected if the regulation were adopted. It will not

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[4] Aloha Airline's last passenger flight departs Kahului Airport at 9:00 PM. Hawaiian Airline's last flight departs at 9:30 PM.

[5] Hawaiian Airlines has a 6:05 AM arrival and a 6:30 AM departure. During 1993 and 1994, Aloha Airlines had arrivals at 6:03 AM and 6:33 AM and departures at 6:25 AM and 6:55 AM. During 1995 it moved its first arrival to before 6:00 AM.

[6] Personal communication from Mr. Jim King, Aloha Airlines, December 15, 1994.

[7] The phase-out schedule requires that 75 percent of each operators' aircraft meet applicable Stage 3 requirement by the end of 1998.

be in effect by the end of 1995 as originally proposed. Even if it is adopted, it would go only a part of the way towards placing Hawaii on the same regulatory footing as the Mainland.

Noise Reduction Provided. The noise reductions provided by this alternative were calculated using the FAA INM (see Figure 7-5 and Tables 7-2 and 7-3, Alternative T5). The results show that it would reduce noise levels by 1 to 2 Ldn below those shown on the 1998 "No Mitigation" map. The greatest improvement would be in Spreckelsville.

Implications Of The Alternative. This measure would cut the number of homes requiring sound attenuation from 81 under the "No Mitigation" scenario to 68 (see Table 7-4). It would reduce the cost of providing the necessary sound attenuation to residences from $6.5 million if no attenuation is provided to $4.25 million, a savings of approximately $2.5 million assuming all owners, including those within the 75 Ldn contour, choose sound attenuation (see Table 7-5). The savings in sound attenuation costs relative to the "No Mitigation" option would be even greater in the event that owners of homes within the 75 Ldn contour choose to sell their homes to the state rather than to exercise the sound attenuation option. In this event, the abatement measure would reduce sound attenuation costs for the Spreckelsville residences from over $15 million to approximately $8 million.

<u>Aloha Airlines.</u> Comparing the anticipated fleet mixes shown above with the percent of its operations that involve Kahului Airport suggests that Aloha Airlines could probably <u>not</u> operate 75 percent of its passenger flights to and from Kahului Airport (its busiest Neighbor Island airport) using only its planned Stage 3 aircraft.[8] Instead, <u>at least</u> two additional Stage 3 aircraft would be needed. Aloha Airlines anticipates that by the end of 1998 four of its six B-737-QC (cargo) aircraft (67 percent) will be Stage 3. This is well above the proportion of its statewide nighttime cargo operations that involve Kahului Airport, which suggests that the airline could meet such a requirement without acquiring additional Stage 3 cargo aircraft. It would, however, sacrifice some scheduling flexibility and be forced to utilize its B-737-300-QC aircraft on shorter stage-length routes than it might otherwise choose.

<u>Hawaiian Airlines.</u> Since Hawaiian Airlines does not plan to acquire any Stage 3 aircraft by the end of 1998 or to retrofit any of its existing Stage 2 aircraft to meet Stage 3 standards, its situation differs substantially from Aloha's. It would not be able to operate at all from the airport in that year if restrictions comparable to those that will be in effect on the Mainland were implemented at Kahului Airport <u>unless</u> it acquired new Stage 3 aircraft (e.g., MD-82) or

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[8] It is theoretically possible for the airline to achieve 75 percent Stage 3 at Kahului Airport without altering its present B-737-300 acquisition plans by concentrating these aircraft on the Honolulu-Kahului route. This would impose scheduling constraints on the airline and force a disproportionate use of Stage 2 aircraft at other airports in the system. Because some of the communities around these airport experience greater land use incompatibilities than Kahului, this would probably be viewed as inequitable. In view of these factors, this approach was not assumed.

retro-fitted its existing Stage 2 DC-9-50 series aircraft with hush kits.[9] The cost of compliance would depend upon the approach taken by the airline. Retrofitting 75 percent of its entire fleet of DC-9-50 aircraft with hush kits would cost approximately $18-$20 million, while purchasing new aircraft, such as the MD-82, would cost approximately $270 million. The costs could be reduced slightly by purchasing only enough aircraft to insure that 75 percent of its operations at Kahului Airport would be by Stage 3 aircraft (assumed in Table 7-5), but this would require special scheduling procedures, the operation of a mixed-aircraft fleet, and other complications. Because aircraft equipped with hush kits are less fuel-efficient and more expensive to maintain than ones which are not so-equipped, the airline might also incur increased operating costs if it chose this route.

From a public perspective, a 75 percent reduction in Hawaiian Airlines' Kahului operations (which would be needed if the airline could not afford to upgrade its fleet so that it could operate at Kahului) would drastically reduce the number of seats available to visitors and local residents. From the airline's perspective, the cutback would be commercially disastrous, since it could not operate an economically viable business without Kahului Airport in its system. Consequently, it appears certain that the airline would attempt to alter its aircraft acquisition plans if this measure were implemented. In view of the fact that it has only recently emerged from bankruptcy, its ability to make this adjustment is uncertain. If it were able to, it is probable that it would do so by retro-fitting its existing (or similar) aircraft rather than purchasing new ones. The "low" estimate for Option T5 assumes that it would do so by adding hush kits to its DC-9-50 series aircraft.

If Hawaiian Airlines could not raise the $18 million to $270 million in capital needed to convert to a 75 percent Stage 3 fleet and was forced from the market, it is possible that Aloha Airlines could increase the size of its interisland fleet somewhat more quickly than it presently plans in order to make up for a portion of the capacity shortfall. It is doubtful that Aloha Airlines and Mahalo Airlines have the financial strength to completely replace the lost capacity, however, and this could induce another airline to enter the market. This possibility was not specifically analyzed as part of this study. If no company enters the market to make up the capacity shortfall, the passenger lift capacity to Maui could be greatly curtailed. While the effect this would have on the island's economy was not quantified, the resulting reduction in visitor arrivals would clearly cause serious hardships.

Because of the severe hardship that this measure would create for Hawaii's interisland air carriers, the adverse effect this could have on the State's air transportation system, and the measure's limited success in providing improved land use compatibility, it is not part of the recommended program.

[9]The estimates shown in Tables 7-2 and 7-3 assume that Hawaiian Airlines would use hush kits to comply with the requirement.

7.2.7.3 Eliminate All Stage 2 Operations (Options T1 and T2)

Bases of the Alternatives. The previous alternative would leave some Stage 2 aircraft still in service. These two alternatives considered the additional noise reduction that could be achieved if <u>all</u> Stage 2 aircraft were prohibited from operating at Kahului Airport. For Option T1, all B-737 operations were assumed to be by B-737-300 aircraft and all DC-9 operations were assumed to be by MD-82 aircraft (the closest Stage 3 match to the DC-9-50 series aircraft that would be replaced). Option T-2 used the same assumptions as Option T-1 for B-737 aircraft, but assumed the use of Hush Kits to bring Hawaiian Airlines' existing DC-9-50 aircraft into compliance with FAR Part 36 Stage 3 noise limits.

Noise Reduction Provided. As shown in Tables 7-2 and 7-3 and Figures 7-1 and 7-2, Options T1 or T2 would substantially reduce aircraft noise levels around the airport. The greatest improvement would be in the relatively high noise areas on the *makai* side of the airport, where the INM indicates T1 and T2 would reduce noise levels by 8 to 10 Ldn and 3 to 5 points, respectively, relative to the Five-Year "No Mitigation" noise levels.[10] Many other locations would experience an improvement of 5-6 Ldn points. Implementation of either option would produce substantial improvements in the land use compatibility situation in the Spreckelsville areas. It would also decrease noise levels in the public use facilities in and around Pu'u-nēnē.

Implications Of The Alternatives. Tables 7-4 and 7-5 show that Option T1, which assumes the use of aircraft originally certified as meeting Stage 3 standards, would shrink the noise contours to the point where no homes would be exposed to noise levels above 75 Ldn. Fewer than 20 homes would require sound attenuation treatment, and the treatment needed to provide interior noise levels of 45 Ldn or below would be just over $1 million.

Achieving this level of aircraft noise abatement would involve an even greater effort than achieving the 75 percent level discussed previously. Again, the exact cost depends upon whether operating considerations force airlines to upgrade their entire interisland fleets in order to insure an all-Stage 3 operation at Kahului or choose to maintain only enough Stage 3 aircraft to serve that airport. In the former case, a capital investment[11] of over $535 million would be required. In the latter, the cost would be on the order of $240 million. The available information indicates that neither airline has the financial resources needed to undertake such an investment between now and the end of 1998.

[10]Note that measurements made during this study suggest that the INM may be overstating the reductions in the Ldn contours from the replacement of noisier aircraft with Stage 3 aircraft. If this is correct, the actual improvement would be up to 3.5 Ldn points less than the model suggests.

[11]This report uses the term "capital investment" whether referring to aircraft that would be purchased outright (a method which has historically been preferred by Aloha) or leased (a method which Hawaiian Airlines has tended to rely on in recent years). Both involve substantial commitment of resources and the leasing costs are presumed to include additional charges to compensate the leasing firm for the risk which it undertakes under the lease agreement.

Option T2 (see Figure 7-2), which assumes that Hawaiian Airlines would use hush kits to meet the Stage 3 requirement, would provide considerably less noise reduction than Option T1 (typically 55 to 65 percent of T1's at noisier locations). It would still insure that no homes would be exposed to noise levels above 75 Ldn and would cut the number of homes requiring mitigation from 81 in the "No Mitigation" scenario to 35. It would trim the cost of needed sound attenuation treatment of homes from $6.7 million under the "No Mitigation" to about $2.25 million. This option still involves substantial costs to the interisland air carriers. Again, the exact cost depends upon whether operating considerations lead airlines to upgrade their entire fleets in order to insure an all-Stage 3 operation at Kahului or chose to maintain only enough Stage 3 aircraft to serve that airport. The costs under this alternative range from a low of $16 million to a high of almost $200 million, with the most likely cost being towards the middle of the range.

All of the caveats expressed previously about the effect that forced large-scale aircraft changes would have on the financial viability of the interisland air carriers apply even more strongly to options T1 and T2. It is possible that they could stretch their financial resources to the breaking point. The extent to which other existing or new airlines might be able to move to fill the vacuum that would be created if Hawaiian and/or Aloha Airlines were unable to obtain the necessary capital cannot be determined at this time. However, the fact that the existing operations are relatively efficient ones that provide service at prices towards the low end of those found elsewhere in the country suggest that new carriers entering the market with service comparable to that provided by the existing carriers would probably not operate with lower fares or otherwise improve the quality of interisland air service. Because of this, neither of these measures is included in the recommended plan.

7.2.7.4 Reschedule Nighttime Aircraft Operations to Daytime Operations (Option T9)

Basis of the Alternative. The noise reduction benefits of converting all nighttime (10:00 PM to 7:00 AM) aircraft operations to daytime operations are shown in Figure 7-9 and in Tables 7-2 and 7-3. These estimates illustrate the effect of a nighttime curfew assuming that all the flights which could not be made at night because of the curfew would, instead, be made during the day.[12] In other words, they assume that a nighttime curfew would not reduce the overall level of activity at the airport. Essentially the same noise reductions would result if only air carrier jet operations (and not propeller aircraft operations) were prohibited during the nighttime period. This is because noise from the jet aircraft (and particularly the Stage 2 interisland jet aircraft) dominate the Ldn noise contours.

[12] It is possible, even likely, that at least some of the flights that the curfew would eliminate would not be rescheduled, but this would not substantially alter the contours.

Noise Reduction Provided. Such a curfew on nighttime operations would reduce noise levels by 1 to 3 Ldn units, depending upon the location. It would reduce Ldn levels in Spreckelsville, where the land use incompatibility problems are concentrated, by about 2.5 Ldn.

Implications Of The Alternative. The primary beneficiaries of this mitigation measure would be residents of Spreckelsville (particularly those who do not work during the night). The risk of sleep interference from single-event nighttime aircraft noise would be eliminated. As indicated in Tables 7-4 and 7-5, this alternative would decrease the number of homes exposed to noise levels of more than 75 Ldn by 7; it would increase the number of homes between the 65 and 75 Ldn contours by 2, but would cut the homes between the 60 and 65 Ldn contours by 8.

The estimated cost of providing sound attenuation for homes that would still be exposed to incompatible levels of aircraft noise following implementation of this noise abatement measure is just under $4.9 million, or about $1.8 million less than for the "No Mitigation" scenario. If all homes within the 75 Ldn contour were purchased, rather than sound-attenuated, the total cost of mitigation under this option would be about $9 million.

A total nighttime curfew would affect virtually all the existing and forecast nighttime cargo flights, the few interisland passenger flights scheduled before 7:00 AM., some heavy aircraft departures past 10:00 PM, and a few nighttime training flights. Elimination of nighttime training flights would have little significant effect on the airport's ability to serve Maui. For reasons summarized below, elimination of the other flights that would be prohibited if this measure were implemented have a substantial adverse effect on air transportation and inter- and intrastate commerce. It would also adversely affect the businesses who currently depend upon the timeliness that only nighttime operations can provide and upon the moderate air cargo shipping rates made possible by the high aircraft utilization rates of the B-737-QC aircraft.

Interisland Passenger Flights. At the present time, 7 interisland passenger flights (4 arrivals and 3 departures) occur at Kahului Airport after 10:00 PM and before 7:00 AM (these "early bird" flights all occur between just before 6:00 AM until 7:00 AM). These flights are heavily used by state residents and local business travellers. Their availability allows people who live on one island to conduct business throughout the state in an efficient manner. Elimination of the "early bird" flights would make it more difficult for this to occur by forcing travellers either to fly the day before, spending the night in a hotel on the other island, or by reducing the effective length of their work day.

In order for interisland airlines to carry the forecast number of passengers within a shorter operating day, they would have to increase fleet utilization (i.e., increase average passenger loads or the proportion of their fleet in service during those hours) or add additional aircraft to their fleets. Since the fleets are already fully utilized, they would each have to add one aircraft at a total cost of about $50 million. Even if each air carrier did add one aircraft, there would probably still be significant crowding on flights for a period of several hours following the end of the curfew. Other things being equal, this would make it difficult for interisland business travellers to carry out their work; it could also make it more difficult for overseas-bound travellers to connect with flights departing from Honolulu in the morning. All things considered, then, the curfew would tend to increase interisland travel costs, decrease the level of service that is provided to the local business travellers who make up a substantial proportion of the passengers on the early morning flights, and harm intrastate commerce.

Overseas Passenger Flights. Very few overseas flights presently depart during hours that would be affected by the curfew. These flights are of two types: charter services that are scheduled for departure between 10:00 PM and 12:00 PM and scheduled flights that normally depart outside of curfew hours but which are occasionally delayed as a result of mechanical failures or other problems. For the most part, it appears likely that the charter flights could be rescheduled to depart before a 10:00 PM curfew, albeit with some inconvenience to passengers in the form of very early arrival times at their Mainland destinations and possible maintenance scheduling difficulties for the airlines.

Unanticipated delays are a much greater problem for the air carriers. This is because a curfew could easily result in minor mechanical problems delaying departures scheduled for 9:00 PM until after the onset of the curfew. If this occurs, the aircraft and its passengers would be forced to remain at Kahului overnight. The economic penalties (costs) associated with such a risk are so great that they would almost certainly lead carriers to forego scheduling flights close to the onset of the curfew. Scheduling departures before 9:00 PM could lead to unreasonably early arrival times on the Mainland. Depending upon the economic circumstances of individual carriers and the risk they are willing to take of having an aircraft grounded overnight on Maui because of the curfew, it could also lead them to eliminate service during this time period entirely. If this should occur, it could reduce visitor arrivals; this, in turn, would have a measurable effect on the island economy.

Nighttime Interisland Cargo Flights. A nighttime curfew would eliminate nighttime air cargo flights at the airport. Because the B-737-QC aircraft that provide most of this service are flown as passenger aircraft during the daytime, and because their passenger duty is by far the most important portion of their use from a revenue standpoint, it is very unlikely that the cargo flights that these aircraft now make during the night would be shifted to the daytime. Revising schedules might permit this for a very small portion of the trips, but it is doubtful that the overall economics of the operation would be positive if the fixed cost of ground equipment and handling remained while the number of revenue ton-miles decreased sharply.

Aloha Airlines has stated that a curfew would almost certainly lead it to terminate the interisland cargo service it currently provides using its B-737-QC aircraft.[13] Some of the lift capability would probably eventually be replaced by an all-cargo carrier operating during the daytime, and by fuller utilization of the cargo holds of passenger aircraft. It is even possible that some all-cargo service might be continued during the day. However, as demonstrated by

[13] See written testimony concerning proposed amendments to Chapter 19-28, dated July 9, 1993, presented to the State Department of Transportation by Watanabe, Ing, and Kawashima on behalf of Aloha Airlines.

the extensive testimony which has been given during hearings on the State's proposed amendment to Chapter 19-28 of Hawaii Administrative Rules, the nature of the cargo (which includes perishable and time-sensitive items such as bread, newspapers, mail, cut flowers, etc.) is such that many of the existing customers would not be as well served by an all-daytime schedule. Moreover, since the all-cargo carriers that were historically in the market have not been able to compete with the nighttime jet cargo service in terms of price and quality of service, elimination of the night cargo flights would almost certainly lead to increased interisland shipping costs, as well as to a decrease in the frequency and speed of service. This would have a clear, but unquantifiable, adverse effect on Maui businesses and residents.

Legal Considerations. Kahului Airport is the only airport on Maui that is capable of handling interisland air carrier jet and other high performance aircraft. It is also the only one that is fully equipped and approved for night and foul-weather operations. Informal feedback from the Federal Aviation Administration suggests that the absence of a reasonable alternative airport is likely to lead the FAA to disapprove a curfew at Kahului Airport if it were recommended in the FAR Part 150 Noise Compatibility Program. Another potential legal problem noted elsewhere in this report arises from the fact that the airport proprietor and operator, the Airports Division of the State of Hawaii Department of Transportation, also operates numerous other airports in the state. Implementing a nighttime curfew at Kahului Airport without implementing, or at least fully evaluating the feasibility or need for similar restrictions on aircraft operations at other State airports could be considered discriminatory and struck down on that basis.

Conclusion. This alternative would completely eliminate nighttime annoyance produced by noise from aircraft operations. However, most of the uses that would be incompatible under the "no-mitigation" scenario would remain in the incompatible range despite the 1 to 3 Ldn reduction in average day-night noise levels produced by this alternative. Only those homes which are on the fringe of the incompatible area would be made fully compatible by this measure. Additional measures that have the potential to reduce noise by a further 10 to 15 dB would be required in addition to the nighttime curfew to address the remaining land use incompatibilities at Spreckelsville. Consequently, this alternative is not part of the recommended noise program.

7.2.7.5 Prohibit Nighttime Use By Stage 2 Aircraft (Options T3, T4, and T11)

Bases of the Alternatives. The noise reduction benefits of prohibiting all Stage 2 aircraft operations between 10:00 PM and 7:00 AM were also evaluated. Both these alternatives would eliminate nighttime operations by the noisiest aircraft during the most noise-sensitive period. Option T3 assumed that the same number of nighttime operations would continue to be made, but that the aircraft making them would all be Stage 3 (B-737-300 and DC-9-50 with hush kits). T4 assumed that the operations would be shifted from the night to the day. Option T11 assumed that the restriction on Stage 2 aircraft would end at 6:00 AM. By stopping the prohibition on nighttime Stage 2 operations at 6:00 AM rather than 7:00 AM, this option eliminated constraints on interisland air carrier passenger operations.

Noise Reduction Provided. The noise contours themselves are depicted in Figures 7-3, 7-4, and 7-11. The results of the Ldn calculations at the monitoring sites are shown in Table 7-2. Changes in the area encompassed by the noise contours are summarized in Table 7-3. They show that neither measure would greatly reduce the size of the noise contours, with the decrease in Spreckelsville being on the order of 1 to 1.5 Ldn points. Option T11 had very little effect on Ldn levels, reducing them by less than one-half point in noise-sensitive areas.

Implications of the Alternatives. Alternatives T3 and T4 would decrease the number of homes requiring sound attenuation in order to achieve noise compatibility from 81 under the 1988 "No Mitigation" scenario to about 70. Option T11 would reduce the number by only 4, to 77. T3 and T4 would reduce the cost of sound-attenuating the affected residences by about $1 million relative to the "No Mitigation" alternative. Option T11 would provide savings of only $0.3 million. In addition to the very modest effect on Ldn levels that this option would provide, they would also reduce single-event noise levels during the night by 5 to 10+ decibels.

Prohibiting Stage 2 aircraft operations at Kahului Airport between 10:00 PM and 7:00 AM would affect the existing and planned operations of both Hawaiian Airlines and Aloha Airlines. With no Stage 3 aircraft currently in its fleet, Hawaiian Airlines would need to purchase additional aircraft or to retrofit some of its existing aircraft with hush kits in order to maintain its current schedule. The number of modifications or replacements needed would depend upon whether it dealt only with the minimum number needed to conform to the requirements at Kahului, accepting the constraints on its aircraft scheduling flexibility that this would impose, or upgraded its entire fleet. Alternative T3 assumes that it would use hush-kits. Alternative T4 assumes that Hawaiian would not add Stage 3 aircraft to its fleet.

Aloha Airlines is in a different position on two levels. First, by 1998 it will have enough Stage 3 passenger aircraft in its fleet to operate its early morning passenger flights to and from Kahului without acquiring additional aircraft (note, however, that it may well not prefer to do this because of the constraints that it would place on its scheduling). Second, it operates nighttime cargo flights using a mixed Stage 2 and Stage 3 fleet of B-737-QC aircraft. Plans in effect near the end of 1994 indicate that by 1998 it will have enough Stage 3 cargo aircraft to operate all of its night cargo service to Kahului using these aircraft. Option T3 assumes that it would operate only Stage 3 aircraft during the nighttime penalty period. Option T4 assumes that it would shift its night Stage 2 operations to the daytime period. For reasons discussed elsewhere in this report, it is virtually certain that Aloha would not use its fleet in this manner, but it was included as a means of determining the extent to which land use compatibility is sensitive to this factor.

As noted in Section 7.2.7.2, except for timing, the State's proposal to amend Hawaii Administrative Rules, Chapter 19-28, to prohibit the use of Stage 2 aircraft at Kahului Airport

between 10:00 PM and 6:00 AM[14] is comparable to Option T11. This proposal is being strenuously opposed by Hawaiian Airlines, whose existing and announced operations would not be seriously affected, and by Aloha Airlines, whose planned operations would be constrained. Aloha would be forced to concentrate its Stage 3 B-737-300-QC aircraft on its Kahului service and to use only BB-737-300 series aircraft on its first scheduled passenger flights of the day and on the charter flights it occasionally operates after 10:00 PM. Aloha's public testimony indicates that it would not choose to operate its fleet in this manner if it were guided solely by economic and operational considerations.

Concentrating quieter aircraft at Kahului will tend to increase noise levels around other airports where the nighttime cargo service is operated. Thus, while nighttime prohibition on Stage 2 operations (Options T3, T4, and T11) would clearly benefit residents of Spreckelsville by reducing nighttime single-event noise, it is less clear that they are the best course of action when viewed from an island-wide or statewide perspective. This point is discussed further in Chapter 8.

7.2.7.6 Disallow Nighttime Departures, But Permit Arrivals Before 7:00AM (Option T10)

Basis of the Alternative. The noise reduction benefits of prohibiting all aircraft departures during the nighttime period from 10:00 PM to 7:00 AM, but allowing early morning arrivals to Kahului Airport before 7:00 AM were also evaluated. The goal was to see if a slight relaxation in the curfew to allow arrivals (which are substantially quieter than departures) before 7:00 AM would have a significant effect on noise levels.

Noise Reduction Provided. The results of the Ldn calculations at the monitoring sites are shown in Table 7-2. Changes in the area encompassed by the noise contours are summarized in Table 7-3. Because the noise contours, and especially the noise contours over noise-sensitive areas, are controlled by departure (rather than arrival) noise, this measure would have essentially the same effect as would a curfew on both arrivals and departures (Option T9).

Implications Of The Alternative. The same number of homes would require mitigation under this option as would require mitigation under option T9 (see Tables 7-4 and 7-5). This alternative would have essentially the same effect on interisland and overseas air travel as Option T9 as well. For reasons outlined in the preceding section, this measure is not included in the recommended plan.

[14] The discussion in this report assumes implementation of the prohibition by the end of 1998, which would allow Aloha Airlines to comply with the Stage 2 limitation through already planned aircraft acquisition. The State's proposed amendment to Chapter 19-28 would take effect much sooner, and this could make compliance significantly more burdensome.

7.2.7.7 Capacity Limitations Based on Relative Noisiness

Some jurisdictions have imposed noise-based capacity limitations on users. These have taken a variety of forms, but, in general, they place a ceiling on the amount of noise that each operator may produce. There are three variables: the number of operations by each aircraft type, the noisiness of the individual aircraft types, and the time of day that the flights are made (day or night). This type of restriction often entails the establishment of a "noise budget" for each operator, which the operator can then "consume" through its operations.

The use of noise-based capacity limitations is most appropriate at airports that are served by carriers whose route structure gives them the flexibility to assign their noisiest aircraft to routes served by airports with few noise-sensitive uses around them. In the case of Kahului Airport, the approach provides no significant advantages relative to the more direct approach of prohibiting some or all Stage 2 aircraft operations. In fact, because such restrictions would provide an incentive for operators to shift their noisier aircraft to other Neighbor Island airports that have more serious land use compatibility problems than does Kahului, they could be counter-productive as a means of reducing overall noise exposure on a statewide basis. This measure is not part of the recommended plan.

7.2.7.8 Landing Fees Based On Aircraft Noise Levels And/Or Time of Operation

Basis of the Alternative. Landing fees based on aircraft noise levels and/or time of operation have been suggested as a means of improving land use compatibility around some airports. It accomplishes this by encouraging carriers to shift to quieter aircraft and/or to shift flights from nighttime to daytime hours. Courts have deemed this approach acceptable if there is reasonable basis for the fee schedule and if the fee schedule is applied without unreasonable discrimination at all airports under the operator's jurisdiction.

Noise Reduction Provided. The amount of noise reduction that would be provided by basing landing fees on the noisiness and/or time of operation is dependent upon the extent to which economic incentives incline operators to accelerate their transition to Stage 3 aircraft and/or minimize nighttime flights. Thus, the noise reduction could range from nothing, if the combined cost of paying the higher fees for all existing flights does not exceed the net income that would be foregone by foregoing them or making them with quieter equipment, to significant, if the fees were so high as to make operations at Kahului Airport prohibitively expensive.

Some insight into intermediate levels of effectiveness can be gained by considering the noise reductions that can be achieved by alternatives discussed previously. These range from 1-2 Ldn points by adopting regulations comparable to those in effect at Mainland airports (Option T5), to 2-3 Ldn points by closing the airport at night.

Implications Of The Alternative. One desired objective of a time-based landing fee system is to provide an incentive for airport users to reschedule their operations from peak to off-peak

and/or from nighttime to daytime periods. At Kahului Airport, the primary complaints have been directed against the nighttime jet cargo flights, rather than peak-hour daytime operations or operations under some limited set of conditions. Consequently, the effectiveness of this measure must be judged by its ability to encourage such a move. If nighttime landing fees are adjusted to provide a disincentive for air carriers to fly cargo operations at night, it is unlikely that it would produce the desired result of shifting the jet cargo operations to the daytime period for the following reasons.

- A small increase in the nighttime landing fee would probably be absorbed by the airline or passed on to shippers without having a substantial effect on cargo volumes or aircraft operations.
- Higher landing fee differentials between day and night would almost certainly lead the carrier (in this case Aloha Airlines) to raise its night cargo rates to offset the higher costs. Shippers who can recover the additional costs through higher prices or decreased profit margins will simply pay the higher fees. Those who cannot will look for less' expensive means of moving their goods, reducing the volume of cargo which they ship at night.
- The night flights which are the principal source of complaints from citizens near Kahului Airport are made by convertible passenger/cargo models of the B-737-200 (and, to a lesser extent the B-737-300) series aircraft. These aircraft are fully utilized for passenger service during the daytime. Since they derive most of their worth from their use as passenger aircraft, it is unlikely that a nighttime landing fee differential would lead Aloha Airlines to use them to transport cargo, instead of passengers, during the daytime. Consequently, a nighttime landing fee schedule which is too high would simply result in termination of the nighttime cargo service by these aircraft.
- If a nighttime landing fee is set so high so as to cause a termination of the cargo service instead of its original intent of providing only an incentive to shift these operations to the daytime hours, the airline which is currently providing this service, the shippers who depend on it, and the consumers who ultimately benefit from the night cargo service's availability would be harmed.

Under these conditions, increasing landing fees for nighttime operations is an effective noise abatement measure only to the extent that it prevents the use of Stage 2 aircraft. Thus, it is simply an alternate method of imposing a curfew on Stage 2 aircraft, which is discussed in Section 7.2.7.5

Charging higher landing fees for noisier (i.e., Stage 2) aircraft operations during the daytime would provide an economic incentive for airlines to accelerate their move to Stage 3 aircraft. At the same time, it would take money from them which might otherwise be used to accomplish the necessary fleet conversion.

In view of the foregoing, the use of increased landing fees based on noise or time of operation is not recommended for inclusion in the Noise Compatibility Program.

7.2.7.9 Voluntary Limitations On Military Training Operations

Military training operations at Kahului Airport mostly involve the quieter propeller-driven C-130 and P-3 aircraft; only a few noisier jet aircraft such as the C-135 and C-20 operate there. Even the relatively quiet propeller aircraft sometime generate noise complaints, probably because of the recurring nature of the local training operations and the attitudinal biases against training operations near residential areas. Although the Airports Division cannot prevent military use of its airports, it can and has requested that military aircraft minimize use of state airports (such as Hilo and Kahului) for training purposes due to noise sensitive areas adjacent to the airport. The Airports Division has also asked the military to concentrate their training activities at Keahole and Lihue Airports, which have few adjacent noise-sensitive land uses. It is recommended that the Airports Division continue to discourage military training operations at Kahului Airport and encourage use of other airports with fewer surrounding noise-sensitive land uses through a continuing process of information dissemination to military users.

7.3 PHYSICAL CHANGES

The second broad category of noise abatement alternatives involves physical changes to on-airport facilities at Kahului Airport for the purpose of reducing land use incompatibilities outside of the airport property boundaries. Examples of such measures include the construction of noise barriers or berms, the construction of new runways or runway extensions, the addition of navigation aids, the addition or reconfiguration of taxiways to reduce ground noise, the displacement or relocation of takeoff or landing points on existing runways away from nearby communities, and the installation of airport noise monitoring systems. Actual examples include: the Reef Runway (Runway 4R-22L) at Honolulu International Airport, the second seaward runway at Lihue Airport, and the construction of a 30-foot high earthen berm between Honolulu International Airport's new interisland terminal and Hickam's Ohana Nui housing area. In the right circumstances, these can be quite effective.

This section discusses the physical alterations to the airport that were considered as a means of improving land use compatibility in surrounding areas. The discussion reviews the effectiveness of the following:

- noise barriers;
- runway extensions;
- new runways: and
- an airport noise monitoring system.

7.3.1 Noise Barriers

In order for a noise barrier to be effective in an airport setting, it must block the visual line-of-sight between the aircraft and the receptor on the ground. This is impossible to do for aircraft which are at 50 feet or greater altitude at their closest point of approach to the community. Since aircraft in flight (rather than aircraft on the ground or ground equipment) are the controlling sources of aircraft noise in the areas around Kahului Airport exposed to incompatible levels of aircraft noise (principally East and West Spreckelsville), noise barriers would not be effective there. Consequently, noise barriers are not recommended.

7.3.2 Runway Extensions

7.3.2.1 Extend Runway 2-20

The *Kahului Airport Master Plan* proposes extending Runway 2-20 2,600 feet to the south to a total length of 9,600 feet. This proposed improvement is shown on the official Airport Layout Plan. The extension is expected to be in operation by 1998, and the 1998 noise exposure maps prepared as part of this study take the extension into account.

7.3.2.2 Extend Runway 5-23

There are no plans to alter Runway 5-23 at the present time. Because the majority of the operations on it consists of propeller aircraft, the Kahului Airport noise contours are relatively insensitive to physical changes to this runway.

Any possibility of extending the runway to the west is severely limited by the presence of the Kanaha Pond Wildlife Refuge. A previously planned 500-foot extension toward the west could very slightly reduce single-event noise from light aircraft departing Runway 5. The change would be too slight to be noticeable, however, and it would not have a significant effect on the Ldn contours. An extension to the east would tend to increase noise levels in East Spreckelsville. In view of the foregoing, no extensions to Runway 5-23 are recommended.

7.3.3 Construct New Runway

Construction of a new runway can reduce land use incompatibilities if it is away from noise sensitive areas or if aircraft flight tracks to the new runway are away from noise- sensitive areas. At Kahului Airport, Hana Highway places constraints on future airport expansion to the south and southwest, but vacant land is available for the construction of a parallel runway southeast of the existing Runway 2-20. The *Kahului Airport Master Plan* recommends that this area be preserved for a possible future runway.

The long-term potential for improving the land use compatibility situation at Kahului Airport through the construction of a parallel runway was evaluated during preparation of the Chapter 343 *Environmental Impact Statement* for the updated airport master plan. That analysis showed that a new parallel runway would not reduce future noise exposure around the airport. For this reason, the parallel runway is not recommended as part of this noise compatibility plan.

7.3.4 Airport Noise Monitoring System

A fixed (as opposed to portable) airport noise monitoring system consists of outdoor microphones on the airport as well in the surrounding community, and a central data collection and recording station. The system automatically operates 24 hours per day, and 365 days per year, except during maintenance outages. Telephone lines are used to transmit noise monitoring data from the outdoor microphones to a central monitoring station. An airport noise monitoring system, similar to the one installed at Honolulu International Airport, can document changes in aircraft Ldn values over time; it can also record aircraft single-event noise levels. If installed with the capability to record air-to-ground communications and/or radar data on magnetic tape, the noise monitoring system can also be used to reconstruct and identify the probable sources of the aircraft noise events in the surrounding community.

One method of establishing the accuracy of the noise exposure maps developed by the FAA INM for Kahului Airport is through the use of a permanent noise monitoring system which continuously records aircraft noise levels at established monitoring sites in the community. A permanent noise monitoring system can also record the changes in noise levels that result from significant changes in day-to-day airport operations or from major improvements to the airport runways. In addition, the monitoring system would also be useful for collecting single-event noise data and other statistical data on the loudest aircraft, number and loudness of nighttime flights, and the variations in noise levels among the various aircraft types. The system would also be able to provide accurate quantitative information on the progress and effectiveness of the Part 150 Program. Because of the current plans for future runway improvements at the airport and the future need to document these changes in aircraft noise levels in the communities around the airport, the installation of a permanent Noise Monitoring System at Kahului Airport is recommended for inclusion in the Part 150 Program.

7.4 OFF-AIRPORT CONSTRUCTION OR ACQUISITIONS

As indicated by the preceding analysis, the relatively high number of air carrier jet operations at Kahului Airport combined with its proximity and physical relationships to the surrounding community make it impossible to eliminate land use incompatibilities completely using operational changes or on-airport construction. Even the most aggressive measure, a complete ban on Stage 2 aircraft operations at the airport, would not completely eliminate the existing incompatible land uses in Spreckelsville. Meeting that goal would require both a Stage 2 ban and the imposition of mandatory reductions in the number of both daytime and nighttime

operations at the airport. That combination of measures is not part of the recommended plan. Instead, the recommended plan combines operational changes with off-airport construction and/or land acquisition.

This section identifies and evaluates those off-airport construction and/or property acquisition measures that were considered. It includes a review of the following:

- sound attenuation treatment of public use buildings;
- sound attenuation treatment of private dwellings;
- property purchases; and
- purchase of avigation rights or easements.

7.4.1 Sound Attenuation Treatment of Public Use Buildings

Several public use buildings are forecasted to be located within the 60 Ldn contour of the 5-Year Noise Exposure Map. These include classroom buildings, a meeting room in Pu'u-nēnē, and the Kaunoa Senior Citizens Center in East Spreckelsville. The Year 2010 Noise Exposure Maps from the July 1992 Chapter 343 EIS for the *Kahului Airport Master Plan* also indicated that these public use facilities would probably continue to be located within the 60 Ldn contour for the foreseeable future. This is true even if a parallel runway were constructed. Because both the near- and long-term forecast noise levels at these two locations exceed 60 Ldn, sound attenuation treatment of these facilities is recommended for inclusion in the Part 150 Plan.

The minimum sound attenuation treatment required to the classroom buildings and church in Pu'u-nēnē consists of the following:

- The addition of central ducted air conditioning at the Adult Day Care Center;
- The addition of window air conditioning units at the Alternative Learning Center and the Employment Training Center.

The minimum sound attenuation treatment required at the Kaunoa Senior Center consists of the following:

- The addition of packaged air conditioning, Sound Transmission Class (STC) 35 glazing, and STC 35 doors to a future classroom that is currently under design;
- The addition of packaged air conditioning, STC 35 glazing, and STC 35 doors to an existing classroom in the Ceramics Building.

7.4.2 Sound Attenuation Treatment of Private Dwellings

7.4.2.1 Priorities

Other Part 150 programs developed for airports that are part of the State of Hawaii Airport system have recommended that the State assume current and future noise abatement responsibility for all existing incompatible land uses which do not conform to the land use compatibility criteria described in Table 4-2 and which are within the published, forecasted 60 Ldn contour. This general policy is also appropriate for Kahului Airport.

Priority for off-airport noise abatement projects is normally given to existing noise-sensitive uses which would be enclosed for the first time by the forecasted 60 Ldn noise contour after the Base Year period as a result of forecasted increases in aircraft operations, the introduction of noisier aircraft, or changes to airport facilities or operations. Second highest priority is normally given to existing noise-sensitive properties which were within the 60 Ldn noise contour during the Base Year and will probably remain there in the Five Year scenario. Noise-sensitive uses within the 60 Ldn contour which were developed or acquired following disclosure of incompatible aircraft noise levels generally deserve the lowest priority.

7.4.2.2 Degree of Attenuation Required

FAR Part 150 land use compatibility criteria were intended to keep aircraft noise levels within residential structures from exceeding 45 Ldn. The range of exterior-to-interior sound attenuation required to meet this interior standard for typical homes in Hawaii is from 15 dB for homes located on the 60 Ldn contour to 35 dB or more for homes on or inside the 75 Ldn contour. Closure and air conditioning, together with some additional structural modifications to structures within the higher noise bands, will be required to achieve this.

In order to determine the typical levels of exterior-to-interior sound attenuation provided by existing residences in Spreckelsville, exterior and interior measurements of aircraft noise events were obtained at five Spreckelsville homes. The exterior-to-interior sound attenuation provided by these homes ranged from 5 to 15 dB with windows and doors opened and from 14 to 22 dB with windows and doors closed. The measurements confirmed that typical residential structures in Hawaii do not provide the 20 dB of sound attenuation with windows opened that was assumed when the National FAR Part 150 land use compatibility criteria were established. The measurements also confirmed that, in order to achieve sound attenuation greater than 15 dB, or interior noise levels of 45 Ldn when within the 60 Ldn contour of the noise exposure map, windows and doors must be closed. In Hawaii, this general requirement for closure of the windows and doors creates an additional requirement for air-conditioning of the affected structures.

Retrofitting existing homes to obtain 20 dB of total sound attenuation (up to 5 dB above the existing) should not require major rework of the existing structures, but will probably require

replacement of existing ventilation openings, windows, and doors, and the addition of air-conditioning. Retrofitting existing homes to achieve 25 to 35 dB of total sound attenuation (5-15 dB above existing) will be much more difficult. It may require installation of new ceilings and furred out walls in addition to sound attenuation treatment of ventilation openings, windows, and doors. Achieving exterior-to-interior noise reductions of more than 15 dB above existing, which would be required to provide compatibility for homes inside the 75 Ldn contour, is extremely difficult and may require complete replacement of the existing structure.

In any event, the use of a design goal of reducing interior noise levels to 45 Ldn or less by sound attenuation treatment should produce parity between the interior noise levels within the treated home and the interior noise levels within a home which is outside the 60 Ldn contour.

Sound attenuation treatment of dwellings may not be acceptable to all residents, because it requires total closure of the dwelling in order to be effective. Sound attenuation treatment of dwellings also does not improve the acoustical environment outside the home. Finally, sound attenuation treatment of bedrooms can reduce the frequency of sleep interference to reasonable levels of 0 to 12 percent for most persons, but cannot reduce the frequency to zero for all individuals.[15] In addition, for some homes which are located in the high noise zones, major reconstruction of the dwelling may be required to achieve the higher sound attenuations of 25 to 35 dB, and this degree of reconstruction may not be economically feasible when compared to relocation costs. For these reasons, the recommended noise compatibility program provides for the State to offer to relocate residents exposed to high levels of aircraft noise. For those residents who chose to not relocate under the land purchase component of the recommended plan, and following complete disclosure of the advantages and disadvantages of sound attenuation treatments, sound attenuation treatment of their homes is the recommended alternative for inclusion in the Part 150 Program.

[15]It is generally agreed that variables which influence the auditory thresholds of awakening during sleep include such factors as: intensity of the sound stimulus; the energy (or Sound Exposure Level) content of the sound stimulus; sleep stage (REM, 1, 2, 3, or 4) of the subject; age of the subject; prior habituation of the subject to the sound stimulus; meaningfulness or familiarity of the sound stimulus to the subject; accumulated sleep time of the subject after first going to sleep; and the amount of sleep deprivation prior to first going to sleep.

In addition to the complexity of sleep disturbance processes associated with acoustical stimulus, other non-acoustical stimuli must also be considered when attempting to determine the cause of a sleep disturbance or awakening. These non-acoustical stimuli include ambient air temperature and biological needs (such as using the bathroom at night). In fact, when counting all of the occurrences of sleep disturbances, the frequency of sleep disturbances from non-acoustical factors can be higher than those associated with acoustical factors for average exterior aircraft noise levels as high as 70 Leq. The significance of the sleep research results is that there can be expected to be wide variations in noise levels which cause sleep disturbances among the entire group of persons who may reside in areas exposed to aircraft noise. In addition, even for those individuals who reside within the higher noise exposure levels of 65 to 70 Ldn, the frequency of sleep disturbances due to non-acoustical factors can be higher than the frequency of sleep disturbances due to aircraft noise.

7.4.3 Land Purchases

The existing 75 Ldn contour extends beyond the airport boundaries, and current forecasts indicate that it will remain outside the airport boundaries through the Year 2010. The outright purchase of land needed to bring the 75 Ldn contour within the airport boundary is desirable, and the land acquisition needed to accomplish this following implementation of the recommended Part 150 Program is described in the following chapter. The 2010 noise contours for Kahului Airport, as defined by the joint federal/state environmental impact statement being prepared by the Airports Division of the State of Hawaii, should be used to define the limits of the purchases.

As noted above, the measures needed to sound-attenuate homes that are between the 60 and 75 Ldn contours incur risks of occupant dissatisfaction with total closure and air- conditioning, increased maintenance and electricity costs associated with the operation of air-conditioning units and other noise mitigation measures, and the risk of continued sleep interference for some individuals. The only means of fully compensating for this is for the State also to offer to purchase homes that would be exposed to aircraft noise levels of 60-75 Ldn following implementation of recommended noise abatement measures. In this way, those residents who wish to relocate away from the airport may do so. Unlike properties inside the 75 Ldn contours, the properties in this area that are acquired could be sound-attenuated and resold with aircraft noise easements in favor of the state.

7.4.4 Purchase of Rights or Easements

If the outright purchase of private lands is not practical or possible, or if present owners wish to utilize the sound attenuation treatment option of the recommended plan, the State DOT should purchase avigation easements in respect to the affected properties in exchange for sound attenuation treatment and/or cash settlements. The acquisition of rights or easements on noise-sensitive lands within the 60 Ldn contour is recommended for inclusion in the plan.

7.5 PLANNING EFFORTS RELATED TO FUTURE LANDSIDE DEVELOPMENTS

7.5.1 Recommendations to Land Use Commission and Counties

In conjunction with the FAR Part 150 Programs it has developed, the Airports Division has determined that a single noise level of 60 Ldn should be uniformly applied in all land use compatibility determinations related to residential, apartment, resort, educational, public use, and other noise-sensitive land uses throughout the state. The State Land Use Commission has applied this guideline in several of its rulings. Other states have adopted, or are considering adopting, 60 Ldn as a guideline as well. Proposed projects involving noise-sensitive land uses should be discouraged when it can be accurately and/or reasonably demonstrated that aircraft

noise levels do or can be expected to exceed 60 Ldn. The Airports Division should not oppose proposed land use changes where it can be accurately and/or reasonably demonstrated that aircraft noise levels do not and will not exceed 60 Ldn in the foreseeable future. A planning level of 60 Ldn is believed to be a reasonable compromise between the level used by federal agencies and that required to insure the health and welfare of the public in the Hawaiian environment.

The Airports Division should provide informational inputs as required for adequate disclosure during its review of environmental assessments, environmental impact statements, permit applications, and other documents involving proposed noise-sensitive uses of lands within the 55 Ldn aircraft noise contours of airports.

7.5.2 Recommendations for Building Codes

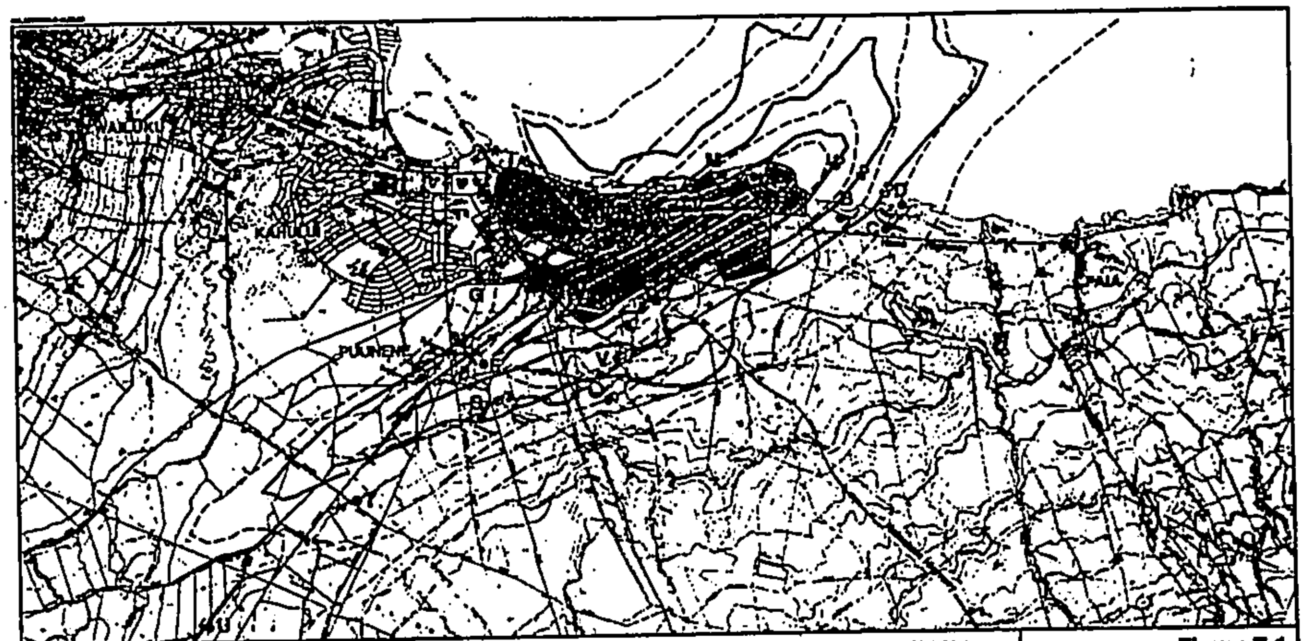
In some situations, changes to building codes can help maintain land use compatibility in areas adjacent to airports by imposing minimum sound attenuation requirements on noise-sensitive structures constructed within the 60 Ldn. Because of the desirability of maintaining the open, island lifestyle, and because of the initial and operating costs associated with providing sufficient sound attenuation for achieving acceptable interior noise levels when the exterior noise levels exceed 60 Ldn, the preferred approach is to minimize future development of noise-sensitive properties within the 60 Ldn contours. Consequently, the establishment of minimum sound attenuation performance standards for habitable structures on Maui is not part of the recommended plan.

7.5.3 Recommendations for Airport Noise Disclosures

In order to minimize possible adverse health and welfare effects attributable to aircraft noise, the Airports Division should support continuation of the aircraft noise disclosure provisions of §467-31, Hawaii Revised Statutes. These require aircraft noise disclosures to potential buyers prior to all transfers of real property and improvements where it can be accurately and/or reasonably demonstrated that aircraft noise levels do or can be expected to exceed 55 Ldn in the foreseeable future. It is recommended that the Airports Division provide all of the necessary assistance to the State Real Estate Commission to insure that the Kahului Airport Five-Year (1998) noise contours are properly represented on the applicable tax maps.

7.6 OTHER ACTIONS RECOMMENDED BY FAA FOR ANALYSIS

No other actions have been recommended for analysis.



KAHULUI AIRPORT
FAR Part 150 Airport
Noise Compatibility Program

LEGEND

Kahului Airport Property

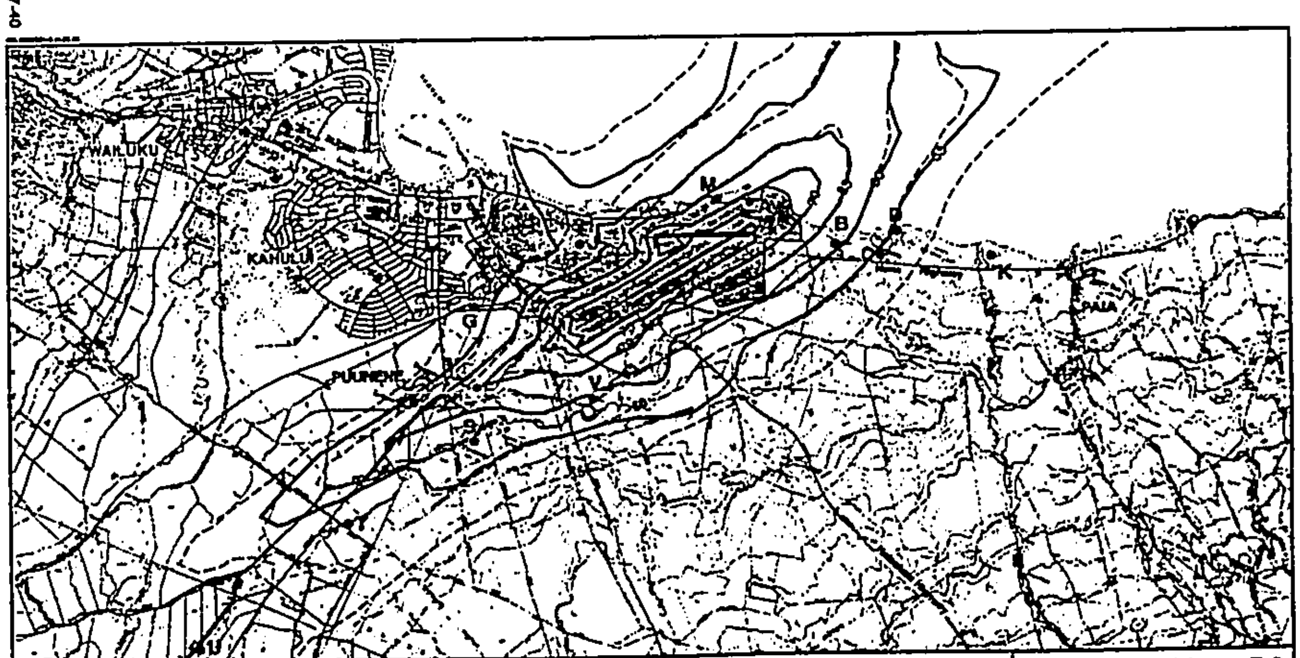
1996 Ldn Level with Noise Abatement Option

1996 No Mitigation Ldn Level

Noise Monitoring Station

Option T1: No Stage 2 (All Aloha Operations by B-737-300 and All Hawaiian Operations by MD-82)

Figure 7-1
OPTION T1



KAHULUI AIRPORT
FAR Part 150 Airport
Noise Compatibility Program

LEGEND

Kahului Airport Property

1996 Ldn Level with Noise Abatement Option

1996 No Mitigation Ldn Level

Noise Monitoring Station

Option T2: No Stage 2 (All Aloha Operations by B-737-300 and All Hawaiian Operations by DC-9-50 with Hush Kits)

Figure 7-2
OPTION T2

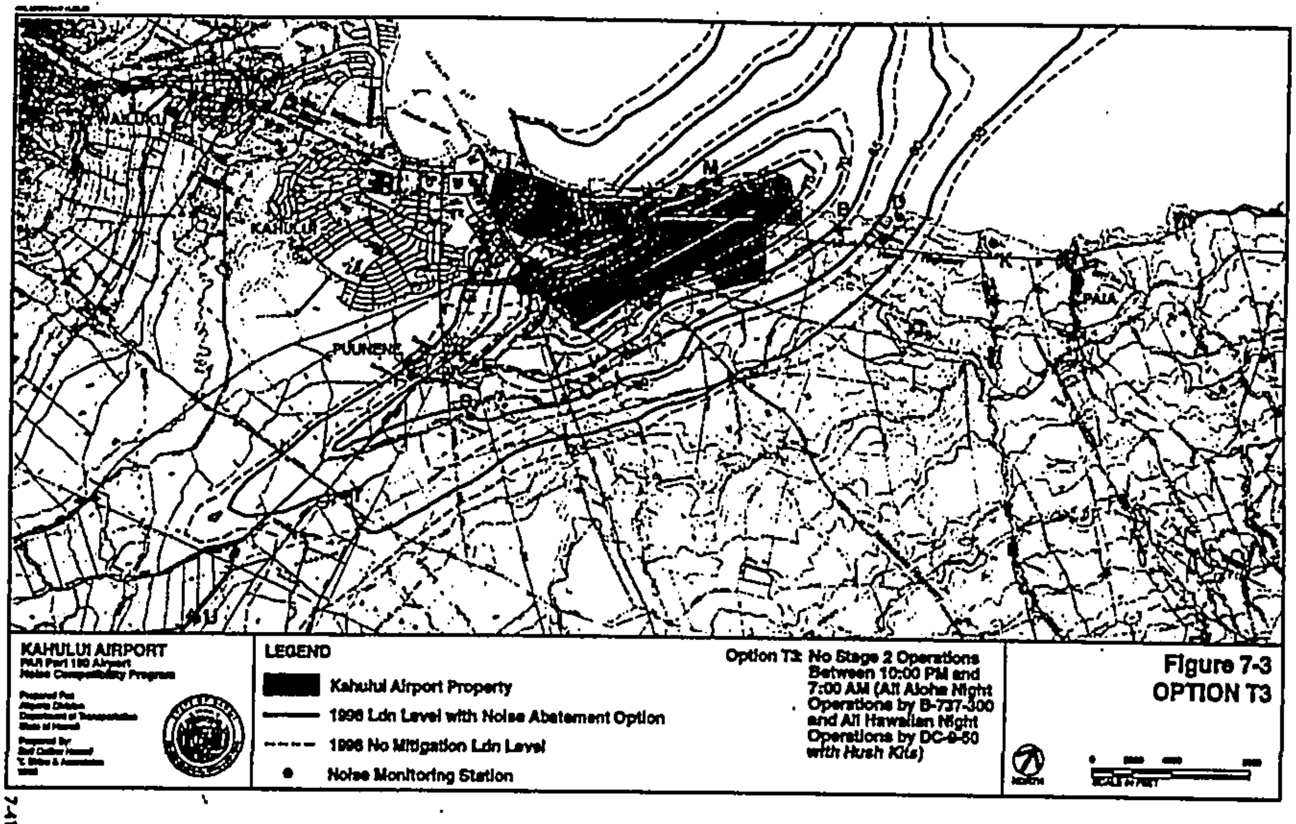


Figure 7-3
OPTION T3

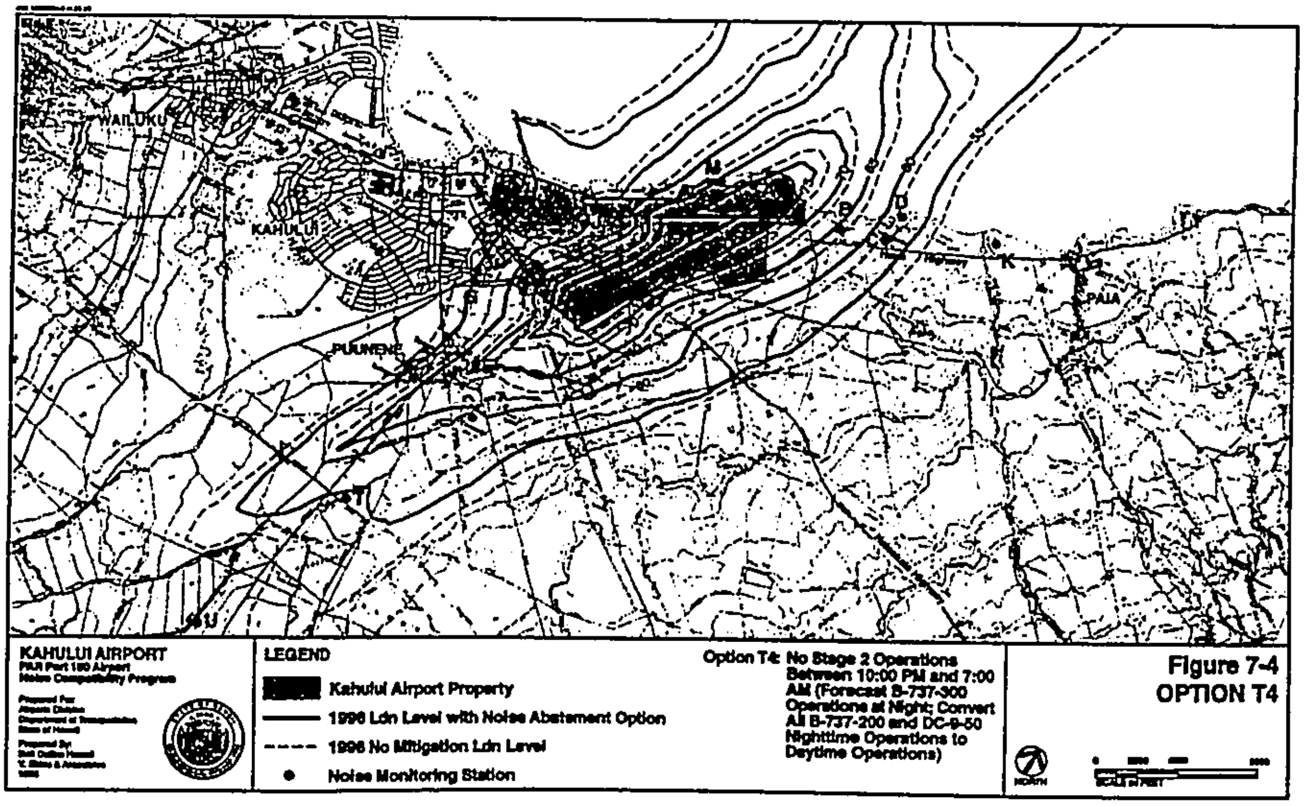


Figure 7-4
OPTION T4

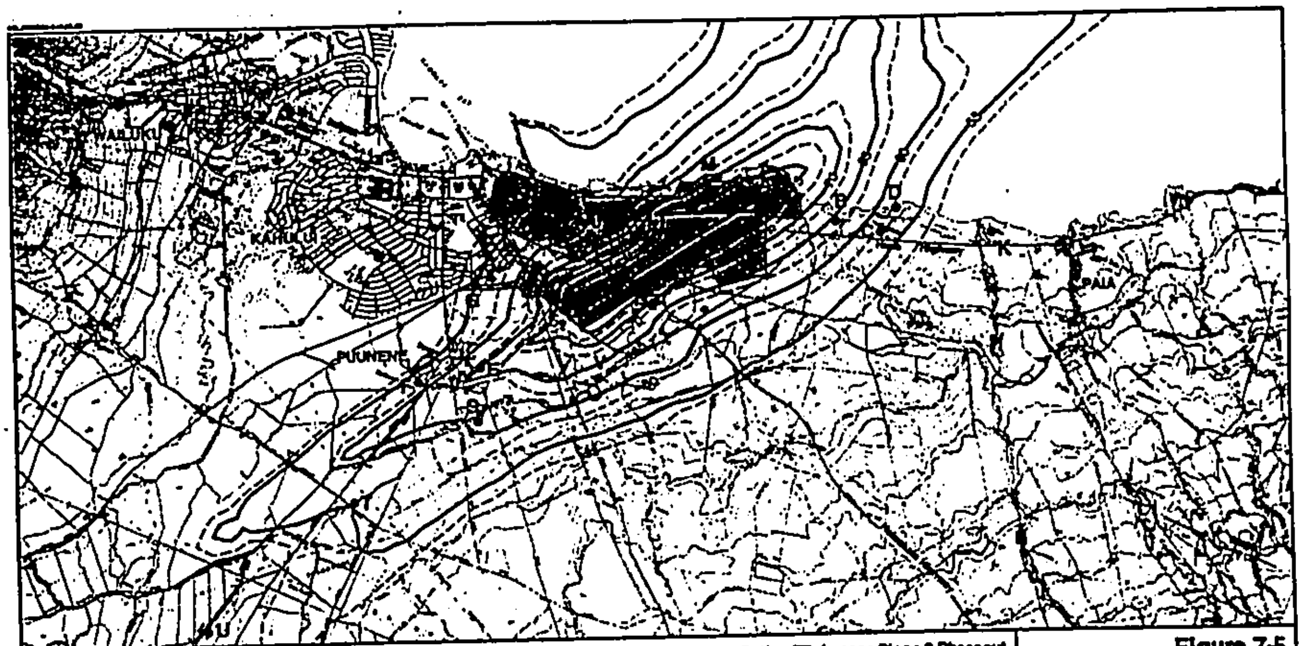


Figure 7-5
OPTION T5

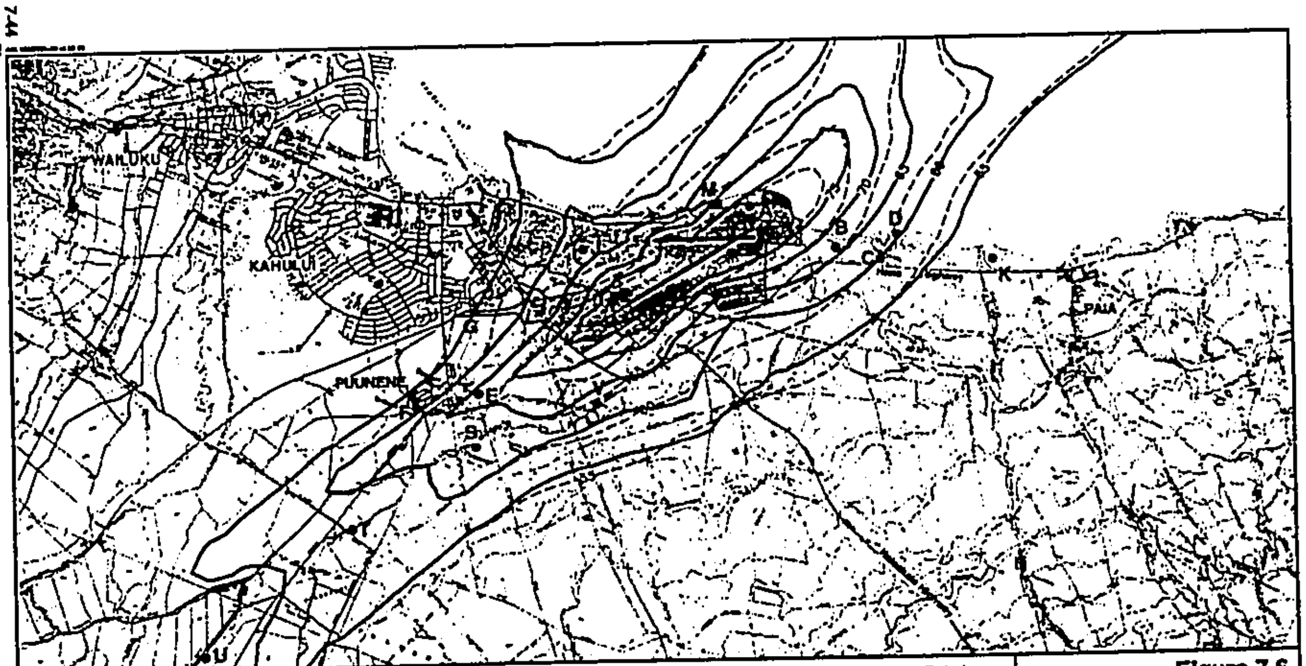
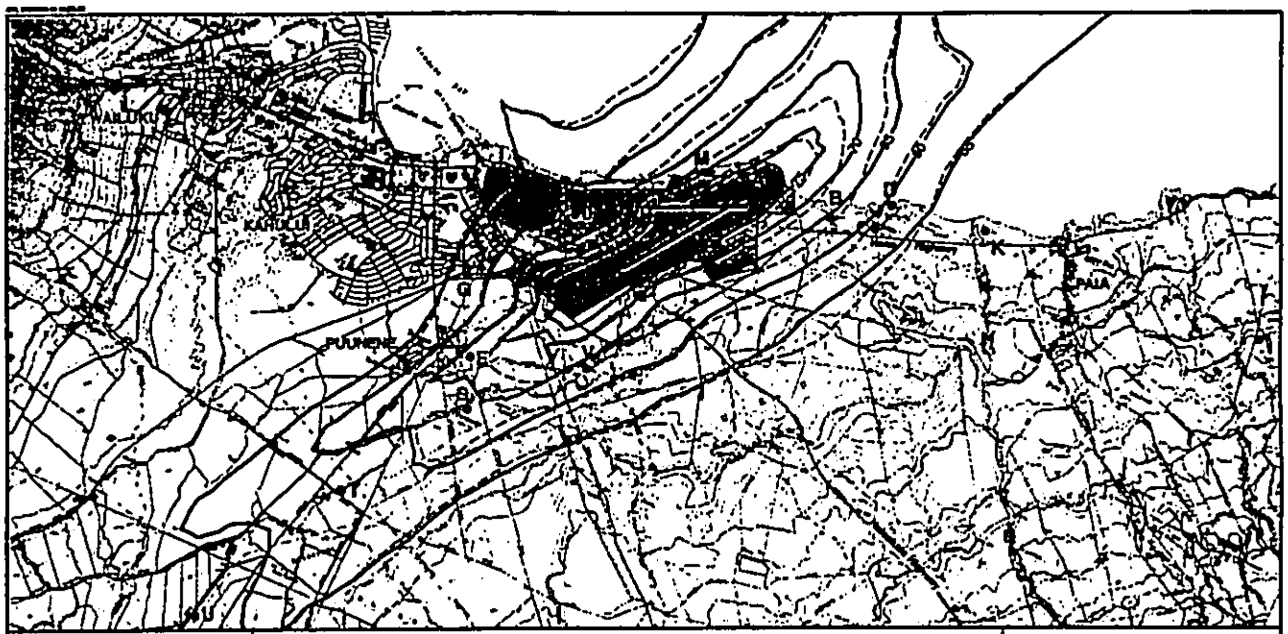


Figure 7-6
OPTION T6



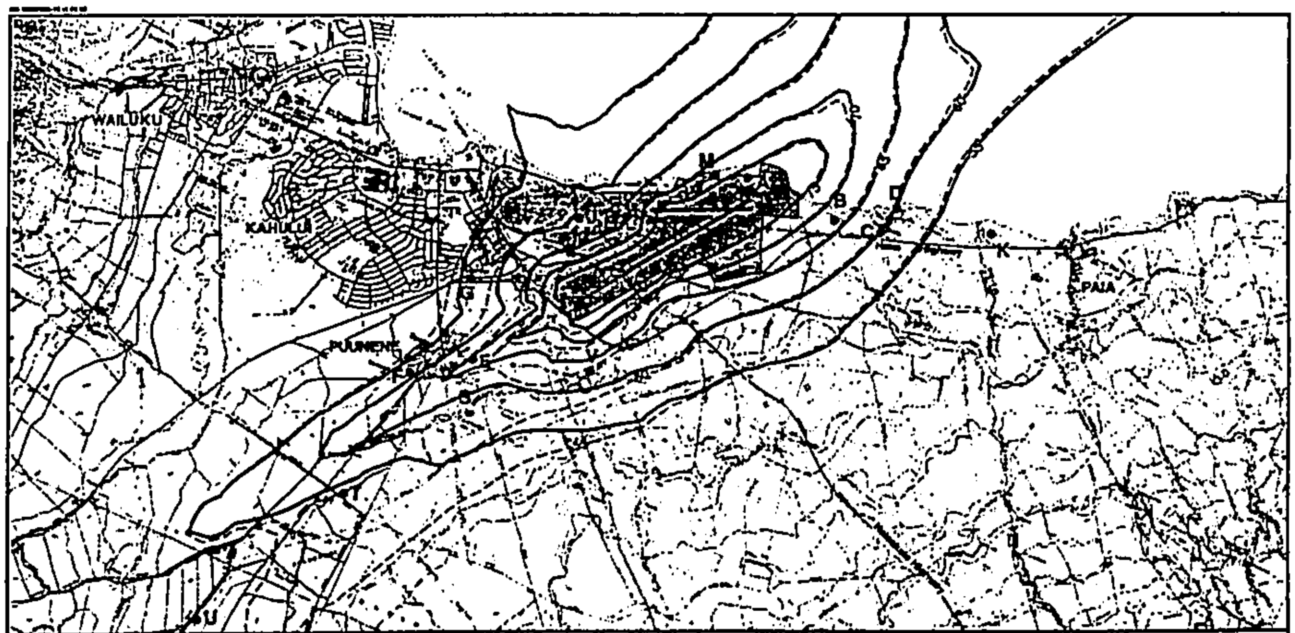
KAHULUI AIRPORT
FAR Part 150 Airport Noise Compatibility Program

LEGEND

- Kahului Airport Property
- 1996 Ldn Level with Noise Abatement Option
- 1996 No Mitigation Ldn Level
- Noise Monitoring Station

Option T7: Use Early Power Cutback at 800-foot Altitude for all DC-9-50 and B-737 Departures

Figure 7-7
OPTION T7



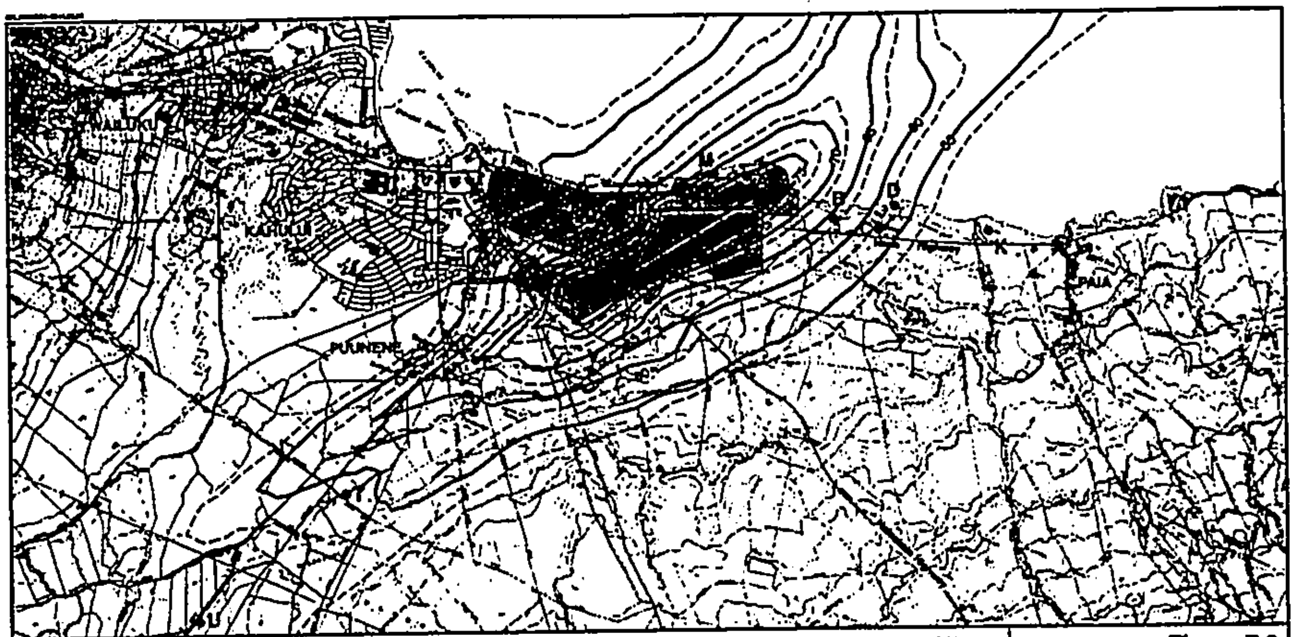
KAHULUI AIRPORT
FAR Part 150 Airport Noise Compatibility Program

LEGEND

- Kahului Airport Property
- 1996 Ldn Level with Noise Abatement Option
- 1996 No Mitigation Ldn Level
- Noise Monitoring Station

Option T8: All Aircraft Use Runway 2 During Light Kona Winds

Figure 7-8
OPTION T8

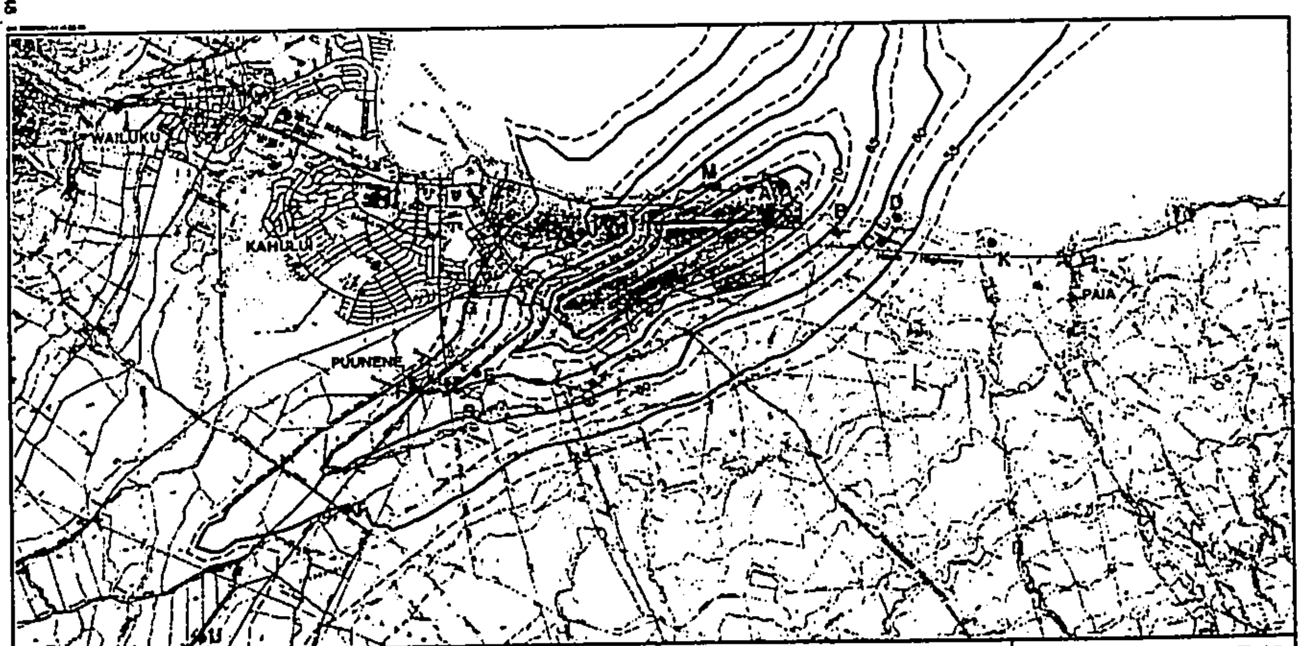


KAHULUI AIRPORT
FAR Part 150 Airport
Noise Compatibility Program

LEGEND
Kahului Airport Property
1998 Ldn Level with Noise Abatement Option
1998 No Mitigation Ldn Level
Noise Monitoring Station

Option T9: Place a 10:00 PM to 7:00 AM Curfew on Airport (Convert Nighttime Operations to Daytime Operations)

Figure 7-9
OPTION T9

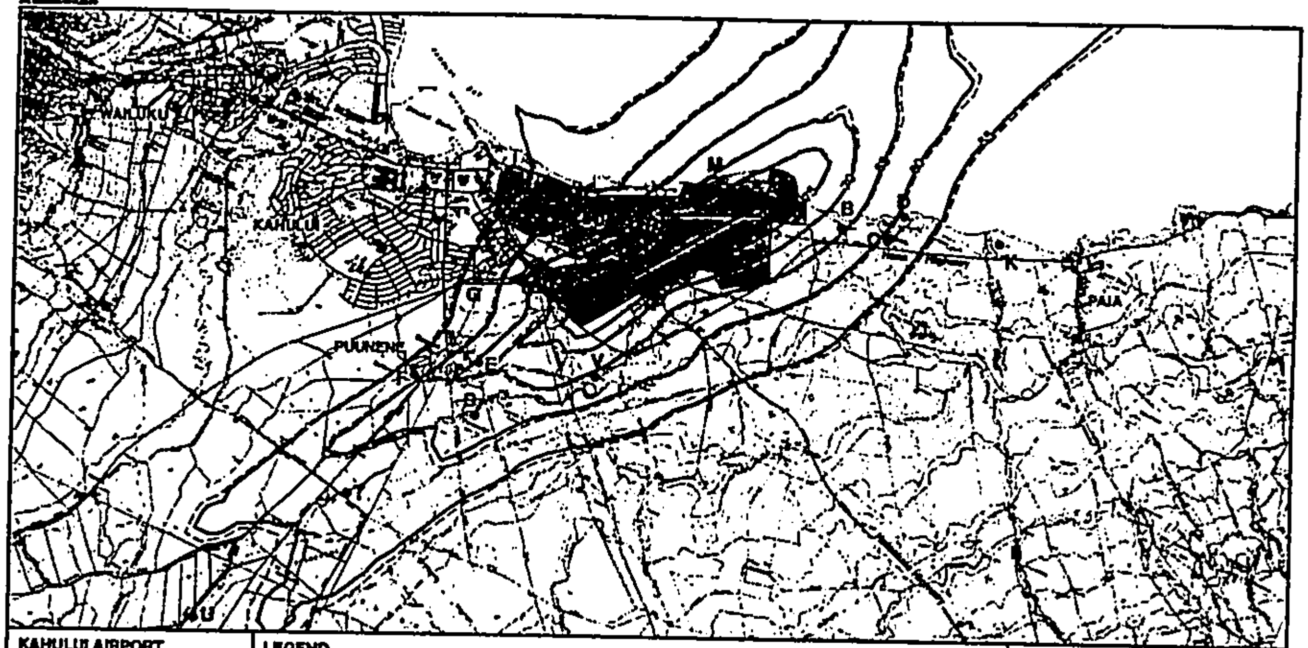


KAHULUI AIRPORT
FAR Part 150 Airport
Noise Compatibility Program

LEGEND
Kahului Airport Property
1998 Ldn Level with Noise Abatement Option
1998 No Mitigation Ldn Level
Noise Monitoring Station

Option T10: Place a 10:00 PM to 7:00 AM Curfew on Airport (Convert Nighttime Operations Except Early Bird Arrivals (6:00 AM to 7:00 AM) to Daytime Operations)

Figure 7-10
OPTION T10



KAHULUI AIRPORT
FAR Part 150 Airport
Noise Compatibility Program

LEGEND

Kahului Airport Property
1998 Ldn Level with Noise Abatement Option
1998 No Mitigation Ldn Level
Noise Monitoring Station

Option T11: No Stage 2 Operations Between 10:00 PM and 6:00 AM. All Night Cargo by B-737-300-QC.

Figure 7-11
OPTION T11

NORTH

SCALE IN FEET

CHAPTER

RECOMMENDED NOISE COMPATIBILITY PROGRAM

CHAPTER 8
RECOMMENDED NOISE COMPATIBILITY PROGRAM

This chapter describes the recommended noise compatibility program for Kahului Airport. It begins with a review of the principal factors that influenced the selection of the recommended measures from among those discussed in Chapter 7. This is followed by a description of the recommended plan. The description includes a map showing the 1998 noise contours expected if the recommended noise abatement measures are implemented, a discussion of the incompatible land uses that would continue to exist, and a summary of the mitigation measures (e.g., land acquisition, sound attenuation treatment, etc.) recommended to address these remaining land use incompatibilities. A recommended implementation program identifying the responsibilities and costs associated with program implementation, as well as recommendations for periodic review, concludes the chapter.

8.1 CONSIDERATIONS USED IN FINAL PLAN DEVELOPMENT

8.1.1 Introduction

Part 150 Program Goals. As previously stated, the Part 150 Program has three broad goals:

- Insure that land exposed to noise levels of 75 Ldn or higher is under the control of the airport operator.
- Convert existing incompatible land uses to compatible uses.
- Prevent new incompatible land uses from becoming established around the airport.

A principal criteria used in evaluating the alternative measures described in Chapter 7 was the extent to which each would allow these goals to be met. Average day-night noise level (Ldn) was used as the principal noise metric as required by FAR Part 150. Other criteria included the relative magnitude of the costs and benefits and the extent to which these would be equitably distributed. Single-event noise levels were considered as a secondary factor.

Three different perspectives were considered in choosing measures for inclusion in the recommended plan:

- The first perspective was that of the owners and occupants of noise-impacted properties. From their viewpoint, the preferred plan is one that achieves land use compatibility entirely through noise abatement measures that decrease the noise to which they are exposed. In general, they place the highest priority on decreasing or eliminating nighttime noise. They tend to accept sound-proofing and other structural methods of reducing interior noise levels only to the extent that the noise cannot be eliminated by noise abatement measures such as aircraft noise limits and curfews. They consider the intangible benefits associated with their ability to enjoy an open-air, "Hawaiian" lifestyle important.

- The second was that of the aircraft operators, who would be made to purchase, modify, and/or operate equipment that they would not otherwise choose or whose income would decline as a result of a curfew. Operators generally prefer an approach to improving land use compatibility that relies solely on noise mitigation through property purchases and sound attenuation treatment of homes rather than on noise abatement measures that impact their operations.
- The third perspective was an economic one that derives from the vital role that air transportation plays in the entire community. Noise abatement measures, such as curfews and/or limitations on aircraft noise levels, which restrict air cargo or passenger movements can have broad economic effects if they make it impossible for movements to occur when desired or result in higher shipping costs. Measures that seek to improve land use compatibility solely through sound attenuation of homes have little direct economic effect on the business community or on homeowners so long as they are compensated for any noise improvements made for the purpose of reducing interior noise levels.

It is estimated that it would cost up to a billion dollars (at current prices) to construct an entirely new airport with facilities equivalent to those now at Kahului. This cost, the absence of an alternate location that offers clear advantages from a noise compatibility standpoint, and other potential environmental consequences associated with development of replacement facilities at a new site led us to focus only on measures that were applicable to the existing airport.

For the purposes of this study, it was assumed the cost to aircraft operators of altering flight paths, using different start-to-roll points, using Runway 2 instead of Runway 20 under light Kona wind conditions, and making other minor adjustments in their practices would be negligible. Consequently, these factors did not influence the selection of measures for inclusion in the Part 150 Program.

The dollar cost of eliminating the incompatible residential and other noise-sensitive uses that remain following implementation of noise abatement measures was assumed to be the sum of the cost of acquiring and/or sound-attenuating incompatible properties within the 60 Ldn contour. This assumption does not take into account the intangible costs associated with the change in lifestyle that closing and air-conditioning the homes in Spreckelsville would have.

8.1.2 Summary Comparison of Possible Noise Abatement and Mitigation Measures

The extent to which various possible measures could provide land use compatibility is discussed in Chapter 7. That analysis shows that:

- Making a greater effort to insure that aircraft follow recommended flight tracks might slightly reduce the number of overflights of residential areas, but it cannot significantly change Ldn levels or improve land use compatibility.

- Requiring aircraft to reduce their engine power settings at the lowest possible elevation would have little effect on aircraft noise levels (no more than 1 Ldn point) or on the number of residences exposed to incompatible levels of aircraft noise, but deserves further consideration if the planned extension of Runway 2-20 is implemented.

- The absence of substantial noise from existing airport ground activities makes it impossible to significantly increase land use compatibility by constructing additional airport facilities (e.g., constructing a noise berm) or modifying existing facilities (e.g., relocating taxiways) at Kahului Airport.

- Closing the airport from 10:00 PM to 7:00 AM (i.e., a night curfew) would reduce noise levels by 1 to 3 Ldn units, with the improvement in Spreckelsville being about 2.5 Ldn. The closure would eliminate single-event nighttime aircraft noise (the greatest source of complaints), but it would still leave most of the residences in West and East Spreckelsville exposed to incompatible Ldn noise levels. A complete night curfew would eliminate nighttime interisland air cargo shipments and "early bird" passenger flights, adversely affect shippers who depend on the nighttime movement of air cargo, and damage the businesses that presently provide nighttime air cargo service. Because no alternate airport is available for use during the hours the airport would be closed, the FAA would probably disapprove a complete nighttime curfew at Kahului Airport. If state and/or federal law is deemed to require that the Airports Division apply restrictions system-wide, rather than simply at Kahului, the cost of implementation would be extremely high.

- Imposing a nighttime curfew on Stage 2 aircraft would reduce Ldn levels in Spreckelsville by .5 to 1.5 points, providing a slight improvement in land use compatibility as determined by the Ldn criteria. It would decrease single-event nighttime noise by 5-10 dBA, reducing complaints from Spreckelsville residents. However, unless the restriction on nighttime use of Stage 2 aircraft is imposed system-wide, the decrease in noise at Spreckelsville would come at others' expense if it led operators to divert Stage 2 aircraft to other airports within the system. Such

a curfew would be particularly costly to operators if it extended to 7:00 AM because it would affect passenger, as well as cargo, operations.

- Requiring all aircraft operating at Kahului Airport to meet Stage 3 requirements would reduce Ldn levels between 4 and 9 Ldn points and would substantially improve the land use compatibility situation there. However, even this would not insure complete land use compatibility or keep single-event noise levels from being intrusive at night. Soundproofing of some residences would still be required. Moreover the interisland air carriers now serving the market are unlikely to be able to bear the financial burden of converting to an all-Stage 3 fleet by 1998, the time horizon for this study. This is true whether operators retro-fit existing aircraft using hush-kits (the least expensive and least effective approach) or lease or purchase equipment originally constructed to meet Stage 3 standards.

- Requiring the fleet mix that is federally mandated in the 48 contiguous states by the end of 1998 (75% Stage 3) would decrease noise in the most noise-sensitive areas by approximately 2 Ldn and slightly reduce the number of homes exposed to noise levels in excess of 75 Ldn. However, most of the homes that would be exposed to incompatible levels of aircraft noise if no action is taken would still require sound attenuation treatment to achieve interior noise levels of 45 Ldn. Moreover, starting at this late date, it is impractical for both interisland carriers to meet the Stage 2 phase-out schedule applicable on the Mainland.

- Noise-based differential landing fees are useful principally when operators have a choice of equipment to operate at a given airport. This is not the case for all operators at Kahului Airport, where one of the two interisland air carriers has only Stage 2 aircraft. Consequently, it is not a desirable means of improving land use compatibility.

- Complete land use compatibility can be achieved by purchasing all of the incompatible properties and preventing their use for noise-sensitive purposes. However, because land represents a high proportion of the total value of the properties near Kahului Airport, this measure is much more costly than soundproofing. Moreover, it requires homeowners to relocate, a move that the great majority of them have indicated they do not wish to make. Consequently, it is a preferred approach only in areas exposed to noise levels of 75 Ldn or greater.

- Soundproofing the structures exposed to incompatible levels of noise can significantly reduce interior noise levels and provide a measure of compatibility for areas exposed to noise levels up to 75 Ldn. It is the most cost-effective way of achieving the desired interior noise levels in areas around Kahului Airport. However, it requires closure and air-conditioning of the structures, as well as ongoing operating and maintenance expenses on the part of the owners. It also requires a change in lifestyle away from the open, outdoor-oriented manner that residents prefer.

8.2 5-YEAR NOISE EXPOSURE MAP WITH RECOMMENDED NOISE ABATEMENT MEASURES

Most of the noise abatement measures that were evaluated reduced Ldn levels in noise-sensitive areas by less than two points and decreased the number of homes exposed to incompatible levels of aircraft noise by twelve or less. The two that promised greater improvement (a 9-point decrease for T1 and a 4-point decrease for T2) had high noise abatement costs—up to $500 million for T1 and $200 million for T2. By way of comparison, soundproofing promises Ldn reductions of up to 5 Ldn points for as little as $6.5 million. In view of its efficacy and cost advantage, soundproofing is recommended as the principal means of achieving land use compatibility. This measure is described in section 8.3.1.2.

While they would not contribute greatly to improving land use compatibility as measured by the Ldn descriptor, two noise abatement measures that would decrease a single-event noise are recommended for consideration. The first is a prohibition on Stage 2 operations between 10:00 PM and 6:00 AM. The second is clarification of the existing informal runway use program. These are discussed in section 8.2.1.

8.2.1 Recommended Noise Abatement Measures

8.2.1.1 Nighttime Prohibition on Stage 2 Aircraft

The State of Hawaii Department of Transportation (DOT) has proposed amending Hawaii Administrative Rules Chapter 19-28 by adding a new section, §19-28-3.1. The revised rule would read as follows:

> *§19-28-3.1 Additional restrictions at Kahului. No aircraft shall take off or land at Kahului Airport between the hours of 10:00 p.m. and 6:00 a.m. as of December 31, 1995 unless it is a stage 3 airplane.*

The proposed regulation is aimed principally at interisland air carrier jets, but it could also affect a few general aviation operations by Stage 2 aircraft. Both interisland operators have opposed the adoption of the regulation, and it is unlikely that it will be adopted by the December 31, 1995, deadline for compliance contained in the present draft of the new regulations.

The analyses conducted as part of this study have shown that a prohibition on nighttime use of Stage 2 aircraft at Kahului Airport will have a limited effect on Ldn levels and, therefore, on

land use compatibility as determined using that metric. Thus, it does not appear to be warranted on that accord. However, single-event noise from the B-737-300-QC aircraft that make up a part of Aloha Airlines' cargo fleet is at least 10 dB less than that of the B-737-200-QC aircraft that make up the remainder. Consequently, shifting to the quieter airplane would result in a noticeable decrease in single-event nighttime aircraft noise in Spreckelsville.

The fleet modernization program that Aloha Airlines has announced will make it possible for that airline to comply with the proposed regulation by the end of 1998 (but not by the proposed effective date of the regulation) without purchasing additional aircraft if it allocates a disproportionate number of Stage 3 aircraft to its Kahului route. A fleet utilization practice that favors Kahului by assigning it a disproportionate share of the Stage 3 aircraft will tend to increase noise levels at other airports in the State. This is because they will receive a higher proportion of nighttime service by Stage 2 aircraft than would otherwise be the case. It could also increase the airline's operating expenses by forcing it to use Stage 3 aircraft on shorter flights than it would otherwise choose to do. Nonetheless, it is recommended that the Department evaluate the impact of imposing this requirement by the end of 1998. This should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes.

8.2.1.2 Clarification of Informal Runway Use Program

To reduce the incidence of light aircraft overflights of homes in Spreckelsville, the wording of the existing informal runway use program should be clarified, as described in section 7.2.6.2. It is recommended that it be revised to read as follows:

- *Aircraft departing Runway 5 to points northwest should delay their left hand turns until they are past the easternmost homes in West Spreckelsville. They should turn seaward at that point and cross the shoreline along the centerline extension of Runway 2-20 to avoid overflights of East Spreckelsville.*
- *Aircraft departing Runway 5 to the north should turn seaward and cross the shoreline along the centerline extension of Runway 2-20. They should remain at least one-half mile offshore to keep from overflying East Spreckelsville.*
- *Aircraft departing Runway 5 to the southeast should turn inland as quickly as practicable after crossing Runway 2-20's centerline to avoid overflying East Spreckelsville.*
- *Aircraft departing Runway 23 to points northeast should delay their right-hand turns seaward until clear of West Spreckelsville, and remain at least one-half mile from the shoreline when in transit.*

- *Large propeller and jet aircraft departing Runway 2 should maintain runway heading until one mile clear of the shoreline before commencing turns. Small propeller aircraft departing Runway 2 should maintain runway heading until ½-mile clear of the shoreline before beginning turns.*

8.2.2 5-Year Noise Exposure Map With Recommended Noise Abatement Measures

The final 5-Year Noise Exposure Map for Kahului Airport with recommended noise abatement measures is shown in Figure 8-1. The map assumes use of the same flight tracks and other operational practices used to generate the 5-Year "No Mitigation" Noise Exposure Map presented in Chapter 6.

The total areas enclosed by each 5-Ldn contour band of the 5-Year "With Mitigation" Noise Exposure Map (see Figure 8-1) and as calculated by the standard FAA INM, Version 4.11 are as follows:

[illegible]	Area Between Contours			Cumulative Area Enclosed	
	Square Miles	Acres	Approx. % Over Ocean	Square Miles	Acres
>75 Ldn	1.30	832	10.9	1.30	832
70 to 75 Ldn	1.15	736	17.4	2.45	1,568
65 to 70 Ldn	2.64	1,640	27.4	5.09	3,258
60 to 65 Ldn	6.89	4,410	35.4	11.98	7,667
55 to 60 Ldn	15.52	9,933	37.4	27.50	17,600

The areas enclosed by the 5-Year (1998) Noise Exposure Map with recommended mitigation measures are the same as those for Option T11 described in Chapter 7. While the recommended Noise Compatibility Program will reduce Ldn levels only slightly, it will have a considerably greater effect on single-event noise levels during the night. The exact impact depends in part on operators' choice of compliance methods. If all new Stage 3 aircraft are used, single-event noise levels will decrease at least 10 dB; if Stage 3 compliance is achieved by using aircraft retrofitted with hush-kits, single-event noise will decline by only 5 dB.

8.2.3 Incompatible Land Uses With Recommended Noise Abatement Measures

While eliminating Stage 2 aircraft from the nighttime fleet mix will reduce noise levels around the airport, the majority of the noise-sensitive uses which were in the incompatible zone in the base year (see Chapter 5) or which would be in that zone in 1998 if no special measures were taken (see Chapter 6) will continue to be exposed to incompatible aircraft noise levels. Consequently, the noise abatement measures described above must be supplemented by the mitigation measures described in the remainder of this chapter in order to achieve land use compatibility.

The areas of incompatible land use that would remain if the recommended noise abatement measures are implemented are summarized in Tables 8-1 and 8-2. The tables also list the number of dwelling units and resident population in the incompatible use area. The slight decrease in exposure of noise-sensitive uses is due to the contraction of the noise contours in the Spreckelsville area.

8.3 PROGRAMS WITHIN AIRPORT OPERATOR'S IMPLEMENTATION AUTHORITY

8.3.1 Essential Governmental Actions

8.3.1.1 Recommended Noise Abatement Measures

The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide.

The Airports Division should also encourage the FAA to clarify the existing informal runway use program by drafting proposed language that delineates the proposed informal runway use program at Kahului Airport and transmitting this to the FAA for consideration and implementation. The State should also publish the final program in its *Airport Directory and Flying Safety Manual*, and request inclusion in the *Area Notices of the Pacific Chart Supplement*. The published information should include an area map of Kahului Airport, which shows the noise sensitive areas surrounding the airport.

Table 8-1 Five-Year "With Program" Incompatible Land Uses[1] Determined Using "Official FAR Part 150 Standards"

LAND USE	Incompatible Land Uses in Acres by Average Day-Night Sound Level		
	65-70	70-75	>75
Single-Family Residential	9.01	9.06	8.87
Multi-Family Residential	4.04	0.00	0.00
Resort	0.00	0.00	0.00
Commercial[1]	0.00	0.00	0.00
Industrial[1]	0.00	0.00	0.00

LAND USE	DWELLING UNITS AND RESIDENTS IN INCOMPATIBLE AREAS					
	No. of Incompatible Dwelling Units by Ldn Band			No. of Persons Residing in Incompatible Areas by Ldn Band[2]		
	65-70	70-75	>75	65-70	70-75	>75
Single-Family Residential	11	8	16	39	28	56
Multi-Family Residential	18	0	0	0	0	0

[1] Compatibility standards are from Table 1 in FAR Part 150, Section A150.101.

[2] Population estimates based on average of 3.5 persons per single-family residential unit and 2.75 persons per multi-family dwelling unit.

Source: Acreages and number of units calculated by Belt, Collins & Associates based on Ldn contours developed by Y. Ebisu & Associates (see Figure 6-1).

Table 8-2 Five-Year with Program Incompatible Land Uses[1] Determined Using Recommended State Guidelines

LAND USE	Incompatible Land Uses in Acres by Average Day-Night Sound Level			
	60-65	65-70	70-75	>75
Single-Family Residential	12.73	9.01	9.06	8.87
Multi-Family Residential	4.04	0	0	0
Schools	0	0	0	0
Public Facilities	2	0	0	0
Churches	0	0	0	0

LAND USE	DWELLING UNITS AND RESIDENTS IN INCOMPATIBLE AREAS							
	No. of Incompatible Dwelling Units by Ldn Band				No. of Persons Residing in Incompatible Areas by Ldn Band			
	60-65	65-70	70-75	>75	60-65	65-70	70-75	>75
Single-Family Residential	24	11	8	16	84	39	28	56
Multi-Family Residential	18	0	0	0	50	0	0	0

[1] Compatibility determination is from the Department of Transportation, State of Hawaii, recommendations for local land use compatibility.

[2] Population estimates based on average of 3.5 persons per single-family residential unit and 2.75 persons per multi-family dwelling unit.

Source: Acreages and number of units calculated by Belt, Collins & Associates based on Ldn contours developed by Y. Ebisu & Associates (see Figure 6-1).

8.3.1.2 Recommended Noise Mitigation Measures

Negotiate with private landowners in West Spreckelsville to purchase the private properties enclosed by the 75 Ldn Contour. The State DOT should begin negotiations to purchase the privately-owned residential units and residentially zoned land in West Spreckelsville enclosed by the 75 Ldn contour shown on Figure 8-1. Properties acquired in this manner should be retained within the Airport boundaries and kept vacant or developed for purposes that are not noise-sensitive. Owners who prefer to retain their properties should be allowed to do so. Homes not being purchased should be included in the Part 150 sound attenuation program. Noise and avigation easements should be obtained by the State DOT in exchange for the sound attenuation

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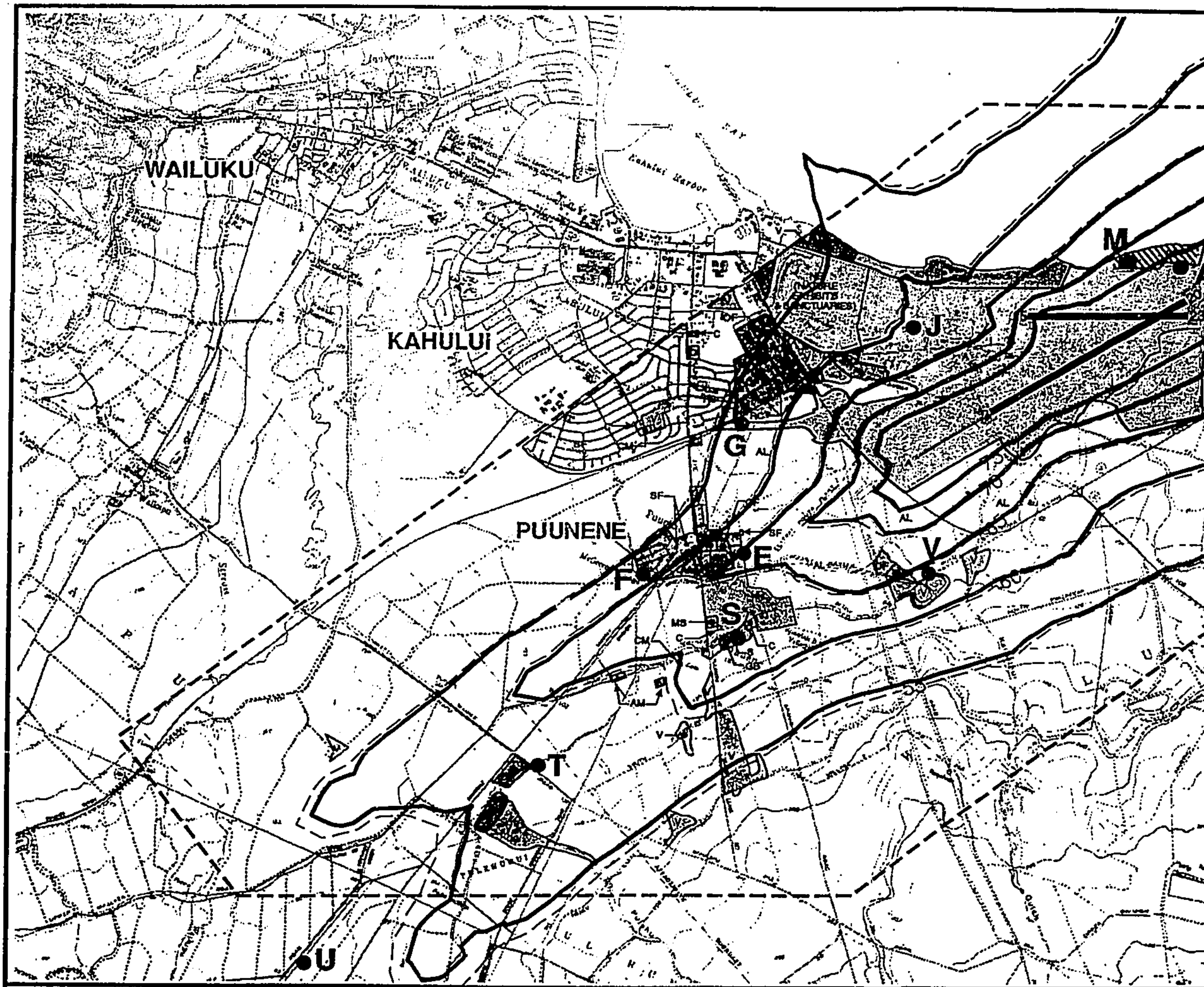


KAHULUI AIRPORT
FAR Part 150 Airport Noise Compatibility Program

Prepared For:
Airports Division
Department of Transportation
State of Hawaii

Prepared By:
Belt Collins Hawaii
Y. Ebisu & Associates
1995

LAND USE CLASSIFICATION

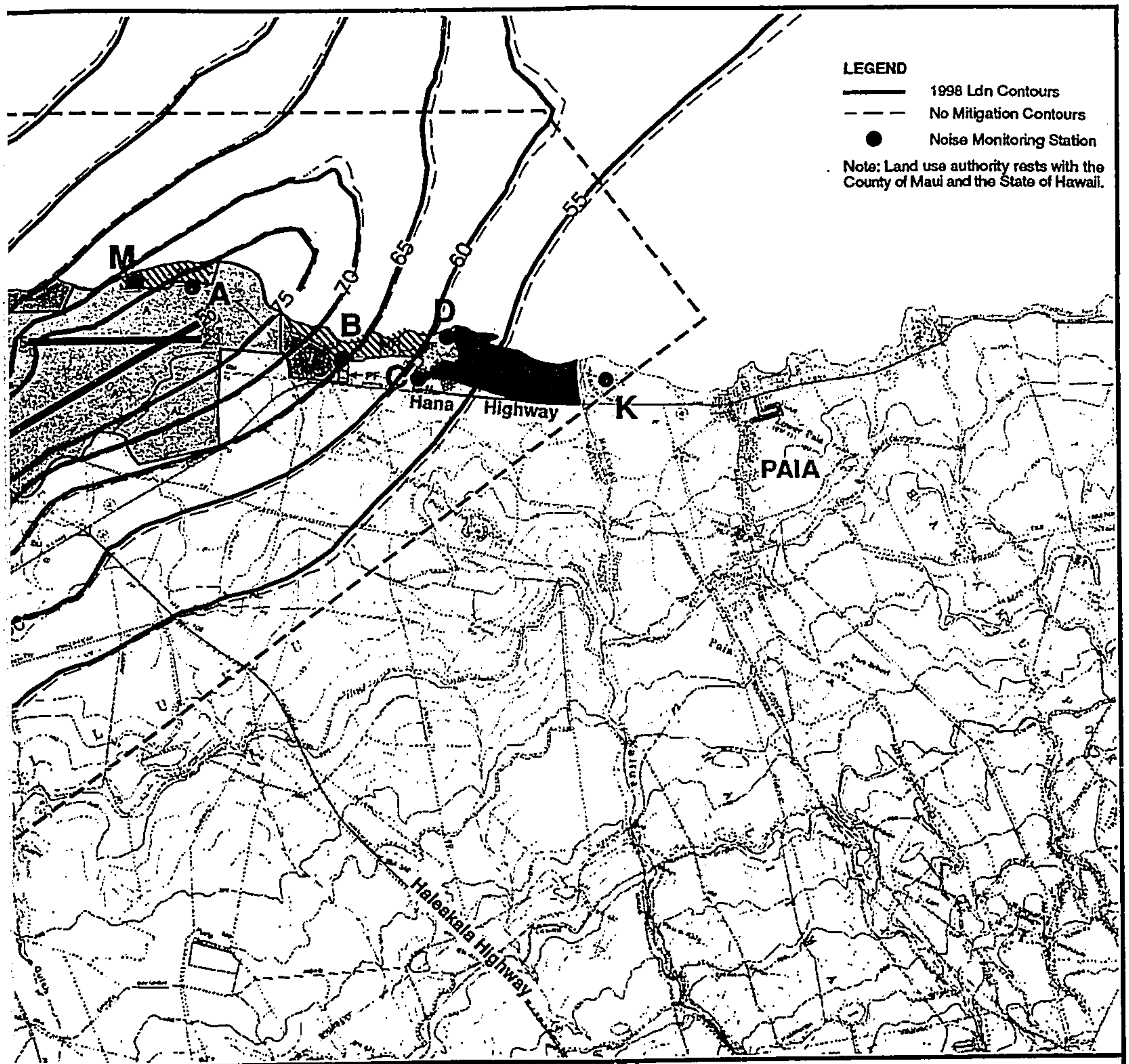
COMMERCIAL AND GOVERNMENT USE
RC RETAIL COMMERCIAL
OF BUSINESS/PROFESSIONAL OFFICES
AC AIRPORT BUSINESSES (car rental agencies, tours, lei stands)
RS RETAIL STORAGE (warehouses)
CS COMMERCIAL SERVICES
GB GOVERNMENT BUILDING

RESIDENTIAL
SF SINGLE FAMILY
MF MULTIPLE FAMILY

PUBLIC USE
S SCHOOL
H HOSPITALS (clinics, health care facilities, nursing homes)
PF PUBLIC FACILITIES (day care, libraries, community centers)
C CHURCH

MANUFACTURING, PRODUCTION & STORAGE
M LIGHT/HEAVY MANUFACTURING
AM AGRICULTURAL MANUFACTURING
MS MANUFACTURING WAREHOUSES

AL AGRICULTURAL LAND



are facilities,

e, libraries,

ODUCTION & STORAGE
RING
TURING
OUSES
LAND

RECREATIONAL
OR OUTDOOR RECREATION
NE NATURE EXHIBITS & SANCTUARIES
G&W GOLF COURSES, GARDENS, WATER RECREATION

OPEN SPACE
CM CEMETERY
P PARK
V VACANT OR UNDEVELOPED LAND

STUDY AREA BOUNDARY
AIRPORT PROPERTY
AREA OF INCOMPATIBLE LAND USE

Figure 8-1
FIVE-YEAR (1998) NOISE CONTOURS WITH THE RECOMMENDED NOISE ABATEMENT MEASURES

NORTH

0 2000 4000 8000
SCALE IN FEET

improvements. The State DOT should also attempt to obtain the first right of refusal to purchase or lease all lots within the 75 Ldn contour in order to obtain future control over those affected properties.

Initiate a Sound Attenuation Program for Remaining Residences in West and East Spreckelsville. The State DOT should initiate a sound attenuation program in Spreckelsville whose goal is to reduce interior noise levels within homes to less than 45 Ldn based on the noise contours shown in Figure 6-1. The highest priority should be given to those homes that experience the highest noise levels. As part of this program, an initial engineering survey should be conducted of all residential structures that are located within the 60 Ldn contour of the 1998 "Without Mitigation" Noise Exposure Map. The purpose of this initial survey would be to determine the feasibility and costs of sound attenuation treatment to the residential structures. For those situations where it is not feasible to achieve the interior goal of 45 Ldn through sound attenuation treatment, options for partial treatment to the structure should be identified and evaluated. These findings and treatment recommendations should be communicated to the affected home owners to assist them in deciding on the available options of relocation or sound attenuation treatment. The State DOT should obtain a first-right-of-refusal to purchase all homes that cannot be practically treated to achieve a 45 Ldn interior noise level. In return for participating in the Part 150 sound attenuation program, residents should provide the State DOT with noise and avigation easements.

Offer to purchase private properties that are between the 60 and 75 Ldn contours whose owners do not wish to participate in the Sound Attenuation Program. The State DOT should offer to purchase privately owned lands and structures between the 60 and 75 Ldn contours of the "No Mitigation" Noise Exposure Map of Kahului Airport (see Figure 6-1) from owners who do not wish to participate in the sound attenuation program providing that the properties have existing noise-sensitive uses or are vacant but are zoned for noise-sensitive uses. The ultimate purpose of this program is two-fold. The first is to assist in relocation of those residents of Spreckelsville who are between the 60 and 75 Ldn contours and who prefer to relocate rather than to remain in Spreckelsville and participate in the sound attenuation program. The second is to afford owners of vacant properties that are zoned for noise-sensitive uses to sell the properties rather than develop compatible uses and/or structures.

Homes that are purchased should be sound-attenuated as necessary to provide interior noise levels of 45 Ldn or less and resold with a noise easement. Vacant properties that are purchased should be resold with a noise easement incorporated in the deed. The State should acquire noise and avigation easements or a first-right-of-refusal to purchase noise-sensitive properties whose owners chose not to participate in the Part 150 sound attenuation program.

Continue monitoring of development proposals in the Kahului Airport environs, disclosing airport noise exposure maps to the community. The State DOT should continue to monitor development proposals that may be impacted by airport noise and/or frequent fly-overs by aircraft operating at Kahului Airport. The Airports Division should review all applications for

land use changes (e.g., State Land Use District Boundary amendments, Community Plan changes, Rezoning, etc.) and provide written testimony for all applications identified through this process. In addition, the DOT should provide updated Noise Exposure Maps, as they are available, to the Maui County Planning Department, the Maui County Building Department, and the State Real Estate Commission. The maps provided to the State Real Estate Commission should be drawn on tax maps so that they can be readily used for airport noise map disclosures as required by §467-31, Hawaii Revised Statutes.

Design, install, and operate a noise monitoring system at Kahului Airport. The State DOT should initiate an engineering design effort to install a permanent Noise Monitoring System at Kahului Airport. The system should be designed to document aircraft noise levels and to help identify the aircraft causing single-event noise in noise-sensitive areas surrounding the Airport.

Annually monitor aircraft noise levels and operations at Kahului Airport, and conduct public informational meetings on the progress of the Part 150 Noise Compatibility Program. The State DOT should annually monitor aircraft noise levels and the level of activity at Kahului Airport to determine if significant and unexpected changes have occurred and if the Part 150 Program is being successful. These results should be provided at annual Public Informational Meetings to discuss the progress of the Part 150 Program and to educate and inform airport users and the affected communities. Discussions with military and civilian users regarding community complaints associated with training operations should be included in these annual reviews. Recommendations for updating the Noise Exposure Maps and Part 150 Program should also be provided if unexpected changes in airport operations occur before 1998 that significantly affect the land use compatibility situation at Kahului Airport and/or the noise abatement cost assumptions used in the development of the current plan. Annual monitoring of the noise levels at Kahului Airport (particularly the contributions from nighttime jet cargo and passenger flights) should be undertaken so that appropriate actions can be taken in a timely fashion to prevent future expansion of the airport noise contours in noise-sensitive areas.

8.3.2 Costs, Funding Sources, Implementation Responsibility, and Relative Effectiveness

8.3.2.1 Prepare Modified Runway Use Program

Program Costs: The estimated cost of engaging a consultant to draft an updated Runway Use Program for Kahului Airport is $10,000.00. The task could be completed for less if it is undertaken by qualified DOT staff.

Funding Source: Airports Division, State Department of Transportation.

Implementation Responsibility: The Airports Division of the State DOT would be responsible for drafting and circulating proposed revisions to the informal runway use program. The FAA has indicated that it will comment on this plan item as part of their formal review of this report. If the recommendation is accepted, the FAA must include the revised program in its next edition of the *Pacific Chart Supplement*.

Relative Effectiveness: This plan recommendation would have a minimal effect on the size of the noise contours around the airport, and it would do little to improve land use compatibility as indicated by the Ldn criteria. However, it would decrease noise complaints by minimizing overflights and single-event noise over the communities surrounding the airport.

8.3.2.2 Negotiate With Private Landowners in West Spreckelsville to Purchase the Private Properties Enclosed by the 75 Ldn Contour

Program Costs: This recommendation would affect 10 parcels containing 19 residences that are located within the 1998 "Without Mitigation" 75 Ldn contour shown on Figure 6-1. These properties have an estimated market value of over $13 million.[1] Many homeowners in the Spreckelsville area have informally expressed a preference to remain in the area despite relatively high noise levels. Consequently, it is to be expected that some may choose not to sell their homes, preferring instead to participate in the sound attenuation treatment program described in Section 8.3.2.3. Because sound attenuation of the structures would be much less costly than acquisition of the entire properties, Program costs will decrease if owners choose sound attenuation.

Funding Sources: The proposed property acquisition would be funded by the Airports Division of the State Department of Transportation and by the FAA under the Part 150 grant program.

Implementation Responsibility: The Airports Division of the State DOT would be responsible for implementing this measure.

Relative Effectiveness: This plan recommendation is intended to ultimately convert the existing residences in West Spreckelsville located within the 75 Ldn contour to more compatible airport or other public uses. These units represent approximately one-fifth of the total number of residential units which are located within the 60 Ldn contour of the "No Mitigation" Noise Exposure Map shown in Figure 6-1.

[1]The methodology used in this study to estimate property values is described elsewhere in this report. The properties are unique ones with little sales activity, which makes their exact value difficult to estimate. Properties have been offered for sale at prices substantially higher than those estimated here, and it is possible that property acquisition costs could be higher than estimated for these parcels.

8.3.2.3 Initiate a Sound Attenuation Program for Remaining Residences in West and East Spreckelsville

Program Costs: This recommendation would affect the 62 residences that are located between the 60 and 75 Ldn contours shown on Figure 6-1. These properties have an estimated market value of at least $45 million dollars. The estimated value of the land on which these homes are located represents over three-quarters of the total estimated value, while the structures represent one-quarter. The estimated cost to the State of providing sound attenuation treatment for all residences between the 60 Ldn and 75 Ldn noise contours shown on Figure 6-1 is approximately $1.8 million.[2] The cost would be as much as $4 million higher if all owners of homes within the 75 Ldn contour choose to participate in this program rather than to sell their property to the State (see discussion in Section 8.3.2.1) and if detailed design studies show that satisfactory attenuation could only be achieved if the homes are completely reconstructed. The costs to the State could be less to the extent that property owners elect to forego (wholly or partially) sound attenuation measures in order to preserve the open-air nature of their homes. Owners choosing the sound attenuation option will incur ongoing operating and maintenance costs for the air-conditioning units that will be needed to provide satisfactory interior temperatures with all openings closed. In any case, the goal would be to reduce interior noise levels within homes to less than 45 Ldn based on the noise contours shown in Figure 6-1 and to secure noise and avigation easements in favor of the State allowing the forecast level of aircraft noise.

In addition to the cost of the improvements themselves, the Airports Division would need additional staff and consultant services to oversee and/or implement the proposed program. Assuming implementation over a three-year period, at least one in-house staff position at $50,000 per year should be allocated for program administration and oversight.

Funding Sources: Funding would be provided by the Airports Division of the State DOT with possible assistance from FAA grants made under the Part 150 Noise Compatibility Program.

Implementation Responsibility: The Airports Division of the State DOT would be responsible for implementing the sound attenuation program.

Relative Effectiveness: Of all the measures included in the recommended program, this one has the greatest potential to reduce incompatible uses. Its actual effectiveness in providing land use compatibility will depend upon the extent to which owners choose to avail themselves of the sound attenuation measures. If all owners of property between the 60 and 75 Ldn contours participate, complete interior compatibility would be achieved. To the extent that some decide

[2]In order to be fair to property owners who do not wish to live in sound-attenuated homes or to continue to live with incompatible aircraft noise levels, the State should offer to relocate them. Since any properties acquired in this fashion would be sound attenuated and resold, homeowners' choice to relocate would not affect overall land use compatibility. However, to the extent that owners' choice of this option would subject the State to additional transaction costs (e.g., real estate sales commissions, moving costs, etc.), the cost to the Program could be somewhat higher than those shown.

not to participate or to participate to only a limited extent (e.g., sound attenuating their bedrooms but not their living rooms and other daytime activity areas), only partial compatibility would be provided. Whatever level of attenuation is chosen, allowing the affected property owners to decide the extent of their participation should increase their degree of satisfaction with the outcome.

8.3.2.4 Continue Monitoring of Development Proposals in the Kahului Airport Environs, Disclosing Airport Noise Exposure Maps to the Community

Program Costs: This measure can be carried out by existing Airports Division staff as part of their regular job responsibilities. No additional costs would be incurred.

Funding Sources: The costs for this program should be included into the annual DOT, Airports Division operating budget.

Implementation Responsibility: The Airports Division planning staff will be responsible for monitoring development proposals. It will also assist the State Real Estate Commission by providing it with copies of the 1998 "No Mitigation" noise exposure map for the airport (Figure 6-1) and tax maps showing parcels which are, or would be, exposed to incompatible levels of aircraft noise. These maps would be used for the purpose of implementing the airport noise disclosure provisions of §467-31, Hawaii Revised Statutes.

Relative Effectiveness: In and of itself, this recommendation will not affect existing land use incompatibility or prevent additional incompatible land uses from becoming established. However, by insuring that potential buyers of properties affected by noise from aircraft using Kahului Airport are aware of the noise before committing to the transaction, it will tend to discourage the development of additional incompatible uses. It will also discourage individuals who are particularly sensitive to noise from moving into the area. The important contribution of these preventive programs over the long term cannot be overemphasized.

8.3.2.5 Design, Install, and Operate a Noise Monitoring System at Kahului Airport

Program Costs: Approximately $50,000 should be budgeted for the engineering design of a noise monitoring system for the airport. The cost of purchasing and installing equipment will depend upon the details of the design. The most influential parameters include the number of monitoring stations and the extent to which the noise recording stations are linked to the radar system to improve the ability to identify aircraft which are the cause of noise complaints. Until additional detail is available, approximately $300,000 should be budgeted for this purpose.

Funding Sources: Airports Division, State Department of Transportation.

Implementation Responsibility: The Airports Division of the State DOT would be responsible for implementing this recommendation.

Relative Effectiveness: The establishment and operation of a noise monitoring system would not affect the size of the Ldn contours around the airport and would not affect land use compatibility as judged by the Ldn contour. However, data produced by the noise monitoring system would allow the State to better document the extent and causes of aircraft noise over the populated communities surrounding Kahului Airport. This information is important when updating the program and responding to individual noise complaints. The noise monitoring system would also provide information useful for the recommended public information program at Kahului Airport.

8.3.2.6 Annually Monitor Aircraft Noise Levels and Operations at Kahului Airport, and Conduct Public Informational Meetings on the Progress of the Part 150 Program

Program Costs: Consultant costs of $10,000 per year are estimated for this effort. Airports Division staff would also need to be assigned responsibility for coordinating the contracting and for reviewing and archiving the monitoring data.

Funding Sources: Airports Division, State Department of Transportation.

Implementation Responsibility: The Airports Division, through a contractor, would be responsible for collecting, analyzing, and archiving the noise data generated by the noise monitoring system. It would also be responsible for carrying out the annual information exchange and Part 150 Noise Compatibility Program review.

Relative Effectiveness: The public information program is intended to increase airport user and community awareness of the progress. The feedback it would provide will help the Airports Division adjust the program in response to the lessons that are learned.

8.4 PROGRAMS WITHIN OTHER STATE AGENCIES' AUTHORITY

8.4.1 Essential Governmental Actions

In order to achieve land use compatibility, sound attenuation will be needed in the two public use structures located within the 60 Ldn contour shown on Figure 6-1 (the Kaunoa Senior Citizens Center in East Spreckelsville, and the adult day care facility and Civil Air Patrol meeting room located in Pu'u-nēnē). A final determination of the desirability of the work in the Pu'u-nēnē facilities should be made only after further discussions with their operators to determine the magnitude of the benefit that would actually be provided.

8.4.2 Costs, Funding Sources, Implementation Responsibility, and Effectiveness

Program Costs: Estimated total cost of providing sound attenuation treatment to the public use facilities is approximately $150,000.

Funding Sources: Airports Division, State Department of Transportation, with possible FAA assistance through grants made under the FAR Part 150 Noise Compatibility Program.

Implementation Responsibility: The Airports Division of the State DOT would be responsible for implementing this recommendation. The State DOT should offer to provide full funding assistance for the sound attenuation treatment of the Kaunoa Senior Citizens Center. It should offer to assist the operators with improvements to the old structures that are located in Pu'u-nēnē.

Relative Effectiveness: Implementation of this recommendation will eliminate incompatibilities associated with public facilities in the Kahului Airport environs.

8.5 PROGRAMS WITHIN FEDERAL AGENCIES' AUTHORITY

Modification of the informal runway use program is the only recommended measure in this category recommended for immediate implementation. However, the early power cutback on departure option (T7) discussed in Section 7.2.2 should be investigated further after Runway 2-20 is extended.

Program Costs: This program can be implemented within the normal operating budget of the local FAA field office. There will be no additional costs to Federal agencies.

Implementation Responsibility: The FAA has indicated that it will assist the State DOT in reviewing the informal runway use program at Kahului Airport. If determined to be acceptable, the FAA has agreed to publish the updated informal runway use program in its Pacific Area Notices regarding Kahului Airport.

Relative Effectiveness: This plan recommendation will not significantly affect land use compatibility in the vicinity of the airport. However, it will tend to reduce complaints resulting from light aircraft overflying homes in East and West Spreckelsville.

8.6 RELATIONSHIP TO OTHER PROGRAMS AND PLANS

8.6.1 Airport Master Plan

The recommended Noise Compatibility Program is consistent with the current Kahului Airport Master Plan. Acquisition of the property enclosed within the 75 Ldn contour was not included in the Airport Master Plan recommendations for two reasons. First, it was not essential for airport operational purposes. Second, it was thought better to await the results of the analysis that was conducted as part of this study. Depending upon the outcome of future discussion between the Airports Division of the State DOT and owners of West Spreckelsville homes, future updates of the Airport Master Plan may, or may not, include acquisition of properties within the 75 Ldn.

8.6.2 Airport Layout Plan

The Noise Compatibility Program recommendations will not require any major changes to the existing Airport Layout Plan. The locations of the airport property boundaries will require updating if land in West Spreckelsville within the 75 Ldn contour is purchased.

8.6.3 Informal Preferential Runway Use Program

The recommended nighttime curfew on Runway 23 will change the existing informal Runway Use Program at Kahului Airport with respect to the current unrestricted use of the runway. However, the nighttime curfew should not affect other components of the existing informal Runway Use Program at the Airport.

8.7 IMPLEMENTATION AND REVIEW SCHEDULE

8.7.1 Implementation Schedule

The following implementation schedule is recommended for the various components of the noise compatibility program:

- **Modify Current Informal Preferential Runway Use Program.** Following final approval of the Part 150 Program by the FAA, the State DOT should draft the proposed changes to the informal Runway Use Program at Kahului Airport, and send them to the FAA for its approval. It is anticipated that the plan will be approved in 1996.

- **Negotiate With Private Landowners in West Spreckelsville to Purchase the Properties Enclosed by the 75 Ldn Contour.** Over the year following FAA approval of the Noise Compatibility Program, the State should meet individually with owners of homes within the 75 Ldn contour shown on Figure 6-1 to discuss their interest in selling the fee interest in their properties to the State. For owners who do not wish to sell, the discussions should be extended to the sale of a noise and avigation easement in favor of the State. Acquisition of fee title or the noise easement should be scheduled for completion by the end of 1998.

- **Initiate a Sound Attenuation Program for Remaining Residences in West and East Spreckelsville.** The Airports Division should meet individually with homeowners during the year following FAA approval of the Program to determine the extent to which they are receptive to noise mitigation measures which will require "closure" of their homes. Meetings should begin with individuals whose homes are between the 70 to 75 Ldn contours shown on Figure 6-1. Specific noise mitigation plans should be developed during the following year for each home whose owner expresses an interest in the sound attenuation program. The construction work needed to bring about noise compatibility should be carried out during the following two years, with a goal of completing the work no later than the end of 1999.

- **Continue Monitoring Development Proposals in the Kahului Airport Environs, Disclosing Airport Noise Exposure Maps to the Community.** This is an ongoing program that should be continued. The disclosure of the Kahului Airport noise contours via Tax Maps has also been initiated by the State DOT.

- **Design, Install, and Operate a Noise Monitoring System at Kahului Airport.** The State DOT should complete its design for the Noise Monitoring System by the end of 1996, with system installation scheduled for completion by the end of 1998.

- **Annually Monitor Aircraft Noise Levels and Operations at Kahului Airport, and Conduct Public Informational Meetings on the Progress of the Part 150 Program.** The State DOT should initiate this program in 1996 following FAA approval of the Part 150 Program to provide continuity between the Part 150 Program updates.

8.7.2 Periodic Program Review

In accordance with FAA requirements, the Airports Division should review and revise the FAR Part 150 Noise Compatibility Program for Kahului Airport at least every five years. This should include an updating of the noise exposure maps based on the latest available data and the then-current five-year aircraft activity and land use forecasts. It is anticipated that use patterns for the extended runway will be well established by the time the update is undertaken.

The periodic revision should be conducted in accordance with FAA regulations and should include, as a minimum, the following:

- A comparison of the current compatibility of the airport and its environs to that outlined in the program's goals and objectives.
- A re-appraisal of the rate of growth of both the community and airport to determine the current and future adequacy of the compatibility plan.
- A review of the airport noise exposure map in light of both current and forecast operations and the noise performance levels of the aircraft then in, or expected to be in, service.
- A review of the adequacy of current operational controls in maintaining aircraft noise within the designated noise impact areas.
- A review of the adequacy of the adopted development controls in protecting the designated noise impact areas from encroachment by noise sensitive uses.
- A review of the effectiveness of the corrective actions employed in resolving existing unprotected noise sensitive uses within the noise impact areas.

CHAPTER 9
REFERENCES

CHAPTER 9
REFERENCES

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APPENDICES

Appendix A

Letter of July 31, 1991 from the Federal Aviation Administration
Accepting the Noise Exposure Maps

US Department of Transportation
Federal Aviation Administration

Western Pacific Region

PO Box 92007
Worldway Postal Center
Los Angeles CA 90009

JUL 31 1991

Mr. Edward Y. Hirata
Director of Transportation
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Kahului Airport, Kahului, Hawaii
Acceptance of Noise Exposure Maps

Dear Mr. Hirata:

This is to notify you that the Federal Aviation Administration (FAA) has evaluated the Noise Exposure Maps and supporting documentation for the Kahului Airport, Kahului, Maui, Hawaii, transmitted by your letters of December 28, 1989. In accordance with Section 103(a)(1) of the Aviation Safety and Noise Abatement Act of 1979 (the Act). The FAA has determined that they are in compliance with applicable requirements of 14 Code of Federal Regulations (CFR) Part 150. Further, we have determined that:

a. The 1987 Ldn contours and the supporting documentation meet the requirements for the current Noise Exposure Map as of the date of submission as set forth in 14 CFR Part 150, Airport Noise Compatibility Planning, Section 150.21(a), and are accordingly found in compliance under this part. This determination is based on the certification by the State of Hawaii accepting the current and five year forecast Noise Exposure Maps by letter dated December 28, 1989.

b. The projected 1992 aircraft operations, the 1992 (Future) Ldn contours and the supporting documentation are accepted as the description of the future conditions as set forth in Part 150 and are accordingly found in compliance under this part.

FAA's determination that your Noise Exposure Maps are in compliance is limited to a finding that the maps were developed in accordance with the procedures contained in Appendix A of Part 150. Such determination does not constitute approval of your data, information or plans. The FAA will publish notice in the Federal Register announcing the compliance finding of the Noise Exposure Maps for Kahului Airport.

The FAA's determination in no way approves or endorses a noise compatibility program, potential related Federal funding of projects identified in such a program, or any related operation restrictions at Kahului Airport.

Should questions arise concerning the precise relationship of specific properties to noise exposure contours depicted on you noise Exposure Maps, you should note that the FAA will not be involved in any way in determining the contours, or interpreting the maps to resolve questions concerning, for example, which properties should be covered by the provisions of Section 107 of the Act. These functions are inseparable from the ultimate land use control and planning responsibilities of local government. These local responsibilities are not changed in any way under Part 150 or through FAA's determination relative to your Noise Exposure Maps. Therefore, the responsibility for the detailed overlaying of noise exposure contours onto the maps depicting properties on the surface rests exclusively with you, the airport operator, or with these public agencies and planning agencies with which consultation is required under Section 150.21 of Part 150, that the statutorily required consultation has been accomplished.

Your notice of this determination and the availability of the Noise Exposure Maps, when published at least three times in a newspaper of general circulation in the county where affected properties are located, will satisfy the requirements of Section 107 of the ASNA Act.

Your attention is called to the requirements of Section 150.21(d) of Part 150, involving the prompt preparation and submission of revisions to these maps if any actual or proposed change in the operation of Kahului Airport might create substantial, new non-compatible use in any area depicted on the maps.

Thank you for your continued support for land use compatibility planning around Kahului Airport.

Sincerely,

ORIGINAL SIGNED BY
HERMAN C. BLISS
Herman C. Bliss
Manager, Airports Division

Appendix B

Membership List of the Technical Advisory Committee

APPENDIX B

TECHNICAL ADVISORY COMMITTEE
FAA PART 150 NOISE COMPATIBILITY STUDY
KAHULUI AIRPORT

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Appendix C

Technical Advisory Committee and Public Informational Meetings—Handouts, Signup Sheets, and Agenda

May 31, 1995 Public Hearing

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KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
SAM CALLEJO
GLENN M. OKIMOTO

IN REPLY REFER TO
AIR-EP
95.107

April 28, 1995

TO: Technical Advisory Committee Members

FROM: Owen Miyamoto, Administrator
Airports Division

SUBJECT: KAHULUI AIRPORT NOISE COMPATIBILITY PROGRAM
STATE PROJECT NO. AH1011-05

Enclosed is a copy of the "Draft Kahului Airport Noise Compatibility Program" (April, 1995) for your review. A public hearing on the Noise Compatibility Program has been scheduled as follows:

DATE: Wednesday, May 31, 1995

TIME: 6:30 p.m.

LOCATION: Gates 34-39, Kahului Airport

Those persons desiring to testify on the FAR Part 150 Noise Compatibility Program may register prior to the public hearing at the 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 by June 15, 1995 will be included in the evaluation of the proposed action.

Should you have any questions, please contact Mr. Stephen Takashima of my Planning Section at 838-8810 in Honolulu at least two weeks prior to the public hearing.

Enclosure: Draft Kahului Airport Noise Compatibility Program

c: BCH - P. White
FAA-ADO - D. Welhouse
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MEETING AGENDA

Kahului Airport
FAR Part 150 Noise Compatibility Program

- Introduction
- 1993 Base Year and 1998 "No Mitigation" Noise Exposure Maps
- Alternative Means of Increasing Land Use Compatibility
- Recommended Noise Compatibility Program
- Public Testimony

Table 5-3. SUMMARY OF AREA EXPOSED TO NOISE LEVELS ABOVE 55 Ldn: 1993 BASE YEAR

Noise Level Band	Area Between Contours		Cumulative Area Enclosed (sq.mi.)
	Square Miles	Approx. % Over-water	
>75 Ldn	1.24	25.4%	1.24
70 to 75 Ldn	1.29	24.7%	2.53
65 to 70 Ldn	2.88	29.7%	5.41
60 to 65 Ldn	6.93	34.6%	12.34
55 to 60 Ldn	15.97	37.7%	28.31

Base Year (1993) Noise Exposure & Land Use Compatibility

- Average Day-Night noise (Ldn) contours were developed using operational data collected from a variety of sources and INM Version 4.11 (Figure 5-1 - Draft Noise Compatibility Report).
- As shown in Table 5-3 and 5-4 and the figure:
- the actual 1993 noise contours are generally smaller than those that were forecast for 1992 in the accepted *Noise Exposure Map* report.
- most of the higher noise areas are over agricultural land and the ocean.
- Table 5-6 tabulates incompatible land uses in the vicinity of the airport; these are associated principally with the residential uses in East and West Spreckelsville north of the airport.

Table 5-4. COMPARISON OF FORECAST 1992 "NO MITIGATION" NOISE LEVELS FROM ACCEPTED NOISE EXPOSURE MAP REPORT WITH ACTUAL 1993 NOISE LEVELS.

Noise Level Band	[illegible]		Actual Minus Forecast	
	Forecast 1992	1993 Actual	Actual Greater	Forecast Greater
>75 Ldn	1.10	1.24	0.14	
70 to 75 Ldn	1.83	1.29		-1.29
65 to 70 Ldn	4.16	2.88		-1.28
60 to 65 Ldn	8.22	6.93		-1.29
55 to 60 Ldn	18.36	15.97		-2.39
TOTAL (> 55 Ldn)	33.87	28.31	0.14	-5.50

Table 5-6. BASE YEAR (1993) INCOMPATIBLE LAND USES DETERMINED USING RECOMMENDED STATE GUIDELINES

LAND USE	No. of Incompatible Units by Ldn Band				
	60-65	65-70	70-75	>75	Total
Single-Family Residential	36	11	5	19	71
Multi-Family Residential	18	0	0	0	18
TOTAL	54	11	5	19	89

1998 "No Mitigation" Noise & Land Use Compatibility

- Ldn contours were developed for 1998 assuming the planned runway extension is in service and no special noise abatement or mitigation measures are implemented (Figure 6-1 - Draft Noise Compatibility Report).
- Table 6-4 compares the actual 1993 noise contours with the forecast 1998 "No Mitigation" noise contours, with little change evident between the two years. In the critical Spreckelsville area, the number of homes in the incompatible area will actually decrease by 4, from 85 to 81.
- The greatest reduction in Ldn levels between the two years is within the Airport boundaries near the ground transportation area west of the airport access road.
- The greatest increase in aircraft noise levels would occur south of the airport, principally as a result of the change in start-to roll point associated with the proposed runway extension.

Table 6-4. CHANGES IN AREAS WITHIN EACH Ldn BAND BETWEEN 1993 BASE YEAR AND "1998 NO MITIGATION SCENARIO"

Noise Level Bands	Area Between Contours (square miles)			Cumulative Area Enclosed (square miles)		
	1993	1998 No Mitig.	Change	1993	1998 No Mitig.	Change
>75 Ldn	1.24	1.37	0.13	1.24	1.37	0.13
70 to 75 Ldn	1.29	1.21	-0.08	2.53	2.58	0.05
65 to 70 Ldn	2.88	2.81	-0.07	5.41	5.39	-0.02
60 to 65 Ldn	6.93	7.36	0.43	12.34	12.75	0.41
55 to 60 Ldn	15.97	16.59	0.62	28.31	29.34	1.03

1998 "No Mitigation" Noise & Land Use Compatibility - Cont'd.

- As shown in Table 6-7, there would be little change in the land use compatibility situation over the five-year period. Residences in East and West Spreckelsville, however, would continue to be exposed to incompatible aircraft noise levels.
- The greatest incompatibility would be in West Spreckelsville, where noise levels at some homes will continue to exceed 75 Ldn, the level that a primary FAR Part 150 Program goal seeks to contain within the airport boundaries.
- Note that the 55 Ldn contour will expand slightly to include some residences in the northeastern corner of Kahului. While the homes will remain compatible uses, owners will be required to disclose this when they sell their homes.

Table 7-1. ALTERNATIVE MEASURES CONSIDERED DURING SCREENING

Alternative Methods of Achieving Land Use Compatibility²	Extent to Which Measure Might Increase Land Use Compatibility at Kahului³
Fan Out Departure Tracks	Low
Change Aircraft Flap Management	Low
Limit Use of Reverse Thrust	Low
Restrict Ground Equipment Use	Low
Restrict Run-up Areas or Times	Low
Limit Ground Movement of Aircraft	Low
Change Takeoff/Landing Procedures	Low¹
Prescribed Flight Tracks	Low¹
Restrict Training Flights	Low
Reschedule Flights	Moderate
Noise-Related Landing Fees	Moderate
Preferential Runway Use	Low
Limit Aircraft Operations	Moderate
Limit Aircraft Types	Moderate
Impose Curfew Operations	Moderate
Construct New Runway(s)	Low
Extend Existing Runway(s)	Low
Displace Runway Threshold	Low
Build High-Speed Exit Taxiway(s)	Low
Relocate Aircraft Parking/Terminal	Low
Construct Noise Barriers	Low
Construct New Engine Run-up Areas	Low
Relocate Airport	High
Acquire Land or Easement	High
Retrofit Sound Insulation	High
Compatible Use Zoning	High

¹ Already in effect through informal Preferential Runway Use Program
² See text for discussion of effectiveness of these measures
³ "Low" = < 3 Ldn Reduction, "Moderate" = 3 to 5 Ldn Reduction and/or reduces overflights, "High" = < 5 Ldn Reduction or eliminates land use incompatibility

Table 8-1 FORECAST 1990 CONTOUR SIZE WITH PROGRAM

NOISE LEVEL BANDS	AREA BETWEEN CONTOURS: SQUARE MILES	AREA BETWEEN CONTOURS: ACRES	% OVER LAND (APPROX. % OVER OCEAN)	CUMULATIVE AREA ENCLOSED: SQUARE MILES	CUMULATIVE AREA ENCLOSED: ACRES
>75 Ldn	1.30	832	10.9	1.30	832
70 to 75 Ldn	1.15	736	17.4	2.45	1,568
65 to 70 Ldn	2.64	1,640	27.4	5.09	3,258
60 to 65 Ldn	6.89	4,410	35.4	11.98	7,667
55 to 60 Ldn	15.52	9,933	37.4	27.50	17,600

Table 8-2 FIVE-YEAR WITH PROGRAM INCOMPATIBLE LAND USES DETERMINED USING RECOMMENDED STATE STANDARDS

LAND USE	DWELLING UNITS AND RESIDENTS IN INCOMPATIBLE AREAS: NO. OF INCOMPATIBLE DWELLING UNITS BY Ldn BAND				
	60-65	65-70	70-75	>75	TOTAL
Single-Family Residential	24	11	8	16	59
Multi-Family Residential	18	0	0	0	18
TOTAL	42	11	8	16	77

Table 6-7. 1998 "NO MITIGATION" INCOMPATIBLE LAND USES DETERMINED USING RECOMMENDED STATE STANDARDS

LAND USE	DWELLING UNITS IN INCOMPATIBLE AREAS: No. of Incompatible Dwelling Units by Ldn Band				
	60-65	65-70	70-75	>75	Total
Single-Family Residential	28	11	5	19	63
Multi-Family Residential	18	0	0	0	18
TOTAL	46	11	5	19	81

Recommended Noise Abatement Measures - (Changes in Aircraft Operations)

- We looked at a wide range of possible noise abatement and noise mitigation measures as shown in Table 7-1. Those which looked most promising were evaluated in detail.
- Continue to evaluate an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport.
- Evaluate the amendment in conjunction with a review of the implications that such a mandate would have statewide.
- Encourage the FAA to clarify and formalize the existing informal runway use program by drafting proposed language and transmitting this to the FAA for consideration and implementation.
- Publish the final runway use program in the *Airport Directory and Flying Safety Manual*, and request inclusion in the *Area Notices of the Pacific Chart Supplement*.

Recommended Noise Mitigation Measures

- Negotiate for the purchase of the 19 residences in West Spreckelsville that are enclosed by the 75 Ldn contour ($13 million). Allow owners who prefer to retain their properties to participate in the sound attenuation program instead, obtaining noise and avigation easements in exchange for the sound attenuation improvements.
- Where appropriate, obtain the first right of refusal to purchase or lease all lots within the 75 Ldn contour in order to obtain future control over those affected properties.
- Initiate a Sound Attenuation Program for the 62 remaining residences in West and East Spreckelsville designed to reduce interior noise levels within homes to less than 45 Ldn ($1.8 million). Give priority to homes which experience the highest noise levels.
- Perform an initial engineering survey of all residential structures within the 60 Ldn contour; determine the feasibility and costs of sound attenuation treatment, and communicate these findings and treatment recommendations to the affected home owners.

Recommended Noise Mitigation Measures - Cont'd.

- Obtain noise and avigation easements in return for sound proofing structures between the 60 and 75 Ldn contours.
- Offer to purchase homes within the 60 Ldn contour whose owners do not wish to participate in the Sound Attenuation Program. Sound-attenuate the structures as needed to achieve interior noise levels of 45-Ldn and re-sell them with noise and avigation easements.
- Sound-attenuate portions of the Kaunoa Senior Citizens Center and public use structures in Puunene that are located within the 60 Ldn contour if more detailed analysis confirms its desirability.
- Continue monitoring development proposals in the Kahului Airport environs, disclosing airport noise exposure maps to the community, and opposing new development of incompatible uses.

Recommended Noise Mitigation Measures - Cont'd.

- Provide updated Noise Exposure Maps, as they are available, to the Maui County Planning Department, the Maui County Building Department, and the State Real Estate Commission.
- Design, install, and operate a noise monitoring system at Kahului Airport.
- Annually monitor aircraft noise levels and operations at Kahului Airport, and conduct public informational meetings on the progress of the Part 150 Noise Compatibility Program.

August 29, 1994 Public Meetings

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION

AIR-EP
94.215

August 17, 1994

Dear Technical Advisory Committee Member:

The Airports Division is re-initiating work on a Noise Compatibility Program for Kahului Airport. The Program, which is being prepared in accordance with Part 150 of the Federal Aviation Regulations (FAR Part 150), is designed to reduce or eliminate incompatibilities between aircraft operations and land uses surrounding the airport.

We are anxious to insure that the knowledge, viewpoints, and concerns of both airport users and the surrounding community are carefully considered in developing the Noise Compatibility Program. Towards this end, we would like to reactivate the Technical Advisory Committee that was consulted during preparation of the base year noise exposure maps. We would appreciate it if you would serve on the Committee.

Because many of the issues had already been identified previously, we anticipate that two to three meetings of the Technical Advisory Committee will be required. The first meeting is scheduled for August 29, 1994. It will take place at 2:00 p.m. at the Sandlewood Country Clubhouse, 2500 Honoapi'ilani Highway, in Waikapu. Additional meetings are planned for October and December. Our goal is to submit a proposed Noise Compatibility Program to the FAA by the first week of February, 1995. A tentative meeting agenda and a list of organizations and individuals who are being invited are attached for your reference.

To insure that the broader community also has an opportunity to make its opinions known, a public informational meeting is scheduled for the same evening at 7:00 p.m. at the Sandlewood Country Clubhouse.

This meeting, like the Technical Advisory Committee Meeting, will provide an opportunity to discuss the kinds of measures that are under consideration and the advantages and disadvantages of each.

Very truly yours,

Owen Miyamoto
Airports Administrator

Enclosures: Agenda
TAC list

c: AIR-ED - Mr. Shuzo Kimura
AIR-M
BCA - Mr. Perry White
EKNA - Mr. Brian Ishii
FAA-ADO - Mr. Dave Welhouse

The Honorable Joseph Souki
Representative
SEVENTEENTH STATE LEGISLATURE
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5 South Beretania Street
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Mr. George N. Kaya
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Department of Public Works
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Wailuku, Hawaii 96793

Mr. Norman Nontes
Station Manager
UNITED AIRLINES
K lui Airport
Ka..lui, Hawaii 96732

The Honorable Paul T. Oshiro
Representative
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41st District
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Mr. Yukio Kitagawa
Chairperson
STATE DEPARTMENT
OF AGRICULTURE
P.O. Box 22159
Honolulu, Hawaii 96822

The Honorable Linda
Crockett Lingle, Mayor
COUNTY OF MAUI
200 South High Street
Wailuku, Hawaii 96793

The Honorable Paula Ishii-
Morikami
SEVENTEENTH STATE LEGISLATURE
District 12
235 South Beretania Street
Room 903
Honolulu, Hawaii 96813

Ms. Bobbi Peters
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Kahului Airport
Kahului, Hawaii 96732

Mr. Harold S. Masumoto
Director
STATE OF HAWAII
Office of State Planning
P.O. Box 3540
Honolulu, Hawaii 96811-3540

LTCOL Jerry Matsuda
STATE OF HAWAII
Department of Defense
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Mr. Stephen J. Pitt
President
MAUI AIR TRAFFIC ASSOCIATION
P.O. Box 330533
Kahului, Hawaii 96732

Maj Gen Edward V. Richardson
Adj Gen & Dir of Civil Defense
STATE DEPARTMENT OF DEFENSE
3949 Diamond Head Road
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The Honorable Michael White
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The Honorable Rick Reed
Senator
235 South Beretania Street
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The Honorable Rosalyn Baker
Senator
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Mr. Owen Miyamoto
Airports Administrator
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TRANSPORTATION
Airports Division
Honolul nternational Airport
400 Rodgers Boulevard
S te 700
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Ms. Lulu Miyasato
President
CENTURY AVIATION, INC.
Maui Flight Center
201 Merchant Street
Suite 2400
Honolulu, Hawaii 96813

Mr. Jon A. Sakamoto
Maui District Manager
STATE DEPARTMENT
OF TRANSPORTATION
Airports Division
Kahului Airport
erminal Building
ahului, Hawaii 96732

Ms. Jeanne Schultz
Interim Director
STATE DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT & TOURISM
P.O. Box 2359
Honolulu, Hawaii 96804

ATTENDANCE SHEET

(Please Print)

Page 3 of 3

Subject: Kahului Airport Noise Compatibility Program Technical Advisory Committee
Place: Sandalwood Country Clubhouse, Waikapu, Maui
Date: August 23, 1998 Time: 2:00 p.m. a.m./p.m.

No.	Name	Organization	Address	Phone No.
	[illegible]	Kahului Airport		872-3[illegible]
	Don Schneider	Running Door	High Street [illegible]	243-773[illegible]
	DAVID CHEVALIER	HAWAII HELICOPTER OPERATOR ASSOCIATION	c/o Blue Hawaiian Helicopters Kahului Heliport #108	871-8844

ATTENDANCE SHEET

(Please Print)

Page 1 of 2

Subject: Kahului Airport Noise Compatibility Program Public Informational Meeting
Place: Sandalwood Country Clubhouse, Waikapu, Maui
Date: August 29, 1998 Time: 7:00 p.m. a.m./p.m.

No.	Name	Organization	Address	Phone No.
1	Perry White	Belt Collins	680 Ala Moana Blvd., #200 Honolulu HI 96813	521-5361
2	STEPHEN TAKASHIMA	DOT	400 [illegible] Blvd, Suite 200	835-5[illegible]
	Lynette Kawaoka	DOT-Airports	"	[illegible]
	Flora Leigh	D.O.H.	54 Old State Rd	871-5580
	Gene D[illegible]	Planning Svcs	12[illegible] [illegible] St #200	943-[illegible]
	Jim Dittmar	[illegible]	[illegible]	54[illegible]
	David Welhouse	FAA HNL-ADO	300 Ala Moana Blvd, #[illegible] Honolulu HI 96813	541-1243
	[illegible]	[illegible]	[illegible]	[illegible]
	Tom [illegible]	[illegible]	P.O. Box [illegible]	
	Charles Kokes	self	PO Box 1413, Paia HI 96779	579-9119

ATTENDANCE SHEET

(Please Print)

Page 2 of 2

Subject: Kahului Airport Noise Compatibility Program Public Informational Meeting
Place: Sandalwood Country Clubhouse, Waikapu, Maui
Date: August 29, 1998 Time: 7:00 p.m. a.m./p.m.

No.	Name	Organization	Address	Phone No.
	Brian Isa	[illegible]	[illegible]	571-5513
	Esme Corbell-Suzuki	BCH	680 Ala Moana Blvd	521-5361
	Maria Suarez	"	"	"
	Lori Bullone	Coffman, Ruppel & Allen	3011 [illegible] Way, Ste 200 [illegible] CA 9[illegible]	(51)431-9561
	PAUL [illegible]	CRI	[illegible] St, #[illegible] [illegible], HI 96[illegible]	[illegible]
	Susan Bendon		451 [illegible] Place Paia	871-6181
	Ed Tanji	[illegible]	[illegible]	[illegible]

PUBLIC

TESTIMONY SIGN IN
(Please Print)

Page 1 of 1

Public Hearing for Kahului Airport
Subject: Noise Compatibility Program
Place: Kahului Airport - Gates 34-35
Date: 05-31-95 Time: 6:30 a.m./(p.m.)

NO.	Name	Organization	Address	Phone #
	Jack Thompson	Spreckelsville Comm. Assoc.	204 Kaiholo Pl. Paia 96779	8775749
	Isaac Hall	MATA	2087 [illegible]	244-5017
	Kenneth Ohama	Maui Farm Bureau	P.O. Box 152	87?-2917
	Terryl Vencl	Maui Hotel Assoc.	1325 S. Kihei [illegible]	244-8625
	Marsha Wienert	Maui Visitors Bureau	1727 Wili Pa Loop Wailuku, HI	244.3530
	Lynn Woods	Maui Chamber of Commerce	26 N. Puunene	871-7711

AGENDA

KAHULUI AIRPORT NOISE COMPATIBILITY PROGRAM TECHNICAL ADVISORY COMMITTEE

(1) BACKGROUND OF THE PROGRAM
- Goals of the Noise Compatibility Program
- Previous Work
- Reasons for Suspending Program Development
- Subsequent Developments

(2) PURPOSE OF THE TECHNICAL ADVISORY COMMITTEE

(3) EXISTING NOISE EXPOSURE AND LAND USE COMPATIBILITY

(4) PRELIMINARY LIST OF MEASURES BEING CONSIDERED

(5) DISCUSSION

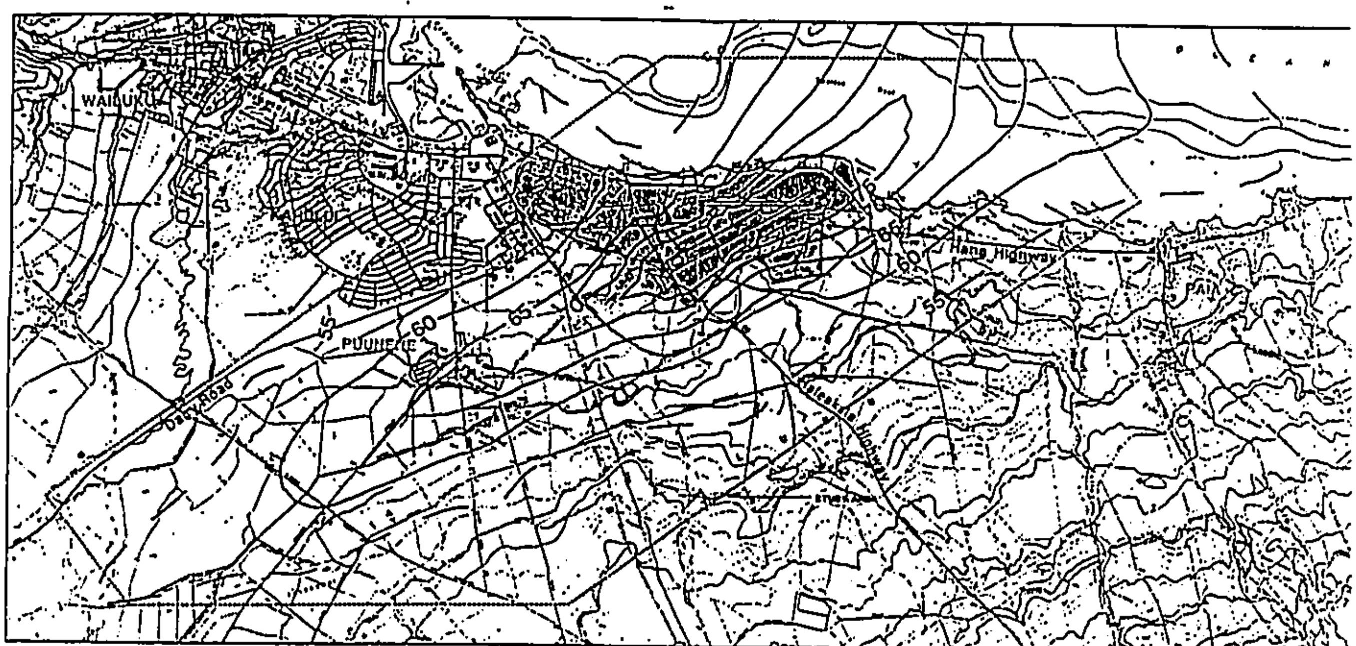
(6) PROCEDURES FOR PROVIDING COMMENTS/FUTURE MEETINGS

KAHULUI AIRPORT

I. GOALS OF PART 150 NOISE COMPATIBILITY PROGRAM
- Confine 75 Ldn contour within airport boundaries.
- Establish and maintain compatible land uses within areas significantly affected by airport noise.

II. FAA CONSTRAINTS ON AIRPORTS IN ACHIEVING GOALS
- Cannot impose undue burden on interstate or foreign commerce.
- Cannot unjustly discriminate.
- Cannot adversely affect safe and efficient use of airspace.
- Cannot exceed powers and duties of the FAA.

III. METHODS OF IMPLEMENTING NOISE COMPATIBILITY PROGRAM
- Modify airport operations.
- Make physical improvements to airport property.
- Make physical changes or improvements to off-airport property.
- Implement land use controls or covenants.



KAHULUI AIRPORT
FAR Part 150 Airport Noise Compatibility Study
FOR: AIRPORTS DIVISION, DEPARTMENT OF TRANSPORTATION, STATE OF HAWAII
BY: BELT COLLINS & ASSOCIATES, Y. EBISU & ASSOCIATES, KPMG PEAT MARWICK

INCOMPATIBLE LAND USES
RESIDENTIAL
PUBLIC USE
STUDY AREA BOUNDARY
NOTE: AUTHORITY TO CONTROL LAND USE RESTS WITH THE COUNTY OF MAUI AND THE STATE OF HAWAII.

FIGURE 6-1
FIVE YEAR (1992
NOISE
EXPOSURE MAF
NO MITIGATION

December 4, 1994 Public Meetings

ATTENDANCE SHEET

(Please Print)

Page 1 of 1

Subject: Kahului Airport Noise Compatibility Program Public Informational Meeting

Place: Highways Baseyard Conference Room

Date: 12/14/94 Time: 7:00 a.m./p.m.

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NO.	Name	Organization	Address	Ph
1	Yoichi Ebisu	Y. Ebisu & Assoc.	1126 12th Ave. #305 96816	735-
2	Vince Mestre	Mestre Greve	280 Newport Center ... Newport Beach CA	714
3	Sherry Dittman		485 Cailukao Pl	39
4	Perry White	Belt Collins Hawaii	680 Ala Moana Blvd., #200 Honolulu, HI 96813	521-5
5	David Welhouse	FAA HNL-ADO	P.O. Box 50244 Hnl, HI. 96850	5
6	Owen Miyamoto	DOT-A	400 Rodgers Blvd	8
7	John Finnegan	Paia Haakana Banyans	190 Hauoli St Wailuku	24
8	Regina Finnegan	Maida Banyan Anti Noise Gr	190 Hauoli St Wailuku	
9	Lori Ballance	Gatzke, Mispagel & Dillon	P.O. Box 1636 Carlsbad, CA	619-
10	Brian Perry	The Maui News	100 Mahalani St.	24
11	Stephen [illegible]	Maui Aeronautic Ass'n	[illegible]	
12	[illegible]	A&B Properties	33 Lono Ave [illegible]	87
13	Edwin Tanji	Honolulu Advertiser	PO Box 1? Wailuku	2
14	Charles Kekes	self	PO Box 1413 Paia HI 96779	579-
15	Steve Takashima	DOT-A	400 Rodgers Blvd Suite 700	83
16	Ben Schlapak	HDOT-AIR-EP	400 Rodgers Blvd. #700, Honolulu 96819	83

ATTENDANCE SHEET

(Please Print)

Page 1 of 1

Subject: Kahului Airport Noise Compatibility Program TAC Meeting

Place: Highways Baseyard Conference Room

Date: 12/14/94 Time: 2:00 a.m./p.m.

Print Legibly

NO.	Name	Organization	Address	Phone
1	Jack Thompson	Spreckels Commun. Assoc	204 Kealakai Pl Paia 96779	877-
2	Lori Ballance	Gatzke, Mispagel & Dillon	P.O. Box 1636 Carlsbad, CA	619-431-9
3	Vince Mestre	Mestre Greve Assoc	280 Newport Center Dr Newport Beach CA	714 760-
4	David Welhouse	FAA HNL-ADO	P.O. Box 50244 Hnl, HI. 96850	541-
5	Jim Dittman	Edward K. Noda & Assoc.	615 Piikoi St #1000 Hono HI 96814	591-855
6	Terryl Vencl	Maui Hotel Assoc	1325 Lower Main #103 Wailuku	244-8
7	Judi Walsh	FAA Maui Tower	Kahului Airport 96732	877-0
8	Rep. Billy Swain	State House of Represent. Dist. 12	~~Kahului~~ State Office Tow	486-857
9	Sarajean Tokunaga	Gov.	54 High St. #215, Wku	243-5
10	[illegible]	AIR-M		
11	Lloyd Lee	C.C.M. DPW-ENGRN.	200 S. HIGH ST. WAILUKU	243-7
12	Lynn Becones	D.O.T. - Airports	400 Rodgers Blvd	838-85
13	Yoichi Ebisu	Y. Ebisu & Assoc.	1126 12th Ave. #305 Hnl 96816	735-163
14	Perry White	Belt Collins Hawaii	680 Ala Moana Blvd., #200 Honolulu 96813	521-53
15	Stephen Takashima	AIR-EP	400 Rodgers Blvd	838-
16	Ben Schlapak	HDOT-AIR-EP	400 Rodgers Blvd #700, Honolulu 96819	838

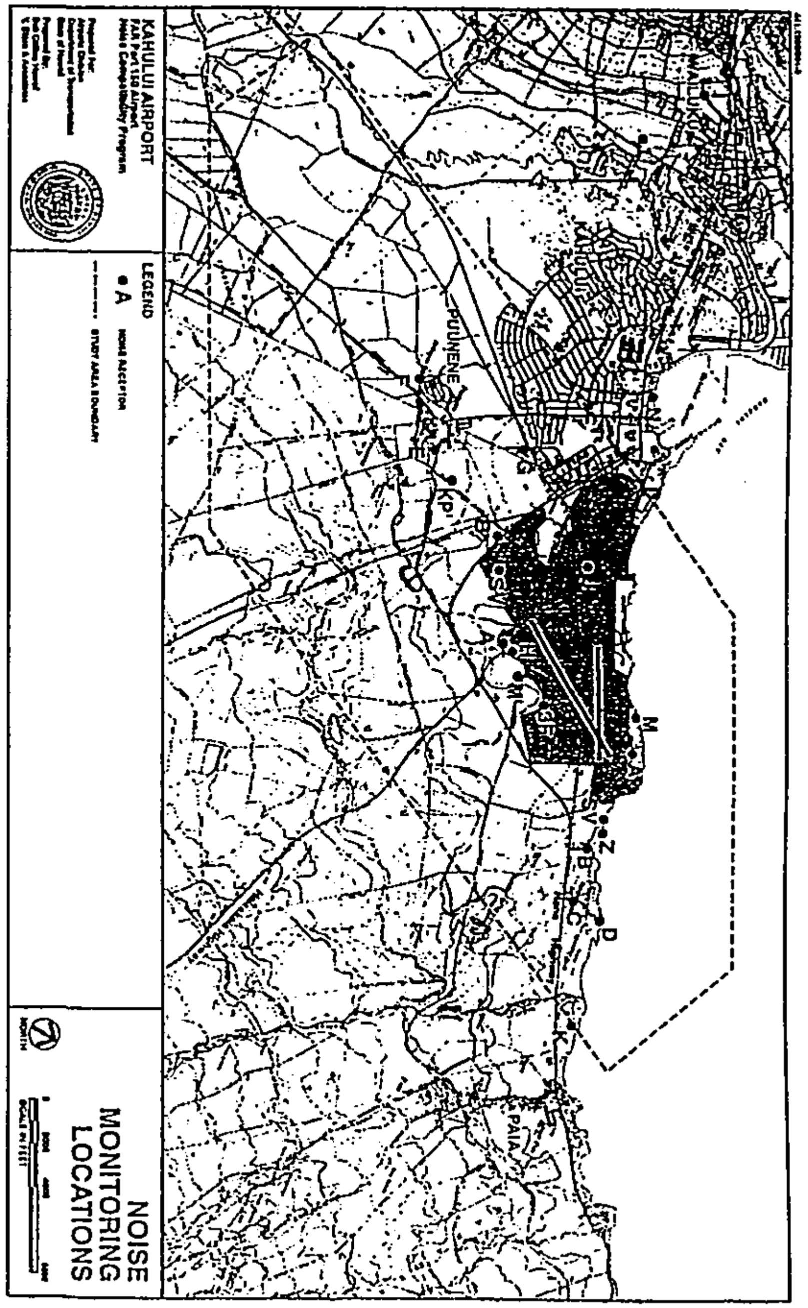
MEETING AGENDA

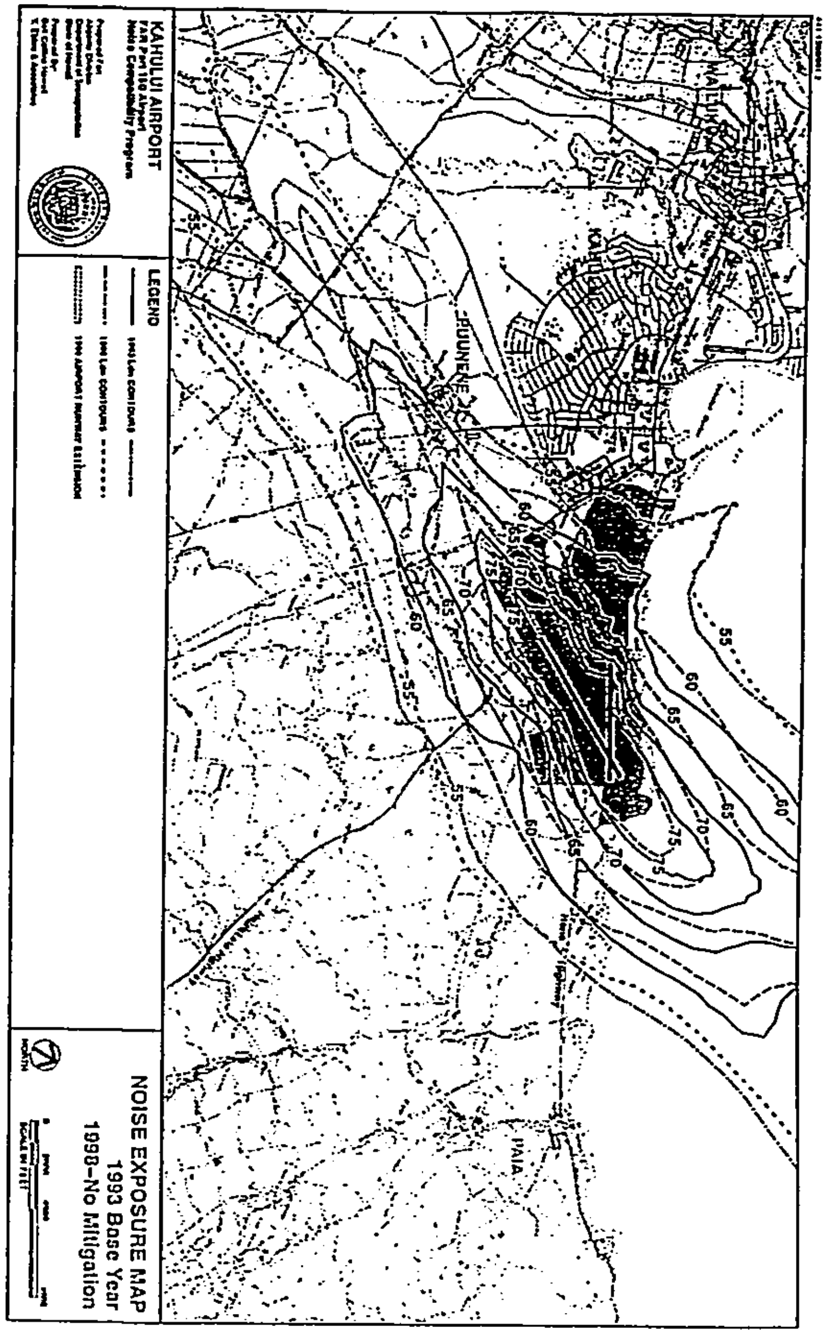
Kahului Airport Far Part 150 Noise Compatibility Program

- Introduction
- Purpose of the Meeting
- Integrated Noise Model Inputs
- 1993 and 1998 No-Mitigation Noise Levels
- Potential Measures to Increase Land Use Compatibility
- Questions and Discussion

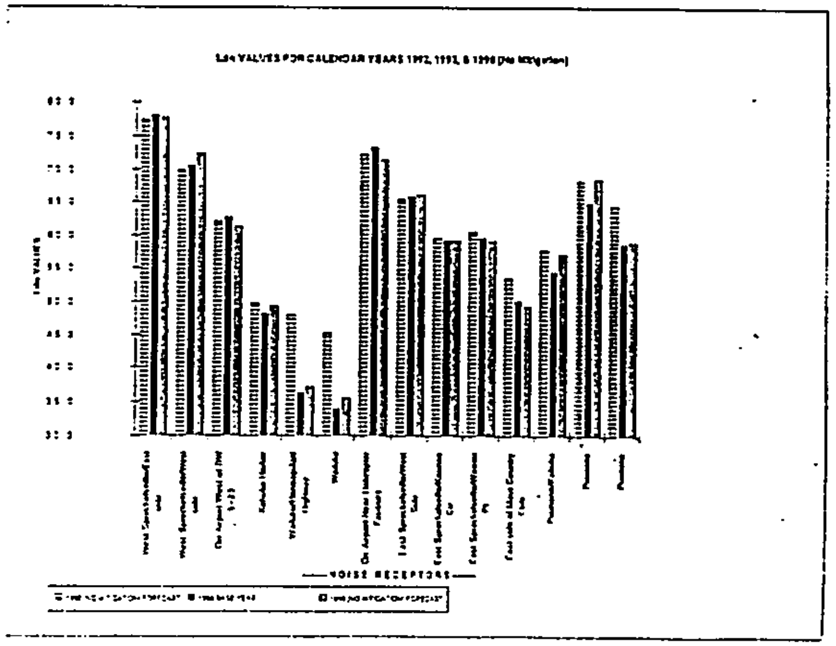
INTEGRATED NOISE MODEL INPUTS

- Runway Characteristics (Location, Length, and Orientation)
- Aircraft Flight Tracks
- Aircraft Operations By Aircraft Type and Flight Track
- Approach and Departure Profiles
- Stage Lengths
- Aircraft Noise Levels, by Aircraft Type





LOCATION	NOISE RECEPTOR	1992 (No Mitigation) Forecast	1993 Base Year	1998 (No Mitigation) Forecast	CHANGE FROM 1992 (No Mitigation)	CHANGE FROM 1993 Base Year
West Spreckelsville/East side	A	77.4	78.1	77.7	0.3	-0.4
West Spreckelsville/West side	M	69.9	70.6	72.5	2.6	1.9
On Airport-West of RW 5-23	J	62.0	62.7	61.4	-0.6	-1.3
Kahului Harbor	N	49.8	48.3	49.5	-0.3	1.2
Wailuku/Honoapiilani Highway	L	48.1	36.5	37.3	-10.8	0.8
Wailuku	I	45.3	34.1	35.7	-9.6	1.6
On Airport-Near Helicopter Facilities	H	72.4	73.5	71.6	-0.8	-1.9
East Spreckelsville/West Side	B	65.4	65.9	66.2	0.8	0.3
East Spreckelsville/Kaunoa Dr	C	59.7	59.3	59.3	-0.4	0.0
East Spreckelsville/Waiehu Pt	O	60.6	59.7	59.2	-1.4	-0.5
East side of Maui Country Club	K	53.6	50.3	49.5	-4.1	-0.8
Puunene/Kahului	G	57.8	54.6	57.2	-0.6	2.6
Puunene	E	63.4	64.9	63.7	0.3	3.3
Puunene	F	64.5	58.7	59.0	-5.5	0.3



Change Flight Tracks

No Significant Benefits at Kahului Airport.

- Noise abatement procedures already in place.
- Most-impacted areas are too close to the airport to avoid.
- Runway limitations make it impractical to change the runway use pattern.
- Using a straight-out departure from Runway 20 would slightly lessen noise levels there, but the same incompatibilities/need for noise mitigation would remain.

Use Noise Abatement Takeoff or Approach Procedures

Limited Potential Benefits at Kahului Airport.

- Noise abatement procedures already in place.
- No noise-sensitive uses beneath approach to Runway 2.
- 1+ Ldn reduction may be possible from earlier power cutback on departure.

Construct New Airport Facilities

No Increase In Land Use Compatibility.

- Planned Runway 2-20 extension will slightly reduce tradewind departure noise.
- Entirely new airport would simply shift contours, placing more noise over land and impacting other communities.
- Noise barriers are not effective for the elevated aircraft noise sources.

Complete or Partial Curfews

Slight Increase in Land Use Compatibility.

- 11:00 pm to 6:00 am curfew would:
  - eliminate night cargo flights
  - reduce Ldn approximately 1-2 points
  - adversely affect interisland cargo shipments and shipping costs
  - eliminate single-event aircraft noise from this time period
  - probably not be approved by the FAA because of the absence of an alternative airport
- 10:00 pm to 7:00 am curfew would:
  - eliminate several early morning passenger flights as well as night cargo operations
  - reduce Ldn approximately 2-3 points
  - eliminate single-event aircraft noise from this time period
  - would probably not be approved by the FAA because of the absence of an alternative airport
- Nighttime curfew on Stage 2 aircraft would:
  - reduce Ldn approximately 1-2 points
  - require Aloha to commit its B-737-QC-300 aircraft to Kahului
  - reduce single-event nighttime noise by 5-15 dB

Capacity Restrictions Based On Cumulative Impact

No Increase in Land Use Compatibility; Would Insure That Noise Exposure Does Not Worsen

- Would involve establishing a noise budget or similar mechanism. Changes in number of operations or type of aircraft would not be allowed to increase exposure.
- Would be complex to administer and require close monitoring.
- Would not eliminate existing incompatibility.
- Would not reward those carriers that now use the quietest aircraft, but would allow increased travel if accompanied by fleet quieting.
- Force some operators to reduce operations and/or begin to acquire/retrofit some aircraft to Stage 3.

Limit Maximum Aircraft Noise Emissions

Could Improve Land Use Compatibility In Exchange for Additional Costs to Air Carriers/Traveling Public.

- Currently available jet passenger and cargo aircraft are not quiet enough to insure complete land use compatibility or to keep single-event noise levels from being intrusive at night. Soundproofing of residences would still be required.
- The greatest improvement (a reduction of 5-8 Ldn) would result from use of all only Stage 3 aircraft. However, it is not likely that the interisland air carriers could acquire and operate fleets composed solely of Stage 3 aircraft by 1998.
- If the interisland carriers used fleets composed entirely of retro-fitted aircraft meeting Stage 3 standards, Ldn levels might be reduced by 2-5 points by 1998.
- Requiring the fleet mix federally mandated in the 48 contiguous states by 1998 (75% Stage 3) would decrease noise by approximately 2-5 Ldn.

Differential Landing Fees Based On Noise

Little Potential To Reduce Noise Exposure.

- Money paid out for this does not directly decrease noise emissions or increase attenuation.
- Airports Division could use payments to fund sound treatment.
- Measure is most effective when operators can choose from a range of equipment, not the case with all of the interisland operators.

Soundproof Structures

Significantly Reduces Interior Noise Levels; Requires Closure and Air-Conditioning Structures.

- Can reduce interior noise levels by 5 to 20 dB, enough to provide compatibility in areas exposed to up to 75 Ldn.
- Requires change in lifestyle.
- Requires on-going operating expenditures on the part of homeowners.

Purchase Incompatible Properties

Can provide complete land use compatibility.

- Is costly compared to sound treatment alternatives.
- Requires homeowners to relocate.
- May be the only way for the program to meet the objective of keeping the 75 Ldn contour within Airport property.

Purchase Avigation Easements

Compensates Landowners for the Intrusion of Aircraft Noise.

- There is an existing avigation easement in West Spreckelsville.
- Insures that future buyers are aware of airport noise at the time they purchase the property.
- Requires a clear definition of the noise levels that are allowed under the easement.

Appendix D

Glossary of Acoustical Descriptors, Symbols, and Terminology

APPENDIX D

GLOSSARY OF NOISE TERMS

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table 1. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table 1.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table 1 was developed (Table 2). The group adopted the ANSI descriptor-symbol scheme, which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.......). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level, which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table 2 permits the inclusion of the "A." For example, a report on blast noise might wish to contrast the L_{Cdn} with the L_{Adn}.

Although not included in the tables, it is also recommended that "L_{pn}" and "L_{epN}" be used as symbols for perceived noise levels and effective perceived noise levels, respectively

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured L_A values were 85 and 75 dB, respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent." Hence, L_{eq} is designated the "equivalent sound level." For L_d, L_n, and L_{dn}, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level," "night sound level," and "day-night sound level," respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the

maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background," "ambient," "residual," or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (L_{pn} was found to be 75 dB. L_{pn} = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighted Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report *Guidelines for Preparing Environmental Impact Statements* (1977).

Table 1 A-Weighted Recommended Descriptor List

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) [1]	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

Source: EPA Acoustic Terminology Guide, BNA 8-14-78, Noise Regulation Reporter.

Table 2 Recommended Descriptor List

TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED[3]
1. Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Maximum Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level[4] over Time (T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_d	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.
(2) Only B-weighting shown. Applies also to C,D,E,.... weighting.
(3) The term "pressure" is used only for the unweighted level.
(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is $L_{eq(1)}$. Time may be specified in non-quantitative terms (e.g., could be specified as $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine.

Appendix E

Validation of the Integrated Noise Model

APPENDIX E. VALIDATION OF THE INTEGRATED NOISE MODEL

E.1 INTRODUCTION

The FAR Part 150 regulations require that the Base Year Noise Exposure Maps be prepared using the Federal Aviation Administration's Integrated Noise Model (INM). The INM contains its own data base of aircraft noise curves and a specific set of noise attenuation assumptions. Generalized procedures for calculating such things as excess sound attenuation effects from shielding (by aircraft fuselage, terrain, and man-made structures), ground interference effects when both receptor and aircraft are at or near ground level, and directional effects with rearward aspect angle from the aircraft during start-to-roll, are built into the model and are employed even when unusual circumstances might make it inappropriate to do so. Finally, the INM is limited by its inability to account for the effects of uneven terrain and the presence of high-rise receptors within the region covered by the noise contours.

The official FAR Part 150 Base Year Noise Exposure Map for Kahului Airport presented in Figure 5-1 was prepared using the standard (i.e., uncalibrated) version of INM Version 4.11. However, because the INM can produce inaccurate results under certain circumstances, a substantial effort was made to confirm the reasonableness of the model's inherent assumptions and output. The results of this validation effort are summarized below.

E.2 AIRCRAFT NOISE CURVES

An earlier validation of the original 1987 Base Year Noise Exposure Map for Kahului Airport was performed using noise monitoring data which was collected during the period from 1977 to 1988 at Honolulu International Airport, Hilo International Airport, and Lihue Airport. The results and methodology used in the 1987 model validation efforts of earlier INM Versions 3.8 and 3.9 were reported in Appendix A of *Volume 1: Noise Exposure Map Report: Kahului Airport, Kahului, Maui* dated December 1989. The present INM Version 4.11 model is similar to the earlier versions, except that some refinements have been incorporated into the new model.

In order to determine if the aircraft noise curves incorporated in the INM Version 4.11 data base are representative of the specific aircraft that use Kahului Airport, they were compared with noise monitoring data collected at Kahului Airport between 1988 and 1995. The older set of noise monitoring data was collected from 1988 to 1992, and the more recent (newer) set of noise monitoring data was collected between December 1994 and January 1995. The noise monitoring sites where aircraft noise data were collected are shown in Figure 5-1.

The comparison showed that the aircraft noise curves built into the INM Version 4.11 are relatively accurate for the noisier interisland jet aircraft types, such as the DC-9(50) and B-737(200) which control the size of the Kahului Airport noise contours. Some differences do exist, however, particularly for the newer B-737(300) aircraft. To determine whether or not the differences in the aircraft noise data bases would produce a significant difference in the noise contours calculated by the standard INM Version 4.11, a "calibrated" data base was constructed

by using the noise monitoring data to adjust (or calibrate) the data base built into the standard INM. This model is referred to subsequently as the "calibrated" model, and was used to determine the accuracy of the 1993 Base Year and 1998 5-Year No Mitigation, and 1998 5-Year With Mitigation Noise Exposure Maps.

E.3 NOISE MONITORING DATA

Tables E-1 and E-2 compare the average sound exposure level results from the older (1988 through 1992) and newer (1994 and 1995) set of noise monitoring data from Kahului Airport with the standard and calibrated FAA INM Version 4.11 model's predictions at the noise monitoring sites. The agreement between the measured data and the model predictions were generally close. Agreement between the measured departure noise data and model predictions for the noisier B-737(200) and DC-9(50) aircraft was very good, with mean errors of less than 1 dB. Because the departure noise of these two interisland jet aircraft tends to dominate and control the Ldn contours at Kahului Airport, the Noise Exposure Maps tend to be very accurate, despite greater inaccuracies in modeling the noise level of the quieter jet and propeller aircraft. In addition to some model inaccuracies in the aircraft noise curves and in describing the sound attenuation directly under, to the sides, and behind the aircraft, the spatial dispersion of actual approach and departure tracks and aircraft altitude during the noise measurements, and the relatively small sample sizes of the measurement data, were the other causes of the largest differences between measured and predicted sound exposure level.

Differences between model predictions and measured rearward start-to-roll noise were confirmed at monitoring Site V, as had been observed previously at Kahului and other state airports. The standard FAA INM Version 4.11 underestimated the rearward start-to-roll noise of interisland jet aircraft by 3.8 to 6.7 dB during the early morning hours of 6:00 AM to 8:00 AM. The significance of these differences on the accuracy of the Noise Exposure Maps is examined in the following section of this appendix.

E.4 SIGNIFICANCE OF DIFFERENCES BETWEEN MONITORING DATA AND INM

The measured noise levels of the quieter (Stage 3) jet aircraft such as the DC-10, L-1011, and B-737(300) were 3.5 to 7.0 dB higher (noisier) than standard FAA INM Version 4.11 model predictions. Because these quieter jet aircraft tend to be overshadowed by the noise contributions from the noisier (Stage 2) B-737(200) and DC-9(50) aircraft, the 1993 Base Year and 1998 5-Year No Mitigation Noise Exposure Maps produced by the standard FAA INM Version 4.11 were not significantly different from those produced by the calibrated version. Comparisons of the standard and calibrated Noise Exposure Maps for 1993 and 1998 (No Mitigation) are shown in Figures E-1 and E-2. The greatest inaccuracies are probably in the order of 2.5 Ldn, and tend to occur in the Puunene area and vacant areas southeast of the airport, since the model tends to underestimate the landing noise of the DC-10, L-1011, DC-9(50), and B-737(300) aircraft by 3 to 5 dB.

The more significant effects of the model's inaccuracies can occur during evaluations of the noise reduction benefits of various mitigation measures, such as the replacement of the noisier B-737(200) aircraft with the quieter B-737(300) aircraft. Because the standard FAA INM Version 4.11 tends to underestimate the noise levels of the quieter aircraft such as the B-737(300), DC-10, and L-1011, the noise reduction benefits from aircraft fleet quieting may be overstated by the standard INM. For this reason, all potential noise mitigation measures were evaluated using both the standard and calibrated versions of the FAA INM.

In addition to the comparisons of the noise contours from the standard and calibrated versions of the FAA INM, tabulations of the differences between the two model outputs were also performed at the noise monitoring sites. These comparisons are shown in Tables E-3 through E-7. From the eighth column of Table E-3, the total differences in the Base Year levels computed by the standard vs. calibrated models were less than 2 Ldn, and typically less than 1 Ldn. From the eighth column of Table E-4, the total differences in the 5th-Year, No Mitigation, levels computed by the standard vs. calibrated models were no greater than 2.5 Ldn, and typically less than 1 Ldn. The total Ldn differences between the standard and calibrated versions of the model were relatively small (2.5 Ldn or less). The primary reason for the good agreement between the models was the dominating influence of the departure noise of the noisier interisland jet aircraft, which are accurately represented by the standard version of the FAA INM model.

The results of the standard vs. calibrated model output comparisons in Tables E-5 through E-7 indicate that the standard FAA INM Version 4.11 may overstate the potential benefits of the aircraft fleet quieting Option T1 by approximately 1.5 to 3.5 Ldn. This is due to the lower than measured sound levels predicted by the standard FAA INM model for the B-737(300) aircraft. Measured data on the MD-82 or hush kit equipped DC-9(50) aircraft were not available to further refine these conclusions.

In view of the differences between measured and predicted sound exposure levels from rearward start-to-roll noise and the possible large increases in noise levels associated with thermal ducting, it was considered prudent to check FAA INM outputs for possible underestimation of the Ldn predictions in regions which may be affected by these start-to-roll noise events. To do this, the Grid Output Module of the INM was used to calculate the Base Year Ldn values at fourteen noise monitoring sites. The relative Ldn contributions of aircraft noise associated with flyby events (air-to-ground propagation) were computed separately from those associated with start-to-roll events during takeoff (ground-to-ground propagation behind the departing aircraft). Separating the components in this way made it possible to evaluate the possible influence of inaccuracies associated with ground-to-ground propagation, and in particular, those associated with nighttime, rearward, start-to-roll events.

The results of these calculations for the 1993 Base Year and 1998 5-Year are shown in Tables E-8 and E-9 respectively. As indicated in the tables' second and fourth columns, the computed "Total Ldn" at most noise monitoring sites were essentially equal to (and dominated by) the Ldn associated with "All Air-to-Ground Events," or aircraft flyby events past the monitoring sites. In these cases, rearward "start-to-roll" noise as computed by the INM was at least 8 Ldn units less than the "air-to-ground" component. At the sideline Site J, start-to-roll noise was as dominant a contributor to the "Total Ldn" as was the "air-to-ground" component at this site.

Earlier comparisons of noise monitoring data with calibrated and standard FAA INM model outputs for ground-to-ground sound propagation during aircraft start-to-roll at takeoff indicated that both the calibrated and standard versions of the model produced sound exposure level results which were generally lower than measured data. This is a built-in characteristic of the model which cannot be altered by the user. Additionally, the model does not account for the reduced sound attenuation that occurs at Kahului during these nighttime and early morning hours when the usual thermal inversion in the atmosphere may allow thermal ducting of aircraft noise. As a consequence, there is a tendency for the INM to underestimate the effects of aircraft start-to-roll noise for receptor (and particularly elevated receptor) locations to the rear of the departing aircraft.

In order to determine what effect this built-in characteristic of the model was having on calculated 1993 and 1998 Ldn contours, worst case Ldn values were calculated at fourteen of the noise monitoring sites (see Tables E-8 and E-9). For the purposes of these calculations the rearward noise components from departure events were increased to reflect the noise monitoring data and worst case conditions of thermal ducting during the nighttime Ldn penalty hours of 10:00 p.m. to 7:00 a.m.

The "Adjusted Total Ldn" results shown in column 9 of Tables E-8 and E-9 were computed after adding separate Ldn correction -factors to the daytime and nighttime Ldn components associated with rearward start-to-roll noise events. The values of the correction factors used are shown in the footnotes to the tables. A comparison of these adjusted results with the unadjusted noise model estimates indicates that the FAA INM model's assumptions regarding rearward departure noise do not have a significant effect on the noise level estimates for Kahului Airport in the East and West Spreckelsville areas enclosed by the Base Year or 5th-Year 60 Ldn contours. However, following the proposed extension of Runway 2-20, sections of the Kahului residential area in the vicinity of Monitoring Site "G" may be exposed to aircraft noise levels greater than 60 Ldn due to nighttime thermal ducting effects. Minimization of the likelihood of the 60 Ldn contour encroaching into the residential area near Site "G" would occur if nighttime departures from Runway 2 use the existing threshold rather than the extended threshold.

A graphic comparison of the Base Year Ldn contours computed by the standard and calibrated versions of the Integrated Noise Model, Version 4.11, is presented in Figure E-1. The contours plotted by the calibrated model indicate slightly higher noise (Ldn) levels in the regions below the aircraft flight tracks, but the two sets of contours were very similar in the airport sideline areas. Similar conclusions can be made in respect to the standard and calibrated versions of the 5-Year No Mitigation contours shown in Figure E-2. The comparisons of the noise contours developed from the standard and calibrated INM models for the six mitigation measures evaluated are shown in Figures E-3 through E-8. A comparison of the land areas (in square miles) enclosed by each contour set is shown in Table E-10.

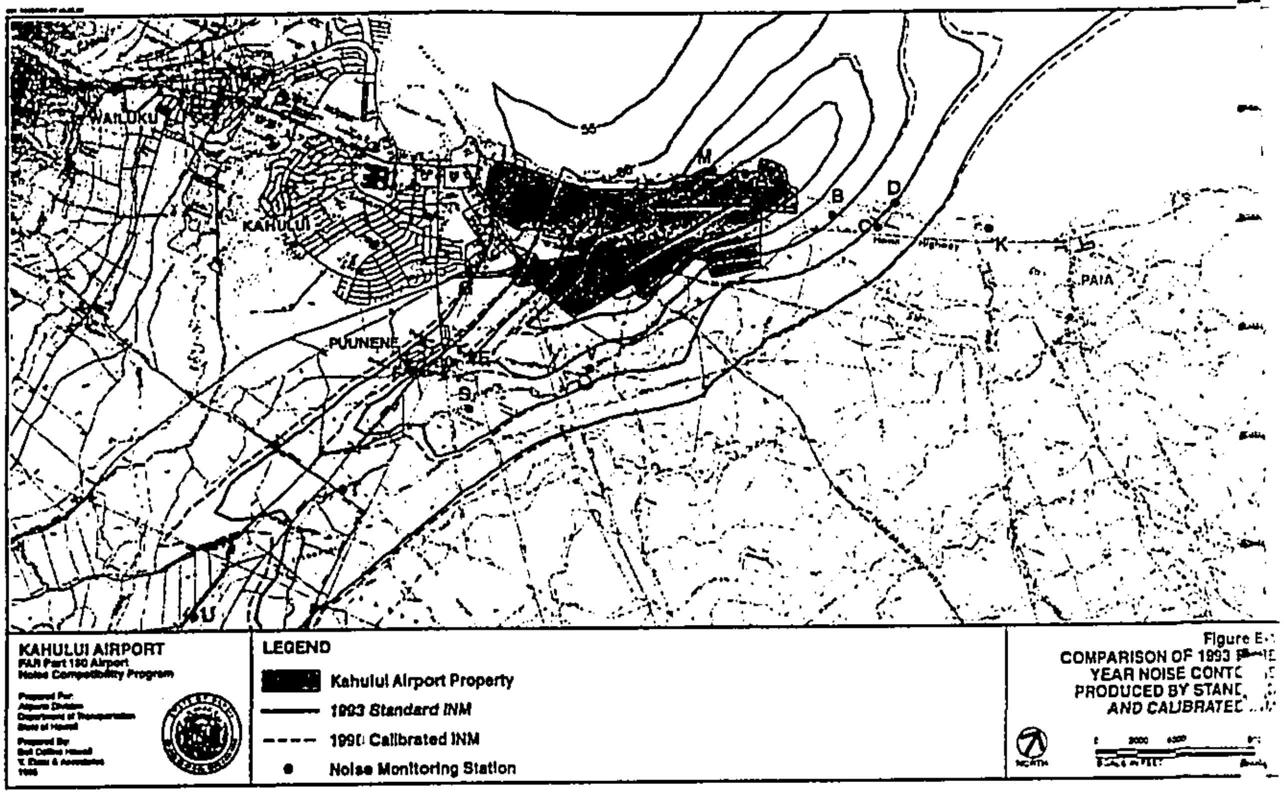


Figure E-
COMPARISON OF 1993 ...
YEAR NOISE CONT...
PRODUCED BY STAND...
AND CALIBRATED ...

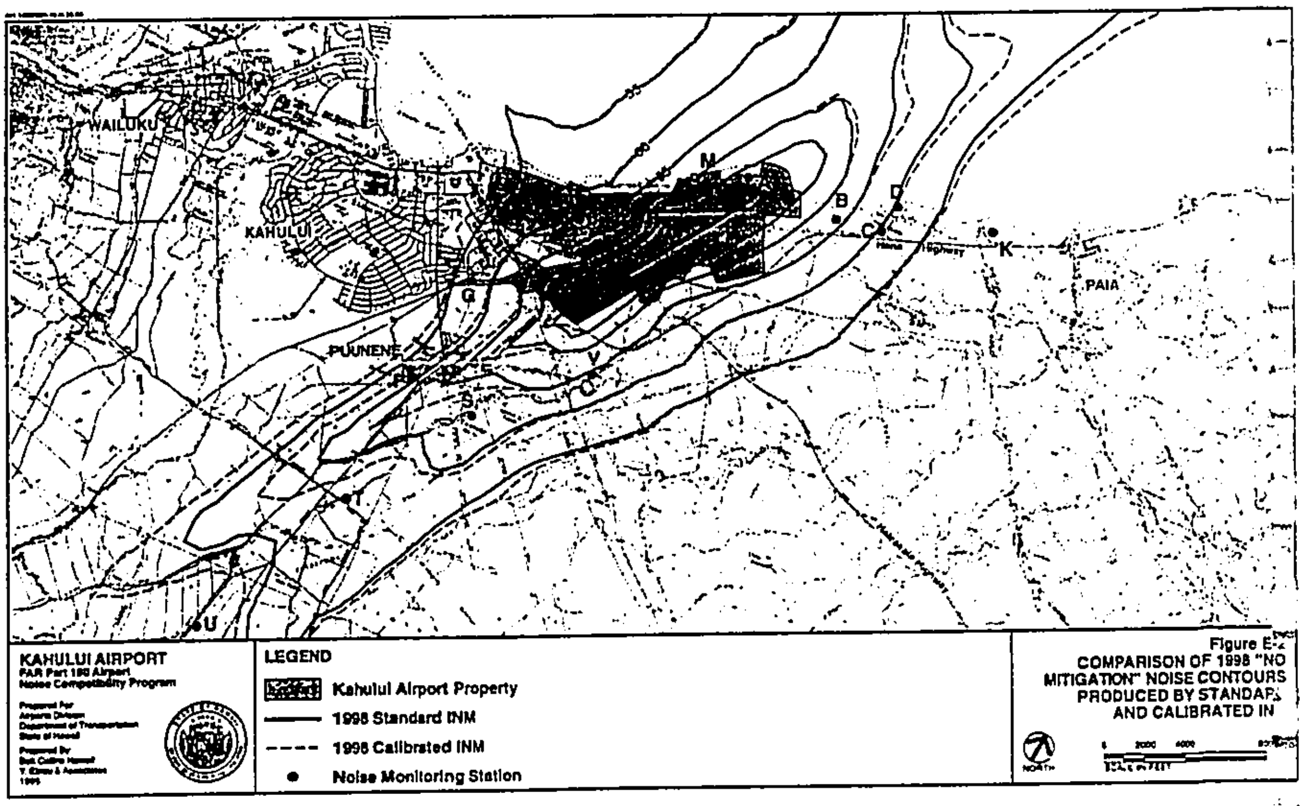


Figure E-
COMPARISON OF 1998 "NO
MITIGATION" NOISE CONTOURS
PRODUCED BY STANDAR...
AND CALIBRATED IN...

TABLE E-1

COMPARISON OF AIRCRAFT DEPARTURE NOISE DATA WITH FAA INM MODEL OUTPUTS

DEPARTING AIRCRAFT		NOISE MEASUREMENT LOCATIONS AT OGG												
		A	B	D	D	K	K	V	S	S	S	T	T	T
DC-10	(1)	96.4												
	(2)	87.0	78.7	84.2		79.2			85.4	89.4			83.7	
	(3)	96.0												
	(4)	87.0	83.4	78.7	80.9	66.2	71.8	72.7	88.0	92.1	92.3	83.5	84.2	86.0
	(5)	101.8	87.9	81.2	85.4	70.7	76.1	76.7	90.9	96.6	96.8	88.0	86.7	90.5
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B
L-1011	(1)													
	(2)			82.7		78.6				92.4			88.0	
	(3)													
	(4)	97.7	83.8	77.6	81.8	67.0	72.5	74.2	87.4	92.7	92.9	84.3	85.1	87.1
	(5)	102.7	88.8	82.6	86.9	72.0	77.5	79.5	92.4	97.7	97.9	89.3	90.1	92.1
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B
B-757	(1)													
	(2)			83.9	81.3	79.4	80.0							
	(3)													
	(4)	81.1	77.6	69.6	73.1	59.7	64.0	70.2	77.4	82.1	82.3	75.2	76.0	77.4
	(5)	105.6	92.1	84.1	87.6	74.2	78.6	83.3	91.9	96.6	96.6	89.7	90.5	91.9
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B
B-737(200)	(1)	103.1	93.5	87.4	89.0	81.1								
	(2)	102.5	91.7	88.8	90.1	82.1	83.6	86.7	95.3	93.6	95.0	92.0	89.3	88.5
	(3)	102.8	92.8	88.0	89.9	81.9								
	(4)	105.8	93.6	86.8	89.6	78.8	80.1	82.9	93.5	98.4	98.7	90.3	91.0	92.4
	(5)	106.8	94.1	87.3	90.1	77.1	80.6	83.4	94.0	98.9	99.2	90.8	91.5	92.9
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B
B-737(300)	(1)	91.6	87.6	80.3	82.0									
	(2)	92.5	83.2	82.3		77.6		75.0		86.5	86.1		81.9	81.6
	(3)	92.2	86.3	81.8										
	(4)	90.8	79.4	72.7	76.2	82.4	86.9	69.2	80.2	84.1	84.3	78.3	78.9	80.0
	(5)	97.8	86.4	79.7	83.2	69.4	73.9	76.2	87.2	91.1	91.3	85.3	85.9	87.0
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B
DC-9(50)	(1)	104.4	98.7	88.5		81.1								
	(2)	105.1	94.6	91.2	92.4	83.4	84.8	92.6	96.5	97.8	99.1	91.8	91.1	92.2
	(3)	105.0	96.1	90.9		83.3								
	(4)	109.3	97.4	90.7	94.1	80.2	85.1	85.9	95.2	99.5	99.7	92.4	93.0	94.9
	(5)	106.8	96.9	90.2	93.6	79.7	82.6	85.4	94.7	99.0	99.2	91.9	92.5	94.4
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B

TABLE E-1 (CONTINUED)

COMPARISON OF AIRCRAFT DEPARTURE NOISE DATA WITH FAA INM MODEL OUTPUTS

DEPARTING AIRCRAFT		NOISE MEASUREMENT LOCATIONS AT OGG												
		A	B	D	D	K	K	V	S	S	S	T	T	T
DASH 8	(1)	79.0	68.8											
	(2)	68.3	74.1	77.5							77.1		75.4	76.4
	(3)	65.1	71.7											
	(4)	65.8	75.7	70.6	73.8	62.0	67.6	62.4	78.7	81.2	81.2	76.3	76.7	77.2
	(5)	66.3	76.1	71.0	74.2	62.4	68.2	62.9	79.1	81.6	81.6	76.7	77.1	77.6
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B
ATR-42	(1)													
	(2)	81.7		73.8		76.2				77.5			74.4	
	(3)													
	(4)	78.7	68.5	63.6	65.9	56.8	61.1	69.4	70.1	72.5	72.5	68.7	69.4	70.1
	(5)	86.7	76.5	71.6	73.9	64.6	69.1	77.4	78.1	80.5	80.5	76.7	77.4	78.1
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B
GA-1	(1)	75.3												
	(2)	80.2	82.8		82.6		76.5							
	(3)	80.0												
	(4)	83.2	72.0	65.4	66.4	56.4	61.2	66.5						
	(5)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B
GA-2	(1)	76.2	70.8											
	(2)	88.2		74.5										
	(3)	86.9												
	(4)	87.6	75.8	70.2	73.9	60.9	65.2	64.5						
	(5)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B
P3	(1)			74.4										
	(2)	85.2								83.3			80.2	
	(3)													
	(4)	93.7	79.9	74.4	78.7	65.3	70.0	69.1	83.7	89.4	89.7	80.7	81.5	83.7
	(5)	67.2	73.4	67.9	72.2	58.8	63.5	62.6	77.2	82.9	83.2	74.2	75.0	77.2
	(6)	TR4	TR4	TR4	TR2	TR4	TR2	TR4	TR29	TR31A	TR31B	TR29	TR31A	TR31B

NOTES:

(1) AVERAGE SEL IN dB OF DATA COLLECTED FROM JANUARY 1988 TO SEPTEMBER 1992.
(2) AVERAGE SEL IN dB OF DATA COLLECTED FROM DECEMBER 1994 TO JANUARY 1995.
(3) AVERAGE SEL IN dB OF DATA COLLECTED FROM JANUARY 1988 TO JANUARY 1995.
(4) PREDICTED SEL USING STANDARD INM VERSION 4.11.
(5) PREDICTED SEL USING CALIBRATED INM VERSION 4.11.
(6) AIRCRAFT FLIGHT TRACK OBSERVED.
(7) ALL STAGE 1 DEPARTURES EXCEPT FOR DC-10, L-1011, AND B-757 DEPARTURES ON TR2 WHICH WERE STAGE 3 DEPARTURES.

TABLE E-2

COMPARISON OF AIRCRAFT ARRIVAL NOISE DATA WITH FAA INM MODEL OUTPUTS

ARRIVING AIRCRAFT		NOISE MEASUREMENT LOCATIONS AT OGG						
		E	F	T	T	U	U	V
DC-10	(1)							
	(2)	96.2	87.3	84.1	84.4	78.1		
	(3)							
	(4)	92.0	84.7	76.5	83.7	68.2	65.6	69.6
	(5)	96.5	89.2	81.0	88.2	72.7	70.1	73.4
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A
L-1011	(1)							
	(2)	95.3	86.5		83.4		82.2	
	(3)							
	(4)	93.9	86.6	78.3	85.2	69.6	66.5	71.0
	(5)	97.0	89.6	81.3	88.2	72.6	69.5	74.1
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A
B-757	(1)							
	(2)				80.1		76.1	
	(3)							
	(4)	89.2	82.7	74.8	81.6	67.8	63.9	67.2
	(5)	94.7	88.2	80.3	87.3	73.3	69.4	73.3
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A
B-737(200)	(1)	90.0	88.6					
	(2)	89.3	81.3	78.3		74.3		74.9
	(3)	89.8	85.5					
	(4)	93.2	86.1	78.0	85.2	70.6	67.1	70.6
	(5)	92.7	85.6	77.5	84.7	70.1	66.6	70.2
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A
B-737(300)	(1)							
	(2)	90.7	84.1	81.9		70.5		75.2
	(3)							
	(4)	88.5	82.2	74.4	81.3	67.4	63.4	67.1
	(5)	92.0	85.7	77.9	84.8	70.9	66.9	70.6
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A
DC-9(50)	(1)	92.4	89.9					
	(2)	94.7	84.4	81.3		73.6		77.2
	(3)	94.3	86.2					
	(4)	89.8	84.1	74.7	82.1	67.4	63.5	69.6
	(5)	94.8	89.1	79.7	87.1	72.4	68.5	74.3
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A
DASH 6	(1)	89.2	85.1					
	(2)	80.6	72.9	72.7		67.1		
	(3)	86.5	83.9					
	(4)	88.4	83.1	75.9	82.0	70.0	66.3	69.2
	(5)	88.4	83.1	75.9	82.0	70.0	66.3	69.2
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A

TABLE E-2 (CONTINUED)

COMPARISON OF AIRCRAFT ARRIVAL NOISE DATA WITH FAA INM MODEL OUTPUTS

ARRIVING AIRCRAFT		NOISE MEASUREMENT LOCATIONS AT OGG						
		E	F	T	T	U	U	V
ATR-42	(1)							
	(2)	89.5	81.9	82.4		75.4		75.2
	(3)							
	(4)	69.1	61.4	50.6	59.2	41.9	40.3	44.0
	(5)	96.1	88.4	77.6	86.2	68.9	67.3	71.1
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A
GA-1	(1)	77.8	76.1					
	(2)	73.2	73.3	71.5				
	(3)	77.0	74.9					
	(4)	76.4	71.1	65.4	71.1	59.6	57.0	57.5
	(5)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A
GA-2	(1)	85.6	75.4					
	(2)	81.9	78.0					
	(3)	84.9	76.9					
	(4)	85.7	77.7	69.5	76.3	63.7	59.9	62.4
	(5)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A
P3	(1)		89.0					
	(2)	90.1	85.9	84.5		73.8		
	(3)		87.2					
	(4)	88.1	82.1	75.3	81.4	70.0	66.3	68.1
	(5)	93.0	87.1	80.2	86.4	74.7	71.1	73.3
	(6)	TR28A	TR28A	TR28A	TR15B	TR28A	TR15B	TR28A

NOTES:

(1) AVERAGE SEL IN dB OF DATA COLLECTED FROM JANUARY 1988 TO SEPTEMBER 1992.
(2) AVERAGE SEL IN dB OF DATA COLLECTED FROM DECEMBER 1994 TO JANUARY 1995.
(3) AVERAGE SEL IN dB OF DATA COLLECTED FROM JANUARY 1988 TO JANUARY 1995.
(4) PREDICTED SEL USING STANDARD INM VERSION 4.11.
(5) PREDICTED SEL USING CALIBRATED INM VERSION 4.11.
(6) AIRCRAFT FLIGHT TRACK OBSERVED.
(7) ALL 4 DEGREE APPROACH SLOPES.

Table E–3. Comparison of Base Year (1993) Ldn Computed Using Standard and Calibrated INM Version 4.11 Data Bases.

	Ldn From Calibrated INM Output			Ldn From Standard INM Output			Calibrated Minus Standard Output		
Site	Total	All Rear Departure Events	All Air-To-Ground Events	Total	All Rear Departure Events	All Air-To-Ground Events	Total	All Rear Departure Events	All Air-To-Ground Events
A	78.2	70.4	77.4	78.1	70.1	77.4	0.1	0.3	0.1
B	66.1	50.9	66.0	65.9	50.6	65.8	0.2	0.3	0.2
C	59.4	45.0	59.2	59.3	44.7	59.1	0.1	0.3	0.1
D	60.0	43.0	59.9	59.8	42.6	59.7	0.2	0.4	0.2
E	66.5	43.4	66.5	65.1	43.2	65.1	1.4	0.2	1.4
F	60.2	40.1	60.2	58.6	39.9	58.5	1.6	0.2	1.6
G	54.8	48.3	53.7	54.5	48.1	53.4	0.3	0.2	0.3
J	62.9	60.5	59.2	62.6	60.3	58.7	0.3	0.2	0.4
K	50.7	36.8	50.5	50.5	36.1	50.3	0.2	0.7	0.2
M	70.8	59.1	70.5	70.6	58.9	70.3	0.2	0.2	0.2
S	62.4	41.8	62.4	61.8	41.6	61.8	0.6	0.2	0.6
T	57.2	34.6	57.2	56.4	34.4	56.4	0.8	0.2	0.8
U	52.5	28.0	52.5	52.0	27.9	52.0	0.5	0.1	0.5
V	62.1	54.6	61.2	62.0	54.3	61.2	0.1	0.3	0.1

Table E–4. Comparison of CY 1998 (No Mitigation) Ldn Computed Using Standard and Calibrated INM Version 4.11 Data Bases.

	Ldn From Calibrated INM Output			Ldn From Standard INM Output			Calibrated Minus Standard Output		
Site	Total	All Rear Departure Events	All Air-To-Ground Events	Total	All Rear Departure Events	All Air-To-Ground Events	Total	All Rear Departure Events	All Air-To-Ground Events
A	77.8	70.6	76.9	77.7	70.2	76.8	0.1	0.4	0.0
B	66.2	51.2	66.1	66.1	50.8	66.0	0.1	0.4	0.1
C	59.4	45.5	59.2	59.3	45.0	59.1	0.1	0.5	0.1
D	59.4	43.4	59.3	59.2	42.9	59.1	0.2	0.5	0.2
E	69.1	47.0	69.1	66.6	46.7	66.6	2.5	0.3	2.5
F	61.3	43.5	61.2	58.9	43.3	58.8	2.4	0.2	2.4
G	57.5	54.9	54.0	57.2	54.6	53.7	0.3	0.3	0.3
J	62.0	58.4	59.5	61.2	58.2	58.2	0.8	0.2	1.3
K	50.2	37.7	49.9	49.9	36.5	49.7	0.3	1.2	0.3
M	72.5	59.5	72.3	72.5	59.2	72.3	0.0	0.3	0.0
S	62.6	45.7	62.5	61.8	45.4	61.7	0.8	0.3	0.8
T	57.5	37.5	57.5	56.4	37.2	56.3	1.1	0.3	1.1
U	52.9	30.4	52.9	52.2	30.1	52.2	0.7	0.3	0.7
V	64.2	60.6	61.7	64.1	60.4	61.7	0.1	0.2	0.0

TABLE E – 5

CHANGES IN LDN AT MEASUREMENT STATIONS FROM MITIGATION OPTIONS T1 THRU T11 (USING STANDARD INM VERSION 4.11)

	A	B	C	D	E	F	G	J	K	M	S	T	U	V
	NOISE MEASUREMENT LOCATIONS AT OGG													
CY 1993 (BASE YEAR)	78.1	65.9	60.3	58.8	65.1	58.8	54.5	62.6	50.5	70.6	61.8	56.4	52.0	62.0
CY 1998 (NO MITIGATION)	77.7	66.1	60.3	58.2	66.6	58.9	57.2	61.2	49.9	72.5	61.8	56.4	52.2	64.1
CHANGE FROM BASE YEAR	-0.4	0.2	0.0	-0.6	1.5	0.3	2.7	-1.4	-0.6	1.9	0.0	0.0	0.2	2.1
OPTION T1	68.0	56.9	50.6	52.4	63.9	55.9	48.8	54.9	45.5	63.2	53.3	51.2	46.2	55.3
OPTION T1 MINUS CY 1998 (NO MIT.)	-9.7	-9.2	-9.7	-5.8	-2.7	-3.0	-8.4	-6.3	-4.4	-9.3	-8.5	-5.2	-6.0	-8.8
OPTION T2	72.3	61.0	55.2	53.8	63.8	55.9	52.1	57.0	46.7	67.2	56.5	52.0	47.4	58.9
OPTION T2 MINUS CY 1998 (NO MIT.)	-5.4	-5.1	-5.1	-4.4	-2.8	-3.0	-5.1	-4.2	-3.2	-5.3	-5.3	-4.4	-4.8	-5.2
OPTION T3	76.2	64.8	58.9	56.9	65.5	57.7	55.5	59.7	48.8	71.0	59.6	54.5	50.2	62.3
OPTION T3 MINUS CY 1998 (NO MIT.)	-1.5	-1.3	-1.4	-1.3	-1.1	-1.2	-1.7	-1.5	-1.1	-1.5	-2.2	-1.9	-2.0	-1.8
OPTION T4	75.9	64.5	58.6	56.6	65.2	57.3	55.2	59.4	48.6	70.7	59.2	54.1	49.7	61.9
OPTION T4 MINUS CY 1998 (NO MIT.)	-1.8	-1.6	-1.7	-1.6	-1.4	-1.6	-2.0	-1.8	-1.3	-1.8	-2.6	-2.3	-2.5	-2.2
OPTION T5	75.5	64.0	58.2	56.4	65.8	57.8	55.2	59.5	48.5	70.4	60.3	54.9	50.4	62.1
OPTION T5 MINUS CY 1998 (NO MIT.)	-2.2	-2.1	-2.1	-1.8	-0.8	-1.1	-2.0	-1.7	-1.4	-2.1	-1.5	-1.5	-1.8	-2.0
OPTION T6	78.6	66.4	60.8	59.3	66.6	58.8	54.9	62.6	50.7	71.0	61.8	56.4	52.2	62.6
OPTION T6 MINUS CY 1998 (NO MIT.)	0.9	0.3	0.5	1.1	0.0	-0.1	-2.3	1.4	0.8	-1.5	0.0	0.0	0.0	-1.5
OPTION T7	76.3	64.6	59.4	58.0	67.1	59.2	56.9	60.7	49.8	70.4	63.6	56.7	52.1	63.4
OPTION T7 MINUS CY 1998 (NO MIT.)	-1.4	-1.5	-0.9	-0.2	0.5	0.3	-0.3	-0.5	-0.1	-2.1	1.8	0.3	-0.1	-0.7
OPTION T8	77.6	66.6	60.6	58.6	66.5	58.3	56.2	60.3	50.1	72.8	57.4	53.3	48.1	62.3
OPTION T8 MINUS CY 1998 (NO MIT.)	-0.1	0.5	0.3	0.4	-0.1	-0.6	-1.0	-0.9	0.2	0.3	-4.4	-3.1	-4.1	-1.8
OPTION T9	75.8	64.3	58.4	56.2	64.5	56.6	55.1	58.8	48.0	70.6	59.0	53.7	49.4	61.9
OPTION T9 MINUS CY 1998 (NO MIT.)	-1.9	-1.8	-1.9	-2.0	-2.1	-2.3	-2.1	-2.4	-1.9	-1.9	-2.8	-2.7	-2.8	-2.2
OPTION T10	75.8	64.4	58.5	56.5	66.2	58.2	55.1	59.2	48.4	70.6	59.0	54.3	49.8	61.9
OPTION T10 MINUS CY 1998 (NO MIT.)	-1.9	-1.7	-1.8	-1.7	-0.4	-0.7	-2.1	-2.0	-1.5	-1.9	-2.8	-2.1	-2.4	-2.2
OPTION T11	77.4	65.8	59.9	57.9	66.2	58.5	56.8	60.8	49.6	72.1	61.1	55.6	51.7	63.7
OPTION T11 MINUS CY 1998 (NO MIT.)	-0.3	-0.3	-0.4	-0.3	-0.4	-0.4	-0.4	-0.4	-0.3	-0.4	-0.7	-0.8	-0.5	-0.4

DESCRIPTION OF MITIGATION OPTIONS

MITIGATION OPTION T1: Convert all B-737(200) operations to B-737(300) operations, and all DC-9(30) operations to MD82 operations.

MITIGATION OPTION T2: Convert all B-737(200) operations to B-737(300) operations, and all DC-9(30) operations to DC-9(30) (HUSH KIT) operations.

MITIGATION OPTION T3: Convert all B-737(200) nighttime operations to B-737(300) nighttime operations, and all DC-9(30) nighttime operations to DC-9(30) (HUSH KIT) nighttime operations.

MITIGATION OPTION T4: Convert all B-737(200) and DC-9(30) nighttime operations to daytime operations.

MITIGATION OPTION T5: Convert 75% of DC-9(30) daytime and nighttime operations to DC-9(30) (HUSH KIT) operations.

MITIGATION OPTION T6: Use non-extended (existing) RWY 02 threshold for interisland and GA aircraft departures from RWY 02.

MITIGATION OPTION T7: Use early power cutback at 800 ft. for B-737(200) and DC-9(30).

MITIGATION OPTION T8: During trade winds, convert daytime arrivals and departures from 88% to 94.8% and nighttime arrivals and departures from 80% to 97.5% for all jets. During Kona winds, convert daytime arrivals and departures from 12.8% to 5.8% and nighttime arrivals and departures from 20% to 2.5% for all jets.

MITIGATION OPTION T9: Convert all nighttime operations to daytime operations.

MITIGATION OPTION T10: Convert all nighttime departures to daytime departures.

MITIGATION OPTION T11: Convert B-737(200) operations between 10:00 pm and 6:00 am to B-737(300) operations.

TABLE E – 6

CHANGES IN LDN AT MEASUREMENT STATIONS FROM MITIGATION OPTIONS T1 THRU T11 (USING CALIBRATED INM VERSION 4.11)

	A	B	C	D	E	F	G	J	K	M	S	T	U	V
	NOISE MEASUREMENT LOCATIONS AT OGG													
CY 1993 (BASE YEAR)	78.2	66.1	60.4	60.0	66.5	60.2	54.8	62.9	50.7	70.8	62.4	57.2	52.5	62.1
CY 1998 (NO MITIGATION)	77.8	66.2	60.4	59.4	69.1	61.3	57.5	62.0	50.2	72.5	62.6	57.5	52.9	64.2
CHANGE FROM BASE YEAR	-0.4	0.1	0.0	-0.6	2.6	1.1	2.7	-0.9	-0.5	1.7	0.2	0.3	0.4	2.1
OPTION T1	71.1	56.8	53.5	54.7	67.0	58.9	52.0	58.4	47.0	63.9	58.5	54.2	49.2	58.2
OPTION T1 MINUS CY 1998 (NO MIT.)	-6.7	-9.4	-6.9	-4.7	-2.1	-2.4	-5.5	-3.6	-3.2	-8.6	-4.1	-3.3	-3.7	-6.0
OPTION T2	73.4	62.1	56.4	56.0	67.2	59.2	53.6	59.3	47.8	68.2	59.0	54.7	49.8	60.1
OPTION T2 MINUS CY 1998 (NO MIT.)	-4.4	-4.1	-4.0	-3.4	-1.9	-2.1	-3.9	-2.7	-2.4	-4.3	-3.6	-2.8	-3.1	-4.1
OPTION T3	76.5	65.0	59.2	58.3	68.4	60.6	56.2	61.0	49.4	71.3	61.0	56.3	51.5	62.7
OPTION T3 MINUS CY 1998 (NO MIT.)	-1.3	-1.2	-1.2	-1.1	-0.7	-0.7	-1.3	-1.0	-0.8	-1.2	-1.6	-1.2	-1.4	-1.5
OPTION T4	76.1	64.7	58.9	58.0	68.1	60.1	55.7	60.7	49.1	70.9	60.6	55.8	50.9	62.3
OPTION T4 MINUS CY 1998 (NO MIT.)	-1.7	-1.5	-1.5	-1.4	-1.0	-1.2	-1.8	-1.3	-1.1	-1.6	-2.0	-1.7	-2.0	-1.9
OPTION T5	76.0	64.4	58.7	57.9	68.0	60.0	55.9	60.9	49.2	70.8	61.4	56.2	51.5	62.6
OPTION T5 MINUS CY 1998 (NO MIT.)	-1.8	-1.8	-1.7	-1.5	-1.1	-1.3	-1.6	-1.1	-1.0	-1.7	-1.2	-1.3	-1.4	-1.6
OPTION T6	78.7	66.6	60.9	60.5	69.1	61.3	55.4	63.3	51.0	71.2	62.6	57.5	52.9	62.7
OPTION T6 MINUS CY 1998 (NO MIT.)	0.9	0.4	0.5	1.1	0.0	0.0	-2.1	1.3	0.8	-1.3	0.0	0.0	0.0	-1.5
OPTION T7	76.6	64.9	59.7	59.3	69.3	61.4	57.3	61.7	50.2	70.7	64.0	57.7	52.8	63.7
OPTION T7 MINUS CY 1998 (NO MIT.)	-1.2	-1.3	-0.7	-0.1	0.2	0.1	-0.2	-0.3	0.0	-1.8	1.4	0.2	-0.1	-0.5
OPTION T8	77.6	66.6	60.8	59.8	69.1	61.1	56.6	61.3	50.4	72.9	58.7	55.2	49.5	62.6
OPTION T8 MINUS CY 1998 (NO MIT.)	-0.2	0.4	0.4	0.4	0.0	-0.2	-0.9	-0.7	0.2	0.4	-3.9	-2.3	-3.4	-1.6
OPTION T9	75.7	64.3	58.4	57.3	67.2	59.3	55.2	59.9	48.3	70.6	59.8	54.9	50.0	61.9
OPTION T9 MINUS CY 1998 (NO MIT.)	-2.1	-1.9	-2.0	-2.1	-1.9	-2.0	-2.3	-2.1	-1.9	-1.9	-2.8	-2.6	-2.9	-2.3
OPTION T10	75.7	64.4	58.5	57.7	68.8	60.8	55.4	60.3	48.7	70.6	60.1	55.8	50.6	61.9
OPTION T10 MINUS CY 1998 (NO MIT.)	-2.1	-1.8	-1.9	-1.7	-0.3	-0.5	-2.1	-1.7	-1.5	-1.9	-2.5	-1.7	-2.3	-2.3
OPTION T11	77.5	66.0	60.1	59.1	69.0	61.2	57.2	61.7	50.0	72.2	62.1	57.2	52.5	63.9
OPTION T11 MINUS CY 1998 (NO MIT.)	-0.3	-0.2	-0.3	-0.3	-0.1	-0.1	-0.3	-0.3	-0.2	-0.3	-0.5	-0.3	-0.4	-0.3

DESCRIPTION OF MITIGATION OPTIONS

MITIGATION OPTION T1: Convert all B-737(200) operations to B-737(300) operations, and all DC-9(30) operations to MD82 operations.

MITIGATION OPTION T2: Convert all B-737(200) operations to B-737(300) operations, and all DC-9(30) operations to DC-9(30) (HUSH KIT) operations.

MITIGATION OPTION T3: Convert all B-737(200) nighttime operations to B-737(300) nighttime operations, and all DC-9(30) nighttime operations to DC-9(30) (HUSH KIT) nighttime operations.

MITIGATION OPTION T4: Convert all B-737(200) and DC-9(30) nighttime operations to daytime operations.

MITIGATION OPTION T5: Convert 75% of DC-9(30) daytime and nighttime operations to DC-9(30) (HUSH KIT) operations.

MITIGATION OPTION T6: Use non-extended (existing) RWY 02 threshold for interisland and GA aircraft departures from RWY 02.

MITIGATION OPTION T7: Use early power cutback at 800 ft. for B-737(200) and DC-9(30).

MITIGATION OPTION T8: During trade winds, convert daytime arrivals and departures from 88% to 94.8% and nighttime arrivals and departures from 80% to 97.5% for all jets. During Kona winds, convert daytime arrivals and departures from 12.8% to 5.8% and nighttime arrivals and departures from 20% to 2.5% for all jets.

MITIGATION OPTION T9: Convert all nighttime operations to daytime operations.

MITIGATION OPTION T10: Convert all nighttime departures to daytime departures.

MITIGATION OPTION T11: Convert B-737(200) operations between 10:00 pm and 6:00 am to B-737(300) operations.

TABLE E - 7

COMPARISON OF LDN AT MEASUREMENT STATIONS USING STANDARD AND CALIBRATED INM VERSION 4.11

	****** NOISE MEASUREMENT LOCATIONS AT OGG ******													
	A	B	C	D	E	F	G	J	K	M	S	T	U	V
CY 1993 (BASE YEAR, STD)	78.1	65.9	60.3	59.8	65.1	58.8	54.5	62.6	60.5	70.6	61.8	56.4	62.0	62.0
CY 1993 (BASE YEAR, CAL.)	78.2	66.1	60.4	60.0	66.5	60.2	54.8	62.9	60.7	70.8	62.4	57.2	62.5	62.1
CAL. MINUS STD.	0.1	0.2	0.1	0.2	1.4	1.8	0.3	0.3	0.2	0.2	0.6	0.8	0.5	0.1
CY 1993 (NO MIT., STD)	77.7	66.1	60.3	60.2	66.6	58.8	67.2	61.2	49.8	72.5	61.8	56.4	52.2	64.1
CY 1993 (NO MIT., CAL.)	77.8	66.2	60.4	60.4	69.1	61.3	67.5	62.0	50.2	72.5	62.6	57.5	52.9	64.2
CAL. MINUS STD.	0.1	0.1	0.1	0.2	2.5	2.4	0.3	0.8	0.3	0.0	0.8	1.1	0.7	0.1
OPTION T1 (STD)	68.0	58.0	50.6	52.4	63.9	55.9	48.8	54.9	45.5	63.2	55.3	61.2	46.2	55.3
OPTION T1 (CAL.)	71.1	60.8	53.5	54.7	67.0	58.9	52.0	58.4	47.0	66.0	58.5	64.2	49.2	58.2
CAL. MINUS STD	3.1	2.8	2.9	2.3	3.1	3.0	3.2	3.5	1.5	2.7	3.2	3.0	3.0	2.9
OPTION T2 (STD)	72.3	61.0	64.2	54.8	63.8	55.9	52.1	57.0	46.7	67.2	56.5	52.0	47.4	58.9
OPTION T2 (CAL.)	73.4	62.1	65.4	56.0	67.2	58.2	53.6	59.3	47.8	68.2	59.0	54.7	49.8	60.1
CAL. MINUS STD	1.1	1.1	1.2	1.2	3.4	2.3	1.5	2.3	1.1	1.0	2.5	2.7	2.4	1.2
OPTION T3 (STD)	76.2	64.8	57.9	57.9	65.6	57.7	55.5	59.7	48.8	71.0	59.6	54.8	50.2	62.3
OPTION T3 (CAL.)	76.5	65.0	58.2	58.3	68.4	60.6	56.2	61.0	49.4	71.3	61.0	56.2	51.5	62.7
CAL. MINUS STD.	0.3	0.2	0.3	0.4	2.9	2.9	0.7	1.3	0.6	0.3	1.4	1.8	1.3	0.4
OPTION T4 (STD)	75.9	64.5	57.6	57.6	65.2	57.3	55.2	59.4	48.6	70.7	59.2	54.1	49.7	61.9
OPTION T4 (CAL.)	76.1	64.7	57.9	58.0	68.1	60.1	55.7	60.7	49.1	70.9	60.6	55.8	50.9	62.3
CAL. MINUS STD.	0.2	0.2	0.3	0.4	2.9	2.8	0.5	1.3	0.5	0.2	1.4	1.7	1.2	0.4
OPTION T5 (STD)	75.5	64.0	57.2	57.4	65.8	57.8	55.2	59.5	48.5	70.4	60.3	54.8	50.4	62.1
OPTION T5 (CAL.)	76.0	64.4	57.7	57.9	68.0	60.0	55.9	60.9	49.2	70.8	61.4	56.2	51.5	62.6
CAL. MINUS STD.	0.5	0.4	0.5	0.5	2.2	2.2	0.7	1.4	0.7	0.4	1.1	1.8	1.1	0.5
OPTION T6 (STD)	76.6	60.4	59.8	60.3	66.6	58.8	54.9	62.6	50.7	71.0	61.8	56.4	52.2	62.5
OPTION T6 (CAL.)	76.7	60.6	59.9	60.5	69.1	61.3	55.4	63.3	51.0	71.2	62.6	57.5	52.9	62.7
CAL. MINUS STD.	0.1	0.2	0.1	0.2	2.5	2.5	0.5	0.7	0.3	0.2	0.8	1.1	0.7	0.2
OPTION T7 (STD)	76.3	64.6	58.4	58.0	67.1	59.2	56.9	60.7	49.8	70.4	63.6	56.7	52.1	63.4
OPTION T7 (CAL.)	76.6	64.9	58.7	58.3	69.3	61.4	57.3	61.7	50.2	70.7	64.0	57.7	52.8	63.7
CAL. MINUS STD.	0.3	0.3	0.3	0.3	2.2	2.2	0.4	1.0	0.4	0.3	0.4	1.0	0.7	0.3
OPTION T8 (STD)	77.6	66.6	60.6	59.6	66.6	59.3	56.2	60.3	50.1	72.8	57.4	63.3	48.1	62.5
OPTION T8 (CAL.)	77.6	66.6	60.8	59.8	69.1	61.1	56.6	61.3	50.4	72.9	58.7	64.2	49.5	62.8
CAL. MINUS STD.	0.0	0.0	0.2	0.2	2.6	2.0	0.4	1.0	0.3	0.1	1.3	1.9	1.4	0.3
OPTION T9 (STD)	75.8	64.2	57.4	57.2	64.5	55.6	55.1	58.8	48.0	70.8	59.0	63.7	49.4	61.8
OPTION T9 (CAL.)	75.7	64.2	57.4	57.3	67.2	59.3	55.2	59.9	48.3	70.8	59.8	64.9	50.0	61.8
CAL. MINUS STD.	-0.1	0.0	0.0	0.1	2.7	3.7	0.1	1.1	0.3	0.0	0.8	1.2	0.6	0.0
OPTION T10 (STD)	75.8	64.4	57.5	57.5	66.2	58.2	55.1	60.2	48.4	70.8	60.2	54.3	48.6	61.9
OPTION T10 (CAL.)	75.7	64.4	57.5	57.7	68.8	60.6	55.4	60.3	48.7	70.8	60.1	55.8	49.6	61.9
CAL. MINUS STD.	-0.1	0.0	0.0	0.2	2.6	2.6	0.3	1.1	0.3	0.0	0.0	1.5	0.6	0.0
OPTION T11 (STD)	77.4	65.8	59.9	59.9	66.2	58.5	56.8	60.8	49.6	72.1	61.1	55.8	51.7	63.7
OPTION T11 (CAL.)	77.5	66.0	60.1	60.1	69.0	61.2	57.2	61.7	50.0	72.2	62.1	57.2	52.5	63.9
CAL. MINUS STD.	0.1	0.2	0.2	0.2	2.8	2.7	0.4	0.9	0.4	0.1	1.0	1.4	0.8	0.2

DESCRIPTION OF MITIGATION OPTIONS

MITIGATION OPTION T1: Convert all B-737(200) operations to B-737(300) operations, and all DC-9(50) operations to MD82 operations.

MITIGATION OPTION T2: Convert all B-737(200) operations to B-737(300) operations, and all DC-9(50) operations to DC-9(50) (HUSH KIT) operations.

MITIGATION OPTION T3: Convert all B-737(200) nighttime operations to B-737(300) nighttime operations, and all DC-9(50) nighttime operations to DC-9(50) (HUSH KIT) nighttime operations.

MITIGATION OPTION T4: Convert all B-737(200) and DC-9(50) nighttime operations to daytime operations.

MITIGATION OPTION T5: Convert 75% of DC-9(50) daytime and nighttime operations to DC-9(50) (HUSH KIT) operations.

MITIGATION OPTION T6: Use non-extended (existing) RWY 02 threshold for Interisland and GA aircraft departures from RWY 02.

MITIGATION OPTION T7: Use early power cutback at 800 ft. for B-737(200) and DC-9(50).

MITIGATION OPTION T8: During trade winds, convert daytime arrivals and departures from 88% to 94.5% and nighttime arrivals and departures from 80% to 87.5% for [illegible] During Kona winds, convert daytime arrivals and departures from 12.5% to 5.5% and nighttime arrivals and departures from 20% to 2.5% for [illegible]

MITIGATION OPTION T9: Convert all nighttime operations to daytime operations.

MITIGATION OPTION T10: Convert all nighttime departures to daytime departures.

MITIGATION OPTION T11: Convert B-737(200) operations between 10:00 pm and 6:00 am to B-737(300) operations.

Table E-8. Evaluation of Possible Errors In Base Year (1993) Noise Contours Attributable to Reduced Excess Ground Attenuation Effects: Kahului Airport.

	******** Ldn From Calibrated INM Grid Output ********								
Site	Total	All Rear Departure Events	All Air-To-Ground Events	Day Rear Departure Events	Night Rear Departure Events	Day Rear Departure Events Plus Ldn Corr.*	Night Rear Departure Events Plus Ldn Corr.*	Adjusted Total Ldn	Difference Between Model and Adjusted Total Ldn
A**	78.2	70.4	77.4	66.2	68.3	66.2	68.3	78.2	0.0
B***	66.1	50.9	66.0	48.7	48.8	51.7	59.8	67.0	0.9
C***	59.4	45.0	59.2	40.9	42.9	45.9	53.9	60.5	1.1
D***	60.0	43.0	59.9	38.8	40.9	43.8	51.9	60.6	0.6
E***	66.5	43.4	66.5	40.7	40.1	45.7	51.1	66.6	0.1
F***	60.2	40.1	60.2	37.4	36.8	42.4	47.8	60.5	0.3
G***	54.8	48.3	53.7	45.6	45.0	50.6	56.0	58.7	3.9
J**	62.9	60.5	59.2	57.8	57.2	57.8	57.2	62.9	0.0
K***	50.7	36.8	50.5	32.7	34.7	37.7	45.7	51.9	1.2
M**	70.8	59.1	70.5	55.1	56.9	55.1	56.9	70.8	0.0
S***	62.4	41.8	62.4	39.1	38.5	44.1	49.5	62.6	0.2
T***	57.2	34.8	57.2	31.9	31.3	33.9	42.3	57.4	0.2
U***	52.5	28.0	52.5	25.4	24.5	30.4	35.5	52.6	0.1
V***	62.1	54.6	61.2	51.8	51.4	56.8	62.4	65.5	3.4

* See notes below for amount of daytime and nighttime correction assumed.
** No Ldn Correction added to daytime or nighttime model outputs.
*** 5 Ldn and 11 Ldn added to daytime and nighttime model outputs, respectively.

Table E-9. Evaluation of Possible Errors in CY 1998 (No Mitigation) Noise Contours Attributable to Reduced Excess Ground Attenuation Effects: Kahului Airport.

	******** Ldn From Calibrated INM Grid Output ********								
Site	Total	All Rear Departure Events	All Air-To-Ground Events	Day Rear Departure Events	Night Rear Departure Events	Day Rear Departure Events Plus Ldn Corr.*	Night Rear Departure Events Plus Ldn Corr.*	Adjusted Total Ldn	Difference Between Model and Adjusted Total Ldn
A**	77.8	70.6	76.9	67.0	68.1	67.0	68.1	77.8	0.0
B***	66.2	51.2	66.1	47.0	48.7	52.6	59.7	67.1	0.9
C***	59.4	45.5	59.2	41.0	43.0	46.9	54.0	60.6	1.2
D***	59.4	43.4	59.3	39.0	40.6	44.9	51.8	60.1	0.7
E***	69.1	47.0	69.1	44.7	43.1	49.7	54.1	69.3	0.2
F***	61.3	43.5	61.2	41.2	39.6	46.2	50.6	61.7	0.4
G***	57.5	54.9	54.0	52.5	51.2	57.5	62.2	63.9	6.4
J**	62.0	58.4	59.5	56.2	54.4	56.2	54.4	62.0	0.0
K***	50.2	37.7	49.9	34.6	34.8	39.6	45.8	51.6	1.4
M**	72.5	59.5	72.3	55.9	57.0	55.9	57.0	72.5	0.0
S***	62.6	45.7	62.5	43.4	41.6	48.4	52.6	63.1	0.5
T***	57.5	37.5	57.5	35.3	33.5	40.3	44.5	57.7	0.2
U***	52.9	30.4	52.9	28.4	26.1	33.4	37.1	53.0	0.1
V***	64.2	60.6	61.7	58.3	56.7	63.3	67.7	69.8	5.6

* See notes below for amount of daytime and nighttime correction assumed.
** No Ldn Correction added to daytime or nighttime model outputs.
*** 5 Ldn and 11 Ldn added to daytime and nighttime model outputs, respectively.

Table E-10 Comparison of Areas Enclosed by Base Year (1993) and 1998 Ldn Contours.

STUDY CONTOUR SET	Area (Sq. Miles) Enclosed by Contour 75 Ldn	70 Ldn	65 Ldn	60 Ldn	55 Ldn
CY 1993, Standard Version 4.11	1.24	2.53	5.41	12.34	28.31
CY 1993, Calibrated Version 4.11	1.27	2.63	5.71	13.14	30.06
CY 1998 (No Mitigation), Standard Version 4.11	1.37	2.58	5.39	12.75	29.34
CY 1998 (No Mitigation), Calibrated Version 4.11	1.39	2.72	5.87	13.98	32.17
CY 1998 (Mitigation Option T1), Standard Version 4.11	0.48	0.78	1.75	3.97	10.31
CY 1998 (Mitigation Option T1), Calibrated Version 4.11	0.59	1.23	2.68	6.62	16.40
CY 1998 (Mitigation Option T2) Standard Version 4.11	0.59	1.36	2.63	5.72	13.87
CY 1998 (Mitigation Option T2) Calibrated Version 4.11	0.72	1.62	3.31	7.96	19.03
CY 1998 (Mitigation Option T3) Standard Version 4.11	1.09	2.13	4.37	9.88	22.90
CY 1998 (Mitigation Option T3) Calibrated Version 4.11	1.16	2.30	4.89	11.58	26.74
CY 1998 (Mitigation Option T4) Standard Version 4.11	1.03	2.05	4.19	9.38	21.88
CY 1998 (Mitigation Option T4) Calibrated Version 4.11	1.10	2.20	4.62	10.86	25.03
CY 1998 (Mitigation Option T5) Standard Version 4.11	0.98	2.01	4.15	9.43	21.87
CY 1998 (Mitigation Option T5) Calibrated Version 4.11	1.08	2.19	4.65	10.98	25.44
CY 1998 (Mitigation Option T6) Standard Version 4.11	1.41	2.74	5.77	13.26	29.95
CY 1998 (Mitigation Option T6) Calibrated Version 4.11	1.46	2.89	6.24	14.45	32.89
CY 1998 (Mitigation Option T7) Standard Version 4.11	1.26	2.61	5.52	12.67	28.96
CY 1998 (Mitigation Option T7) Calibrated Version 4.11	1.30	2.76	5.97	13.89	31.79

Table E–10 (Continued) Comparison of Areas Enclosed by Base Year (1993) and 1998 Ldn Contours.

STUDY CONTOUR SET	Area (Sq. Miles) Enclosed by Contour				
	75 Ldn	70 Ldn	65 Ldn	60 Ldn	55 Ldn
CY 1998 (Mitigation Option T8) Standard Version 4.11	1.37	2.56	5.29	12.62	28.51
CY 1998 (Mitigation Option T8) Calibrated Version 4.11	1.41	2.69	5.79	13.84	31.44
CY 1998 (Mitigation Option T9) Standard Version 4.11	1.00	2.00	4.07	8.96	20.71
CY 1998 (Mitigation Option T9) Calibrated Version 4.11	1.01	2.06	4.27	9.82	22.48
CY 1998 (Mitigation Option T10) Standard Version 4.11	1.01	2.04	4.16	9.38	21.63
CY 1998 (Mitigation Option T10) Calibrated Version 4.11	1.04	2.11	4.46	10.33	23.65
CY 1998 (Mitigation Option T11) Standard Version 4.11	1.30	2.45	5.09	11.98	27.50
CY 1998 (Mitigation Option T11) Calibrated Version 4.11	1.33	2.60	5.59	13.37	30.75

Appendix F

FAA INM Input Data Listing

1993 INM Input File

```
BEGIN.

SETUP:

 TITLE <1993 BASE YEAR STANDARD VER 4.11>
 AIRPORT <KAHULUI, MAUI>
 ALTITUDE 53
 TEMPERATURE 75 F
FT.

 RUNWAYS
  RW 02-20       0     0 TO 6995     0
  RW 05-23    2544  2098 TO 6875  -441
  RW 03R-21L   926  -750 TO 1120  -750
  RW 03L-21R  4024  2010 TO 4184  1900

AIRCRAFT:

 TYPES
  AC DC1010
  AC DC1030
  AC MD11GE
  AC MD11PW
  AC 747400
  AC 747200
  AC L1011
  AC A310
  AC 767CF6
  AC 767JT9
  AC 757RR
  AC 757PW
  AC 737
  AC 737300
  AC 737400
  AC DC950
  AC L10115
  AC L188
  AC DC8QN
  AC DHC7
  AC DC3
  AC DHC6
  AC CNA441
  AC HS748A
```



```
  AC SD330
  AC BEC58P
  AC GASEPV
  AC GASEPF
  AC 707320
  AC C130
  AC COMJET

  AC P3     CURVE=P3 PARAM= AP81  STAGE 1=TOP304
        CATEGORY= PMIL

  AC S76      CURVE=NS76 PARAM=HS76 STAGE 1=HFLT
          CATEGORY=PGA

  AC H500D    CURVE=N50D PARAM=H50D STAGE 1=HFLT
          CATEGORY=PGA

  AC B206L    CURVE=N206 PARAM=206L STAGE 1=HFLT
          CATEGORY=PGA

  AC SA350D   CURVE=SA35 PARAM=A350 STAGE 1=HFLT
          CATEGORY=PGA

  AC CH47  CURVE=CH47 PARAM= HS76  STAGE 1= HFLT
        CATEGORY= PGA

NOISE CURVES

  NC P3       2 BY 10  2 BY 10
   EPNL
   THRUSTS     28      100
      200    103.1    112.7
      400     98      107.1
      630     94.3    104.8
     1000     90.2    101.3
     2000     83.4     95.5
     4000     76       88.7
     6300     70.3     82.9
    10000     64.1     76.7
    16000     57.4     70.7
    25000     49.3     63.9
```

```
SEL
  THRUSTS      28      100
     200     96.5    106.1
     400     91.9    101.2
     630     88.7     97.8
    1000     85.5     94.1
    2000     80.3     88.5
    4000     74.9     82.6
    6300     71.0     78.6
   10000     67.0     74.3
   16000     62.6     69.5
   25000     57.6     63.9

NC NS76         3 BY 8  3 BY 8
EPNL
THRUSTS    1       2       3
   200  94.0    94.1    95.6
   400  90.6    90.6    92.4
   600  88.1    88.1    90.2
  1000  85.4    85.4    87.9
  2000  80.8    80.6    84.1
  4000  75.1    74.7    79.8
  6000  70.6    70.1    76.4
 10000  65.1    64.8    72.4
SEL
THRUSTS    1       2       3
   200  94.0    94.1    95.6
   400  90.6    90.6    92.4
   600  88.1    88.1    90.2
  1000  85.4    85.4    87.9
  2000  80.8    80.6    84.1
  4000  75.1    74.7    79.8
  6000  70.6    70.1    76.4
 10000  65.1    64.8    72.4

NC N50D         3 BY 8  3 BY 8
EPNL
THRUSTS    1       2       3
   200  89.3    87.4    90.9
   400  86.0    83.9    87.5
   600  83.7    81.6    85.1
  1000  81.2    78.9    82.4
  2000  76.9    74.5    77.8
  4000  71.7    69.1    72.1
```



```
  6000  67.6    65.0    67.4
 10000  62.4    60.0    61.6
SEL
THRUSTS    1       2       3
   200  89.3    87.4    90.9
   400  86.0    83.9    87.5
   600  83.7    81.6    85.1
  1000  81.2    78.9    82.4
  2000  76.9    74.5    77.8
  4000  71.7    69.1    72.1
  6000  67.6    65.0    67.4
 10000  62.4    60.0    61.6

NC N206         3 BY 8  3 BY 8
EPNL
THRUSTS    1       2       3
   200  87.9    88.2    93.1
   400  84.2    84.6    89.8
   600  81.6    82.0    87.5
  1000  78.8    79.1    85.1
  2000  74.1    74.3    81.1
  4000  68.7    68.5    76.3
  6000  64.6    64.1    72.5
 10000  60.0    59.2    68.0
SEL
THRUSTS    1       2       3
   200  87.9    88.2    93.1
   400  84.2    84.6    89.8
   600  81.6    82.0    87.5
  1000  78.8    79.1    85.1
  2000  74.1    74.3    81.1
  4000  68.7    68.5    76.3
  6000  64.6    64.1    72.5
 10000  60.0    59.2    68.0

NC SA35         3 BY 8  3 BY 8
EPNL
THRUSTS    1       2       3
   200  92.5    89.7    94.2
   400  88.8    86.1    90.9
   600  86.4    83.5    88.6
  1000  83.6    80.6    86.1
  2000  78.8    75.7    82.0
  4000  73.0    69.8    77.1
```

```
 6000  68.4   65.2   73.3
 10000 63.0   59.9   68.7
SEL
THRUSTS  1      2      3
 200   92.5   89.7   94.2
 400   88.8   86.1   90.9
 600   86.4   83.5   88.6
 1000  83.6   80.6   86.1
 2000  78.8   75.7   82.0
 4000  73.0   69.8   77.1
 6000  68.4   65.2   73.3
 10000 63.0   59.9   68.7

NC CH47      3 BY 8   3 BY 8
   EPNL
   THRUSTS      1       2       3
      200    93.10   92.07   99.80
      400    89.37   88.27   96.47
      630    86.70   85.63   94.23
      1000   83.77   82.73   91.87
      2000   78.80   77.87   87.93
      4000   72.90   72.30   83.37
      6300   68.40   68.20   79.83
      10000  63.23   63.67   75.57

   SEL
   THRUSTS      1       2       3
      200    93.10   92.07   99.80
      400    89.37   88.27   96.47
      630    86.70   85.63   94.23
      1000   83.77   82.73   91.87
      2000   78.80   77.87   87.93
      4000   72.90   72.30   83.37
      6300   68.40   68.20   79.83
      10000  63.23   63.67   75.57

APPROACH PARAMETERS

 AP HS76  WEIGHT=10000 ENGINE=2 STOP=1
        FINSP= 60 TAXI=30
        LNDFFS=3 LEVAPP=2
 AP H50D  WEIGHT=2550 ENGINE=2 STOP=1
        FINSP= 60 TAXI=30
        LNDFFS=3 LEVAPP=2
```

INM Input File for 1993


```
 AP 206L  WEIGHT=4000 ENGINE=2 STOP=1
        FINSP= 60 TAXI=30
        LNDFFS=3 LEVAPP=2
 AP A350  WEIGHT=4300 ENGINE=2 STOP=1
        FINSP= 60 TAXI=30
        LNDFFS=3 LEVAPP=2


FT.
PROFILES APPROACH

 PF COPTR SEGMENTS=7
DISTANCES   23696    18836    14582    9722    4861      0  0
ALTITUDES    1500     1500     1500    1250    1000      0  0
SPEEDS      FINSP    FINSP    FINSP   FINSP   FINSP   FINSP TAXI
THRUSTS     LEVAPP   LEVAPP   LEVAPP  LNDFFS  LNDFFS  LNDFFS


 PF ALT4D   SEGMENTS=7
DISTANCES   84801.4  41899.4  20448.4  13298.1  -1002.56  REVDS   STOP
ALTITUDES   6000     3000.    1500.    1000.    0.        0.      0.
SPEEDS      TERMSP   INTSP    APPSP    FINSP    LNDSP     REVSP   TAXI
THRUSTS     INTFIS   APPFAS   LNDFFS   LNDFLS   REV       IDLE

ECHO.
FT.

PROFILES TAKEOFF

  PF HFLT SEGMENTS=6 WEIGHT=10000 ENGINES=2
   DISTANCES    0   100   562  4032  5800  99999
   ALTITUDES    0    15    30  1000  1500   1500
   SPEEDS      16    30    60    60   100    100
   THRUSTS      1     1     1     1     2

INT.NM.
TAKEOFFS BY FREQUENCY:
 TRACK TR2 RWY 02 STRAIGHT 4.28 RIGHT 29.04 D 1.36 RIGHT 14.39 D 4.07
  STRAIGHT 8.23
  OPER DC1010        STAGE 3 D=1.31  N=0
```

INM Input File for 1993

```
   OPER DC1030      STAGE 3 D=0.26  N=0
   OPER L1011       STAGE 3 D=0.44  N=0
   OPER L10115      STAGE 3 D=0.11  N=0
   OPER 757PW       STAGE 3 D=0.08  N=0.14
   OPER DC8QN       STAGE 3 D=0.02  N=0
   OPER 737         STAGE 1 D=3.81  N=0.46
   OPER 737300      STAGE 1 D=0.64  N=0.22
   OPER 737400      STAGE 1 D=0.64  N=0.03
   OPER DC950       STAGE 1 D=2.04  N=0.12
   OPER P3          STAGE 1 D=0.80  N=0.01
   OPER 707320      STAGE 1 D=0.27  N=0
   OPER COMJET      STAGE 1 D=0.01  N=0

TRACK TR3 RWY 02 STRAIGHT 2.63 RIGHT 47 D 3.29 STRAIGHT 8.23
   OPER DC8QN       STAGE 1 D=0.02  N=0
   OPER DC3         STAGE 1 D=0.15  N=0
   OPER C130        STAGE 1 D=0.19  N=0
   OPER P3          STAGE 1 D=0.28  N=0
   OPER 707320      STAGE 1 D=0.09  N=0
   OPER COMJET      STAGE 1 D=0.01  N=0.00
   OPER DHC6        STAGE 1 D=0.04  N=0
   OPER CH47        STAGE 1 D=0.55  N=0.00

TRACK TR4 RWY 02 STRAIGHT 1.32 LEFT 30.13 D 1.31 LEFT 35.64 D 3.41
STRAIGHT 2.96
   OPER DC1010      STAGE 1 D=2.70  N=0
   OPER DC1030      STAGE 1 D=0.53  N=0
   OPER L1011       STAGE 1 D=1.33  N=0
   OPER L10115      STAGE 1 D=0.32  N=0
   OPER DC8QN       STAGE 1 D=0.02  N=0
   OPER 737         STAGE 1 D=19.57 N=2.39
   OPER 737300      STAGE 1 D=3.26  N=1.16
   OPER 737400      STAGE 1 D=3.26  N=0.15
   OPER DC950       STAGE 1 D=18.79 N=1.08
   OPER DHC7        STAGE 1 D=0.03  N=0
   OPER DC3         STAGE 1 D=0.36  N=0
   OPER BEC58P      STAGE 1 D=0.28  N=0.09
   OPER DC3         STAGE 1 D=0.14  N=0.04
   OPER BEC58P      STAGE 1 D=0.10  N=0.03
   OPER HS748A      STAGE 1 D=0.08  N=0.02
   OPER SD330       STAGE 1 D=0.04  N=0.01
   OPER CNA441      STAGE 1 D=0.03  N=0.01
   OPER CNA441      STAGE 1 D=0.04  N=0.01
   OPER COMJET      STAGE 1 D=0.01  N=0.00
```



```
   OPER HS748A      STAGE 1 D=0.03  N=0.00
   OPER COMJET      STAGE 1 D=0.01  N=0.00
   OPER C130        STAGE 1 D=0.45  N=0.01
   OPER P3          STAGE 1 D=0.64  N=0.01
   OPER 707320      STAGE 1 D=0.23  N=0
   OPER DHC6        STAGE 1 D=0.01  N=0
   OPER COMJET      STAGE 1 D=0.011 N=0.00
   OPER DHC6        STAGE 1 D=0.09  N=0
   OPER CH47        STAGE 1 D=1.28  N=0.00

TRACK TR6 RWY 02 STRAIGHT 1.81 RIGHT 53.7 D .92 RIGHT 36.28 D .34
RIGHT 57.16 D .43 RIGHT 28.01 D 3.05 STRAIGHT 8.23
   OPER DHC7        STAGE 1 D=0.03  N=0

TRACK TR7 RWY 02 STRAIGHT .64 RIGHT 64.12 D .62 RIGHT 25.87 D .33
RIGHT 68.27 D .16 STRAIGHT 6.58
   OPER DHC7        STAGE 1 D=1.02  N=0

TRACK TR8 RWY 05 STRAIGHT .49 RIGHT 122 D .49 RIGHT 6.71 D 5.24
STRAIGHT 8.23
   OPER DHC6        STAGE 1 D=2.42  N=0.74
   OPER CNA441      STAGE 1 D=0.33  N=0.10
   OPER GASEPF      STAGE 1 D=0.01  N=0.00
   OPER GASEPV      STAGE 1 D=0.09  N=0.01
   OPER GASEPV      STAGE 1 D=0.20  N=0.03
   OPER CNA441      STAGE 1 D=0.20  N=0.01

TRACK TR9 RWY 20 STRAIGHT 1.81 LEFT 53.13 D 1.34 LEFT 36.87 D .82
LEFT 39.45 D 1.08 LEFT 50.52 D 1.08 STRAIGHT 8.23
   OPER DC1010      STAGE 3 D=0.178 N=0
   OPER DC1030      STAGE 3 D=0.035 N=0
   OPER L1011       STAGE 3 D=0.061 N=0
   OPER L10115      STAGE 3 D=0.014 N=0
   OPER 757PW       STAGE 3 D=0.011 N=0.04
   OPER DC8QN       STAGE 3 D=0.007 N=0
   OPER DC3         STAGE 1 D=0.034 N=0
   OPER DHC6        STAGE 1 D=0.22  N=0.12
   OPER C130        STAGE 1 D=0.083 N=0.002
   OPER P3          STAGE 1 D=0.117 N=0.003
   OPER 707320      STAGE 1 D=0.04  N=0.001
   OPER DHC6        STAGE 1 D=0.002 N=0
   OPER DHC6        STAGE 1 D=0.016 N=0
   OPER CH47        STAGE 1 D=0.212 N=0.00
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TRACK TR10 RWY 20 STRAIGHT 8.23
  OPER DC1010      STAGE 1 D=0.037 N=0
  OPER DC1030      STAGE 1 D=0.007 N=0
  OPER L1011       STAGE 1 D=0.016 N=0
  OPER L10115      STAGE 1 D=0.004 N=0
  OPER 737         STAGE 1 D=0.319 N=0.071
  OPER 737300      STAGE 1 D=0.053 N=0.034
  OPER 737400      STAGE 1 D=0.053 N=0.004
  OPER DC950       STAGE 1 D=0.284 N=0.030
  OPER DC3         STAGE 1 D=0.01  N=0
  OPER DHC6        STAGE 1 D=0.10  N=0.06
  OPER C130        STAGE 1 D=0.008 N=0
  OPER P3          STAGE 1 D=0.012 N=0
  OPER 707320      STAGE 1 D=0.004 N=0
  OPER DHC6        STAGE 1 D=0.002 N=0
  OPER CH47        STAGE 1 D=0.024 N=0

TRACK TR11 RWY 05 STRAIGHT .82 LEFT 10 D .02 STRAIGHT 4.94
  OPER DHC6        STAGE 1 D=1.61  N=0.50
  OPER CNA441      STAGE 1 D=0.17  N=0.05
  OPER GASEPF      STAGE 1 D=0.01  N=0.00
  OPER GASEPV      STAGE 1 D=0.04  N=0.01
  OPER GASEPV      STAGE 1 D=0.10  N=0.02
  OPER CNA441      STAGE 1 D=0.10  N=0.00

TRACK TR12 RWY 05 STRAIGHT .74 LEFT 103.03 D .37 LEFT 7.42 D 13.2
STRAIGHT 2.96
  OPER DHC6        STAGE 1 D=4.83  N=1.48
  OPER BEC58P      STAGE 1 D=1.96  N=0.62
  OPER DC3         STAGE 1 D=0.95  N=0.29
  OPER CNA441      STAGE 1 D=2.81  N=0.88
  OPER BEC58P      STAGE 1 D=0.88  N=0.27
  OPER HS748A      STAGE 1 D=0.71  N=0.22
  OPER SD330       STAGE 1 D=0.32  N=0.10
  OPER CNA441      STAGE 1 D=0.25  N=0.08
  OPER CNA441      STAGE 1 D=0.36  N=0.11
  OPER GASEPF      STAGE 1 D=0.13  N=0.02
  OPER GASEPV      STAGE 1 D=0.78  N=0.12
  OPER GASEPV      STAGE 1 D=1.72  N=0.26
  OPER BEC58P      STAGE 1 D=1.50  N=0.06
  OPER GASEPV      STAGE 1 D=2.79  N=0.11
  OPER GASEPF      STAGE 1 D=5.68  N=0.22
  OPER CNA441      STAGE 1 D=1.70  N=0.07
  OPER COMJET      STAGE 1 D=0.13  N=0.01
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  OPER HS748A      STAGE 1 D=0.39  N=0.01
  OPER COMJET      STAGE 1 D=0.09  N=0.00

TRACK TR13 RWY 23 STRAIGHT .84 RIGHT 46.7 D 1.02 RIGHT 39.6 D 3.04
STRAIGHT 2.47
  OPER BEC58P      STAGE 1 D=0.30  N=0.18
  OPER DC3         STAGE 1 D=0.15  N=0.08
  OPER CNA441      STAGE 1 D=0.45  N=0.26
  OPER BEC58P      STAGE 1 D=0.13  N=0.08
  OPER HS748A      STAGE 1 D=0.11  N=0.06
  OPER SD330       STAGE 1 D=0.05  N=0.03
  OPER CNA441      STAGE 1 D=0.04  N=0.02
  OPER CNA441      STAGE 1 D=0.05  N=0.03
  OPER GASEPF      STAGE 1 D=0.02  N=0.01
  OPER GASEPV      STAGE 1 D=0.12  N=0.03
  OPER GASEPV      STAGE 1 D=0.28  N=0.08
  OPER BEC58P      STAGE 1 D=0.20  N=0.01
  OPER GASEPV      STAGE 1 D=0.38  N=0.02
  OPER GASEPF      STAGE 1 D=0.78  N=0.03
  OPER CNA441      STAGE 1 D=0.27  N=0.01
  OPER COMJET      STAGE 1 D=0.02  N=0.00
  OPER HS748A      STAGE 1 D=0.06  N=0.00
  OPER COMJET      STAGE 1 D=0.01  N=0.00

TRACK TR29 RWY 20 STRAIGHT 4.12 LEFT 12.48 D 4.95 LEFT 5.53 D 10.96
STRAIGHT 7.41
  OPER DHC7        STAGE 1 D=0.07  N=0

TRACK T31A RWY 20 STRAIGHT 1.18 LEFT 15 D .66 STRAIGHT 49.37
  OPER DC1010      STAGE 1 D=0.11  N=0
  OPER DC1030      STAGE 1 D=0.021 N=0
  OPER L1011       STAGE 1 D=0.049 N=0
  OPER L10115      STAGE 1 D=0.012 N=0
  OPER 737         STAGE 1 D=0.947 N=0.211
  OPER 737300      STAGE 1 D=0.168 N=0.102
  OPER 737400      STAGE 1 D=0.158 N=0.013
  OPER DC950       STAGE 1 D=0.844 N=0.089
  OPER DHC7        STAGE 1 D=0.02  N=0
  OPER DHC6        STAGE 1 D=0.29  N=0.17
  OPER C130        STAGE 1 D=0.025 N=0.001
  OPER P3          STAGE 1 D=0.035 N=0.001
  OPER 707320      STAGE 1 D=0.012 N=0
  OPER DHC6        STAGE 1 D=0.001 N=0
  OPER COMJET      STAGE 1 D=0.001 N=0
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OPER DHC6         STAGE 1 D=0.005 N=0
OPER CH47         STAGE 1 D=0.069 N=0.00

TRACK T31B RWY 20 STRAIGHT 1.48 LEFT 14 D .66 STRAIGHT 49.37
 OPER DC1010      STAGE 1 D=0.113 N=0
 OPER DC1030      STAGE 1 D=0.022 N=0
 OPER L1011       STAGE 1 D=0.05 N=0
 OPER L10115      STAGE 1 D=0.012 N=0
 OPER 737         STAGE 1 D=0.976 N=0.217
 OPER 737300      STAGE 1 D=0.163 N=0.105
 OPER 737400      STAGE 1 D=0.163 N=0.013
 OPER DC950       STAGE 1 D=0.869 N=0.091
 OPER DHC7        STAGE 1 D=0.02 N=0
 OPER DC3         STAGE 1 D=0.01 N=0
 OPER DHC6        STAGE 1 D=0.29 N=0.17
 OPER C130        STAGE 1 D=0.025 N=0.001
 OPER P3          STAGE 1 D=0.036 N=0.001
 OPER 707320      STAGE 1 D=0.012 N=0
 OPER DHC6        STAGE 1 D=0.001 N=0
 OPER COMJET      STAGE 1 D=0.001 N=0
 OPER DHC6        STAGE 1 D=0.005 N=0
 OPER CH47        STAGE 1 D=0.070 N=0

TRACK T31C RWY 20 STRAIGHT 1.04 LEFT 15 D .66 STRAIGHT 49.37
 OPER DC1010      STAGE 1 D=0.110 N=0
 OPER DC1030      STAGE 1 D=0.021 N=0
 OPER L1011       STAGE 1 D=0.049 N=0
 OPER L10115      STAGE 1 D=0.012 N=0
 OPER 737         STAGE 1 D=0.947 N=0.211
 OPER 737300      STAGE 1 D=0.158 N=0.102
 OPER 737400      STAGE 1 D=0.158 N=0.013
 OPER DC950       STAGE 1 D=0.844 N=0.089
 OPER DHC7        STAGE 1 D=0.02 N=0
 OPER DC3         STAGE 1 D=0.01 N=0
 OPER DHC6        STAGE 1 D=0.29 N=0.17
 OPER C130        STAGE 1 D=0.026 N=0.001
 OPER P3          STAGE 1 D=0.035 N=0.001
 OPER 707320      STAGE 1 D=0.012 N=0
 OPER DHC6        STAGE 1 D=0.001 N=0
 OPER COMJET      STAGE 1 D=0.001 N=0
 OPER DHC6        STAGE 1 D=0.005 N=0
 OPER CH47        STAGE 1 D=0.069 N=0
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TRACK T58A RWY 03L STRAIGHT .03 LEFT 201 D .25 RIGHT 60 D .25
STRAIGHT 1.31 RIGHT 34 D 1.07 STRAIGHT 8.23
 OPER SA350D      STAGE 1 D=2.37 N=0.02
 OPER B206L       STAGE 1 D=1.27 N=0.01
 OPER H500D       STAGE 1 D=0.76 N=0.01
 OPER H500D       STAGE 1 D=0.28 N=0.00

TRACK T58B RWY 03L STRAIGHT .03 LEFT 201 D .25 STRAIGHT .33     RIGHT
44 D .25 STRAIGHT .58 RIGHT 52 D 1.23 STRAIGHT 8.23
 OPER SA350D      STAGE 1 D=4.74 N=0.05
 OPER B206L       STAGE 1 D=2.55 N=0.03
 OPER H500D       STAGE 1 D=1.52 N=0.02
 OPER H500D       STAGE 1 D=0.01 N=0.00
 OPER H500D       STAGE 1 D=0.55 N=0.01

TRACK T58C RWY 03L STRAIGHT .03 LEFT 180 D .25 RIGHT 60 D .25
STRAIGHT .82 RIGHT 12 D 1.07 STRAIGHT 8.23
 OPER SA350D      STAGE 1 D=2.37 N=0.02
 OPER B206L       STAGE 1 D=1.27 N=0.01
 OPER H500D       STAGE 1 D=0.76 N=0.01
 OPER H500D       STAGE 1 D=0.28 N=0.00

TRACK T54A RWY 03R STRAIGHT .03 RIGHT 123 D .13 STRAIGHT 8.23
 OPER SA350D      STAGE 1 D=7.11 N=0.07
 OPER B206L       STAGE 1 D=3.82 N=0.04
 OPER H500D       STAGE 1 D=2.27 N=0.02
 OPER H500D       STAGE 1 D=0.01 N=0.00
 OPER H500D       STAGE 1 D=0.83 N=0.01

TRACK T54B RWY 03R STRAIGHT .03 RIGHT 116 D .25 STRAIGHT 8.23
 OPER SA350D      STAGE 1 D=14.21 N=0.14
 OPER B206L       STAGE 1 D=7.64 N=0.08
 OPER H500D       STAGE 1 D=4.55 N=0.05
 OPER H500D       STAGE 1 D=0.03 N=0.00
 OPER H500D       STAGE 1 D=1.65 N=0.03

TRACK T54C RWY 03R STRAIGHT .03 RIGHT 105 D .3 STRAIGHT 8.23
 OPER SA350D      STAGE 1 D=7.11 N=0.07
 OPER B206L       STAGE 1 D=3.82 N=0.04
 OPER H500D       STAGE 1 D=2.27 N=0.02
 OPER H500D       STAGE 1 D=0.01 N=0.00
 OPER H500D       STAGE 1 D=0.83 N=0.01
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TRACK TR55 RWY 03R STRAIGHT .03 RIGHT 136 D .13 STRAIGHT 8.23
  OPER SA350D        STAGE 1 D=9.48  N=0.10
  OPER B206L         STAGE 1 D=5.09  N=0.05
  OPER H500D         STAGE 1 D=3.03  N=0.03
  OPER H500D         STAGE 1 D=0.02  N=0.00
  OPER H500D         STAGE 1 D=1.10  N=0.02

LANDINGS BY FREQUENCY:
 TRACK TR1R RWY 20 STRAIGHT 8.23
  OPER DC1010        PROF ALT4D D=0.27  N=0
  OPER DC1030        PROF ALT4D D=0.05  N=0
  OPER L1011         PROF ALT4D D=0.21  N=0
  OPER L10115        PROF ALT4D D=0.05  N=0
  OPER 757PW         PROF ALT4D D=0.01  N=0.04
  OPER 737           PROF ALT4D D=0.52  N=0.116
  OPER 737300        PROF ALT4D D=0.09  N=0.06
  OPER 737400        PROF ALT4D D=0.09  N=0.01
  OPER DC950         PROF ALT4D D=0.28  N=0.03
  OPER DHC7          PROF ALT4D D=0.08  N=0
  OPER DC3           PROF ALT4D D=0.034 N=0
  OPER C130          PROF ALT4D D=0.08  N=0
  OPER P3            PROF ALT4D D=0.11  N=0
  OPER 707320        PROF ALT4D D=0.04  N=0
  OPER DHC6          PROF ALT4D D=0.016 N=0
  OPER CH47          PROF COPTR D=0.21  N=0.00

 TRACK T15A RWY 02 STRAIGHT 9.88 RIGHT 188 D 2.06 STRAIGHT 2.14
  OPER DC1010        PROF ALT4D D=0.50  N=0
  OPER DC1030        PROF ALT4D D=0.10  N=0
  OPER L1011         PROF ALT4D D=0.39  N=0
  OPER L10115        PROF ALT4D D=0.09  N=0
  OPER 757PW         PROF ALT4D D=0.02  N=0.04
  OPER DHC6          PROF ALT4D D=0.02  N=0.01

 TRACK T15B RWY 02 STRAIGHT 9.88 RIGHT 188 D 1.65 STRAIGHT 2.14
  OPER DC1010        PROF ALT4D D=1.00  N=0
  OPER DC1030        PROF ALT4D D=0.20  N=0
  OPER L1011         PROF ALT4D D=0.78  N=0
  OPER L10115        PROF ALT4D D=0.18  N=0
  OPER 757PW         PROF ALT4D D=0.04  N=0.07
  OPER DC8QN         PROF ALT4D D=0.01  N=0
  OPER DHC6          PROF ALT4D D=0.04  N=0.01
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 TRACK T15C RWY 02 STRAIGHT 9.88 RIGHT 188 D 1.46 STRAIGHT 2.14
  OPER DC1010        PROF ALT4D D=0.50  N=0
  OPER DC1030        PROF ALT4D D=0.10  N=0
  OPER L1011         PROF ALT4D D=0.39  N=0
  OPER L10115        PROF ALT4D D=0.09  N=0
  OPER 757PW         PROF ALT4D D=0.02  N=0.03
  OPER DHC6          PROF ALT4D D=0.02  N=0.01

 TRACK T16 RWY 02 STRAIGHT 8.23 LEFT 52 D 2.47 STRAIGHT 4.36 RIGHT
188 D     1.65 STRAIGHT 2.14
  OPER DC8QN         PROF ALT4D D=0.04  N=0
  OPER BEC58P        PROF ALT4D D=2.01  N=0.63
  OPER DC3           PROF ALT4D D=0.97  N=0.30
  OPER BEC58P        PROF ALT4D D=0.49  N=0.15
  OPER HS748A        PROF ALT4D D=0.40  N=0.12
  OPER SD330         PROF ALT4D D=0.18  N=0.06
  OPER CNA441        PROF ALT4D D=0.14  N=0.04
  OPER CNA441        PROF ALT4D D=0.20  N=0.06
  OPER BEC58P        PROF ALT4D D=1.35  N=0.05
  OPER GASEPV        PROF ALT4D D=1.39  N=0.06
  OPER GASEPF        PROF ALT4D D=2.84  N=0.11
  OPER COMJET        PROF ALT4D D=0.07  N=0.00
  OPER HS748A        PROF ALT4D D=0.21  N=0.01
  OPER COMJET        PROF ALT4D D=0.05  N=0.00
  OPER P3            PROF ALT4D D=0.80  N=0.01
  OPER 707320        PROF ALT4D D=0.27  N=0

 TRACK T17A RWY 02 STRAIGHT 8.23 RIGHT 22 D 4.94 STRAIGHT 2.96
  OPER 737           PROF ALT4D D=0.92  N=0.11
  OPER 737300        PROF ALT4D D=0.15  N=0.05
  OPER 737400        PROF ALT4D D=0.15  N=0.01
  OPER DC950         PROF ALT4D D=0.52  N=0.03
  OPER DHC7          PROF ALT4D D=0.08  N=0
  OPER DC3           PROF ALT4D D=0.015 N=0
  OPER C130          PROF ALT4D D=0.02  N=0
  OPER P3            PROF ALT4D D=0.03  N=0
  OPER 707320        PROF ALT4D D=0.01  N=0
  OPER CH47          PROF COPTR D=0.04  N=0.00

TRACK T17B RWY 02 STRAIGHT 8.23 RIGHT 33 D 3.29 STRAIGHT 2.96
  OPER 737           PROF ALT4D D=1.83  N=0.22
  OPER 737300        PROF ALT4D D=0.31  N=0.11
  OPER 737400        PROF ALT4D D=0.31  N=0.01
  OPER DC950         PROF ALT4D D=1.03  N=0.06
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OPER DHC7        PROF ALT4D D=0.17  N=0
OPER DC3         PROF ALT4D D=0.03  N=0
OPER C130        PROF ALT4D D=0.04  N=0
OPER P3          PROF ALT4D D=0.05  N=0
OPER 707320      PROF ALT4D D=0.02  N=0
OPER DHC6        PROF ALT4D D=0.01  N=0
OPER CH47        PROF COPTR D=0.11  N=0.00

TRACK T17C RWY 02 STRAIGHT 8.23 RIGHT 40 D 2.47 STRAIGHT 2.96
  OPER 737       PROF ALT4D D=0.92  N=0.11
  OPER 737300    PROF ALT4D D=0.15  N=0.05
  OPER 737400    PROF ALT4D D=0.15  N=0.01
  OPER DC950     PROF ALT4D D=0.52  N=0.03
  OPER DHC7      PROF ALT4D D=0.08  N=0
  OPER DC3       PROF ALT4D D=0.015 N=0
  OPER C130      PROF ALT4D D=0.02  N=0
  OPER P3        PROF ALT4D D=0.03  N=0
  OPER 707320    PROF ALT4D D=0.01  N=0
  OPER CH47      PROF COPTR D=0.04  N=0.00

TRACK T18 RWY 02 STRAIGHT 6.09 LEFT 118 D 1.42 LEFT 13.28 D 1.52
LEFT 13.47 D 4.59 STRAIGHT 1.07
  OPER 737       PROF ALT4D D=0.15  N=0.018
  OPER 737300    PROF ALT4D D=0.03  N=0.01
  OPER 737400    PROF ALT4D D=0.03  N=0
  OPER DC950     PROF ALT4D D=0.13  N=0.01
  OPER DHC7      PROF ALT4D D=0.24  N=0
  OPER DHC6      PROF ALT4D D=0.24  N=0.07

TRACK TR20 RWY 20 STRAIGHT 6.58 RIGHT 65 D 1.98 STRAIGHT .49
  OPER DC1010    PROF ALT4D D=0.27  N=0
  OPER DC1030    PROF ALT4D D=0.05  N=0
  OPER L1011     PROF ALT4D D=0.03  N=0
  OPER L10115    PROF ALT4D D=0.01  N=0
  OPER 737       PROF ALT4D D=2.67  N=0.59
  OPER 737300    PROF ALT4D D=0.44  N=0.29
  OPER 737400    PROF ALT4D D=0.44  N=0.04
  OPER DC950     PROF ALT4D D=2.56  N=0.27
  OPER DHC7      PROF ALT4D D=0.07  N=0
  OPER DC3       PROF ALT4D D=0.034 N=0
  OPER C130      PROF ALT4D D=0.09  N=0
  OPER P3        PROF ALT4D D=0.12  N=0
  OPER 707320    PROF ALT4D D=0.04  N=0
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  OPER DHC6      PROF ALT4D D=0.016 N=0
  OPER CH47      PROF COPTR D=0.26  N=0.00

TRACK TR21 RWY 05 STRAIGHT 5.76 LEFT 64.72 D 1.52 LEFT 22.85 D 2.57
STRAIGHT .49
  OPER 737       PROF ALT4D D=0     N=0.05
  OPER 737300    PROF ALT4D D=0     N=0.05

TRACK TR22 RWY 05 STRAIGHT 4.94 LEFT 39.6 D 3.04 LEFT 46.7 D 1.02
STRAIGHT .02
  OPER DHC7      PROF ALT4D D=0.23  N=0
  OPER DHC6      PROF ALT4D D=4.59  N=1.41
  OPER BEC58P    PROF ALT4D D=0.11  N=0.04
  OPER DC3       PROF ALT4D D=0.05  N=0.02
  OPER CNA441    PROF ALT4D D=2.97  N=0.93
  OPER BEC58P    PROF ALT4D D=0.44  N=0.14
  OPER HS748A    PROF ALT4D D=0.36  N=0.11
  OPER SD330     PROF ALT4D D=0.16  N=0.05
  OPER CNA441    PROF ALT4D D=0.12  N=0.04
  OPER CNA441    PROF ALT4D D=0.18  N=0.05
  OPER GASEPF    PROF ALT4D D=0.13  N=0.02
  OPER GASEPV    PROF ALT4D D=0.81  N=0.12
  OPER GASEPV    PROF ALT4D D=1.82  N=0.27
  OPER BEC58P    PROF ALT4D D=0.07  N=0
  OPER GASEPV    PROF ALT4D D=1.26  N=0.05
  OPER GASEPF    PROF ALT4D D=2.56  N=0.10
  OPER CNA441    PROF ALT4D D=1.80  N=0.07
  OPER COMJET    PROF ALT4D D=0.06  N=0.00
  OPER HS748A    PROF ALT4D D=0.18  N=0.01
  OPER COMJET    PROF ALT4D D=0.04  N=0.00

TRACK TR23 RWY 05 STRAIGHT 6.58 LEFT 44.05 D 1.11 LEFT 52.53 D .68
LEFT     15.19 D 1.15 LEFT 74.8 D .37 STRAIGHT .49
  OPER DHC6      PROF ALT4D D=1.53  N=0.47
  OPER BEC58P    PROF ALT4D D=0.11  N=0.04
  OPER DC3       PROF ALT4D D=0.05  N=0.02
  OPER BEC58P    PROF ALT4D D=0.05  N=0.02
  OPER HS748A    PROF ALT4D D=0.04  N=0.01
  OPER SD330     PROF ALT4D D=0.02  N=0.01
  OPER CNA441    PROF ALT4D D=0.01  N=0.00
  OPER CNA441    PROF ALT4D D=0.02  N=0.01
  OPER BEC58P    PROF ALT4D D=0.07  N=0
  OPER GASEPV    PROF ALT4D D=0.14  N=0.01
  OPER GASEPF    PROF ALT4D D=0.28  N=0.01
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OPER COMJET       PROF ALT4D D=0.01  N=0.00
OPER HS748A       PROF ALT4D D=0.03  N=0
OPER COMJET       PROF ALT4D D=0.01  N=0.00

TRACK TR24 RWY 23 STRAIGHT 8.23
 OPER DHC6        PROF ALT4D D=0.22  N=0.12
 OPER BEC58P      PROF ALT4D D=0.30  N=0.18
 OPER DC3         PROF ALT4D D=0.15  N=0.08
 OPER CNA441      PROF ALT4D D=0.45  N=0.26
 OPER BEC58P      PROF ALT4D D=0.13  N=0.08
 OPER HS748A      PROF ALT4D D=0.11  N=0.06
 OPER SD330       PROF ALT4D D=0.05  N=0.03
 OPER CNA441      PROF ALT4D D=0.04  N=0.02
 OPER CNA441      PROF ALT4D D=0.05  N=0.03
 OPER GASEPF      PROF ALT4D D=0.02  N=0.01
 OPER GASEPV      PROF ALT4D D=0.12  N=0.03
 OPER GASEPV      PROF ALT4D D=0.28  N=0.08
 OPER BEC58P      PROF ALT4D D=0.20  N=0.01
 OPER GASEPV      PROF ALT4D D=0.38  N=0.03
 OPER GASEPF      PROF ALT4D D=0.77  N=0.06
 OPER CNA441      PROF ALT4D D=0.27  N=0.02
 OPER COMJET      PROF ALT4D D=0.02  N=0.00
 OPER HS748A      PROF ALT4D D=0.06  N=0
 OPER COMJET      PROF ALT4D D=0.01  N=0.00

TRACK T28A RWY 02 STRAIGHT 9.05
 OPER DC1010      PROF ALT4D D=1.00  N=0
 OPER DC1030      PROF ALT4D D=0.20  N=0
 OPER L1011       PROF ALT4D D=0.11  N=0
 OPER L10115      PROF ALT4D D=0.03  N=0
 OPER 737         PROF ALT4D D=9.79  N=1.16
 OPER 737300      PROF ALT4D D=1.63  N=0.55
 OPER 737400      PROF ALT4D D=1.63  N=0.07
 OPER DC950       PROF ALT4D D=9.31  N=0.53
 OPER DHC7        PROF ALT4D D=0.14  N=0
 OPER DC3         PROF ALT4D D=0.22  N=0
 OPER DHC6        PROF ALT4D D=0.06  N=0.02
 OPER CNA441      PROF ALT4D D=0.17  N=0.05
 OPER GASEPF      PROF ALT4D D=0.01  N=0.00
 OPER GASEPV      PROF ALT4D D=0.04  N=0.01
 OPER GASEPV      PROF ALT4D D=0.10  N=0.02
 OPER CNA441      PROF ALT4D D=0.10  N=0
 OPER C130        PROF ALT4D D=0.29  N=0
 OPER P3          PROF ALT4D D=0.40  N=0.01
```



```
 OPER 707320      PROF ALT4D D=0.14  N=0
 OPER DHC6        PROF ALT4D D=0.01  N=0
 OPER COMJET      PROF ALT4D D=0.01  N=0.00
 OPER DHC6        PROF ALT4D D=0.06  N=0
 OPER CH47        PROF COPTR D=0.80  N=0.00

TRACK T28B RWY 02 STRAIGHT 8.23 RIGHT 22 D 4.94 STRAIGHT 4.12
 OPER DC1010      PROF ALT4D D=1.00  N=0
 OPER DC1030      PROF ALT4D D=0.20  N=0
 OPER L1011       PROF ALT4D D=0.11  N=0
 OPER L10115      PROF ALT4D D=0.03  N=0
 OPER 737         PROF ALT4D D=9.79  N=1.16
 OPER 737300      PROF ALT4D D=1.63  N=0.55
 OPER 737400      PROF ALT4D D=1.63  N=0.07
 OPER DC950       PROF ALT4D D=9.31  N=0.53
 OPER DHC7        PROF ALT4D D=0.14  N=0
 OPER DC3         PROF ALT4D D=0.22  N=0
 OPER DHC6        PROF ALT4D D=0.06  N=0.02
 OPER CNA441      PROF ALT4D D=0.17  N=0.05
 OPER GASEPF      PROF ALT4D D=0.01  N=0.00
 OPER GASEPV      PROF ALT4D D=0.04  N=0.01
 OPER GASEPV      PROF ALT4D D=0.10  N=0.02
 OPER CNA441      PROF ALT4D D=0.10  N=0
 OPER C130        PROF ALT4D D=0.29  N=0
 OPER P3          PROF ALT4D D=0.40  N=0.01
 OPER 707320      PROF ALT4D D=0.14  N=0
 OPER DHC6        PROF ALT4D D=0.01  N=0
 OPER COMJET      PROF ALT4D D=0.01  N=0.00
 OPER DHC6        PROF ALT4D D=0.06  N=0
 OPER CH47        PROF COPTR D=0.80  N=0.00

TRACK T32  RWY 05 STRAIGHT 49.4 RIGHT 39 D 3.29 STRAIGHT 0.99
 OPER DHC6        PROF ALT4D D=2.30  N=0.71

TRACK T33  RWY 23 STRAIGHT 49.4 RIGHT 87 D 1.48 STRAIGHT 0.08
 OPER DHC6        PROF ALT4D D=0.66  N=0.37

TRACK T34  RWY 23 STRAIGHT 49.4 RIGHT 30 D 2.63 STRAIGHT 0.54
LEFT 157 D 0.99 STRAIGHT 0.13
 OPER DHC6        PROF ALT4D D=0.33  N=0.19

TRACK T51A RWY 03L STRAIGHT 8.23 LEFT 35 D 1.07 STRAIGHT 1.15
LEFT 36 D .08 STRAIGHT .03
 OPER SA350D      PROF COPTR D=2.39  N=0
```

```
OPER B206L       PROF COPTR D=1.28  N=0
OPER H500D       PROF COPTR D=0.77  N=0
OPER H500D       PROF COPTR D=0.27  N=0

TRACK T51B RWY 03L STRAIGHT 8.23 LEFT 55 D 1.23 STRAIGHT .99
LEFT 20 D .08 STRAIGHT .03
OPER SA350D      PROF COPTR D=4.77  N=0
OPER B206L       PROF COPTR D=2.56  N=0
OPER H500D       PROF COPTR D=1.53  N=0
OPER H500D       PROF COPTR D=0.01  N=0
OPER H500D       PROF COPTR D=0.55  N=0

TRACK T51C RWY 03L STRAIGHT 8.23 LEFT 12 D 1.07 STRAIGHT 1.15
LEFT 60 D .08 STRAIGHT .03
OPER SA350D      PROF COPTR D=2.39  N=0
OPER B206L       PROF COPTR D=1.28  N=0
OPER H500D       PROF COPTR D=0.77  N=0
OPER H500D       PROF COPTR D=0.27  N=0

TRACK T52A RWY 03R STRAIGHT 8.23 LEFT 30 D 3.13 STRAIGHT 1.97
LEFT 50 D 3.79 STRAIGHT 1.81 RIGHT 16 D 0.33 STRAIGHT 1.60     RIGHT 8 D
0.33 STRAIGHT 1.81 RIGHT 150 D 0.30 STRAIGHT 0.03
OPER SA350D      PROF COPTR D=14.35 N=0
OPER B206L       PROF COPTR D=7.72  N=0
OPER H500D       PROF COPTR D=4.61  N=0
OPER H500D       PROF COPTR D=0.03  N=0
OPER H500D       PROF COPTR D=1.64  N=0

TRACK T52B RWY 03R STRAIGHT 8.23 LEFT 30 D 3.13 STRAIGHT 1.65
LEFT 47 D 3.26 STRAIGHT 1.85 RIGHT 12 D 0.33 STRAIGHT 2.00     RIGHT 8 D
0.33 STRAIGHT 1.51 RIGHT 150 D 0.39 STRAIGHT 0.03
OPER SA350D      PROF COPTR D=14.21 N=0.14
OPER B206L       PROF COPTR D=7.64  N=0.08
OPER H500D       PROF COPTR D=4.61  N=0
OPER H500D       PROF COPTR D=0.03  N=0
OPER H500D       PROF COPTR D=1.64  N=0

TRACK TR53 RWY 03R STRAIGHT 8.23 LEFT 37 D .33 STRAIGHT .99     RIGHT
150 D .25 STRAIGHT .03
OPER SA350D      PROF COPTR D=4.79  N=0
OPER B206L       PROF COPTR D=2.58  N=0
OPER H500D       PROF COPTR D=1.54  N=0
OPER H500D       PROF COPTR D=0.01  N=0
OPER H500D       PROF COPTR D=0.55  N=0
```



```
TRACK TR56 RWY 03R STRAIGHT 8.23 RIGHT 35 D .25 STRAIGHT .03
OPER SA350D      PROF COPTR D=2.39  N=0
OPER B206L       PROF COPTR D=1.28  N=0
OPER H500D       PROF COPTR D=0.77  N=0
OPER H500D       PROF COPTR D=0.27  N=0

TRACK TR57 RWY 03R STRAIGHT 8.23 LEFT 19 D .25 STRAIGHT .03
OPER SA350D      PROF COPTR D=2.39  N=0
OPER B206L       PROF COPTR D=1.28  N=0
OPER H500D       PROF COPTR D=0.77  N=0
OPER H500D       PROF COPTR D=0.27  N=0

TOUCHGOS BY FREQUENCY:

TRACK TR27 RWY 02 STRAIGHT 2.3 RIGHT 41.88 D 1.41 RIGHT 48.08 D .25
RIGHT 14.57 D .51 RIGHT 64.46 D .59 STRAIGHT 5.20 RIGHT 61.52 D 1.08
RIGHT 39.45 D 1.08 RIGHT 36.87 D .82 RIGHT 53.13 D 1.34 STRAIGHT 2.3
OPER C130        STAGE 1 PROF ALT4D D=0.56  N=0.01
OPER DHC6        STAGE 1 PROF ALT4D D=0.01  N=0
OPER DHC6        STAGE 1 PROF ALT4D D=0.11  N=0
OPER CH47        STAGE 1 PROF COPTR D=1.58  N=0.00

TRACK TR30 RWY 05 STRAIGHT .82 LEFT 180 D .38 STRAIGHT 1.48     LEFT
180 D .38 STRAIGHT .66
OPER GASEPV      STAGE 1 PROF ALT4D D=8.16   N=0.35
OPER GASEPF      STAGE 1 PROF ALT4D D=16.61  N=0.71
OPER BEC58P      STAGE 1 PROF ALT4D D=4.37   N=0.19

FT.

PROCESSES:

GRID LDN START=  7450 1000  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=  185 -1559  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= 10050 -2980 STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -4065 570   STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= 11690 -4680 STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= 13100 -4100 STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -8850  100  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -11850 1100 STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -6800 3600  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=  700 -1350  STEP= 0 0  SIZE= 1 BY 1  DETAIL
```

```
GRID LDN START= -16000 18750 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= -700 3550 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= 16420 -7550 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= -7264 2 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= -15800 15250 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= 6150 1950 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= 1786 -1725 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= -5700 9800 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= 9300 -1650 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= -2748 -201 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= 9840 -2000 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= 3500 -1420 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START=-40600 -250 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START=-43800 1150 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START=-36600 -12150 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= 10350 -3200 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= 11200 -3350 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= 13000 -4400 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= -10375 -2120 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= -17750 -2400 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= -27270 -4150 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= -4250 -3350 STEP= 0 0 SIZE= 1 BY 1 DETAIL
GRID LDN START= -24500 -6350 STEP= 0 0 SIZE= 1 BY 1 DETAIL

  CONTOUR LDN AT 75 70 65 60 55
   WITH TOLERANCE = 0.5

END.
```


1998 INM Input File

```
BEGIN.

SETUP:

  TITLE <1998 NO MITIGATION, STANDARD VERSION 4.11>
  AIRPORT <KAHULUI, MAUI>
  ALTITUDE 53
  TEMPERATURE 75 F
FT.

  RUNWAYS
    RW 02-20    -2600    0 TO 6995     0
    RW 03-04    -2200    0 TO 6995     0
    RW 06-07        0    0 TO 6995     0
    RW 05-23     2544  2098 TO 6875  -441
    RW 03R-21L    926  -750 TO 1120  -750
    RW 03L-21R   4024  2010 TO 4184  1900

 AIRCRAFT:

  TYPES
    AC DC1010
    AC DC1030
    AC MD11GE
    AC MD11PW
    AC 747400
    AC 747200
    AC L1011
    AC A310
    AC 767CF6
    AC 767JT9
    AC 757RR
    AC 757PW
    AC 737
    AC 737300
    AC 737400
    AC DC950
    AC L10115
    AC L188
    AC DC8QN
    AC DHC7
    AC DC3
    AC DHC6
    AC CNA441
```

```
AC HS748A
AC SD330
AC BEC58P
AC GASEPV
AC GASEPF
AC 707320
AC C130
AC COMJET
AC DHC8

AC P3     CURVE=P3 PARAM= AP81  STAGE 1=TOP304
        CATEGORY= PMIL

AC S76      CURVE=NS76 PARAM=HS76 STAGE 1=HFLT
          CATEGORY=PGA

AC H500D    CURVE=N50D PARAM=H50D STAGE 1=HFLT
          CATEGORY=PGA

AC B206L    CURVE=N206 PARAM=206L STAGE 1=HFLT
          CATEGORY=PGA

AC SA350D   CURVE=SA35 PARAM=A350 STAGE 1=HFLT
          CATEGORY=PGA

AC CH47  CURVE=CH47 PARAM= HS76  STAGE 1= HFLT
        CATEGORY= PGA


NOISE CURVES

  NC P3        2 BY 10   2 BY 10
    EPNL
    THRUSTS      28       100
      200     103.1     112.7
      400      98       107.1
      630      94.3     104.8
     1000      90.2     101.3
     2000      83.4      95.5
     4000      76        88.7
     6300      70.3      82.9
    10000      64.1      76.7
    16000      57.4      70.7
    25000      49.3      63.9
```



```
  SEL
    THRUSTS      28      100
      200      96.5    106.1
      400      91.9    101.2
      630      88.7     97.8
     1000      85.5     94.1
     2000      80.3     88.5
     4000      74.9     82.6
     6300      71.0     78.6
    10000      67.0     74.3
    16000      62.6     69.5
    25000      57.6     63.9

NC NS76          3 BY 8  3 BY 8
EPNL
THRUSTS    1       2       3
  200   94.0    94.1    95.6
  400   90.6    90.6    92.4
  600   88.1    88.1    90.2
 1000   85.4    85.4    87.9
 2000   80.8    80.6    84.1
 4000   75.1    74.7    79.8
 6000   70.6    70.1    76.4
10000   65.1    64.8    72.4
SEL
THRUSTS    1       2       3
  200   94.0    94.1    95.6
  400   90.6    90.6    92.4
  600   88.1    88.1    90.2
 1000   85.4    85.4    87.9
 2000   80.8    80.6    84.1
 4000   75.1    74.7    79.8
 6000   70.6    70.1    76.4
10000   65.1    64.8    72.4

NC N50D          3 BY 8  3 BY 8
EPNL
THRUSTS    1       2       3
  200   89.3    87.4    90.9
  400   86.0    83.9    87.5
  600   83.7    81.6    85.1
 1000   81.2    78.9    82.4
 2000   76.9    74.5    77.8
```

```
 4000  71.7   69.1   72.1
 6000  67.6   65.0   67.4
10000  62.4   60.0   61.6
SEL
THRUSTS   1      2      3
  200  89.3   87.4   90.9
  400  86.0   83.9   87.5
  600  83.7   81.6   85.1
 1000  81.2   78.9   82.4
 2000  76.9   74.5   77.8
 4000  71.7   69.1   72.1
 6000  67.6   65.0   67.4
10000  62.4   60.0   61.6

NC N206       3 BY 8  3 BY 8
EPNL
THRUSTS   1      2      3
  200  87.9   88.2   93.1
  400  84.2   84.6   89.8
  600  81.6   82.0   87.5
 1000  78.8   79.1   85.1
 2000  74.1   74.3   81.1
 4000  68.7   68.5   76.3
 6000  64.6   64.1   72.5
10000  60.0   59.2   68.0
SEL
THRUSTS   1      2      3
  200  87.9   88.2   93.1
  400  84.2   84.6   89.8
  600  81.6   82.0   87.5
 1000  78.8   79.1   85.1
 2000  74.1   74.3   81.1
 4000  68.7   68.5   76.3
 6000  64.6   64.1   72.5
10000  60.0   59.2   68.0

NC SA35       3 BY 8  3 BY 8
EPNL
THRUSTS   1      2      3
  200  92.5   89.7   94.2
  400  88.8   86.1   90.9
  600  86.4   83.5   88.6
 1000  83.6   80.6   86.1
 2000  78.8   75.7   82.0
```



```
 4000  73.0   69.8   77.1
 6000  68.4   65.2   73.3
10000  63.0   59.9   68.7
SEL
THRUSTS   1      2      3
  200  92.5   89.7   94.2
  400  88.8   86.1   90.9
  600  86.4   83.5   88.6
 1000  83.6   80.6   86.1
 2000  78.8   75.7   82.0
 4000  73.0   69.8   77.1
 6000  68.4   65.2   73.3
10000  63.0   59.9   68.7

NC CH47      3 BY 8   3 BY 8
   EPNL
   THRUSTS     1       2       3
      200   93.10   92.07   99.80
      400   89.37   88.27   96.47
      630   86.70   85.63   94.23
     1000   83.77   82.73   91.87
     2000   78.80   77.87   87.93
     4000   72.90   72.30   83.37
     6300   68.40   68.20   79.83
    10000   63.23   63.67   75.57

   SEL
   THRUSTS     1       2       3
      200   93.10   92.07   99.80
      400   89.37   88.27   96.47
      630   86.70   85.63   94.23
     1000   83.77   82.73   91.87
     2000   78.80   77.87   87.93
     4000   72.90   72.30   83.37
     6300   68.40   68.20   79.83
    10000   63.23   63.67   75.57

APPROACH PARAMETERS

 AP HS76  WEIGHT=10000 ENGINE=2 STOP=1
        FINSP= 60 TAXI=30
        LNDFFS=3 LEVAPP=2
 AP H50D  WEIGHT=2550 ENGINE=2 STOP=1
        FINSP= 60 TAXI=30
```

```
        LNDFFS=3 LEVAPP=2
  AP 206L  WEIGHT=4000 ENGINE=2 STOP=1
        FINSP= 60 TAXI=30
        LNDFFS=3 LEVAPP=2
  AP A350  WEIGHT=4300 ENGINE=2 STOP=1
        FINSP= 60 TAXI=30
        LNDFFS=3 LEVAPP=2


FT.
PROFILES APPROACH

PF COPTR SEGMENTS=7
  DISTANCES   23696   18836   14582   9722   4861     0   0
  ALTITUDES    1500    1500    1500   1250   1000     0   0
  SPEEDS     FINSP   FINSP   FINSP  FINSP  FINSP  FINSP TAXI
  THRUSTS    LEVAPP  LEVAPP  LEVAPP LNDFFS LNDFFS LNDFFS
PF ALT4D  SEGMENTS=7
   DISTANCES  84801.4  41899.4  20448.4  13298.1  -1002.56 REVDS  STOP
   ALTITUDES  6000     3000.    1500.    1000.    0.       0.     0.
   SPEEDS     TERMSP   INTSP    APPSP    FINSP    LNDSP    REVSP  TAXI
   THRUSTS    INTFIS   APPFAS   LNDFFS   LNDFLS   REV      IDLE

ECHO.
FT.

 PROFILES TAKEOFF

  PF HFLT SEGMENTS=6 WEIGHT=10000 ENGINES=2
   DISTANCES    0   100   562  4032  5800  99999
   ALTITUDES    0    15    30  1000  1500   1500
   SPEEDS      16    30    60    60   100    100
   THRUSTS      1     1     1     1     2

INT.NM.
TAKEOFFS BY FREQUENCY:
 TRACK TR2 RWY 02 STRAIGHT 4.71 RIGHT 29.04 D 1.36 RIGHT 14.39 D 4.07
  STRAIGHT 8.23
   OPER DC1010       STAGE 3 D=4.38  N=0
   OPER DC1030       STAGE 3 D=0.85  N=0
   OPER MD11GE       STAGE 3 D=0.88  N=0
   OPER L1011        STAGE 3 D=2.27  N=0
   OPER L10115       STAGE 3 D=0.54  N=0
   OPER 757PW        STAGE 3 D=0.12  N=0.22
```



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   OPER 767JT9       STAGE 3 D=0.88  N=0
   OPER 737          STAGE 1 D=2.25  N=0.29
   OPER 737300       STAGE 1 D=3.54  N=0.51
   OPER DC950        STAGE 1 D=3.29  N=0.16
   OPER P3           STAGE 1 D=0.80  N=0.01
   OPER 707320       STAGE 1 D=0.27  N=0
   OPER COMJET       STAGE 1 D=0.01  N=0

TRACK TR3 RWY 02 STRAIGHT 3.06 RIGHT 47 D 3.29 STRAIGHT 8.23
   OPER C130         STAGE 1 D=0.21  N=0
   OPER P3           STAGE 1 D=0.28  N=0
   OPER 707320       STAGE 1 D=0.09  N=0
   OPER COMJET       STAGE 1 D=0.01  N=0
   OPER DHC6         STAGE 1 D=0.04  N=0
   OPER CH47         STAGE 1 D=0.52  N=0

 TRACK TR4 RWY 02 STRAIGHT 1.75 LEFT 30.13 D 1.31 LEFT 35.64 D 3.41
STRAIGHT 2.96
   OPER 737          STAGE 1 D=11.66 N=1.60
   OPER 737300       STAGE 1 D=18.16 N=2.68
   OPER DC950        STAGE 1 D=29.26 N=1.45
   OPER C130         STAGE 1 D=0.49  N=0.01
   OPER P3           STAGE 1 D=0.64  N=0.01
   OPER 707320       STAGE 1 D=0.23  N=0
   OPER DHC6         STAGE 1 D=0.01  N=0
   OPER COMJET       STAGE 1 D=0.014 N=0
   OPER DHC6         STAGE 1 D=0.09  N=0
   OPER CH47         STAGE 1 D=1.21  N=0

 TRACK TR4P RWY 06 STRAIGHT 1.32 LEFT 30.13 D 1.31 LEFT 35.64 D 3.41
STRAIGHT 2.96
   OPER DHC8         STAGE 1 D=7.04  N=0
   OPER BEC58P       STAGE 1 D=0.23  N=0.07
   OPER DC3          STAGE 1 D=0.11  N=0.03
   OPER BEC58P       STAGE 1 D=0.08  N=0.02
   OPER HS748A       STAGE 1 D=0.06  N=0.02
   OPER SD330        STAGE 1 D=0.03  N=0.01
   OPER CNA441       STAGE 1 D=0.02  N=0.01
   OPER CNA441       STAGE 1 D=0.03  N=0.01
   OPER COMJET       STAGE 1 D=0.01  N=0
   OPER HS748A       STAGE 1 D=0.03  N=0
   OPER COMJET       STAGE 1 D=0.01  N=0
```

```
TRACK TR8 RWY 05 STRAIGHT .49 RIGHT 122 D .49 RIGHT 6.71 D 5.24
STRAIGHT 8.23
  OPER DHC8        STAGE 1 D=2.64  N=0
  OPER CNA441      STAGE 1 D=0.27  N=0.08
  OPER GASEPF      STAGE 1 D=0.01  N=0
  OPER GASEPV      STAGE 1 D=0.04  N=0.01
  OPER GASEPV      STAGE 1 D=0.10  N=0.01
  OPER CNA441      STAGE 1 D=0.21  N=0.01

TRACK TR9 RWY 20 STRAIGHT 1.81 LEFT 53.13 D 1.34 LEFT 36.87 D .82
LEFT 39.45 D 1.08 LEFT 50.52 D 1.08 STRAIGHT 8.23
  OPER DC1010      STAGE 3 D=0.60  N=0
  OPER DC1030      STAGE 3 D=0.12  N=0
  OPER-MD11GE      STAGE 3 D=0.12  N=0
  OPER L1011       STAGE 3 D=0.31  N=0
  OPER L10115      STAGE 3 D=0.07  N=0
  OPER 757PW       STAGE 3 D=0.02  N=0.06
  OPER 767JT9      STAGE 3 D=0.12  N=0
  OPER C130        STAGE 1 D=0.090 N=0.002
  OPER P3          STAGE 1 D=0.117 N=0.003
  OPER 707320      STAGE 1 D=0.04  N=0.001
  OPER DHC6        STAGE 1 D=0.002 N=0
  OPER DHC8        STAGE 1 D=0.016 N=0
  OPER CH47        STAGE 1 D=0.201 N=0.0036

TRACK TR10 RWY 20 STRAIGHT 8.23
  OPER 737         STAGE 1 D=0.189 N=0.045
  OPER 737300      STAGE 1 D=0.296 N=0.080
  OPER DC950       STAGE 1 D=0.444 N=0.040
  OPER DHC6        STAGE 1 D=0.08  N=0.045
  OPER C130        STAGE 1 D=0.009 N=0.0002
  OPER P3          STAGE 1 D=0.012 N=0.0003
  OPER 707320      STAGE 1 D=0.004 N=0.0001
  OPER DHC6        STAGE 1 D=0.002 N=0
  OPER CH47        STAGE 1 D=0.025 N=0.0004

TRACK TR11 RWY 05 STRAIGHT .82 LEFT 10 D .02 STRAIGHT 4.94
  OPER DHC6        STAGE 1 D=1.30  N=0.39
  OPER CNA441      STAGE 1 D=0.13  N=0.04
  OPER GASEPV      STAGE 1 D=0.02  N=0
  OPER GASEPV      STAGE 1 D=0.05  N=0.01
  OPER CNA441      STAGE 1 D=0.11  N=0
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TRACK TR12 RWY 05 STRAIGHT .74 LEFT 103.03 D .37 LEFT 7.42 D 13.2
STRAIGHT 2.96
  OPER DHC6        STAGE 1 D=3.89  N=1.18
  OPER BEC58P      STAGE 1 D=1.59  N=0.48
  OPER DC3         STAGE 1 D=0.76  N=0.23
  OPER CNA441      STAGE 1 D=2.27  N=0.69
  OPER BEC58P      STAGE 1 D=0.71  N=0.22
  OPER HS748A      STAGE 1 D=0.56  N=0.17
  OPER SD330       STAGE 1 D=0.25  N=0.08
  OPER CNA441      STAGE 1 D=0.20  N=0.06
  OPER CNA441      STAGE 1 D=0.29  N=0.09
  OPER GASEPF      STAGE 1 D=0.08  N=0.01
  OPER GASEPV      STAGE 1 D=0.36  N=0.05
  OPER GASEPV      STAGE 1 D=0.81  N=0.12
  OPER BEC58P      STAGE 1 D=1.58  N=0.06
  OPER GASEPV      STAGE 1 D=2.97  N=0.11
  OPER GASEPF      STAGE 1 D=6.04  N=0.23
  OPER CNA441      STAGE 1 D=1.80  N=0.07
  OPER COMJET      STAGE 1 D=0.14  N=0.01
  OPER HS748A      STAGE 1 D=0.41  N=0.01
  OPER COMJET      STAGE 1 D=0.10  N=0.01

TRACK TR13 RWY 23 STRAIGHT .84 RIGHT 46.7 D 1.02 RIGHT 39.6 D 3.04
STRAIGHT 2.47
  OPER BEC58P      STAGE 1 D=0.25  N=0.14
  OPER DC3         STAGE 1 D=0.12  N=0.07
  OPER CNA441      STAGE 1 D=0.36  N=0.20
  OPER BEC58P      STAGE 1 D=0.11  N=0.06
  OPER HS748A      STAGE 1 D=0.09  N=0.05
  OPER SD330       STAGE 1 D=0.04  N=0.02
  OPER CNA441      STAGE 1 D=0.03  N=0.02
  OPER CNA441      STAGE 1 D=0.04  N=0.02
  OPER GASEPF      STAGE 1 D=0.01  N=0
  OPER GASEPV      STAGE 1 D=0.06  N=0.02
  OPER GASEPV      STAGE 1 D=0.13  N=0.04
  OPER BEC58P      STAGE 1 D=0.22  N=0.01
  OPER GASEPV      STAGE 1 D=0.40  N=0.02
  OPER GASEPF      STAGE 1 D=0.82  N=0.03
  OPER CNA441      STAGE 1 D=0.29  N=0.01
  OPER COMJET      STAGE 1 D=0.02  N=0
  OPER HS748A      STAGE 1 D=0.06  N=0
  OPER COMJET      STAGE 1 D=0.01  N=0
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TRACK TR29 RWY 20 STRAIGHT 4.12 LEFT 12.48 D 4.95 LEFT 5.53 D 10.96
STRAIGHT 7.41
  OPER DHC8          STAGE 1 D=0.36  N=0

TRACK T31A RWY 20 STRAIGHT 1.18 LEFT 15 D .66 STRAIGHT 49.37
  OPER 737           STAGE 1 D=0.560 N=0.133
  OPER 737300        STAGE 1 D=0.879 N=0.238
  OPER DC950         STAGE 1 D=1.318 N=0.119
  OPER DHC8          STAGE 1 D=0.32  N=0
  OPER DHC6          STAGE 1 D=0.23  N=0.135
  OPER C130          STAGE 1 D=0.027 N=0.0006
  OPER P3            STAGE 1 D=0.035 N=0.0009
  OPER 707320        STAGE 1 D=0.012 N=0.0003
  OPER DHC6          STAGE 1 D=0.001 N=0
  OPER COMJET        STAGE 1 D=0.001 N=0
  OPER DHC6          STAGE 1 D=0.005 N=0
  OPER CH47          STAGE 1 D=0.072 N=0.0012

TRACK T31B RWY 20 STRAIGHT 1.48 LEFT 14 D .66 STRAIGHT 49.37
  OPER 737           STAGE 1 D=0.577 N=0.138
  OPER 737300        STAGE 1 D=0.906 N=0.246
  OPER DC950         STAGE 1 D=1.358 N=0.123
  OPER DHC8          STAGE 1 D=0.33  N=0
  OPER DHC6          STAGE 1 D=0.24  N=0.135
  OPER C130          STAGE 1 D=0.027 N=0.0006
  OPER P3            STAGE 1 D=0.035 N=0.0009
  OPER 707320        STAGE 1 D=0.012 N=0.0003
  OPER DHC6          STAGE 1 D=0.001 N=0
  OPER COMJET        STAGE 1 D=0.001 N=0
  OPER DHC6          STAGE 1 D=0.005 N=0
  OPER CH47          STAGE 1 D=0.072 N=0.0012

TRACK T31C RWY 20 STRAIGHT 1.04 LEFT 15 D .66 STRAIGHT 49.37
  OPER 737           STAGE 1 D=0.560 N=0.133
  OPER 737300        STAGE 1 D=0.879 N=0.238
  OPER DC950         STAGE 1 D=1.318 N=0.119
  OPER DHC8          STAGE 1 D=0.32  N=0
  OPER DHC6          STAGE 1 D=0.23  N=0.135
  OPER C130          STAGE 1 D=0.027 N=0.0006
  OPER P3            STAGE 1 D=0.035 N=0.0009
  OPER 707320        STAGE 1 D=0.012 N=0.0003
  OPER DHC6          STAGE 1 D=0.001 N=0
  OPER COMJET        STAGE 1 D=0.001 N=0
  OPER DHC6          STAGE 1 D=0.005 N=0
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  OPER CH47          STAGE 1 D=0.072 N=0.0012

TRACK T58A RWY 03L STRAIGHT .03 LEFT 201 D .25 RIGHT 60 D .25
STRAIGHT 1.31 RIGHT 34 D 1.07 STRAIGHT 8.23
  OPER SA350D        STAGE 1 D=2.47  N=0.03
  OPER B206L         STAGE 1 D=1.33  N=0.01
  OPER H500D         STAGE 1 D=1.08  N=0.01

TRACK T58B RWY 03L STRAIGHT .03 LEFT 201 D .25 STRAIGHT .33     RIGHT
44 D .25 STRAIGHT .58 RIGHT 52 D 1.23 STRAIGHT 8.23
  OPER SA350D        STAGE 1 D=4.94  N=0.05
  OPER B206L         STAGE 1 D=2.65  N=0.03
  OPER H500D         STAGE 1 D=2.16  N=0.03

TRACK T58C RWY 03L STRAIGHT .03 LEFT 180 D .25 RIGHT 60 D .25
STRAIGHT .82 RIGHT 12 D 1.07 STRAIGHT 8.23
  OPER SA350D        STAGE 1 D=2.47  N=0.03
  OPER B206L         STAGE 1 D=1.33  N=0.01
  OPER H500D         STAGE 1 D=1.08  N=0.01

TRACK T54A RWY 03R STRAIGHT .03 RIGHT 123 D .13 STRAIGHT 8.23
  OPER SA350D        STAGE 1 D=7.41  N=0.08
  OPER B206L         STAGE 1 D=3.98  N=0.04
  OPER H500D         STAGE 1 D=3.24  N=0.03

TRACK T54B RWY 03R STRAIGHT .03 RIGHT 116 D .25 STRAIGHT 8.23
  OPER SA350D        STAGE 1 D=14.82 N=0.15
  OPER B206L         STAGE 1 D=7.96  N=0.08
  OPER H500D         STAGE 1 D=6.49  N=0.08

TRACK T54C RWY 03R STRAIGHT .03 RIGHT 105 D .3 STRAIGHT 8.23
  OPER SA350D        STAGE 1 D=7.41  N=0.08
  OPER B206L         STAGE 1 D=3.98  N=0.04
  OPER H500D         STAGE 1 D=3.24  N=0.03

TRACK TR55 RWY 03R STRAIGHT .03 RIGHT 136 D .13 STRAIGHT 8.23
  OPER SA350D        STAGE 1 D=9.88  N=0.10
  OPER B206L         STAGE 1 D=5.31  N=0.05
  OPER H500D         STAGE 1 D=4.33  N=0.05

LANDINGS BY FREQUENCY:
 TRACK TR1R RWY 20 STRAIGHT 8.23
  OPER DC1010        PROF ALT4D D=0.30  N=0
  OPER DC1030        PROF ALT4D D=0.06  N=0
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OPER MD11GE     PROF ALT4D D=0.06  N=0
OPER L1011      PROF ALT4D D=0.27  N=0
OPER L10115     PROF ALT4D D=0.06  N=0
OPER 757PW      PROF ALT4D D=0.02  N=0.06
OPER 767JT9     PROF ALT4D D=0.12  N=0
OPER 737        PROF ALT4D D=0.31  N=0.08
OPER 737300     PROF ALT4D D=0.49  N=0.13
OPER DC950      PROF ALT4D D=0.44  N=0.04
OPER C130       PROF ALT4D D=0.08  N=0
OPER P3         PROF ALT4D D=0.11  N=0
OPER 707320     PROF ALT4D D=0.04  N=0
OPER DHC6       PROF ALT4D D=0.016 N=0
OPER CH47       PROF COPTR D=0.21  N=0

TRACK T15A RWY 03 STRAIGHT 9.88 RIGHT 188 D 2.06 STRAIGHT 2.14
 OPER DC1010    PROF ALT4D D=0.55  N=0
 OPER DC1030    PROF ALT4D D=0.11  N=0
 OPER MD11GE    PROF ALT4D D=0.11  N=0
 OPER L1011     PROF ALT4D D=0.60  N=0
 OPER L10115    PROF ALT4D D=0.12  N=0
 OPER 757PW     PROF ALT4D D=0.03  N=0.06
 OPER 767JT9    PROF ALT4D D=0.22  N=0
 OPER DHC6      PROF ALT4D D=0.02  N=0.01

TRACK T15B RWY 03 STRAIGHT 9.88 RIGHT 188 D 1.65 STRAIGHT 2.14
 OPER DC1010    PROF ALT4D D=1.10  N=0
 OPER DC1030    PROF ALT4D D=0.21  N=0
 OPER MD11GE    PROF ALT4D D=0.22  N=0
 OPER L1011     PROF ALT4D D=0.99  N=0
 OPER L10115    PROF ALT4D D=0.23  N=0
 OPER 757PW     PROF ALT4D D=0.06  N=0.11
 OPER 767JT9    PROF ALT4D D=0.44  N=0
 OPER DHC6      PROF ALT4D D=0.03  N=0.01

TRACK T15C RWY 03 STRAIGHT 9.88 RIGHT 188 D 1.46 STRAIGHT 2.14
 OPER DC1010    PROF ALT4D D=0.55  N=0
 OPER DC1030    PROF ALT4D D=0.11  N=0
 OPER MD11GE    PROF ALT4D D=0.11  N=0
 OPER L1011     PROF ALT4D D=0.50  N=0
 OPER L10115    PROF ALT4D D=0.12  N=0
 OPER 757PW     PROF ALT4D D=0.03  N=0.06
 OPER 767JT9    PROF ALT4D D=0.22  N=0
 OPER DHC6      PROF ALT4D D=0.02  N=0.01
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TRACK T16 RWY 03 STRAIGHT 8.23 LEFT 52 D 2.47 STRAIGHT 4.36 RIGHT
188 D 1.65 STRAIGHT 2.14
 OPER BEC58P    PROF ALT4D D=1.63  N=0.50
 OPER DC3       PROF ALT4D D=0.78  N=0.24
 OPER BEC58P    PROF ALT4D D=0.40  N=0.12
 OPER HS748A    PROF ALT4D D=0.32  N=0.10
 OPER SD330     PROF ALT4D D=0.14  N=0.04
 OPER CNA441    PROF ALT4D D=0.11  N=0.03
 OPER CNA441    PROF ALT4D D=0.16  N=0.05
 OPER BEC58P    PROF ALT4D D=1.43  N=0.06
 OPER GASEPV    PROF ALT4D D=1.48  N=0.06
 OPER GASEPF    PROF ALT4D D=3.02  N=0.12
 OPER COMJET    PROF ALT4D D=0.07  N=0
 OPER HS748A    PROF ALT4D D=0.22  N=0.01
 OPER COMJET    PROF ALT4D D=0.05  N=0
 OPER P3        PROF ALT4D D=0.80  N=0.01
 OPER 707320    PROF ALT4D D=0.27  N=0

TRACK T17A RWY 03 STRAIGHT 8.23 RIGHT 22 D 4.94 STRAIGHT 2.96
 OPER 737       PROF ALT4D D=0.64  N=0.08
 OPER 737300    PROF ALT4D D=0.85  N=0.13
 OPER DC950     PROF ALT4D D=0.81  N=0.04
 OPER C130      PROF ALT4D D=0.02  N=0
 OPER P3        PROF ALT4D D=0.03  N=0
 OPER 707320    PROF ALT4D D=0.01  N=0
 OPER CH47      PROF COPTR D=0.04  N=0

TRACK T17B RWY 03 STRAIGHT 8.23 RIGHT 33 D 3.29 STRAIGHT 2.96
 OPER 737       PROF ALT4D D=1.08  N=0.14
 OPER 737300    PROF ALT4D D=1.70  N=0.25
 OPER DC950     PROF ALT4D D=1.62  N=0.08
 OPER C130      PROF ALT4D D=0.04  N=0
 OPER P3        PROF ALT4D D=0.05  N=0
 OPER 707320    PROF ALT4D D=0.02  N=0
 OPER DHC6      PROF ALT4D D=0.01  N=0
 OPER CH47      PROF COPTR D=0.09  N=0

TRACK T17C RWY 03 STRAIGHT 8.23 RIGHT 40 D 2.47 STRAIGHT 2.96
 OPER 737       PROF ALT4D D=0.64  N=0.08
 OPER 737300    PROF ALT4D D=0.85  N=0.13
 OPER DC950     PROF ALT4D D=0.81  N=0.04
 OPER C130      PROF ALT4D D=0.02  N=0
 OPER P3        PROF ALT4D D=0.03  N=0
 OPER 707320    PROF ALT4D D=0.01  N=0
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OPER CH47        PROF COPTR D=0.04  N=0

 TRACK T18 RWY 03 STRAIGHT 6.09 LEFT 118 D 1.42 LEFT 13.28 D 1.52
LEFT 13.47 D 4.59 STRAIGHT 1.07
  OPER 737         PROF ALT4D D=0.09  N=0.01
  OPER 737300      PROF ALT4D D=0.14  N=0.02
  OPER DC950       PROF ALT4D D=0.20  N=0.01
  OPER DHC8        PROF ALT4D D=0.04  N=0
  OPER DHC6        PROF ALT4D D=0.19  N=0.06

 TRACK TR20 RWY 20 STRAIGHT 6.58 RIGHT 65 D 1.98 STRAIGHT .49
  OPER DC1010      PROF ALT4D D=0.30  N=0
  OPER DC1030      PROF ALT4D D=0.06  N=0
  OPER MD11GE      PROF ALT4D D=0.06  N=0
  OPER L1011       PROF ALT4D D=0.04  N=0
  OPER L10115      PROF ALT4D D=0.01  N=0
  OPER 737         PROF ALT4D D=1.58  N=0.38
  OPER 737300      PROF ALT4D D=2.48  N=0.67
  OPER DC950       PROF ALT4D D=4.00  N=0.36
  OPER DHC8        PROF ALT4D D=0.96  N=0
  OPER C130        PROF ALT4D D=0.10  N=0
  OPER P3          PROF ALT4D D=0.12  N=0
  OPER 707320      PROF ALT4D D=0.04  N=0
  OPER DHC6        PROF ALT4D D=0.016 N=0
  OPER CH47        PROF COPTR D=0.25  N=0

 TRACK TR21 RWY 05 STRAIGHT 5.76 LEFT 64.72 D 1.52 LEFT 22.85 D 2.57
STRAIGHT .49
  OPER 737         PROF ALT4D D=0    N=0.02
  OPER 737300      PROF ALT4D D=0    N=0.06

 TRACK TR22 RWY 05 STRAIGHT 4.94 LEFT 39.6 D 3.04 LEFT 46.7 D 1.02
STRAIGHT .02
  OPER DHC6        PROF ALT4D D=3.70  N=1.12
  OPER BEC58P      PROF ALT4D D=0.09  N=0.03
  OPER DC3         PROF ALT4D D=0.04  N=0.01
  OPER CNA441      PROF ALT4D D=2.41  N=0.73
  OPER BEC58P      PROF ALT4D D=0.36  N=0.11
  OPER HS748A      PROF ALT4D D=0.29  N=0.09
  OPER SD330       PROF ALT4D D=0.13  N=0.04
  OPER CNA441      PROF ALT4D D=0.10  N=0.03
  OPER CNA441      PROF ALT4D D=0.14  N=0.04
  OPER GASEPF      PROF ALT4D D=0.06  N=0.01
  OPER GASEPV      PROF ALT4D D=0.38  N=0.06
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  OPER GASEPV      PROF ALT4D D=0.86  N=0.13
  OPER BEC58P      PROF ALT4D D=0.08  N=0
  OPER GASEPV      PROF ALT4D D=1.33  N=0.05
  OPER GASEPF      PROF ALT4D D=2.72  N=0.10
  OPER CNA441      PROF ALT4D D=1.91  N=0.07
  OPER COMJET      PROF ALT4D D=0.06  N=0
  OPER HS748A      PROF ALT4D D=0.19  N=0.01
  OPER COMJET      PROF ALT4D D=0.05  N=0

 TRACK TR23 RWY 05 STRAIGHT 6.58 LEFT 44.05 D 1.11 LEFT 52.53 D .68
LEFT    15.19 D 1.15 LEFT 74.8 D .37 STRAIGHT .49
  OPER DHC6        PROF ALT4D D=1.23  N=0.37
  OPER BEC58P      PROF ALT4D D=0.09  N=0.03
  OPER DC3         PROF ALT4D D=0.04  N=0.01
  OPER BEC58P      PROF ALT4D D=0.04  N=0.01
  OPER HS748A      PROF ALT4D D=0.03  N=0.01
  OPER SD330       PROF ALT4D D=0.01  N=0.00
  OPER CNA441      PROF ALT4D D=0.01  N=0
  OPER CNA441      PROF ALT4D D=0.02  N=0
  OPER BEC58P      PROF ALT4D D=0.08  N=0
  OPER GASEPV      PROF ALT4D D=0.15  N=0.01
  OPER GASEPF      PROF ALT4D D=0.30  N=0.01
  OPER COMJET      PROF ALT4D D=0.01  N=0
  OPER HS748A      PROF ALT4D D=0.03  N=0
  OPER COMJET      PROF ALT4D D=0.01  N=0

 TRACK TR24 RWY 23 STRAIGHT 8.23
  OPER DHC6        PROF ALT4D D=0.18  N=0.10
  OPER BEC58P      PROF ALT4D D=0.25  N=0.14
  OPER DC3         PROF ALT4D D=0.12  N=0.07
  OPER CNA441      PROF ALT4D D=0.36  N=0.20
  OPER BEC58P      PROF ALT4D D=0.11  N=0.06
  OPER HS748A      PROF ALT4D D=0.09  N=0.05
  OPER SD330       PROF ALT4D D=0.04  N=0.02
  OPER CNA441      PROF ALT4D D=0.03  N=0.02
  OPER CNA441      PROF ALT4D D=0.04  N=0.02
  OPER GASEPF      PROF ALT4D D=0.01  N=0
  OPER GASEPV      PROF ALT4D D=0.06  N=0.02
  OPER GASEPV      PROF ALT4D D=0.13  N=0.04
  OPER BEC58P      PROF ALT4D D=0.22  N=0.02
  OPER GASEPV      PROF ALT4D D=0.40  N=0.03
  OPER GASEPF      PROF ALT4D D=0.82  N=0.06
  OPER CNA441      PROF ALT4D D=0.29  N=0.02
  OPER COMJET      PROF ALT4D D=0.02  N=0
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OPER HS748A         PROF ALT4D D=0.06  N=0
OPER COMJET         PROF ALT4D D=0.01  N=0

TRACK T28A RWY 03 STRAIGHT 9.05
 OPER DC1010        PROF ALT4D D=1.10  N=0
 OPER DC1030        PROF ALT4D D=0.21  N=0
 OPER MD11GE        PROF ALT4D D=0.22  N=0
 OPER L1011         PROF ALT4D D=0.14  N=0
 OPER L10115        PROF ALT4D D=0.03  N=0
 OPER 737           PROF ALT4D D=5.78  N=0.74
 OPER 737300        PROF ALT4D D=9.08  N=1.31
 OPER DC950         PROF ALT4D D=14.56 N=0.71
 OPER DHC8          PROF ALT4D D=3.50  N=0
 OPER DHC6          PROF ALT4D D=0.05  N=0.01
 OPER CNA441        PROF ALT4D D=0.13  N=0.04
 OPER GASEPV        PROF ALT4D D=0.02  N=0
 OPER GASEPV        PROF ALT4D D=0.05  N=0.01
 OPER CNA441        PROF ALT4D D=0.11  N=0
 OPER C130          PROF ALT4D D=0.31  N=0
 OPER P3            PROF ALT4D D=0.40  N=0.01
 OPER 707320        PROF ALT4D D=0.14  N=0
 OPER DHC6          PROF ALT4D D=0.01  N=0
 OPER COMJET        PROF ALT4D D=0.02  N=0
 OPER DHC6          PROF ALT4D D=0.06  N=0
 OPER CH47          PROF COPTR D=0.75  N=0

TRACK T28B RWY 03 STRAIGHT 8.23 RIGHT 22 D 4.94 STRAIGHT 4.12
 OPER DC1010        PROF ALT4D D=1.10  N=0
 OPER DC1030        PROF ALT4D D=0.21  N=0
 OPER MD11GE        PROF ALT4D D=0.22  N=0
 OPER L1011         PROF ALT4D D=0.14  N=0
 OPER L10115        PROF ALT4D D=0.03  N=0
 OPER 737           PROF ALT4D D=5.78  N=0.74
 OPER 737300        PROF ALT4D D=9.08  N=1.31
 OPER DC950         PROF ALT4D D=14.56 N=0.71
 OPER DHC8          PROF ALT4D D=3.50  N=0
 OPER DHC6          PROF ALT4D D=0.05  N=0.01
 OPER CNA441        PROF ALT4D D=0.13  N=0.04
 OPER GASEPV        PROF ALT4D D=0.02  N=0
 OPER GASEPV        PROF ALT4D D=0.05  N=0.01
 OPER CNA441        PROF ALT4D D=0.11  N=0
 OPER C130          PROF ALT4D D=0.31  N=0
 OPER P3            PROF ALT4D D=0.40  N=0.01
 OPER 707320        PROF ALT4D D=0.14  N=0
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 OPER DHC6          PROF ALT4D D=0.01  N=0
 OPER COMJET        PROF ALT4D D=0.02  N=0
 OPER DHC6          PROF ALT4D D=0.06  N=0
 OPER CH47          PROF COPTR D=0.75  N=0

TRACK T32  RWY 05 STRAIGHT 49.4 RIGHT 39 D 3.29 STRAIGHT 0.99
 OPER DHC8          PROF ALT4D D=2.64  N=0

TRACK T33  RWY 23 STRAIGHT 49.4 RIGHT 87 D 1.48 STRAIGHT 0.08
 OPER DHC6          PROF ALT4D D=0.53  N=0.29

TRACK T34  RWY 23 STRAIGHT 49.4 RIGHT 30 D 2.63 STRAIGHT 0.54
LEFT 157 D 0.99 STRAIGHT 0.13
 OPER DHC8          PROF ALT4D D=0.36  N=0

TRACK T51A RWY 03L STRAIGHT 8.23 LEFT 35 D 1.07 STRAIGHT 1.15
LEFT 36 D .08 STRAIGHT .03
 OPER SA350D        PROF COPTR D=2.50  N=0
 OPER B206L         PROF COPTR D=1.34  N=0
 OPER H500D         PROF COPTR D=1.09  N=0

TRACK T51B RWY 03L STRAIGHT 8.23 LEFT 55 D 1.23 STRAIGHT .99      LEFT
20 D .08 STRAIGHT .03
 OPER SA350D        PROF COPTR D=4.99  N=0
 OPER B206L         PROF COPTR D=2.68  N=0
 OPER H500D         PROF COPTR D=2.19  N=0

TRACK T51C RWY 03L STRAIGHT 8.23 LEFT 12 D 1.07 STRAIGHT 1.15
LEFT 60 D .08 STRAIGHT .03
 OPER SA350D        PROF COPTR D=2.50  N=0
 OPER B206L         PROF COPTR D=1.34  N=0
 OPER H500D         PROF COPTR D=1.09  N=0

TRACK T52A RWY 03R STRAIGHT 8.23 LEFT 30 D 3.13 STRAIGHT 1.97
LEFT 50 D 3.79 STRAIGHT 1.81 RIGHT 16 D 0.33 STRAIGHT 1.60    RIGHT 8 D
0.33 STRAIGHT 1.81 RIGHT 150 D 0.30 STRAIGHT 0.03
 OPER SA350D        PROF COPTR D=14.97 N=0
 OPER B206L         PROF COPTR D=8.04  N=0
 OPER H500D         PROF COPTR D=6.57  N=0

TRACK T52B RWY 03R STRAIGHT 8.23 LEFT 30 D 3.13 STRAIGHT 1.65
LEFT 47 D 3.26 STRAIGHT 1.85 RIGHT 12 D 0.33 STRAIGHT 2.00    RIGHT 8 D
0.33 STRAIGHT 1.51 RIGHT 150 D 0.39 STRAIGHT 0.03
 OPER SA350D        PROF COPTR D=14.82 N=0.15
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  OPER B206L        PROF COPTR D=8.02  N=0.08
  OPER H500D        PROF COPTR D=6.49  N=0.00

 TRACK TR53 RWY 03R STRAIGHT 8.23 LEFT 37 D .33 STRAIGHT .99     RIGHT
150 D .25 STRAIGHT .03
  OPER SA350D       PROF COPTR D=4.99  N=0
  OPER B206L        PROF COPTR D=2.68  N=0
  OPER H500D        PROF COPTR D=2.19  N=0

 TRACK TR56 RWY 03R STRAIGHT 8.23 RIGHT 35 D .25 STRAIGHT .03
  OPER SA350D       PROF COPTR D=2.50  N=0
  OPER B206L        PROF COPTR D=1.34  N=0
  OPER H500D        PROF COPTR D=1.09  N=0

 TRACK TR57 RWY 03R STRAIGHT 8.23 LEFT 19 D .25 STRAIGHT .03
  OPER SA350D       PROF COPTR D=2.50  N=0
  OPER B206L        PROF COPTR D=1.34  N=0
  OPER H500D        PROF COPTR D=1.09  N=0

TOUCHGOS BY FREQUENCY:

 TRACK TR27 RWY 03 STRAIGHT 2.66 RIGHT 41.88 D 1.41 RIGHT 48.08 D .25
  RIGHT 14.57 D .51 RIGHT 64.46 D .59 STRAIGHT 5.20 RIGHT 61.52 D 1.08
RIGHT 39.45 D 1.08 RIGHT 36.87 D .82 RIGHT 53.13 D 1.34     STRAIGHT 1.94
  OPER C130         STAGE 1 PROF ALT4D D=0.61  N=0.01
  OPER DHC6         STAGE 1 PROF ALT4D D=0.01  N=0
  OPER DHC6         STAGE 1 PROF ALT4D D=0.11  N=0
  OPER CH47         STAGE 1 PROF COPTR D=1.50  N=0

 TRACK TR30 RWY 05 STRAIGHT .82 LEFT 180 D .38 STRAIGHT 1.48      LEFT
180 D .38 STRAIGHT .66
   OPER GASEPV      STAGE 1 PROF ALT4D D=8.66   N=0.37
   OPER GASEPF      STAGE 1 PROF ALT4D D=17.63  N=0.75
   OPER BEC58P      STAGE 1 PROF ALT4D D=4.64   N=0.20

FT.

PROCESSES:

GRID LDN START=  7450  1000  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=  185  -1559  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= 10050 -2980  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -4065  570   STEP= 0 0  SIZE= 1 BY 1  DETAIL
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GRID LDN START= 11690 -4680  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= 13100 -4100  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -8850   100  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -11850 1100  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -6800  3600  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=   700 -1350  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -16000 18750 STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=  -700  3550  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= 16420 -7550  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -7264  2     STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -15800 15250 STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=  6150  1950  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=  1786 -1725  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -5700  9800  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=  9300 -1650  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -2748 -201   STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=  9840 -2000  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=  3500 -1420  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=-40600  -250  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=-43800  1150  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START=-36600 -12150 STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= 10350 -3200  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= 11200 -3350  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= 13000 -4400  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -10375 -2120 STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -17750 -2400 STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -27270 -4150 STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -4250 -3350  STEP= 0 0  SIZE= 1 BY 1  DETAIL
GRID LDN START= -24500 -6350 STEP= 0 0  SIZE= 1 BY 1  DETAIL

   CONTOUR LDN AT 75 70 65 60 55
   WITH TOLERANCE = 0.5

END.
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Appendix G

Comments and Responses

WATANABE, ING & KAWASHIMA
ATTORNEYS AT LAW
A PARTNERSHIP INCLUDING LAW CORPORATIONS
HAWAII TOWER, 5th & 6th FLOORS
745 FORT STREET
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June 15, 1995

HAND DELIVERED

State of Hawaii
Department of Transportation
Airports Division
400 Rodgers Blvd., Suite 700
Honolulu, Hawaii 96819

Re: Kahului Airport Noise Compatibility Program
State Project No. AM1011-05

Gentlemen:

On behalf of Aloha Airlines, we are submitting the enclosed documents as written testimony and comment on the "Draft Kahului Airport Noise Compatibility Program" (April 1995).

Since the draft report relies, in part, on a prior cost benefit analysis prepared for the Department of the Attorney General, we are also enclosing as testimony our letter of December 30, 1994, which discussed Aloha's position with regard to certain proposed amendments to Hawaii Administrative Rules, Chapter 19-28.

Respectfully submitted,

J. DOUGLAS ING
for
WATANABE, ING & KAWASHIMA

JDI:dfp

Enclosure
cc: Aloha Airlines, Inc.
0067500.01

WRITTEN COMMENTS OF ALOHA AIRLINES, INC. TO DRAFT KAHULUI AIRPORT - FAR PART 150 NOISE COMPATIBILITY PROGRAM REPORT VOLUME II

Aloha Airlines, Inc. ("Aloha") submits the following comments to the Draft Kahului Airport - FAR Part 150 Noise Compatibility Program dated April 1995 ("Report") prepared by Belt Collins Hawaii and Y. Ebisu and Associates.

The Report considered a number of noise abatement alternatives. The noise reduction benefits of eleven most promising alternatives were calculated and a noise compatibility program was prepared.

Aloha concurs with the decision not to include the following alternatives into the noise compatibility plan:

Noise Abatement Based on Operational Changes:

Limitations or Restrictions on Type or Class of Aircraft based on Aircraft Noise Levels (Section 7.2.7)

1. Impose Noise Restrictions Comparable to Those Applicable on the Mainland (Option T5 - Section 7.2.7.2)

   "Because of the severe hardship that it would create for Hawaii's interisland air carriers, the adverse effect this could have on the State's air transportation system, and the measure's limited success in providing improved land use compatibility, this measure is not part of the recommended program."

2. Eliminate All Stage 2 Operations (Options T1 and T2) (Section 7.2.7.3)

   "...the fact that the existing operations are relatively efficient ones that provide service at prices towards the low end of those found elsewhere in the country suggest that new carriers entering the market with service comparable to that provided by the existing carriers would probably not operate with lower fares or otherwise improve the quality of interisland air service. Because of this, neither of these measures is included in the recommended plan."

3. Reschedule Nighttime Aircraft Operations to Daytime Operations (Option T9)

   "...most of the uses that would be incompatible under the "no-mitigation" scenario would remain in the incompatible range despite the 1 to 3 Ldn reduction in average day-night noise levels produced by this alternative. Only those homes which are on the fringe of the incompatible area would be made fully compatible by this measure. Additional measures that have the potential to reduce noise by a further 10 to 15 Db would be required in addition to the nighttime curfew to address the remaining land use incompatibilities at Spreckelsville. Consequently, this alternative is not part of the recommended noise program."

Aloha is pleased to learn that the report does not recommend a nighttime curfew for Kahului Airport. If enacted, this restriction would have had a most devastating effect on the island's economy, with an increase in interisland shipping costs as well as a decrease in the quantity, quality, and speed of goods shipped.

Hawaii's economy depends on air cargo service. Unlike other states which have intrastate trucking and rail service, Hawaii has no other means of transporting time sensitive cargo between the islands. The interisland air carriers are the intrastate highways and railways of Hawaii.

Aloha has five (5) cargo aircraft with a capability to carry passengers during the day and cargo at night, four of which are generally in operation at night. Most major shippers utilize Aloha's nighttime cargo to provide next day service to the neighbor islands. This is particularly true for time sensitive and perishable cargo.

The scheduling of Aloha's cargo flights is dictated by customer delivery time requirements. Frequently, Aloha has only a four to six hour window within which to move cargo from Honolulu International Airport to the neighbor islands. Aloha's movement is usually the last segment of a continuous stream of commerce, frequently originating earlier in the day from locations in other time zones. Aloha is therefore not fully in control of the timing of freight movements.

The elimination of night cargo flights would prevent time sensitive cargo such as newspapers, UPS parcels, U.S. mail, and bakery products from being delivered in a timely manner to Maui. This would, in turn, have a negative economic impact on the Maui community, and the selection of goods and services available to Maui residents and visitors, as well as large and small businesses.

It is not practical to assume that this cargo could be moved during daytime hours for several reasons. First and most importantly, the timely arrival of U.S. mail, newspapers, and products such as bread and fresh fruit is critical to its use and value. Secondly, economics require that Aloha's cargo aircraft must be utilized for interisland passenger service during the day. Finally, the volume of night cargo could not be accommodated on daytime passenger aircraft, since most of that space must be allocated to passenger baggage.

If a stage 2 night curfew is imposed, Aloha would be forced to discontinue its cargo operation. Since Aloha currently offers the only reliable air cargo service in the State that has

timely service at affordable rates, the neighbor islands would have essentially been cut off.

Although the negative impact of a curfew falls primarily on Aloha's cargo operation, passenger flights will also be affected. Aloha frequently charters its aircraft for late night passenger service into Maui. Occurring seasonally, these interisland flights are timed to coincide with late arriving trans-Pacific flights into Honolulu and provide crucial connections for visitors whose final destination is Maui. Aloha does not have sufficient Stage 3 passenger aircraft to ensure that charters would not conflict with a noise curfew.

4. Disallow Nighttime Departures, but Permit Arrivals Before 7:00 a.m. (Option 10) Section 7.2.7.6

"The same number of homes would require mitigation under this option as would require mitigation under Option T9. This alternative would have essentially the same effect on interisland and overseas air travel as Option T9 as well. For reasons outlined in the preceding section, this measure is not included in the recommended plan."

5. Capacity Limitations Based on Relative Noisiness - Section 7.2.7.7

"...because such restrictions would provide an incentive for operators to shift their noisier aircraft to other Neighbor Island airports that have more serious land use compatibility problems than does Kahului, they could be counter-productive as a means of reducing overall noise exposure. This measure is not part of the recommended plan."

6. Landing fees based on aircraft noise levels and/or time of operation Section 7.2.7.8

"...increasing landing fees for nighttime operations is an effective noise abatement measure only to the extent that it prevents the use of Stage 2 aircraft. Charging

> *higher landing fees for noisier aircraft operations during the daytime would provide an economic incentive for airlines to accelerate their move to Stage 3 aircraft. At the same time, it would take money from them which might otherwise be used to accomplish the necessary fleet conversion. In view of the foregoing, the use of increased landing fees based on noise or time of operation is not recommended for inclusion in the Noise Compatibility Program."*

Aloha concurs with the report's recommendations listed above. These noise abatement options should therefore not be included in the plan.

RECOMMENDED NOISE COMPATIBILITY PROGRAM

Nighttime Prohibition on Stage 2 Aircraft

One of the components of the Noise Compatibility Program is the consideration of a nighttime prohibition on Stage 2 Aircraft. The Report recommends that the State Department of Transportation continue to pursue an amendment to Chapter 19-28 of the Hawaii Administrative Rules to include a 10:00 p.m. to 6:00 p.m. ban on the operation of Stage 2 aircraft at Kahului Airport. The Report summarizes its analysis of the nighttime prohibition on Stage 2 aircraft as follows:

> *[A] prohibition on nighttime use of Stage 2 aircraft at Kahului Airport will have a limited effect on Ldn levels...thus it does not appear to be warranted on that accord. However, single-event noise from the B737-300-QC aircraft that make up a part of Aloha Airlines' cargo fleet is at least 10 Db less than that of the B-737-200-QC aircraft that make up the remainder. Consequently, shifting to the quieter airplane would result in a noticeable decrease in single-event nighttime aircraft noise in Spreckelsville."*

Further, the Report recommends "that the Department [of Transportation] evaluate the impact of imposing this requirement

by the end of 1998. This should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes."

Aloha opposes the imposition of any such administrative rule and the subsequent ban on Stage 2 aircraft for the following reasons:

1. The Cost/Benefit Analysis upon which the recommendation is based is inadequate.

This recommendation mistakenly relies on the statement below from the 1992 Cost/Benefit Analysis Report relating to alternative noise restrictions at Kahului Airport prepared by KPMG Peat Marwick, which states in part that:

> *"The only effect on airlines (from a nighttime restriction on Stage 2 aircraft) would be to assign the Stage 3 quick change aircraft already on order to cargo routes serving Kahului, and the potential conversion of future Stage 3 aircraft to the quick change configuration. There would be no effect on local businesses, as they would receive shipments according to current schedules."*

This statement does not take into account the following:

a. It is not economically feasible for Aloha to continue to integrate Stage 3 aircraft into the market structure. The cost of acquiring new Stage 3 aircraft (737-300) in the quick change configuration is extremely high (estimated at more than $35 million per aircraft) and the converted aircraft is expensive to maintain and operate. Passengers and local businesses, therefore, <u>will</u> be affected by this requirement. Increased aircraft capital costs must be borne by both the passenger service as well as the cargo service.

b. Assigning all Stage 3 aircraft to Kahului would negatively impact other airports in the State since the number of Stage 2 aircraft, and therefore the level of noise, would increase at these other locations. The Report concedes that:

> *concentrating quieter aircraft at Kahului will tend to increase noise levels around other airports where the nighttime cargo service is operated. Thus, while nighttime prohibition on Stage 2 operations . . . would clearly benefit residents of Spreckelsville by reducing nighttime single event noise, it is less clear that they are the best course of action when viewed from a statewide perspective.*[1]

The report's reliance on the cost/benefit analysis findings is thus heavily flawed since, among other things, it does not take into account the heavy burden of cost that Aloha, local businesses, and neighbor island consumers would have to bear.

2. <u>The Stage 2 ban does not significantly decrease Ldn levels.</u>

If the report is basing the requirement for using only Stage 3 aircraft at night on single-event noise data, then Aloha must strongly object. The Report itself states that "the FAA requires that the noise be described in the Ldn metric." The Report concludes that prohibiting nighttime use by Stage 2 aircraft does not greatly reduce Ldn levels.

[1] Report § 7.2.7.5.

Based upon this federal requirement, the fact that single event noise from Stage 3 aircraft is quieter than Stage 2 aircraft is completely irrelevant. The report should rely solely on Ldn levels, as required by the FAR, and if it does, "a prohibition on nighttime use of Stage 2 aircraft at Kahului Airport...does not appear to be warranted."

3. <u>Spreckelsville Lawsuit</u>

Aloha objects to the proposed imposition of the nighttime ban to the extent that it is being adopted for the purpose of settling a lawsuit. On February 3, 1989, certain residents from Spreckelsville, Maui, filed a lawsuit in the Circuit Court of the Second Circuit, State of Hawaii. See <u>Maui Air Traffic Ass'n, Inc. et al. v. Edward Y. Hirata, et al.</u>, Civil No. 89-0048(1) (herein "Spreckelsville Lawsuit"). By Stipulation filed on September 30, 1991 in the Spreckelsville Lawsuit, the State and plaintiffs agreed to resolve the lawsuit on certain terms and conditions. The Report itself admits that:

> [t]o an extent, the Stipulation [for Stay of Proceedings signed by the <u>Spreckelsville</u> plaintiffs] assumes that certain provisions of the <u>Federal Airport Noise and Capacity Expansion Act of 1990</u> would be implemented in Hawaii through subsequent amendments to FAR Part 91 and the promulgation of FAR Part 161, but it precedes these two final rules . . . and the December 1991 amendment to the Act.

One of the major provisions of the stipulation was that the State would consider restrictions on nighttime operations of Stage 2 aircraft prior to 2000. Therefore, Aloha objects to the imposition of a Stage 2 ban on nighttime flights for the purpose of settling the <u>Spreckelsville</u> lawsuit.

Based on the these reasons, Aloha objects to the inclusion of a Nighttime Prohibition on Stage 2 Aircraft in the Noise Compatibility Program.

Recommended Noise Mitigation Measures

The Report recommends that noise mitigation measures supplement the noise abatement measures sought to be implemented. These mitigation measures include:

- *Negotiate with private landowners in West Spreckelsville to purchase the private properties enclosed by the 75 Ldn Contour;*
- *Initiate a Sound Attenuation Program for remaining residences in West and East Spreckelsville;*
- *Offer to purchase private properties in West and East Spreckelsville enclosed by the 60 Ldn Contour whose owners do not wish to participate in the Sound Attenuation Program;*
- *Continue monitoring of development proposals in the Kahului Airport environs, disclosing airport noise exposure maps to the community*
- *Design, install, and operate a noise monitoring system at Kahului Airport*
- *Annually monitor aircraft noise levels and operations at Kahului Airport, and conduct public informational meetings on the progress of the Part 150 Noise Compatibility Program.*

Aloha concurs with the report's mitigation measures listed above. The options should be included in the noise compatibility program.

SUMMARY

Aloha objects to the inclusion of a nighttime ban on Stage 2 aircraft in the noise compatibility plan. The Report suggests the pursuit of a nighttime curfew on Stage 2 aircraft at

Kahului Airport, even though it cannot substantiate a legitimate basis for doing so. It recommends that the State DOT continue to pursue an amendment to HRS Chapter 19-28 to impose the nighttime curfew, even though the report states that "neither measure would greatly reduce the size of the noise contours, with the decrease in Spreckelsville being on the order of 1 to 1.5 Ldn points." The recommendation is inapposite to the report's findings.

This curfew would force Aloha to bear a substantial, economically unfeasible obligation which would yield only a very small return in noise reduction, while resulting in a large negative impact on the State's businesses and most importantly, the consumers of Maui.

Aloha supports the Report's recommendations to include various mitigation measures as discussed above and concurs with the recommendation not to impose a total nighttime curfew at the Kahului airport.

C0019301

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

KAZU ... DIRECTOR
DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
AIR-EP
95.234

August 28, 1995

Mr. J. Douglas Ing
Watanabe, Ing, & Kawashima
745 Fort Street, 5th & 6th Floors
Honolulu, Hawaii 96813

Dear Mr. Ing:

Subject: Comments On Draft Kahului Airport Noise Compatibility Program Report
Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your June 15, 1995, letter concerning the draft *Kahului Airport FAR Part 150 Noise Compatibility Program Report* which was forwarded to me by the Director for a response.

I appreciate the time you and your staff spent reviewing the report and preparing your detailed written comments. Aloha's insights are a welcome input to our efforts to improve the land use compatibility situation around the State's airports. Point-by-point responses to your comments follow below.

(1) Comment: Page 1. *Aloha concurs with the decision not to include the following alternatives into the noise compatibility plan:*

- *Noise Restrictions Comparable to Those Applicable on the Mainland (Option T5, Section 7.2.7);*
- *Elimination of All Stage 2 Operations (Options T1 and T2, Section 7.2.7.3);*
- *Reschedule Nighttime Operations to Daytime Operations (Option T9)*

Response: Thank you for expressing agreement with these findings.

(2) Comment: Page 4, First Full Paragraph. *Although the negative impact of a curfew falls primarily on cargo*

operation, passenger flights will also be affected. Aloha frequently charters its aircraft for late night passenger service into Maui. Occurring seasonally, these interisland flights are timed to coincide with late arriving trans-Pacific flights into Honolulu and provide crucial connections for visitors whose final destination is Maui. Aloha does not have sufficient Stage 3 aircraft to ensure that charters would not conflict with a noise curfew.

Response: We understand your concern for possible impacts on your charter operations if the curfew were imposed immediately or by the end of 1995. However, such effects seem unlikely to occur in the study's 1998 forecast year for the reasons discussed below.

Information obtained from Aloha Airlines in December 1994 indicated that 11 out of the 18 aircraft which Aloha Airlines expects to have in its fleet by the end of 1998 would be Stage 3. This is shown on page 7-18 of the draft report. Subtracting the convertible (QC) aircraft from this on the assumption that they would all be employed in cargo (rather than passenger) service, leaves seven Stage 3 passenger aircraft. Even if two or three of these were undergoing maintenance, a minimum of four or five Stage 3 passenger aircraft would be available to accommodate the late-night passenger traffic mentioned in your letter. The data in our possession indicates that this is sufficient to accommodate the anticipated passenger volume during late-night hours. Consequently, our analysis indicates that Aloha Airlines will have sufficient Stage 3 passenger aircraft in 1998 to ensure that charters would not conflict with a noise curfew.

(3) Comment: Page 6, beginning first full paragraph. *Aloha opposes the imposition of any such administrative rule [amendments to Chapter 19-28, Hawaii Revised Statutes] and the subsequent ban on Stage 2 aircraft for the following reasons:*

1. *The Cost/Benefit Analysis upon which the recommendation is based is inadequate. This recommendation mistakenly relies on the statement below from the 1992 Cost/Benefit Analysis Report relating to alternative*

noise restrictions at Kahului Airport prepared by KPMG Peat Marwick, which states in part that:

> *"The only effect on airlines (from a nighttime restriction on Stage 2 aircraft) would be to assign the Stage 3 quick change aircraft already on order to cargo routes serving Kahului, and the potential conversion of future Stage 3 aircraft to the quick change configuration. There would be no effect on local businesses, as they would receive shipments according to current schedules.*

This statement does not take into account the following:

a. It is not economically feasible for Aloha to continue to integrate Stage 3 aircraft into the market structure. The cost of acquiring new Stage 3 aircraft (737-300) in the quick change configuration is extremely high (estimated at more than $35 million per aircraft) and the converted aircraft is expensive to maintain and operate. Passengers and local businesses, therefore, will be affected by this requirement. Increased aircraft capital costs must be borne by both the passenger service as well as the cargo service.

b. Assigning all Stage 3 aircraft to Kahului would negatively impact other airports in the State since the number of Stage 2 aircraft, and therefore the level of noise, would increase at these other locations. The report concedes that:

> *concentrating quieter aircraft at Kahului will tend to increase noise levels around other airports where the nighttime cargo service is operated. Thus, while nighttime prohibitions on Stage 2 operations...would clearly benefit residents of Spreckelsville by reducing nighttime single-event noise, it is less clear that they are the best course of action when viewed from a statewide perspective. [Report § 7.2.7.5]*

The report's reliance on the cost/benefit analysis is thus heavily flawed since, among other things, it does not take into account the heavy burden of cost that Aloha, local businesses, and neighbor island consumers would have to bear.

Response: We would like to make a few clarifications.

- First, the measure cited is a curfew which restricts their operations to the hours of 6:00 am to 10:00 pm. and does not constitute a ban on Stage 2 aircraft. As a consequence, it would affect very few passenger aircraft operations. In fact, the decision to terminate the curfew at 6:00 am instead of the more commonly used 7:00 am was entirely the result of efforts to accommodate the interisland air carriers' schedules.

- Second, the recommendation does not depend entirely upon the 1992 cost-benefit analysis. It was based on our comparison of Aloha's planned 1998 fleet mix, as reported to us in December 1994, with the number of aircraft needed to provide cargo service to Kahului Airport in that year. That information, which is presented on page 7-18 of the report, showed that Aloha would have four B-737-300-QC aircraft in its fleet in 1998, enough to adequately serve Kahului Airport.

- Finally, the report recognizes that a statewide analysis may be needed before a Stage 2 curfew can be implemented.

Please note that most of Aloha's expressed concerns with the recommendation are based on the effects it would have on its current (1995) operations, whereas the Part 150 analysis focused on 1998. The information which was collected does indicate potential implementation problems and impacts if the restrictions were made effective January 1, 1996. However, it suggests Aloha would have a much less difficult time accommodating restrictions that do not become fully effective until the end of 1998. The report recognizes that further investigations are warranted before a nighttime Stage 2 curfew is implemented at Kahului Airport. These include: (*i*) the possibility that nighttime restrictions at Kahului alone might shift noise impacts to other, potentially more noise sensitive airports, (*ii*) the limited cost impact data that is available concerning the impact that restrictions at Kahului Airport would have on air carrier and shipper costs on service to and from that airport and other airports in the state system, and (*iii*) the fact that sound attenuation treatment of dwelling units and/or resident relocation would be the quickest and most effective means of improving land use compatibility during nighttime hours (when residents are normally indoors).

Before imposing restrictions on aircraft operations, the State must comply with the requirements of FAR Part 161. This entails a comprehensive review of all of these issues. We are confident that this review will provide the additional detail that is needed to come to a final decision concerning nighttime restrictions on Stage 2 operations at Kahului Airport.

(4) Comment: *If the report is basing the requirement for using only Stage 3 aircraft at night on single-event noise data, then Aloha must strongly object. The Report itself states that "the FAA requires that the noise be described in the Ldn metric." The Report concludes that prohibiting nighttime use by Stage 3 aircraft does not greatly reduce Ldn levels.*

Based upon the Federal requirement, the fact that single-event noise from Stage 3 aircraft is quieter than Stage 2 aircraft is completely irrelevant. The report should rely solely on Ldn levels, as required by the FAR, and if it does, "a prohibition on nighttime use of Stage 2 aircraft at Kahului Airport...does not appear to be warranted."

Response: The report does not base its recommendations concerning a nighttime curfew on Stage 2 aircraft solely on single-event noise levels. Referring to the discussion of Option T11 (see Section 7.2.7.5 and elsewhere), eliminating Stage 2 aircraft between 10:00 pm and 6:00 am would also marginally decrease Ldn levels.

The report is correct in stating that the FAA requires that noise be described using the Ldn metric. However, the FAA's regulations do not prohibit the use of other, supplementary noise metrics. In fact, the FAA supports supplementing the Ldn cumulative noise analysis with additional metrics when appropriate. It was in this supplementary capacity that single-event noise was used in the report. Other airport noise studies conducted under the FAR Part 150 Program (e.g., Jackson Hole, Wyoming) have also considered single-event noise in formulating their recommended airport noise compatibility plans.

(5) Comment: Page 8, Item 3, Spreckelsville Lawsuit. *Aloha*

objects to the proposed imposition of the nighttime ban to the extent that it is being adopted for the purpose of settling a lawsuit. On February 3, 1989, certain residents from Spreckelsville, Maui, filed a lawsuit in the Circuit Court of the Second Circuit, State of Hawaii. See 'Maui Air Traffic Ass'n, Inc. et al. v. Edward Y. Hirata, et al.' Civil No. 89-0048(1) (herein "Spreckelsville Lawsuit"). By Stipulation filed on September 30, 1991, in the Spreckelsville Lawsuit, the State and plaintiffs agreed to resolve the lawsuit on certain terms and conditions. The Report itself admits that:

> *[t]o an extent, the Stipulation [for Stay of Proceedings signed by the Spreckelsville plaintiffs] assumes that certain provisions of the Federal Airport Noise and Capacity Expansion Act of 1990 would be implemented in Hawaii through subsequent amendments to FAR Part 91 and the promulgation of FAR Part 161, but it precedes these two final rules . . .and the December 1991 amendment to the Act.*

One of the major provisions of the stipulation was that the State would consider restrictions on nighttime operations of Stage 2 aircraft prior to 2000. Therefore, Aloha objects to the imposition of a Stage 2 ban on nighttime flights for the purpose of settling the Spreckelsville lawsuit.

Based on these reasons, Aloha objects to the inclusion of a Nighttime prohibition on Stage 2 Aircraft in the Noise Compatibility Program.

Response: The Draft Noise Compatibility Program recommendation concerning pursuit of possible restrictions on nighttime operations by Stage 2 aircraft was not included for the purpose of settling a lawsuit. The technical bases for the recommendation are explained in the report. Note also that adherence to the lawsuit settlement agreement would require that the restriction on nighttime Stage 2 activity be in place after December 31, 1995, whereas the draft Kahului Airport Noise Compatibility Program report does not specify a start date.

It is anticipated that further investigation of possible nighttime restrictions on Stage 2 operations will occur through the FAR Part 161 process. This will provide a suitable forum for the cost/benefit analysis of possible Stage 2 restrictions that the Airports Division plans to undertake. The results of the analysis will provide information that will help in our decision making at Kahului Airport.

(6) Comment: Page 9, Recommended Noise Mitigation Measures. *The Report recommends that noise mitigation measures supplement the noise abatement measures sought to be implemented....Aloha concurs with these mitigation measures. The options should be included in the noise compatibility program.*

Response: The mitigation measures that are referred to will be included in the recommended program.

(7) Comment: Page 9, Summary. *Aloha objects to the inclusion of a nighttime ban on Stage 2 aircraft in the noise compatibility plan. The Report suggests the pursuit of a nighttime curfew on Stage 2 aircraft at Kahului Airport, even though it cannot substantiate a legitimate basis for doing so. It recommends that the State DOT continue to pursue an amendment to HRS Chapter 19-28 to impose the nighttime curfew, even though the report states that "neither measure would greatly reduce the size of the noise contours, with the decrease in Spreckelsville being on the order of 1 to 1.5 Ldn points." The recommendation is inapposite to the report's findings.*

This curfew would force Aloha to bear a substantial, economically unfeasible obligation which would yield only a very small return in noise reduction, while resulting in a large negative impact on the State's businesses and most importantly, the consumers of Maui.

Aloha supports the Report's recommendations to include various mitigation measures as discussed above and concurs with the recommendation not to impose a total nighttime curfew at the Kahului Airport.

Response: Although your comments did not contain quantitative information to support your comment that the recommendation would "...*force Aloha to bear a substantial, economically unfeasible obligation*....", we felt that the

information that Aloha provided to us previously, showed that Aloha would still be able to meet Maui's needs in 1998 and beyond with the imposition of a nighttime Stage 2 curfew. If we have been incorrect in our assumptions, please provide us with documentation to indicate otherwise.

Thank you again for your comments on the noise compatibility program. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

for Owen Miyamoto
Airports Administrator

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

Grand Wailea Resort
HOTEL & SPA
3850 Wailea Alanui, Wailea, Maui, Hawaii 96753
Phone (808) 875-1234 Fax (808) 874-5143

June 5, 1995

Mr. Karu Hayashida
Director
State of Hawaii
DEPARTMENT OF TRANSPORTATION
869 Punchbowl
Honolulu, HI 96813

Via facsimile: (808) 587-2167

Dear Mr. Hayashida:

I am writing with regard to the Kahului Airport Runway Extension and proposed night curfew which was discussed at the Public Hearing held on May 31, 1995.

As I am sure you are aware, a great number of residents on the island of Maui rely on the visitor industry as part of their livelihood. I am concerned that the impact of such a night curfew would greatly affect the normal flow of business, and affect the overall climate of this viable industry. With such a restriction, the hotel industry, as well as other important businesses, may not be able to receive goods on a timely basis. However, allowing a maximum number of flights in for this purpose will help the visitor industry to continue to thrive and prosper.

Your consideration in ruling against the proposed Administrative Rule would be greatly appreciated.

Sincerely,

Stacey Hiramoto
Senior Director of Human Resources

SH:nmp

cc: Peter O'Connor
Terryl Vencl

GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819-1880

DIRECTOR
DEPUTY DIRECTORS
GLENN M. OKAMOTO
JERRY M. MATSUOA

IN REPLY REFER TO:
AIR-EP
95.224

August 28, 1995

Ms. Stacey Hiramoto
Senior Director of Human Relations
Grand Wailea Resort
3850 Wailea Alanui
Wailea, Maui, Hawaii 96753

Dear Ms. Hiramoto:

Subject: Comments on Draft Kahului Airport FAR Part 150 Noise Compatibility Program
Kahului Airport Noise Compatibility Program
Project No. AH1011-05

Thank you for your May 30, 1995 letter concerning Kahului Airport which was forwarded to me by the Director for a response.

The Airports Division understands your desire to avoid restrictions on aircraft operations that would adversely affect the normal flow of business and the overall climate for your industry. Other individuals and organizations have expressed similar concerns. The recommended noise compatibility program was prepared with these in mind.

The recommendations in the draft report relating to restrictions on the use of Stage 2 aircraft at Kahului Airport read as follows:

> *...it is recommended that the Department evaluate the impact of imposing this requirement [prohibiting the use of Stage 2 aircraft between the hours of 10:00 PM and 6:00 AM] by the end of 1998 [emphasis added]. This should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes.* (page 8-6)
>
> *The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide.* (page 8-8)

As you can see, the report does not recommend the immediate imposition of restrictions on the nighttime operation of Stage 2 aircraft at Kahului Airport. Rather, it recommends that the Airports Division continue to evaluate the implications of implementing such restrictions by the end of 1998.

Any restrictions would be implemented in conformance with Part 161 of the Federal Aviation Regulations (FAR Part 161). These regulations stipulate the kinds of cost-benefit analyses that must be undertaken by an airport operator who wishes to impose more stringent noise limits than are provided for under Federal law. The FAR Part 161 process will ultimately determine whether nighttime restrictions are imposed. However, we felt it important for the Part 150 Noise Compatibility Program to express our support for the continuation of that process.

The Airports Division will do its best to insure that Kahului Airport continues to meet the needs of Maui's residents and businesses and that restrictions on the use of the airport do not adversely affect the ability of Maui's businesses to compete.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

for Owen Miyamoto
Airports Administrator

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

96 in 96

THE MAUI PUEO COALITION Jun 5 10 32 AM '95 Jimmy Rust, Chairman

May 31, 1995

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hi 96813

RE: Noise Compatability Study...Kahului Runway Extension

Dear Mr. Hayashida:

My name is Jimmy Rust, chairman of the Pueo Coalition. Our coalition represents over 20,000 jobs on the island of Maui.

Our concern on the Noise Compatability Study is a recommendation for night curfew at the Kahului Airport. This curfew would effect passenger flights as well as cargo movement. Maui has most recently lost a number of seats with the cancellation of United's direct flight to Chicago and we cannot afford to lose any further seats to Maui.

The idea of forcing interisland carriers to move to "stage 3" aircraft by December of 1995 is cost prohibitive in our struggling economy. Maui depends on time-sensitive and perishable products which arrive on those night cargo flights. We CANNOT give up the five flights that now arrive on a daily basis with our goods and products. This kind of action will further cripple our economy.

The federal government recognized the unique situation of both Hawaii and Alaska and exempted us from their rule. I recommend you give further thought to removing the stipulation of Hawaii complying by December, 1995 and work with the inter-island carriers to decide what an appropriate date might be.

Our local agriculture community has recently experienced set backs in moving their products off the island due to the aforementioned cancellation of a United flight. They struggle now to find enough space to get cargo off island and if more flights are cancelled, the agriculture community will experience further complications and added costs.

26 N. PUUNENE AVE. • KAHULUI, MAUI, HI 96732 • PHONE 871-PUEO

Noise Compatability Study
page two

I urge you to give further thought and negotiate with local carriers before imposing a night time curfew at the Kahului Airport.

Thank you for your consideration.

Sincerely,

Jimmy Rust
Jimmy Rust
Chairman

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
GLENN M. OKIMOTO
JERRY M. MATSUDA

IN REPLY REFER TO
AIR-EP
95.228

August 28, 1995

Mr. James Rust, Chairman
Pueo Coalition
26 North Puunene Avenue
Kahului, Maui, Hawaii 96732

Dear Mr. Rust:

Subject: Comments on Draft Kahului Airport FAR Part 150 Noise Compatibility Program
Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your May 31, 1995 letter concerning the Draft Kahului Airport FAR Part 150 Noise Compatibility Program report, which the Director forwarded to me for a response.

We understand your concern about the effect that prohibiting the operation of Stage 2 aircraft at Kahului Airport after the end of 1995 could have on Maui's economy and on the air carriers that serve it. Other individuals and organizations have expressed similar concerns. These concerns were taken into account in formulating the recommendations contained in the draft Noise Compatibility Program.

The recommendations in the draft report relating to restrictions on the use of Stage 2 aircraft at Kahului Airport read as follows:

> *...it is recommended that the Department evaluate the impact of imposing this requirement [prohibiting the use of Stage 2 aircraft between the hours of 10:00 PM and 6:00 AM] by the end of 1998 [emphasis added]. This should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes.* (page 8-6)
>
> *The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide.* (page 8-8)

As you can see, unlike the previously proposed amendments to the Hawaii Administrative Rules Chapter 19-28 (which would have become effective at the end of 1995), the *Kahului Airport Noise Compatibility Program Report* does not recommend the immediate imposition of restrictions on the nighttime operation of Stage 2 aircraft at Kahului Airport. Rather, it recommends that the Department of Transportation continue to evaluate the implications of implementing such restrictions by the end of 1998.

Part 161 of the Federal Aviation Regulations (FAR Part 161) requires the State to complete a rigorous cost-benefit analysis demonstrating an overall positive effect before imposing a nighttime curfew or other limitation on aircraft activity. The outcome of the FAR Part 161 process will ultimately determine whether nighttime restrictions are imposed. However, we felt it important for the Part 150 Noise Compatibility Program to express our support for the continuation of that process.

The Airports Division will do its best to insure that Kahului Airport continues to meet the needs of Maui's residents and businesses and that restrictions on the use of the airport do not adversely affect the ability of Maui businesses to compete.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

for Owen Miyamoto
Airports Division

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

MAUI CHAMBER
OF COMMERCE

May 31, 1995

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
Airports Division
Honolulu, HI. 96813

Dear Mr. Hayashida:

I am writing to you on behalf of the Maui Chamber of Commerce and its 1,300 business members.

Our concern is the proposed Administrative Rule which will impose a curfew on cargo flights into Kahului Airport between the hours of 10:00 p.m. and 6:00 a.m. if they are not "stage 3" aircraft, effective December 1995.

It is my understanding that Hawaii and Alaska are exempt from a similar Federal Rule/Law because of our unique transportation situation. If this is so, then why would our State impose such an economic crippling rule upon our island business? We on the neighbor islands depend upon air transportation for many of our time sensitive consumer goods. If we could import these goods from Oahu by truck or rail then perhaps this Administrative Rule would not have such an adverse economic effect, but we cannot.

To demand our already struggling airlines retrofit their aircraft to "stage 3" by December, 1995 is financial suicide for our carriers. In fact it appears, upon investigation, that your considerations toward a very small minority of homeowners versus your financial demands upon our air carriers and our struggling businesses displays a very narrow focus on the part of our State Department of Transportation.

We need economic stimulation not more government regulation.

Yours truly,

Lynne Woods

Lynne Woods, President
Maui Chamber of Commerce

[illegible] Puunene Avenue • Kahului, Maui, HI 96732 • Phone: (808) 871-7711 • FAX: (808) 877-664n

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819-1880

DIRECTOR
DEPUTY DIRECTORS
GLENN M. OKIMOTO
JERRY M. MATSUDA

IN REPLY REFER TO
AIR-EP
95.227

August 28, 1995

Ms. Lynne Woods, President
Maui Chamber of Commerce
26 North Puunene Avenue
Kahului, Maui, Hawaii 96732

Dear Ms. Woods:

Subject: Comments on Draft Kahului Airport FAR Part 150 Noise Compatibility Program
Kahului Airport Noise Compatibility Program
Project No. AM1011-5

Thank you for your May 31, 1995 letter concerning Kahului Airport, which was forwarded to me by the Director for a response.

The first paragraph of your letter indicates that your comments are directed principally at the State's proposal to amend Hawaii Administrative Rules Chapter 19-28 by adding a new section, §19-28-3.1, prohibiting the nighttime use of Stage 2 aircraft at Kahului Airport after December 31, 1995. This is different from the Noise Compatibility Program which was the subject of the May 31, 1995 public hearing. Hearings have already been held on the proposed changes to Chapter 19-28, and we have subsequently decided to study the matter further before proceeding. Nonetheless, there is sufficient overlap between these regulations and the draft Noise Compatibility Program that I would like to take this opportunity to respond to your concerns.

The Airports Division shares your desire to avoid any unnecessary restrictions on aircraft operations that would adversely affect Maui's economy. Other individuals and organizations have expressed similar concerns. The recommendations in the draft report relating to restrictions on the use of Stage 2 aircraft at Kahului Airport were drafted with these concerns in mind. They read as follows:

> *...it is recommended that the Department evaluate the impact of imposing this requirement [prohibiting the use of Stage 2 aircraft between the hours of 10:00 PM and 6:00 AM] by the end of 1998 [emphasis added]. This should be done as part of its continuing efforts to*

> *amend Chapter 19-28, Hawaii Revised Statutes.* (page 8-6)
>
> *The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide.* (page 8-8)

As you can see, the report does <u>not</u> recommend the immediate imposition of restrictions on the nighttime operation of Stage 2 aircraft at Kahului Airport. Rather, it recommends that we continue to evaluate the implications of implementing such restrictions by the end of 1998.

Please note that Part 161 of the Federal Aviation Regulations (FAR Part 161) requires the State to complete a rigorous cost-benefit analysis demonstrating an overall positive effect before imposing a nighttime curfew or other limitation on aircraft activity. The outcome of the FAR Part 161 process will ultimately determine whether nighttime restrictions are imposed. However, we felt it important for the Part 150 Noise Compatibility Program to express our support for the continuation of that process.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

Owen Miyamoto
Airports Administrator

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

Maui Pineapple Company, Ltd.

May 31, 1995

State of Hawaii
Department of Transportation
Airport Division
Honolulu International Airport
Honolulu, Hi 96819

To Whom It May Concern:

My name is Joe Kekiwi and I am the Fresh Fruit Superintendent for Maui Pineapple Company. As a follow-up to my letter of December 29, 1994, I would like to submit this written testimony against the Hawaii DOT Airports Division implementing an amendment to its Administrative Rules, which will restrict Stage 2 aircraft from operating between the hours of 10:00 pm to 6:00 am at the Kahului Airport.

For one inter-island carrier, Aloha Airlines (which carries the bulk of the inter-island air freight), this new restriction will curtail as much as 80 percent of its night-time freight service into Maui, because of its present mix of cargo aircraft.

For the year 1994, we have shipped 85,000 pounds of product on Aloha Airlines to Oahu, then connecting on another carrier to the mainland. We have shipped some product through Matson, but have found it not a profitable venture for two reasons: the quality of our product is greatly effected, and we cannot compete in price with our competitors. Therefore, to stay competitive, we target the jet side of the industry.

There are three carriers that transport our product from Maui to the mainland. We fill our allotted container positions on each aircraft on a regular basis. Aloha Airlines has enabled us to increase our sales to the mainland by shipping our product on their night-time freighters to Oahu.

For 1995 we have projected a 20 percent increase in tonnage to the mainland. This goal cannot be achieved without the utilization of Aloha Airlines night freighters. It is extremely important to fulfill our customers' needs, provide them with the best quality product and stay price competitive in the produce market place.

Post Office Box 187 • Kahului, Hawaii 96732-0187 • Telephone (808) 877-3351 • FAX (808) 871-0953

For all of these reasons, we are opposed to this new rule and respectfully suggest you strongly reconsider implementing this amendment.

Sincerely,

for. Donna Clayton
Joe Kekiwi
Fresh Fruit Superintendent
Maui Pineapple Company, Ltd.

/dc

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819-1880

DEPUTY DIRECTORS
GLENN M. OKIMOTO
JERRY M. MATSUDA

IN REPLY REFER TO:
AIR-EP
95.225

August 28, 1995

Mr. Joe Kekiwi
Fresh Fruit Superintendent
Maui Pineapple Company, Ltd.
P.O. Box 187
Kahului, Maui, Hawaii 96732-0187

Dear Mr. Kekiwi:

Subject: Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your May 31, 1995 testimony and letter concerning the FAR Part 150 Program for Kahului Airport, which the Director forwarded to me for a response.

The first paragraph of your letter indicates that your comments are directed principally at the State's proposal to amend Hawaii Administrative Rules Chapter 19-28 by adding a new section, §19-28-3.1. This is different from the Noise Compatibility Program which was the subject of the May 31, 1995 public hearing. Hearings on the proposed changes to Chapter 19-28 were held in December, 1994, and we have subsequently decided to study the matter further before proceeding. Nonetheless, there is sufficient overlap between the proposed changes to the Administrative Rules and the draft Noise Compatibility Program that I would like to take this opportunity to respond to your concerns.

The Airports Division understands your desire to avoid restrictions on aircraft operations that would adversely affect your ability to use Aloha Airlines' nighttime freighter service to ship pineapple from Maui to Oahu. The draft report's recommendations relating to restrictions on the nighttime use of Stage 2 aircraft (including the B-737-200-QC aircraft that make up a part of Aloha Airlines' interisland fleet) read as follows:

> *...it is recommended that the Department evaluate the impact of imposing this requirement [prohibiting the use of Stage 2 aircraft between the hours of 10:00 PM and 6:00 AM] by the end of 1998 [emphasis added]. This*

> *should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes. (page 8-6)*
>
> *The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide. (page 8-8)*

As you can see, the report does not recommend the immediate imposition of restrictions on the nighttime operation of Stage 2 aircraft at Kahului Airport. Rather, it recommends that the Department of Transportation continue to evaluate the implications of implementing such restrictions by the end of 1998.

Please note that Part 161 of the Federal Aviation Regulations (FAR Part 161) requires the State to complete a rigorous cost-benefit analysis demonstrating an overall positive effect before imposing a nighttime curfew or other limitation on aircraft activity. The outcome of the FAR Part 161 process will ultimately determine whether nighttime restrictions are imposed at Kahului Airport. However, we felt it important for the Part 150 Noise Compatibility Program to express our support for the continuation of that process.

The Airports Division will do its best to insure that Kahului Airport continues to meet the needs of Maui's residents and businesses and that restrictions on the use of the airport do not adversely affect the ability of Maui businesses to compete.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

Owen Miyamoto
Airports Administrator

c: AIR-M

Maui County Farm Bureau
Affiliate of the Hawaii Farm Bureau Federation & the American Farm Bureau
Post Office Box 148 • Kula, Hawaii 96790

State of Hawaii
Department of Transportation
Honolulu International Airport
Honolulu, HI 96813

May 30, 1995

Dear Sirs;

On behalf of the Board of Directors of the Maui County Farm Bureau, I am forwarding a second request (refer to letter to Owen Miyamoto dated December 30, 1994) to reconsider the institution of a proposed administrative rule designed to restrict night cargo flights into Kahului Airport to aircraft which meet FAA stage three rules for noise control.

If it is true that such aircraft are not currently in our local cargo fleet, and that the purchase of such aircraft to enhance the current fleet is not financially viable or likely for existing carriers, then the resulting rule would in effect reduce significantly the capacity for inter-island night air freight movement. This would impose another unnecessary burden on local agriculture operations, including fresh produce, fruit, and flower growers, as well as livestock and dairy producers, and further diminish the ability of neighbor island growers and producers from competing against Oahu growers and mainland and overseas fruit, vegetable, and flower importers.

The marketing problems faced by neighbor island farmers are already serious, and additional regulation that might have a negative impact of air cargo movement and rates must be opposed by all thinking members of the local agricultural community. I would hope that those individuals responsible for implementation of any transportation rules which will damage the ability of local farmers, growers, and ranchers to survive in today's market would think twice before implementing any such measures.

Mahalo for your consideration of these thoughts,

Kenneth M. Okamura, President
Maui County Farm Bureau
KMO/ws.

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO:
AIR-EP
95.235

August 28, 1995

Mr. Kenneth M. Okamura, President
Maui County Farm Bureau
P.O. Box 148
Kula, Hawaii 97690

Dear Mr. Okamura:

Subject: Comments on Draft Kahului Airport FAR Part 150 Noise Compatibility Program
Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your May 31, 1995, written and oral testimony concerning the FAR Part 150 Program for Kahului Airport.

Your testimony indicates that your concerns relate principally to the State's proposal to amend Hawaii Administrative Rules Chapter 19-28 by adding a new section, §19-28-3.1, prohibiting the nighttime use of Stage 2 aircraft at Kahului Airport after December 31, 1995. This is different from the Noise Compatibility Program which was the subject of the May 31, 1995 public hearing. Hearings have already been held on the proposed changes to Chapter 19-28, and we have subsequently decided to study the matter further before proceeding. Nonetheless, there is sufficient overlap between these regulations and the draft Noise Compatibility Program that I would like to take this opportunity to respond to your concerns.

The Airports Division shares your desire to avoid any unnecessary restrictions on aircraft operations that would adversely affect Maui's economy, especially the local agricultural community. Other individuals and organizations have expressed similar concerns. The recommendations in the draft report relating to restrictions on the use of Stage 2 aircraft at Kahului Airport were drafted with these concerns in mind. They read as follows:

> *...it is recommended that the Department evaluate the impact of imposing this requirement [prohibiting the use of Stage 2 aircraft between the hours of 10:00 PM*

> *and 6:00 AM] by the end of 1998 (emphasis added). This should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes.* (page 8-6)
>
> *The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide.* (page 8-8)

As you can see, the report does <u>not</u> recommend the immediate imposition of restrictions on the nighttime operation of Stage 2 aircraft at Kahului Airport. Rather, it recommends that we continue to evaluate the implications of implementing such restrictions by the end of 1998.

Please note that Part 161 of the Federal Aviation Regulations (FAR Part 161) requires the State to complete a rigorous cost-benefit analysis demonstrating an overall positive effect before imposing a nighttime curfew or other limitation on aircraft activity. The outcome of the FAR Part 161 process will ultimately determine whether nighttime restrictions are imposed. However, we felt it important for the Part 150 Noise Compatibility Program to express our support for the continuation of that process.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

for Owen Miyamoto
Airports Administrator

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

May 24, 1995

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
869 Punchbowl
Honolulu, Hawaii

Re Kahului Airport Noise Compatibility Study

Dear Mr. Hayashida,

The Maui Visitors Bureau is concerned about the Administration Rule included in the Noise Compatibility Study which limits flights into Kahului Airport between the hours of 10:00pm and 6:00am which are not of the 'Stage 3-type' aircraft category.

It is our understanding that this issue has arisen due to a proposed Administrative Rule which states that all aircraft must be of Stage 3-type by December 1995. It is also our understanding that currently there is a Federal Rule which exempts Hawaii from this regulation due to our unique situation.

Our inter island carriers that operate during this time period do not have Stage 3-type aircraft and because of todays economy, as I understand it, will not be able to upgrade their fleet due to financial reasons.

Maui is dependent upon night flights that bring cargo into our island. The visitor industry as well as the public depend on the airlines to bring us fresh bread, milk and many other items that arrive during this proposed shut-down period.

Whether or not passenger planes would fall under this rule has not been explained to us however with a lagging visitor economy the last thing we need to do is limit our availability to potential guests.

Please reconsider the portion of the Noise Compatibility Study that addresses the curfew hours of non-Stage 3-type aircraft.

Thank you for considering our request,

Marsha L. Wienert
Executive Director

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
AIR-EP
95.232

August 28, 1995

Ms. Marsha L. Weinert, Executive Director
Maui Visitors Bureau
1727 Wili Pa Loop
Wailuku, Maui 96793

Dear Ms. Weinert:

Subject: Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your written and oral testimony presented at the May 31, 1995 public hearing for the Federal Aviation Regulation Part 150 Noise Compatibility Program for Kahului Airport.

Your testimony indicates that your concerns relate principally to the State's proposal to amend the Hawaii Administrative Rules Chapter 19-28 by adding a new section, §19-28-3.1, prohibiting the nighttime use of Stage 2 aircraft at Kahului Airport after December 31, 1995. This is different from the Noise Compatibility Program which was the subject of the May 31, 1995 public hearing. Hearings have already been held on the proposed changes to Chapter 19-28, and we have subsequently decided to study the matter further before proceeding. Nonetheless, there is sufficient overlap between these regulations and the draft Noise Compatibility Program that I would like to take this opportunity to respond to your concerns.

The Airports Division shares your desire to avoid any unnecessary restrictions on aircraft operations that would adversely affect Maui's economy, especially the visitor industry. Other individuals and organizations have expressed similar concerns. The recommendations in the draft report relating to restrictions on the use of Stage 2 aircraft at Kahului Airport were drafted with these concerns in mind. They read as follows:

> *...it is recommended that the Department evaluate the impact of imposing this requirement [prohibiting the use of Stage 2 aircraft between the hours of 10:00 PMand 6:00 AM] by the end of 1998 [emphasis added]. This should be done as part of its continuing*

> *efforts to amend Chapter 19-28, Hawaii Revised Statutes.* (page 8-6)
>
> *The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide.* (page 8-8)

As you can see, the report does not recommend the immediate imposition of restrictions on the nighttime operation of Stage 2 aircraft at Kahului Airport. Rather, it recommends that we continue to evaluate the implications of implementing such restrictions by the end of 1998. The rule would have little or no effect on passenger operations because there are no scheduled interisland passenger flights between 10:00 P.M. and 6:00 A.M., and the overseas air carriers that do have flights during this period already use Stage 3 aircraft.

Please note that Part 161 of the Federal Aviation Regulations (FAR Part 161) requires the State to complete a rigorous cost-benefit analysis demonstrating an overall positive effect before imposing a nighttime curfew or other limitation on aircraft activity. The outcome of the FAR Part 161 process will ultimately determine whether nighttime restrictions are imposed. However, we felt it important for the Part 150 Noise Compatibility Program to express our support for the continuation of that process.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

Owen Miyamoto
Airports Administrator

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

May 24, 1995

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hayashida:

We are very concerned about the proposed Administrative Rule which states that all aircraft will be of Stage 3 type by December 1995.

Maui Island, by its very nature, is dependent upon outside venders and carriers for most of its supplies and transportation. It does not seem feasible, therefore, to put added burdens upon businesses seeking transportation for their goods, nor upon residents dependent upon receiving goods.

The imposition of this Rule, from which Hawaii is exempt, certainly carries the message that your department neither cares for nor is concerned about the citizens of islands other than Oahu.

Everyone deserves to have fresh food, timely newspapers, current mail, etc., and for your department to impose unnecessary restrictions on us seems unconscionable.

Sincerely,

Avery B. Chumbley
President

ABC:am

PHONE (808) 244-9570 P.O. BOX 520, WAILUKU, HAWAII 96793 FAX: (808) 242-7068
a C. BREWER company

GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819-1880

DEPUTY DIRECTORS
GLENN M. OKIMOTO
JERRY M. MATSUDA

IN REPLY REFER TO:
AIR-EP
95.222

August 28, 1995

Mr. Avery Chumbley, President
P.O. Box 520
Wailuku, Maui, Hawaii 96793

Dear Mr. Chumbley:

Subject: Comments on Draft Kahului Airport FAR Part 150 Noise Compatibility Program
Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your May 24, 1995 letter concerning Kahului Airport, which was forwarded it to me by the Director for a response.

The first paragraph of your letter indicates that your comments are directed at the State's proposal to amend Hawaii Administrative Rules Chapter 19-28 by adding a new section, §19-28-3.1, prohibiting the nighttime use of Stage 2 aircraft at Kahului Airport after December 31, 1995. This is different from the Noise Compatibility Program which was the subject of the May 31, 1995 public hearing. Hearings have already been held on the proposed changes to Chapter 19-28, and we have subsequently decided to study the matter further before proceeding. Nonetheless, there is sufficient overlap between these regulations and the draft Noise Compatibility Program that I would like to take this opportunity to respond to your concerns.

The Airports Division shares your desire to avoid any unnecessary restrictions on aircraft operations that would adversely affect Maui's economy. Other individuals and organizations have expressed similar concerns. The recommendations in the draft report relating to restrictions on the use of Stage 2 aircraft at Kahului Airport were drafted with these concerns in mind. They read as follows:

> *...it is recommended that the Department evaluate the impact of imposing this requirement [prohibiting the use of Stage 2 aircraft between the hours of 10:00 PM*

> *and 6:00 AM] by the end of 1998 [emphasis added]. This should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes.* (page 8-6)
>
> *The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide.* (page 8-8)

As you can see, the report does <u>not</u> recommend the immediate imposition of restrictions on the nighttime operation of Stage 2 aircraft at Kahului Airport. Rather, it recommends that we continue to evaluate the implications of implementing such restrictions by the end of 1998.

Please note that Part 161 of the Federal Aviation Regulations (FAR Part 161) requires the State to complete a rigorous cost-benefit analysis demonstrating an overall positive effect before imposing a nighttime curfew or other limitation on aircraft activity. The outcome of the FAR Part 161 process will ultimately determine whether nighttime restrictions are imposed. However, we felt it important for the Part 150 Noise Compatibility Program to express our support for the continuation of that process.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

[signature]

for Owen Miyamoto
Airports Administrator

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

MAUI HOTEL ASSOCIATION

1325 Lower Main, Suite 103, Wailuku, Maui, Hawaii 96793 • Fax (808) 244-3094 • Phone (808) 244-8625

May 31, 1995

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

RE: Noise Compatability Study...Kahului Runway Extension

Dear Mr. Hayashida:

The members of the visitor industry on the island of Maui are very concerned over the proposed night curfew suggested in the Noise Compatability Study.

Our obvious concern is that cargo may sit at Maui's Kahului Airport because there are not enough "stage 3" planes to move it and that time-sensitive cargo would not be able to arrive in a timely fashion on Maui due to the lack of "stage 3" aircraft. It also seems a possibility that this curfew may effect a couple of night passenger flights. We have recently lost our direct United flight to Chicago, we cannot afford to lose anymore seats or cargo capacity incoming or outgoing.

As I understand the FAR Part 150 rule, the federal government understood the unique situation of both Hawaii and Alaska, and chose to exempt these states. Why then would our own state suggest that interisland carriers turnover five or six aircraft to "stage 3" aircraft by the end of 1995 or face a night curfew. Are we willing to make the population of our entire island suffer the consequences to satisfy the vocal minority? Would the vocal minority like receiving their perishable goods or time-sensitive products in an un-timely fashion? Would they like to see our agriculture folks suffer further costs to move their products off Maui?

It is cost-prohibitive for our cargo carriers to convert by the end of 1995. There should be further discussions with the cargo carriers about the feasibility of the proposed conversion to "stage 3" aircraft and we would hope the state would work with the interisland carriers to further negotiate what a reasonable timeframe might be for the conversion of aircraft.

We hope you will give further consideration to the idea of a night curfew. The proposed timeframe is not acceptable to the majority of people of Maui. Our business community, visitor industry, and the economic strength of our island depend on time sensitive goods arriving in a timely fashion. Our farmers depend on being able to move their products. Please don't make it more difficult than it already is.

Sincerely,

Terry Vencl
Executive Director

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

IN REPLY REFER TO:
AIR-EP
95.231

August 28, 1995

Ms. Terryl Vencl, Executive Director
Maui Hotel Association
1325 Lower Main, Suite 103
Wailuku, Maui 96793

Dear Ms. Vencl:

Subject: Comments on Draft Kahului Airport FAR Part 150 Noise Compatibility Program
Kahului Noise Compatibility Program
Project No. AM1011-05

Thank you for your written and oral testimony presented at the May 31, 1995 public hearing for the Federal Aviation Regulation Part 150 Noise Compatibility Program for Kahului Airport.

Your letter indicates that your concerns relate principally to the State's proposal to amend Hawaii Administrative Rules Chapter 19-28 to prohibit the nighttime use of Stage 2 aircraft at Kahului Airport after December 31, 1995. This is different from the Noise Compatibility Program which was the subject of the May 31, 1995 public hearing. Hearings have already been held on the proposed changes to Chapter 19-28, and we have subsequently decided to study the matter further before proceeding. Nonetheless, there is sufficient overlap between these regulations and the draft Noise Compatibility Program that I would like to take this opportunity to respond to your concerns.

The Airports Division shares your desire to avoid any unnecessary restrictions on aircraft operations that would adversely affect Maui's economy. Other individuals and organizations have expressed similar concerns. The recommendations in the draft report relating to restrictions on the use of Stage 2 aircraft at Kahului Airport were drafted with these concerns in mind. They read as follows:

> ...*it is recommended that the Department evaluate the impact of imposing this requirement [prohibiting the use of Stage 2 aircraft between the hours of 10:00 PM and 6:00 AM] by the end of 1998 [emphasis added]. This should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes.* (page 8-6)
>
> *The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide.* (page 8-8)

As you can see, the report does not recommend the immediate imposition of restrictions on the nighttime operation of Stage 2 aircraft at Kahului Airport. Rather, it recommends that we continue to evaluate the implications of implementing such restrictions by the end of 1998.

Please note that Part 161 of the Federal Aviation Regulations (FAR Part 161) requires the State to complete a rigorous cost-benefit analysis demonstrating an overall positive effect before imposing a nighttime curfew or other limitation on aircraft activity. The outcome of the FAR Part 161 process will ultimately determine whether nighttime restrictions are imposed. However, we felt it important for the Part 150 Noise Compatibility Program to express our support for the continuation of that process.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

for Owen Miyamoto
Airports Administrator

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

MAUI
INTER-CONTINENTAL
RESORT

3700 Wailea Alanui,Wailea, Maui, Hawaii, U.S.A 96753
808-879-1922

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
869 Punchbowl
Honolulu, HI 96813

Dear Mr. Hayashida:

The employees of the Maui Intercontinental Resort are concerned with the potential negative effects caused by the proposed Administrative Rule that states all aircraft will be of Stage 3 type by December 1995.

The inability of receiving and sending perishable products such as produce, fish, flowers, newspapers, etc. on a timely basis is not acceptable to the residents of Maui.

Per Federal Rules, Hawaii and Alaska are allowed to use Stage 2 aircraft. What reason warrants burdening the total population of Maui from receiving or meeting their daily needs and expectations as they do today?? Who benefits from the change from Stage 2 to Stage 3 aircraft?? Probably, only a small segment of residents benefit, while the majority suffer!!

The interisland carriers say it is cost prohibitive to convert to Stage 3 at this time. If that is true, aren't there other methods to avert and or control the reported noise levels. Is the noise level really worthy of the impact eliminating night cargo service would have on the entire island's residents? We think not.

Thank you for your consideration in maintaining Maui's daily staples.

Sincerely,

Brad Jencks
General Manager

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
GLENN M. OKIMOTO
JERRY M. MATSUDA

IN REPLY REFER TO
AIR-EP
95.229

August 28, 1995

Mr. Brad Jencks, General Manager
Maui Inter-Continental Resort
3700 Wailea Alanui
Wailea, Maui, Hawaii 96753

Dear Mr. Jencks:

Subject: Comments on Draft Kahului Airport FAR Part 150 Noise Compatibility Program
Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your May 31, 1995 letter concerning Kahului Airport, which was forwarded to me by the Director for a response.

The first paragraph of your letter suggests that your comments are directed principally at the State's proposal to amend Hawaii Administrative Rules Chapter 19-28 by adding a new section, §19-28-3.1, prohibiting the nighttime use of Stage 2 aircraft at Kahului Airport after December 31, 1995. This is different from the Noise Compatibility Program which was the subject of the May 31, 1995 public hearing. Hearings have already been held on the proposed changes to Chapter 19-28, and we have subsequently decided to study the matter further before proceeding. Nonetheless, there is sufficient overlap between these regulations and the draft Noise Compatibility Program that I would like to take this opportunity to respond to your concerns.

The Airports Division shares your desire to avoid any unnecessary restrictions on aircraft operations that would adversely affect the flow of goods and passengers to and from Maui. Other individuals and organizations have expressed similar concerns. The recommendations in the draft report relating to restrictions on the use of Stage 2 aircraft at Kahului Airport were drafted with these concerns in mind. They read as follows:

> *...it is recommended that the Department evaluate the impact of imposing this requirement [prohibiting the use of Stage 2 aircraft between the hours of 10:00 PM and 6:00 AM] by the end of 1998 [emphasis added]. This should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes.* (page 8-6)

> *The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide.* (page 8-8)

As you can see, the report does <u>not</u> recommend the immediate imposition of restrictions on the nighttime operation of Stage 2 aircraft at Kahului Airport. Rather, it recommends that we continue to evaluate the implications of implementing such restrictions by the end of 1998.

Please note that Part 161 of the Federal Aviation Regulations (FAR Part 161) requires the State to complete a rigorous cost-benefit analysis demonstrating an overall positive effect before a nighttime curfew or other limitations on aircraft activity more stringent then those imposed by the FAA can be put into effect. The outcome of the FAR Part 161 process will ultimately determine whether nighttime restrictions are imposed. However, we felt it important for the Part 150 Noise Compatibility Program to express our support for the continuation of that process.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

for Owen Miyamoto
Airports Administrator

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

BENJAMIN J. CAYETANO
Governor

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813
Telephone: 587-3822

ESTHER UEDA
Executive Officer

May 9, 1995

RECEIVED
'95 MAY 26 A 10:04

Mr. Owen Miyamoto, Administrator
Airports Division
Department of Transportation
State of Hawaii
Honolulu International Airport
400 Rodgers Boulevard, Suite 700
Honolulu, Hawaii 96819-1880

Dear Mr. Miyamoto:

Subject: Draft Kahului Airport Noise Compatibility Program (April 1995) [State Project No. AM1011-05]

We have reviewed the draft Kahului Airport Noise Compatibility Program (April 1995) transmitted by your letter dated April 28, 1995, and have the following comments to offer:

1) In regards to the lands within the official boundaries of Kahului Airport, there are other areas that are not within the State Land Use Urban District as listed on page 2-10, Section 2.2.1.

Based on Figures 2-3 and 2-4 of the draft document, portions of land in the northern and eastern sections of the airport (location of FAA Control Tower, ARFF Unit, and areas to the northeastern corner of the airport), are currently within the State Land Use Agricultural District.

2) We confirm that the Department of Transportation currently has a petition before the Commission to reclassify approximately 210 acres to the Urban District. The land proposed to be reclassified includes the vacant buffer zone located south of Runway 2-20, and the area of the FAA control Tower and ARFF Unit.

3) In regards to Section 6.3 on page 6-13 of the draft document, paragraph 2 of the section states that State and County zoning ordinances allow single-family residences within agriculturally zoned lands.

Please note that residences within the State Land Use Agricultural District must be "farm dwellings" as defined in Section 205-4.5, HRS.

4) In regards to Section 7.5.1 on page 7-37 of the draft document, we confirm that the Commission has considered the position of the Airports Division in regards to proposed land use developments that may be impacted by airport noise. We also confirm that in a number of reclassifications throughout the State, the Commission has incorporated the position of the Airports Division in its decisions.

We have no further comments to offer at this time.

Thank you for the opportunity to provide comments on this matter.

If you have any questions in regards to this matter, please feel free to contact me or Leo Asuncion of my staff at 587-3822.

Sincerely,

Esther Ueda

ESTHER UEDA
Executive Officer

EU:th

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
GLENN M. OKIMOTO
JERRY M. MATSUDA

IN REPLY REFER TO
AIR-EP
95.226

August 28, 1995

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

Dear Ms. Ueda:

Subject: Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your May 9, 1995, letter concerning the *Draft Kahului Airport FAR Part 150 Noise Compatibility Program Report*, which was forwarded to me by the Director for a response.

I appreciate the time you and your staff spent reviewing the report and preparing your comments. Point-by-point responses are provided below. The responses indicate the changes that will be made to the report to address your concerns.

(1) Comment: *In regards to the lands within the official boundaries of Kahului Airport, there are other areas that are not within the State Land Use Urban District as listed on Page 2-10, Section 2.2.1.*

Based on Figures 2-3 and 2-4 of the draft document, portions of land in the northern and eastern sections of the airport (location of FAA Control Tower, ARFF Unit, and areas to the northeastern corner of the airport), are currently within the State Land Use Agricultural District.

Response: The two bullet items in the draft report were intended only to highlight the two relatively large areas. The final *Part 150 Noise Compatibility Program Report* will be revised to clarify this.

Change to Document: Line three of the second paragraph on Page 2-10 will be revised to read:

Several parts of the Airport are not within the State Urban District:

An additional bullet item reading as follows will also be inserted:

- *Portions of the eastern side of the Airport containing the FAA Control Tower, the Airport Rescue and Fire-Fighting Facility, the general aviation T-hangars, and minor support facilities are in the Agricultural District. A petition to change the designation of this area to Urban is pending before the State Land Use Commission.*

(2) Comment: *We confirm that the Department of Transportation currently has a petition before the Commission to reclassify approximately 210 acres to the Urban District. The land proposed to be reclassified includes the vacent buffer zone located south of Runway 2-20, and the area of the FAA Control Tower and ARFF Unit.*

Response: Thank you for this confirmation.

(3) Comment: *In regards to Section 6.3 on page 6-13 of the draft document, paragraph 2 of the section states that State and County zoning ordinances allow single-family residences within agriculturally zoned lands. Please note that residences within the State Land Use Agricultural District must be "farm dwellings" as defined in Section 205-4.5, HRS.*

Response: Thank you for pointing out that residences within the State Agricultural District must qualify as "farm dwellings" as defined in Section 205-4.5, Hawaii Revised Statutes to be considered permissable.

Change to Document: To clarify the constraint noted in your letter, the third sentence in the second paragraph in Section 6.3 will be revised to read:

Since State and County zoning ordinances and regulations allow single-family residences on agriculturally zoned lots so long as they qualify as farm dwellings, this would allow an increase in incompatible uses in this area.

AIR-EP
95.226

(4) Comment: *In regards to Section 7.5.1 on page 7-37 of the draft document, we confirm that the Commission has considered the position of the Airports Division in regards to proposed land use developments that may be impacted by airport noise. We also confirm that in a number of reclassifications throughout the State, the Commission has incorporated the position of the Airports Division in its decisions.*

Response: Thank you for this confirmation.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

for Owen Miyamoto
Airports Division

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

ISAAC DAVIS HALL
ATTORNEY AT LAW
2087 WELLS STREET
WAILUKU, MAUI, HAWAII 96793
(808) 244-9017
FAX (808) 244-6775

OF COUNSEL:
G. RICHARD GESCH

May 31, 1995

Mr. Owen Miyamoto, Administrator
Airports Division, Dept. of Transportation
State of Hawaii
400 Rodgers Blvd. #700
Honolulu International Airport
Honolulu, HI 96819-1880

Re: Comments upon Volume II of the FAR Part 150 Noise Compatibility Program (April, 1995)

Dear Owen Miyamoto:

This letter is written on behalf of the Maui Air Traffic Association ("MATA") whose members own and enjoy the use of properties in the Spreckelsville area. Excessive, unabated aircraft noise has been imposed upon them for at least ten years. Thank you for the opportunity to comment upon Volume II of the FAR Part 150 Noise Compatibility Program dated April, 1995. This document must be withdrawn, rewritten to bring it into compliance with the relevant regulations and resubmitted within an appropriate time period.

This Report's almost total reliance upon sound attenuation as a noise abatement measure is unacceptable. The message to those upon whom excessive aircraft noise has been imposed is to stay inside your houses, close all of your windows and doors and turn up your air conditioner if you want any relief from aircraft noise. The message is that you cannot open your windows and doors to enjoy Hawaii's breezes, you cannot go out onto your patios, your children cannot play outside and you cannot enjoy your lawns or gardens unless you are willing to have your family subjected to excessive aircraft noise. There is another message also, and that is that the Report's authors find it acceptable that Hawaii can be the home for Hawaiian Airlines with a fleet that is totally comprised, into the foreseeable future, of Stage 2, noise-polluting, aircraft, even though this will no longer be acceptable in any of the 48 contiguous states.

In Chicago, residents affected by excessive aircraft noise participated in good faith in the development of an FAR Part 150 Noise Compatibility Program. The recommended noise compatibility program there was so unsatisfactory that it was rejected and the participants are attempting to reach agreement on a noise compatibility program which is more realistic and will provide actual relief from excessive noise. Unless this Report is withdrawn and rewritten, it may have to be rejected as it was in Chicago.

MATA has the following general comments on Volume II, as follows.

1. Procedural considerations

The Aviation Safety and Noise Abatement Act of 1979 and the regulations of the Federal Aviation Administration ("FAA") found in Part 150 establish a two-step process for airport noise compatibility planning. First, noise exposure maps for the airport are prepared for a base year and five years hence. These noise exposure maps must be accepted by the FAA before proceeding to the second step. The second step involves the preparation of a noise compatibility program.

The Airports Division, Department of Transportation, State of Hawaii ("DOT"), hired Belt Collins & Associates and Y. Ebisu & Associates as consultants to prepare these maps and programs. Volume I, the Noise Exposure Map Report, in a draft form, for the Kahului Airport, was published in July, 1989. It presented a 1987 base year map with a 1992 five year map. These maps were subsequently approved by the FAA.

Because these noise exposure maps are now inaccurate and outdated, the DOT, in Volume II, proposes two new noise exposure maps, one for the new base year of 1993 and one new five year map for 1998. These maps have not yet been accepted by the FAA. The FAA cannot approve of the noise compatibility program, unless and until it accepts the noise exposure maps.

What DOT has essentially done is to rewrite Volume I, the Noise Exposure Map Report, in Volume II, which is intended to be devoted to the development of a noise compatibility program. Compare Chapters 1 through 6 of Volumes I and II. Chapters 7 and 8 of Volume II are devoted to the development of a noise compatibility program. Maui's citizens deserve a great deal more than two slender chapters based upon unaccepted FAA noise exposure maps for the development of a comprehensive noise compatibility program at the Kahului Airport.

2. Information obscured

Any meaningful review and analysis of the adverse impacts of aircraft noise and the development of abatement measures requires the presentation of data in a manner which is decipherable by the general public. The information and data presented in Volume II is perhaps intentionally made obscure, inaccessible and difficult to follow.

Several examples suffice to make this point. In describing aircraft operations, the Report refers only to aircraft types. Most readers do not know the amount of noise which is emitted by these aircraft types, the identity of the operators of the aircraft or the routes flown by these aircraft.

The information on fleet mixes is not presented in a meaningful way. The Report does not simply disclose the number of Stage 2 and Stage 3 aircraft currently operated by Hawaiian and Aloha Airlines. Without this information, it is impossible to evaluate changes in the fleet mix.

The charts depicting land use incompatibility are extremely obscure and misleading. Some of the charts intended to graphically depict "incompatible" areas do not line out all of the areas subjected to excessive noise. One chart, the text states, shows that the area anticipated to be "incompatible" in 1992 is actually less than the area which was found to be exposed in 1993. This is simply not true with respect to areas on the land and is only true when areas over the ocean are factored in.

3. Critical points are made in footnotes

In general, the noise compatibility program has not been developed in a rigorous fashion based upon facts presented in the Report. There has been an over-reliance upon footnotes to present critical points in the Report as well as disclaimers and caveats. In many cases, these disclaimers and caveats are absolutely essential to the recommendations and conclusions contained in the Report and they are based upon unwarranted assumptions and/or undemonstrated facts. Many of these footnotes should have been presented as part of the text and explored on a more rational basis.

4. The bias of the Report

The Report is infused with the bias of the authors in favor of the noise polluters, the aircraft operators, and against those upon whom excessive noise is being imposed, the surrounding communities. This discredits the objectivity of the Report and undermines its chances for acceptance in the community. The Report emphasizes the "strenuous" objections of Aloha Airlines to any operational abatement measures. It emphasizes the "strenuous" objections of Hawaiian Airlines to operational noise abatement measures. Nowhere in the Report is there any acceptable description of the impacts of excessive aircraft noise on the surrounding community or the "strenuous" objections of surrounding landowners to this pollution.

Y. Ebisu is a professional apologist for noise polluters. Perry White, of Belt Collins & Associates, was the principal author of the judicially rejected State Environmental Impact Statement for the expansion of the Kahului Airport. It comes as no surprise that these two authors recommend sound attenuation rather than operational abatement measures.

5. Over-reliance on Ldn as noise descriptor

The Report is almost wholly based upon the use of Ldn as a noise descriptor. The FAA has not prevented the use of other, more accurate, noise descriptors, such as the single event noise descriptor. The Report contains a statement that the single event descriptor has also been utilized; however the only reference in the text to the single event descriptor is with respect to a study undertaken by others. The single event descriptor is much more accurate particularly for nighttime flights at the Kahului Airport because of the time

between the noise events and the particularly disruptive nature of these noise events during nighttime hours. This Report will not be accurate unless it analyzes the costs and benefits of the alternative noise abatement measures in terms of single event noise levels as well as Ldn.

6. Inadequate description of the noise environment

What are the adverse impacts of excessive noise? How long has excessive aircraft noise been imposed upon the surrounding community? These are simple questions which in the asking demonstrate how inadequate this Report is. It is impossible to begin to weigh the costs and benefits of a proposed mitigation measure if the adverse effects of excessive noise are not considered. The Report forthrightly states that the only "cost" to the communities which is considered is the cost of sound attenuation. The loss of the use and enjoyment of outdoor activities, even with sound attenuation, has not been considered. Sleep interference has only been dealt with in a tangential fashion. There is no analysis of minimizing risks of community complaints or speech interference. This Report will remain wholly inadequate until and unless it acknowledges all of the many adverse affects of aircraft noise.

The Report does not even disclose the length of time the surrounding communities have had excessive aircraft noise pollution imposed upon them. The 1989 Noise Exposure Map contained in Volume I is an admission that excessive noise was being imposed at that time. Complaints about excessive aircraft noise were received well before then. It cannot be disputed that the airport proprietor and the aircraft operators, particularly Hawaiian and Aloha Airlines, have been allowing excessive noise to be imposed upon the surrounding communities for at least ten years. During this ten-year or more period, no significant steps have been taken to reduce this excessive noise to even marginally acceptable levels. This is without a doubt a cost which should have been included in the Report. What is this ten-year period of excessive noise worth? What is a ten-year period free of restraint upon the aircraft operators worth? This should have been evaluated in the Report.

Finally, the Report excludes from consideration whole areas upon which excessive noise is being imposed. There is no evaluation of noise impacts at Kanaha Beach Park or along the beaches in the area. There is no analysis of the excessive noise being imposed upon users of the nearshore ocean waters. There is no analysis of the excessive noise being imposed upon the Kanaha Wildlife Refuge, particularly during construction of any extended runway.

The Department of Education has formally offered the Puunene School for use by the Hawaiian Language Immersion Program, which is a public DOE program. The Report does not consider the impacts of excessive aircraft noise upon public schools or the ability to teach and to learn in such an environment. This must be addressed in the Report.

7. 1998 is a poor choice for the five-year noise exposure map

1998 is a poor choice for the new, proposed five-year noise exposure map. The noise exposure map supposedly assesses the impacts which will result from the extension of Runway 2-20 to 9,600 feet which will supposedly be completed in 1998. The full impacts of lengthening the runway will not be experienced the day after it is opened for use. The impacts will be experienced over a number of years. This should have been acknowledged and the potential impacts addressed in the study.

The year 2000 would be a more appropriate date for the assessment of noise impacts. This is the year during which DOT has committed the State to prevent the operation of Stage 2 aircraft at Kahului Airport, during the day and the night, should the cost/benefit analysis which it is preparing conclude that this is cost/ beneficial. This commitment by the State of Hawaii is never acknowledged or addressed in the Report. Should the State of Hawaii implement such a regulation, this would have a tremendous impact upon the costs and benefits of the various alternative operational abatement measures discussed in the Report.

8. Inadequate description of existing and future aircraft operations
The Report does not adequately describe existing and future aircraft operations at the Kahului Airport. It notes that Aries Consultants, Inc. recently completed in 1994 an update for these aircraft operations. The results of this update should have been disclosed in a more detailed fashion. A forecast for 1998 is included, however it is impossible to determine what it means because it only lists aircraft types and not the operators or the routes. The importance of this inadequacy is that flights from Japan and/or the midwest, which the extended runway would facilitate, could arrive and/or depart during nighttime hours and exacerbate the already deteriorated nighttime noise environment.

9. Inadequate description of the aircraft fleet mix
The Report does not adequately disclose the current or anticipated aircraft fleet mixes. First, listing new, anticipated flights by aircraft type number does not identify the noise characteristics of the aircraft, the operator of the aircraft or the route, as noted above.

Second, particularly with respect to Hawaiian and Aloha Airlines, there is no description of the number of aircraft currently in use or the "stage" of each of these aircraft.

Third, the Report does not take into consideration the "retirement" of aircraft between 1990 and 1998 or 2000. It is inconceivable that Hawaiian Airlines is not "retiring" a single Stage 2 aircraft in this period of time.

Fourth, while Aloha Airlines appears to be making what might be considered a good faith effort to add Stage 3 aircraft to its fleet, Aloha has been on notice since at least 1990 of the State's goal to prohibit Stage 2 aircraft between 10:00 p.m. and 6:00 a.m., effective December 31, 1995. There is really no excuse for the primary nighttime aircraft noise polluter to ignore this goal.

Finally, the Report does not take into consideration the importance of the new service, and perhaps an increase in the number of Stage 2 aircraft, by Hawaiian Airlines. The Federal Airport Noise and Capacity Act ("ANCA"), in §47528(e), contains a "non-addition" term for Hawaiian operations which prohibits the increase in the number of Stage 2 aircraft which are operated in Hawaii beyond the number owned, leased or operated in Hawaii on November 5, 1990. It also prohibits any air carrier from providing air turnaround service in Hawaii using Stage 2 aircraft beyond the service provided on November 5, 1990. This statute prevents any increase in Stage 2 aircraft or services in Hawaii, in part, to prevent the further deterioration of the noise environment. The implementation by Hawaiian Airlines of its "every half hour" service to Maui in 1994, increasing the turnaround service by 27 "services," may well violate ANCA's restrictions on turnaround services as well as ANCA's prohibition against any increase in the number of Stage 2 aircraft. The import of the federal "non-addition" rule in Hawaii should have been discussed in the Report. The enforcement of this "non-addition" rule could have important beneficial impacts on the noise environment at Kahului.

10. Viable alternative operational abatement measures were not addressed

In 1991, DOT committed itself to the rigorous evaluation of two significant operational noise abatement measures affecting Kahului and other airports in the State of Hawaii through a stipulation entered in Pitt et al. v. Hirata et al., Civil No. 89-0048(1) in the Second Circuit Courts of the State of Hawaii. First, the State of Hawaii, in its capacity as airport proprietor, envisaged mandating the use of Stage 3 aircraft at the Kahului Airport according to the deadlines established in the Airport Noise and Capacity Act of 1990.

Second, the State of Hawaii has commenced rule promulgation proceedings with respect to prohibiting the landing or taking off of Stage 2 aircraft between the hours of 10:00 p.m. and 6:00 a.m., effective December 31, 1995, also at the Kahului Airport.

These are two significant alternatives which the DOT has already endorsed in principle. Neither of these alternatives was studied in the Report. Instead, the Report considers the prohibition of all Stage 2 aircraft, effective 1998, thus excluding two important years for the airlines to bring themselves into compliance with the prohibition. Likewise, the Report does not consider a ban on Stage 2 aircraft between 10:00 p.m. and 6:00 a.m., unless it is to be effective in 1998, three years after the proposal which is the subject of current rule-making. The effect of this three-year extension, which allows three additional years of excessive noise to be imposed upon surrounding communities, is not considered or evaluated in the Report, as a cost to the communities. This is improper and unfair.

11. <u>The weighing of the costs and benefits of the alternatives studied is inadequate</u>

The weighing of the costs and benefits of the various alternatives studied is unarguably the most important analysis to be contained within any noise compatibility program report. Unfortunately, the analysis contained within this Report is very weak and could not satisfy even minimally the applicable FAA regulations pertinent to cost/benefit analyses. The type of balancing undertaken by the authors was designed to tip in favor of the aircraft operators and against operational restrictions. First, significant impacts upon the surrounding communities, as "costs," were not even weighed. The only cost considered was the cost of sound attenuation, not the loss of property value, not the loss of the use and enjoyment of the property, not the number of years to which the communities have been subjected to excessive aircraft noise, not sleep interference, and not the adverse health impacts of excessive noise. Naturally, if none of these are weighed, the balance will tip in favor of sound attenuation.

Costs to the aircraft operators and those dependent upon the aircraft operators were speculative and undocumented as matters of fact. For example, the Report concludes that it would not cost Aloha Airlines anything to comply with a prohibition on Stage 2 aircraft between 10:00 p.m. and 6:00 a.m., effective 1998, if Aloha modified certain routes and schedules. In a footnote, however, the authors reject this approach because it would "impose scheduling constraints on the airline." There is absolutely no factual substantiation that this is a real constraint or that Aloha Airlines could not accommodate such a constraint. There is only the skimpiest of documentation for the "parade of horrors" in terms of expenses, airlines going out of business and inability to pay for Stage 3 aircraft or hush kits. Yet it is only based upon these speculations that the balance can tip in favor of the aircraft operators and against operational restrictions. This is unfair and unwarranted based upon FAA regulations.

Step back and consider the effects of these rationalizations. Will Hawaii remain the home of Hawaiian Airlines, an airline which refuses to add a single additional Stage 3 aircraft to its fleet by 1998? Hawaii cannot countenance this kind of purposeful noise pollution by one of its airlines.

12. <u>Unsupported assumption that rule-making must be statewide</u>
The Report contains two principal unsupported assumptions about the statewide implication of noise abatement measures enacted at the Kahului Airport. First, the Report states on numerous occasions that the implementation of noise abatement measures applicable to the Kahului Airport will worsen noise conditions at other airports. Nowhere is there any factual demonstration that this would occur or that other airports have worse noise environments. Under these circumstances, these statements cannot be taken to be true or determinative.

Second, the two non-lawyer authors of the Report challenge whether noise implementation measures could be implemented on anything but a statewide basis. A simple review of the existing Administrative Rules for Public Airports in the State of Hawaii demonstrates the fallacy of this proposition. There already exist rules which are applicable only to the Honolulu International Airport, only to the General Lyman Field, only to the Ala Wai Heliport and only to the Kapalua-West Maui Airport. The Report itself indicates that the noise regulations of the State Department of Health apply only to Oahu. Airports in California are regulated on an individual and not a statewide basis. This unwarranted legal assumption should be eliminated from the Report and should not be weighed in the cost/benefit analysis.

13. <u>Costs/passenger facility charges</u>
The Airport Noise and Capacity Act enacted in 1990 authorized airport proprietors to assess each passenger a charge of up to $3.00 per passenger (passenger facility charge; "PFC") and to use these funds for noise mitigation projects. FAA data shows that 46 airports are using $782.2 million in such charges for noise mitigation projects. There is no discussion of PFCs in the Report or the amount of money that could be made available through PFCs for noise mitigation purposes at the Kahului Airport. This should have been discussed in the draft.

Sound attenuation has a fatal defect as a noise abatement measure. At best, it is only a half measure. It can only protect those who are exposed to excessive noise from the impacts of this noise so long as they stay inside their dwellings, with windows and doors shut and the air conditioner turned on. It provides absolutely no relief while they are outdoors. The importance of Hawaii's outdoor environment has not been acknowledged. The extent to which residents are outdoors and the importance to them of being outdoors has nowhere been valued. This is equally true of our parks, shoreline areas and wildlife refuges. Sound attenuation offers nothing here.

Taking surrounding residents' outdoor life on behalf of an airline which refuses to incorporate any Stage 3 aircraft into its fleet in the near future is unsupportable. The authors' failure to recommend the expenditure of money by Aloha and Hawaiian Airlines to bring a sufficient number of Stage 3 aircraft into their fleets in order to preserve some remnant of Hawaii's outdoor lifestyle cannot be justified. Noise pollution must, in the final analysis, be curbed at its source.

Unless this draft is withdrawn, re-analyzed and resubmitted, the residents of Maui will be shortchanged just as the residents of Chicago were. The Part 150 Program can work but only if a greater effort is made to fairly weigh the costs and benefits involved.

To be meaningful, Kahului's noise abatement program must (1) prohibit Stage 2 aircraft between 10:00 p.m. to 6:00 a.m., effective December 31, 1995 and (2) prohibit Stage 2 aircraft during all hours, effective the year 2000.

Thank you for the opportunity to comment upon this Report.

Sincerely yours,

Isaac Hall

IH/jp

cc: Governor Ben Cayetano
Kazu Hayashida
David Welhouse
Maui Air Traffic Association

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IN REPLY REFER TO
AIR-EP
95.238

August 28, 1995

Mr. Isaac Davis Hall, Esq.
2087 Wells Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Hall:

Subject: Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your May 31, 1995, letter concerning the April 1995 draft Kahului Airport FAR Part 150 Noise Compatibility Program report. Responses to the comments you submitted on behalf of the Maui Air Traffic Association are provided below. Because of the length of your comments, the portions that are relevant to specific responses are included in the text.

(1) Comment: Page 1, Paragraph 1, Last sentence. *The document must be withdrawn, rewritten to bring it into compliance with the relevant regulations, and resubmitted within an appropriate time period.*

Response: This assertion is neither specific nor documented. Responses to specific allegations are provided later in this letter.

Change to Document: None required.

(2) Comment: Page 1, Paragraph 2, First two sentences. *This report's almost total reliance upon sound attenuation as a noise abatement measure is unacceptable. The message to those upon whom excessive aircraft noise has been imposed is to stay inside your houses, close all of your windows and doors and turn on your air conditioner if you want any relief from aircraft noise.*

Response: The Federal Aviation Administration is charged with determining the acceptability of the Noise Compatibility Program. The State Department of Transportation Airports Division (DOTA) is charged with acting in the best interests of all our citizens, not

Hana Like No Ke Ala Aloha
Working Together to Provide Gateways of Aloha

just those who reside in noise-impacted parts of Spreckelsville. We have developed the Noise Compatibility Program with that responsibility in mind.

Change to Document: None required.

(3) Comment: Page 2, Item 1, Last two paragraphs. *...the DOT, in Volume II, proposes two new noise exposure maps, one for the new base year of 1993 and one new five year map for 1998. These maps have not yet been accepted by the FAA. The FAA cannot approve of the noise compatibility program unless and until it accepts the noise exposure maps.*

What DOT has essentially done is to rewrite Volume I, the Noise Exposure Map Report, in Volume II, which is intended to be devoted to the development of a noise compatibility program. Compare Chapters 1 through 6 of Volumes I and II. Chapters 7 and 8 of Volume II are devoted to the development of a noise compatibility program. Maui's citizens deserve a great deal more than two slender chapters based upon unaccepted FAA noise exposure maps for the development of a comprehensive noise compatibility program at the Kahului Airport.

Response: The statement that the report contains updated noise exposure maps is correct, as is the assertion that they have not yet been accepted by the FAA.

However, FAR Part 150, §150.23(b) explicitly states: *An airport operator may submit the noise compatibility program at the same time as the noise exposure map.* Many airport operators have submitted Part 150 Noise Compatibility Program reports which combine the noise exposure maps and program in one document. This is true even when the FAA has not previously accepted noise exposure maps for that airport. The Noise Compatibility Program reports for Honolulu International Airport and Keahole Airport are good examples from Hawaii.

In the case of Kahului Airport, the FAA has already accepted noise exposure maps developed using essentially the same methodology as was employed in preparing these maps. The principal difference between the noise exposure maps contained in the *Draft Kahului Airport Noise Compatibility Program Report* and the previously accepted maps from the *Kahului Airport Noise Exposure Map Report* is the use of a newer version

(4.11) of the FAA's Integrated Noise Model (INM), updated land use information, and updated operational information and forecasts in preparing the new maps. In view of the FAA's acceptance of the earlier noise exposure maps and the extensive effort that was made to validate the model's results, we believe this was a reasonable and prudent approach.

Some of the information in Chapters 1 through 6 are the same because it is still relevant, but there have been extensive changes. These six chapters incorporate the results of extensive recent data collection and analyses concerning flight track usage under varying wind conditions, aircraft operations and fleet mix, and other factors affecting the modeled noise levels. The 1993 and 1998 noise contours are the result of entirely new INM model runs. The output of version 4.11 of the INM was thoroughly evaluated and tested against predictions made by the earlier version of the model and actual noise measurements conducted in the field. These efforts are described in the main body of the report and in the appendices.

Change to Document: None required.

(4) Comment: <u>Page 2, Item 2 (continuing to Page 3).</u> *Any meaningful review and analysis of the adverse impacts of aircraft noise and the development of abatement measures requires the presentation of data in a manner which is decipherable by the general public. The information and data presented in Volume II is perhaps intentionally obscure, inaccessible and difficult to follow.*

Several examples suffice to make the point. In describing aircraft operations, the Report refers only to aircraft types. Most readers do not know the amount of noise which is emitted by those aircraft types, the identity of the operators of the aircraft or the routes flown by these aircraft.

The information on fleet mixes is not presented in a meaningful way. The Report does not simply disclose the number of Stage 2 and Stage 3 aircraft currently operated by Aloha and Hawaiian Airlines. Without this information, it is impossible to evaluate changes in the fleet mix.

The charts depicting land use incompatibility are

extremely obscure and misleading. Some of the charts intended to graphically depict "incompatible" areas do not line out all of the areas subjected to excessive noise. One chart, the text states, shows that the area anticipated to be "incompatible" in 1992 is actually less than the area which was found to be exposed in 1993. This is simply not true with respect to areas on the land and is only true when areas over the ocean are factored in.

Response: In order to answer these comments, separate responses are provided below.

- *The information and data presented in Volume II is perhaps intentionally obscure, inaccessible and difficult to follow.* A thorough analysis of means of improving land use compatibility in the vicinity of Kahului Airport involved the collection and analysis of a large amount of data. The report presents this information in a clear and concise fashion.

As noted elsewhere in the comment, the discussion follows the pattern established in the *Volume I Kahului Airport Noise Exposure Map Report*. The FAA accepted it following a thorough review. During the review and acceptance of that report no one asserted that the presentation was "obscure, inaccessible, or difficult to follow." Your assertion that the authors <u>intended</u> to make the report difficult to comprehend is not true. On the contrary, a sustained effort was made to take highly technical material and make it understandable to readers.

- *In describing aircraft operations, the Report refers only to aircraft types. Most readers do not know the amount of noise which is emitted by those aircraft types, the identity of the operators of the aircraft or the routes flown by these aircraft.*

No specific section reference was provided for this comment which makes it difficult to interpret your concern. However, we will attempt to answer your concerns.

The report discusses noise in terms of the types of aircraft that emit it because this is the only reasonable basis for such a discussion. There are two reasons for this. First, the amount of noise that results from an aircraft operation (takeoff or landing) does not depend upon the particular air carrier that is operating the flight. Second, many air carriers operate more than one type of aircraft, each with its own unique noise emission characteristics. This is why the operational data for the 1993 Base Year and the 5-Year 1998 No Mitigation Scenario (Tables 5-1 and 6-1, respectively) are provided in terms of aircraft types. As an example, Table 5-1 lists five different types of B-737 aircraft that are operated by a single carrier, while the DC-10s in this table are operated by several different carriers.

The report also clearly links aircraft types to their operators in Chapters 7 and 8, where the information is relevant. The bottom half of page 7-18, for example, shows the forecast aircraft fleet mix for the two interisland air carriers in 1998. The paragraph at the top half of page 7-19 also discusses nighttime fleet mix. Moreover, the discussion of possible noise abatement measures elsewhere in the chapter talks extensively about the aircraft that would be operated by each carrier in the future and the implications of forcing air carriers to use aircraft other than those which they would freely choose.

The routes that would be flown by each aircraft type under varying wind conditions are tabulated in Tables 5-1 and 6-1. This is the only type of presentation which can accurately depict the complex set of data (number of operations by aircraft type, flight track, and time of day) that was used for the noise modeling. The information in these tables corresponds to the flight tracks that are presented in Figures 3-2 through 3-5. Table 3-1 provides a tabular summary of the types of operations on each flight track.

- *The information on fleet mixes is not presented in a meaningful way. The Report does not simply disclose the number of Stage 2 and Stage 3 aircraft currently operated by Aloha and Hawaiian Airlines. Without this information, it is impossible to evaluate changes in the fleet mix.*

The existing aircraft mix of the interisland air carrier jet fleet is discussed on page 7-18 of the draft report, which states:

At present, approximately 75 percent of Aloha's interisland fleet consists of Stage 2 aircraft, the remainder, (including two of the "Quick Change" passenger-cargo aircraft that it uses for its night cargo operations) consists of Stage 3 aircraft.

Hawaiian Airlines is presently operating an all-Stage 2 fleet of DC-9-50s.

We believe this is a clear description of the existing fleet mix.

The draft report does not list the number of aircraft of each type currently in each air carrier's fleets because it is not relevant to determining noise levels at Kahului Airport. Noise levels are determined by the number of operations by each aircraft type that actually occur at Kahului Airport. The report contains this information. However, as a means of reassuring you that it is not our intent to suppress this information, the number of DC-9s and B-737s owned by Aloha Airlines and Hawaiian Airlines during 1993 and forecast to be owned by them in 1998 will be added to the discussion of aircraft mix in Section 7.2.7.1.

- *The charts depicting land use incompatibility are extremely obscure and misleading. Some of the charts intended to graphically depict "incompatible" areas do not line out all of the areas subjected to excessive noise.*

Cross-hatching was inadvertently left out of the area between the 60 and 65 Ldn contours in three figures in the draft report. This was discovered before the public hearing, and the maps were immediately revised; consequently, the noise exposure maps contained in the materials that were distributed at the public hearing contained corrected maps. I believe you received them at that time. The noise exposure maps in the final report will include the cross-hatching of areas between the 60 and 65 Ldn contours. Please note that this affected only the drawings in Figures 5-1, 6-1, and 8-1. The tabulations of noise exposure and incompatible land use are correct and include areas between the 60 and 65 Ldn contours.

- *One chart, the text states, shows that the area anticipated to be "incompatible" in 1992 is actually less* *than the area which was found to be exposed in 1993. This is simply not true with respect to areas on the land and is only true when areas over the ocean are factored in.*

Response: Although no page reference is given in this comment, it appears to refer to the first full sentence at the top of page 5-20. This sentence states: *The comparison indicates that the actual 1993 noise contours are generally smaller than those that were forecast for 1992 in the accepted* Noise Exposure Map Report. The sentence in the report simply compares the size (i.e., area enclosed by) of the noise contours; it makes no mention of the size of incompatible land use areas.

Change to Document: The number (as well as the percent of the total fleet) of Stage 2 versus Stage 3 aircraft in Aloha and Hawaiian's fleet in 1993 will be included in the discussion of "fleet Mix" in Section 7.2.7.1.

(5) Comment: Page 3, Item 3. *In general, the noise compatibility program has not been developed in a rigorous fashion based upon facts presented in the Report. There has been an over-reliance on footnotes to present critical points in the Report as well as disclaimers and caveats. In many cases these disclaimers and caveats are absolutely essential to the recommendations and conclusions contained in the Report and they are based upon unwarranted assumptions and/or undemonstrated facts. Many of these footnotes should have been presented as part of the text and explored on a more rational basis.*

Response: The absence of specific page or section references makes it difficult to respond to this assertion in detail. Footnotes were used to present information when we felt that this was the most effective means of imparting information without disrupting the overall flow of the discussion. They were presented on the same page as the material which they elaborated on, rather than as endnotes, to make the information as accessible as possible.

Change to Document: None required.

(6) Comment: Page 3, Item 4. *The Report is infused with the bias of the authors in favor of the noise polluters, the aircraft operators, and against those upon whom excessive noise is being imposed, the surrounding*

communities. This discredits the objectivity of the Report and undermines its chances for acceptance in the community. The report emphasizes the "strenuous" objections of Aloha Airlines to any operational abatement measures. It emphasizes the "strenuous" objections of Hawaiian Airlines to any operational noise abatement measures. Nowhere in the Report is there any acceptable description of the impacts of excessive aircraft noise on the surrounding community or the "strenuous" objections of surrounding landowners to this pollution.

Y. Ebisu is a professional apologist for noise polluters. Perry White, of Belt Collins & Associates, was the principal author of the judicially rejected State Environmental Impact Statement for the expansion of Kahului Airport. It comes as no surprise that these two authors recommend sound attenuation rather than operational abatement measures.

Response: Again, the absence of specific references and/or substantiating evidence to your claims makes it difficult to respond in detail. However, I would like to make a few clarifications about your comment.

- The report does not "emphasize" the interisland airlines' objections to operational abatement measures. It simply reports them, just as it reports residents' desire that operational noise abatement measures be implemented.
- The noise exposure maps contained in the report make it quite clear that the level of aircraft noise in residential areas in East and West Spreckelsville is incompatible with the existing residential uses there. The discussion is appropriately presented in terms of land use compatibility rather than "impacts" (the word used in your comment) because the document is a Noise Compatibility Program Report, not an environmental impact statement. However, the report does conclude that there is a noise problem in the vicinity of the airport that needs attention.
- The report contains numerous references to the surrounding community's objections to noise associated with Kahului Airport. For example:
  - The first full paragraph on page 1-5 states: *...the relationship between the Airports Division and some*

residents of nearby areas, particularly East Spreckelsville, became more contentious. This eventually culminated in a lawsuit being filed against the [Airports] Division.

- The first paragraph of Section 7.2.5 states; *It [an informal runway use program] was instituted in response to noise complaints from area residents and has helped address some of their concerns.*

A major effort was made during the course of the study to explore causes and possible solutions to noise-related concerns raised during meetings and written communications between DOTA and the community. Several of the noise abatement options that were evaluated (e.g., Options T7, T8, etc.) were based directly on suggestions made by community members.

- Y. Ebisu is not a professional apologist for noise polluters, rather he is a registered engineer whose specialty is acoustics. As you know, he has worked closely with a number of Spreckelsville residents to determine aircraft noise levels in their homes and to identify measures that could be taken to reduce them. I believe that if you check with these individuals you would find that his analyses have been thorough and professional. It is for this reason that the DOTA engaged his services for this important work.

- Mr. White is <u>not</u> the author of the State's environmental impact statement for the expansion of Kahului Airport. That document was prepared by Pacific Planning & Engineering, an entirely separate firm. This has been explained to you several times in the past by Mr. White and others. Moreover, the Chapter 343 EIS for the Kahului Airport Master Plan was not rejected; it was accepted by the Governor on August 5, 1992. The "judicial rejection" which you refer to has to do with whether or not that document met all of the requirements of the settlement agreement between the state and your client, which is quite a different matter.

Change to Document: None required.

(7) Comment: <u>Page 3, Item 5, First two sentences.</u> *The report is almost wholly based upon the use of Ldn as a noise descriptor. The FAA has not prevented the use of other, more accurate, noise descriptors such as the single-event noise descriptor.*

Response: The FAA specifies that the average day-night noise metric be used for Noise Compatibility Programs. The report complies with this instruction.

In 1990, the Federal Interagency Committee on Noise (FICON) was formed to review Federal policies that govern the assessment of airport noise impacts. The Committee summarized its findings in a report issued in August, 1992. The Executive Summary of that report reached the following conclusions concerning the most appropriate noise metric to use when evaluating aircraft noise:

- *There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL cumulative noise exposure metric.* [DNL is the same as Ldn]
- *The methodology employing DNL as the noise exposure metric and appropriate dose-response relationships (primarily the Schulz curve for Percent Highly Annoyed) to determine noise impacts on populations is considered the proper one for civil and military aviation scenarios in the general vicinity of airports.*
- *DNL is sometimes supplemented by other metrics on a case-by-case basis.*
- *The dose-effect relationship, as represented by DNL...remains the best available approach for analyzing overall health and welfare impacts for the vast majority of transportation noise impacts.*
- *Although the A-weighted Maximum Sound Level (L_{max}) for a single flyover is easily understood, it is useful only for analyzing short-term responses.*
- *The 10 dB penalty levied against noise during the 10 PM to 7 AM period is specifically designed to account for the intrusiveness of noise during this period, and its potential impact on sleep. There are no new hard data which would justify a change in this penalty.*

- *If supplemental analysis for sleep disturbance is desired, use may be made of an interim dose-response model developed by the AF Armstrong Laboratories (AL). Although this relationship is described in terms of Sound Exposure Level (SEL), single event metrics are of limited use in predicting and interpreting cumulative noise exposure impacts.*

- *Public health and welfare effects below DNL 60 dB have not been established, but are assumed to decrease according to the decrease in percent of people highly annoyed.*
- *DNL represents the accepted noise metric for input to compatible land use planning.*

FICON was an impartial panel convened to review all of the available scientific evidence. Its conclusions show that average day-night sound levels remain the most appropriate metric for use in land use compatibility planning under FAR Part 150. They completely refute your contention that there are "...other, more accurate noise descriptors, such as the single event noise descriptor." In fact they confirm that single event noise metrics are appropriate only as a supplement to the Ldn cumulative noise exposure metric for land use compatibility planning.

Change to Document: None required.

(8) Comment: Page 3, Item 5, Third sentence to end of item. *The Report contains a statement that the single-event descriptor has also been utilized; however, the only reference in the text to a single event descriptor is with respect to a study undertaken by others. The single event descriptor is much more accurate particularly for nighttime flights at the Kahului Airport because of the time between the noise events and the particularly disruptive nature of these noise events during nighttime hours. This Report will not be accurate unless it analyzes the costs and benefits of the alternative noise abatement measures in terms of single event noise levels as well as Ldn.*

Response: This allegation that the report's only reference to single-event noise levels relates to a report prepared by others is incorrect. Without trying to list all of the information provided on single-event noise levels, I call your attention to the recommendation contained in Section 8.2.1.1 of the

report. As shown by the following extract, this recommendation is based upon its effect on single-event noise levels:

> *The analyses conducted as part of this study have shown that a prohibition on nighttime use of Stage 2 aircraft at Kahului Airport will have a limited effect on Ldn levels and, therefore, on land use compatibility as determined using that metric. Thus, it does not appear to be warranted on that accord. However, single-event noise from the B-737-300-QC aircraft that make up a part of Aloha Airlines' cargo fleet is at least 10 dB less than that of the B-737-200-QC aircraft that make up the remainder. Consequently, shifting to the quieter airplane would result in a noticeable decrease in single-event nighttime aircraft noise in Spreckelsville.*

Further information on single-event noise levels may be found in Appendix E.

Change to Document: None required.

(9) Comment: Page 4, Item 6. *What are the adverse impacts of excessive noise? How long has excessive aircraft noise been imposed upon the surrounding community? These are simple questions which in the asking demonstrate how inadequate this Report is. It is impossible to begin to weigh the costs and benefits of a proposed mitigation measure if the adverse effects of excessive noise are not considered. The Report forthrightly states that the only "cost" to the communities which is considered is the cost of sound attenuation. The loss of the use and enjoyment of outdoor activities, even with sound attenuation, has not been considered. Sleep interference has only been dealt with in a tangential fashion. There is no analysis of minimizing risks of community complaints or speech interference. This Report will remain wholly inadequate until and unless it acknowledges all of the many adverse affects of aircraft noise.*

The Report does not even disclose the length of time the surrounding communities have had excessive aircraft noise pollution imposed upon them. The 1989 Noise Exposure Map contained in Volume I is an admission that excessive noise was being imposed at that time. Complaints about excessive aircraft noise were received *well before then. It cannot be disputed that the airport proprietor and the aircraft operators, particularly Hawaiian and Aloha Airlines, have been allowing excessive noise to be imposed upon the surrounding communities for at least ten years. During this ten-year or more period, no significant steps have been taken to reduce this excessive noise to even marginally acceptable levels. This is without a doubt a cost which should have been included in the Report. What is this ten-year period of excessive noise worth? What is a ten-year period free of restraint upon the aircraft operators worth? This should have been evaluated in the Report.*

Finally, the Report excludes from consideration whole areas upon which excessive noise is being imposed. There is no evaluation of noise impacts at Kanaha Beach Park or along the beaches in the area. There is no analysis of the excessive noise being imposed upon users of the nearshore ocean waters. There is no analysis of the excessive noise being imposed upon the Kanaha Wildlife Refuge, particularly during the construction of any extended runway.

The Department of Education has formally offered the Puunene School for use by the Hawaiian Language Immersion Program, which is a public DOE program. The Report does not consider the impacts of excessive aircraft noise upon public schools or the ability to teach and to learn in such an environment. This must be addressed in the Report.

Response: This comment contains numerous assertions concerning the adequacy of the report's description of the noise environment. Some of these are untrue. Many that are true are unrelated to the purpose of the noise compatibility program. In an attempt to respond coherently to as many issues as possible, we have categorized the comments and provided responses to each category of criticism.

Noise Compatibility Program Reports are not intended to be impact analyses. Neither are they supposed to be catalogs of past noise events. Rather their purpose is to identify existing noise problems (as evidenced by conflicts between existing aircraft noise levels and existing land use in the vicinity of the airport) and to propose and analyze means of rectifying these problems. Just as it would be unfair for an airport operator to tell a community that it was not taking action now to correct existing

noise problems because there had not been problems in the past, it is inappropriate to base recommended noise mitigation measures on past problems. Consequently, the report focuses on the present and the near future, just as is specified in the FAR Part 150 regulations.

The report notes that there is a history of complaints about noise from aircraft operations in the vicinity of Kahului Airport (Page 3-8, Section 3.3.2 *History of Noise Complaints and Relevant Legal Action*). A number of the statements contained in the second paragraph of this comment go well beyond the facts. In particular, you repeatedly use the term "excessive," asserting that the State and the airlines have been "*...allowing excessive noise to be imposed upon the surrounding communities for at least ten years. During this ten-year period, no significant steps have been taken to reduce this excessive noise to even marginally acceptable levels.*" The objective record shows that the State has worked within the confines of Federal regulations to improve the noise situation at Kahului Airport. In fact, Spreckelsville residents praised DOTA for the steps that were taken to alleviate noise during work on the repaving of Runway 2-20. Aloha Airlines, which operates the night cargo flights that were affected by the runway resurfacing project, went out of its way to cooperate with DOTA's efforts to avoid undue noise impacts during that necessary maintenance project. In addition, Aloha Airlines fleet modernization program has, by your own admission, substantially reduced cumulative noise emissions from its aircraft.

Your assertion that "*...the Report excludes from consideration whole areas upon which excessive noise is being imposed....*" is incorrect. The methodology used in the report considers the full range of land uses, including the recreational activities mentioned in your comment (e.g., beach use, recreational use of nearshore waters, etc.). For example, Table 4-2, which contains the State's land use compatibility criteria, shows that beach parks (as in Kanaha Beach Park), are considered compatible with noise levels up to 75 Ldn, well above the level that is experienced there. Some offshore areas are exposed to noise levels of more than 75 Ldn. Relatively few individuals use these areas, and many who do are engaged in activities that either insulate them from some of the noise (diving) or expose them to substantial levels of natural environmental noise (wind-surfing).

With respect to noise impacts associated with the proposed extension of Runway 2-20, as you know they are being evaluated in the environmental impact statement being prepared for that project. Because the runway extension is not being recommended as a noise abatement measure, this subject is not discussed in the Noise Compatibility Program report. However, the report does assume that Runway 2-20 will have been extended to 9,600 feet by 1998.

Wildlife specialists with both the State Department of Land and Natural Resources and the U.S. Fish & Wildlife Service have indicated that the biota in the Kanaha Wildlife Refuge are well adapted to aircraft noise and occasional overflights. Contrary to your comment, these specialists do not consider this noise to be "excessive." In the absence of any "incompatibility," this topic was not discussed in the Kahului Airport Noise Compatibility Program Report.

Finally, the statement that the report "...*does not consider the impacts of excessive aircraft noise on public schools or the ability to teach and to learn in such an environment*" is incorrect. As demonstrated by the compatibility criteria in Table 4-2, the need to maintain reasonable levels of noise in public schools is an important part of the FAR Part 150 Noise Compatibility Program. As you know, the old Puunene School is not presently used for classrooms. The 1989 *Noise Exposure Map Report* clearly shows that the school building is exposed to aircraft noise levels which make it incompatible for school use unless building specific analyses demonstrate that soundproofing is capable of reducing interior noise levels to tolerable levels. The report is a matter of public record, and we presume that the need to sound-proof the building before using it for the Hawaiian Language Immersion Program is being taken into consideration. The attached letter has been sent to the Department of Education to insure that noise exposure is not overlooked during the planning for this important program.

Change to Document: None required.

(10) Comment: Page 4, Item 7. *1998 is a poor choice for the five-year noise exposure map. The noise exposure map supposedly assesses the impacts which will result from the extension of Runway 2-20 to 9,600 feet which will supposedly be completed in 1998. The full impacts of lengthening the*

runway will not be experienced the day after it is opened for use. The impacts will be experienced over a number of years. This should have been acknowledged and the potential impacts addressed in the study.

The year 2000 would be a more appropriate date for the assessment of noise impacts. This is the year during which DOT has committed the State to prevent the operation of Stage 2 aircraft at Kahului Airport, during the day and the night, should the cost/benefit analysis which it is preparing conclude that this is cost/beneficial. This commitment by the State of Hawaii is never acknowledged or addressed in the Report. Should the State of Hawaii implement such a regulation, this would have a tremendous impact upon the costs and benefits of the various alternative operational abatement measures discussed in the Report.

Response: The use of 1998 is dictated by the fact that it is five years from the 1993 base year. Its use did not involve an element of choice since the five-year time frame is specified by the FAA's FAR Part 150 guidelines.

Your concern for the long-term impacts of the proposed 2,600-foot extension of Runway 2-20 is understandable, but the *Kahului Airport Noise Compatibility Program Report* is not the appropriate place to carry on this discussion. The environmental impact statement that is being prepared for that project will provide the information you have requested.

Your letter states: *This [the year 2000] is the year during which DOT has committed the State to prevent the operation of Stage 2 aircraft at Kahului Airport, during the day and the night, should the cost/benefit analysis which it is preparing conclude that this is cost/beneficial.* This is incorrect. While the Airports Division continues to work to reduce incompatible land use in the vicinity of all the airports in its system, it has not made a specific commitment to achieve this goal by the year 2000 at Kahului Airport or elsewhere. In view of this, the criticism of the report contained in the second paragraph of this item is mistaken.

Change to Document: None required.

(11) Comment: Page 5, Item 8. *The report does not adequately*

describe existing and future aircraft operations at Kahului Airport. It notes that Aries Consultants, Inc. recently completed in 1994 an update for these aircraft operations. The results of this update should have been disclosed in a more detailed fashion A forecast for 1998 is included, however it is impossible to determine what it means because it only lists aircraft types and not the operators or the routes. The importance of this inadequacy is that flights from Japan and/or the midwest, which the extended runway could facilitate, could arrive and/or depart during nighttime hours and exacerbate the already deteriorated nighttime noise environment.

Response: Tables 5-1 and 6-1 contain extremely detailed breakdowns of aircraft operations by aircraft type, route, and time of day for 1993 and 1998, respectively. Table 6-1 is derived in part from the system-wide Aries forecasts cited in your comment. It is not necessary to know an aircraft's operator, the other item mentioned in your comment, in order to understand its noise emissions. The operational numbers in the tables in the report already reflect the anticipated arrival and departure times of aircraft arriving and departing Kahului Airport, including those moving to and from overseas airports.

Change to Document: None required.

(12) Comment: Page 5, Item 9. This item contains a number of assertions. Responses to each are provided separately below.

- *The report does not adequately disclose the current or anticipated aircraft fleet mixes. First, listing new, anticipated flights by aircraft type number does not identify the noise characteristics of the aircraft, the operator of the aircraft or the route, as noted above. Second, particularly with respect to Hawaiian and Aloha Airlines, there is no description of the number of aircraft currently in use or the "stage" of each of these aircraft.*

  Response: Issues relating to fleet mix are discussed above under Item 4.

- *Third, the Report does not take into consideration the "retirement" of aircraft between 1990 and 1998 or 2000.*

  It is inconceivable that Hawaiian Airlines is not "retiring" a single Stage 2 aircraft in this period of time.

  Response: You have placed the term "retirement" in quotation marks, but have not defined the special meaning that you have in mind. The report clearly states the aircraft fleet mixes that are anticipated at Kahului Airport in 1998, and these mixes take into account aircraft that the airlines expect to add and take out of service between the 1993 base year and 1998. The information on Hawaiian Airlines plans with respect to fleet mix was obtained from official airline sources, as noted in the report. We have no reason to believe that they will not comply fully with all laws affecting the use of Stage 2 aircraft in Hawaii.

- *Fourth, while Aloha Airlines appears to be making what might be considered a good faith effort to add Stage 3 aircraft to its fleet, Aloha has been on notice since at least 1990 of the State's goal to prohibit Stage 2 aircraft between 10:00 p.m. and 6:00 a.m., effective December 31, 1995. There is really no excuse for the primary nighttime noise polluter to ignore this goal.*

  Response: You do not explain the basis for your assertion that Aloha Airlines is "ignoring" the goal of reducing nighttime noise in the vicinity of Kahului Airport. Aloha has been praised by Spreckelsville residents for its help in controlling nighttime noise during the recent runway repair project. Aloha has opposed restrictions on its night cargo operations for economic reasons, but, as you noted, it has made a special effort to convert B-737-300 series aircraft into QC versions for use in its night cargo operations.

- *Finally, the Report does not take into consideration the importance of the new service, and perhaps an increase in the number of Stage 2 aircraft, by Hawaiian Airlines. The Federal Airport Noise and Capacity Act ("ANCA"), in §47528(e), contains a "non-addition" term for Hawaiian operations which prohibits the increase in the number of Stage 2 aircraft which are operated in Hawaii beyond the number which are owned, leased, or operated in Hawaii on November 5, 1990. This statute prevents any increase in Stage 2 aircraft* *or services in Hawaii, in part to prevent further deterioration of the noise environment. The implementation by Hawaiian Airlines of "every half hour" service to Maui in 1994, increasing the turnaround service by 27 "services," may well violate ANCA's restrictions on turnaround services as well as ANCA's prohibition against any increase in the number of Stage 2 aircraft. The import of the Federal "non-addition" rule in Hawaii should have been discussed in the Report. The enforcement of the non-addition rule could have important beneficial impacts on the noise environment at Kahului.*

Response: This assertion is incorrect in several ways:

- First, Hawaiian Airlines' increased frequency of service is, in fact, accounted for by the 1998 operational numbers that are used in the report.

- Second, your assertion that the increased frequency somehow violates provisions of ANCA is based on a misreading of that Act and implementing regulations. Nothing in the report, your comment, or the other material we have seen indicates that Hawaiian Airlines has violated the non-addition rule. Changes in the frequency of service by an air carrier which uses Stage 2 aircraft legally in Hawaii are not prohibited or regulated. The limitation applies to the total number of Stage 2 aircraft owned or otherwise controlled by the airline. The determination of compliance is based on aircraft in interisland service and aircraft used to serve routes between Hawaii and the Mainland.

- ANCA's "non-addition rule" was not discussed in the draft report because the fleet numbers obtained from the airlines showed that it would not come into play. However, to insure that readers of the report are fully aware of this provision, a brief description of it will be added to the final report.

- Your letter does not explain how: ...*enforcement of the non-addition rule in Hawaii could have important beneficial impacts on the noise environment at Kahului.* To the best of DOTA's knowledge, the non-addition provisions of the Act are being adhered to. Consequently, it is difficult to understand any basis for the benefits you allege.

Change to Document: The following sentence will be inserted after the second sentence in the first paragraph of Section 7.2.7.2 (page 7-19): *The Act does contain a "non-addition" provision which limits the number of Stage 2 aircraft owned, leased, or operated in Hawaii from exceeding the number of such aircraft present on November 5, 1990.*

(13) Comment: Page 6, Item 10. *In 1991 DOT committed itself to the rigorous evaluation of two significant operational noise abatement measures affecting Kahului and other airports in the State of Hawaii through a stipulation entered in Pitt et al. v. Hirata et al., Civil No.89-0048(1) in the Second Circuit Courts (sic) of the State of Hawaii. First, the State of Hawaii, in its capacity as airport proprietor, envisaged mandating the use of Stage 3 aircraft at Kahului Airport according to the deadlines established in the Airport Noise and Capacity Act of 1990.*

Second, the State of Hawaii has commenced rule promulgation proceedings with respect to prohibiting the landing or taking off of Stage 2 aircraft between the hours of 10:00 p.m. and 6:00 a.m., effective December 31, 1995, also at Kahului Airport.

These are two significant alternatives which the DOT has already endorsed in principal. Neither of these alternatives was studied in the Report. Instead, the Report considers the prohibition of all Stage 2 aircraft, effective 1998, thus excluding two important years for the airlines to bring themselves into compliance with the prohibition. Likewise, the Report does not consider a ban on Stage 2 aircraft between 10:00 p.m. and 6:00 a.m., unless it is to be effective in 1998, three years after the proposal which is the subject of the current rule-making. The effect of the three-year extension, which allows three additional years of excessive noise to be imposed on surrounding communities, is not considered or evaluated *in the Report, as a cost to the communities. This is improper and unfair.*

Response: We disagree with the comments that were made.

Section 7.2.7.2 of the report evaluates the effect of imposing exactly the same Stage 2 phase-out requirements on Hawaii as are already imposed on the 48 contiguous states.

Section 7.2.7.5 evaluates a ban on nighttime use of the airport by Stage 2 aircraft. Your comment incorrectly infers that the report stipulates a 1998 start date for the nighttime ban. The report simply complies with FAR Part 150 requirements by evaluating the effect that the ban would have on noise levels five years following the base year, which happens to be 1998. While the procedural requirement that must be fulfilled make it infeasible for the ban to be imposed by the December 31, 1995 target date, it is possible that a ban on nighttime operations by Stage 2 aircraft could begin sooner than December 31, 1998, if DOTA is able to comply with the requirement of FAR Part 161 and other applicable Federal regulations by an earlier date and if the results of the detailed economic analyses that are performed to comply with FAR Part 161 show those measures to be cost-beneficial.

In accordance with the letter and intent of the FAR Part 150 Noise Compatibility Program, the report does not focus on perceptions of past wrongs or damages. Instead, it takes a positive approach to improving the future land use compatibility situation around the airport. Moreover, given the legal hurdles which must be overcome before a state-initiated ban can become effective, we believe that attempting to differentiate between alternative effective dates of this provision would be unproductive.

Change to Document: None required.

(14) Comment: Page 7, Item 11. *The weighting of the costs and benefits of the various alternatives studied is unarguably the most important analysis to be contained within any noise compatibility program report. Unfortunately, the analysis contained within this Report is very weak and could not satisfy even minimally the applicable FAA regulations pertinent to cost/benefit analyses. The type of balancing undertaken by the authors was*

designed to tip in favor of the aircraft operators and against operational restrictions. First, significant impacts upon the surrounding communities, as "cost," were not even weighed. The only cost considered was the cost of sound attenuation, not the loss of property value, not the loss of the use and enjoyment of the property, not the number of years to which the communities have been subjected to excess aircraft noise, not sleep interference, and not the adverse health effects of excessive noise. Naturally, if none are weighed, the balance will tip in favor of sound attenuation.

Costs to the aircraft operators and to those who were dependent upon the aircraft operators were speculative and undocumented as a matter of fact. For example, the Report concludes that it would not cost Aloha Airlines anything to comply with a prohibition on Stage 2 aircraft between 10:00 p.m. and 6:00 a.m. effective 1998, if Aloha modified certain routes and schedules. In a footnote, however, the authors reject this approach because it would "impose scheduling constraints on the airline." There is absolutely no factual substantiation that this is a real constraint or that Aloha Airlines could not accommodate such a constraint. There is only the skimpiest of documentation for the "parade of horrors" in terms of expenses, airlines going out of business and inability to pay for Stage 3 aircraft or hush kits. Yet it only based upon these speculations that the balance can tip in favor of the aircraft operators and against operational restrictions. This is unfair and unwarranted based on FAA regulations.

Step back and consider the effects of these rationalizations. Will Hawaii remain the home of Hawaiian Airlines, an airline which refuses to add a single additional Stage 3 aircraft to its fleet by 1998? Hawaii cannot countenance this kind of purposeful noise pollution by one of its airlines.

Response: The allegations made in the comment, few of which have specific references in the report, are inaccurate. More specifically:

- The analysis was not intentionally biased against operational measures. All measures were evaluated on the same basis.

- The report correctly notes that it may be impossible to achieve interior noise levels consistent with accepted standards in homes within the 75 Ldn contour and recommends that these homes be purchased so that owners are able to move to quieter locales. Even the strongest of the operational restrictions that the comment implies are preferable (i.e. a complete ban on Stage 2 aircraft at Kahului Airport combined with the assumption that compliance would be achieved through the use of new, rather than retro-fitted, aircraft) would not provide land use compatibility in homes exposed to noise levels of 65 Ldn or greater as shown in the 1998 No Mitigation Noise Exposure Map. Only homes located outside the 65 Ldn contour shown on that map would be totally freed from the need for soundproofing. Less stringent operational restrictions would free even fewer homes from the need for sound mitigation measures.

- There is no clear evidence that airport operations have decreased property values in the vicinity of the Airport. In fact, property values in the area have remained strong despite the aircraft noise. The fact that both Ldn and single-event noise is likely to remain stable or decrease between now and 1998 suggests that there will be no such effect during the period covered by the study. This does not guarantee that property values will remain stable; they may either increase or decrease depending upon the state of the Maui economy and overall real estate market forces.

- The report notes that sound-proofing will not decrease exterior noise levels. However, a comparison of the forecast noise contours with accepted land use compatibility criteria suggests that most outdoor activities likely to occur in the vicinity of the Airport will continue to fall within the compatible range.

  - The determination of incompatible land uses was based on guidelines established in consideration of such things as sleep interference, potential adverse health effects, and other possible noise effects. It is not correct to state that these factors were not taken into account.

- The costs to the aircraft operators and to those who were

dependent upon the aircraft operators were not speculative and undocumented. This is confirmed by a closer look at the following "example" included in the comment.

The comment states:

> the *Report concludes that it would not cost Aloha Airlines anything to comply with a prohibition on Stage 2 aircraft between 10:00 p.m. and 6:00 a.m. effective 1998, if Aloha modified certain routes and schedules. In a footnote, however, the authors reject this approach because it would "impose scheduling constraints on the airline."*

A search of the document failed to reveal the quoted material. What the document does say with respect to scheduling is:

- *Aloha Airlines is in a different position on two levels. First, by 1998 it will have enough Stage 3 passenger aircraft in its fleet to operate its 6:00 AM to 7:00 AM passenger flights to and from Kahului without acquiring additional aircraft (note, however, that it may well not prefer to do this because of the constraints that it would place on its scheduling). Second, it operates nighttime cargo flights using a mixed Stage 2 and Stage 3 fleet of B-737-QC aircraft. Plans in effect near the end of 1994 indicate that by 1998 it will have enough Stage 3 cargo aircraft to operate all of its night cargo service to Kahului using these aircraft.* (page 7-27, beginning of third full paragraph)

- *With no Stage 3 aircraft currently in its fleet, Hawaiian Airlines would need to purchase additional aircraft or to retrofit some of its existing aircraft with hush kits in order to maintain its current schedule. The number of modifications or replacements needed would dependupon whether it dealt only with the minimum number needed to conform to the requirements at Kahului, accepting the constraints on its aircraft scheduling flexibility that this would impose. [page 7-27, second full paragraph]*

A nighttime curfew on Stage 2 operations is never "...*rejected because it would impose scheduling constraints on the airlines*." The analysis simply notes that such constraints exist and that there are potential cost implications associated with requiring airlines to concentrate their limited Stage 3 aircraft on their Kahului service. Both of these are true and relevant to the decision-making process.

With respect to your statement that: "*There is absolutely no factual substantiation that this is a real constraint or that Aloha Airlines could not accommodate such a constraint*," one would have to believe that Aloha's and Hawaiian's strong objections to the regulations affecting the use of Stage 2 aircraft at night are done without a belief that such regulations would harm their business.

Without being privy to confidential business information, it is impossible to establish the exact degree of burden that a prohibition on nighttime Stage 2 operations would impose on the airlines. This is why the report provided a range of possible values depending upon the difficulty each would have in adjusting its operations. In view of the tremendous uncertainties, DOTA believes this is the best that can be done. The recommendation that the State continue to investigate proposed amendments to Chapter 28 despite the fact that it was not clearly cost-beneficial on a system-wide basis was included in the report largely to account for this uncertainty. The cost-benefit analysis that must be undertaken before imposing restrictions under FAR Part 161 will provide the additional insight into this issue needed to make a reasoned decision.

Change to Document: None required.

(15) Comment: <u>Page 7, Item 12.</u> *The Report contains two principal unsupported assumptions about the statewide implication of noise abatement measures enacted at the Kahului Airport. First, the Report states on numerous occasions that the implementation of the noise abatement measures applicable to Kahului Airport will worsen noise conditions at other airports. Nowhere is there any factual demonstration that this would occur or that other airports have worse noise environments. Under these circumstances, these statements cannot be*

taken as true or determinative.

Second, the two non-lawyer authors of the Report challenge whether noise implementation measures could be implemented on anything but a statewide basis. A simple review of the existing Administrative Rules for Public Airports in the State of Hawaii demonstrates the fallacy of this proposition. There already exist rules which are applicable only to the Honolulu International Airport, only to the General Lyman Field, only to the Ala Wai Heliport and only to the Kapalua-West Maui Airport. The Report itself indicates that the noise regulations of the Department of Health apply only to Oahu. Airports in California are regulated on an individual, and not a statewide basis. This unwarranted legal assumption should be eliminated from the Report and should not be weighed in the cost/benefit analysis.

Response: The fact that the interisland air carriers will have a limited number of Stage 3 aircraft in their 1998 fleets is undisputed. The fact that forcing airlines to allocate a disproportionate share of what Stage 3 aircraft they will have to Kahului Airport would lead them to use more Stage 2 aircraft at the other State airports which they serve is also indisputable. Finally, even a cursory glance at the Noise Compatibility Program for Hilo International Airport shows that far more homes adjacent to that airport are exposed to incompatible levels of aircraft noise than is true at Kahului Airport. Thus, it is quite possible that a measure undertaken to improve the noise situation at Kahului will actually exacerbate the problem when viewed from a statewide perspective.

The report does not "challenge whether noise implementation measures could be implemented on anything but a statewide basis." Rather, it states:

> "*If the courts hold that all airports within the state airport system must be treated similarly, the imposition of operating restrictions at Kahului Airport could require the adoption of similar rules applicable statewide.*"

The "non-lawyer" authors of the Noise Compatibility Program Report intended this simply as recognition that the courts will ultimately decide the issue. Failure to include this observation in the report could have hidden an important fact that should be considered in the formulation of program recommendations.

The lecture about the many precedents that exist for regulations affecting only a single state-owned facility or jurisdiction is based on a misreading of the report. The examples cited in the comment are all State regulations, whereas the Noise Compatibility Program Report's warning that:

> *"An important legal consideration that could affect all of the options is the extent to which the establishment of noise regulations applicable only to Kahului Airport which are more restrictive than those in effect at other airports within the Airports Division's statewide system may run afoul of non-discrimination provisions of the law."* [Section 7.2.7.1, bottom of page 7-17]

was based on a concern for the way in which the Federal non-discrimination clause would be interpreted when applied to a single, statewide, airport system The examples cited in your comment are for Mainland airports operated by separate jurisdictions, a fact which could distinguish them from Hawaii's system of state-owned public airports.

Change to Document: None required.

(16) **Comment:** Page 8, Item 11. *The Airport Noise and Capacity Act enacted in 1990 authorized airport proprietors to assess each passenger a charge of up to $3.00 per passenger (passenger facility charge: "PFC") and to use these funds for noise mitigation projects. FAA data shows (sic) that 46 airports are using $782.2 million in such charges for noise mitigation projects. There is no discussion of PFCs in the Report or the amount of money that could be made available through PFCs for noise mitigation purposes at the Kahului Airport. This should have been discussed in the draft.*

Response: PFCs represent one of several sources of funds that the State can use to implement the proposed noise compatibility program. Since the source of funds does not affect the action that is proposed, it was not discussed in the Noise Compatibility Program Report. It may also be worth noting that PFCs have typically been used to fund noise attenuation treatment of homes or purchase of private property to bring it within the Airport boundary. They have not typically been used to subsidize fleet quieting.

Change to Document: None required.

(17) **Comment:** Page 8, Paragraphs 3 through 6. *Sound attenuation has a fatal defect as a noise abatement measure. At best, it is only half a measure. It can only protect those who are exposed to excessive impacts of this noise so long as they stay inside their dwellings, with windows and doors shut and the air conditioner turned on. It provides absolutely no relief while they are outdoors. The importance of Hawaii's outdoor environment has not been acknowledged. The extent to which residents are outdoors and the importance of them being outdoors has nowhere been valued. This is equally true of our parks, shoreline areas and wildlife refuges. Sound attenuation offers nothing here.*

Taking surrounding residents' outdoor life on behalf of an airline which refuses to incorporate any Stage 3 aircraft in its fleet in the near future is insupportable. The authors' failure to recommend the expenditure of money by Aloha and Hawaiian Airlines to bring a sufficient number of Stage 3 aircraft into their fleets to preserve some remnant of Hawaii's outdoor lifestyle cannot be justified. Noise pollution must, in the final analysis, be curbed at its source.

Unless this draft is withdrawn, re-analyzed and resubmitted, the residents of Maui will be shortchanged just as the residents of Chicago were. The Part 150 Program can work but only if a greater effort is made to weigh the costs and benefits involved.

To be meaningful, Kahului's noise abatement program must (1) prohibit Stage 2 aircraft between 10:00 p.m. to (sic) 6:00 a.m., effective December 31, 1995 and (2) prohibit Stage 2 aircraft during all hours, effective the year 2000.

Response: The report explicitly recognizes that closure and sound-proofing of residences are imperfect solutions. For example, the last bullet item on page 8-4 states:

> *Soundproofing the structures exposed to incompatible levels of noise can significantly reduce interior noise levels and provide a measure of compatibility for areas exposed to noise levels up to 75 Ldn. It is the most cost-effective way of achieving the desired interior noise levels in areas around Kahului Airport. However,*

it requires closure and air-conditioning of the structures, as well as ongoing operating and maintenance expenses on the part of the owners. It also requires a change in lifestyle away from the open, outdoor-oriented manner that residents prefer.

The land use compatibility guidelines that are used as the basis for compatibility determinations in the report already address the other outdoor activities which you list, including use of parks, shoreline areas, and wildlife refuges. Consequently, these uses are dealt with as an inherent part of the analysis.

The residents desire that the aircraft operators take some of the responsibility for reducing aircraft noise is understandable. However, the analyses conducted as part of the study and reported in Chapter 7 makes it clear that (*i*) operational changes simply cannot achieve complete land use compatibility and (*ii*) are generally a much more expensive means of reducing exposure to incompatible levels of aircraft noise in the vicinity of Kahului Airport than are elimination of noise sensitive uses from the most exposed areas and sound-proofing of structures. This is true because even a 24-hour ban on the use of Stage 3 aircraft would reduce noise levels by only 5 Ldn (if it were met with retro-fitted aircraft) to 10 Ldn (if it were met using all new aircraft), whereas a reduction of up to 18 Ldn points is needed for complete compatibility. The recommendation that the State offer to purchase the homes of all owners who choose not to participate in the sound-proofing program provides an alternative to those who prefer not to live in closed homes.

Change to Document: None required.

Thank you again for your comments on the noise compatibility program. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

for
Owen Miyamoto
Airports Administrator

Grand Wailea Resort
HOTEL & SPA

FAXED 5-30-95

May 30, 1995

Mr. Kazu Hayashida
Director
State of Hawaii
DEPARTMENT OF TRANSPORTATION
869 Punchbowl
Honolulu, HI 96813

Via facsimile: 808-587-2167

Dear Mr. Hayashida:

I am writing regarding the hearing which is scheduled May 31, 1995 regarding the Kahului Airport Runway Extension and the proposed night curfew.

As a major employer on the island we are very concerned about the impact such a curfew would impose on the majority of the island population who are largely dependent on the visitor industry for their income. This decision would increase spoilage and subsequent cost of perishable goods to the hotels as well as disrupt the basic flow of operations reliant on certain supplies subject to critical timing.

We need all the support we can get to keep the visitor industry alive by allowing maximum flights for goods and services. A reduction in "lift" both visitor and cargo will result in lost jobs and tax revenue to the County and State and will overall impact the financial health of the island.

Being somewhat isolated as an island closed community, we are even more dependant on timely delivery of supplies and basic goods and services. Please consider our concerns seriously before ruling in favor of a small group of concerned parties at the expense of the overwhelming population on Maui.

Thank you for your consideration.

Sincerely,

Peter O'Connor
Executive Vice President and Managing Director

PO:ed

cc: Greg Koestering
Terryl Vencl

BENJAMIN CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU INTERNATIONAL AIRPORT • HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
GLENN M. OKIMOTO
JERRY M. MATSUDA

IN REPLY REFER TO:
AIR-EP
95.223

August 28, 1995

Mr. Peter O'Connor
Executive Vice-President & Managing Director
Grand Wailea Resort
3850 Wailea Alanui
Wailea, Maui, Hawaii 96753

Dear Mr. O'Connor:

Subject: Comments on Draft Kahului Airport FAR Part 150 Noise Compatibility Program
Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your May 30, 1995 letter concerning Kahului Airport, which was forwarded to me by the Director for a response.

The Airports Division understands your desire to avoid restrictions on aircraft operations that would adversely affect the flow of goods and passengers to and from Maui. Other individuals and organizations have expressed similar concerns. The recommendations in the draft report relating to restrictions on the use of Stage 2 aircraft at Kahului Airport read as follows:

> *...it is recommended that the Department evaluate the impact of imposing this requirement [prohibiting the use of Stage 2 aircraft between the hours of 10:00 PM and 6:00 AM] by the end of 1998 [emphasis added]. This should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes.* (page 8-6)
>
> *The Airports Division of the State of Hawaii Department of Transportation should continue to pursue an amendment to Chapter 19-28, Hawaii Revised Statutes, to include a 10:00 PM to 6:00 AM ban on the operation of Stage 2 aircraft at Kahului Airport as described above. However, this should be done in conjunction with a statewide review of the implications that such a mandate would have statewide.* (page 8-8)

AIR-EP
95.223

As you can see, the report does not recommend the immediate imposition of restrictions on the nighttime operation of Stage 2 aircraft at Kahului Airport. Rather, it recommends that we continue to evaluate the implications of implementing such restrictions by the end of 1998.

Please note that Part 161 of the Federal Aviation Regulations (FAR Part 161) requires the State to complete a rigorous cost-benefit analysis demonstrating an overall positive effect before imposing a nighttime curfew or other limitation on aircraft activity. The outcome of the FAR Part 161 process will ultimately determine whether nighttime restrictions are imposed at Kahului Airport or elsewhere in the State Airport system. However, we felt it important for the Part 150 Noise Compatibility Program to express our support for the continuation of that process.

The Airports Division will do its best to insure that Kahului Airport continues to meet the needs of Maui's residents and businesses and that restrictions on the use of the airport do not adversely affect the ability of Maui businesses to compete.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

for Owen Miyamoto
Airports Administrator

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

TESTIMONY - KAHULUI AIRPORT FAR PART 150, Noise Compatibility
May 31, 1995
Submitted by Jack Thompson representing
Spreckelsville Community Association

There are several statements in this Part 150 draft that need clarification, expansion or reconsideration. These include:

5.1.? LDN is, "...the only noise metric which has been tested with social surveys to correlated noise levels with annoyance of those hearing the noise." There is a strong need to look seriously at single events in terms of their annoyance factor. Helicopters and prop airplanes (both civilian and military) are examples of annoyance that has nothing to do with noise level.

6.2.2.1 At the present time the stack at the Puunene mill extends 5 feet into the airspace approaching runway 2. If the runway is extended south 2600 feet and Kona takeoffs are required, that stack then protrudes 65 feet into the air space leaving runway 20. What is meant by the plan's statement, "The runway threshold would be displaced 400 feet from the southern end of the runway to insure adequate clearance over stacks..."?

6.2.2.2 This states that interisland pilots want to use Track 18 more frequently. This brings them directly over Wailuku Heights, Wailuku and more of Kahului. Yet, it is concluded that it would not alter aircraft noise levels in these areas. How can this be?

6.3 A&B has plans to develop 2 acre lots in Spreckelsville beginning before the end of this year. The draft states this would not happen before 1998. (That project is reportedly sold to another developer.) Since one of the three goals of Part 150 states, "Prevent new incompatible land uses from becoming established around the airport", does the state plan to stop this development?

6.4 "The higher noise level at Station M in West Spreckelsville is due to the fact that departing air carrier aircraft will be at a higher altitude than at present because of the 2,600 foot extension of runway 2-20" If this is true, why doesn't the same increase occur at Stations A,B,C,D in East Spreckelsville?

7.2.5.1 This pertains to the recommendation that runway 2 should be used in light Kona wind conditions. This was requested by East Spreckelsville residents because of the extreme noise generated by Kona takeoffs. The draft statement suggests reverse thrust and fuel fumes generated the complaints. The recommendation was not approved based upon faulty information. Kona takeoff noise needs to be measured and this recommendation be approved.

7.2.6.2 Suggests that residents complaints about overflights are primarily associated with light, propeller driven aircraft. In reality these are minor. The major complaints are the result of interisland jets (usually Hawaiian Airlines) turning towards Kona so quickly that they overfly the Spreckelsville community at relatively low altitudes. This problem needs to be addressed in the Runway Use Program.

7.2.7.7 The installation of a noise monitoring system at Kahului is a good start towards initiating a true noise abatement program. The purpose behind the DOT proposed system is to monitor existing noise to help keep noise contours current. This program does nothing to reduce noise or even maintain it at the present levels. Controlling noise at Kahului is long overdue and an effective program could easily be installed which could keep aircraft noise within agreed-upon levels. Levels based upon single events for specified aircraft and airlines.

FAR PART 150 STUDY FOR KAHULUI AIRPORT - May 31, 1995
Oral Testimony by Jack Thompson
President, Spreckelsville Community Association

The good news is that this Part 150 plan calls for a noise monitoring system at Kahului Airport. The bad news is that it is not being installed for noise abatement purposes.

As pointed out many times in this draft report, East and West Spreckelsville are the residential communities most effected by aircraft noise. Many of these residents were in their present homes when propeller aircraft dominated the airport and before jet aircraft took away the quiet enjoyment of those homes. It is past time for the state to take their responsibility and, if unable to reduce the noise, at least insure that it get no worse. This can be done through a noise abatement program that describes what is acceptable noise levels and what is not.

With the monitoring system recommended for installation, we could easily do the following:

1. We, the state and effected residents, can agree that specified aircraft and airlines will not exceed certain noise levels at specified monitoring stations based upon single event measurements.
2. The state will not allow an airline to increase the number of Stage 2 aircraft using the Kahului Airport. For example, current noise contours were made before Hawaiian Airlines added nine flights to its schedule for their "every half hour" program. Adding these Stage 2 flights increases the LDN and is not reflected in published noise maps.
3. No Stage 2 aircraft will land or takeoff from Kahului Airport between the hours of 10:00 pm and 6:00 am. The arguments in this report against such a curfew are based on shallow reasoning. It says, protecting our airport in this way would place more Stage 2 activity at other airports in the state. This may be true but this Part 150 is designed for Kahului and if this curfew will reduce noise on Maui then it should be implemented. If it results in noise problems at other airports, that can be dealt with when their Part 150s are reviewed.
4. The DOT will do all in its power to remove Hawaii from the federal exemption which allows Stage 2 aircraft to continue using our airports beyond the year 2000 as mandated for all mainland states.

5. The state and county will exert all their powers to keep Kahului from becoming an international airport.

State attempts to provide residents within the 60 LDN contours options to sell their homes to the state or have sound proofing installed is a reasonable and fair offer. However, for residents who choose neither of these options, the state needs to provide whatever noise protection it has at its disposal. This noise abatement program will do this. I urge you to use this Part 150 plan as the springboard for taking control of the aircraft noise pollution on Maui.

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO:
AIR-EP
95.233

August 28, 1995

Mr. Jack Thompson
President
Spreckelsville Community Association
204 Kealakai Pl.
Paia, Hawaii 96779

Dear Mr. Thompson:

Subject: Comments on Draft Kahului Airport FAR Part 150 Noise Compatibility Program
Kahului Airport Noise Compatibility Program
Project No. AM1011-05

Thank you for your May 31, 1995 written and oral testimony concerning the FAR Part 150 Program for Kahului Airport. I appreciate your continuing participation in our efforts to develop a satisfactory Noise Compatibility Program. Responses to the eight written comments which you submitted are as follows:

(1) Comment: 5.1.3 *Ldn is, "...the only noise metric which has been tested with social surveys to correlate noise levels with annoyance of those hearing the noise." There is a strong need to look seriously at single events in terms of their annoyance factor. Helicopters and prop airplanes, both civilian and military) are examples of annoyance that has nothing to do with noise level.*

Response: The FAA specifies that the average day-night noise metric be used for Noise Compatibility Programs. The report complies with this instruction.

In 1990, the Federal Interagency Committee on Noise (FICON) was formed to review Federal policies that govern the assessment of airport noise impacts. The Committee summarized its findings in a report issued in August, 1992. The report reached the following conclusions concerning the most appropriate noise metric to use when evaluating aircraft noise:

- *There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL*

cumulative noise exposure metric. [DNL is the same as Ldn]

- *The methodology employing DNL as the noise exposure metric and appropriate dose-response relationships (primarily the Schulz curve for Percent Highly Annoyed) to determine noise impacts on populations is considered the proper one for civil and military aviation scenarios in the general vicinity of airports.*
- *DNL is sometimes supplemented by other metrics on a case-by-case basis.*
- *The dose-effect relationship, as represented by DNL...remains the best available approach for analyzing overall health and welfare impacts for the vast majority of transportation noise impacts.*
- *Although the A-weighted Maximum Sound Level (L_{max}) for a single flyover is easily understood, it is useful only for analyzing short-term responses.*
- *The 10 dB penalty levied against noise during the 10 PM to 7 AM period is specifically designed to account for the intrusiveness of noise during this period, and its potential impact on sleep. There are no new hard data which would justify a change in this penalty.*
- *If supplemental analysis for sleep disturbance is desired, use may be made of an interim dose-response model developed by the AF Armstrong Laboratories (AL). Although this relationship is described in terms of Sound Exposure Level (SEL), single event metrics are of limited use in predicting and interpreting cumulative noise exposure impacts.*
- *Public health and welfare effects below DNL 60 dB have not been established, but are assumed to decrease according to the decrease in percent of people highly annoyed.*
- *DNL represents the accepted noise metric for input to compatible land use planning.*

FICON was an impartial panel convened to review all of the available scientific evidence. Its conclusions show that average day-night sound levels remain the most appropriate metric for use in land use compatibility planning under FAR Part 150.

While our analysis concludes that sound-proofing of structures is unquestionably the single most effective means of improving land use compatibility and would have the lowest overall cost, the draft report recommended that the State continue to investigate a nighttime curfew on the use of Stage 2 aircraft at Kahului Airport as well. This would provide some marginal benefits, and the Airports Division is currently preparing a cost-benefit analysis of the recommendation in accordance with the provisions of FAR Part 161. The outcome of this study, as determined by the FAA, will ultimately determine whether a nighttime curfew is eventually implemented at Kahului Airport.

Change to Document: None required.

(2) Comment: 6.2.2.1 *At the present time the stack at the Puunene mill extends 5 feet into the airspace approaching Runway 2. If the runway is extended 2,600 feet [to the south] and Kona takeoffs are required, that stack then protrudes 65 feet into the air space leaving runway 20. What is meant by the plan's statement, "the runway threshold would be displaced 400 feet from the southern end of the runway to insure adequate clearance over stacks [at the Puunene Hill].*

Response: The proposed 2,600-foot extension of Runway 2-20 will not affect the space available to aircraft landing or taking off on Runway 20. It will increase the runway length available to aircraft taking off on Runway 2 because those aircraft will be able to start their rolls at the new runway end. However, to insure that aircraft landing on Runway 2 (whose end will be 2,600 feet closer to the stacks at the Puunene Mill than at present) have adequate clearance over the stacks, the runway threshold markings will be placed 400 feet north (makai) of the physical end of the runway. This will keep aircraft landing on Runway 2 a bit higher on their final approach, thereby insuring adequate clearance as they overfly the mill.

Change to Document: None required.

(3) Comment: 6.2.2.2 *This states that interisland pilots want to use Track 18 more frequently. This brings them*

directly over Wailuku Heights, Wailuku, and more of Kahului. Yet it is concluded that it would not alter noise levels in these areas. How can this be.

Response: The section states: *Preliminary analyses indicate that it would not substantially [emphasis added] alter aircraft noise levels in noise sensitive areas if it were.* The noise levels being referred to were Ldn noise levels, which is consistent with the nomenclature used throughout the report. Because of the small number of flights that it involves and the fact that nearly all of the affected flights are likely to be during daytime hours, increased use of this flight track, should it occur, would not increase Ldn noise levels substantially. It would increase the number of aircraft flying near residential areas, and the number of complaints about single-event noise would probably rise. The FAA will have to balance this against the improved passenger comfort and aircraft safety that increased usage of the turbulent tradewind route would provide.

Change to Document: The last sentence of Section 6.2.2.2 will be revised to clarify that the reference is to Ldn levels. The revised sentence will read as follows:

Preliminary analyses indicate that it would not substantially alter Ldn levels in noise sensitive areas if it were. The change would slightly increase the number of single-event noise events experienced by residents of homes in these areas, however..

(4) Comment: 6.3 *A&B has plans to develop 2 acre lots in Spreckelsville beginning before the end of the year. The draft states that this would not happen before the end of 1998. (That project is reportedly sold to another developer.) Since one of the three goals of the Part 150 states, "Prevent new incompatible land uses from becoming established around the airport," does the state plan to stop this development?*

Response: The Airports Division opposes all development of incompatible uses around Kahului Airport. Because the proposed Agricultural subdivision which you referred could have up to one residence per 2-acre lot, we have made our concern that it might increase the extent of incompatible use known both to the landowner and to the County of Maui. The noise exposure maps that were developed in

1989 and subsequently approved by the FAA have been extremely helpful in supporting our position, and we will continue to work with Maui County officials to contain incompatible development.

While the Airports Division has made it clear that it believes the development of noise-sensitive residential units in this area is unwise, the only sure means of stopping the proposed agricultural subdivision is to purchase the land or certain development rights over it. Budget constraints make such a purchase impossible at this time.

Change to Document: None required.

(5) Comment: 6.4 *"The Higher noise level at Station H in West Spreckelsville is due to the fact that departing aircraft will be at a higher altitude than at present because of the 2,600 foot extension of Runway 2-20." If this is true, why doesn't the same increase occur at Stations A, B, C, D in East Spreckelsville?*

Response: First, a correction to the statement: Site A, like Site M, is in West Spreckelsville, not in East Spreckelsville. Ldn level is determined by a combination of factors. Before discussing these, it is worth tabulating the relationship of the different noise-monitoring sites to the runway centerline and the end of the runway.

Site	Location	Distance From Rwy. Centerline (in ft.)	Distance from Runway End (in ft.)	Change in Ldn
A	West Spreckelsville	500	500	-0.4
B	East Spreckelsville	1,500	2,000	+0.2
C	East Spreckelsville	2,500	3,200	No Change
D	East Spreckelsville	2,000	3,600	-0.6
M	West Spreckelsville	1,000*	1,100*	+1.9

*Unlike the other sites, where measurements to the runway centerline are from an extension of the line beyond the end of the runway, the distance to Site M is from the runway centerline itself.

The noise level at each monitoring site is a complex function of many variables. These include the site's distance from the runway centerline, its distance from the start-to-roll point, its distance from the runway threshold, and the aircraft altitude.

As can be seen from the tabulation, the greatest noise increase occurs at the location (Site M) which is both relatively close to the Runway centerline and runway threshold <u>and</u> which aircraft pass on every takeoff made on Runway 2 and on every landing on Runway 20-20. Aircraft pass the other sites, which are beyond the runway end, only when they are taking off under tradewind conditions or arriving under Kona conditions. The greatest decrease in forecast noise occurs at the location that is farthest from: (*i*) the runway centerline, (*ii*) the runway threshold, and, (*iii*) the start-to-roll point for tradewind takeoffs on Runway 2.

Change to Document: None required.

(6) Comment: 7.2.5.1 *This pertains to the recommendation that runway 2 should be used in light Kona wind conditions. This was requested by East Spreckelsville residents because of the extreme noise generated by Kona <u>takeoffs</u>. The draft statement suggests reverse thrust and fuel fumes generated the complaints. The recommendation was not approved based on faulty information. Kona takeoff noise needs to be measured and this recommendation be approved.*

Response: The listing was not meant to exclude start-to-roll noise from aircraft departing on Runway 20 under Kona conditions as a contributor to noise in Spreckelsville. That noise is, as noted in your letter, a major source of the noise complaints that are received from the community. The wording will be revised to read as indicated below to clarify this.

While the narrative may have led you to believe that Kona takeoff noise was not considered, this is not the case. The INM Model that was used to estimate noise levels considers <u>all</u> aircraft noise sources.

The INM model run for Option T8 (Using Runway 2 instead of 20 when Kona winds are light) did indicate that making this change in operational patterns would increase Ldn noise exposures at Spreckelsville. Since it is not possible to justify an operational measure that would increase noise exposure, it was not included in the recommended program.

As explained in the report, several steps were taken to insure that the INM model provided accurate predictions. First, the effect of INM inaccuracies in modelling rearward start-to-roll noise in Spreckelsville was examined (see Tables E-8 and E-9) to increase our confidence in the conclusion that this measure would not significantly reduce incompatible land use in Spreckelsville. Also, rearward start-to-roll noise was measured during the Runway 2-20 repair project to validate the INM predictions and to alleviate East Spreckelsville residents' concerns about noise from B-737-200-QC aircraft when departing on Runway 23.

Change to Document: The second sentence of the first paragraph of Section 7.2.5.1 has been revised to read as follows:

> *North flow operations on Runway 2 expose Spreckelsville residents to in-flight noise from departing aircraft, to thrust-reversal noise from arriving aircraft, and to taxi noise from aircraft returning to the terminal following completion of their landing roll. South-flow operations on Runway 20 expose the same residents to start-to-roll noise from departing aircraft, and to taxi noise and fuel fumes from aircraft moving into position and holding prior to takeoff.*

(7) Comment: 7.2.6.2 *Suggests that resident complaints about overflights are primarily associated with light, propeller driven aircraft. In reality these are minor. The major complaints are the result of interisland jets (usually Hawaiian Airlines) turning towards Kona so quickly that they overfly the Spreckelsville community at relatively low altitude. This problem needs to be addressed in the Runway Use Program.*

Response: The problem is addressed in the recommended program. The last bullet item in Section 8.2.1.2 of the

report states: *Large propeller and jet aircraft departing Runway 2 should maintain runway heading until 1 mile clear of the shoreline before commencing turns. Small propeller aircraft departing Runway 2 should maintain runway heading until 1/2-mile clear of the shoreline before commencing turns.* Aircraft following this procedure would not overfly Spreckelsville.

Change to Document: None required.

(8) Comment: 7.2.7.7 *The installation of a noise monitoring system at Kahului is a good start towards initiating a true noise abatement program. The purpose behind the DOT proposed system is to monitor existing noise to help keep noise contours current. This program does nothing to reduce noise or even to maintain it at the present levels. Controlling noise at Kahului is long overdue and an effective program could easily be installed which could keep aircraft noise within agreed-upon levels. Levels based upon single events for specified aircraft and airlines.*

Response: As shown in Table 7-2 of the report, anticipated 1998 noise levels are slightly lower than the existing levels. The decrease in overall noise levels, combined with the recommended sound-proofing of structures containing noise-sensitive uses, is expected to improve land use compatibility around the airport.

Change to Document: None required.

Thank you again for your comments. If you have any further suggestions or would like to discuss this matter further, please call Mr. Ben Schlapak of my staff at 838-8821.

Very truly yours,

for Owen Miyamoto
Airports Administrator

c: AIR-M
BCH - P. White
FAA-ADO - D. Welhouse

Appendix H

Public Hearing Testimony

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INDEX

TRANSCRIPT OF PUBLIC HEARING
OF THE FEDERAL AVIATION REGULATION
PART 150 NOISE COMPATIBILITY PROGRAM
FOR KAHULUI AIRPORT

Date of Public Hearing: May 31, 1995

Time: 6:48 p.m.

Place: Gates 34-39
Kahului Airport
Kahului, Maui

HEARINGS OFFICER:

RICHARD KIBE
State of Hawaii, Department of Transportation
Airports Division
400 Rodgers Boulevard
Honolulu, Hawaii 96819
(808) 838-8600

REPORTED BY: RITA SCOTT
and
MARY ANNE YOUNG, RPR, CSR 369
Notary Public, State of Hawaii

(Pursuant to Rule 14 of the Rules Governing Court Reporting in Hawaii, the reporter's disclosure was made and is attached hereto.)

P R O C E E D I N G S

MR. KIBE: Good evening, ladies and gentlemen.

It is now 6:48. And I hereby declare the public hearing concerning the Federal Aviation Regulation Part 150 Noise Compatibility Program for the Kahului Airport now opened here at the Kahului Airport on May 31st, 1995, in accordance with the Notice of Public Hearing advertised by the Maui News, the Honolulu Star-Bulletin and the Honolulu Advertiser.

My name is Richard Kibe. I am a commissioner of Transportation. I am commissioned by the Director of Transportation to chair this public hearing on his behalf.

The purpose of this hearing is to comply with Section 19-34-10 Hawaii Administrative Rules by affording all interested persons an opportunity to submit data, views or arguments, orally or in writing, with respect to Part 150 Noise Compatibility Program for the Kahului Airport.

The general agenda for tonight will be as follows:

POWERS & ASSOCIATES (808) 521-7815

First, Mr. Ben Schlapak of the Department of Transportation will present an introduction and introduce the consultants working on this program for the Airports Division. The consultant will then make a short presentation.

Following the presentation, you have two options. The first option is for public testimony where you remain seated and wait for your name to be called to give your testimony. The second option is to provide a private oral or written testimony to a court reporter in the back of the room.

We ask that you limit your testimony to three 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 everyone else has been given a chance to speak for the allotted three minutes.

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

Written submissions will be accepted until June 30th, 1995 at the Airports Division, Honolulu International Airport, Honolulu, Hawaii, 96819.

If you wish to speak and have not done so

already, please enter your name on the sign-in sheet together with your address, the organization you represent, if any, and await your turn.

We're here tonight to solicit factual testimonies from you on this program. 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 now get into the details of the Noise Compatibility Program for the Kahului Airport.

I call on Mr. Ben Schlapak.

MR. SCHLAPAK: Thank you, Mr. Kibe. Good evening, ladies and gentlemen, and welcome to our public hearing. We look forward to your testimony and your views on this Part 150 Noise Compatibility Program for Kahului Airport.

The Federal Aviation Regulation Part 150 Noise Compatibility Program implements portions of the Aviation Safety and Noise Abatement Act of 1979. It is intended as a planning tool to help improve land use compatibility around our airports. It establishes a single system for the measurement of airport noise, background noise, a standardized procedure for determining the exposure of individuals to noise, and a formal airport noise compatibility planning process. It includes land use planning and implementation elements deemed necessary to achieve the objectives of the Airport Safety and Noise Act.

Although participation in this Part 150 program is voluntary, our Part 150 Noise Compatibility Program for Kahului Airport was initiated by the State Department of Transportation in 1987. A Technical Advisory Committee was established by DOT during the preparation of the 1989 Kahului Airport Noise Exposure Map Report which was -- the committee consisted of federal, state and county agencies, air carriers, business interests and local residents.

The FAR Part 150 Noise Compatibility Program for Kahului was suspended after litigation was brought against the State after the environmental assessment for the Kahului Airport Development Plan was published in 1989. The Noise Compatibility study was reinitiated in the summer of 1994. Two combined Public Information and Technical Advisory Committee meetings were held in August and December of 1994. The draft Kahului Airport FAR Part 150 Noise Compatibility Program was available for review on the 1st of May, 1995 at the

Maui public libraries and at the Kahului Airport District Office.

Now, our Noise Compatibility Program planning consultant for this report is Belt Collins & Associates, and they have used technical experts as subconsultants. An individual who has worked primarily on this study is Mr. Perry White of Belt Collins. The draft report outlines a lot of the recommendations that they have given to us, and we would like your views on these recommendations and on the report in general. And I will now call on Perry White to give you a little information, explanation on the high points of his report. Perry.

MR. WHITE: Thank you, Ben, and thank you all for braving the long walk down to the end of the terminal to be here tonight. The agenda for the meeting is up on the board there. I'm going to cover the three middle items right here. I'm going to try to do it fairly quickly because I think the major point is to hear what you have to say, not to hear what I have to say.

Many of you have probably read the draft report or at least heard what its contents are. I don't want to get redundant on that but I do want to hit the high points on it so that those of you who have not had an opportunity to go through it completely will at least know what we're talking about and understand the comments that you might hear.

There are three topics that I want to cover. The first is the noise exposure maps for both 1993 and 1998, what we call no mitigation, which is what will happen if nobody takes any special actions. The second is the alternative means of improving the noise situation around the airport that we looked at. And finally, to cover very briefly the recommended Noise Compatibility Program.

Over on the far left of me you'll see three colored maps. The one on the far left is the base year, in other words, the 1993 noise exposure map which shows noise contours around the airport as they existed in 1993. That was the latest year for which we had complete data at the time we started this study. We have obviously gotten more recent data now that we have done a double check against the '93 data and found that the '93 data adequately represents 1994.

There are just a couple or things I want to say about how we came up with the contours. It's done using a lot of data in terms of the aircraft operations at the airport, data on the kind of airplanes, the time of day that they flew, where they flew, the routes they

flew, that sort of thing. All of this information goes into a computer model which is called the integrated noise model. It's been developed by the Federal Aviation Administration, and the use of the model is designed to ensure that everybody works with the same tool in coming up with estimates of what noise will be around an airport.

The noise metric or the way of measuring noise that is used is an average day/night noise level. It takes into account operations over a 24-hour period based on what they call the average day, and it's computed on a year-long average. And it penalizes nighttime activity because the nighttime activity by airplanes, the noise level is more intrusive than during the daytime.

If you look at Table 5-3 in the handouts, and we'll put that up, too, there are just a couple -- what I've done is extract some information from some of the tables that are in the report. There are just a couple of things I want to point out to you in this particular table, which is a listing of the area that is enclosed within the noise contours.

I'm going to step away from the mike. When I talk about enclosed by noise contours, it's the area inside of a particular contour. The inside contour on all of the maps is what we call the 75 LDN contour, and it moves outward from that from 70, 65, 60 and the outside one is 55. All of you who picked up a packet at the back of the room will have an example of that, and that is for the recommended program, it's figure 8-1. You can get a sense of what I'm talking about by taking a look at that. We included that because you would have something to walk away with and really take a closer look away from here.

When we did Table -- the point here that I want to make is we had about one and a quarter square miles that are in the highest noise area, and the areas that are within the lower noise contours increase as the contours grow around the airport. The cumulative area, the total area that's enclosed by the 60 LDN contour -- and 60 is a critical number in all of this because it represents the noise level beneath which basically all land uses are compatible, okay? Above that there are some land uses which are incompatible with those particular levels of noise. We've got about twelve square miles in this instance.

The next table is Table 5-4. I wanted to call your attention to this because it's been mentioned, this program started a long time ago. The first time we did base year noise exposure maps and five-year no

mitigation exposure maps, the base year was 1987 and the five-year was 1992. And we wanted to take a look at the estimates that we had made back then for 1992 with what we calculated for 1993 using actual data. And as you can see from this table, and particularly from the right-hand column in that Table 5-4, we really weren't too far off in our estimates. And where we were off, we tended to have overestimated the amount of noise that would actually occur. In other words, things in 1993 seemed to have been a little bit quieter than we had thought that they would be when we were making the earlier projections. So basically the points seem to be fairly consistent between the two years, and if anything, the forecast has gotten a little quieter.

The next step in all of this was to take a look at the incompatible land uses around the airport and Table 5-6 gives a tabulation of that. In this, we were measuring in terms of residential units which was the key incompatible use that we discovered. And I'm going to step back to the maps again and you can also look at the ones that you have on your handout and point out the areas of incompatible land use.

The main runway at the airport is runway 2-20. Most of the takeoffs occur under tradewind conditions, and they depart towards the ocean off this runway. The two areas that are exposed to the highest noise levels are West and East Spreckelsville. West Spreckelsville gets the greatest exposure. And as you can see from this map and actually from the one that is in your packets, there are actually portions of West Spreckelsville that are exposed to noise levels of more than 75 LDN, which is quite noisy. Most of the higher noise areas are either over the ocean or agricultural land.

So it's those limited uses in Spreckelsville, and in 1993, the base year, a few units in Puunene, which is on the opposite side of the airport over close to the mill in this area, that had incompatible residential uses. There were also a few other public uses, the Kanoa, the senior citizen center near Spreckelsville, and a couple of public use activities over in the Puunene area that were also judged incompatible in the 1993 base year. The total number of the incompatible units in 1993 were 89. That shows up at the right-hand bottom corner of Table 5-6.

Something else you can see from that table is that the majority of the incompatible residential units are at the lower end of the incompatible band; they're down in the 60 to 65 LDN contours. The greater than 75 units, which are of particular concern because

they're very difficult to mitigate that problem by sound-proofing the buildings, amounted to 19 in 1993.

We'll move on now to 1998. Again, this is the no mitigation scenario. This is what we think would happen if no special actions are taken to abate noise at the airport. We took forecasts that had been made and prepared for the Airports Division, ran those again through the integrated noise model to come up with these contours.

Table 6-4, which is in your handout, compares the 1993 with the 1998 no mitigation contours. And just a couple of points to make there: One is that there's not very much change that shows up in the change column both for the area between contours and for the cumulative area between contours, so we don't seem to be seeing a lot of change there. And you can see that by comparing the middle map over here with the first one that we looked at. We still have incompatible residential units in Spreckelsville. The ones that we had identified earlier in Puunene are not there anymore, and it doesn't mean it got quieter over there, it just means that those old residential units that were once part of the plantation village are being phased out. We expect that they will to be gone by 1998. The number there was four.

If you look at Table 6-7, which is in the handout, again there is a tabulation of dwelling units in the incompatible zone. And you can see the total on the right-hand bottom corner which had been 89 before and has dropped to 81. Okay. This is a very slight shrinkage of the number of units exposed to incompatible noise levels, not a great change when comparing 81 versus 89. Again we still have the 19 units that are in the 75 and greater LDN band, one of the larger problems.

A couple of other points I'd like to make on that is the greatest reduction in noise that occurred between these two years occurred near the ground transportation area within the airport boundary, basically over in this area to the west of runway 2-20 to the west of the terminal that we're in now. The greatest increase occurred south of the airport down in this area here. There was a significant change that we assumed would take place between the base year 1993 and the 1998 forecast year, and that's the extension of runway 2-20 2,600 feet to the south.

As a result of that move and the fact that the interisland and overseas jets that use it would begin their takeoff roll about 2,600 feet farther to the south than they presently do, noise levels in the portion of Kahului Town that are closest to the airport

would increase slightly. Basically we're moving the airplanes when they start their takeoff roll, which is the noisy portion of their operation, closer to those residential units.

As you can see from this map, though, and I'll point it out in just a second, we're not getting them into an incompatible area, but we are getting them inside -- a few units inside the 55 LDN contour, and that's the level which triggers a requirement to notify potential buyers when you're going to sell your home. Okay. So it's not an incompatible use, but a notification level. The area that I'm talking to is in this yellow portion up here of Kahului where the dotted contour intersects the yellow. Again, as before, the greatest incompatibility in terms of land use remains in West Spreckelsville with incompatibilities also remaining in East Spreckelsville.

I'd like to move on now to maybe the most important part of tonight and that has to do with the various noise abatement and noise mitigation measures that we looked at in an effort to improve the noise situation around Kahului Airport. There is a relatively long table in your handout, Table 7-1, which lists the different kinds of techniques that we considered and gives a first screening look at whether or not they are appropriate to the kinds of noise that are generated by this airport and also a first cut at the extent to which they might improve the noise situation here. And that's shown in 7-1. The shaded areas represent those areas which are potentially useful here, and the words in the right-hand column give, again, the preliminary estimate of whether or not that particular measure might get you a lot of good here or not very much, so we've got low, moderate and high.

Just a couple of things to point out there because they were the ones that we focused the detailed work on during the bulk of our study: We looked at a lot of rescheduling flights, moving them out of the noise-sensitive nighttime areas. We looked at ways of trying to encourage airlines -- either encourage or force airlines to schedule flights outside of the noise-sensitive areas. We looked at ways of trying to encourage them to move to quieter aircraft from what we call the Stage 2 aircraft, which is typified by the DC-9-50 series of aircraft that Hawaiian Airlines flies and also the B-737 200 series which Aloha flies, to something like a 737-300 or 737-400, two aircraft which Aloha already has in its fleet. A really critical issue in all of this is that Hawaiian presently has an all Stage 2 fleet and Aloha has a mixed Stage 2 and Stage 3

fleet.

When we were doing all of our forecasts, we contacted the airlines to find out what they expected to have in 1998, an extent to which that might be different than what it is now. Hawaiian tends to keep with its Stage 2 airplanes at least through that year. Aloha expects to continue to have a mixed fleet with a slight increase in the number of Stage 3 aircraft which it would have.

We also looked very briefly at things like relocating the airport and found that economically that was not something. Even though it would provide a lot of improvement immediately around Kahului, it would not improve a lot of improvement overall because it would just simply shift where the impact area is. Again, if you remember from the tables you looked at before, a lot of the noise impact from Kahului is over the ocean, which is a relatively good situation. We looked at a number of inland sites, and the problem is that they tend to impact an even larger area.

And we also looked at -- this will come up a lot later -- acquiring easements, acquiring lands. In other words, purchasing property as a way of being able to remove the uses that are on those properties now and thereby removing the incompatible uses.

We also looked at things like compatible use zoning. That doesn't do a lot of good for uses that are already in place but it does keep incompatible uses from creeping into areas which don't have them now. And that is an issue around Kahului where there have been proposals to build residential units in areas that are within the 60 LDN contour, and therefore using the standards that we used incompatible with the existing levels or forecast levels of aircraft noise.

When we had completed the analysis that's described in the report, we found that there were a limited number of things which seemed to make sense economically and operationally for this airport in terms of noise abatement; in other words, of changing the way the airlines or the other operators of aircraft fly into and out of this airport.

We looked, for example, at an all Stage 3 fleet and found that it would provide a significant improvement in land use compatibility around the airport, dropping noise levels in the really critical areas by eight to nine LDN points, basically moving two of the contours that you see there, and that would obviously take a lot of the yellow outside of the incompatible areas. It would also impose tremendous costs upon the operators of those airlines; remember

again I told you that Hawaiian does not plan to have any Stage 3 aircraft, so they would either have to retrofit its existing fleet or to purchase new aircraft that would be all new. And in order to operate that way with an all Stage 3 fleet here, Aloha Airlines would either have to dedicate most -- actually have to purchase additional Stage 3 aircraft to comply with that or at least to retrofit more of its existing Stage 2 aircraft. The cost numbers come out relatively high there.

Even if we impose regulations that require the expenditure of the money required to purchase this new equipment, we would still have substantial areas of incompatible land use. In other words, even if we require the spending of anywhere from tens to hundreds of millions of dollars, a lot of existing residential units would still be in the incompatible use zones, so it's not a very perfect solution.

We did wind up recommending that the State continue to investigate and pursue an amendment to Chapter 19-28 that provides for a 10:00 p.m. to 6:00 a.m. ban on the operation of Stage 2 aircraft at Kahului Airport. That would affect primarily air cargo operations presently being run by Aloha, but anyone else who wanted to run that kind of operation would also be affected. And we asked that they -- recommended that they evaluate that possibility in view of the effect that it would have on the statewide system. And this is a really important part because if you tell an operator who owns both Stage 2 and Stage 3 aircraft that they can't use their Stage 2 aircraft at Kahului. If they are going to use only Stage 3 here, that means that they're either going to have to buy more Stage 3 aircraft, which we already talked about, or they're going to have to use a disproportionate number of their Stage 2 aircraft at other airports.

In some cases, this probably is not a great concern from a noise standpoint. If you look at a place like Keahole Airport, it becomes much more of a concern when you recognize that a lot of the night cargo operations are at Hilo, where residential units are even closer to the main airport's main runway than are the ones at Kahului. So we felt that this really needed to be dealt with on a statewide rather than an airport by airport basis.

The other -- and they're really a pair, these last two bullet items here -- is encouraging the FAA to clarify and formalize the existing informal runway use program here, basically affecting runway 5-23 and basically affecting operations by light aircraft. At the present time some of those aircraft turn

relatively soon after takeoff and overfly West Spreckelsville or continue too long in a straight line after takeoff and overfly East Spreckelsville. We'd like to see more emphasis put on that program to try to reduce that number. We concluded that we would only get modest improvements out of these changes in the way the aircraft operate. That meant we had to turn attention to the homes that are presently affected by those operations.

And there are two categories there: The first is the homes that are inside the 75 LDN as opposed to 75 or higher, the other is the homes that were exposed to 60 to 75 LDN. From a noise standpoint, the best thing to do for the homes that are inside the 75 LDN contour is to purchase them, take them out of residential use. This doesn't always sit well with the people who live in those homes now because they like it there even if they don't like the noise. So what we proposed was allowing an option: The State should offer to purchase the homes but they should allow the people to stay if they wish to, to provide sound attenuation treatment to those homes and also to seek a first right of refusal so that when the existing residents want to sell their homes, the State gets a shot at purchasing those.

For those homes that are between the 60 and 75 LDN contour, we recommended that -- and that amounted to 62 homes -- we recommended that a sound mitigation program be undertaken, sound-proofing those homes to try to bring the interior noise levels down to the 45 LDN level that is generally accepted as a compatible use level. As part of that, and we did some analysis as a part of this study to make sure that we thought it was feasible, we think a more detailed engineering analysis on a home by home basis ought to be undertaken. And remember, we're not talking about mass-produced subdivision homes, we're talking about one very different from one another kinds of homes.

We're also talking about homes which derive a lot of their value and provide a lot of enjoyment to the residents by the fact that they're relatively open to the outside environment, which means the kinds of sound mitigation that you can do by putting in thicker windows, beefing up the walls, those kind of things. You also have to seal yourself from the outside world with air conditioning, and a lot of people in those homes may not want that. So we want to approach that in a fairly cautious manner to find out what works best for the residents.

We expected that there would be some people

who own homes that are between the 60 and 65 who might choose to move out, move some place else rather than accept the kind of building enclosures that it would take to achieve interior noise compatibility. We think the State should acquire those homes, put in the sound-proofing that's required and then sell them back on the market. That gives both sides what they need. It gives the residents an opportunity to move to a place that has lower noise levels. It gives the State the opportunity to convert the homes into structures that can provide adequate interior noise levels.

We also have a recommendation to sound attenuate portions of the Kanoa Senior Citizens Center and the public use structures, including Puunene, that are located within the 60 LDN contour if a more detailed analysis confirms its desirability. Just like going back and taking a further look at the homes that are affected, we want to make sure that this is really going to fit in with the kinds of operations that are conducted at those public use structures.

We recommended that the State continue monitoring development proposals in the environs of Kahului Airport disclosing noise exposure maps to the community and disclosing new development of incompatible uses, that's a point I also mentioned earlier.

And then finally the last items, I'd like to see the airport provide updated noise exposure maps to the community as they are available, make sure that they're available to the Planning Department, to the Building Department and to the State Real Estate Commission so that people in the community know that there is aircraft noise out there, have a good idea of what the levels are and can take their actions accordingly.

We recommended that the State install and operate a noise monitoring system at Kahului Airport as a means of being able to track the success or failures of the noise monitoring program of being able to track down people or aircraft that cause violations or don't adhere to the recommended runway use program, and otherwise provide the kinds of information that the next go-around of planning would need to have.

And that also ties in with the last item here where we're recommending that there be annual monitoring on a continuous basis if at all possible and the presentation of the results of that monitoring to the public so that people know what's going on.

I've gone through this very quickly. The last map is included in your handout. It shows the noise contours as we think they would exist in 1990 if

the recommended measures were implemented. It shows that incompatible uses will continue, and it's to deal with those the kinds of mitigation measures in terms of sound-proofing that I just discussed were considered.

I hope this gives you the kind of background that you need. We do have some additional copies of the report that are available. I brought a few anyway. If people wanted to pursue this in more depth, they can see me after the meeting or Ben Schlapak. We can make those available to you. I'm going to turn this back over to Ben. Do you want to take it now?

MR. KIBE: Those wishing to give private testimony can approach the secretary in the back of the room there. We don't have that many people. Please come up as I call you. Jack Thompson followed by Isaac Hall.

MR. THOMPSON: Since we don't have very many people, I'd like an extra minute because I think I have four minutes' worth of words.

The good news is that this Part 150 plan calls for a noise monitoring system at Kahului Airport. The bad news is that it is not being installed for noise abatement purposes.

As pointed out many times in this draft

report, East and West Spreckelsville are the residential communities most affected by aircraft noise. Many of these residents were in their present homes when propeller aircraft dominated the airport and before jet aircraft took away the quiet enjoyment of those homes. It is past time for the State to take their responsibility, and if unable to reduce the noise, at least insure that the noise get no worse. This can be done through a noise abatement program that describes what is acceptable noise levels and what is not.

With the monitoring system recommended for installation, we could easily do the following things:

1). We, the State and affected residents, can agree that specified aircraft and airlines will not exceed certain noise levels at specified monitoring stations based upon single event measurements.

2). The State will not allow an airline to increase the number of Stage 2 aircraft using the Kahului Airport. For example, current noise contours were made before Hawaiian Airlines added nine flights to its schedule for their every half hour program. Adding these Stage 2 flights increases the LDN and is not reflected in published noise maps.

3). No Stage 2 aircraft will land or take off from Kahului Airport between the hours of 10:00 p.m.

and 6:00 a.m. The arguments in this report against such a curfew are based on shallow reasoning. It says protecting our airport in this way would place more Stage 2 activity at other airports in the State. This may be true, but this Part 150 is designed for Kahului and if this curfew will reduce noise on Maui then it should be implemented. If it results in noise problems at other airports, that can be dealt with when their Part 150s are reviewed.

4). The DOT will do all in its power to remove Hawaii from the federal exemption which allows Stage 2 aircraft to continue using our airports beyond the year 2000 as mandated for all Mainland states.

And 5). The State and County will exert all their powers to keep Kahului from becoming an international airport.

State attempts to provide residents within the 60 LDN contours options to sell their homes to the State or have sound-proofing installed is a reasonable and fair offer. However, for residents who choose neither of these options, the State needs to provide whatever noise protection it has at its disposal. The noise abatement program will do this. I urge you to use this Part 150 plan as the springboard for taking control of the aircraft noise pollution on Maui. Thank you.

MR. KIBE: Isaac Hall followed by Kenneth Okamura.

MR. HALL: Good evening. My name is Isaac Hall. I'm representing the Maui Air Traffic Association tonight. I have about an eight-page letter of comments on this report which I won't endeavor to read tonight but I'll kind of go over the central points.

Members of MATA own and enjoy properties in the Spreckelsville area. Excessive, unabated aircraft noise has been imposed upon them for at least ten years. This report's almost total reliance on noise attenuation as a noise abatement measure is totally unacceptable. The message to those upon whom excessive aircraft noise has been imposed is to stay inside your houses, close all of your windows and doors, and turn up your air conditioning if you want any relief from aircraft noise pollution. The message is that you cannot open your windows, you cannot open your doors to enjoy Hawaii's breezes, you cannot go out on your patios, your children cannot play outside, and you cannot enjoy your lawns and gardens unless you're willing to have your family subjected to excessive aircraft noise.

There's another message here also, and that is that the report's authors find it acceptable that Hawaii can be the home of Hawaiian Airlines with a fleet

that is totally comprised into the foreseeable future of Stage 2 noise-polluting aircraft even though this will no longer be acceptable in any of the 48 contiguous states in the United States.

In Chicago, people went through this Part 150 process and were so turned off by its results, as I am by what I saw here, that they threw the whole thing out and said, "Let's start over and work on something more real." This is probably what should happen here.

I want to go through some points that I make in this letter. First, Volume I of the Part 150 study was published years ago and Chapters 1 through 6 dealt with noise exposure maps. We were hoping those maps or earlier maps were accepted by the FAA. What we're getting here in Volume II is really a rewrite of Volume I. Chapters 1 through 6 are merely Chapters 1 through 6 of Volume I rewritten, and all we're given here is two new chapters developing a noise abatement program. That's too little, too skimpy, too small an effort to actually get together any kind of noise exposure or noise compatibility program.

I found the information wholly obscured. Perry White, I'll just use his Table 5-4 where he says what was predicted for 1993 is pretty much identical for what was shown for 1992. Sure, if you focus on what kind of noise is going to occur way out in the ocean. If you look at the noise exposure contours 1992, 1993, it's pretty much the same, if not worse.

I also found that there were, in describing the fleet mixes, et cetera, the only reference to flight types of aircraft numbers. Who knows what they are? Who knows what kind of aircraft noise emanations there are? Who knows who is flying them? You know none of these things. And this information was obscure and extremely difficult to deal with.

I had a terrible time because a whole lot of essential points were relegated to footnotes. There are one million caveats and disclaimers and explanations and et cetera in the footnotes that are absolutely critical to the conclusion of this report. That can't ever happen to justify any of the major conclusions.

Another point, there is a total reliance on the LDN descriptor in this report. This has been an on-going dispute. The LDN only tells you some things; it doesn't tell you everything about the noise environment. It particularly doesn't tell you very much about the adverse impacts of excessive noise and at night. The FAA does not foreclose the use of other descriptors, such as single event descriptors. This report says that they're going to analyze these things

in terms of single events, but there isn't any analysis in this report based on single event noise exposure except for in reliance in a report that was done by somebody else. There is an inadequate description of the noise environment.

Just ask some simple questions. What are the adverse impacts of excessive aircraft noise? You'll search through that report and there will be no discussion of what the adverse impacts of excessive noise are. How long has excessive aircraft noise been imposed on the surrounding community? There is no analysis of how long anybody has been forced to live with the noise pollution of aircrafts. It's impossible to begin to weigh the costs and benefits for a proposed mitigation measure if the adverse impacts of the excessive noise aren't even considered.

The report, in footnote of course, says that the only cost that is attributed to communities is the cost of sound attenuation. They never say, "Well, what about sleep interruption? Has that happened a lot? Is that a problem? What about sleep interference? Does that happen a lot. What kind of problem is that?" The FAA regulations say that you've got to consider where the complaints are coming from and the extent of those complaints. Nowhere is it in there. Mr. White talked about the Kahului area as if it wasn't impacted by noise. At the Land Use Commission hearings that he appeared at, there were witnesses from the Kahului Airport who complained about the existing noise there. Complaints about the existing noise are coming from areas much more widespread than these contours would have you believe, but yet none of that is analyzed.

As I said before, the length of time is not discussed. The report excludes from conversation whole areas upon which excessive noise is being imposed. I sat here incredulously as Mr. White says, "You know, it's mainly Spreckelsville." How about Kamaha Park? That is not addressed at all. What are the noise contours in Kamaha Park? 75, 70, 65? That's not even addressed in this report. It doesn't matter that people in Kamaha Park are getting exposed to that kind of noise. What about the people who are using the recreational areas along the coastline there? What kind of noise is being imposed upon them? It's not discussed anywhere in that report. What about the people wind-surfing out there? What kind of impact does this noise have on them? Nowhere is it discussed in the report.

Also, and this is dear and near my heart, to hear Mr. White say that there's nothing going to

happen in Puunene is outrageous to me. The DOE has offered the old Puunene School to a Hawaiian language immersion program for its elementary, intermediate and high school. That's of record. And what's in the report? There's no real use of that school in there. And that school, unlike what he says, is well within the 60 LDN contour now and will remain there, and it's only going to get worse. There's no real analysis of whole areas that are going to be adversely impacted.

There is an inadequate description of existing and future aircraft operations. I looked through that report, I couldn't find any. How about Stage 2 and 3? How many Stage 2 and Stage 3 aircraft does Aloha Airlines have right now? It's not in there. How many Stage 2 aircraft does Hawaiian Airlines have right now? It's not in there. There's no adequate description of the existing and future aircraft operations. The areas disclosed in a report done in 1994 setting all this out, why isn't that in there? It's not in there.

The report indicates that Hawaiian Airlines has "x" number of the Stage 2 aircraft and they plan to keep those Stage 2 aircraft forever if they can. The report doesn't take into consideration the retirement of aircraft between 1990 and the year 2000. Do you mean to tell me Hawaiian is not going to retire a single Stage 2 aircraft between 1990 and the year 2000? I think this point is really important because under the Federal Airport Noise and Capacity Act there's a non-addition rule that applies to Hawaii. This report, in my view, discloses that Hawaiian Airlines is possibly violating this federal statute, because the statute says that Hawaiian Airlines cannot add any new Stage 2 aircraft after 1990 and it can't add any new services after 1990. That provision is not even discussed in there and ought to be discussed.

Viable alternative operational abatement measures are not even addressed. The State Department of Transportation has already committed to two, in my view, very viable operational mitigation measures: One, a ban on Stage 2 aircraft between 10:00 and 6:00 p.m. at night in the year 1995. There has already been a cost benefit study of that which indicates that that is viable.

The second one is that the State is said to consider a ban on all Stage 2 aircraft by the year 2000. And I want to point out here, because in the report there's a lot of grumbling about "Gee, it would cost poor old Hawaiian Airlines a lot of money to comply with that," or "Gee, it would cost a lot of money for poor

Aloha to comply with that," on the Mainland the airlines do not have that choice. They have got to convert to Stage 3 on or around the year 2000 unless they get a waiver. And so no matter what kind of money they've got to spend, they've got to do that. And that is even more important in Hawaii because we are dealing with an outside noise environment rather than an urban landscape, let's say, in wintertime. Those two proposals were not analyzed at all.

Now, the weighing of the costs and benefits to me was weak and can't be justified. It showed the bias of the authors of this report in favor of the airlines, against the communities, in favor of sound attenuation and none of the other alternatives. As I said before, none of the adverse impacts to the communities were even considered or weighed in the balance. There's a little footnote that says, "The only thing we're going to consider is the cost to you, not whether we have disrupted your sleep, whether there is speech interference, whether it's difficult to learn, whether there are adverse health impacts, whether you've been exposed to this for ten years;" none of that is thrown into the mix. And it's no wonder sound attenuation comes out on top because none of those things have been weighed.

Now, on the other hand, it's no wonder sound attenuation came out on top because the most speculative kind of information is used to justify all these amounts of money that the aircraft operators are going to have to spend to comply. There is no justification for so many of the figures that are in that report about what it's going to cost our poor old airlines to comply, none of which is substantiated. That's small wonder when you get a weighing process like that that it comes out in favor of sound attenuation.

There is an unsupported assumption in there that rule-making has to be statewide. Mr. White cannot have looked at the DOT's own regulations, which have regulations specifically for Honolulu International, Kapalua, West Maui; they're all specific to those airports. There is no problem with doing that here.

Another problem I think is that the Airport Noise and Capacity Act allows for passenger facility charges to pay for noise mitigation measures. That's not even mentioned in the report. Nothing is discussed about what's happening in Hawaii with that. Are we getting passenger facility charges? Are we devoting those moneys to noise mitigation measures? That's got to be discussed.

Finally, sound attenuation has a fatal

defect as a noise abatement measure. At best it is only a half measure. It can only protect those who are exposed to excessive noise for the impacts of this noise so long as they stay inside their dwellings with windows and doors shut and the air conditioning turned on. It provides absolutely no relief whether outdoors. The importance of Hawaii's outdoor environment has not been acknowledged. The extent to which residents are outdoors and the importance of them being outdoors has nowhere been valued, and this is equally true, as I've said before, of our parks and shoreline areas.

To me, it's unforgivable to have in our state an airline that says, "We have nothing but Stage 2 aircraft and God damn it, we're not going to do anything to change that. We're just going to continue to have Stage 2 aircraft and pollute your environment." Any report, as this one does, that suggests that this is acceptable can't be worth anything. As with the Chicago report, it ought to be thrown out so long as the conclusion is that we can allow an airline to be here that is just going to use Stage 2 aircraft. Thank you.

MR. KIBE: Mr. Kenneth Okamura followed by Terryl Vencl.

MR. OKAMURA: Hello. My name is Kenneth Okamura. I'm the president of the Maui County Farm

Bureau. The Maui County Farm Bureau is an organization of farmers and ranchers, and on Maui we have about 300 farm and ranch family members. Statewide we have about 3,000 farm and ranch family members.

Now, on behalf of the Board of Directors of the Maui County Farm Bureau, I am forwarding a request to reconsider the institution of a proposed Administrative Rule designed to restrict night cargo flights into Kahului Airport to aircraft which meets FAA Stage 3 rules for noise control.

If it is true that such aircraft are not currently in our cargo fleet and that the purchase of such aircraft to enhance the current fleet is not financially viable or likely to exist -- or likely for existing carriers, then the resulting rule would in effect reduce significantly the capacity for interisland night air freight movement. This would impose another unnecessary burden on our local agriculture operations, including fresh produce, fruit and flower growers as well as livestock and dairy producers, and further diminish the ability of neighbor island growers and producers from competing against Oahu growers and mainland and overseas fruit, vegetable and flower importers.

The marketing problems faced by neighbor

island farmers are already serious, and additional regulations that might have a negative impact on air cargo movement and rates must be opposed by all thinking members of the local agricultural community. I would hope that those individuals responsible for the implementation of any transportation rules which will damage the ability of local farmers and growers and ranchers to survive in today's market would think twice before implementing any such measures. Thank you.

MR. KIBE: Terryl Vencl followed by Marsha Wienert.

MS. VENCL: Good evening. My name is Terryl Vencl, and I'm the executive director of the Maui Hotel Association. The members of the visitor industry on the Island of Maui have a very big concern over the proposed night curfew suggested in the Noise Compatibility Study.

Our obvious concern is that cargo may sit at Maui's Kahului Airport because there are not enough Stage 3 aircraft to move it, and the time-sensitive cargo would not be able to arrive in a timely fashion on our island due to the lack of, once again, this Stage 3 aircraft. It also seems a possibility that this curfew may affect a couple of night passenger flights. We recently lost our direct United flight to Chicago and already are experiencing the difficulty in the loss of those seats and certainly the loss of the belly of that plane as in cargo area to move our goods.

The federal government understood the unique situation of both Hawaii and Alaska and chose to exempt those two states. Why then would we suggest that our interisland carriers turn over five or six aircraft to Stage 3 aircraft by the end of 1995 or face a night curfew? Are we willing to make the population of our entire island suffer the consequences to satisfy a vocal minority? Would the residents of Maui like receiving their perishable goods or time-sensitive products in an untimely fashion? Would we like to see our agricultural folks suffer further costs to move their products off of our island?

I've been told that it's cost prohibitive for our cargo carriers to convert by the end of 1995. There should be further discussions with the cargo carriers about the feasibility of the proposed conversion to Stage 3 aircraft, and we would hope that the State and FAA would work with the interisland carriers to further negotiate what would be a reasonable timeframe for conversion of their aircraft.

We hope that you'll give further consideration to the idea of a night curfew. The

proposed timeframe is not acceptable to the majority of the people on Maui. Our business community, our visitor industry and the economic strength of our island depend on time-sensitive goods arriving in a timely fashion. Our farmers depend on being able to move their products. Please don't make it anymore difficult than it already is. Mahalo.

MR. KIBE: Marsha Wienert followed by Lynne Woods.

MS. WIENERT: I'm Marsha Wienert from the Maui Visitors Bureau. The Maui Visitors Bureau is concerned about the portion of the Noise Compatibility Study which limits flights into Kahului Airport between the hours of 10:00 p.m. and 6:00 a.m. which are not of the Stage 3-type aircraft category.

It is our understanding that this issue has arisen due to a proposed Administrative Rule which states that all aircraft must be of Stage 3-type by December 1995. It is also our understanding that currently there is a federal rule which exempts Hawaii from this regulation due to our unique situation.

Our interisland carriers that operate during this time period do not have Stage 3-type aircraft and because of today's economy, as I understand it, will not be able to upgrade their fleet due to financial reasons by the end of '95.

Maui is dependent upon its night flights that bring cargo into our island. The visitor industry as well as the public depend on the airlines to bring us our fresh bread, our milk, our paper and many other items that arrive during this proposed shut-down period.

Whether or not the passenger planes would fall under this rule has not been explained to our satisfaction; however, with a lagging visitor economy, the last thing we need to do is limit our availability to potential guests.

Please reconsider the portion of the Noise Compatibility Study that addresses the curfew hours of non-Stage 3-type aircraft. Thank you.

MR. KIBE: Lynne Woods.

MS. WOODS: Good evening. My name is Lynne Woods, and as president of the Maui Chamber of Commerce, I am here to testify on behalf of our business members. Our concern is the proposed Administrative Rule which will impose a curfew on cargo flights into Kahului Airport between the hours of 10:00 p.m. and 6:00 a.m. if they are not Stage 3 aircraft effective December 1995.

It is our understanding that Hawaii and Alaska are exempt from a similar federal rule because of our unique transportation situation. If this is so,

then why would our State impose such an economic crippling rule upon our island businesses? We on the neighbor islands depend upon transportation for many of our time-sensitive consumer goods. If we could import these goods from Oahu or to Oahu by truck or rail then perhaps this Administrative Rule would not have such an adverse effect but we cannot.

To demand our already struggling airlines retrofit their aircraft to Stage 3 by December 1995 is financial suicide for our carriers. In fact, it appears upon investigation that your considerations towards a very small minority of homeowners versus your financial demands upon our air carriers and our struggling businesses displays a very narrow focus on the part of our State Department of Transportation.

We need economic stimulation not more government regulation. Thank you.

MR. KIBE: Are there any others who wish to make comments? Please state your name.

MR. EMERY: My name is Richard Emery, and I'm appalled at some of the untruths that are going on. United stopped flying, but it was a Stage 3 aircraft so United in their late night flight would not have been illegal under this proposed rule.

During the repair of the major runway out here, Stage 3 aircraft were used at night by Aloha Airlines except for one flight. So there was no disruption of the cargo going in and out of Maui. And so this idea that Stage 3 doesn't exist for Aloha is not true; they own two or three. And if I were writing this report, I would want to know that information, so I would know how it was being affected because it is totally acceptable to have Stage 3 aircraft now and not cut off what's coming in and out of the island. Okay? Are there any questions about that? Thank you.

MR. KIBE: Anyone else? Please state your name.

MR. THOMPSON: I'm Jack Thompson and I too am concerned about the misconception that this rule has.

First of all, I wish the representatives of the farmer group would hear, Aloha Airlines cargo flights leave here either empty or almost empty. Aloha will tell you that. So nobody is being hurt by the present situation and the present situation would be no different in the number of flights which are four or five depending upon need coming into Maui. So nothing would change as a result of this suggestion. I want you people to understand that if you get up and testify, as you did tonight, you're going to have people believing that that's the situation and that just isn't the

situation. Thank you.

MR. KIBE: Yes?

MR. HALL: I too am appalled by the comments of the Maui Visitors Bureau, the Hotel Association, the Farm Bureau and the Maui Chamber of Commerce because they're totally not based on any facts, as have already been pointed out. If you had taken the time to read the report prepared by Mr. White, there would be zero cost, according to his report, to Aloha Airlines to comply with this rule if they're willing to do some scheduling changes, that's all that's being asked of Aloha Airlines.

So before you get up and give knee-jerk testimony that I don't know who wrote for you, please read the reports and you'll find that none of the impacts that you guys have alleged on behalf of your organizations, when I'm positive there were no votes taken within them on these positions that you're asserting, at least they should be fact-based and they aren't. And I think at public hearings like this, you should not appear on behalf of large organizations and make the kinds of statements that you have made that have nothing to do with existing facts to attempt to scare people.

MR. KIBE: Are there any other comments?

I'd like to remind you that the Department of Transportation will be accepting written comments up until the end of June, so you're free to do so.

It is the Department's expectation that your testimony will be a valuable addition to their program proposal and will help to guide them in adopting a viable and effective program.

The staff of the Department of Transportation will weigh the effects of your testimonies and information presented tonight together with factual data they already have. If it is believed that the data, views or arguments indicate a necessity for any revisions, these revisions will be made.

We thank you for taking your time to attend and to participate in this hearing. It is now 7:50 p.m. and I declare this public hearing concerning the Part 150 Noise Compatibility Program for Kahului Airport hereby concluded. Thank you.

CERTIFICATE

My name is Richard Emery, and I live at 28 Nonohe Place. Spreckelsville. Phone number is 871-9421.

I think the rule to limit night flights is very reasonable and long overdue, and Aloha presently is the only one using night flights, and they have at least 2, if not 3, stage 3 aircraft already. So it's not going to be a big burden to them.

As far as I know, no produce or flowers, et cetera, and so forth go out on night flights, so the farmers shouldn't be affected by a stage 2 aircraft ban at that time.

I wish the report dealt in detail with just exactly what the noise pollution does to the residences of Spreckelsville. I think it's totally lacking in that factor, and it should be redone and consider just exactly what's happening.

Also, if they are going from 1993, it's totally out of date. The increase of stage 2 aircraft by Hawaiian has thrown in an increase and increased the noise problems. Stage 3 aircraft will be used more and more by other airlines, and all the major airlines going to the Mainland use them already, so the real culprit here is Hawaiian Airlines, and I don't think it's a responsibility of the State of Hawaii to keep them in business if they are not going to switch over to stage 3 aircraft.

I remember when Discovery Airlines got going, they had the quietest aircraft of all, and they were 4 jets on each one. Mahalo Airlines is running now, and they have extremely quiet airplanes because they are turbo props.

So continuing the use of stage 2 aircraft just perpetrates a business practice that I don't believe in, give the other guy a chance, or the little guy, with the quieter airplane.

I, Mary Anne Young, hereby certify that the foregoing is a full, true and correct statement of the proceedings had on May 31, 1995, as taken down by me in stenotype and thereafter transcribed into typewriting under my supervision.

[signature]

CERTIFICATE

I, RITA SCOTT, hereby certify that the foregoing is a full, true and correct statement of the proceedings had on May 31, 1995, as taken down by me in stenotype and thereafter transcribed into typewriting under my supervision.

[signature]

TESTIMONY - KAHULUI AIRPORT FAR PART 150, Noise Compatibility
May 31, 1995
Submitted by Jack Thompson representing
Spreckelsville Community Association

There are several statements in this Part 150 draft that need clarification, expansion or reconsideration. These include:

5.1.3 LDN is, "...the only noise metric which has been tested with social surveys to correlated noise levels with annoyance of those hearing the noise." There is a strong need to look seriously at single events in terms of their annoyance factor. Helicopters and prop airplanes (both civilian and military) are examples of annoyance that has nothing to do with noise level.

6.2.2.1 At the present time the stack at the Puunene mill extends 5 feet into the airspace approaching runway 2. If the runway is extended south 2600 feet and Kona takeoffs are required, that stack then protrudes 65 feet into the air space leaving runway 20. What is meant by the plan's statement, "The runway threshold would be displaced 400 feet from the southern end of the runway to insure adequate clearance over stacks..."?

6.2.2.2 This states that interisland pilots want to use Track 18 more frequently. This brings them directly over Wailuku Heights, Wailuku and more of Kahului. Yet, it is concluded that it would not alter aircraft noise levels in these areas. How can this be?

6.3 A&B has plans to develop 2 acre lots in Spreckelsville beginning before the end of this year. The draft states this would not happen before 1998. (That project is reportedly sold to another developer.) Since one of the three goals of Part 150 states, "Prevent new incompatible land uses from becoming established around the airport", does the state plan to stop this development?

6.4 "The higher noise level at Station M in West Spreckelsville is due to the fact that departing air carrier aircraft will be at a higher altitude than at present because of the 2,600 foot extension of runway 2-20" If this is true, why doesn't the same increase occur at Stations A,B,C,D in East Spreckelsville?

7.2.5.1 This pertains to the recommendation that runway 2 should be used in light Kona wind conditions. This was requested by East Spreckelsville residents because of the extreme noise generated by Kona takeoffs. The draft statement suggests reverse thrust and fuel fumes generated the complaints. The recommendation was not approved based upon faulty information. Kona takeoff noise needs to be measured and this recommendation be approved.

7.2.6.2 Suggests that residents complaints about overflights are primarily associated with light, propeller driven aircraft. In reality these are minor. The major complaints are the result of interisland jets (usually Hawaiian Airlines) turning towards Kona so quickly that they overfly the Spreckelsville community at relatively low altitudes. This problem needs to be addressed in the Runway Use Program.

7.2.7.7 The installation of a noise monitoring system at Kahului is a good start towards initiating a true noise abatement program. The purpose behind the DOT proposed system is to monitor existing noise to help keep noise contours current. This program does nothing to <u>reduce</u> noise or even <u>maintain</u> it at the present levels. Controlling noise at Kahului is long overdue and an effective program could easily be installed which could keep aircraft noise within agreed-
upon levels. Levels based upon single events for specified aircraft and airlines.

FAR PART 150 STUDY FOR KAHULUI AIRPORT - May 31, 1995
Oral Testimony by Jack Thompson
President, Spreckelsville Community Association

The good news is that this Part 150 plan calls for a noise monitoring system at Kahului Airport. The bad news is that it is not being installed for noise abatement purposes.

As pointed out many times in this draft report, East and West Spreckelsville are the residential communities most effected by aircraft noise. Many of these residents were in their present homes when propeller aircraft dominated the airport and before jet aircraft took away the quiet enjoyment of those homes. It is past time for the state to take their responsibility and, if unable to reduce the noise, at least insure that it get no worse. This can be done through a noise abatement program that describes what is acceptable noise levels and what is not.

With the monitoring system recommended for installation, we could easily do the following:

1. We, the state and effected residents, can agree that specified aircraft and airlines will not exceed certain noise levels at specified monitoring stations based upon single event measurements.
2. The state will not allow an airline to increase the number of Stage 2 aircraft using the Kahului Airport. For example, current noise contours were made before Hawaiian Airlines added nine flights to its schedule for their "every half hour" program. Adding these Stage 2 flights increases the LDN and is not reflected in published noise maps.
3. No Stage 2 aircraft will land or takeoff from Kahului Airport between the hours of 10:00 pm and 6:00 am. The arguments in this report against such a curfew are based on shallow reasoning. It says, protecting our airport in this way would place more Stage 2 activity at other airports in the state. This may be true but this Part 150 is designed for Kahului and if this curfew will reduce noise on Maui then it should be implemented. If it results in noise problems at other airports, that can be dealt with when their Part 150s are reviewed.
4. The DOT will do all in its power to remove Hawaii from the federal exemption which allows Stage 2 aircraft to continue using our airports beyond the year 2000 as mandated for all mainland states.

5. The state and county will exert all their powers to keep Kahului from becoming an international airport.

State attempts to provide residents within the 60 LDN contours options to sell their homes to the state or have sound proofing installed is a reasonable and fair offer. However, for residents who choose neither of these options, the state needs to provide whatever noise protection it has at its disposal. This noise abatement program will do this. I urge you to use this Part 150 plan as the springboard for taking control of the aircraft noise pollution on Maui.

ISAAC DAVIS HALL
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OF COUNSEL
G. RICHARD GESCH

May 31, 1995

Mr. Owen Miyamoto, Administrator
Airports Division, Dept. of Transportation
State of Hawaii
400 Rodgers Blvd. #700
Honolulu International Airport
Honolulu, HI 96819-1880

Re: Comments upon Volume II of the FAR Part 150 Noise Compatibility Program (April, 1995)

Dear Owen Miyamoto:

This letter is written on behalf of the Maui Air Traffic Association ("MATA") whose members own and enjoy the use of properties in the Spreckelsville area. Excessive, unabated aircraft noise has been imposed upon them for at least ten years. Thank you for the opportunity to comment upon Volume II of the FAR Part 150 Noise Compatibility Program dated April, 1995. This document must be withdrawn, rewritten to bring it into compliance with the relevant regulations and resubmitted within an appropriate time period.

This Report's almost total reliance upon sound attenuation as a noise abatement measure is unacceptable. The message to those upon whom excessive aircraft noise has been imposed is to stay inside your houses, close all of your windows and doors and turn up your air conditioner if you want any relief from aircraft noise. The message is that you cannot open your windows and doors to enjoy Hawaii's breezes, you cannot go out onto your patios, your children cannot play outside and you cannot enjoy your lawns or gardens unless you are willing to have your family subjected to excessive aircraft noise. There is another message also, and that is that the Report's authors find it acceptable that Hawaii can be the home for Hawaiian Airlines with a fleet that is totally comprised, into the foreseeable future, of Stage 2, noise-polluting, aircraft, even though this will no longer be acceptable in <u>any</u> of the 48 contiguous states.

In Chicago, residents affected by excessive aircraft noise participated in good faith in the development of an FAR Part 150 Noise Compatibility Program. The recommended noise compatibility program there was so unsatisfactory that it was rejected and the participants are attempting to reach agreement on a noise compatibility program which is more realistic and will provide actual relief from excessive noise. Unless this Report is withdrawn and rewritten, it may have to be rejected as it was in Chicago.

MATA has the following general comments on Volume II, as follows.

1. <u>Procedural considerations</u>
The Aviation Safety and Noise Abatement Act of 1979 and the regulations of the Federal Aviation Administration ("FAA") found in Part 150 establish a two-step process for airport noise compatibility planning. First, noise exposure maps for the airport are prepared for a base year and five years hence. These noise exposure maps must be accepted by the FAA before proceeding to the second step. The second step involves the preparation of a noise compatibility program.

The Airports Division, Department of Transportation, State of Hawaii ("DOT"), hired Belt Collins & Associates and Y. Ebisu & Associates as consultants to prepare these maps and programs. Volume I, the Noise Exposure Map Report, in a draft form, for the Kahului Airport, was published in July, 1989. It presented a 1987 base year map with a 1992 five year map. These maps were subsequently approved by the FAA.

Because these noise exposure maps are now inaccurate and outdated, the DOT, in Volume II, proposes two new noise exposure maps, one for the new base year of 1993 and one new five year map for 1998. These maps have not yet been accepted by the FAA. The FAA cannot approve of the noise compatibility program, unless and until it accepts the noise exposure maps.

What DOT has essentially done is to rewrite Volume I, the Noise Exposure Map Report, in Volume II, which is intended to be devoted to the development of a noise compatibility program. Compare Chapters 1 through 6 of Volumes I and II. Chapters 7 and 8 of Volume II are devoted to the development of a noise compatibility program. Maui's citizens deserve a great deal more than two slender chapters based upon unaccepted FAA noise exposure maps for the development of a comprehensive noise compatibility program at the Kahului Airport.

2. <u>Information obscured</u>
Any meaningful review and analysis of the adverse impacts of aircraft noise and the development of abatement measures requires the presentation of data in a manner which is decipherable by the general public. The information and data presented in Volume II is perhaps intentionally made obscure, inaccessible and difficult to follow.

Several examples suffice to make this point. In describing aircraft operations, the Report refers only to aircraft types. Most readers do not know the amount of noise which is emitted by these aircraft types, the identity of the operators of the aircraft or the routes flown by these aircraft.

The information on fleet mixes is not presented in a meaningful way. The Report does not simply disclose the number of Stage 2 and Stage 3 aircraft currently operated by Hawaiian and Aloha Airlines. Without this information, it is impossible to evaluate changes in the fleet mix.

The charts depicting land use incompatibility are extremely obscure and misleading. Some of the charts intended to graphically depict "incompatible" areas do not line out all of the areas subjected to excessive noise. One chart, the text states, shows that the area anticipated to be "incompatible" in 1992 is actually less than the area which was found to be exposed in 1993. This is simply not true with respect to areas on the land and is only true when areas over the ocean are factored in.

3. <u>Critical points are made in footnotes</u>
In general, the noise compatibility program has not been developed in a rigorous fashion based upon facts presented in the Report. There has been an over-reliance upon footnotes to present critical points in the Report as well as disclaimers and caveats. In many cases, these disclaimers and caveats are absolutely essential to the recommendations and conclusions contained in the Report and they are based upon unwarranted assumptions and/or undemonstrated facts. Many of these footnotes should have been presented as part of the text and explored on a more rational basis.

4. <u>The bias of the Report</u>
The Report is infused with the bias of the authors in favor of the noise polluters, the aircraft operators, and against those upon whom excessive noise is being imposed, the surrounding communities. This discredits the objectivity of the Report and undermines its chances for acceptance in the community. The Report emphasizes the "strenuous" objections of Aloha Airlines to any operational abatement measures. It emphasizes the "strenuous" objections of Hawaiian Airlines to operational noise abatement measures. Nowhere in the Report is there any acceptable description of the impacts of excessive aircraft noise on the surrounding community or the "strenuous" objections of surrounding landowners to this pollution.

Y. Ebisu is a professional apologist for noise polluters. Perry White, of Belt Collins & Associates, was the principal author of the judicially rejected State Environmental Impact Statement for the expansion of the Kahului Airport. It comes as no surprise that these two authors recommend sound attenuation rather than operational abatement measures.

5. <u>Over-reliance on Ldn as noise descriptor</u>
The Report is almost wholly based upon the use of Ldn as a noise descriptor. The FAA has not prevented the use of other, more accurate, noise descriptors, such as the single event noise descriptor. The Report contains a statement that the single event descriptor has also been utilized; however the only reference in the text to the single event descriptor is with respect to a study undertaken by others. The single event descriptor is much more accurate particularly for nighttime flights at the Kahului Airport because of the time

between the noise events and the particularly disruptive nature of these noise events during nighttime hours. This Report will not be accurate unless it analyzes the costs and benefits of the alternative noise abatement measures in terms of single event noise levels as well as Ldn.

6. <u>Inadequate description of the noise environment</u>
What are the adverse impacts of excessive noise? How long has excessive aircraft noise been imposed upon the surrounding community? These are simple questions which in the asking demonstrate how inadequate this Report is. It is impossible to begin to weigh the costs and benefits of a proposed mitigation measure if the adverse effects of excessive noise are not considered. The Report forthrightly states that the only "cost" to the communities which is considered is the cost of sound attenuation. The loss of the use and enjoyment of outdoor activities, even with sound attenuation, has not been considered. Sleep interference has only been dealt with in a tangential fashion. There is no analysis of minimizing risks of community complaints or speech interference. This Report will remain wholly inadequate until and unless it acknowledges all of the many adverse affects of aircraft noise.

The Report does not even disclose the length of time the surrounding communities have had excessive aircraft noise pollution imposed upon them. The 1989 Noise Exposure Map contained in Volume I is an admission that excessive noise was being imposed at that time. Complaints about excessive aircraft noise were received well before then. It cannot be disputed that the airport proprietor and the aircraft operators, particularly Hawaiian and Aloha Airlines, have been allowing excessive noise to be imposed upon the surrounding communities for at least ten years. During this ten-year or more period, no significant steps have been taken to reduce this excessive noise to even marginally acceptable levels. This is without a doubt a cost which should have been included in the Report. What is this ten-year period of excessive noise worth? What is a ten-year period free of restraint upon the aircraft operators worth? This should have been evaluated in the Report.

Finally, the Report excludes from consideration whole areas upon which excessive noise is being imposed. There is no evaluation of noise impacts at Kanaha Beach Park or along the beaches in the area. There is no analysis of the excessive noise being imposed upon users of the nearshore ocean waters. There is no analysis of the excessive noise being imposed upon the Kanaha Wildlife Refuge, particularly during construction of any extended runway.

The Department of Education has formally offered the Puunene School for use by the Hawaiian Language Immersion Program, which is a public DOE program. The Report does not consider the impacts of excessive aircraft noise upon public schools or the ability to teach and to learn in such an environment. This must be addressed in the Report.

7. <u>1998 is a poor choice for the five-year noise exposure map</u>
1998 is a poor choice for the new, proposed five-year noise exposure map. The noise exposure map supposedly assesses the impacts which will result from

the extension of Runway 2-20 to 9,600 feet which will supposedly be completed in 1998. The full impacts of lengthening the runway will not be experienced the day after it is opened for use. The impacts will be experienced over a number of years. This should have been acknowledged and the potential impacts addressed in the study.

The year 2000 would be a more appropriate date for the assessment of noise impacts. This is the year during which DOT has committed the State to prevent the operation of Stage 2 aircraft at Kahului Airport, during the day and the night, should the cost/benefit analysis which it is preparing conclude that this is cost/ beneficial. This commitment by the State of Hawaii is never acknowledged or addressed in the Report. Should the State of Hawaii implement such a regulation, this would have a tremendous impact upon the costs and benefits of the various alternative operational abatement measures discussed in the Report.

8. <u>Inadequate description of existing and future aircraft operations</u>

The Report does not adequately describe existing and future aircraft operations at the Kahului Airport. It notes that Aries Consultants, Inc. recently completed in 1994 an update for these aircraft operations. The results of this update should have been disclosed in a more detailed fashion. A forecast for 1998 is included, however it is impossible to determine what it means because it only lists aircraft types and not the operators or the routes. The importance of this inadequacy is that flights from Japan and/or the midwest, which the extended runway would facilitate, could arrive and/or depart during nighttime hours and exacerbate the already deteriorated nighttime noise environment.

9. <u>Inadequate description of the aircraft fleet mix</u>

The Report does not adequately disclose the current or anticipated aircraft fleet mixes. First, listing new, anticipated flights by aircraft type number does not identify the noise characteristics of the aircraft, the operator of the aircraft or the route, as noted above.

Second, particularly with respect to Hawaiian and Aloha Airlines, there is no description of the number of aircraft currently in use or the "stage" of each of these aircraft.

Third, the Report does not take into consideration the "retirement" of aircraft between 1990 and 1998 or 2000. It is inconceivable that Hawaiian Airlines is not "retiring" a single Stage 2 aircraft in this period of time.

Fourth, while Aloha Airlines appears to be making what might be considered a good faith effort to add Stage 3 aircraft to its fleet, Aloha has been on notice since at least 1990 of the State's goal to prohibit Stage 2 aircraft between 10:00 p.m. and 6:00 a.m., effective December 31, 1995. There is really no excuse for the primary nighttime aircraft noise polluter to ignore this goal.

Finally, the Report does not take into consideration the importance of the new service, and perhaps an increase in the number of Stage 2 aircraft, by Hawaiian Airlines. The Federal Airport Noise and Capacity Act ("ANCA"), in §47528(c), contains a "non-addition" term for Hawaiian operations which prohibits the increase in the number of Stage 2 aircraft which are operated in Hawaii beyond the number owned, leased or operated in Hawaii on November 5, 1990. It also prohibits any air carrier from providing air turnaround service in Hawaii using Stage 2 aircraft beyond the service provided on November 5, 1990. This statute prevents any increase in Stage 2 aircraft or services in Hawaii, in part, to prevent the further deterioration of the noise environment. The implementation by Hawaiian Airlines of its "every half hour" service to Maui in 1994, increasing the turnaround service by 27 "services," may well violate ANCA's restrictions on turnaround services as well as ANCA's prohibition against any increase in the number of Stage 2 aircraft. The import of the federal "non-addition" rule in Hawaii should have been discussed in the Report. The enforcement of this "non-addition" rule could have important beneficial impacts on the noise environment at Kahului.

10. <u>Viable alternative operational abatement measures were not addressed</u>

In 1991, DOT committed itself to the rigorous evaluation of two significant operational noise abatement measures affecting Kahului and other airports in the State of Hawaii through a stipulation entered in <u>Pitt et al. v. Hirata et al.</u>, Civil No. 89-0048(1) in the Second Circuit Courts of the State of Hawaii. First, the State of Hawaii, in its capacity as airport proprietor, envisaged mandating the use of Stage 3 aircraft at the Kahului Airport according to the deadlines established in the Airport Noise and Capacity Act of 1990.

Second, the State of Hawaii has commenced rule promulgation proceedings with respect to prohibiting the landing or taking off of Stage 2 aircraft between the hours of 10:00 p.m. and 6:00 a.m., effective December 31, 1995, also at the Kahului Airport.

These are two significant alternatives which the DOT has already endorsed in principle. Neither of these alternatives was studied in the Report. Instead, the Report considers the prohibition of all Stage 2 aircraft, effective 1998, thus excluding two important years for the airlines to bring themselves into compliance with the prohibition. Likewise, the Report does not consider a ban on Stage 2 aircraft between 10:00 p.m. and 6:00 a.m., unless it is to be effective in 1998, three years after the proposal which is the subject of current rule-making. The effect of this three-year extension, which allows three additional years of excessive noise to be imposed upon surrounding communities, is not considered or evaluated in the Report, as a cost to the communities. This is improper and unfair.

11. The weighing of the costs and benefits of the alternatives studied is inadequate

The weighing of the costs and benefits of the various alternatives studied is unarguably the most important analysis to be contained within any noise compatibility program report. Unfortunately, the analysis contained within this Report is very weak and could not satisfy even minimally the applicable FAA regulations pertinent to cost/benefit analyses. The type of balancing undertaken by the authors was designed to tip in favor of the aircraft operators and against operational restrictions. First, significant impacts upon the surrounding communities, as "costs," were not even weighed. The only cost considered was the cost of sound attenuation, not the loss of property value, not the loss of the use and enjoyment of the property, not the number of years to which the communities have been subjected to excessive aircraft noise, not sleep interference, and not the adverse health impacts of excessive noise. Naturally, if none of these are weighed, the balance will tip in favor of sound attenuation.

Costs to the aircraft operators and those dependent upon the aircraft operators were speculative and undocumented as matters of fact. For example, the Report concludes that it would not cost Aloha Airlines anything to comply with a prohibition on Stage 2 aircraft between 10:00 p.m. and 6:00 a.m., effective 1998, if Aloha modified certain routes and schedules. In a footnote, however, the authors reject this approach because it would "impose scheduling constraints on the airline." There is absolutely no factual substantiation that this is a real constraint or that Aloha Airlines could not accommodate such a constraint. There is only the skimpiest of documentation for the "parade of horrors" in terms of expenses, airlines going out of business and inability to pay for Stage 3 aircraft or hush kits. Yet it is only based upon these speculations that the balance can tip in favor of the aircraft operators and against operational restrictions. This is unfair and unwarranted based upon FAA regulations.

Step back and consider the effects of these rationalizations. Will Hawaii remain the home of Hawaiian Airlines, an airline which refuses to add a single additional Stage 3 aircraft to its fleet by 1998? Hawaii cannot countenance this kind of purposeful noise pollution by one of its airlines.

12. Unsupported assumption that rule-making must be statewide

The Report contains two principal unsupported assumptions about the statewide implication of noise abatement measures enacted at the Kahului Airport. First, the Report states on numerous occasions that the implementation of noise abatement measures applicable to the Kahului Airport will worsen noise conditions at other airports. Nowhere is there any factual demonstration that this would occur or that other airports have worse noise environments. Under these circumstances, these statements cannot be taken to be true or determinative.

Second, the two non-lawyer authors of the Report challenge whether noise implementation measures could be implemented on anything but a statewide basis. A simple review of the existing Administrative Rules for Public Airports in the State of Hawaii demonstrates the fallacy of this proposition. There already exist rules which are applicable only to the Honolulu International Airport, only to the General Lyman Field, only to the Ala Wai Heliport and only to the Kapalua-West Maui Airport. The Report itself indicates that the noise regulations of the State Department of Health apply only to Oahu. Airports in California are regulated on an individual and not a statewide basis. This unwarranted legal assumption should be eliminated from the Report and should not be weighed in the cost/benefit analysis.

13. Costs/passenger facility charges

The Airport Noise and Capacity Act enacted in 1990 authorized airport proprietors to assess each passenger a charge of up to $3.00 per passenger (passenger facility charge; "PFC") and to use these funds for noise mitigation projects. FAA data shows that 46 airports are using $782.2 million in such charges for noise mitigation projects. There is no discussion of PFCs in the Report or the amount of money that could be made available through PFCs for noise mitigation purposes at the Kahului Airport. This should have been discussed in the draft.

Sound attenuation has a fatal defect as a noise abatement measure. At best, it is only a half measure. It can only protect those who are exposed to excessive noise from the impacts of this noise so long as they stay inside their dwellings, with windows and doors shut and the air conditioner turned on. It provides absolutely no relief while they are outdoors. The importance of Hawaii's outdoor environment has not been acknowledged. The extent to which residents are outdoors and the importance to them of being outdoors has nowhere been valued. This is equally true of our parks, shoreline areas and wildlife refuges. Sound attenuation offers nothing here.

Taking surrounding residents' outdoor life on behalf of an airline which refuses to incorporate any Stage 3 aircraft into its fleet in the near future is unsupportable. The authors' failure to recommend the expenditure of money by Aloha and Hawaiian Airlines to bring a sufficient number of Stage 3 aircraft into their fleets in order to preserve some remnant of Hawaii's outdoor lifestyle cannot be justified. Noise pollution must, in the final analysis, be curbed at its source.

Unless this draft is withdrawn, re-analyzed and resubmitted, the residents of Maui will be shortchanged just as the residents of Chicago were. The Part 150 Program can work but only if a greater effort is made to fairly weigh the costs and benefits involved.

To be meaningful, Kahului's noise abatement program must (1) prohibit Stage 2 aircraft between 10:00 p.m. to 6:00 a.m., effective December 31, 1995 and (2) prohibit Stage 2 aircraft during all hours, effective the year 2000.

Thank you for the opportunity to comment upon this Report.

Sincerely yours,

Isaac Hall

II/jp
cc: Governor Ben Cayetano
Kazu Hayashida
David Welhouse
Maui Air Traffic Association

Maui County Farm Bureau
Affiliate of the Hawaii Farm Bureau Federation & the American Farm Bureau
Post Office Box 148 • Kula, Hawaii 96790

State of Hawaii
Department of Transportation
Honolulu International Airport
Honolulu, HI 96813

May 30, 1995

Dear Sirs;

On behalf of the Board of Directors of the Maui County Farm Bureau, I am forwarding a second request (refer to letter to Owen Miyamoto dated December 30, 1994) to reconsider the institution of a proposed administrative rule designed to restrict night cargo flights into Kahului Airport to aircraft which meet FAA stage three rules for noise control.

If it is true that such aircraft are not currently in our local cargo fleet, and that the purchase of such aircraft to enhance the current fleet is not financially viable or likely for existing carriers, then the resulting rule would in effect reduce significantly the capacity for inter-island night air freight movement. This would impose another unnecessary burden on local agriculture operations, including fresh produce, fruit, and flower growers, as well as livestock and dairy producers, and further diminish the ability of neighbor island growers and producers from competing against Oahu growers and mainland and overseas fruit, vegetable, and flower importers.

The marketing problems faced by neighbor island farmers are already serious, and additional regulation that might have a negative impact of air cargo movement and rates must be opposed by all thinking members of the local agricultural community. I would hope that those individuals responsible for implementation of any transportation rules which will damage the ability of local farmers, growers, and ranchers to survive in today's market would think twice before implementing any such measures.

Mahalo for your consideration of these thoughts,

Kenneth M. Okamura

Kenneth M. Okamura, President
Maui County Farm Bureau
KMO/ws.

MAUI HOTEL ASSOCIATION

1325 Lower Main, Suite 103, Wailuku, Maui, Hawaii 96793 • Fax (808) 244-3094 • Phone (808) 244-8625

May 31, 1995

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hi 96813

RE: Noise Compatability Study...Kahului Runway Extension

Dear Mr. Hayashida:

The members of the visitor industry on the island of Maui are very concerned over the proposed night curfew suggested in the Noise Compatability Study.

Our obvious concern is that cargo may sit at Maui's Kahului Airport because there are not enough "stage 3" planes to move it and that time-sensitive cargo would not be able to arrive in a timely fashion on Maui due to the lack of "stage 3" aircraft. It also seems a possibility that this curfew may effect a couple of night passenger flights. We have recently lost our direct United flight to Chicago, we cannot afford to lose anymore seats or cargo capacity incoming or outgoing.

As I understand the FAR Part 150 rule, the federal government understood the unique situation of both Hawaii and Alaska, and chose to exempt these states. Why then would our own state suggest that interisland carriers turnover five or six aircraft to "stage 3" aircraft by the end of 1995 or face a night curfew. Are we willing to make the population of our entire island suffer the consequences to satisfy the vocal minority? Would the vocal minority like receiving their perishable goods or time-sensitive products in an un-timely fashion? Would they like to see our agriculture folks suffer further costs to move their products off Maui?

It is cost-prohibitive for our cargo carriers to convert by the end of 1995. There should be further discussions with the cargo carriers about the feasibility of the proposed conversion to "stage 3" aircraft and we would hope the state would work with the interisland carriers to further negotiate what a reasonable timeframe might be for the conversion of aircraft.

We hope you will give further consideration to the idea of a night curfew. The proposed timeframe is not acceptable to the majority of people of Maui. Our business community, visitor industry, and the economic strength of our island depend on time sensitive goods arriving in a timely fashion. Our farmers depend on being able to move their products. Please don't make it more difficult than it already is.

Sincerely,

Terry Vencl
Executive Director

May 24, 1995

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
869 Punchbowl
Honolulu, Hawaii

Re Kahului Airport Noise Compatibility Study

Dear Mr. Hayashida.

The Maui Visitors Bureau is concerned about the Administration Rule included in the Noise Compatibility Study which limits flights into Kahului Airport between the hours of 10:00pm and 6:00am which are not of the 'Stage 3-type' aircraft category.

It is our understanding that this issue has arisen due to a proposed Administrative Rule which states that all aircraft must be of Stage 3-type by December 1995. It is also our understanding that currently there is a Federal Rule which exempts Hawaii from this regulation due to our unique situation.

Our inter island carriers that operate during this time period do not have Stage 3-type aircraft and because of todays economy, as I understand it, will not be able to upgrade their fleet due to financial reasons.

Maui is dependent upon night flights that bring cargo into our island. The visitor industry as well as the public depend on the airlines to bring us fresh bread, milk and many other items that arrive during this proposed shut-down period.

Whether or not passenger planes would fall under this rule has not been explained to us however with a lagging visitor economy the last thing we need to do is limit our availability to potential guests.

Please reconsider the portion of the Noise Compatibility Study that addresses the curfew hours of non-Stage 3-type aircraft.

Thank you for considering our request,

Marsha L. Wienert
Executive Director

MAUI CHAMBER OF COMMERCE

May 31, 1995

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
Airports Division
Honolulu, HI. 96813

Dear Mr. Hayashida:

I am writing to you on behalf of the Maui Chamber of Commerce and its 1,300 business members.

Our concern is the proposed Administrative Rule which will impose a curfew on cargo flights into Kahului Airport between the hours of 10:00 p.m. and 6:00 a.m. if they are not "stage 3" aircraft, effective December 1995.

It is my understanding that Hawaii and Alaska are exempt from a similar Federal Rule/Law because of our unique transportation situation. If this is so, then why would our State impose such an economic crippling rule upon our island business? We on the neighbor islands depend upon air transportation for many of our time sensitive consumer goods. If we could import these goods from Oahu by truck or rail then perhaps this Administrative Rule would not have such an adverse economic effect, but we cannot.

To demand our already struggling airlines retrofit their aircraft to "stage 3" by December, 1995 is financial suicide for our carriers. In fact it appears, upon investigation, that your considerations toward a very small minority of homeowners versus your financial demands upon our air carriers and our struggling businesses displays a very narrow focus on the part of our State Department of Transportation.

We need economic stimulation not more government regulation.

Yours truly,

Lynne Woods

Lynne Woods, President
Maui Chamber of Commerce

... • Kahului, Maui, HI 96732 • Phone (808) 871-7711 • FAX: (808) 877-6646

May 24, 1995

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hayashida:

We are very concerned about the proposed Administrative Rule which states that all aircraft will be of Stage 3 type by December 1995.

Maui Island, by its very nature, is dependent upon outside venders and carriers for most of its supplies and transportation. It does not seem feasible, therefore, to put added burdens upon businesses seeking transportation for their goods, nor upon residents dependent upon receiving goods.

The imposition of this Rule, from which Hawaii is exempt, certainly carries the message that your department neither cares for nor is concerned about the citizens of Islands other than Oahu.

Everyone deserves to have fresh food, timely newspapers, current mail, etc., and for your department to impose unnecessary restrictions on us seems unconscionable.

Sincerely,

Avery B. Chumbley
President

ABC:am

PHONE (808) 244-9570 — P.O. BOX 520, WAILUKU, HAWAII 96793 — FAX. (808) 242-7068
a C. BREWER company

Grand Wailea Resort
HOTEL & SPA

FAXED 5-30-95

May 30, 1995

Mr. Kazu Hayashida
Director
State of Hawaii
DEPARTMENT OF TRANSPORTATION
869 Punchbowl
Honolulu, HI 96813

Via facsimile: 808-587-2167

Dear Mr. Hayashida:

I am writing regarding the hearing which is scheduled May 31, 1995 regarding the Kahului Airport Runway Extension and the proposed night curfew.

As a major employer on the island we are very concerned about the impact such a curfew would impose on the majority of the island population who are largely dependent on the visitor industry for their income. This decision would increase spoilage and subsequent cost of perishable goods to the hotels as well as disrupt the basic flow of operations reliant on certain supplies subject to critical timing.

We need all the support we can get to keep the visitor industry alive by allowing maximum flights for goods and services. A reduction in "lift" both visitor and cargo will result in lost jobs and tax revenue to the County and State and will overall impact the financial health of the island.

Being somewhat isolated as an island closed community, we are even more dependant on timely delivery of supplies and basic goods and services. Please consider our concerns seriously before ruling in favor of a small group of concerned parties at the expense of the overwhelming population on Maui.

Thank you for your consideration.

Sincerely,

Peter O'Connor
Executive Vice President and Managing Director

PO:ed

c: Greg Koestering
Terryl Vencl ← 244.309A

MAUI INTER-CONTINENTAL RESORT

3700 Wailea Alanui, Wailea, Maui, Hawaii, U.S.A 96753
808-879-1922

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
869 Punchbowl
Honolulu, HI 96813

Dear Mr. Hayashida:

The employees of the Maui Intercontinental Resort are concerned with the potential negative effects caused by the proposed Administrative Rule that states all aircraft will be of Stage 3 type by December 1995.

The inability of receiving and sending perishable products such as produce, fish, flowers, newspapers, etc. on a timely basis is not acceptable to the residents of Maui.

Per Federal Rules, Hawaii and Alaska are allowed to use Stage 2 aircraft. What reason warrants burdening the total population of Maui from receiving or meeting their daily needs and expectations as they do today?? Who benefits from the change from Stage 2 to Stage 3 aircraft?? Probably, only a small segment of residents benefit, while the majority suffer!!

The interisland carriers say it is cost prohibitive to convert to Stage 3 at this time. If that is true, aren't there other methods to avert and or control the reported noise levels. Is the noise level really worthy of the impact eliminating night cargo service would have on the entire island's residents? We think not.

Thank you for your consideration in maintaining Maui's daily staples.

Sincerely

Brad Jencks
General Manager

90 in 90
THE MAUI PUEO COALITION

Jimmy Rust, Chairman

May 31, 1995

Mr. Kazu Hayashida
Director, State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hi 96813

RE: Noise Compatability Study...Kahului Runway Extension

Dear Mr. Hayashida:

' name is Jimmy Rust, chairman of the Pueo Coalition. Our coalition represents over 20,000 jobs on the island of Maui.

Our concern on the Noise Compatability Study is a recommendation for night curfew at the Kahului Airport. This curfew would effect passenger flights as well as cargo movement. Maui has most recently lost a number of seats with the cancellation of United's direct flight to Chicago and we cannot afford to lose any further seats to Maui.

The idea of forcing interisland carriers to move to "stage 3" aircraft by December of 1995 is cost prohibitive in our struggling economy. Maui depends on time-sensitive and perishable products which arrive on those night cargo flights. We CANNOT give up the five flights that now arrive on a daily basis with our goods and products. This kind of action will further cripple our economy.

The federal government recognized the unique situation of both Hawaii and Alaska and exempted us from their rule. I recommend you give further thought to removing the stipulation of Hawaii complying by December, 1995 and work with the inter-island carriers to decide what an appropriate date might be.

Our local agriculture community has recently experienced set backs in moving their products off the island due to the aforementioned cancellation of a United flight. They struggle now to find enough space to get cargo off island and if more flights are cancelled, the agriculture community will experience further complications and added costs.

25 N. PUUNENE AVE. • KAHULUI, MAUI, HI 96732 • PHONE 871-PUEO

I urge you to give further thought and negotiate with local carriers before imposing a night time curfew at the Kahului Airport.

Thank you for your consideration.

Sincerely,

Jimmy Rust
Chairman

Maui Pineapple Company, Ltd.

May 31, 1995

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

To Whom It May Concern:

My name is Joe Kekiwi and I am the Fresh Fruit Superintendent for Maui Pineapple Company. As a follow-up to my letter of December 29, 1994, I would like to submit this written testimory against the Hawaii DOT Airports Division implementing an amendment to its Administrative Rules, which will restrict Stage 2 aircraft from operating between the hours of 10:00 pm to 6:00 am at the Kahului Airport.

For one inter-island carrier, Aloha Airlines (which carries the bulk of the inter-island air freight), this new restriction will curtail as much as 80 percent of its night-time freight service into Maui, because of its present mix of cargo aircraft.

For the year 1994, we have shipped 85,000 pounds of product on Aloha Airlines to Oahu, then connecting on another carrier to the mainland. We have shipped some product through Matson, but have found it not a profitable venture for two reasons: the quality of our product is greatly effected, and we cannot compete in price with our competitors. Therefore, to stay competitive, we target the jet side of the industry.

There are three carriers that transport our product from Maui to the mainland. We fill our allotted container positions on each aircraft on a regular basis. Aloha Airlines has enabled us to increase our sales to the mainland by shipping our product on their night-time freighters to Oahu.

For 1995 we have projected a 20 percent increase in tonnage to the mainland. This goal cannot be achieved without the utilization of Aloha Airlines night freighters. It is extremely important to fulfill our customers' needs, provide them with the best quality product and stay price competitive in the produce market place.

Post Office Box 187 • Kahului, Hawaii 96732-0187 • Telephone (808) 877-3351 • FAX (808) 871-0953

For all of these reasons, we are opposed to this new rule and respectfully suggest you strongly reconsider implementing this amendment.

Sincerely,

for, Lianne Clayton

Joe Kekiwi
Fresh Fruit Superintendent
Maui Pineapple Company, Ltd.

/dc

Grand Wailea Resort
HOTEL & SPA

June 5, 1995

Mr. Kazu Hayashida
Director
State of Hawaii
DEPARTMENT OF TRANSPORTATION
869 Punchbowl
Honolulu, HI 96813

Via facsimile: (808) 587-2167

Dear Mr. Hayashida:

I am writing with regard to the Kahului Airport Runway Extension and proposed night curfew which was discussed at the Public Hearing held on May 31, 1995.

As I am sure you are aware, a great number of residents on the island of Maui rely on the visitor industry as part of their livelihood. I am concerned that the impact of such a night curfew would greatly affect the normal flow of business, and affect the overall climate of this viable industry. With such a restriction, the hotel industry, as well as other important businesses, may not be able to receive goods on a timely basis. However, allowing a maximum number of flights in for this purpose will help the visitor industry to continue to thrive and prosper.

Your consideration in ruling against the proposed Administrative Rule would be greatly appreciated.

Sincerely,

Stacey Hiramoto
Senior Director of Human Resources

SH:nmp

cc: Peter O'Connor
Terryl Vencl

WATANABE, ING & KAWASHIMA
ATTORNEYS AT LAW
A PARTNERSHIP INCLUDING LAW CORPORATIONS
HAWAII TOWER, 5th & 6th FLOORS
745 FORT STREET
HONOLULU, HAWAII 96813

June 15, 1995

HAND DELIVERED

State of Hawaii
Department of Transportation
Airports Division
400 Rodgers Blvd., Suite 700
Honolulu, Hawaii 96819

Re: Kahului Airport Noise Compatibility Program
State Project No. AM1011-05

Gentlemen:

On behalf of Aloha Airlines, we are submitting the enclosed documents as written testimony and comment on the "Draft Kahului Airport Noise Compatibility Program" (April 1995).

Since the draft report relies, in part, on a prior cost benefit analysis prepared for the Department of the Attorney General, we are also enclosing as testimony our letter of December 30, 1994, which discussed Aloha's position with regard to certain proposed amendments to Hawaii Administrative Rules, Chapter 19-28.

Respectively submitted,

J. DOUGLAS ING
for
WATANABE, ING & KAWASHIMA

JDI:dfp

Enclosure
cc: Aloha Airlines, Inc.

WRITTEN COMMENTS OF ALOHA AIRLINES, INC. TO DRAFT KAHULUI AIRPORT - FAR PART 150 NOISE COMPATIBILITY PROGRAM REPORT VOLUME II

Aloha Airlines, Inc. ("Aloha") submits the following comments to the Draft Kahului Airport - FAR Part 150 Noise Compatibility Program dated April 1995 ("Report") prepared by Belt Collins Hawaii and Y. Ebisu and Associates.

The Report considered a number of noise abatement alternatives. The noise reduction benefits of eleven most promising alternatives were calculated and a noise compatibility program was prepared.

Aloha concurs with the decision not to include the following alternatives into the noise compatibility plan:

Noise Abatement Based on Operational Changes:

Limitations or Restrictions on Type or Class of Aircraft based on Aircraft Noise Levels (Section 7.2.7)

1. Impose Noise Restrictions Comparable to Those Applicable on the Mainland (Option T5 - Section 7.2.7.2)

"Because of the severe hardship that it would create for Hawaii's interisland air carriers, the adverse effect this could have on the State's air transportation system, and the measure's limited success in providing improved land use compatibility, this measure is not part of the recommended program."

2. Eliminate All Stage 2 Operations (Options T1 and T2) (Section 7.2.7.3)

"...the fact that the existing operations are relatively efficient ones that provide service at prices towards the low end of those found elsewhere in the country suggest that new carriers entering the market with service comparable to that provided by the existing carriers would probably not operate with lower fares or otherwise improve the quality of interisland air service. Because of this, neither of these measures is included in the recommended plan."

3. Reschedule Nighttime Aircraft Operations to Daytime Operations (Option T9)

"...most of the uses that would be incompatible under the "no-mitigation" scenario would remain in the incompatible range despite the 1 to 3 Ldn reduction in average day-night noise levels produced by this alternative. Only those homes which are on the fringe of the incompatible area would be made fully compatible by this measure. Additional measures that have the potential to reduce noise by a further 10 to 15 Db would be required in addition to the nighttime curfew to address the remaining land use incompatibilities at Spreckelsville. Consequently, this alternative is not part of the recommended noise program."

Aloha is pleased to learn that the report does not recommend a nighttime curfew for Kahului Airport. If enacted, this restriction would have had a most devastating effect on the island's economy, with an increase in interisland shipping costs as well as a decrease in the quantity, quality, and speed of goods shipped.

Hawaii's economy depends on air cargo service. Unlike other states which have intrastate trucking and rail service, Hawaii has no other means of transporting time sensitive cargo between the islands. The interisland air carriers are the intrastate highways and railways of Hawaii.

Aloha has five (5) cargo aircraft with a capability to carry passengers during the day and cargo at night, four of which are generally in operation at night. Most major shippers utilize Aloha's nighttime cargo to provide next day service to the neighbor islands. This is particularly true for time sensitive and perishable cargo.

The scheduling of Aloha's cargo flights is dictated by customer delivery time requirements. Frequently, Aloha has only a four to six hour window within which to move cargo from Honolulu International Airport to the neighbor islands. Aloha's movement is usually the last segment of a continuous stream of commerce, frequently originating earlier in the day from locations in other time zones. Aloha is therefore not fully in control of the timing of freight movements.

The elimination of night cargo flights would prevent time sensitive cargo such as newspapers, UPS parcels, U.S. mail, and bakery products from being delivered in a timely manner to Maui. This would, in turn, have a negative economic impact on the Maui community, and the selection of goods and services available to Maui residents and visitors, as well as large and small businesses.

It is not practical to assume that this cargo could be moved during daytime hours for several reasons. First and most importantly, the timely arrival of U.S. mail, newspapers, and products such as bread and fresh fruit is critical to its use and value. Secondly, economics require that Aloha's cargo aircraft must be utilized for interisland passenger service during the day. Finally, the volume of night cargo could not be accommodated on daytime passenger aircraft, since most of that space must be allocated to passenger baggage.

If a stage 2 night curfew is imposed, Aloha would be forced to discontinue its cargo operation. Since Aloha currently offers the only reliable air cargo service in the State that has

timely service at affordable rates, the neighbor islands would have essentially been cut off.

Although the negative impact of a curfew falls primarily on Aloha's cargo operation, passenger flights will also be affected. Aloha frequently charters its aircraft for late night passenger service into Maui. Occurring seasonally, these interisland flights are timed to coincide with late arriving trans-Pacific flights into Honolulu and provide crucial connections for visitors whose final destination is Maui. Aloha does not have sufficient Stage 3 passenger aircraft to ensure that charters would not conflict with a noise curfew.

4. Disallow Nighttime Departures, but Permit Arrivals Before 7:00 a.m. (Option 10) Section 7.2.7.6

   "The same number of homes would require mitigation under this option as would require mitigation under Option T9. This alternative would have essentially the same effect on interisland and overseas air travel as Option T9 as well. For reasons outlined in the preceding section, this measure is not included in the recommended plan."

5. Capacity Limitations Based on Relative Noisiness - Section 7.2.7.7

   "...because such restrictions would provide an incentive for operators to shift their noisier aircraft to other Neighbor Island airports that have more serious land use compatibility problems than does Kahului, they could be counter-productive as a means of reducing overall noise exposure. This measure is not part of the recommended plan."

6. Landing fees based on aircraft noise levels and/or time of operation Section 7.2.7.8

   "...increasing landing fees for nighttime operations is an effective noise abatement measure only to the extent that it prevents the use of Stage 2 aircraft. Charging

higher landing fees for noisier aircraft operations during the daytime would provide an economic incentive for airlines to accelerate their move to Stage 3 aircraft. At the same time, it would take money from them which might otherwise be used to accomplish the necessary fleet conversion. In view of the foregoing, the use of increased landing fees based on noise or time of operation is not recommended for inclusion in the Noise Compatibility Program."

Aloha concurs with the report's recommendations listed above. These noise abatement options should therefore not be included in the plan.

RECOMMENDED NOISE COMPATIBILITY PROGRAM

Nighttime Prohibition on Stage 2 Aircraft

One of the components of the Noise Compatibility Program is the consideration of a nighttime prohibition on Stage 2 Aircraft. The Report recommends that the State Department of Transportation continue to pursue an amendment to Chapter 19-28 of the Hawaii Administrative Rules to include a 10:00 p.m. to 6:00 p.m. ban on the operation of Stage 2 aircraft at Kahului Airport. The Report summarizes its analysis of the nighttime prohibition on Stage 2 aircraft as follows:

> *[A] prohibition on nighttime use of Stage 2 aircraft at Kahului Airport will have a limited effect on Ldn levels...thus it does not appear to be warranted on that accord. However, single-event noise from the B737-300-QC aircraft that make up a part of Aloha Airlines' cargo fleet is at least 10 Db less than that of the B-737-200-QC aircraft that make up the remainder. Consequently, shifting to the quieter airplane would result in a noticeable decrease in single-event nighttime aircraft noise in Spreckelsville."*

Further, the Report recommends "that the Department [of Transportation] evaluate the impact of imposing this requirement

by the end of 1998. This should be done as part of its continuing efforts to amend Chapter 19-28, Hawaii Revised Statutes."

Aloha opposes the imposition of any such administrative rule and the subsequent ban on Stage 2 aircraft for the following reasons:

1. The Cost/Benefit Analysis upon which the recommendation is based is inadequate.

This recommendation mistakenly relies on the statement below from the 1992 Cost/Benefit Analysis Report relating to alternative noise restrictions at Kahului Airport prepared by KPMG Peat Marwick, which states in part that:

> *"The only effect on airlines (from a nighttime restriction on Stage 2 aircraft) would be to assign the Stage 3 quick change aircraft already on order to cargo routes serving Kahului, and the potential conversion of future Stage 3 aircraft to the quick change configuration. There would be no effect on local businesses, as they would receive shipments according to current schedules."*

This statement does not take into account the following:

a. It is not economically feasible for Aloha to continue to integrate Stage 3 aircraft into the market structure. The cost of acquiring new Stage 3 aircraft (737-300) in the quick change configuration is extremely high (estimated at more than $35 million per aircraft) and the converted aircraft is expensive to maintain and operate. Passengers and local businesses, therefore, will be affected by this requirement. Increased aircraft capital costs must be borne by both the passenger service as well as the cargo service.

b. Assigning all Stage 3 aircraft to Kahului would negatively impact other airports in the State since the number of Stage 2 aircraft, and therefore the level of noise, would increase at these other locations. The Report concedes that:

> *concentrating quieter aircraft at Kahului will tend to increase noise levels around other airports where the nighttime cargo service is operated. Thus, while nighttime prohibition on Stage 2 operations . . . would clearly benefit residents of Spreckelsville by reducing nighttime single event noise, it is less clear that they are the best course of action when viewed from a statewide perspective.*[1]

The report's reliance on the cost/benefit analysis findings is thus heavily flawed since, among other things, it does not take into account the heavy burden of cost that Aloha, local businesses, and neighbor island consumers would have to bear.

2. The Stage 2 ban does not significantly decrease Ldn levels.

If the report is basing the requirement for using only Stage 3 aircraft at night on single-event noise data, then Aloha must strongly object. The Report itself states that "the FAA requires that the noise be described in the Ldn metric." The Report concludes that prohibiting nighttime use by Stage 2 aircraft does not greatly reduce Ldn levels.

[1] Report § 7.2.7.5.

Based upon this federal requirement, the fact that single event noise from Stage 3 aircraft is quieter than Stage 2 aircraft is completely irrelevant. The report should rely solely on Ldn levels, as required by the FAR, and if it does, "a prohibition on nighttime use of Stage 2 aircraft at Kahului Airport...does not appear to be warranted."

3. Spreckelsville Lawsuit

Aloha objects to the proposed imposition of the nighttime ban to the extent that it is being adopted for the purpose of settling a lawsuit. On February 3, 1989, certain residents from Spreckelsville, Maui, filed a lawsuit in the Circuit Court of the Second Circuit, State of Hawaii. See Maui Air Traffic Ass'n, Inc. et al. v. Edward Y. Hirata, et al., Civil No. 89-0048(1) (herein "Spreckelsville Lawsuit"). By Stipulation filed on September 30, 1991 in the Spreckelsville Lawsuit, the State and plaintiffs agreed to resolve the lawsuit on certain terms and conditions. The Report itself admits that:

> [t]o an extent, the Stipulation [for Stay of Proceedings signed by the Spreckelsville plaintiffs] assumes that certain provisions of the Federal Airport Noise and Capacity Expansion Act of 1990 would be implemented in Hawaii through subsequent amendments to FAR Part 91 and the promulgation of FAR Part 161, but it precedes these two final rules . . . and the December 1991 amendment to the Act.

One of the major provisions of the stipulation was that the State would consider restrictions on nighttime operations of Stage 2 aircraft prior to 2000. Therefore, Aloha objects to the imposition of a Stage 2 ban on nighttime flights for the purpose of settling the Spreckelsville lawsuit.

Based on the these reasons, Aloha objects to the inclusion of a Nighttime Prohibition on Stage 2 Aircraft in the Noise Compatibility Program.

<u>Recommended Noise Mitigation Measures</u>

The Report recommends that noise mitigation measures supplement the noise abatement measures sought to be implemented. These mitigation measures include:

- *Negotiate with private landowners in West Spreckelsville to purchase the private properties enclosed by the 75 Ldn Contour;*
- *Initiate a Sound Attenuation Program for remaining residences in West and East Spreckelsville;*
- *Offer to purchase private properties in West and East Spreckelsville enclosed by the 60 Ldn Contour whose owners do not wish to participate in the Sound Attenuation Program;*
- *Continue monitoring of development proposals in the Kahului Airport environs, disclosing airport noise exposure maps to the community*
- *Design, install, and operate a noise monitoring system at Kahului Airport*
- *Annually monitor aircraft noise levels and operations at Kahului Airport, and conduct public informational meetings on the progress of the Part 150 Noise Compatibility Program.*

Aloha concurs with the report's mitigation measures listed above. The options should be included in the noise compatibility program.

SUMMARY

Aloha objects to the inclusion of a nighttime ban on Stage 2 aircraft in the noise compatibility plan. The Report suggests the pursuit of a nighttime curfew on Stage 2 aircraft at

Kahului Airport, even though it cannot substantiate a legitimate basis for doing so. It recommends that the State DOT continue to pursue an amendment to HRS Chapter 19-28 to impose the nighttime curfew, even though the report states that "neither measure would greatly reduce the size of the noise contours, with the decrease in Spreckelsville being on the order of 1 to 1.5 Ldn points." The recommendation is inapposite to the report's findings.

This curfew would force Aloha to bear a substantial, economically unfeasible obligation which would yield only a very small return in noise reduction, while resulting in a large negative impact on the State's businesses and most importantly, the consumers of Maui.

Aloha supports the Report's recommendations to include various mitigation measures as discussed above and concurs with the recommendation not to impose a total nighttime curfew at the Kahului airport.

0011930 01

WATANABE, ING & KAWASHIMA
ATTORNEYS AT LAW
A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS
HAWAII TOWER 5th & 6th FLOORS
745 FORT STREET
HONOLULU, HAWAII 96813
TELEPHONE (808) 544 8300

December 30, 1994

HAND DELIVERED

State of Hawaii
Department of Transportation
Airports Division
400 Rodgers Blvd., Suite 700
Honolulu, Hawaii 96819

Re: Second Public Hearing and Notice Regarding Proposed Amendments to Hawaii Administrative Rules, Chapter 19-28

Gentlemen:

The State of Hawaii Department of Transportation ("DOT") issued a second Notice of Public Hearing regarding proposed amendments to the Hawaii Administrative Rules, Chapter 19-28. The proposed amendment adopting Section 19-28-3.1 is substantially similar to a prior proposed amendment issued by DOT in 1993. Pursuant to the prior Notice of Public Hearing, Aloha Airlines, Inc ("Aloha") submitted detailed written comments to DOT by letter dated July 9, 1993. Aloha hereby incorporates those comments by reference.

DOT's Second Notice of Public Hearing was issued in October 1994 and scheduled public hearings on December 6 and 7, 1994. Aloha appeared at the December 6 public hearing and again opposed the proposed rule. DOT was informed at the time that Aloha had not received any response to its detailed written comments to the Department of Attorney General's Cost Benefit Analysis (March 1992), nor to its letter of July 9, 1993, to DOT, nor to its Request for Public information under Chapter 92F Hawaii Revised Statutes. DOT was also advised that the information sought was necessary in order to prepare its comments to DOT's proposed amendment adopting new Section 19-28-3.1.

By letter dated December 16, 1994 and received by Aloha on December 19, 1994, Owen Miyamoto wrote to Aloha responding to Aloha's comments and testimony of July 9, 1993 and enclosed a September 28, 1993 letter prepared by the Department of the Attorney General's consultant KPMG Peat Marwick. DOT's letter gave no explanation as to why the KPMG response was withheld from Aloha until December 19, 1994, fourteen months after its apparent preparation.

The last minute revelation of this letter is highly suspect. On December 6, 1994, Aloha's attorney went to the Airports Division to examine the information referenced in DOT's Second Notice of Public Hearing. While a copy of the Cost Benefit Analysis was available, the KPMG letter of September 28, 1993 was not, nor was it contained in any of the DOT files or records regarding the proposed amendment made available for review. It appears that DOT has thus intentionally withheld public information from Aloha's review and has prejudiced Aloha's ability to comment upon the proposed rulemaking.

Aloha reiterates its position that the proposed rule will seriously disrupt and eliminate essential transportation services to the Island of Maui. In addition, the proposed rule and the procedure utilized to adopt the rule violates state and federal law and constitutes an unreasonable restraint on the flow of interstate commerce.

Aloha's further detailed comments and testimony opposing the proposed rule are attached. Alohas has not yet received a response to its request for disclosure of public records regarding the preparation of the cost benefit analysis. Aloha therefore reserves its right to submit further comments.

Aloha again requests that it be provided with notice and an opportunity to be present at any public meeting held to adopt this rule or any variation of it.

Respectively submitted,

J. DOUGLAS ING
for
WATANABE, ING & KAWASHIMA

JDI:dk 00675C0 01
Enclosure
cc: Aloha Airlines, Inc.

FURTHER
WRITTEN TESTIMONY & COMMENTS
OF
ALOHA AIRLINES, INC.

On December 6 and 7, 1994, the State of Hawaii, Department of Transportation, Airport Division ("State") held public hearings to consider proposed changes to Chapter 19-28 of the Hawaii Administrative Rules. If approved, the proposed amendment would ban any aircraft from taking off and landing at Kahului Airport between the hours of 10 p.m. and 6 a.m. as of December 31, 1995, unless it is a Stage 3 aircraft.

The proposed amendment should not be adopted, nor implemented for the following reasons:

1. The proposed amendment will unreasonably restrain the movement of both intrastate and interstate commerce and will result in the loss of vital transportation services, which would negatively impact residents, businesses, and major industries which depend on these services;
2. The State has not followed the proper procedures regarding the proposed restriction in violation of state and federal law;
3. The State has not properly prepared an analysis of the proposed amendment in violation of federal law.

Background

For more than 48 years, Aloha Airlines, Inc. has provided the State of Hawaii with dependable and frequent air transportation services for the major Hawaiian islands of Maui, Oahu, Kauai and Hawaii. Aloha's extensive route structure connects the five largest and busiest island airports of Honolulu, Kahului, Lihue, Hilo and Keahole. In 1993, Aloha

flew more available seat miles and more revenue passenger miles, as well as more cargo revenue ton miles (including mail), within the State of Hawaii than any other air carrier.

Because Aloha's operations are exclusively focused on intrastate air transportation services (except for a weekly charter flight to Johnston Island), Aloha's fleet consists of aircraft from the Boeing 737 family. These short-haul aircraft are very well suited operationally and economically to interisland flights. In the current and extremely competitive airline industry environment, a careful evaluation of fleet requirements is essential, not only for success, but for sheer survival. Moreover, the complex process of fleet evaluation is constant and fluid, and must respond to the fast-paced changes taking place in the industry. With this in mind, Aloha Airlines, in 1985, looked to nighttime cargo operations to increase its operating efficiency and aircraft utilization.

Prior to Aloha's introduction of modern jet aircraft, interisland air cargo service was largely provided by 1950s vintage propeller aircraft and was not reliable. Previous attempts to operate jet cargo service were not viable on an economic basis and eventually failed because they relied on cargo revenues alone. As a consequence, the growth of interisland air cargo was constrained by the irregular and undependable service provided by a succession of weak and undercapitalized cargo airlines.

In 1985, Aloha introduced a nighttime freighter operation utilizing Boeing 737-QC aircraft which can be configured for either passenger or cargo operation. The Boeing 737-QC possesses "quick change" capability, allowing the removal of all passenger seats in approximately 30 minutes thereby leaving the interior open to accommodate up to eight pallets of cargo. In 1986, the first full year that Aloha provided Boeing 737-QC service, interisland air cargo jumped nearly 13 percent. Starting with one Boeing 737-QC, Aloha's operation has grown to five aircraft which carried more than 132 million pounds in 1993 (including both night freight and limited day freight carried on passenger flights) or about 73 percent (by weight) of Hawaii's interisland air cargo.

It is Aloha's ability to maximize the utilization of these aircraft that has made Aloha's air freight business successful, where others have failed. Without the dual utilization of these aircraft, Aloha's air cargo service could not survive. In other words, the interisland air cargo market alone cannot justify the capital cost of modern reliable jet aircraft. More significantly, Hawaii's economy depends on air cargo service. Unlike other states which have intrastate trucking and rail service, Hawaii has no other means of transporting time-sensitive cargo between the islands. The interisland air carriers are the intrastate highways and railways of Hawaii.

1. Loss of Vital Transportation Services

Aloha Airlines is a part of a rapidly evolving interstate commerce system which transports and delivers cargo at night. Aloha has five (5) cargo aircraft with a capability to carry passengers during the day and cargo at night. Four of these are generally in operation at night, delivering cargo between air cargo facilities at Honolulu, Lihue, Kahului, Keahole and Hilo airports.

Most major shippers utilize Aloha's nighttime cargo to provide next day service to the neighbor islands. This is particularly true for time-sensitive and perishable cargo such as newspapers, mail, flowers and produce. It is Aloha Airlines that provides the

intrastate neighbor island link for many national and international delivery systems such as UPS, the U.S. Postal Service, mainland newspapers, DHL, Burlington Air Express, Airborne Express and Emery Worldwide Freight.

a. Customer Requirements

The scheduling of Aloha's cargo flights is dictated by customer delivery time requirements. Frequently, Aloha has only a four to six hour window within which to move cargo from Honolulu International Airport to the neighbor islands. Bakery products, for example, are delivered in the early evening hours and must be ready for pick up at neighbor island destinations no later than 4 a.m. Newspapers are delivered to Aloha after midnight and must be available for pick up by 3 a.m. on the neighbor islands. The U.S. mail is not available until 1 or 2 a.m. and must be available to the postal service on the neighbor islands between 4 and 5 a.m.

UPS, the largest interisland shipper, tenders its cargo to Aloha between 12:30 a.m. and 3:30 a.m., and requires it to be available at 6 a.m. at the neighbor island destinations.

Frequency of flights and scheduling is thus determined by customer need. To provide you with some idea of the scale of night operations, about 20 million pounds of mail per year moves interisland, with 12 million pounds moving at night. Approximately 75 percent of the annual 125 million pounds of interisland air freight also moves on cargo flights during the hours of 9 p.m. to 6 a.m.

b. Aloha's Cargo Aircraft

In responding to the State's need for a timely, reliable, and efficient cargo service, Aloha selected the 737-QC aircraft, which could be used for passenger service during the day and cargo service at night. Of the five (5) 737-QC freighters operated by Aloha, only two are Stage 3 Boeing 737-300 models.

Aloha's two 737-300 QC aircraft underwent a conversion program at Pemco Aeroplex for the installation of a cargo door on what was originally a pure passenger-configured 737-300 aircraft. The cost of this modification program was nearly $2 million per aircraft. Aloha is the first and only U.S. carrier to operate the Pemco modified cargo planes. The first of these began service in July 1992 and the second was placed in service in October 1992.

Aloha has now had two full years of operating experience with the two 737-300 QC aircraft. Because of Aloha's high cycle utilization of aircraft, maintenance costs have been substantially more than anticipated, resulting in less utilization as well. Given the high acquisition cost, high maintenance cost, increased downtime for maintenance, and the highly competitive Hawaii market, it is not likely that Aloha could acquire additional 737-300 QC aircraft within the reasonable future. In any case, the lead time required to acquire and modify an aircraft at the Pemco facility virtually precludes delivery before January 1, 1997.

c. Honolulu/Kahului Freight Movement

Like most other Hawaii destinations, Kahului's night freight consists of small parcels and bakery products. Freight forwarders generally pick up their cargo from various

shippers during the day, consolidate it, and deliver it to Aloha Airlines sometime around 7 p.m. They require the cargo to be in Kahului by 6 a.m. the next morning. Once cargo has been received by Aloha, it must be segregated by destination, invoiced, weighed, and staged for loading onto the aircraft. Small parcels from UPS and others arrive at midnight or later, and must be available by early morning.

On average, Aloha carries approximately 90,000 pounds of freight per night into Kahului; however some nights are considerably more. Aloha's aircraft are usually limited by volume, rather than weight. In order to move the volume of cargo tendered on a daily basis, five night flights are needed into Maui. Most of the cargo, however, is received in a highly compressed time frame, and likewise must be moved in a compressed time frame. Several aircraft are required to accomplish the needed flights in that limited time. The process is further complicated by the need to integrate the cargo schedules for the other islands as well. It must also be remembered that Aloha's movement is usually the last segment of a continuous stream of commerce, frequently originating earlier in the day from locations in other time zones. Therefore, Aloha is not fully in control of the timing of freight movements.

d. Impact of Noise Curfew

If a noise curfew were imposed on Kahului, Aloha would not be able to move the tendered cargo. Aloha lacks sufficient number of Stage 3 aircraft to handle the 90,000 to 100,000 pounds that must be moved during a limited time frame each night. In addition, Aloha's Stage 3 aircraft are removed from service on a regular basis for required maintenance. Aloha must therefore frequently utilize its 737-200 Stage 2 aircraft to provide the service.

As previously stated, 737-300 QC aircraft are not being manufactured and must be modified on a custom-built basis, to accommodate the proposed Kahului curfew. Aloha would thus face the high cost of purchasing and converting 737-300 aircraft to QC's, currently estimated at more than $35 million each. Given the downturn in Hawaii's economy, the economics of the airline industry, and rising aircraft costs, the acquisition of such an expensive asset is not economically attractive. The imposition of the Stage 2 restrictions would inevitably result in the loss of vital transportation services into Kahului, Maui. Furthermore, the resulting scale-back of night cargo operations could impact service to other islands as well.

The reduction of night cargo flights would prevent time-sensitive cargo such as newspapers, UPS parcels, U.S. mail, and bakery products from being delivered in a timely manner to Maui. This would, in turn, have a negative economic impact on the Maui community, and the selection of goods and services available to Maui residents and visitors, as well as large and small businesses.

It is not practical to assume that this cargo could be moved during daytime hours for several reasons. Most importantly, the timely arrival of products such as bread and newspapers is critical to its use and value. Secondly, economics require that Aloha's cargo aircraft must be utilized for interisland passenger service during the day. Finally, the volume of night cargo could not be accommodated on daytime passenger aircraft, since most of that space must be allocated to passenger baggage. Even if night cargo could be

transported on passenger aircraft, large shipments would have to be broken down into smaller multiple shipments, making the transport of such cargo untimely, labor-intensive and uneconomical.

Although the negative impact of a curfew falls primarily on cargo operation, passenger flights are also affected. Aloha frequently charters its aircraft for late night passenger service into Maui. Occurring seasonally, these interisland flights are timed to coincide with late arriving trans-Pacific flights into Honolulu and provide crucial connections for visitors whose final destination is Maui. Aloha does not have sufficient Stage 3 passenger aircraft to ensure that charters would not conflict with a noise curfew.

2. Procedural Defects

The State has not complied with the notice and other procedural requirements regarding proposed restrictions on Stage 2 aircraft as set forth by the Federal Aviation Administration ("FAA") in 14 CFR section 161.203.

This regulation mandates that an airport operator (in this case the State) may not implement a Stage 2 restriction unless the airport operator provides public notice and an opportunity for comment in the manner dictated by 14 CFR section 161.203.

The State has not satisfied the requirements for public notice and opportunity for comment as mandated by 14 CFR section 161.203, and cannot implement any regulations imposing access restrictions on Stage 2 aircraft.

Notwithstanding the State's failure to satisfy the proper notice requirements, Aloha is unable to determine whether the following additional requirements of 14 CFR section 161.203 have been satisfied:

-- Has the State provided the FAA with the required text outlining sanctions for noncompliance with this restriction?

-- Has the FAA published the required announcement of the proposed Stage 2 restriction in the Federal Register?

Given these defects, the proposed amendment regarding the restriction of Stage 2 aircraft should not be approved. The State would merely be inviting litigation on these issues.

3. Required Analysis

14 CFR section 161.203 provides that the State may not implement a Stage 2 restriction unless the State provides the FAA with an analysis of the proposed restriction prepared in accordance with specific requirements. Although the State has prepared a cost/benefit analysis, its analysis is not in accordance with CFR requirements.

The State's analysis is entitled "Cost/Benefit Analysis Related to Alternative Noise Restrictions at Kahului Airport" ("Cost/Benefit Analysis") and was released in March 1992. One of the ten alternatives studied by the State was the limitation of nighttime turbojet cargo operations to Stage 3 aircraft. As drafted, the contemplated restriction was to occur between the hours of 11 p.m. and 6 a.m. The Notice, however, provides that the proposed restriction will occur between the hours of 10 p.m. and 6 a.m.

In addition, the Cost/Benefit Analysis is deficient since it: analyzes a cargo market which does not exist; disregards the requirements of the Airport Noise and Capacity Act of 1990; ignores the substantial costs for the proposed aircraft restrictions; and draws conclusions which are based upon flawed methodology and questionable assumptions. Aloha

provided detailed comments addressing the many shortcomings and inaccuracies in the Cost/Benefit Analysis. KPMG Peat Marwick ("KPMG"), in its response dated September 28, 1993 admitted that:

-- It did not prepare an FAR Part 161 Cost/Benefit Analysis. Rather it was hired by the Department of Attorney General to develop alternatives to reduce noise impacts by nighttime jet air cargo operations.

-- The analysis was restricted to nighttime air cargo noise and sought to avoid any impact on passenger carrier. KPMG acknowledges that the study appears to discriminate against a particular class of carrier-the nighttime cargo carrier.

-- The Department of Attorney General required KPMG to assume that the phase in costs of Stage 3 aircraft would be borne by Aloha without consideration of the economic impact. This was premised on the mistaken assumption that the State would enact similar legislation to FAR Part 91, mandating a Stage 3 phase-in similar to that in the 48 contiguous states (which all have alternative transportation systems like rail and highways). The State has not enacted any such legislation that would mandate a phase-in of Stage 3 aircraft.

Because DOT did not provide Aloha with its response to Aloha's Comments Regarding Cost/Benefits Analysis Related to Alternative Noise Restrictions Kahului Airport (attached) until December 19, 1994, Aloha will not be able to reply until after December 30, 1994. The DOT is advised that Aloha does intend to reply and hereby incorporates its reply.

In addition to the above inadequacies, the Cost/Benefit Analysis fails to satisfy the requirements set forth in 14 CFR section 161.205 for the following reasons.

a. Noise descriptors

14 CFR section 161.9 requires that sound levels at the airport and surrounding areas, and the exposure of individuals to noise, must be measured with the specifications and methods prescribed under Appendix A of 14 CFR section 150 ("Appendix A"). Appendix A states that the A-Weighted Sound Level must be employed as the unit for measurement of single event noise at airports and in the areas surrounding the airport. The State's ...st/Benefits Analysis uses the sound exposure level ("SEL") metric to measure sound levels.

b. Economic methodology

The State's Cost/Benefit Analysis did not use currently accepted economic methodology. The Cost/Benefit Analysis fails to provide the basis for the assumptions utilized and draws erroneous conclusions.

c. The Analysis is Dated

The State's Cost/Benefit Analysis was largely conducted in 1991 and issued in 1992. Underlying costs, assumptions, and technologies (although unspecified) have substantially changed. The analysis is therefore too dated to be of meaningful utility in assessing access restrictions to be implemented in 1996. Rather it should be redone in its entirety.

An objective observer could only conclude that the State's analysis is seriously deficient, does not comply with the CFR requirements, and should therefore not be implemented.

Sprecklesville Lawsuit

This rule is being adopted for the sole purpose of settling a lawsuit and is in violation of the Hawaii Administrative Procedures Act, H.R.S. Chapter 91. On February 3, 1989, certain residents from Spreckelsville, Maui, filed a lawsuit in the Circuit Court of the Second Circuit, State of Hawaii. See Maui Air Traffic Association, Inc., et al. vs. Edward Y. Hirata, et al., Civil No. 89-0048(1) (herein "Sprecklesville Lawsuit").

In order to settle this lawsuit the State agreed to implement restrictions on Stage 2 aircraft and to, in effect, administratively adopt federal legislation restricting utilization of these aircraft. As enacted by Congress, the Airport Noise and Capacity Act of 1990 ("ANCA") exempts Hawaii from provisions phasing out the use of Stage 2 aircraft.

However, by Stipulation filed on September 20, 1991 in the Sprecklesville Lawsuit, the State and plaintiffs agreed to resolve the lawsuit on certain terms and conditions. Among other things, the State agreed to prepare a cost/benefit analysis and to, in effect, adopt this rule amending Chapter 19-28. As a consequence, the outcome of the cost/benefit analysis was a foregone conclusion and the analysis lacked objectivity.

Even prior to the preparation of the cost/benefit analysis, the DOT indicated publicly that the State would adopt the federal noise policy by implementing Stage 2 aircraft restrictions. This intent undermined any opportunity for meaningful analysis of alternatives to aircraft restrictions and rendered rule-making procedures moot and devoid of substance.

Even more perplexing is the fact that rather than allowing the flexibility contained in ANCA to phase out Stage 2 aircraft, the proposed rule specifically targets Aloha's night cargo service into Kahului. There is no "phase-in" of restrictions. From and after the implementation date (December 31, 1995), no Stage 2 aircraft may operate between 10 p.m. and 6 a.m. into Kahului. Such a sudden and precipitous prohibition on Stage 2 aircraft amounts to an unreasonable restraint on the flow of interstate commerce and is unconstitutional. Unlike the 48 contiguous states, Hawaii does not have alternative transportation systems like rail and highways between its counties.

Summary

In summary, the proposed amendment to Chapter 19-28 should not be implemented. The State has not complied with the notice and other procedural requirements set forth in 14 CFR section 161.203. The Cost/Benefits analysis prepared by the State is deficient and is not in accordance with CFR requirements. Finally and most significantly, enforcement of the proposed amendment would result in the loss of vital transportation services to the Island of Maui, which will have a substantial negative impact on the community.

If restrictions to Kahului are implemented, Stage 2 access restrictions at the State's other airports will follow in close succession. The effect of this noise restriction is thus statewide and not limited to Kahului. The ultimate statewide prohibition on Stage 2 aircraft at night will have dramatic impact to neighbor island communities, resulting in higher costs for goods to its consumers and reduced availability of products.

KAHULUI AIRPORT NOISE COMPATIBILITY PROGRAM
SUPPLEMENTAL INFORMATION PACKET

A "Sponsor Certification"

B Revised Figure 2-1 containing an inset showing Maui's relationship to the other islands in the Hawaiian chain.

C Map showing the boundaries of Maui Island's four districts.

D Copy of the runway data table from the Kahului Airport Layout Plan.

E An enlarged version of Figure 2-5.

F Clarification of terminology The term "single-family home" used in the first and third bullet items in Section 2.6.1 has the same meaning as the term "single-family residential" in Figure 2-6. The term "industrial in-fill development" in the second bullet item in Section 2.6.1 is equivalent to the term "manufacturing and storage" used in Figure 2-6.

G Copy of Figure 2-1 from the *Kahului Airport Master Plan* providing additional details concerning the airport facilities referenced in the text:

H Copy of Figure 6-2 from the *Kahului Airport Master Plan* providing additional details concerning the airport facilities referenced in the text.

I Table showing the general relationship between the routes discussed in Sections 3.2.1.1 through 3.2.1.4 and the flight tracks depicted in the figures.

J Replacement for pages 7-17 and 7-18 deleting text as requested by the FAA.

K Replacement for page 7-26 deleting text as requested by the FAA.

L A table summarizing elements of the recommended noise compatibility program

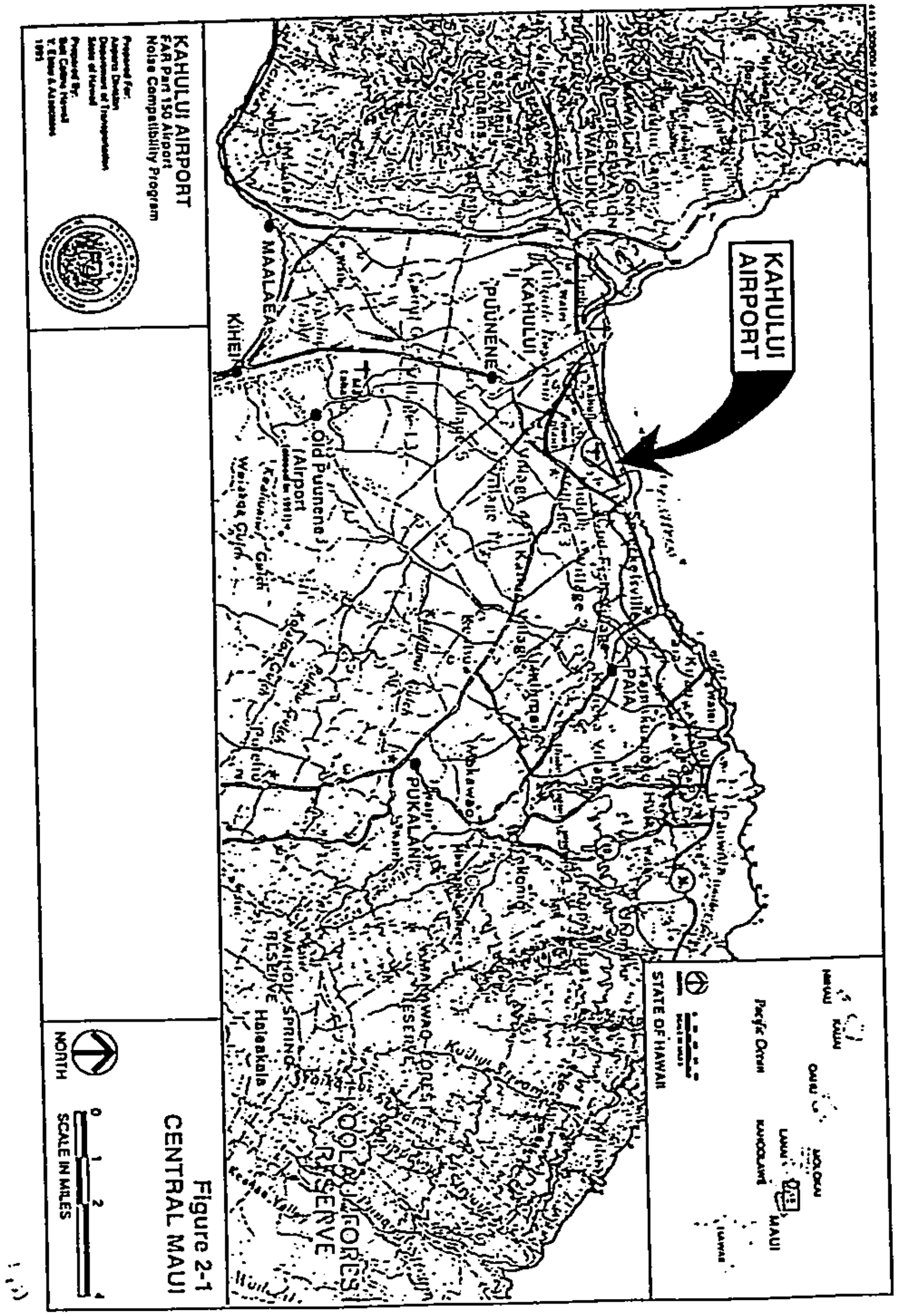


Figure 2-1
CENTRAL MAUI

SPONSOR CERTIFICATION

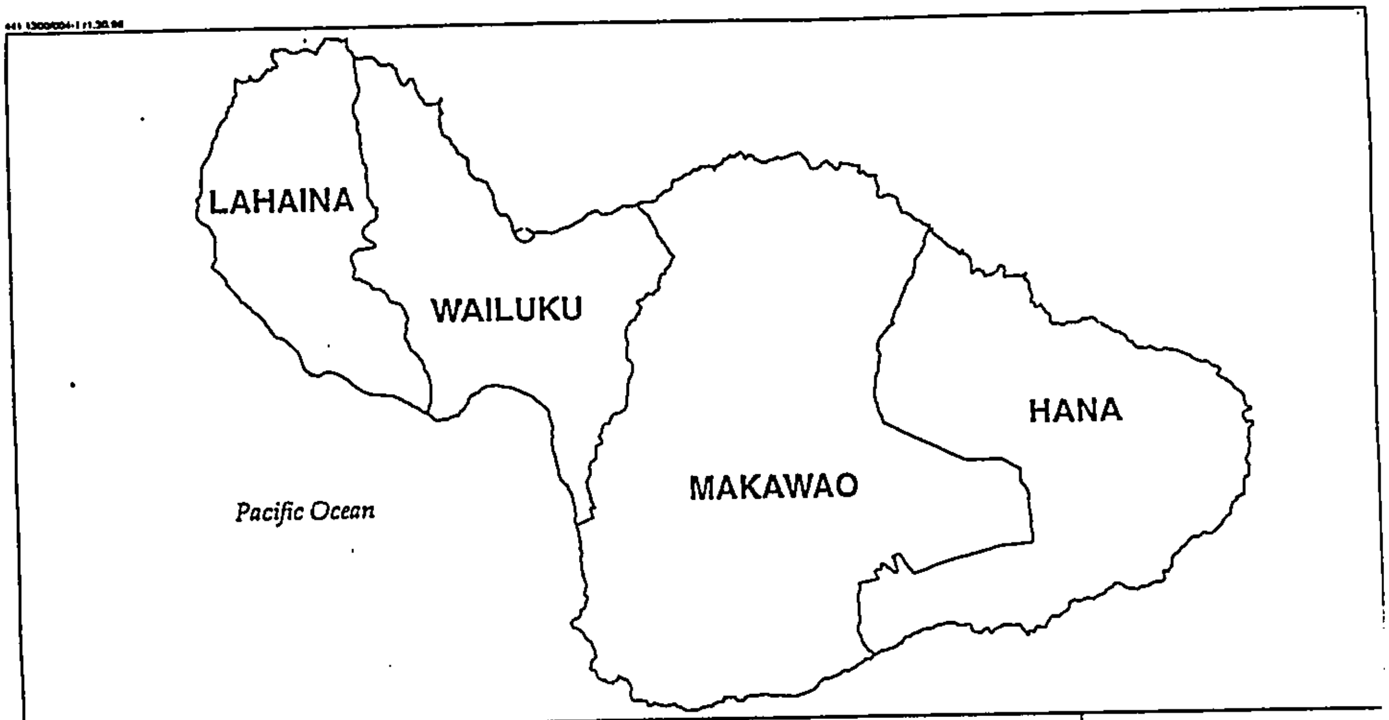
The Noise Compatibility Program for Kahului Airport, including all accompanying documentation, was prepared with the best available information and is hereby certified as true and complete to the best of my knowledge and belief. It is certified that this documentation is the official Noise Compatibility Program for Kahului Airport.

It is further certified that adequate opportunity has been afforded interested persons to submit their views, data, and comments concerning the correctness and adequacy of the Noise Compatibility Program, and the supporting documentation and forecasts.

2/28/96
Date of Signature

Owen Miyamoto
Airports Administrator
Department of Transportation
State of Hawaii

441 1300/004-1 11.30.96



KAHULUI AIRPORT
FAR Part 150 Airport
Noise Compatibility Program

Prepared For:
Airports Division
Department of Transportation
State of Hawaii

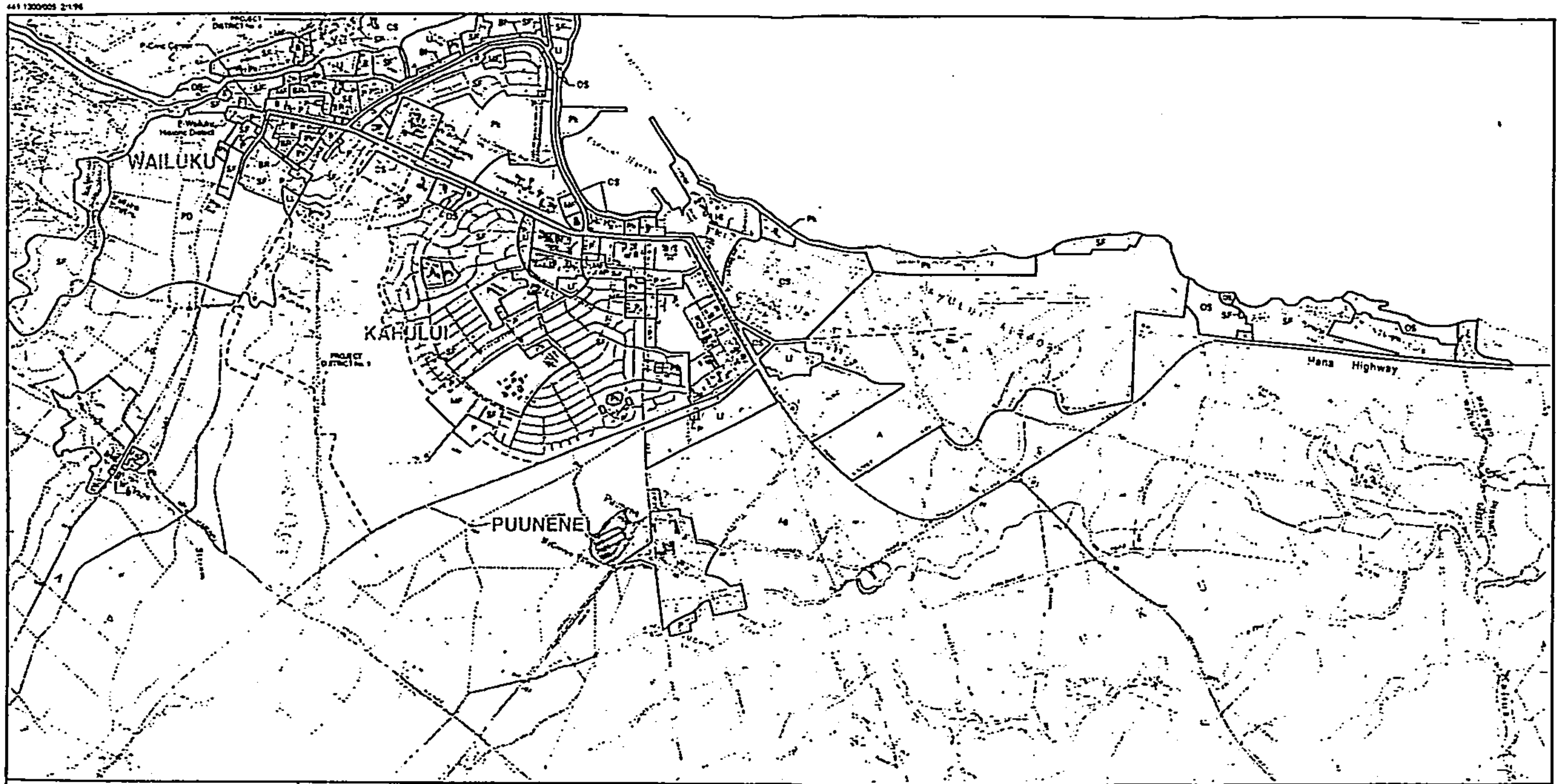
Prepared By:
Bob Collins Hawaii
Y. Ebisu & Associates
1995

Figure ?
MAUI DISTRICTS

RUNWAY PROTECTION ZONE DIMENSIONS		
	EXISTING	ULTIMATE
	L X IW X OW	L X IW X OW
2L	2,500' X 1,000' X 1,750'	SAME
20R	2,500' X 1,000' X 1,750'	SAME
5	1,700' X 500' X 1,010'	SAME
23	1,700' X 500' X 1,010'	SAME
2R		2,500' X 1'000' X 1,750'
20L		2,500' X 1'000' X 1,750'
L=LENGTH IW=INNER WIDTH OW=OUTER WIDTH		

RUNWAY DATA

RUNWAY		EXISTING 2L	EXISTING 20R	ULTIMATE 2L	ULTIMATE 20R	ULTIMATE 2R	ULTIMATE 20L	EXISTING 5	EXISTING 23	ULTIMATE 5	ULTIMATE 23
APPROACH SURFACES		50:1	50:1	50:1	50:1	50:1	50:1	34:1	34:1	34:1	34:1
RUNWAY SAFETY AREA		1,000'x400'	1,000'x400'	1,000'x500'	1,000'x500'	1,000'x500'	1,000'x500'	1,000'x370'	1,000'x370'	1,000'x500'	1,000'x500'
NAVIGATIONAL AIDS		ILS, MALSR, VASI	VASI	SAME	VASI, ODALS	ILS, MALSR, PAPI	PAPI	VASI, ODALS	NONE	SAME	PAPI
EFFECTIVE GRADIENT (%)		0.30		0.37		0.47		0.08		SAME	
WIND COVERAGE (13 KTS)		88.1%		SAME		94.1%		94.4%		SAME	
INSTRUMENT RUNWAY		YES		SAME		YES		NO		SAME	
RUNWAY LIGHTING		HIRL		SAME		HIRL		MIRL		SAME	
RUNWAY MARKING		PIR		SAME		PIR		NPIR		SAME	
RUNWAY ELEVATIONS		54'	13'	67'	SAME.	66'	48'	30'	18'	SAME	SAME
PAVEMENT STRENGTH (LBS)	SINGLE	130,000		SAME		130,000		130,000		SAME	
	DUAL	170,000		SAME		170,000		170,000		SAME	
	DUAL TANDEM	360,000		500,000		300,000		270,000		SAME	
	DC-10-30	480,000		600,000		600,000		N/A		N/A	
	DOUBLE DUAL TANDEM	530,000		900,000		900,000		N/A		N/A	



KAHULUI AIRPORT
FAR Part 150 Airport
Noise Compatibility Program

Prepared For:
Airports Division
Department of Transportation
State of Hawaii

Prepared By:
Belt Collins Hawaii
Y. Ebisu & Associates
1995

LEGEND

Ag	Agriculture	BR	Business/Multi-Family	P	Public/Quasi-Public		
R	Rural	BI	Business/Industrial	Pk	Park		
SF	Single Family Residential	LI	Light Industrial	OS	Open Space		
MF	Multi-Family Residential	HI	Heavy Industrial	PD	Project District		
B	Business/Commercial	H	Hotel	A	Airport		

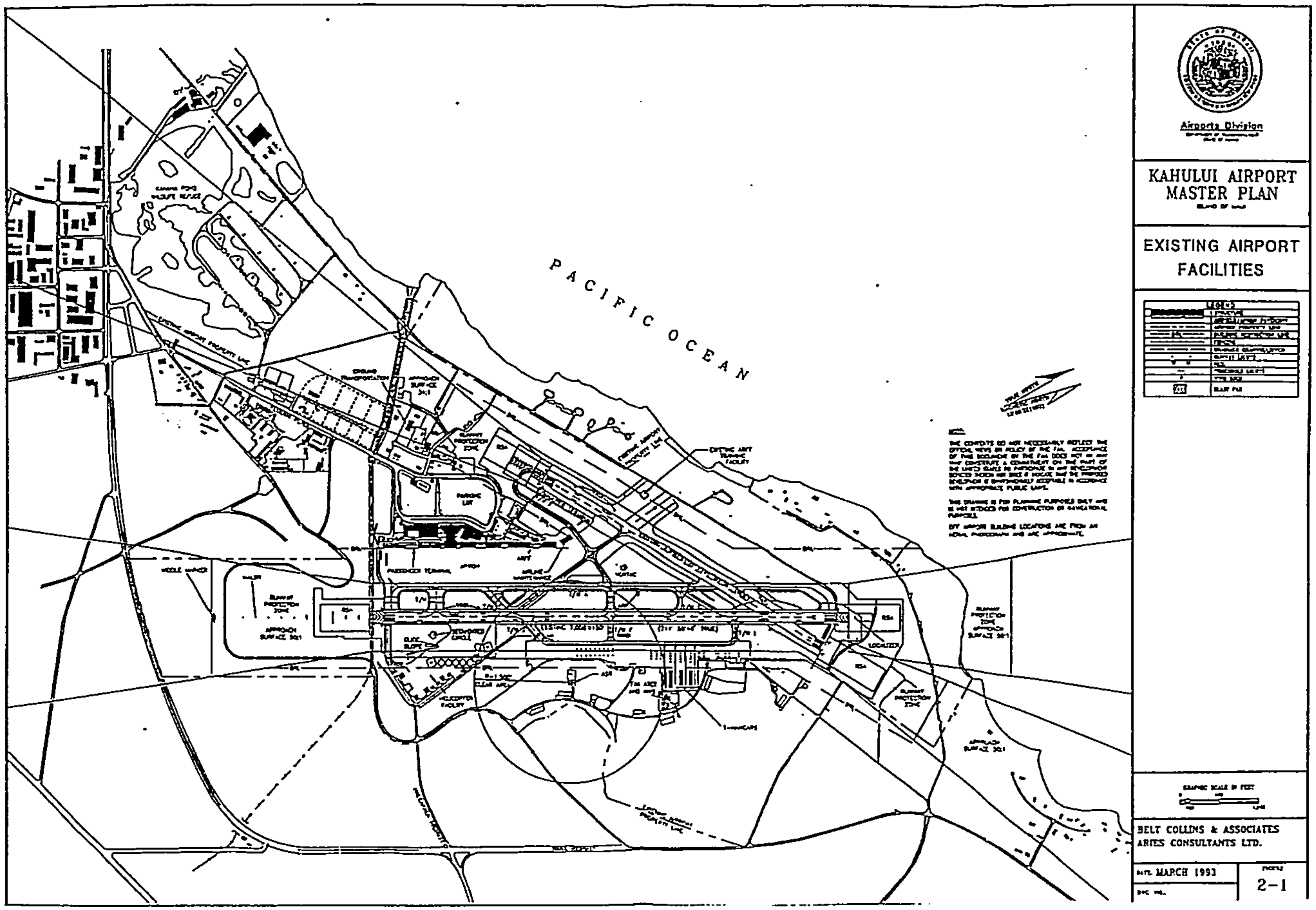
Figure 2-5
WAILUKU-KAHULUI COMMUNITY PLAN

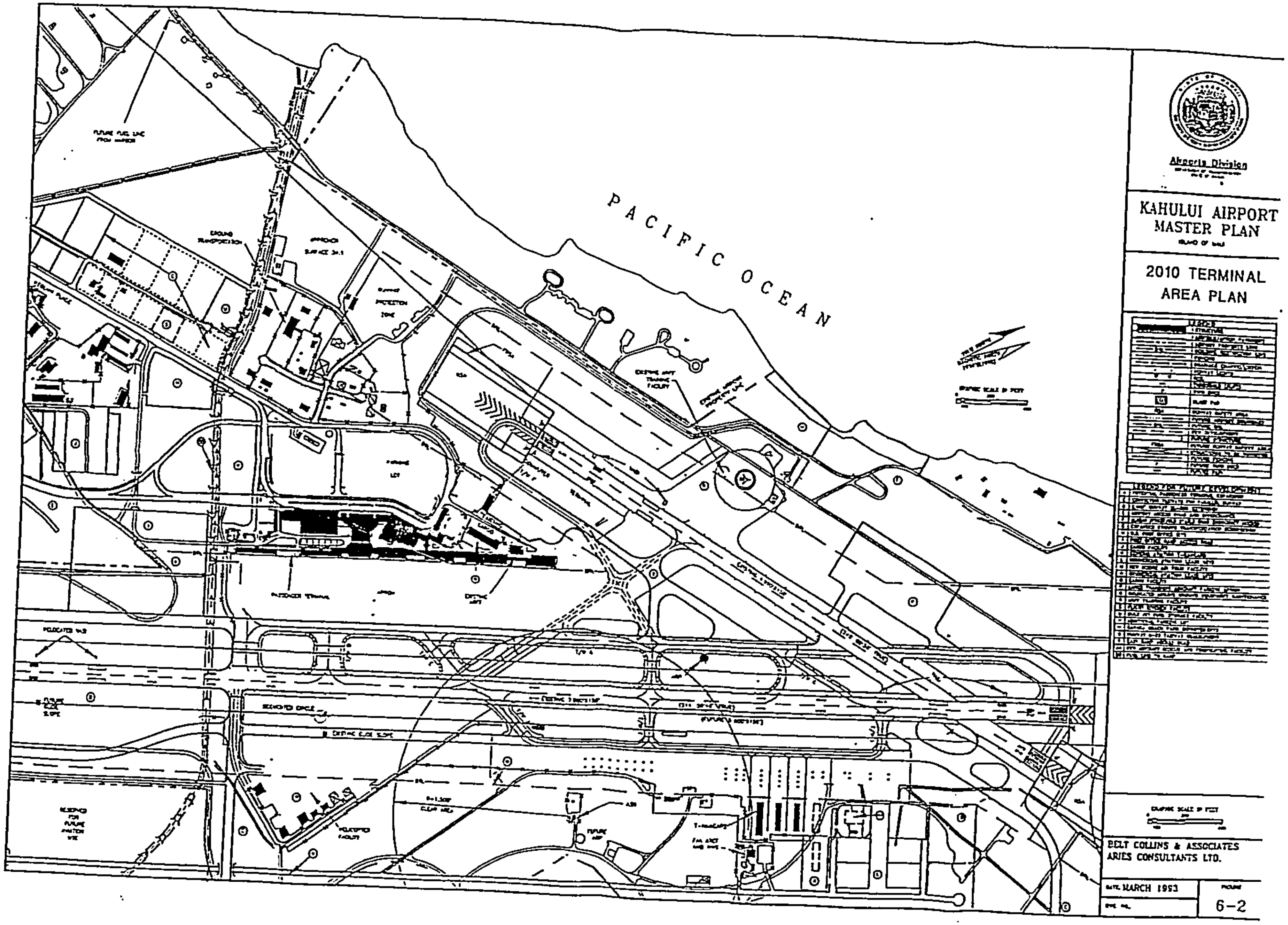
NORTH

0 1600 3200 6400
SCALE IN FEET

ATTACHMENT F

The term "single-family home" used in the first and third bullet items in Section 2.6.1 has the same meaning as the term "single-family residential" in Figure 2-6. The term "industrial in-fill development" in the second bullet item in Section 2.6.1 is shown as "manufacturing and storage" on Figure 2-6.


PACIFIC OCEAN
Airports Division
KAHULUI AIRPORT
MASTER PLAN
EXISTING AIRPORT
FACILITIES
LEGEND
BELT COLLINS & ASSOCIATES
ARIES CONSULTANTS LTD.
MARCH 1993
2-1


PACIFIC OCEAN
Airports Division
KAHULUI AIRPORT
MASTER PLAN
2010 TERMINAL
AREA PLAN
PASSENGER TERMINAL
BELT COLLINS & ASSOCIATES
ARIES CONSULTANTS LTD.
MARCH 1993
6-2

CORRELATION OF REGIONAL ARRIVAL DEPARTURE ROUTES WITH INDIVIDUAL FLIGHT TRACKS: KAHULUI AIRPORT.

ARRIVALS	TR1R	TR2	TR3	TR4	TR6	TR7	TR8	TR9	TR10	TR11	TR12	TR13	TR15	TR16	TR17	TR18	TR20	TR21	TR22	TR23	TR24	TR28	TR29	TR31	TR32	TR33	TR34
Tradewind																											
HNL-LNY-CAMPS1-OGG																						X			X		
ITO-MAKEN-CAMPS1-OGG														X	X					X							
KOA-MAKEN-OGG	X														X						X						
Mainland-OGG													X														
MKK-V2-OGG																X		X	X								
Kona Wind																											
HNL-BLUSH-OGG																	X									X	X
ITO-BARBY-OGG	X																				X						X
KOA-BARBY-OGG	X																				X						X
Mainland-OGG	X																										
DEPARTURES																											
Trade Wind																											
OGG-V6-BLUSH-V8-MKK-HNL				X							X	X															
OGG-LNY-JULLE4-HNL					X	X	X																X				
OGG-OPANA1-BARBY-V22-BONUS-V21-PUMIC-ITO		X	X							X																	
OGG-OPANA1-BARBY-V22-VECKIS-KOA		X	X							X																	
OGG-BEACH1-LNY					X	X	X																				
OGG-BEACH1-HARPO-KOA/ITO						X	X																				
OGG-North America		X																									
Kona Wind																											
OGG-BEACH1-LNY-HNL									X			X											X				
OGG-BEACH1-HARPO-V21-PUMIC-ITO																								X			
OGG-BEACH1-HARPO-V5-KOA																								X			
OGG-Mainland								X																			

Note: Localized flight tracks used in training and helicopters are not included in this table

7.2.6.3 Maximize North Flow Routing of Arrivals Under Trade Wind Conditions

This change was implemented by the FAA in 1989 and will remain in effect for the foreseeable future. Except during conditions of high turbulence along the south central shore of Maui, overflights of Wailuku and Kahului by arriving interisland jet aircraft have been eliminated during approaches to Runway 2. This straight-in approach to Runway 2 should be identified as a noise abatement route in the Runway Use Program for Kahului Airport.

7.2.7 Limitations or Restrictions On Type Or Class Of Aircraft Based on Aircraft Noise Levels

7.2.7.1 Introduction

A variety of possible restrictions on aircraft activity based on the noisiness of the aircraft were formulated and evaluated. These included:

- denial of use of the airport to classes of aircraft which do not meet federal noise standards, i.e., imposition of the same Stage 2 aircraft phase-out requirement already applicable to airports on the Mainland (Option T5, see Section 7.2.7.2);
- complete elimination of Stage 2 aircraft (Options T1 and T2, see Section 7.2.7.3);
- capacity limitations based on the relative noisiness of different types or classes of aircraft (see Section 7.2.7.7);
- differential landing fees based on FAA certificated or estimated noise emission levels or on time of arrival (see Section 7.2.7.7); and
- partial or complete curfews, e.g., limitations on the use of Stage 2 aircraft based on the time of day (Options T3, T4, T9, T10, and T11, see Sections 7.2.7.4 and 7.2.7.5).

Background information concerning aircraft mix and scheduling that is important to the discussion is provided below. The specific economic and legal implications of the various alternatives are highlighted in the discussion of each alternative.

The Hawaii State Department of Transportation would be responsible for implementing restrictions in this category, and an important consideration that could affect all of the options is the extent to which the establishment of noise regulations applicable only to Kahului Airport which are more restrictive than those in effect at other airports within the Airports Division's statewide system may run afoul of non-discrimination provisions of the law.

Since the two interisland air carriers that use turbojet aircraft (Aloha Airlines and Hawaiian Airlines) operate virtually all of the Stage 2 aircraft likely to operate at the Airport, the analysis focuses on the implications that the various alternatives would have on their operations. Two characteristics of their operations are particularly important: 1) the mix of Stage 2 and Stage 3 aircraft that they fly and 2) the extent to which they operate these aircraft during nighttime hours where the Ldn "10 dB noise penalty" is in effect.

Aircraft Mix. At present, approximately 75 percent of Aloha's interisland fleet consists of Stage 2 aircraft, the remainder (including two of the "Quick Change" passenger-cargo aircraft that it uses for its night cargo operations) consists of Stage 3 aircraft. Aloha Airlines estimates that its 1998 Stage 2/Stage 3 split will be as follows:

Aircraft Type	Stage	1993 Fleet Mix		1998 Fleet Mix	
		Number of A/C	Percent of Fleet	Number of A/C	Percent of Fleet
B-737-200 pax	2	9	56.3	5	27.8
B-737-200 QC[3]	2	3	18.7	2	11.1
Stage 2 Subtotal		12	75.0	7	38.9
B-737-300 pax	3	0	0.0	7	38.9
B-737-300 QC[3]	3	2	12.5	4	0.2
B-737-400 pax	3	2	12.5	0	0.0
Stage 3 Subtotal		4	25.0	11	61.1
GRAND TOTAL		16	100.0	18	100.0

Source: King (December 13, 1994)

[3] The "QC" stands for "Quick Change." It refers to the ability to quickly change their configuration from passenger mode (with rows of seats) to cargo mode (with tie-downs for standard air cargo pallets).

the extensive testimony which has been given during hearings on the State's proposed amendment to Chapter 19-28 of Hawaii Administrative Rules, the nature of the cargo (which includes perishable and time-sensitive items such as bread, newspapers, mail, cut flowers, etc.) is such that many of the existing customers would not be as well served by an all-daytime schedule. Moreover, since the all-cargo carriers that were historically in the market have not been able to compete with the nighttime jet cargo service in terms of price and quality of service, elimination of the night cargo flights would almost certainly lead to increased interisland shipping costs, as well as to a decrease in the frequency and speed of service. This would have a clear, but unquantifiable, adverse effect on Maui businesses and residents.

Other Considerations. Kahului Airport is the only airport on Maui that is capable of handling interisland air carrier jet and other high performance aircraft. It is also the only one that is fully equipped and approved for night and foul-weather operations.

Conclusion. This alternative would completely eliminate nighttime annoyance produced by noise from aircraft operations. However, most of the uses that would be incompatible under the "no-mitigation" scenario would remain in the incompatible range despite the 1 to 3 Ldn reduction in average day-night noise levels produced by this alternative. Only those homes which are on the fringe of the incompatible area would be made fully compatible by this measure. Additional measures that have the potential to reduce noise by a further 10 to 15 dB would be required in addition to the nighttime curfew to address the remaining land use incompatibilities at Spreckelsville. Consequently, this alternative is not part of the recommended noise program.

7.2.7.5 Prohibit Nighttime Use By Stage 2 Aircraft (Options T3, T4, and T11)

Bases of the Alternatives. The noise reduction benefits of prohibiting all Stage 2 aircraft operations between 10:00 PM and 7:00 AM were also evaluated. Both these alternatives would eliminate nighttime operations by the noisiest aircraft during the most noise-sensitive period. Option T3 assumed that the same number of nighttime operations would continue to be made, but that the aircraft making them would all be Stage 3 (B-737-300 and DC-9-50 with hush kits). Option T11 assumed T4 assumed that the operations would be shifted from the night to the day. Option T11 assumed that the restriction on Stage 2 aircraft would end at 6:00 AM. By stopping the prohibition on

SUMMARY OF RECOMMENDED NOISE COMPATIBILITY PROGRAM: KAHULUI AIRPORT

Measure	Direct Cost to Airport or Government	Direct Cost to Users	Timing	Lead Responsibility	Potential Funding Sources
NOISE ABATEMENT ELEMENT					
Continue to explore 10 pm to 6 am curfew on Stage 2 aircraft	$50,000	None	Ongoing	State DOTA	State Airports Div. Operating Budget
Prepare modified runway use program	$10,000	None	1996-97	State DOTA	State Airports Div. Operating Budget
Modify informal runway use program	No Additional	None	1996-97	State DOTA & FAA	State Airports Div. Operating Budget
NOISE MITIGATION ELEMENT					
Negotiate purchase of homes within 75 DNL contours	$13,700,000	None	1996-2000	State DOTA	Airport capital budget (10%) FAA (90%)
Soundproof homes between 75 and 60 DNL contours	$2,000,000	None	1996-2000	State DOTA	Airport capital budget (10%) FAA (90%)
PROGRAM MANAGEMENT ELEMENT					
Continue monitoring and commenting on development proposals in the Airport environs	No additional	None	Ongoing	State DOTA	State Airports Div. Operating Budget
Design, install, and operate a noise monitoring system at Kahului Airport	$350,000	None	1996-1998	State DOTA	State Airports Div. Operating Budget
Annually monitor aircraft noise levels and operations and conduct public information meeting	$10,000	None	Ongoing	State DOTA	State Airports Div. Operating Budget

APPENDIX P

2020 TRAFFIC ANALYSIS AND RELATED STUDIES

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2020 Traffic Analysis and Related Studies

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YEAR 2020 TRAFFIC ASSESSMENT OF KAHULUI AIRPORT ACCESS ROAD

Prepared for

Edward K. Noda and Associates

by

VISA

December, 1995

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EXECUTIVE SUMMARY

The State of Hawaii Department of Transportation (State DOT) plans to construct a number of modifications at Kahului Airport in order to improve operations at the facility. These proposed modifications, herein referred to as the "Preferred Plan" or "Airport Project", include major changes to the roadway system adjacent to and within the Airport, as well as new or expanded airfield and terminal facilities. As part of the environmental analysis process, an assessment has previously been made of the traffic impacts of the Airport Project, and project alternatives, for Year 2010, the horizon year for the Airport Master Plan.

This Year 2020 traffic study augments the analysis made in the preceding study of Year 2010 traffic impacts. The purpose of this 2020 study is twofold:

1. The primary purpose is to assess the need for and cost-effectiveness of the proposed interchange at the junction of the proposed Airport Access Road with Hana Highway. This includes an assessment of an at-grade intersection and alternative types of interchanges at the junction of the two roadways.

2. As a secondary purpose, the study assesses the capability of the proposed roadway modifications in the Airport area to accommodate traffic demands through Year 2020.

PROJECT DESCRIPTIONS

The Preferred Plan includes a number of modifications to the roadway system in the Airport area. The key changes include:

- Construction of a new Airport Access Road to provide access to the West Ramp passenger terminal area.
- Construction of a partial cloverleaf interchange at the junction of the new Airport Access Road with Hana Highway, with loop ramps provided for the Hana-to-Lahaina and Wailuku-to-Airport movements.
- Closure of the section of Haleakala Highway through the Airport.
- Construction of a new Spine Road to serve the East Ramp general aviation area.
- Relocation of the Pulehu and Hansen Road connections with Hana Highway to a single intersection, opposite the Spine Road connection.

The Airport modifications also include several changes that would affect ground traffic demands:

- Extension of the primary runway could facilitate takeoffs for direct overseas flights to additional destinations and increase airport traffic to the West Ramp area.
- Relocation of helicopter facilities from the Airport could reduce airport traffic to the East Ramp area.

With these modifications, Kahului Airport is forecast to accommodate 9,712,000 interisland and overseas air passengers in Year 2020. This compares to 5,748,600 air passengers in 1994 and 7,988,000 estimated air passengers in 2010.

METHODOLOGY FOR TRAFFIC FORECASTS

The ground traffic forecasts were developed from the Year 2020 traffic forecasts prepared by the *Maui Long-Range Islandwide Land Transportation Planning Study*. The 2020 traffic forecasts select the following overall levels of growth between 1990 and 2020 for the Island of Maui:

- Population: .... +61%
- Employment: .... +61%
- Hotel Rooms: .... +23%
- Weekday Vehicle Trips: ..... +66%

Except for employment, the Year 2020 forecasts are lower than the previous forecasts for Year 2010. As a result, present forecasts are for an average increase in weekday traffic of 1.7 percent per year between 1990 and 2020, versus the previous forecast of 3.5 percent per year between 1987 and 2010.

The Statewide Transportation Planning Office of the State DOT provided a set of the Year 2020 Island-Wide Study traffic assignments for use in the Airport traffic studies. These traffic assignments were for the baseline (minimum) future roadway system consisting of existing roadways and the small number of planned roadway projects that are included in current funding plans, which includes the Airport Access Road.

For the Preferred Plan, the Island-Wide Study traffic assignments were refined to provide the level of detail needed for the analysis of the planned Airport area roadway system. The Island-Wide Study, by virtue of its larger scale of analysis, results in traffic assignments that may not fully reflect localized traffic patterns at the community level, and existing traffic counts and traffic impact studies for planned developments were used to refine movements at specific intersections.

For the No Action Scenario, the Preferred Plan traffic assignments were modified as follows:

- Airport West Ramp traffic was reduced to reflect the 3.3 percent fewer air passengers anticipated without the runway extension, based on the assumption that the same relationship between "Project" and "No Project" air passengers would exist in both 2010 and 2020.

- Airport East Ramp traffic was increased to reflect the continuation of helicopter operations.
- Roadway traffic assignments were modified to reflect the absence of the planned Airport roadway modifications, including the deletion of the Airport Access Road.

The roadway traffic forecasts used in this study are for an "average weekday", as compared to the "design day" forecasts used in the 2010 study. The "average weekday" forecasts are needed for input to the financial feasibility analysis conducted during this study. The "average weekday" forecasts are approximately 4.7 percent lower than those for the "design day."

AIRPORT TRAFFIC GENERATIOII

The estimated numbers of weekday vehicle trips to or from Kahului Airport in Year 2020 are as follows:

	With Airport Project	Without Airport Project (No Action)
Daily	33,100	33,450
Morning Peak Hour	2,167	2,225
Afternoon Peak Hour	2,404	2,541

The estimated vehicle trips to or from the Airport is slightly higher for the "No Action" Scenario than with the Airport Project, since the relocation of helicopter operations away from the Airport would eliminate more trips than the estimated increase in air passenger-related trips with the Airport Project runway extension.

SUFFICIENCY OF PROPOSED AIRPORT ROADWAY MODIFICATIONS

The Year 2020 assessment presented herein is based on the forecast of "average weekday" traffic, versus the use of "design day" for the previous Year 2010 assessment. Traffic volumes on the "design day" are estimated to be about 4.7 percent higher than those for an "average weekday". Therefore, a traffic signal-controlled intersection with average weekday traffic volumes equalling or exceeding 96 percent of capacity (volume-to-capacity (V/C) of 0.96 or greater) would be expected to have "design day" traffic volumes in excess of capacity (V/C of greater than 1.00) and thus, indicate inadequate capacity to accommodate the forecast 2020 traffic volumes.

The level-of-service (LOS) presented for traffic signal-controlled intersections reflects average delay time per vehicle, and is not directly correlated to the V/C. Generally, intersections with LOS E or F conditions warrant consideration of mitigative actions.

Table 1
(Page 1 of 2)
LEVELS-OF-SERVICE AT KEY INTERSECTIONS
PREFERRED PLAN YEAR 2020 AVERAGE WEEKDAY
Year 2020 Traffic Assessment of Kahului Airport Access Road

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
5	Haleakala Hwy.	Hana Hwy. (West Jct.)	1994 2020 NA 2020 PP		-213 -337 -231	F F F		173 -271 -140	D F F
6	Dairy Rd.-Keolani Pl.	Haleakala Hwy.	1994 2020 NA 2020 PP	 0.61 0.25	177	D C C	 0.86 0.41	-58	F D D
7	Dairy Rd.	Hana Hwy.	1994 2020 NA 2020 PP	0.71 1.10 0.93		C F D	1.02 1.22 0.89		E F E
8	Dairy Rd.-Kuihelani Hwy. Airport Access Rd.	Puunene Ave. Puunene Ave.	1994 2020 NA 2020 PP	0.86 1.09 1.09		D E/F E/F	0.81 1.03 1.00		E F F
10	Pulehu Rd.	Hansen Rd.	1994 2020 NA 2020 PP		389 194 216	B D C		358 149 221	B D C
12	Haleakala Hwy.	Hana Hwy. (Pukalani Jct.)	1994 2020 NA 2020 PP	0.91 1.34 1.26		E F C	0.58 0.94 0.66		C E B

The level-of-service for STOP and YIELD sign-controlled intersections is based on reserve capacity and reflects average delays to vehicles controlled by the STOP or YIELD conditions. LOS F conditions warrant consideration of mitigative actions, which most likely would be the installation of traffic signal controls.

The conditions at the key intersections affected by the planned Airport roadway modifications are summarized in Table 1. Existing (1994) and 2020 No Action conditions are included for comparison.

Traffic Conditions with No Action

Without the Airport Project, the forecast traffic increases would result in introducing or worsening congestion at several locations. At traffic signal-controlled intersections, forecast volumes would exceed capacity at:

- The Hana Highway-Dairy Road intersection during both peak hours;
- The Dairy Road-Kuihelani Highway-Puunene Avenue intersection during both peak hours; and
- The Hana Highway-Haleakala Highway intersection during the morning peak hour.

Very long delays (LOS F) would occur for traffic waiting at STOP or YIELD controls for:

- The left-turn from eastbound Hana Highway to Haleakala Highway (West Junction) during both peak hours; and
- The left- and/or right-turns from both Pulehu and Hansen Roads onto Hana Highway during both peak hours.

Traffic Conditions with Preferred Plan

The roadway modifications included in the Preferred Plan would improve conditions at most traffic-signal controlled intersections as compared to the conditions with No Action. However, the projected Year 2020 peak hour traffic would exceed planned capacity at several of the intersections:

- At the Hana Highway intersection with Haleakala Highway (Pukalani Junction), the closure of the north (Airport) leg of the intersection would improve conditions, but morning peak hour volumes would still exceed capacity.
- At the Airport Access Road (present Dairy Road) intersection with Puunene Avenue and Kuihelani Highway, traffic volumes would exceed capacity during both peak hours.
- At the new Airport Access Road intersection with Dairy Road, afternoon peak hour traffic volumes would exceed the planned capacity.

Table 1
(Page 2 of 2)
LEVELS-OF-SERVICE AT KEY INTERSECTIONS
PREFERRED PLAN YEAR 2020 AVERAGE WEEKDAY
Year 2020 Traffic Assessment of Kahului Airport Access Road

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
9	Pulehu Rd.	Hana Hwy.	1994 2020 NA		227 -36	C F		12 -6	E F
11	Hansen Rd.	Hana Hwy.	1994 2020 NA		121 -201	D F		-16 -66	F F
14	Hansen - Spine Rd.	Hana Hwy.	2020 PP		-78	F		-41	F
15	Airport Access Rd.	Dairy Rd.	2020 PP	0.89		D	1.06		E
16	Airport Access Rd.	Hana Hwy. EB On-Ramp	2020 PP		341	B		260	C
17	Airport Access Rd	Hana Hwy. WB On-Ramp	2020 PP		446	A		210	C

1994 = Existing Conditions (Year 1994)
2020 NA = No Action Alternative (Year 2020)
2020 PP = Preferred Plan (Year 2020)
V/C = Ratio of traffic volumes to estimated capacity for signalized intersection.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service

Wilbur Smith Associates; March 1996

T-23/502b

For STOP or YIELD-controlled movements, LOS F conditions are anticipated at several intersections:

- For the left-turn from eastbound Hana Highway onto Haleakala Highway (West Junction), the diversion of some airport traffic to the new Airport Access Road would reduce delays, but conditions would remain at LOS F.

- At the relocated intersection of Hansen Road with the Airport Spine Road and Hana Highway, traffic turning left from the cross streets would experience very long delays (LOS F).

Analysis of traffic conditions for the ramps at the Airport Access Road-Hana Highway interchange indicate LOS E or F conditions at the terminus of several ramps:

- During the morning peak hour, LOS F conditions would occur for both the traffic exiting westbound Hana Highway onto the off-ramps and the traffic in the adjacent through lanes.

- During the afternoon peak hour, LOS E conditions would occur for traffic entering eastbound Hana Highway from the on-ramp.

Mitigation Actions for Preferred Plan

At several locations, the roadway capacities with the planned airport roadway modifications are expected to be insufficient to accommodate 2020 traffic based on the Committed Highway System for Maui. Potential roadway modifications for consideration in improving conditions at these locations are as follows:

Hana Highway Intersection with Haleakala Highway (Pukalani Junction)

- Provide three left-turn lanes from northbound Haleakala Highway; or
- Provide a flyover ramp from northbound Haleakala Highway to westbound Hana Highway; or
- Construct a new bypass roadway from Upcountry Maui to Central or South Maui to divert traffic from this route.

Airport Access Road Intersection with Dairy Road

- Provide second (double) left-turn lane on northbound Airport Access Road.

Hana Highway Intersection with Hansen/Airport Spine Road

- Install traffic signal controls, and
- Either construct an Upcountry Maui-Central Maui route as a bypass to reduce Hana Highway traffic, or widen this segment of Hana Highway to six lanes.

Airport Access Road Intersection with Kuihelani Highway and Puunene Avenue

- Add a second left-turn lane on eastbound Puunene Avenue, and
- Add right-turn lanes on southbound Airport Access Road and northbound Kuihelani Highway.

Hana Highway Intersection with Haleakala Highway (West Junction)

- Install traffic signal controls.

Airport Interchange Ramps

- For westbound off-ramps, either provide more separation between ramp entrances, or provide auxiliary lane.
- For eastbound on-ramp, provide auxiliary lane to facilitate merging maneuver.

ASSESSMENT OF INTERCHANGE ALTERNATIVES

The principal element of the planned roadway modifications for Kahului Airport is the construction of a new Airport Access Road, with a grade-separated interchange at Hana Highway, to improve access to the West Ramp passenger terminal complex. The Preferred Plan calls for a partial cloverleaf-type interchange with two loop ramps. Preliminary engineering design has been completed for this interchange and right-of-way has been obtained to accommodate the proposed interchange layout.

Federal funds are being sought for construction of the Airport Access Road and Airport Interchange project. This study assesses the need for and economic feasibility of the proposed interchange as part of the Airport Access Road project.

Consideration of an At-Grade Intersection

Both Hana Highway and the Airport Access Road are planned as four-lane divided highways. An assessment was made of peak hour traffic conditions with Year 2020 average weekday traffic volumes. Each roadway approach was assumed to have separate left-turn and right-turn lanes. Because of the large volume of turning traffic, the westbound approach was assumed to have two (double) left-turn lanes, and the northbound approach was assumed to have two (double) right-turn lanes.

With the four-lane highways, the forecast Year 2020 average weekday traffic would exceed intersection capacity by 11 (V/C 1.11) and 18 (V/C 1.18) percent for the morning and afternoon peak hours, respectively.

Hana Highway would have to be widened to six lanes to provide sufficient capacity for the estimated 2020 average weekday peak hour traffic volumes. This would result in volume-to-capacity ratios of V/C 0.89 and 0.91 for average weekday morning and afternoon peak hours, respectively. Year 2020 design day volumes would approach capacity of the intersection.

Alternatively, Year 2020 traffic volumes would have to be 25 percent or more below the forecast volumes to provide acceptable traffic conditions with the at-grade intersection. Expanded use of travel demand management (TDM) measures (to increase carpool and public transportation use, or to reduce travel in the peak hours) would not likely be able to provide such lower traffic levels.

Development of Interchange Alternatives

A broad range of interchange configurations was identified as alternatives to the proposed two-loop cloverleaf interchange. These alternatives, and the proposed interchange, are depicted in Figure 1.

The interchange alternatives were developed to provide a range of options varying from lower-cost/lower service types to higher-cost/higher service types, and to generally reflect the forecast traffic volumes for the various movements.

Assessment of Interchange Alternatives

The six interchange configurations were evaluated relative to traffic and operational considerations, right-of-way requirements, costs, and construction impacts. Table 2 provides a summary comparison of the interchanges for several key factors. Key features of each include the following:

- **Proposed Partial Cloverleaf:**
  - Requires no traffic signals on Airport Access Road for 2020 traffic;
  - Moderately low cost of $24.9 million; and
  - Least construction impact to Hana Highway traffic.
- **Conventional Diamond Interchange:**
  - Least convenient for the high-volume Hana-to-Lahaina movement;
  - Requires two traffic signals on Airport Access Road;
  - Lowest cost ($21.3 million); and
  - Most compatible with accommodating bicycle travel along Hana Highway and Airport Access Road.
- **Single Point Diamond Interchange:**
  - Requires additional rights-of-way from Kahului Industrial Park;
  - Worst construction impacts to Hana Highway traffic; and
  - Non-standard configuration for Hawaii.
- **Single Loop Cloverleaf Interchange:**
  - Deletion of southeast quadrant loop ramp saves $1.1 million over proposed two-loop cloverleaf; and
  - Deletion of loop ramp results in need for traffic signal on Airport Access Road.
- **Full Cloverleaf Interchange:**
  - Requires no traffic signals on Airport Access Road;
  - Requires substantial amount of right-of-way acquisition from Kahului Industrial Park;
  - Highest cost; and
  - Least construction impacts to Hana Highway.

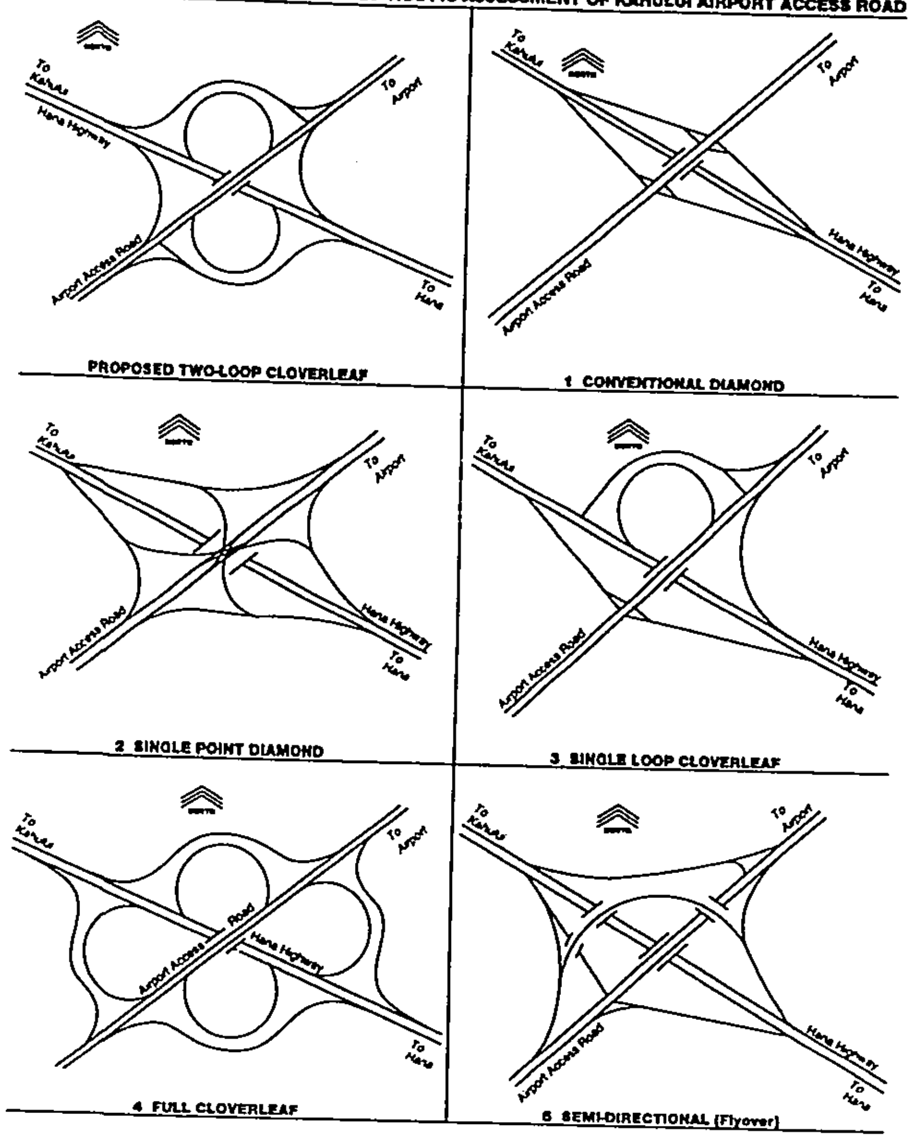

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Figure 1
PROPOSED AND ALTERNATIVE INTERCHANGE CONFIGURATIONS
HANA HIGHWAY AT AIRPORT ACCESS ROAD

CORRECTION

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

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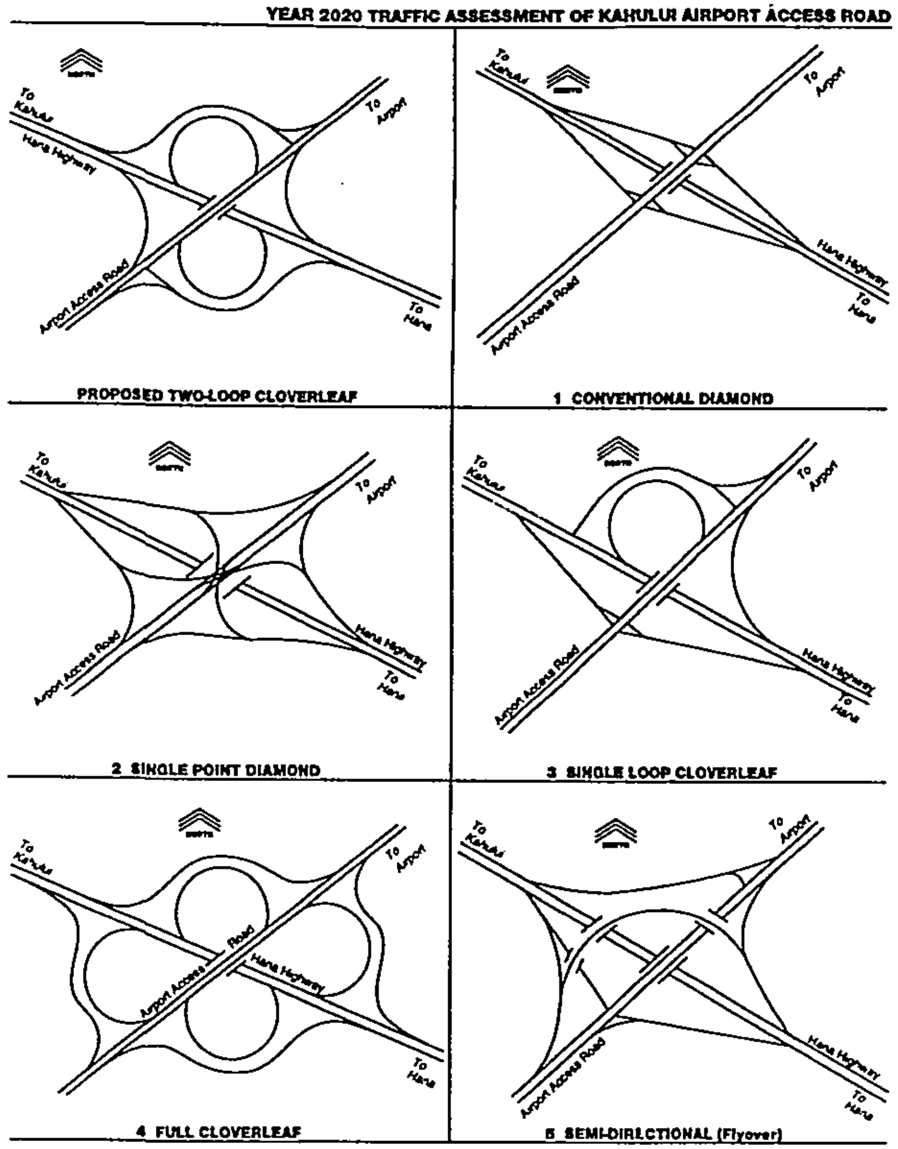
- **Single Loop Cloverleaf Interchange:**
  - Deletion of southeast quadrant loop ramp saves $1.1 million over proposed two-loop cloverleaf; and
  - Deletion of loop ramp results in need for traffic signal on Airport Access Road.
- **Full Cloverleaf Interchange:**
  - Requires no traffic signals on Airport Access Road;
  - Requires substantial amount of right-of-way acquisition from Kahului Industrial Park;
  - Highest cost; and
  - Least construction impacts to Hana Highway.



WSA WILBUR SMITH ASSOCIATES

Figure 1
PROPOSED AND ALTERNATIVE INTERCHANGE CONFIGURATIONS
HANA HIGHWAY AT AIRPORT ACCESS ROAD

- **Semi-Directional Interchange (Flyover):**
  - Most convenient for the high-volume Hana-to-Lahaina movement;
  - Requires substantial amount of right-of-way acquisition from Kahului Industrial Park; and
  - High construction costs.

Based on the assessment, the proposed Two-Loop Partial Cloverleaf Interchange and the Conventional Diamond Interchange were selected for further detailed analysis of economic feasibility. The Two-Loop Cloverleaf was selected because: it is included in the current plans; design plans are near completion; and right-of-way is already acquired. The Two-Loop Cloverleaf represents a lower-cost option that is well suited to the forecast traffic volumes. The Conventional Diamond was selected because it is the lowest cost option, and should provide adequate, though not optimal, service to the forecast volumes.

ECONOMIC EVALUATION OF THE AIRPORT INTERCHANGE

A benefit-cost analysis was made for the development of either the proposed Two-Loop Partial Cloverleaf or the Conventional Diamond Interchange at the junction of Hana Highway and the Airport Access Road. The analysis estimates the economic value of various user benefits that would accrue from each interchange, as compared to an at-grade intersection, and then compares these benefits to the incremental increase in project costs over those for the at-grade intersection to determine if the interchange project would provide a net positive return for the increased investment costs.

Benefit-Cost Methodology

The benefit-cost analysis compares the overall economic benefits to the costs needed to create these benefits over the major "life cycle" of the project. The assessment of benefits for the interchange project addresses the direct transportation efficiency improvements over an at-grade intersection. These include:

- The estimated value of travel time savings
- Estimated vehicle operating cost savings
- The estimated value of accident reductions.

Project costs encompass the costs of building the facilities, as well as future costs to maintain the facilities.

The assumptions and methodology used in this analysis are presented in Chapter 7. Key aspects include the following:

- The analysis covers an approximately 30-year period after completion of the project:
  - Construction: January 1997 - mid-1998
  - Traffic Service: Mid-1998 - Yearend 2027

Table 2

COMPARISON OF ALTERNATIVE INTERCHANGE CONFIGURATIONS
Year 2020 Traffic Assessment of Kahului Airport Access Road

Interchange Configuration	Accommodation of Hana-to-Lahaina Left-Turn	Left-Turn Movements with Opposing Traffic	Traffic Signals on Airport Access Road	Additional Right-of-Way (sq. ft.)	Construction Costs (millions 1995 $)	Compatibility with Bicycles	Safety	Construction Impacts
Proposed Two-Loop Partial Cloverleaf	Loop Ramp Merge	2	-0-	None	$24.9	Poor	Good	Least
1. Conventional Diamond	Left-Turn From Ramp	4	2	None	21.3	Fair	Good	Moderate
2. Single Point Diamond	Left-Turn From Ramp	4	1	27,500	28.1	Poor	Good	Worst
3. Single Loop Cloverleaf	Loop Ramp Merge	3	1	None	23.8	Poor	Good	Moderate
4. Full Cloverleaf	Loop Ramp Merge	-0-	-0-	675,000	51.6	Poor	Good	Least
5. Semi-Directional	Direct Ramp Merge	3	1	210,000	42.8	Poor	Good	Bad

Wilbur Smith Associates; December 1995

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- All benefits and costs are based on constant 1995 dollars to exclude inflation assumptions from the analysis.

- A discount rate of 7 percent is used for the analyses, which represents the minimum rate of return desired for the investment (in constant dollars).

- The estimates of vehicle travel times, vehicle operating costs and accidents are based on analyses of 1994 and 2020 travel conditions. The values for other years between 1998 and 2027 were calculated by interpolation or extrapolation of the results on a straight-line basis.

- The annual values for travel time savings, vehicle operating costs and accidents for 1994 and 2020 are estimated by calculations of these values for the morning peak hour, afternoon peak hour, and average off-peak hour of an average weekday, and then annualizing these values.

- The analyses was made for those costs and benefits within the limits of the interchange area. This results in a "study area" encompassing a segment of about 0.6-mile in length on each roadway.

Highway User Benefits

The "benefits" for the two interchange configurations represent the net savings in travel time, vehicle operating costs and accidents as compared to the at-grade intersection.

Travel Time Savings - Travel times were estimated for the at-grade intersection and the two interchanges for each travel path through the junction of the two roadways for both 1994 and 2020 peak and off-peak conditions. The travel time included both running time and stop time. The value of this time was estimated based on the following:

- **Unit Value of Travel Time** - The time value for trucks and work-related vehicle trips is based on the average hourly wage and benefits for Maui. Trucks are assumed to have only one person, while work-related trips are assumed to have an average of 1.2 persons per vehicle. Time value for all other trip types was assumed at one-half the Maui wage rate, without benefits, and with 1.2 adults per vehicle.

- **Composition of Traffic** - Estimates of the types of vehicles and trip purposes is based on recent vehicle classification counts and roadside surveys conducted in the Kahului area.

The estimated annual value of travel times in the 1994 and 2020 analysis years are presented in Table 3 for the at-grade intersection and the two interchanges. The proportional reduction (savings) in the value of travel time by the interchanges is:

Table 3
ESTIMATED TRAVEL BENEFITS FOR 1994 AND 2020 ANALYSIS YEARS

Year/Item	Annual Highway User Costs/Time Values			Annual Benefits with Interchange	
	At-Grade Intersection	Diamond Interchange	Two-Loop Partial Cloverleaf	Diamond Interchange	Two-Loop Partial Cloverleaf
YEAR 1994					
Vehicle Operating Costs					
▸ Automobile	$2,422,885	$2,319,828	$2,364,529		
▸ Truck[1]	339,704	329,312	321,443		
Total	2,762,589	$2,649,140	$2,686,294	$113,449	$76,295
Value of Travel Time					
▸ Trucks[1]	309,867	251,091	253,531		
▸ Autos, Work[2]	2,256,274	1,812,248	1,842,569		
▸ Autos, Non-Work[3]	869,565	676,114	706,752		
▸ Autos, Tourists[4]	679,027	583,215	552,913		
Total	$4,114,773	$3,321,718	$3,355,766	$793,055	$759,006
Value of Accidents	187,425	115,815	82,604	71,610	104,821
TOTAL 1994	$7,064,787	$6,086,674	$6,124,663	$978,114	$940,124
YEAR 2020					
Vehicle Operating Costs					
▸ Automobile	4,127,476	3,853,067	3,897,203		
▸ Truck[1]	573,243	556,124	539,833		
Total	$4,700,720	$4,409,211	$4,437,036	$291,509	$263,684
Value of Travel Time					
▸ Trucks[1]	583,904	426,663	417,762		
▸ Autos, Work[2]	4,606,352	3,061,428	2,995,283		
▸ Autos, Non-Work[3]	1,554,011	1,077,677	1,104,465		
▸ Autos, Tourists[4]	1,355,204	1,091,962	987,549		
Total	$8,094,471	$5,659,930	$5,504,569	$2,439,951	$2,594,902
Value of Accidents	303,313	220,517	159,068	82,796	144,245
TOTAL 2020	$13,103,505	$10,289,658	$10,100,673	$2,813,848	$3,002,831

(1) Midsize and larger trucks; and buses; pickups and vans are included with autos.
(2) Business trips and commute trips.
(3) Non-work trips by residents, excluding recreation.
(4) Tourist trips and recreation trips by residents.

Wilbur Smith Associates: March 1996

Year	Partial Cloverleaf	Diamond Interchange
1994	-18.7%	-19.3%
2020	-30.7%	-26.6%

The Diamond Interchange would result in a slightly larger saving in 1994, but the Partial Cloverleaf would result in a greater time saving in the future as traffic volumes increase.

Vehicle Operating Cost Savings - Vehicle operating costs encompass expenses such as gasoline, tires, oil, maintenance, and vehicle depreciation. These costs are largely related to travel distance, but also are affected by factors such as the need to decelerate/accelerate, idling costs while stopped, travel speeds, and roadway grades. The vehicle operating costs were estimated for each travel path, by vehicle type, for each of the analyses time periods for the at-grade intersections and the two interchanges. The results for 1994 and 2020 are presented in Table 3, with the proportional savings over the at-grade intersection as follows:

Year	Partial Cloverleaf	Diamond Interchange
1994	-2.8%	-4.1%
2020	-5.6%	-6.2%

The savings are slightly greater for the Diamond Interchange since the loop ramps of the Partial Cloverleaf Interchange result in longer travel distances for those traffic movements.

Value of Accident Savings - The two grade-separated interchanges should have a lesser number of accidents, and fewer severe accidents, as compared to an at-grade intersection. The estimated annual number of accidents are:

Year	At-Grade Intersection	Partial Cloverleaf	Diamond Interchange
1994	17	7	10
2020	28	12	19

The estimated value of these accidents is presented in Table 3. These values reflect average costs for property-damage-only and injury accidents. The "costs" of a fatal accident reflects society's willingness to pay to avoid a traffic fatality, rather than the actual expenses and lost years of life.

Roadway Costs

The initial capital costs, annual maintenance costs, and the residual value of the capital costs remaining at the end of the 30-year analyses period, each expressed in 1995 dollars, are as follows:

	Initial Capital Costs	Annual Maintenance Costs	Residual Value After 30 Years
At-Grade Intersection	$ 6,530,000	$ 9,700	$1,700,000
Diamond Interchange	21,258,000	20,900	6,069,000
Partial Cloverleaf	24,901,000	23,100	8,067,000

The residual value is treated as a benefit in the last year of the analyses period for the purpose of the benefit-cost analysis.

Analysis of Economic Feasibility

To assess whether a highway investment is economically feasible, the costs of constructing and maintaining the improvements are compared with the economic benefits estimated to be attributable to the highway improvements. The cost and benefit comparison yields three indicators of economic feasibility:

- **Net Present Value** - All costs and benefits in future years are discounted back to the base year using the adopted discount rate. The future stream of discounted costs are subtracted from the future stream of discounted benefits. If the sum of the discounted benefits is greater than the sum of the discounted costs, the "net present value" is positive and the highway improvement is deemed to be "economically feasible", at the adopted discount rate.

- **Discounted Benefit/Cost Ratio** - After the future streams of costs and benefits are discounted, the sum of the discounted benefits are divided by the sum of the discounted costs. If the result is 1.0 or greater, the highway improvement is "economically feasible" at the selected discount rate.

- **Internal Rate of Return** - This calculation determines that discount rate at which the net present value difference between costs and benefits is zero. If the rate of return, expressed as a percentage, is equal to or greater than the adopted discount rate, then the highway improvement is deemed to be "economically feasible".

The "benefits" for each interchange are the savings in travel time, vehicle operating costs and accidents from those of the at-grade intersection. The "costs" for each interchange are the increment of additional capital and maintenance costs over those for the at-grade intersection.

The results of the cost-benefit comparison of the two interchanges to the at-grade intersection are presented in Table 4. In addition to the baseline "Initial Assessment," three supplemental analyses are also presented to test the sensitivity of the assessment for the travel time savings and value of accidents. Based on this economic analysis, the key findings are:

- With the baseline assumptions, the increased costs of both the proposed Partial Cloverleaf Interchange and the Diamond Interchange are economically justified by the estimated benefits.
- The Diamond Interchange is estimated to provide a slightly higher return on the investment than the Partial Cloverleaf Interchange.
- From the sensitivity tests, both interchange types are economically feasible if no value is placed on travel time of tourists or resident recreation trips.
- From the sensitivity tests, both interchange types are economically feasible if no value is placed on accident reductions, as well as no value for tourist or resident recreation trips.
- From the sensitivity tests, the Diamond Interchange is economically feasible while the Partial Cloverleaf Interchange is just feasible if only the travel time of work and commute trips are assumed to have value.

Other Factors for Consideration

The assessment of the relative attractiveness of the two interchange types should also consider several factors not included in the financial analyses:

1. The Partial Cloverleaf Interchange provides increasing benefits, relative to the Diamond Interchange, as traffic volumes increase. This changing relationship is largely lost through the much higher discounting of benefits in later years. Although this provides an accurate portrayal for an economic analysis, it does not reflect the increasing differential in traffic operations over a long period of time.

2. As a corollary to Item 1, if traffic volumes increase at a faster rate than the present forecasts, the economic attractiveness of the Partial Cloverleaf Interchange would improve relative to the Diamond Interchange, and both interchanges would improve relative to the At-Grade Intersection.

3. The Diamond Interchange would require traffic signals on Airport Access Road at the ramp junctions, whereas the Partial Cloverleaf Interchange would not. Many economic studies use an additional weighting or time penalty to reflect the intangible effect of the stop upon the driver. Incorporation of such a penalty would reduce the differential in the economic results between the two interchanges.

4. The Diamond Interchange would result in the junction of the westbound on-ramp with Hana Highway being located several hundred feet closer to the Dairy Road traffic signal as compared to the Partial Cloverleaf. This may result in delays to traffic exiting the diamond ramp, which are not included in the economic analyses.

Table 4

SUMMARY OF ECONOMIC ANALYSES
Year 2020 Traffic Assessment of Kahului Airport Access Road

Scenario	Interchange	Net Present Value	Benefit-Cost Ratio	Internal Rate of Return
Initial Assessment with Baseline Assumptions	Partial Cloverleaf Interchange	$6,350,909	1.42	9.9%
	Diamond Interchange	8,488,113	1.70	11.7
Sensitivity Tests				
1. No Time Value for Tourist and Recreation Trips	Partial Cloverleaf Interchange	3,666,300	1.24	8.7
	Diamond Interchange	6,539,667	1.54	10.7
2. No Time Value for Tourist and Recreation Trips; No Accident Savings	Partial Cloverleaf Interchange	2,349,500	1.16	8.1
	Diamond Interchange	5,729,337	1.47	10.2
3. No Time Value Except Trips Associated with Income Producing Activities	Partial Cloverleaf Interchange	342,633	1.02	7.2
	Diamond Interchange	2,914,630	1.24	8.7

Wilbur Smith Associates; March 1996

1. INTRODUCTION

The State of Hawaii Department of Transportation (State DOT) plans to construct a number of modifications at Kahului Airport in order to improve operations at the facility. These modifications include major changes to the area roadway system adjacent to and within the Airport, as well as new or expanded airfield and terminal facilities. These recommended modifications were identified through the Kahului Airport Master Plan Study.[1] Collectively, the recommended modifications are referred to as the "Preferred Plan" or the "Airport Project", and are intended to serve as the Master Plan of airport improvements through Year 2010.

As part of the environmental analysis process, an assessment has previously been made of the traffic impacts of the Airport Project, and project alternatives, through Year 2010, the horizon year for the Airport Master Plan. That traffic study[2] analyzed the effect of the Preferred Plan, and alternative plans, on Year 2010 traffic conditions and identified additional roadway improvements to mitigate impacts.

This traffic study augments the analyses made in the preceding study of Year 2010 traffic impacts. The purpose of this study is twofold:

1. The primary purpose is to assess the need for and cost effectiveness of the proposed interchange at the junction of the proposed Airport Access Road with Hana Highway.

2. As a secondary purpose, the study assesses the capability of the proposed roadway modifications in the Airport area to accommodate traffic demands through Year 2020.

PROJECT DESCRIPTION

Kahului Airport is located at the eastern edge of the Wailuku-Kahului area on the north shore of the island of Maui (Figure 1-1). The Airport currently has a 7,000-foot long primary runway and a 4,990-foot long secondary runway. The West Ramp area, located west of the primary runway, includes the air passenger terminal facilities, air cargo facilities, and most of the support services for the air carrier operations. The East Ramp area includes the general aviation and helicopter facilities, as well as the airport control tower. Access to the West Ramp is primarily via Keolani Place, while access to the East Ramp is primarily via Haleakala Highway.

(1) *Kahului Airport Master Plan*, prepared for State of Hawaii Department of Transportation Airports Division, by Belt Collins & Associates and Aries Consultants, Ltd., June 1993.

(2) *Kahului Airport Improvements Traffic Impact Study*, prepared for Edward K. Noda and Associates by Wilbur Smith Associates, June 1995 (Draft).

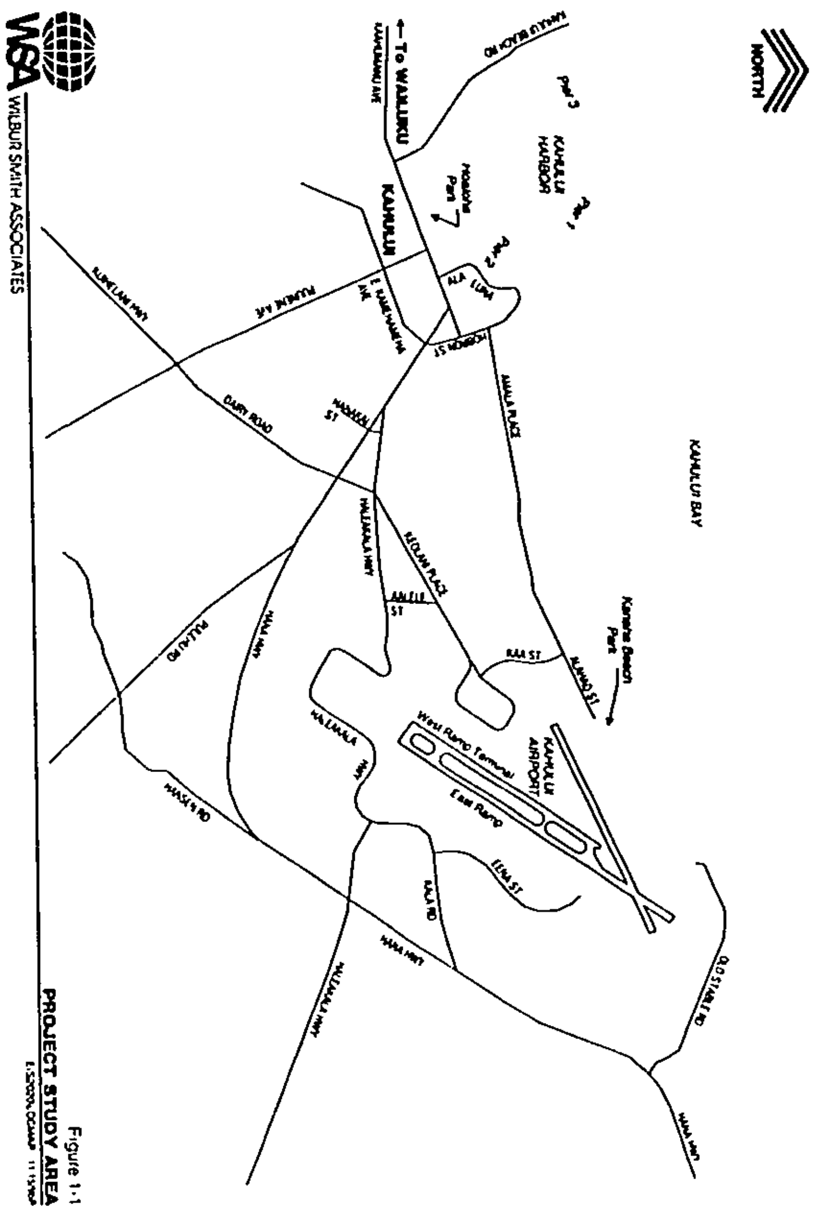

Figure 1-1
PROJECT STUDY AREA

WILBUR SMITH ASSOCIATES

The Preferred Plan includes a number of modifications to upgrade and/or expand the present facilities at Kahului Airport. Those that most directly affect ground travel demands and traffic conditions are the following:

1. **Modifications that could affect traffic demands:**

- Relocation of the helicopter facilities away from Kahului Airport.
- Extension of the primary runway and construction of a parallel runway that could facilitate takeoffs for direct overseas flights to additional destinations.

2. **Modifications that would affect the roadway network:**

- Construction of a new Airport Access Road, with an interchange at Hana Highway, to allow airport traffic to bypass Keolani Place/Dairy Road when entering or exiting the West Ramp terminal area.
- Abandonment of Haleakala Highway between Hana Highway (Pukalani junction) and Aalele Street to accommodate the extension of the present main runway.
- Construction of a new Spine Road parallel to the east side of the existing primary runway that would serve the general aviation, air cargo, and airport operations facilities of the East Ramp area.
- Abandonment of the present segments of Hansen and Pulehu Roads between their junction and Hana Highway, and replacement with a single roadway intersecting Hana Highway opposite the Spine Road.
- Abandonment of Kala Road north of Hana Highway.

The new Airport Access road is planned to have a grade-separated interchange at Hana Highway to minimize traffic delays. A two-loop partial "cloverleaf" interchange is planned, with loop ramps provided in the northwest and southeast quadrants to serve the Hana-to-Lahaina and Kahului-to-Airport direction traffic movements. The other turning movements would be served by direct or diamond-type ramps.

STUDY PURPOSE AND SCOPE

The central element of the proposed airport access plan is the construction of the new Airport Access Road with a grade-separated interchange at Hana Highway. The primary purpose of this study is to assess the need for and cost-effectiveness of the proposed grade-separated interchange at Hana Highway. This report is intended to serve as an "Interchange Justification Study" relative to potential use of Federal highway monies in the funding of the roadway project. Federal regulations require that the assessment encompass a period of at least 20 years beyond the anticipated construction of the project (1997-1998). Thus, Year 2020 is used for the analysis. Year 2020 is also the study horizon year for the *Maui Island-Wide Long Range Land Transportation Plan Study*, which was ongoing at the time of this study.

Given that the interchange analyses was conducted for Year 2020, the study was also expanded to analyze Year 2020 conditions at the key locations affected by the other proposed Airport Project roadway modifications. This analyses was performed to assess the adequacy of the proposed roadway projects to meet travel needs on these roadways through Year 2020.

Interchange Justification Assessment

This study element assesses the appropriateness of a grade-separated interchange to serve traffic demands through Year 2020 at the planned junction of Hana Highway and the new Airport Access Road. The study encompasses:

- An analysis of an at-grade intersection to meet traffic demands.
- Identification and initial screening of alternative interchange types and configurations.
- Estimation of right-of-way needs and construction costs for the various interchange configurations.
- A comparative assessment of traffic conditions and road user benefits between an at-grade intersection, the proposed partial cloverleaf interchange, and a conventional diamond-type interchange.
- A benefit-cost analysis of the partial cloverleaf and diamond interchanges, relative to an at-grade intersection.

Year 2020 Assessment of Airport Project Roadways

The assessment focuses on the adequacy of the roadways modified or most directly affected by the Airport Project. The key roadway intersections included within this analysis are:

- Hana Highway intersections between the two Haleakala Highway intersections (Pukalani Junction and the Airport triangle/west junction).
- Dairy Road intersections with Haleakala Highway and the Airport Access Road.
- Puunene Avenue - Kuihelani Highway - Airport Access Road intersection.
- Hansen Road - Pulehu Road intersection.

The analyses are based on average weekday conditions since the average weekday is used for the interchange analyses, as well as for the *Maui Island-Wide Study*. Those locations are noted where the August design day traffic[1] would be likely to substantially affect traffic conditions.

[1] See Chapter 2 for discussion of average and design day.

The report includes a description of average weekday traffic conditions for:

- Existing (1994) traffic levels.
- Year 2020 traffic levels and roadway network with no Airport Project (airfield or roadway modifications).
- Year 2020 traffic levels and roadway network with the Preferred Airport Plan.

REPORT CONTENT AND ORGANIZATION

Following this introductory chapter (#1), the report first summarizes in Chapters 2 through 4, the overall assessment of traffic conditions in the Airport area. Although this is the secondary purpose of the study, it is presented first to provide the broader overview of area traffic conditions. The remaining chapters (5 through 7) summarize the assessment regarding the need for an interchange at the junction of Hana Highway and the Airport Access Road. The general content of these chapters is summarized in the following paragraphs.

Chapter 2: Existing Conditions

This chapter presents an overview of the existing roadway system, traffic characteristics and travel conditions in the vicinity of the Airport. The existing conditions are provided to allow a comparison with future usage and conditions. The chapter encompasses:

- Description of the methodology for analyzing traffic conditions for both existing and future scenarios.
- Description of present key roadways.
- Description of traffic volumes and conditions on roadways in the Airport vicinity.

Chapter 3: No Action Alternative

Year 2020 conditions without the airport improvements are presented as a baseline from which to compare the effects of the Preferred Plan. The chapter addresses:

- The methodology used to develop these 2020 forecasts of both airport and nonairport traffic.
- The level of both airport-related and nonairport-related traffic increases forecast to occur even without the Airport modifications.
- The roadway modifications expected to occur both as a result of the island-wide highway improvement plans and from new developments in the Airport vicinity.
- The resultant roadway traffic conditions near the Airport.

Chapter 4: Preferred Plan

Chapter 4 describes Year 2020 traffic conditions with the proposed modifications to the Airport roadway access and airfield facilities. Included in this chapter are the following:

- Description of the proposed on-site and off-site roadway modifications.
- Discussions of the methodology used to forecast changes in ground traffic volumes and of the resultant traffic increases and decreases on area roadways.
- Description of the traffic conditions with the proposed roadway system, and identification of potential capacity deficiencies.
- Discussions of actions to mitigate identified roadway capacity deficiencies.

Chapter 5: Development of Interchange Alternatives

This chapter discusses the traffic conditions anticipated at the junction of Hana Highway and Airport Access Road if an at-grade intersection is provided instead of a grade-separated interchange. Also discussed are the potential types of interchanges that may be appropriate at the junction and the identification of five alternative interchange configurations for further consideration.

Chapter 6: Assessment of Interchange Alternatives

The proposed interchange and five alternative interchange configurations are presented at a concept design level of detail. Each is assessed relative to:

- Traffic laneage and control needs;
- Right-of-way requirements;
- Costs;
- Impacts on bicycles; and
- Construction impacts.

Chapter 7: Economic Evaluation of Kahului Airport Interchange

The chapter summarizes an evaluation of the economic feasibility of providing either the proposed Two-Loop Partial Cloverleaf Interchange, or a Conventional Diamond Interchange at the junction of Hana Highway and the Airport Access Road. The assessment calculates the net present value, benefit cost ratio, and internal rate of return for each of these two interchanges based on the incremental highway user benefits and increased costs over those with an at-grade intersection. The benefits include travel time savings, reductions to vehicle operating costs, and potential reductions in traffic accidents.

WSA

2. EXISTING CONDITIONS

Kahului Airport is located at the eastern end of the Kahului-Wailuku urbanized area. The area surrounding the Airport contains a mixture of land uses which include industrial, commercial, residential, agricultural, and recreational uses, as well as natural features such as beaches and wetlands. The coastal area between Kahului Airport and the Pacific Ocean includes the Kanaha Pond wetlands, Kanaha Beach Park, and the Spreckelsville residential area. Commercial and industrial areas are located west and northwest of the airport area, including the State's harbor facilities. The area south of Kahului Airport is in agricultural uses.

The network of roadways in the vicinity of the airport serves both local Kahului and regional traffic, with the Hana Highway and Dairy Road functioning as key links in the regional roadway system. An extensive inventory of roadways and traffic information was collected in 1990 for the Airport area, and was used as the basis of the 1991-1992 traffic studies[1] for the Airport.

Given the time since the prior Kahului Airport traffic study, a new data collection effort was undertaken by this study to update and supplement the 1990 information. The new data collection effort was used to establish 1994 as the base year for existing conditions concerning roadway capacities, traffic volumes, and traffic characteristics.

METHODOLOGY AND ASSUMPTIONS

The collection and analyses of ground transportation facilities and usage was structured to provide an overview of current conditions in the Airport area, and to establish a baseline with which to assess future changes in travel conditions in the future.

Average Day Versus Design Day

The traffic volumes and traffic conditions presented in this report represent "average weekday" travel, both for the existing conditions and the Year 2020 forecasts. In comparison, the preceding traffic study of Year 2010 conditions[2] reflected "design day" travel on the area roadways.

Average Weekday Traffic represents the traffic volumes which occur on a typical weekday; it should represent the majority of days during the year, with about as many lower-volume days as higher-volume days relative to this average day. The average weekday is used as the basis for studies of economic feasibility and justification of roadway projects. The benefits and costs of these roadway projects are analyzed for traffic on an average weekday, and then these benefits/costs are factored

(1) *Traffic Impact Assessment Report of Kahului Airport*, prepared for the State of Hawaii Department of Transportation Airports Division by Pacific Planning & Engineering, Inc., June 1992.

(2) *Kahului Airport Improvements Traffic Impact Study*, prepared for Edward K. Noda and Associates, by Wilbur Smith Associates, June 1995 (Draft).

to an annual basis. Use of a high- or low-volume traffic day would overstate or understate, respectively, the traffic benefits of a project when converted to a yearly total.

Design Day Traffic is used to estimate the roadway capacities—to size roadway facilities—needed to accommodate travel demands. The design day peak hour conditions usually represents traffic volumes expected to occur during the 30th highest hourly volume of the year. The design day traffic does not represent the highest hourly volumes of the year, since it would be generally considered an uneconomic use of limited funding resources to provide acceptable travel conditions for those highest traffic levels that occur only several times a year. For an airport area, the design day is generally regarded as an average day in the peak month of the year (August for Kahului Airport). For Maui, the design day traffic volumes are estimated to be about 4.7 percent higher than the average day.[3]

The major purpose of this Year 2020 study is to assess the travel benefits and economic justification of an interchange at the junction of the Airport Access Road with Hana Highway. Therefore, this report presents the peak hour traffic volumes and traffic conditions (intersection volume-to-capacity ratios and service levels) for an average weekday on the airport area roadways to provide an overview of travel conditions on such a day.

However, where the adequacy of planned roadway capacities is considered, the assessment does reflect the higher design day traffic levels. Given that the design day volumes are 4.7 percent higher than the average weekday volumes, for any intersection where the existing or forecast average weekday traffic volumes are equal to or more than 96 percent of the intersection capacity, the design day volumes would be expected to exceed the intersection capacity.

The analysis of ground traffic conditions is presented for the morning and afternoon commute peak hours, rather than the early afternoon period when Airport-related traffic typically peaks. The commute peak hours represent the highest traffic volumes on most major roads in the Airport vicinity. Given the comparative relationships of Airport and total traffic volumes, additional Airport-related traffic would most likely have the greatest effect upon traffic conditions during these heavily-travelled commute hours than in lower-volume mid-day period when Airport-related traffic is highest.

Methodology for Data Collection

Roadway and traffic control information were obtained through field reconnaissance by Wilbur Smith Associates (WSA) engineers during May 1994. The roadway inventory included those items needed to estimate roadway capacities, such as the number and width of lanes, shoulder conditions, types of traffic controls, and traffic signal phasing and timing.

Recent twenty-four hour machine counts of weekday traffic was obtained from State DOT count stations in the Kahului area. The most recent available counts were made during June 1993. In addition, the machine counts were obtained for the State DOT station on Keolani Place for 1987 through 1991. Monthly traffic summaries were also obtained for State DOT station CC-3, located

(3) Op cit., Chapter 2.

on Honoapiilani Highway south of Kaanapali Road, and which provides the only year-round traffic count information on Maui.

Existing commute peak hour traffic volumes at key intersections were developed from manual intersection turning movement counts made by WSA, as well as counts previously made by The Traffic Management Consultant (TTMC). The TTMC counts were made in January 1994 as part of traffic studies for the Triangle Square and Kahului Industrial Park developments. The WSA counts were made at the intersections of:

- Hana Highway with Dairy Road;
- Hana Highway with Haleakala Highway (east of Pukalani junction);
- Hana Highway with Old Stable Road; and
- Pulehu Road with Hansen Road.

The WSA counts were made on May 18 to 19, 1994. Turning movement counts made previously by TTMC were used for the intersections of Dairy Road/Kuihelani Highway with Puunene Avenue, and Haleakala Highway with Dairy Road and with Hana Highway (west junction).

The traffic turning movements were counted and recorded every 15 minutes during the weekday morning and afternoon peak commute traffic periods. The turning movement count data was analyzed to determine the morning and afternoon peak one-hour periods, which were used to evaluate intersection conditions. The various traffic counts were adjusted to reflect an average weekday in 1994.

Methodology for Analyzing Traffic Conditions

The Transportation Research Board (TRB), a division of the National Science Foundation, has developed standardized methods for use in evaluating the effectiveness and quality of service for roadways and streets. Different methodologies are available for analyzing traffic signal-controlled intersections and unsignalized intersections, both of which were used in evaluating present and future conditions for this study.

The TRB evaluation methods use a concept known as level-of-service (LOS). This concept describes facility operations on a letter basis from A to F, which signify excellent to unacceptable conditions, respectively. The methods are generally based on a comparison of traffic volumes on a facility to the facility's theoretical capacity. Capacity is estimated based on the facility's physical characteristics (e.g. number of lanes), traffic conditions (e.g. types of vehicles), and type of traffic controls. The methodologies are described in the *1985 Highway Capacity Manual* (1985 HCM).[4]

Traffic Signal-Controlled Intersections - Traffic conditions at traffic signal-controlled intersections were evaluated using the *Operations Analysis* methodology described in the 1985 HCM. Using this method, the level-of-service is based on the average delay time per vehicle passing through the intersection. The delay time, calculated in seconds, is the result of the phasing and timing of the traffic signal as well as the intersection's physical layout and the composition of the traffic. Average delay time and level-of-service are determined for the entire intersection, for each roadway

(4) Highway Capacity Manual, Special Report 209, Transportation Research Board, 1985.

approach, and for each traffic movement or lane group. A description of the characteristics and criteria associated with LOS A through LOS F is provided in Figure 2-1.

The methodology also calculates the ratio of actual or estimated peak hour traffic volumes to the theoretical capacity of the intersection. This indicates the proportion of available capacity being used by traffic volumes and where there is unused capacity available for future traffic increases. This volume-to-capacity ratio (V/C) reflects the physical characteristics of the intersection and the traffic characteristics, and is somewhat independent of the level-of-service, which also is affected by the efficiency of the traffic signal phasing/timing.

Unsignalized Intersections - At intersections with STOP sign controls, the level-of-service was calculated using the 1985 HCM procedures for intersections with two-way STOP sign control (STOP or YIELD signs on minor streets). As with signal-controlled intersections, six levels-of-service, A through F, are used to describe traffic conditions.

For three-leg ("T") and four-leg intersections with STOP or YIELD controls on the minor street approaches, the standard procedure provides a comparative measure of delay for those movements which must yield to conflicting movements at the intersection. The movements which must yield include:

- Left-turn out of the side street;
- Right-turn out of the side street; and
- Left-turn into the side street.

Through vehicles on the major streets are not required to yield to other movements at T- and two-way controlled intersections. The general indicator of intersection delay is determined by calculating the one-hour capacity for each key movement, based on conflicting traffic volumes, and then comparing the number of vehicles making that maneuver to the calculated capacity. The unused or "reserve" capacity for the movement is then used to identify a level-of-service for that movement. Unlike analysis of signal-controlled intersections, an overall intersection level-of-service is not calculated but rather a level-of-service is calculated for each lane group.

The level-of-service criteria for unsignalized intersections with minor street STOP controls are defined in Table 2-1A.

Freeway Ramps - The junction of an interchange ramp with a freeway, or other roadway, is generally designed to permit high-speed merging or diverging to take place with a minimum of disruption to the adjacent roadway traffic flow. Traffic conditions at the ramp junctions with Hana Highway were evaluated using the methodology described in the 1985 HCM, which identifies the level of service based on the combined traffic flow of the ramp and the adjacent freeway lane at the merge or diverge point. The level-of-service criteria for the ramp-Hana Highway terminal, and for the freeway (Hana Highway) traffic are summarized in Table 2-1B. LOS F represents unstable operations, with potential for average speeds to drop below 42 mph and possible formation of vehicle queues on an on-ramp, or on the freeway (Hana Highway) in advance of an off-ramp.

The **OPERATIONS LEVEL METHODOLOGY**, which is described in the Transportation Research Board's Highway Capacity Manual, defines Level of Service (LOS) for signalized intersections in terms of delay. Technically, delay is the amount of time an average vehicle must wait at an intersection before being able to pass through the intersection. For signalized intersections, the relationship between LOS and delay is based on the average stopped delay per vehicle for a fifteen minute period.

LEVEL OF SERVICE 'A' - Delay 0.0 to 5.0 seconds
Describes operations with very low delay, i.e., less than 5 seconds per vehicle. This occurs when signal progression is extremely favorable. Most vehicles arrive during the green phase and are not required to stop at all.
Corresponding V/C ratios usually range from 0.00 to 0.60.

LEVEL OF SERVICE 'B' - Delay 5.1 to 15.0 seconds
Describes operations with delay in the range of 5 to 15 seconds per vehicle generally characterized by good signal progression and/or short cycle lengths. More vehicles are required to stop than for LOS 'A' causing higher levels of average delay.
Corresponding V/C ratios usually range from 0.61 to 0.70.

LEVEL OF SERVICE 'C' - Delay 15.1 to 25.0 seconds
Describes operations with delay in the range of 15 to 25 seconds per vehicle. Occasionally, vehicles may be required to wait more than one red signal phase. The number of vehicles stopping at this level is significant although many still pass through the intersection without stopping.
Corresponding V/C ratios usually range from 0.71 to 0.80.

LEVEL OF SERVICE 'D' - Delay 25.1 to 40.0 seconds
Describes operations with delay in the range of 25 of 40 seconds per vehicle. At LOS 'D', the influence of congestion becomes more noticeable. Many vehicles stop, and the proportion of vehicles not stopping declines. The number of vehicles failing to clear the signal during the first green phase is noticeable.
Corresponding V/C ratios usually range from 0.81 to 0.90.

LEVEL OF SERVICE 'E' - Delay 40.1 to 60.0 seconds
Describes operations with delay in the range of 40 to 60 seconds per vehicle. These high delay values generally indicate poor signal progression, long cycle lengths and high V/C ratios. Vehicles frequently fail to clear the intersection during the first green phase.
Corresponding V/C ratios usually range from 0.91 to 1.00.

LEVEL OF SERVICE 'F' - Delay 60.1 seconds plus
Describes operations with delay in excess of 60 seconds per vehicle. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection.
Corresponding V/C ratios of over 1.00 are usually associated.

SOURCE: Transportation Research Board, "Operations Level Methodology Signalized Intersections", Highway Capacity Manual Special Report 209, 1985

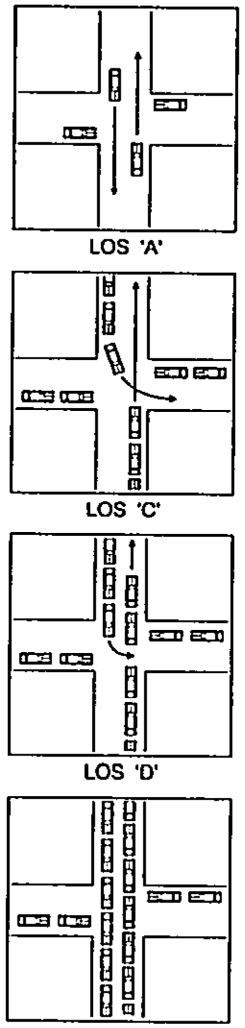

Figure 2-1
LEVEL OF SERVICE DIAGRAM

Table 2-1A

LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

LOS	Reserve Capacity (pcph)	Expected Delay
A	400 or More	Little or no delays
B	300 - 399	Short traffic delays
C	200 - 299	Average traffic delays
D	100 - 199	Long traffic delays
E	-0- - 99	Very long traffic delays
F	Negative Value	Exceeds capacity with extreme traffic delays

LOS = Level-of-Service
pcph = passenger cars per hour
Source: *Highway Capacity Manual*, Chapter 10

Table 2-1B
LEVEL-OF-SERVICE CRITERIA FOR FLOW RATES AT RAMP-FREEWAY TERMINALS

LOS	Merge Flow Rate(1) (pcph)	Diverge Flow Rate(2) (pcph)	Freeway Flow Rate(3) (pcph)
A	≤ 600	≤ 650	---
B	≤1,000	≤1,050	≤2,000
C	≤1,450	≤1,500	≤2,800
D	≤1,750	≤1,800	≤3,400
E	≤2,000	≤2,000	≤4,000
F	LOS F widely variable since unstable operation.		

LOS = Level-of-Service.
pcph = Passenger cars per hour.
(1) = On-ramp volume plus volume in adjacent lane at merge.
(2) = Volume in outside lane immediately upstream of off-ramp.
(3) = Total directional flow upstream of off-ramp or downstream of on-ramp.
Source: *1985 Highway Capacity Manual*, Chapter 5.

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AREA ROADWAY SYSTEM

The major elements of the roadway system in the vicinity of Kahului Airport serve a mix of regional and local travel. The key roadways relevant to this study are depicted in Figure 2-2.

Key Streets and Highways

At present, Keolani Place is the primary access route into the main airport passenger terminal area (West Ramp), with many of the airport-related uses (car rentals, airport maintenance, air cargo) also reached via this street. The East Ramp area of the airport (general aviation, helicopter facilities, control tower) is accessed primarily via Haleakala Highway, which also provides a connection between the main airport terminal area and the East Ramp area. An overview of these and other key area roadways is provided in the following paragraphs.

Hana Highway - This State highway is the principal east-west facility through the study area. The highway connects the East Maui and Upcountry areas to Kahului-Wailuku, as well as providing a connection from the East and Upcountry Maui areas to the Kihei and West Maui areas. Between Kaahumanu Avenue and Haleakala Highway (Pukalani junction), Hana Highway has two through lanes in each direction with a landscaped median divider. East of Haleakala Highway, Hana Highway narrows to a two-lane roadway. The posted speed limit is 45 miles per hour (mph) west of Dairy Road and 55 mph east of Dairy Road.

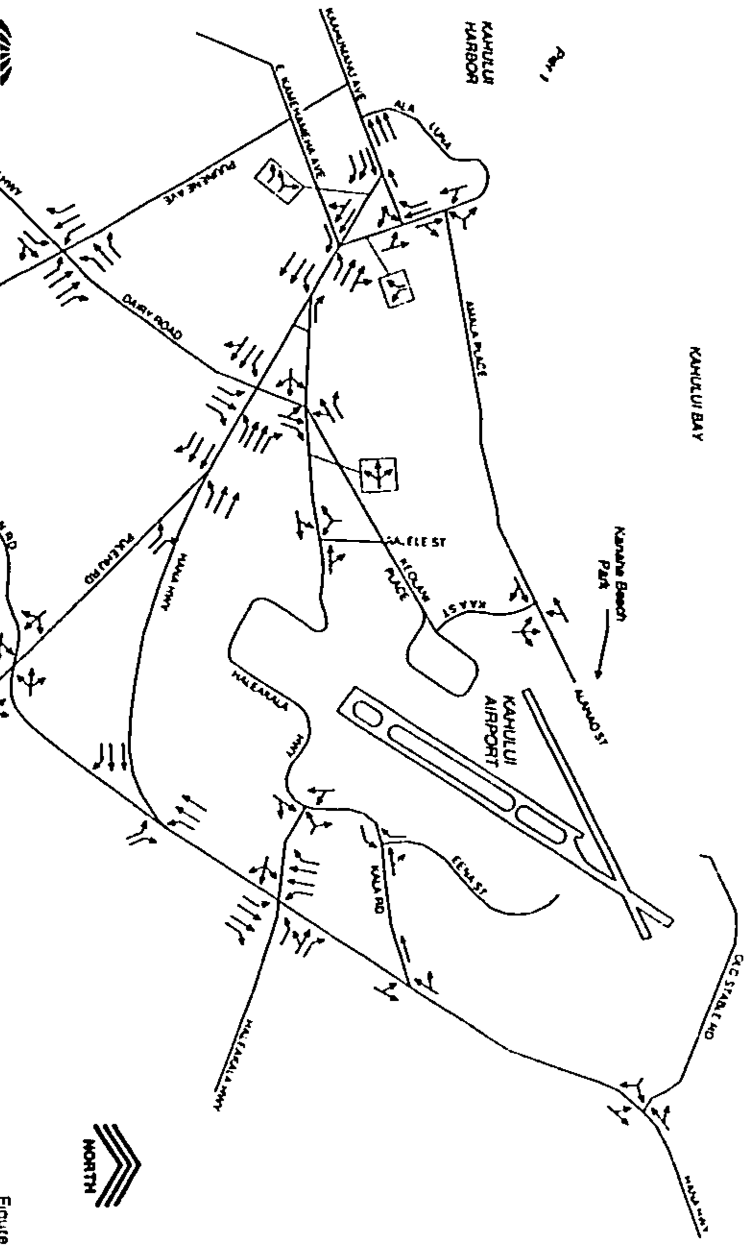
Haleakala Highway - This State highway links the Upcountry areas of Maui to Hana Highway and to Kahului Airport. North of Hana Highway, Haleakala Highway is a two-lane road with a posted speed limit of 30 mph. South of Hana Highway, it is a three-lane road with the section closest to the intersection providing two northbound lanes and one southbound lane, with a changeover about one-quarter mile from the intersection to two southbound (uphill) lanes and one northbound lane. South of Hana Highway, the speed limit increases to 55 mph.

Keolani Place - This street provides four lanes between Haleakala Highway and the Airport Terminal loop roadway, with a speed limit of 30 mph.

Dairy Road - Dairy Road is a two-lane roadway with a 30 mph speed limit between Haleakala Highway and Puunene Avenue. South of Puunene Avenue, it becomes Kuihelani Highway, a two-lane roadway with 55 mph speed limit that connects the Wailuku-Kahului area to the south and west Maui coastal areas.

Puunene Avenue - This State roadway extends from the Kahului harbor area south to the Puunene community. In Puunene, it connects to Mokulele Highway, to provide access between the Kihei-Wailea area and the Kahului area. The roadway provides one lane in each direction for most of its length.

Pulehu Road - This two-lane minor roadway parallels Haleakala Highway between the airport area and the Kula area. It primarily serves the agricultural areas west of Haleakala Highway. Posted speed limit is 45 mph near the Airport.



WILBUR SMITH ASSOCIATES

Figure 2-2
EXISTING LANES AT KEY INTERSECTIONS

Hansen Road - Hansen Road connects Puunene to Hana Highway at the south boundary of the Airport. The two-lane roadway is primarily used by traffic between the East Maui/Maui Upcountry areas and the Kihei area.

Key Area Intersections

Most of the intersections in the vicinity of Kahului Airport are presently controlled by STOP signs. Three intersections are currently controlled by traffic signals. These are:

1. **Dairy Road at Hana Highway** - The signal operations include separate left-turn phases and overlapping through/left-turn phases for Hana Highway traffic, primarily to accommodate the large volume of traffic turning left from westbound Hana Highway. Dairy Road traffic operates on a single phase.

2. **Dairy Road at Puunene Avenue** - Both the Puunene Avenue and Dairy Road/Kuihelani Highway approaches are provided separate, protected left-turn phases.

3. **Hana Highway at Haleakala Highway** - Hana Highway traffic is provided with protected left-turn phases, as well as overlapping left-turn/through phases. Each approach on Haleakala Highway is provided with a separate signal phase.

A traffic signal is planned for installation at the intersection of Haleakala Highway with Keolani Place/Dairy Road. This intersection currently provides free flow for the westbound approach of Haleakala Highway, with the other three approaches controlled by STOP signs.

The lane configurations for key study area intersections are depicted in Figure 2-2.

COMMUTE PEAK HOUR TRAFFIC VOLUMES

The manual traffic counts taken at key study area intersections during early to mid-1994 were adjusted to reflect traffic levels on an average weekday in 1994. The average weekday traffic volumes are approximately 4.7 percent lower than traffic volumes for the design day (average day in August) documented as existing conditions in the traffic impact study for the airport improvements.[5]

The traffic volumes on area roadways during the morning and afternoon commute peak hours are depicted in Figures 2-3 and 2-4, respectively. Due to locational differences, the start of the morning commute peak hour varies between 6:30 and 7:30 AM, while the beginning of the afternoon commute peak hour generally ranges from 4:00 to 5:00 PM.

The highest traffic volumes in the study area occur along the segments of Haleakala Highway and Hana Highway connecting the Maui Upcountry area to Kahului. Along this route, traffic flows are substantially higher in the westbound direction during the morning peak hour and eastbound during the afternoon.

[5] Op. Cit. Chapter 2.

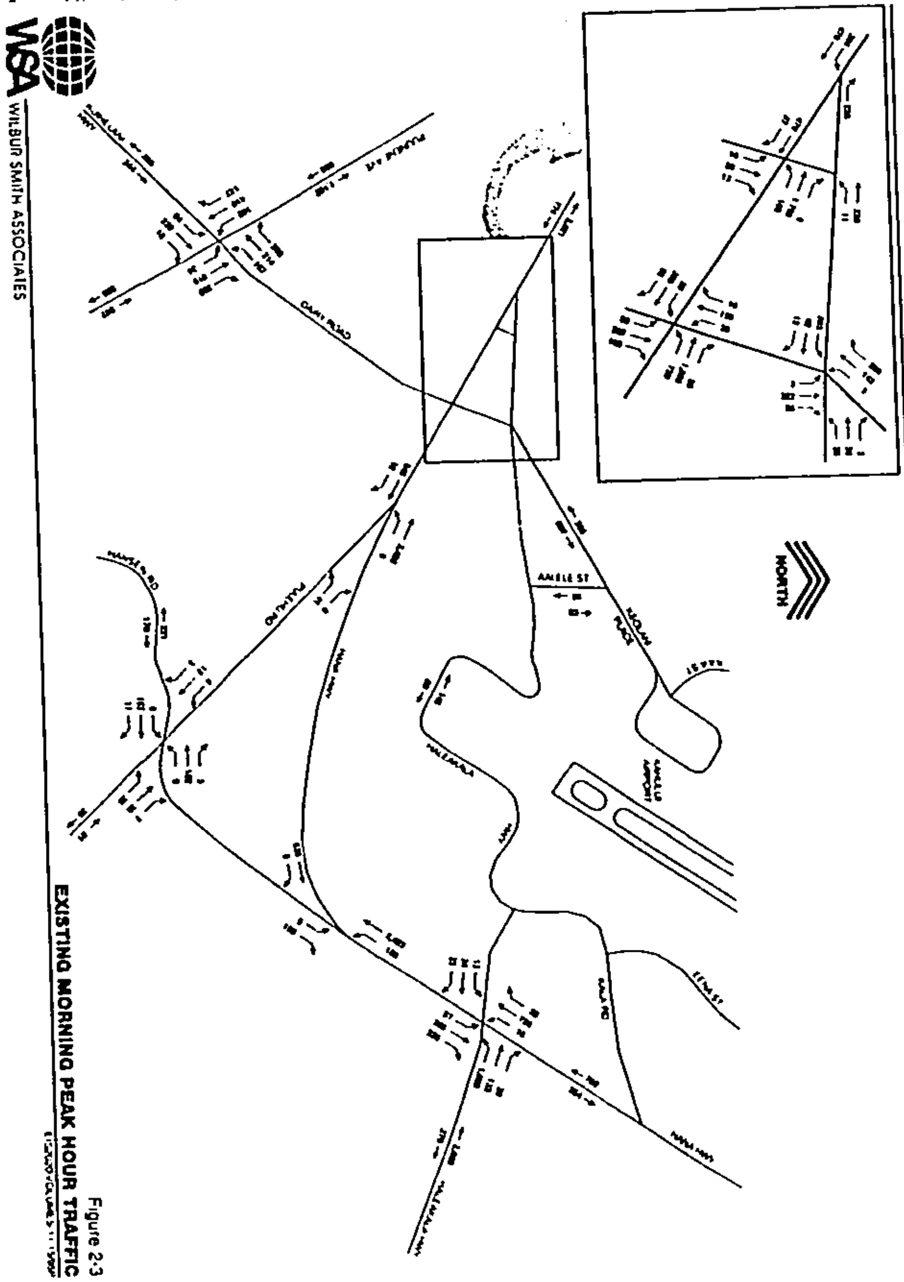


Figure 2-3
EXISTING MORNING PEAK HOUR TRAFFIC

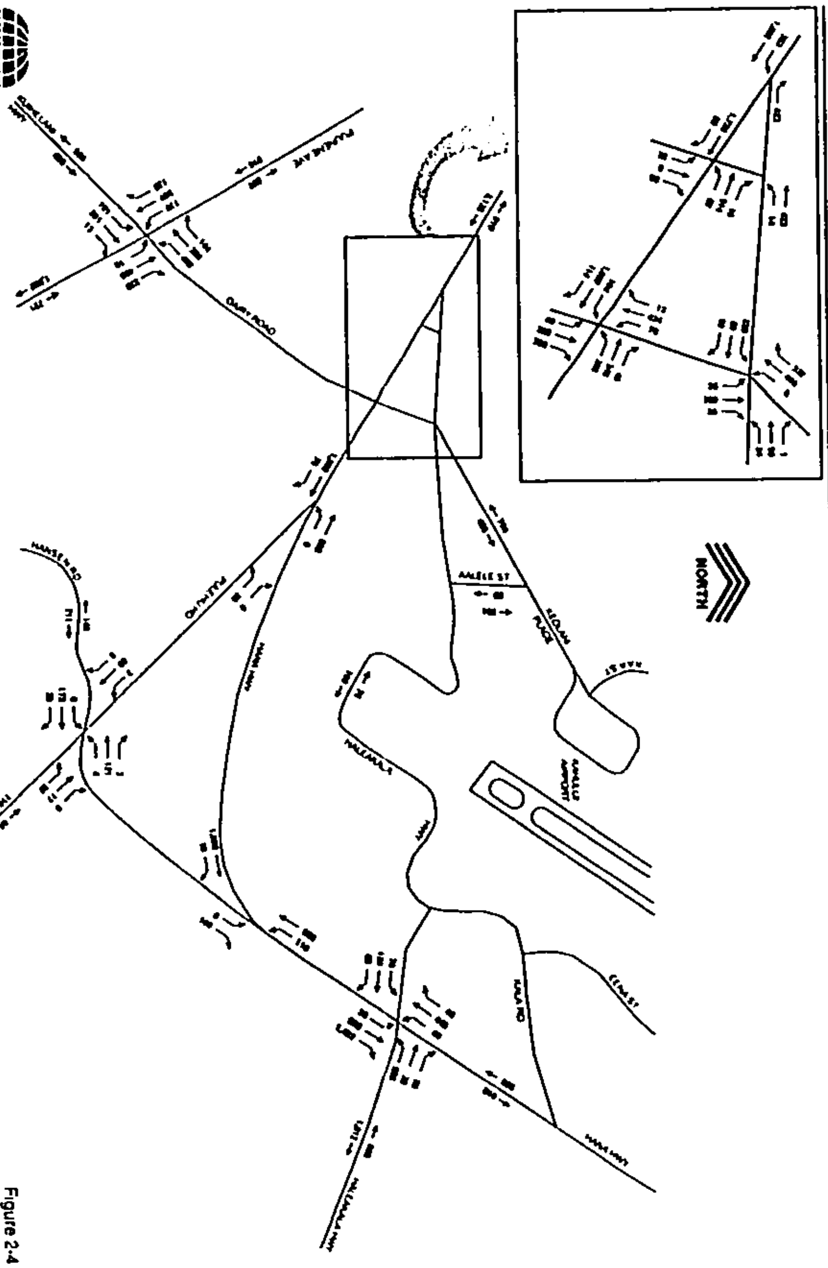


Figure 2-4
EXISTING AFTERNOON PEAK HOUR TRAFFIC

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The traffic volumes along this route are highest for the segment of Hana Highway between the east junction with Haleakala Highway and Dairy Road. High volumes of vehicle turns occur at the intersections at each end of this segment. In the morning peak hour, the left-turn movement from Haleakala Highway onto westbound Hana Highway approximates 1,900 vehicles, while the left-turn movement from Hana Highway to southbound Dairy Road approximates 700 vehicles. Slightly lower volumes of right-turn vehicles occur for the return movements (eastbound) at these two intersections in the afternoon peak hour.

TRAFFIC CONDITIONS AT KEY INTERSECTIONS

The analysis of the three traffic signal-controlled intersections indicates that the average weekday volumes result in undesirable conditions (LOS E or F) at each intersection during either the morning or afternoon peak hour (see Table 2-2). The worst conditions occur at the intersection of Hana Highway and Dairy Road during the afternoon peak hour. The long vehicle delays (LOS E) at this intersection result from the competing demands for signal green time by the high volume of eastbound through traffic on Hana Highway, coupled with a large volume of left-turn vehicles from westbound Hana Highway and large volumes of traffic in both directions along Dairy Road. The estimated average weekday day volumes exceed the theoretical capacity of the intersection by 2 percent (V/C of 1.02), which indicates that typical annual average weekday volumes approximate the calculated capacity of the intersection.

At the intersection of Hana Highway with Haleakala Highway (Pukalani junction), the morning peak hour volumes approximate 91 percent of the calculated capacity, with conditions at LOS E. These conditions result from the large volume of northbound traffic on Haleakala Highway and westbound traffic along Hana Highway.

Peak hour traffic volumes at the Dairy Road-Puunene Avenue intersection utilize 78 and 81 percent of the calculated capacity during the morning and afternoon peak hours, respectively. Slightly longer vehicle delays (LOS E) occur during the afternoon peak hour due to higher left-turn volumes and a longer signal cycle length.

LOS F conditions (very long delays) are indicated for several STOP sign-controlled intersections along Hana Highway. At the Haleakala Highway intersection, the LOS F conditions are for eastbound left-turns crossing the high volume of westbound through traffic during the morning peak hour. The large negative reserve capacity (-213) at the Haleakala Highway overstates the difficulty of that left-turn movement since the analysis methodology does not account for gaps in westbound traffic flow created by the nearby traffic signal at Dairy Road. Field observations indicate queuing and delays do occur.

LOS F conditions also occur for through traffic on the Dairy Road and Keolani Place approaches to the intersection with Haleakala Highway. The delays occur during the afternoon peak hour.

Table 2-2

LEVELS OF SERVICE AT KEY INTERSECTIONS - EXISTING CONDITIONS
(YEAR 1994)
AVERAGE WEEKDAY
Year 2020 Traffic Assessment of Kahului Airport Access Road

No.	Intersection		Traffic Control Device	Morning Commute Peak Hour			Afternon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
5	Haleakala Hwy.	Hana Hwy.	STOP Sign	—	-213	F	—	173	D
6	Dairy Rd. - Kaolani Pl.	Haleakala Hwy.	STOP Sign	—	177	D	—	-58	F
7	Dairy Rd.	Hana Hwy.	Signal	0.71	—	C	1.02	—	E
8	Dairy Rd. - Kuihelani Hwy.	Puunene Ave.	Signal	0.78	—	D	0.81	—	E
9	Pulehu Rd.	Hana Hwy.	STOP Sign	—	227	C	—	12	E
10	Pulehu Rd.	Hansen Rd.	STOP Sign	—	369	B	—	358	B
11	Hansen Rd.	Hana Hwy.	STOP Sign	—	121	D	—	-12	F
12	Haleakala Hwy.	Hana Hwy.	Signal	0.91	—	E	0.65	—	C

V/C = Ratio of traffic volumes to estimated capacity at signalized intersections.
RC = Reserve, or unused, capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.
LOS = Level-of-Service.

Wilbur Smith Associates; November 1995

3. YEAR 2020 CONDITIONS WITHOUT AIRPORT IMPROVEMENTS - NO ACTION ALTERNATIVE

The present facilities at Kahului Airport are expected to permit continued growth in air passenger activity through the Year 2010, and possibly through 2020. As discussed in the *Socio-Economic Impact Assessment*,[1] the existing Airport facilities could accommodate most or all of the forecast air passenger increases through 2010, with the current Airport facilities imposing little or no constraints in attaining these forecast volumes. This analysis of Year 2020 conditions is based on the present airport facilities continuing to accommodate air passenger growth through 2020.

This chapter summarizes the analyses of traffic conditions in 2020 without the proposed Airport improvements. The analysis indicates where traffic problems may occur that would affect access to the Airport if the roadway modifications included in the Airport plan are not implemented by 2020. This assessment is intended to serve as a baseline against which the traffic impacts of the Preferred Plan roadway modifications can be measured.

The estimates of regional travel growth for this "No Action" scenario reflect the forecasts of population and economic growth on Maui as envisioned in the *Maui Long-Range Island-Wide Land Transportation Planning Study*. Through that study, the State DOT and Maui County are currently preparing traffic forecasts and roadway plans for a horizon year of 2020. Although the study results and recommended plan were not available at the time of this study, the traffic forecasts for this study were based on interim travel forecasts prepared by the Island-Wide Study.

ASSUMPTIONS AND METHODOLOGY

The traffic forecasts for this "No Project" scenario were developed from the Year 2020 traffic forecasts prepared by the Island-Wide Study for the "Committed Highway Network." The Committed Highway Network represents the baseline, or minimum, future roadway system consisting of existing roadways and the small number of planned roadway projects that are included in current funding plans. The planned Airport Access Road (Kuihelani Highway Extension) is included within the Committed Highway Network.

The Statewide Transportation Planning Office of State DOT provided a set of Year 2020 traffic assignments to the Committed Highway Network in the Wailuku-Kahului area for use in the Airport traffic studies. These traffic assignments, dated August 1, 1995, include forecasts for morning peak hour, afternoon peak hour, and average daily traffic volumes on the existing and committed future roadways near the Airport.

For the analyses of the No Airport Project scenario, the Year 2020 traffic forecasts from the Island-Wide Study were modified to reflect the following:

[1] *Socio-Economic Impact Assessment of Proposed Kahului Airport Master Plan Improvements, Draft Report*, prepared by Community Resources, Inc., November 1994.

1. The traffic volumes to/from the Airport West Ramp area were reduced to reflect the slightly lower air passenger volumes that are forecast without the runway extension.

2. The traffic volumes were revised to reflect continued helicopter operations in the Airport East Ramp area.

3. The Airport Access Road was deleted from the roadway network and the traffic rerouted to the Airport West Ramp area via Keolani Place or Haleakala Highway.

4. The computer assignment of roadway volumes and traffic turning movements at several intersections were refined to better reflect actual development plans and area travel patterns.

The following sections provide an overview of the assumptions and methodology used in the development of the Year 2020 forecasts for the No Action scenario.

Island-Wide Long Range Land Transportation Plan Study

The Island-Wide Study, jointly undertaken by the State DOT and Maui County, is identifying an island-wide highway plan to serve Maui travel growth through Year 2020. The study represents an update of and modification of the Year 2010 forecasts, which were used as the basis for the previous traffic studies at Kahului Airport. At the time of this airport study (September 1995), the Island-Wide Study was ongoing, with no recommended plan of improvements available.

Existing conditions for the current Island-Wide Study reflect Year 1990. The study is using projections of land uses and socio-economic data through Year 2020 to develop traffic forecasts. The 2020 forecasts are first tested against the minimum "Existing Plus Committed Highway Network" to identify future deficiencies. These findings are then used to identify and test alternative highway plans, and to select and prioritize a recommended plan of improvements.

The Maui socio-economic data used for the 1990 base year and the 2020 forecast year are summarized in Table 3-1. Data used as the basis of the previous Year 2010 forecasts is also included for comparison purposes. Population and employment are expected to increase by about 60 percent during the 30-year period. Hotel rooms are expected to increase by 23 percent. Due to the change in economic conditions since the previous island-wide study (1990), the new 2020 population and employment forecasts approximate levels that Maui was previously expected to reach by 2010.

Based on these socio-economic projections, the Island-Wide Study forecast a 66 percent increase in the number of weekday vehicle trips between 1990 (268,367) and 2020 (444,900).

Adjustments to Island-Wide Study Traffic Forecasts

The 2020 traffic assignments to the Existing Plus Committed Highway Network, as provided by State DOT, were refined to reflect several factors.

The land use inputs to the Island-Wide Study reflect these developments. A portion of the refinements identified as Item 4 in the previous section involved the adjustment of the Island-Wide Study forecasts on individual roadways to more accurately reflect traffic routing to/from the access locations for these future developments.

Roadway Improvements

The No Action Scenario includes those roadway projects identified for the Airport area in the Island-Wide Study *Existing Plus Committed Highway Network*, except for the Airport Access Road, which is deleted as part of the Airport Preferred Plan. Aside from the Airport Access Road, most of the "Committed" new roadway projects involve improvements made to Dairy Road as part of the private development projects planned along that roadway. These roadway modifications are listed under *Roadway Modifications Included in the No Action Scenario.*

Airport-Related Vehicle Trip Generation and Distribution

Vehicle Trip Generation - Ground traffic at Kahului Airport is primarily a factor of the level of air passenger activity at the West Ramp passenger terminal. Increases in the volume of air passengers result in increased numbers of rental car, private car, taxi, and charter vehicle trips to serve these passengers, but also result in increased employee traffic as well as trips by various types of service vehicles (baggage, food service, concessionaires, maintenance, etc.). Therefore, estimates of the future traffic volumes for the West Ramp terminal area of the airport are based on the forecasts of future air passenger volumes. Trip rates relating observed ground counts of peak hour and daily vehicle trips on Keolani Place to the air passenger activity were developed as part of the *Traffic Impact Study for Kahului Airport Improvements.*[3] These trip rates are listed in Table 3-2.

Ground traffic to/from the East Ramp area was estimated using trip generation rates for general aviation, helicopter, and air cargo operations. Standard trip rates for warehouse distribution centers were used to represent air cargo operations. The trip rates and sources are summarized in Table 3-2.

Trip Distribution - The travel forecasting model used in the Island-Wide Study distributed the West Ramp trips to the various areas of Maui based on population, employment, and hotel rooms projected for those areas in Year 2020. The Island-Wide Study distribution of West Ramp trips was also used in this study, although the routing of trips in the airport area was modified to reflect changes to the roadway system.

Distribution of trips to/from the East Ramp activities were made using the distribution identified in the *Traffic Impact Study for Kahului Airport Improvements.*[4]

(3) Op.cit. Chapter 2.

(4) Op. cit., Table 3-5.

Table 3-1

COMPARISON OF SOCIO-ECONOMIC DATA
USED AS BASIS OF MAUI ISLAND-WIDE TRANSPORTATION PLAN FORECASTS
Year 2020 Traffic Assessment of Kahului Airport Access Road

Item		Year 1990[1]	Year 2010[2]		Year 2020[1]	
			Number	Increase over 1990	Number	Increase over 1990
Resident Population		91,380	149,088	63.2%	147,490	61.4%
Dwelling Units:	Single Family	19,140	38,453	—	30,444	—
	Multi Family	12,724	15,767	—	20,482	—
	Combined	31,864	54,220	70.2%	50,926	59.8%
Employment		51,788	80,271	55.1	83,400	61.1%
Hotel Rooms		18,756	30,070	60.3%	23,062	23.1%

Sources:

(1) = Memorandum to Dean Nakagawa (Hawaii DOT Statewide Transportation Planning Office) from Dick Kaku (Kaku Associates), November 10, 1994.

(2) = *Maui Long-Range Highway Planning Study, Island-Wide Plan, Final Report*, prepared for State of Hawaii DOT, County of Maui Department of Public Works, and County of Maui Department of Planning, by Austin, Tsutsumi & Associates, Inc., May 1991.

Wilbur Smith Associates; October 1995

Table 3-2

VEHICLE TRIP GENERATION RATES FOR AIRPORT USES
Kahului Airport Improvements - Traffic Impact Study

Land Use	Unit	Morning Peak Hour		Afternoon Peak Hour		Daily
		Enter	Exit	Enter	Exit	
West Ramp Terminal Area[1]	Air Passenger	0.0359	0.0308	0.0294	0.0441	1.0356
General Aviation[2]	Based Aircraft	0.38	0.29	0.48	0.52	6.6
Heliport[3]	Based Aircraft	1.64	1.22	2.30	2.29	30.6
Air Cargo[3]	Acres	7.11	2.77	3.06	5.69	56.1

Sources:

(1) Wilbur Smith Associates, based on Kahului Airport data.
(2) *Maui General Aviation Study, Airport Site Selection Report*, prepared for State DOT airports division by Edward K. Noda and Associates, Inc., December 1994.
(3) *Trip Generation*, Institute of Transportation Engineers, 1991.

Wilbur Smith Associates; April 1994

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1. The traffic assignments primarily reflect trips to/from the West Ramp area, and do not fully reflect trips to/from the East Ramp helicopter and general aviation areas. The estimated East Ramp trips were added to the Island-Wide Study forecasts.

2. The 2020 Island-Wide Study forecasts include West Ramp traffic equivalent to the Preferred Plan with runway extension. The No Action scenario was assumed to represent 3.3 percent fewer air passengers than the Preferred Plan, the same differential as projected for Year 2010 by the *Socio-Economic Impact Assessment for Kahului Airport*.[1] Traffic to/from West Ramp was reduced by this amount.

3. The Island-Wide Study committed highways includes the planned Airport Access Road, which is not included in the Airport No Action scenario. This roadway was deleted for the No Action network and the estimated traffic volumes on this road were rerouted, primarily via Keolani Place.

4. The Island-Wide Study, by virtue of its island-wide scale of analysis, results in traffic assignments that may not fully reflect localized traffic patterns at the community level. Existing intersection traffic counts, roadway counts, and traffic impact studies for planned future developments were reviewed to identify such problem locations, and to refine the traffic movements at specific intersections.

The amount of traffic growth forecast by the Island-Wide Study between 1990 and 2020 on roadways east/southeast of the Airport (Hana Highway, Haleakala Highway, and Pulehu Road), south of the Airport (Puunene Avenue and Kuihelani Highway) and west of the Airport (Puunene Avenue and Hana Highway) was used as a control in making the refinements and adjustments to the forecast travel patterns in the vicinity of the Airport.

Development in the Airport Vicinity

In the past several years, three future developments have been identified for the area along Dairy Road. These are:

- Phase II of Triangle Square, a factory outlet retail center of about 79,000 sq. ft. of floor area, now under construction in the triangular area bounded by Dairy Road, Hana Highway, and Haleakala Highway.
- A Costco Warehouse Club of about 136,000 sq. ft. of floor area, located at the southeast corner of Dairy Road and Haleakala Highway.
- The Kahului Industrial Park, covering about 73 acres along the east side of Dairy Road between Hana Highway and Puunene Avenue.

[1] Op. cit. Community Resources, Inc.

ROADWAY MODIFICATIONS INCLUDED IN THE NO ACTION SCENARIO

The No Action Scenario includes those future roadway projects identified as part of the Existing Plus Committed Highway Network in the Island-Wide Study, with the exception of the Airport Access Road (Kuihelani Highway Extension) since it is the major element of the proposed Kahului Airport roadway improvements. The other "Committed" projects in the airport study area are those modifications to be made as part of traffic mitigation for the new developments planned in the Dairy Road area. These roadway modifications include:

- Dairy Road is to be widened to five lanes between Hana Highway and Haleakala Highway, with two lanes in each direction plus a center left-turn lane.
- The Haleakala Highway/Dairy Road/Keolani Place intersection is to be reconstructed to provide an exclusive left-turn lane on each approach, and a traffic signal installed.
- The westbound approach of Hana Highway at Dairy Road is to be widened to provide two left-turn lanes.
- Eastbound Hana Highway at the Dairy road intersection is to be widened to provide an additional through/right-turn lane at the intersection, with the additional lane ending a short distance beyond the intersection.
- The section of Dairy Road between Hana Highway and Puunene Avenue is to be widened to five lanes, with two lanes in each direction plus a center left-turn lane. At the Puunene Avenue intersection, southbound Dairy Road would be further widened to include a second (double) left-turn lane.
- Puunene Avenue is to be widened to provide a second southeast bound through lane at the Dairy Road-Kuihelani Highway intersection.

AIRPORT VEHICLE TRIP GENERATION

For Year 2010, the *Socio-Economic Impact Analysis Study*[1] estimated that the No Action Scenario would result in 3.3 percent fewer air passengers than the Preferred Plan. The differential is attributed to less convenient connections to many overseas origin areas of visitor trips to Maui. The Airport facilities could support the air passenger volumes, but the existing runway lengths would require most overseas visitors to connect through Honolulu or West Coast cities rather than fly nonstop to Maui. This same relationship (96.7 percent of air passengers with the Preferred Plan) is assumed to continue through Year 2020.

Ground traffic forecasts for Year 2020 with the No Action scenario are based on the following activity levels at Kahului Airport:

[1] Op. cit.

9,393,000 Annual Air Passengers
63 Based Generation Aviation Aircraft
54 Based Helicopters

The Year 2020 annual air passengers with the No Action scenario represent a 21.6 percent increase over the number estimated for this scenario for 2010.

The 2020 No Action scenario results in an estimated 33,450 daily vehicle trips to or from Kahului Airport. The estimated peak hour and daily vehicle trips are summarized in Table 3-3.

COMMUTE PEAK HOUR TRAFFIC VOLUMES

The resultant estimated traffic volumes in the morning and afternoon commute peak hours for the Year 2020 average weekday are depicted in Figures 3-1 and 3-2, respectively. These average weekday volumes are about 5 percent lower than the volumes on an August "design day".

The highest volumes occur along the section of Hana Highway between Haleakala Highway (Pukalani Junction) and Dairy Road. Peak travel direction volumes are well over 3,000 vehicles during each of these peak hour periods. The 2020 volumes represent increases of about 25 to 35 percent over the volumes forecast for 2010 in the *Kahului Airport Improvements Traffic Impact Study*. Much of this increase is due to the 2020 forecast reflecting only the Committed Highway Network improvements, which do not include an Upcountry-Kihei connector roadway. The proposed connector roadway would divert a portion of the Upcountry traffic to Kihei and West Maui away from using Hana Highway.

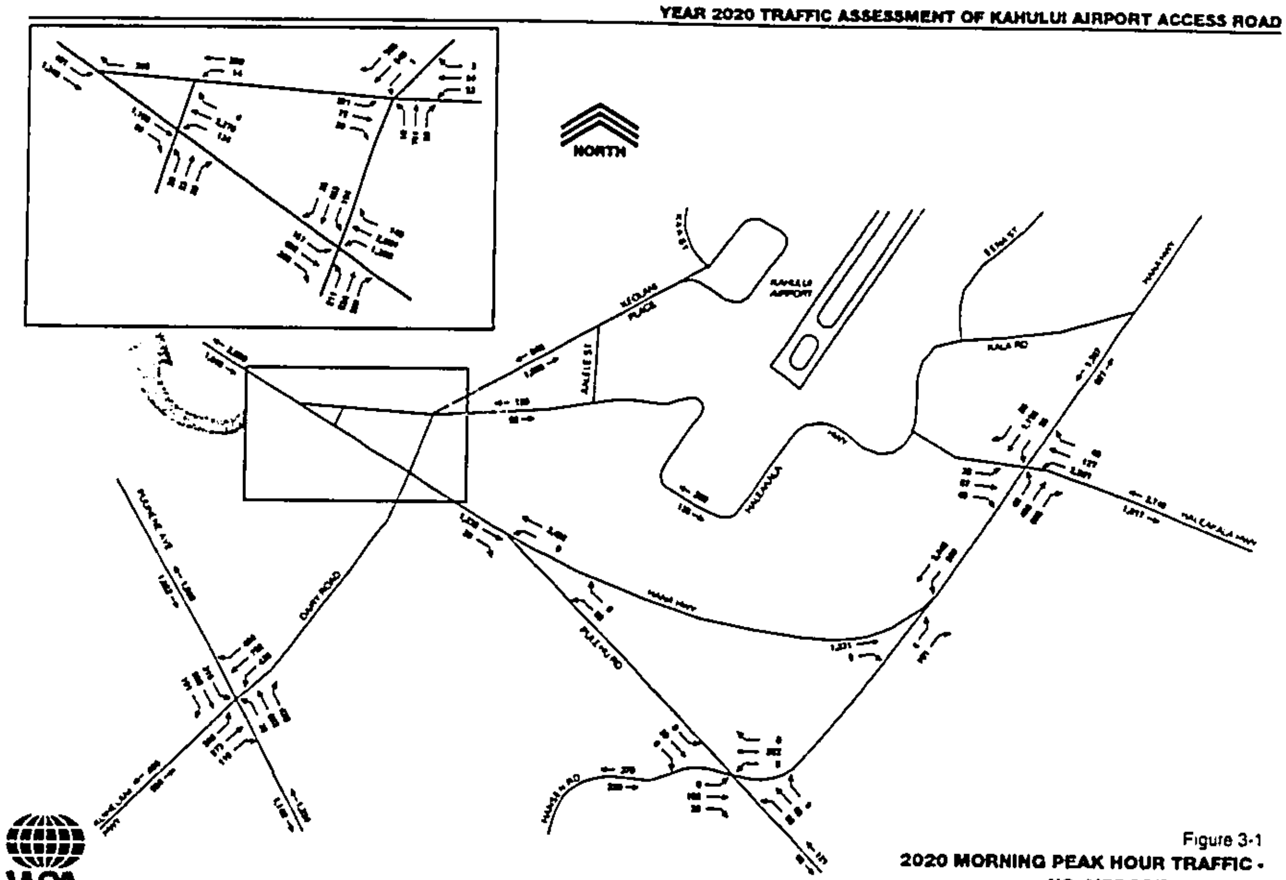
Substantial traffic increases are projected for Dairy Road. For the No Action scenario, Dairy Road would continue to serve as the principal access to/from Kahului Airport, as well as provide access to the Costco, Triangle Square, and Kahului Industrial Park developments.

TRAFFIC CONDITIONS AT KEY INTERSECTIONS

The traffic increases would result in congested conditions for Year 2020 average weekday, and design day, at many of the intersections in the Airport area. The peak hour conditions for the average weekday are listed in Table 3-4; design day conditions would be about 5 percent worse.

At three of the four traffic-signal controlled intersections, the projected traffic increases would exceed planned roadway capacity for one or both peak hour periods on an average weekday. The fourth, Haleakala Highway at Dairy Road/Keolani Place, would provide acceptable conditions for either the average weekday or design day traffic volumes. The problem intersections include:

- At the Hana Highway-Dairy Road intersection, the projected 2020 average weekday traffic during both morning and afternoon peak hours would exceed capacity by 10 percent or more, and result in LOS F conditions.



WILBUR SMITH ASSOCIATES

Figure 3-1
2020 MORNING PEAK HOUR TRAFFIC - NO AIRPORT PROJECT

YEAR 2020 TRAFFIC ASSESSMENT OF KAHULUI AIRPORT ACCESS ROAD

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Table 3-3

VEHICLE TRIP GENERATION AT KAHULUI AIRPORT
YEAR 2020 WITH NO ACTION SCENARIO
Year 2020 Traffic Assessment of Kahului Airport Access Road

Activity	Quantity	Morning Commute Peak Hour			Afternoon Commute Peak Hour			Daily
		Enter	Exit	Total	Enter	Exit	Total	
West Ramp								
▸ Terminal Area	9.393 MAAP	1,088	928	2,016	891	1,338	2,229	31,380
East Ramp								
▸ Generation Aviation	63 Aircraft	24	19	43	31	33	64	420
▸ Helicopter	54 Aircraft	100	66	166	124	124	248	1,650
Subtotal		124	85	209	155	157	312	2,070
TOTAL		1,212	1,013	2,225	1,046	1,495	2,541	33,450

MAAP - Million Annual Air Passengers

Wilbur Smith Associates; October 1995

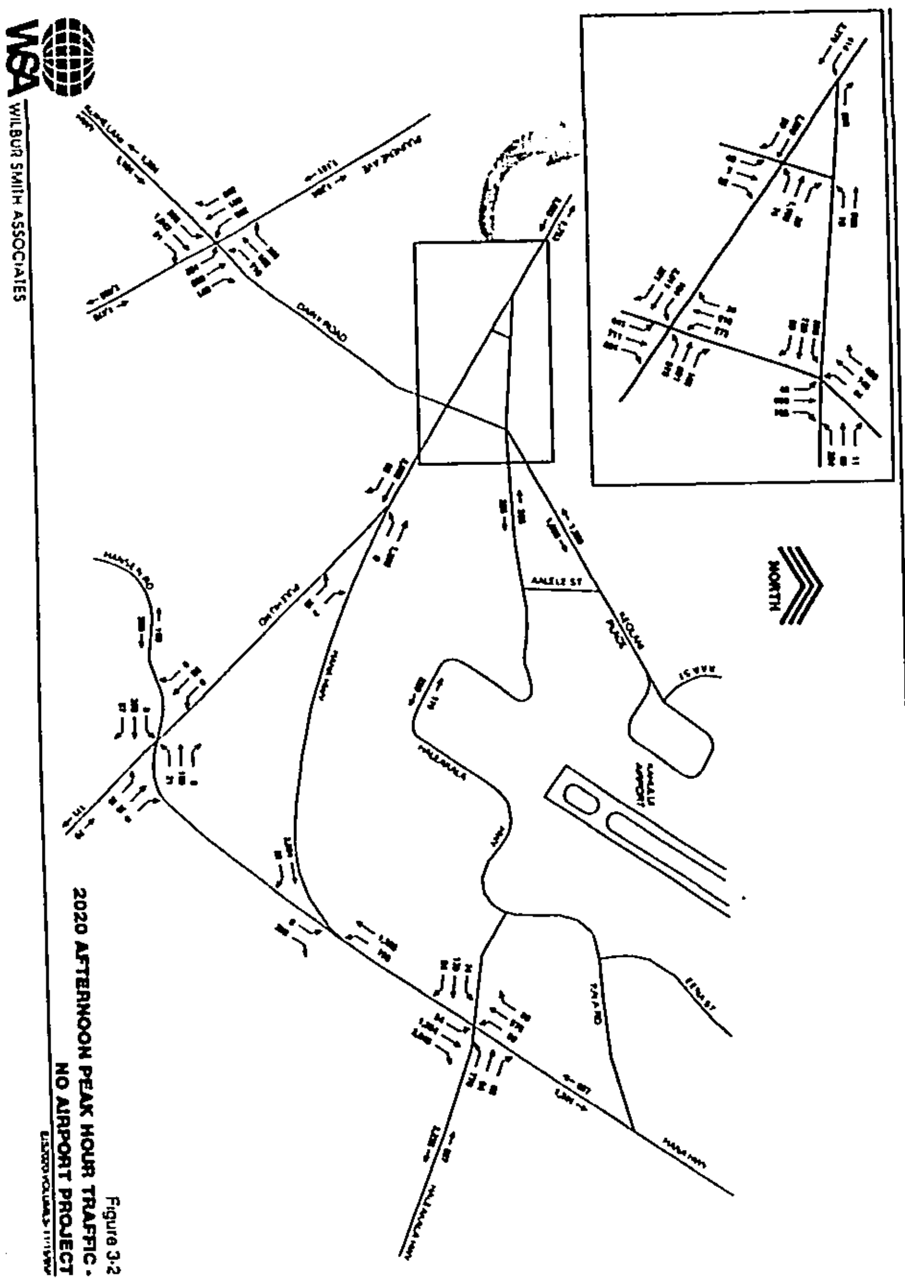

Figure 3-2
2020 AFTERNOON PEAK HOUR TRAFFIC - NO AIRPORT PROJECT

Table 3-4

**LEVEL OF SERVICE AT KEY INTERSECTIONS
FOR AVERAGE WEEKDAY YEAR 2020 NO ACTION ALTERNATIVE
WITHOUT AIRPORT MODIFICATIONS**
Year 2020 Traffic Assessment of Kahului Airport Access Road

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	N-S Street	E-W Street		V/C	RC	LOS	V/C	RC	LOS
5	Haleakala Hwy.	Hana Hwy. West Jct.	1994		-213	F		173	D
			2020 NA		-337	F		-271	F
6	Dairy-Keolani Pl.	Haleakala Hwy.	1994		177	D		-58	F
			2020 NA	0.61		C	0.85		D
7	Dairy Rd.	Hana Hwy.	1994	0.71		D	1.02		E
			2020 NA	1.10		F	1.22		F
8	Dairy-Kuihelani	Puunene Ave.	1994	0.78		D	0.81		E
			2020 NA	1.09		E	1.03		F
9	Pulehu Rd.	Hana Hwy.	1994		227	C		12	E
			2020 NA		-38	F		-6	F
10	Pulehu Rd.	Hansen Rd.	1994		389	B		358	B
			2020 NA		194	D		149	D
11	Hansen Rd.	Hana Hwy.	1994		121	D		-18	F
			2020 NA		-201	F		-66	F
12	Haleakala Hwy.	Hana Hwy. Pukalani Jct.	1994	0.91		E	0.58		C
			2020 NA	1.34		F	0.94		E

1994 = Existing Conditions (Year 1994).
2020 NA = No Action Alternative (Year 2020).
V/C = Ratio of traffic volume to estimated capacity for signalized intersections.
RC = Reserve or unused capacity for the most critical movement controlled by a STOP or YIELD sign. Negative values imply that traffic volume exceeds capacity.

Wilbur Smith Associates, November 1995

T05502

- At the intersection of Dairy Road, Kuihelani Highway, and Puunene Avenue, the average weekday traffic would exceed capacity by 9 and 3 percent during the morning and afternoon peak hours, respectively.
- At the intersection of Hana and Haleakala Highways (Pukalani Junction), the large volume of westbound traffic from Haleakala Highway would exceed intersection capacity by 34 percent and result in LOS F conditions during the morning peak hour. The afternoon traffic would approach capacity.

Traffic conditions are projected to worsen at the STOP sign-controlled intersections. The largest change would occur for left-turn traffic from eastbound Hana Highway to Haleakala Highway (west junction) where the increased Airport and development traffic would result in severe LOS F conditions during both peak hours. The large increase in through traffic along Hana Highway would contribute to the worsening of conditions to LOS F for traffic exiting from both Pulehu and Hansen Roads onto Hana Highway during both the morning and afternoon peak hours.

4. YEAR 2020 TRAFFIC CONDITIONS WITH THE PLANNED AIRPORT ROADWAY MODIFICATIONS

A number of major roadway modifications are included within the Preferred Plan of future improvements at Kahului Airport. The principal component of these changes is the construction of a new Airport Access Road to improve access to the West Ramp passenger terminal complex. The Preferred Plan also includes a relocated access to the East Ramp area, as well as the closure of several roadway segments as a result of these new access roadways. The Preferred Plan is intended to improve access to the Airport and relieve traffic conditions at several existing or future problem locations. However, these roadway modifications would also affect regional and local traffic in vicinity of the Airport.

This chapter describes the planned roadway modifications, and analyzes conditions at key intersections to assess whether the planned roadway modifications would provide sufficient capacity to serve travel demands through 2020. The Preferred Plan of airport improvements, also collectively referred to as the Project, could be completed well before Year 2020.

PROJECT DESCRIPTION

The Preferred Plan includes a number of modifications to upgrade and/or expand facilities at Kahului Airport. Area traffic patterns and travel conditions would be affected by the proposed roadway modifications included within the Project, but also several airfield modifications that could affect travel demands to/from the Airport. Those that most directly affect ground travel demands and traffic conditions are the following:

1. **Modifications that would affect roadway network:**

   - Construction of a new Airport Access Road with an interchange at Hana Highway, to allow airport traffic to bypass Keolani Place/Dairy Road when entering or exiting the Airport West Ramp area.
   - Abandonment of Haleakala Highway between Hana Highway (Pukalani junction) and Aalele Street to avoid a crossing of the Airport Access Road and to accommodate the extension of the present runway.
   - Construction of a new Spine Road parallel to the east side of the existing runway that would serve the general aviation, air cargo, and airport operations facilities.
   - Abandonment of the present segments of Hansen and Pulehu Roads between their junction and Hana Highway, and replacement with a single roadway intersecting Hana Highway opposite the Spine Road.
   - Abandonment of Kala Road north of Hana Highway.

2. **Modifications that could affect traffic demands:**

   - Relocation of the helicopter facilities away from Kahului Airport.
   - Runway extension and parallel runway that could facilitate takeoffs for direct overseas flights to additional destinations.

METHODOLOGY AND ASSUMPTIONS

The 2020 roadway travel volumes were forecast using a similar methodology to that described for the No Action forecasts. These forecasts are based on the Maui Island-Wide Long-Range Land Transportation Study travel projections for Year 2020 with a roadway system including only existing and "committed" roadways.

Traffic Forecasts

The Year 2020 traffic forecasts for the "Existing Plus Committed Highway Network", as prepared by the *Maui Island-Wide Long-Range Land Transportation Study*, was used as the basis of this study's forecasts with the Preferred Plan of Airport roadway improvements. The Island-Wide Study forecasts reflect the planned Airport Access Road, but not the modifications in the East Ramp area. The general methodology used to estimate roadway volumes with the Preferred Plan was as follows:

1. The No Action traffic assignments were used as the basis for estimating the Preferred Plan forecasts. The No Action volumes were developed from the Island-Wide Study forecasts of 2020 morning and afternoon peak hour traffic[1] with a roadway system comprising existing and committed roadway projects. (See Chapter 3.)
2. Changes were made to the estimated number of vehicle trips generated by the airport to reflect the increase in air passenger-related travel to/from West Ramp, and the relocation of helicopter operations from the East Ramp to elsewhere on Maui.
3. The revised numbers of Airport trips were assigned to the roadway system.
4. Airport and non-airport traffic were reassigned to the roadway network modified to include the changes proposed in the Preferred Plan.

[1] Year 2020 traffic assignments, dated August 1, 1995, as provided by Statewide Transportation Planning Office of the State DOT.

Forecast Air Passengers

With the Preferred Plan, the Kahului Airport West Ramp terminal is estimated to serve 9,712,000 air passengers in 2020. This reflects forecasts made in the 1994 update of Hawaii aviation demands.[1] Design day air passengers would total 31,328 in 2020.

Air passenger activity levels for the Preferred Plan are estimated to be about 3.4 percent higher than for the No Action scenario due to the increased convenience of direct flights to several additional mainland market areas with the proposed runway extension.

Roadway System

The Preferred Plan includes those non-Airport-related roadway modifications identified as Committed projects in the Island-Wide Study forecasts of August 1, 1995. These are described in Chapter 3.

The Airport roadway modifications included in the Preferred Plan are listed on Pages 4-4 and 4-6

Analysis of Roadway Sufficiency

The assessment of roadway conditions uses the analysis methodologies outlined on Pages 2-1 through 2-4.

The traffic forecasts represent average weekday traffic volumes, which are about 4.7 percent lower than the roadway volumes for a "design day." Therefore, the criteria for identifying problems at traffic signal-controlled intersections is adjusted to reflect this differential in traffic forecasts. Criteria for STOP-sign controlled intersections and interchange ramps have not been modified. The criteria used to identify the likely need for additional roadway modifications are as follows:

Traffic Signal-Controlled Intersections - An intersection with average weekday traffic equal to or above 96 percent of intersection capacity (volume-to-capacity, or V/C, ratio of 0.96) would likely have design day traffic volumes in excess of capacity. Actions to improve conditions may thus be necessary with a V/C ratio of 0.96 or above.

STOP and YIELD Sign-Controlled Intersections - Level-of-Service (LOS) F conditions indicate that delays to traffic controlled by the STOP or YIELD condition may warrant actions to improve conditions.

Interchange Ramps - LOS F conditions indicate delays to ramp traffic and/or possible disruption to through traffic that may warrant actions to improve conditions.

(1) *Update, Hawaii Aviation Demand Forecasts*, prepared for State of Hawaii Department of Transportation by Aries Consultants, Ltd., August 1994.

DESCRIPTION OF AIRPORT ROADWAY MODIFICATIONS

The roadway modifications included as elements of the Preferred Plan are intended to improve access to Kahului Airport, as well as to benefit non-airport traffic in the adjacent areas. A description of each key modification is provided in the following paragraphs.

New Airport Access Road and Interchange

The new Airport Access Road would extend northeastward from Dairy Road, from a location about 700 feet north of its intersection with Puunene Avenue, across Hana Highway to intersect the West Ramp Terminal loop road. Key features of the new roadway are:

- The new Airport Access Road would be a four-lane highway with a median divider strip, and with full control of access.
- At the south end of the new road segment, the Airport Access Road/Kuihelani Highway would be the through route, with Dairy Road ending at a T-intersection with the new road.
- The Dairy Road approach would have separate left- and right-turn lanes at the intersection, and a northbound left-turn lane would be provided on the Airport Access Road. For purposes of this assessment, the intersection is assumed to have traffic signal controls.
- A grade-separated crossing and partial cloverleaf interchange would be provided at Hana Highway. The interchange would provide for all through and turning movements.
- The Airport Access Road would connect directly into the southern end of the West Ramp Terminal loop roadway.
- No at-grade street intersections are planned between Dairy Road and the Terminal loop roadway.

The configuration of the Airport Access Road-Hana Highway interchange would include the following key features:

- Direct ramps would be provided for each of the four right-turn movements at the junction of the two roads.
- Loop ramps would be provided for the high-volume Hana-to-Lahaina movement, and for the Wailuku-to-Airport movement.
- The Airport-to-Hana and Lahaina-to-Wailuku movements would be accommodated by at-grade left-turns onto the direct ramps in the southeast and northwest quadrants, respectively. Left-turn storage lanes would be provided on the Airport

Access Road for these two movements, with no traffic signal controls assumed at either location.

Abandonment of the Airport Section of Haleakala Highway

The portion of Haleakala Highway between the Pukalani junction with Hana Highway and the new Airport Access Road would be permanently closed to public traffic to avoid an at-grade crossing of the Airport Access Road and to permit the runway extension.

- At the Pukalani junction, the southeastern portion of Haleakala Highway would end as a T-intersection with Hana Highway.
- At the west end, Aalele Street would be realigned to connect to Haleakala Highway west of the Airport Access Road. An airport service road would extend from Haleakala Highway beneath the Airport Access Road to provide access to the airside areas.
- The segment of Kala Road between Hana Highway and Haleakala Highway would also be abandoned.

These road closures would require traffic now using these segments to use Hana Highway.

New Airport Spine Road

A new public roadway would be constructed east of and parallel to the existing runway to provide access to the general aviation, air cargo, and airport operations facilities in this area. Roadway features include:

- The new roadway would provide one lane in each direction. At the Hana Highway intersection, separate right-turn lanes would be provided for turning vehicles.
- On Hana Highway, an eastbound left-turn and westbound right-turn lane would be provided for turns into the Spine Road.
- The Spine Road approach to Hana Highway would be STOP sign controlled.

Modifications to Hansen and Pulehu Roads

The construction of the Airport Access Road interchange would necessitate the eastward relocation of the Pulehu Road connection to Hana Highway. With the future construction of a new Spine Road intersection with Hana Highway, the Preferred Plan seeks to minimize disruption to Hana Highway traffic by consolidating the Pulehu, Hansen, and Spine Road connections into a single intersection at the Spine Road junction.

- The existing segments of Hansen and Pulehu Roads between their junction and Hana Highway would be abandoned.

- Hansen Road would be extended from Pulehu Road to intersect Hana Highway opposite Spine Road, with the extension having one travel lane in each direction.
- Pulehu Road would form a T-intersection with Hansen Road, with the Pulehu Road approach controlled by a STOP sign. Separate left- and right-turn lanes would be provided on both roadways.
- The Hansen Road approach to Hana Highway would be STOP sign-controlled and would include a separate right-turn lane. An eastbound right-turn lane and westbound left-turn lane would be provided on Hana Highway.

AIRPORT TRIP GENERATION

Ground traffic forecasts for the Preferred Plan are based on the increase in air passenger activity above the level projected for the No Action Scenario, and on the relocation of helicopter facilities away from Kahului Airport. The Preferred Plan traffic estimates for 2020 are based on:

9,712,000 Annual Air Passengers
63 Based General Aviation Aircraft

The Preferred Plan results in an estimated 32,450 daily vehicle trips to or from the Airport West Ramp area on the 2020 design day, and 650 daily vehicle trips to the East Ramp area. The estimated daily and peak hour trips are summarized in Table 4-1 for the design day.

The Preferred Plan would result in a slightly larger trip generation for the West Ramp area, approximately 3.4 percent higher, as compared to the No Action Scenario. However, the relocation of the helicopter facilities results in substantially lower traffic generation for the East Ramp area, as well as an overall one percent lower trip generation for the combined East and West Ramp activities.

PEAK HOUR TRAFFIC VOLUMES

The projected 2020 peak hour traffic volumes on roadways in the vicinity of Kahului Airport are depicted in Figures 4-1 and 4-2 for the morning and afternoon commute hours, respectively. The traffic assignment reflects both the proposed roadway modification for the Airport, and the changes in Airport activity levels.

The new Airport Access Road is estimated to divert over one-half of the traffic volumes from Keolani Place. On the segments entering/exiting the West Ramp terminal area, the Airport Access Road would accommodate approximately twice as much traffic as Keolani Place in the morning peak hour (1,457 versus 726 vehicles), and almost 70 percent more in the afternoon peak hour (1,541 versus 916 vehicles). The Airport Access Road would serve most of the terminal area traffic, while Keolani Place would primarily serve traffic to the adjacent land uses and a portion of the terminal area traffic to/from the Wailuku-Kahului area.

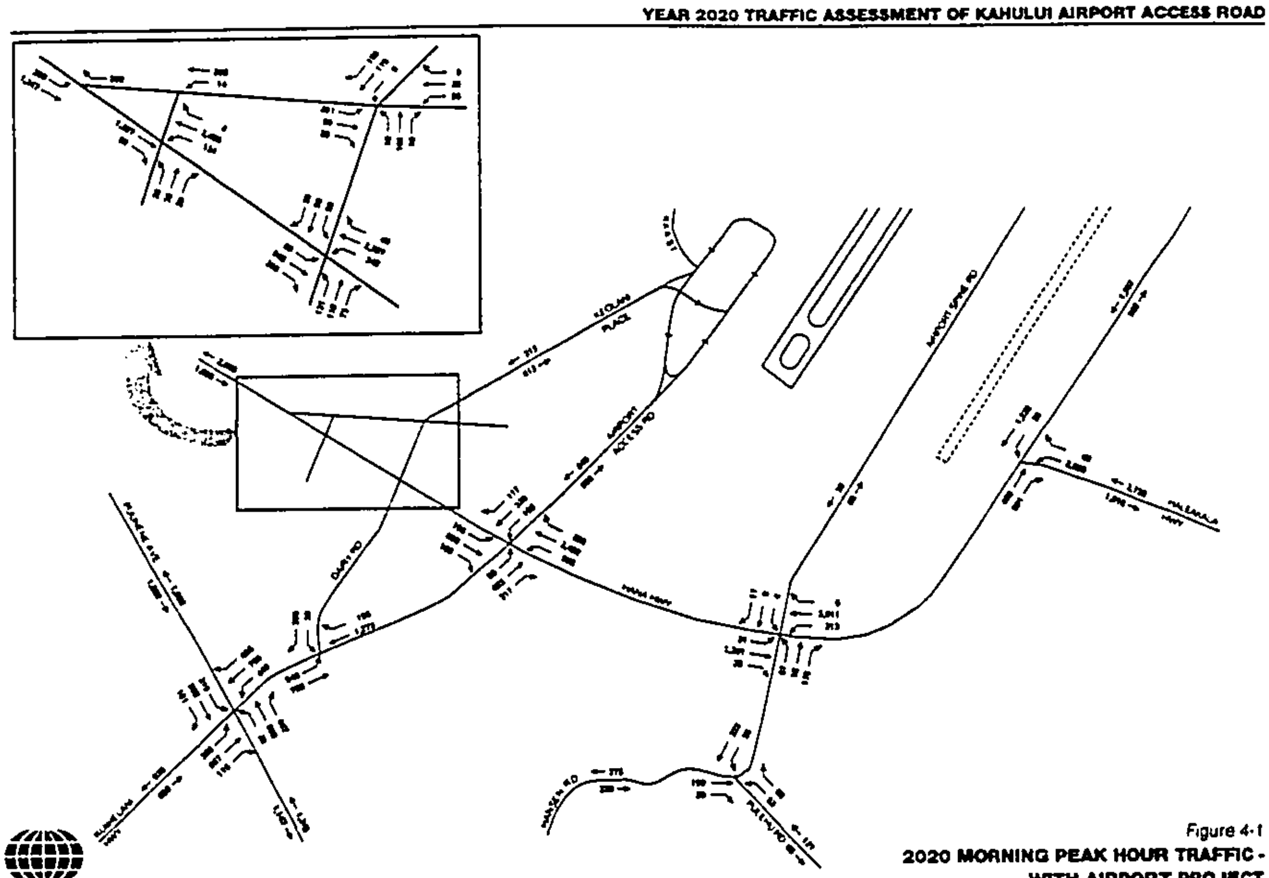

Figure 4-1
2020 MORNING PEAK HOUR TRAFFIC - WITH AIRPORT PROJECT

WILBUR SMITH ASSOCIATES

Table 4-1

VEHICLE TRIP GENERATION AT KAHULUI AIRPORT
2020 WITH PREFERRED PLAN
Year 2020 Traffic Assessment of Kahului Airport Access Road

Scenario/Activity	Quantity	Morning Commute Peak Hour			Afternoon Commute Peak Hour			Daily
		Enter	Exit	Total	Enter	Exit	Total	
Preferred Plan								
West Ramp								
▸ Terminal Area	9.712 MAAP	1,125	959	2,084	921	1,383	2,304	32,450
East Ramp								
▸ General Aviation	63 Aircraft	24	19	43	31	[illegible]	64	420
▸ Air Cargo	4 Acres	29	11	40	13	23	36	230
Subtotal		53	30	83	44	56	100	650
TOTAL		1,178	989	2,167	946	1,439	2,404	33,100
Difference Compared to No Action								
West Ramp		+37	+31	+68	+30	+45	+75	+1,070
East Ramp		-71	-55	-126	-111	-101	-212	-1,420
Combined		-34	-24	-58	-81	-56	-137	-350

MAAP = Million Annual Air Passengers.

Wilbur Smith Associates; November 1995

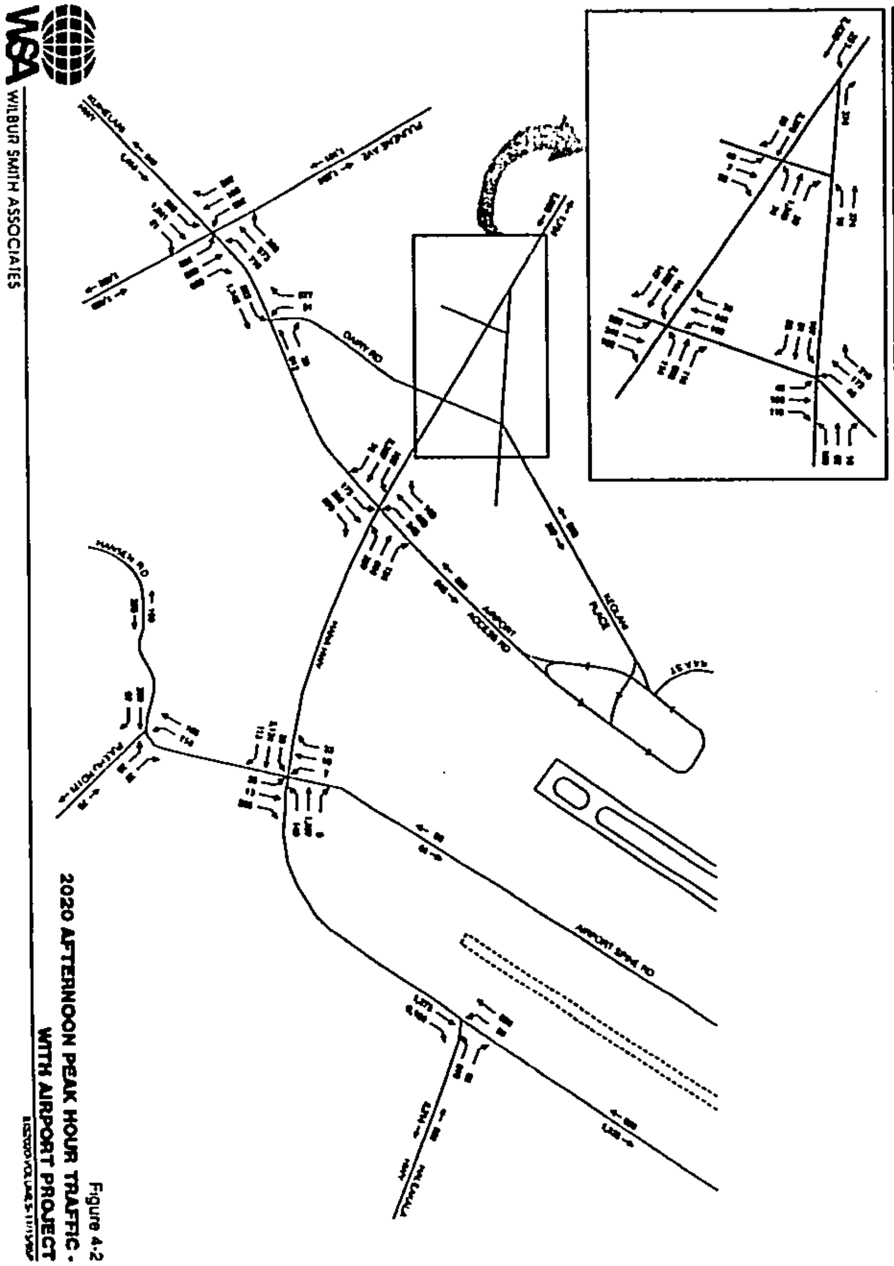

Figure 4-2
2020 AFTERNOON PEAK HOUR TRAFFIC - WITH AIRPORT PROJECT

WILBUR SMITH ASSOCIATES

Large changes to peak hour traffic volumes would occur along Dairy Road. Diversion of most West Ramp terminal traffic to the new Airport Access Road would reduce traffic volumes on the segment north of Hana Highway, in the Kmart/Triangle Square blocks, by about 50 percent as compared to the No Action Scenario. A larger reduction would occur on the segment south of Hana Highway (about 60-70 percent) since the Airport Access Road would also divert from this segment the traffic between East Maui and the South and West Maui areas.

The effects of the Preferred Plan would vary along the different segments of Hana Highway:

- Beyond the Pukalani and West Junctions with Haleakala Highway, the Preferred Plan traffic volumes would show small increases or decreases from the No Action Scenario. These nominal changes would result from the offsetting effects of the small increases in air passenger trips and the elimination of helicopter-related trips.
- Between Pukalani Junction and the Airport Access Road, traffic volumes would increase by 5 to 10 percent. The increase would result from the closure of Haleakala Highway between Pukalani Junction and Aalele Street, and the diversion of this traffic to Hana Highway.
- Between the Airport Access Road and Dairy Road, a variety of changes would occur due to the following:
  - Most of the traffic between East Maui and West Maui would be diverted to the new Airport Access Road, thus reducing volumes; and
  - Much of the Wailuku-Kahului traffic to the Airport would likely use the new Airport Access Road, thus increasing volumes on this segment.

  The net result would be a reduction in peak direction traffic volumes and increases to the off-peak direction traffic volumes.

Decreases of 25 percent or more would occur along Haleakala Highway near Dairy Road. This would occur due to less usage by airport traffic, and to the closure of the segment through the Airport.

Most other roadways would experience small decreases to no change in traffic volumes.

PEAK HOUR TRAFFIC CONDITIONS

Traffic conditions were analyzed at key locations with the Preferred Plan traffic forecasts and roadway modifications. These analyses represent Year 2020 conditions without any other roadway improvements in the area other than the Airport-related projects and the widening of Dairy Road (i.e. no bypass roads that would divert traffic away from the study area roadways).

Conditions at Key Intersections

Conditions during the commute peak hours are summarized at the key intersections in Table 4-2. The conditions reflect the average weekday in Year 2020.

Table 4-2
(Page 2 of 2)
LEVELS-OF-SERVICE AT KEY INTERSECTIONS
PREFERRED PLAN YEAR 2020 AVERAGE DAY
Year 2020 Traffic Assessment of Kahului Airport Access Road

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
14	Hansen - Spine Rd.	Hana Hwy.	2020 PP		-78	F		-41	F
15	Airport Access Rd.	Dairy Rd.	2020 PP	0.89		D	1.08		E
16	Airport Access Rd.	Hana Hwy. EB On-Ramp	2020 PP		341	B		280	C
17	Airport Access Rd	Hana Hwy. WB On-Ramp	2020 PP		448	A		210	C

1994 = Existing Conditions (Year 1994)
2020 NA = No Action Alternative (Year 2020)
2020 PP = Preferred Plan (Year 2020)
V/C = Volume-to-Capacity Ratio at a signalized intersection.
RC = Worst Reserve Capacity for movements controlled by a STOP or YIELD sign.
LOS = Level-of-Service

Wilbur Smith Associates; October 1995

Table 4-2
(Page 1 of 2)
LEVELS-OF-SERVICE AT KEY INTERSECTIONS
PREFERRED PLAN YEAR 2020 AVERAGE DAY
Year 2020 Traffic Assessment of Kahului Airport Access Road

No.	Intersection		Scenario	Morning Commute Peak Hour			Afternoon Commute Peak Hour		
	North-South Street	East-West Street		V/C	RC	LOS	V/C	RC	LOS
5	Haleakala Hwy.	Hana Hwy. (West Jct.)	1994		-213	F		173	D
			2020 NA		-337	F		-271	F
			2020 PP		-231	F		-140	F
6	Dairy Rd.-Keolani Pl.	Haleakala Hwy.	1994		177	D		-58	F
			2020 NA	0.61		C	0.85		D
			2020 PP	0.25		C	0.41		D
7	Dairy Rd.	Hana Hwy.	1994	0.71		C	1.02		E
			2020 NA	1.10		F	1.22		F
			2020 PP	0.93		D	0.89		E
8	Dairy Rd.-Kuihelani Hwy.	Puunene Ave.	1994	0.68		D	0.81		E
			2020 NA	1.09		E/F	1.03		F
	Airport Access Rd.	Puunene Ave.	2020 PP	1.09		E/F	1.00		F
10	Pulehu Rd.	Hansen Rd.	1994		369	B		358	B
			2020 NA		194	D		149	D
			2020 PP		218	C		221	C
12	Haleakala Hwy.	Hana Hwy. (Pukalani Jct.)	1994	0.91		E	0.58		C
			2020 NA	1.34		F	0.94		E
			2020 PP	1.28		C	0.68		B

The Preferred Plan roadway modifications would improve traffic conditions at most of the present intersections in the airport area, as compared to conditions without the project (No Action). However, forecast traffic volumes at several of the problem locations would still exceed the roadway capacity with the planned improvements. Year 2020 traffic would exceed capacity of the following signal-controlled intersections:

Airport Access Road (present Dairy Road) Intersection with Puunene Avenue and Kuihelani Highway - Traffic would equal or exceed the capacity of the intersection, with little change from conditions without the Airport project. The intersection would remain congested with the average weekday, as well as the design day, traffic volumes.

Hana Highway Intersection with Haleakala Highway (Pukalani Junction) - The closure of the north leg of Haleakala Highway (Airport leg) would result in an improvement in traffic conditions at this intersection. However, the traffic volumes in the morning peak hour would still substantially exceed capacity.

New Airport Access Road Intersections with Dairy Road - With traffic signal controls, estimated traffic volumes would exceed the intersection capacity in the afternoon peak hours.

The traffic signal-controlled intersections of Dairy Road with Hana Highway and with Haleakala Highway would each have sufficient capacity to accommodate the reduced volume levels with the diversion of traffic to the Airport Access Road.

For the existing STOP sign-controlled intersections, the Preferred Plan would have the largest effect on the left-turn from Hana Highway onto Haleakala Highway at Triangle Square. The Preferred Plan would reduce the left-turn volume and thereby reduce the delays, although the left-turn conditions are projected to remain at LOS F during both peak hours. Installation of traffic signal controls may be needed both with or without the Preferred Plan.

The Preferred Plan would introduce four new key intersections with STOP or YIELD controls:

- The new T-intersection of Pulehu Road with Hansen Road would operate at LOS C, an acceptable condition.
- The new consolidated four-way intersection of Hansen and Airport Spine Roads with Hana Highway would operate at LOS F during both peak hours, with long delays for traffic turning left from the cross streets.
- On Airport Access Road, within the Hana Highway interchange, the northbound left-turn onto the westbound on-ramp and the southbound left-turn onto the eastbound on-ramp would both be required to yield to on-coming through traffic. Both movements should experience acceptable conditions of LOS C or better.

Conditions at the Airport Interchange Ramps

Traffic conditions were evaluated for the ramps of the planned partial cloverleaf interchange at the junction of the Airport Access Road with Hana Highway. The analyses were made for the individual ramp entry and exit points to the through lanes along Hana Highway, and for the conditions along the ramps.

Traffic conditions at the ramp merge and diverge points with Hana Highway are summarized in Table 4-3. During the morning peak hour, each ramp terminus would operate at LOS C or better except for the two westbound off-ramps. The entry to the westbound loop off-ramp (Hana-to-Lahaina movement) and the adjacent Hana Highway traffic would operate at LOS F due to the large traffic volume (985 vehicles) projected to use the ramp. The nearby upstream (east side) entry to the westbound off-ramp to the Airport would operate at LOS F. Even though the Airport off-ramp would accommodate a smaller volume of traffic (228 vehicles), conditions at the ramp entry area would be adversely affected by the large volume of traffic preparing to exit the nearby entry to the loop off-ramp.

For the afternoon peak hour, all of the ramp merge-diverge locations would operate at LOS C or better except for the eastbound on-ramp terminus area. At the eastbound ramp, the large volume of ramp traffic, coupled with the large volume of through traffic along Hana Highway, would result in LOS D conditions for Hana Highway traffic and LOS E conditions for traffic exiting the ramp.

MITIGATION ACTIONS

The planned roadway capacities of the airport roadway modifications are expected to be insufficient to accommodate Year 2020 traffic volumes forecast at several locations. These locations and potential roadway alternatives to improve conditions are discussed in the following paragraphs.

Hana Highway Intersection with Haleakala Highway (Pukalani Junction)

The combined large volumes of westbound traffic on the Hana and Haleakala Highways would exceed capacity during the morning peak hour. Conditions at the intersection could be improved by:

1. Widen the northbound Haleakala Highway approach to provide three lanes turning left towards Kahului. This would also require widening a section of westbound Hana Highway to three lanes to receive the triple-left-turn-lane movement. This would improve the intersection to V/C 0.97 for average weekday conditions.
2. Construct a flyover ramp from northbound Haleakala Highway to westbound Hana Highway. This would eliminate the principal conflict between traffic movements, and reduce the remaining conflicting movements to a small faction of intersection capacity.

3. Construct a new roadway between Upcountry Maui and the South or Central Maui areas to provide an alternative route for traffic between these two areas, which should divert much of this traffic from travel through this intersection. The bypass route would have to reduce the morning peak hour traffic by 25 to 30 percent to alleviate the forecast problems at this intersection.

Airport Access Road Intersection with Dairy Road

With the proposed numbers of lanes, both the average weekday and design day traffic volumes would exceed the intersection capacity during the afternoon peak hour.

- Provision of a second northbound left-turn lane on the Airport Access Road would result in average weekday traffic equalling 83 and 92 percent of capacity for the morning and afternoon peak hours, respectively.

Hana Highway Intersection with Hansen/Airport Spine Road

The proposed STOP sign controls would result in LOS F conditions for left-turns from the Hansen Road and Airport Spine Road approaches. Alternative actions are:

1. Traffic signal controls to provide protected movement for traffic exiting the cross streets. This would result in V/C ratios of 1.16 and 1.18 for morning and afternoon peak hours, respectively.

2. Widen this section of Hana Highway to six lanes and install traffic signal controls. This would improve the V/C ratios to 0.84 and 0.88 for the morning and afternoon peak hours, respectively.

3. Construct a new roadway between Upcountry Maui and the South or Central Maui areas, and/or connect Old Stable Road and Alahao Street as a bypass route for East Maui traffic to Kahului, to provide an alternative route(s) for traffic that would otherwise have to use this segment of Hana Highway. The bypass route(s) would need to divert about 20 percent or more of the peak hour, peak direction traffic from this section of Hana Highway to reduce traffic volumes below the capacity of a four-lane Hana Highway.

Relocation of the Airport Spine Road and the East Ramp access to connect to Hana Highway at another location, such as at Old Stable Road or Airport Access Road, would not alleviate the problem since the Hansen Road intersection would remain a problem.

Airport Access Road Intersection with Kuihelani Highway and Puunene Avenue

The capacity constraints of this intersection would be the same with or without the Airport Project. Conditions at this intersection could be improved by:

Table 4-3

**LEVEL-OF-SERVICE AT RAMP TERMINI WITH HANA HIGHWAY-AIRPORT ACCESS ROAD INTERCHANGE
PREFERRED PLAN YEAR 2020 AVERAGE DAY
Year 2020 Traffic Assessment of Kahului Airport Access Road**

Ramp	Morning Peak Hour		Afternoon Peak Hour	
	Hana Highway Lanes Traffic	Ramp Merge/ Diverge Traffic	Hana Highway Lanes Traffic	Ramp Merge/ Diverge Traffic
Eastbound Hana Highway				
▸ Lahaina Off-Ramp	A	B	C	C
▸ Airport Loop Off-Ramp	A	B	C	C
▸ Eastbound On-Ramp	B	B	D	E
Westbound Hana Highway				
▸ Airport Off-Ramp	E	F	B	B
▸ Lahaina Loop Off-Ramp	F	F	B	B
▸ Westbound On-Ramp	C	C	A	B

Wilbur Smith Associates; November 1995

- Add a second left-turn lane on eastbound Puunene Avenue;
- Add a right-turn lane on southbound Airport Access Road; and
- Add a right-turn lane on northbound Kuihelani Highway.

The additional turn lanes would result in average weekday traffic equalling 90 percent of intersection capacity during morning and afternoon peak hours.

Airport Interchange Ramps

The large volume of traffic using the westbound off-ramps from Hana Highway to the Airport Access Road during the morning peak hour would result in LOS F conditions for both the Hana-to-Lahaina loop ramp and the Hana-to-Airport direct ramp.

- Conditions could be improved at the entry to these two ramps by relocating the entry to the Hana-to-Airport several hundred feet eastward to provide more separation between the two ramp entrances.

The large volume of traffic using the eastbound on-ramp from the Airport Access Road to Hana Highway during the afternoon peak hour would result in LOS E conditions at the merge point with Hana Highway.

- The merge conditions could be improved by construction of an auxiliary lane along eastbound Hana Highway to provide more distance for merging of the ramp traffic into the through traffic.

5. DEVELOPMENT OF INTERCHANGE ALTERNATIVES

Among the principal elements of the Preferred Plan of Improvements for Kahului Airport is the construction of a new Airport Access Road into the Airport, with a grade-separated interchange to be provided at its junction with Hana Highway. The Preferred Plan indicates the interchange would be a partial cloverleaf-type interchange with two loop ramps, one in the northwest quadrant and one in the southeast quadrant. Preliminary engineering design has been completed for the interchange and right-of-way has been obtained to accommodate the proposed interchange layout.

The primary purpose of this study is to reassess the need for, and cost-effectiveness of an interchange to serve traffic movements at the Hana Highway junction with the new Airport Access Road within the Year 2020 time horizon. The study also assesses the appropriateness and cost-effectiveness of the planned interchange configuration.

In this chapter, the conditions with an at-grade intersection are evaluated for the junction of Hana Highway with the Airport Access Road, as well as the potential for travel demand management measures. This chapter also identifies the alternative interchange configurations considered for this location and the positive and negative attributes of each relative to this location. This initial screening narrowed the alternatives to six configurations for further assessment (Chapter 6).

FACTORS CONSIDERED DURING IDENTIFICATION OF ALTERNATIVES

Factors considered in deriving alternatives for analysis included state and federal warrants for interchanges, state and federal guidelines for selection of interchange types, and standard interchange configurations that are common in the United States and world today. The screening of alternatives included consideration of the site features, including the physical constraints adjacent to the airport and anticipated future traffic patterns.

Physical and Traffic Features

Locational features such as topography, right-of-way availability, and traffic forecasts were considered in the identification of alternative interchange configurations.

Right-of-Way Availability - In general, three quadrants of the Hana Highway/Airport Access Road junction are relatively unencumbered with respect to available right-of-way. Only the southwest quadrant of the intersection poses some restriction.

At the present time, right-of-way has been acquired at the future junction for an interchange. In the northwest and southeast quadrants, the right-of-way will accommodate loop ramps with radii of approximately 300 feet along with direct ramp connections for the northbound-to-eastbound and southbound-to-westbound movements. In the other quadrants, a smaller amount of right-of-way has been acquired. The present right-of-way is sufficient to accommodate eastbound-to-southbound and westbound-to-northbound movements with direct ramps having radii in the 350-foot to 375-foot range.

In the northeast quadrant, the property beyond the existing interchange right-of-way is part of Kahului Airport. The area adjacent to the junction is now and is expected to remain as open space. If needed, additional property would be available in this quadrant to provide for an additional loop ramp or a flyover ramp.

In the southwest quadrant, the property beyond the limited right-of-way for the eastbound-to-southbound ramp is planned for use by the Kahului Industrial Park. A major drainage channel is planned parallel and adjacent to the direct ramp included in the Preferred Plan interchange configuration. Acquisition costs for additional right-of-way would likely reflect the intended industrial uses for this area.

Topography - the area is flat to gently rolling with elevations ranging between 15 and 35 feet above sea level in the area of the interchange. The terrain should not significantly affect selection of an interchange configuration.

Years 2010 and 2020 Traffic Forecasts - The traffic volumes documented in the *Kahului Airport Improvements Traffic Impact Study*[1] were initially considered in the identification and screening of alternative interchange types and configurations. Later, Year 2020 traffic forecasts were also considered. The final interchange traffic analyses (Chapter 7) reflect the Year 2020 traffic forecasts for the network of existing and committed highways. The roadway system and 2020 traffic forecasts are presented in Chapters 2 through 4 of this report.

The traffic forecasts at the junction are typified by very high traffic volumes along Hana Highway, and a very high volume of traffic between the east and south legs of the two roadways (Hana-to-Lahaina and return movements).

Interchange Warrants and Guidelines

Both the current Hawaii Statewide Uniform Design Manual for Streets and Highways[2] and the American Association of State Highway and Transportation Officials (AASHTO) Policy on Geometric Design of Highways and Streets[3] present policy for justification of interchanges. The Hawaii design manual contains the following narrative regarding warrants for interchanges for non-freeway conditions:

> *"On highways with only partial control or no control of access, definite warrants cannot be specified as they may differ at each location. The following factors should be considered in analyzing a particular situation:*

---

(1) *Kahului Airport Improvements Traffic Impact Study*, prepared for Edward K. Noda and Associates by Wilbur Smith Associates, June 1995 (Draft).

(2) *Statewide Uniform Design Manual for Streets and Highway*, State of Hawaii Department of Transportation Division, October 1980.

(3) *A Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials (AASHTO), 1994.

"1. *Elimination of Congestion*

Insufficient capacity at the intersection of heavily traveled highways results in intolerable delays and congestion on one or all approaches. The inability to provide the essential capacity with an intersection at grade provides the warrant for an interchange . . .

"4. *Traffic Volume*

For a new interchange under design, an interchange would be warranted where a capacity analysis indicates that an at-grade design cannot be provided to satisfactorily serve, without undue delay and congestion, the traffic volumes and turning movements expected."

The national AASHTO policy contains similar guidelines regarding the needs for interchanges. Given the Year 2020 traffic forecasts, the projected traffic volumes at the junction of Hana Highway and Airport Access Road would be difficult to accommodate at an acceptable level-of-service with an at-grade intersection, and thus merit consideration of an interchange.

Both the Hawaii Design Manual and AASHTO publications provide guidelines that affect the interchange types to be considered during project planning. Key relevant guidelines include:

- Uniformity is stressed to accommodate reasonable driver expectation. Standard interchange configurations are preferred, as opposed to less conventional designs.
- Interchanges with non access-controlled highways should provide ramps to serve all basic directions. Partial interchanges are discouraged.
- The interchange should provide ramp junctions that are located at least 300 feet from the closest intersection (Dairy Road).

ALTERNATIVES TO AN INTERCHANGE

An at-grade intersection could be provided at the junction of Hana Highway and the Airport Access Road. The study evaluated future traffic conditions with an at-grade intersection at the junction. The study also assessed the potential for achieving acceptable conditions with the at-grade intersection through expanded use of travel demand management measures.

At-Grade Intersection

Both Hana Highway and the Airport Access Road are planned as four-lane divided highways. If an at-grade intersection is provided at the junction, each roadway approach would be expected to provide separate left-turn and right-turn lanes to facilitate traffic flow and increase intersection capacity. Because of the large volumes of vehicle turns between the Hana (east) side and Lahaina (south) side legs of the intersection, the intersection is assumed to have double (two) left-turn lanes on the westbound approach and double (two) right-turn lanes on the northbound approach to increase capacity for these turning movements.

An analysis was made of peak hour traffic conditions with estimated Year 2020 average weekday traffic volumes. Optimum traffic signal operations were assumed for the intersection. With the four-lane highways, the forecast Year 2020 average weekday traffic would exceed intersection capacity by 11 and 18 percent in the morning and afternoon peak hours, respectively. As summarized in the following table, traffic would experience LOS F conditions with long delays. Design day traffic conditions would be about 5 percent worse.

Year 2020 Average Weekday	Morning Peak Hour			Afternoon Peak Hour		
	V/C	AD	LOS	V/C	AD	LOS
With Four-Lane Highway	1.11	75.5	F	1.18	92.0	F
With Six-Lane Hana Highway	0.89	33.4	D	0.92	38.2	D

V/C = Volume-to-Capacity Ratio.
AD = Average delay per vehicle (in seconds).
LOS = Level-of-Service.

Hana Highway would have to be widened to a six-lane roadway to provide sufficient capacity to accommodate the average weekday traffic at acceptable service levels. Peak hour traffic on an average weekday would approximate 90 percent of the intersection capacity, with traffic conditions at LOS D.

Year 2020 design day traffic volumes would approach the intersection capacity with a six-lane Hana Highway. Traffic operations would be a LOS E in the traffic peak hour.

Travel Demand Management Measures

Travel demand management (TDM) refers to measures taken to reduce vehicle travel during the peak traffic hours. This reduction could be accomplished by increasing vehicle occupancies (serving the same numbers of travellers with fewer vehicles) and/or encouraging a shift of trips to off-peak hours. Typical TDM measures include:

- Ride-sharing (carpools, vanpools);
- Public transportation; and
- Staggered or flex-time work hours.

With the planned four-lane roadways, such TDM measures would need to reduce Year 2020 peak hour travel volumes by about 25 percent or more to provide acceptable travel conditions with an at-grade intersection at the junction of Hana Highway and the Airport Access Road.

Kahului Airport, by virtue of the transportation characteristics inherent to its airport operations, already exhibits extensive use of such TDM-type measures. These include:

- An estimated 25 to 30 percent of air passengers presently arrive/depart in high-occupancy vehicles (tour vans, charter buses, taxis).[4]
- Air operations and air passenger activity are evenly distributed throughout the daytime and early evening hours, with the peak occurring during the midday[5] and having little effect on highway peak hour conditions.
- Employee work shifts are likely to already exhibit considerable use of staggered work hours given the multi-shift operations and the need for employees to staff most major airport operations from very early morning through late evening hours.

The State of Hawaii and County of Maui currently sponsor TDM-type programs for general public use:

- Park-and-ride lots are provided at several locations to facilitate ridesharing.
- Carpool matching services are provided by Maui Economic Opportunity, Inc. (MEO).
- Public transit shuttle service is provided by MEO.[6]
- Vanpool program is marketed by Vanpool Hawaii.
- The State DOT promotes TDM to private employers through its Transportation Management Program.

Opportunities for increased use of TDM measures could encompass:

- Increased use of staggered work hours by administrative-type workers at the Airport.
- Increased use of staggered work hours by County and private employers in the Kahului-Wailuku area.
- Increased public transit services by MEO, which would likely require additional public subsidies of operating costs.
- Increased employer funding support for vanpool and transit usage by their employees.

It is unlikely that such increased use of TDM actions could reduce peak hour travel through the Hana Highway-Airport Access Road junction by 25 percent or more. To accomplish this level of reduction, broader factors would likely be required, such as slower economic growth on Maui or much higher driving costs.

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(4) Op cit. *Kahului Airport Improvements Traffic Impact Study.*

(5) Ibid.

(6) Ibid.

REVIEW OF INTERCHANGE TYPES

A broad range of interchange types were considered relative to the appropriateness/applicability to the physical and traffic features of the future junction of Hana Highway and the Airport Access Road. The interchange types and features relative to the site is summarized in the following sections.

Conventional Diamond Interchange

The most common type of interchange in use today is the conventional diamond interchange (see Figure 5-1). In general, diamond interchanges are in widespread use for the following reasons:

- Construction cost is generally low
- Right-of-way requirements are among the lowest
- Direct turning movements are provided at the crossroad
- Exits from the major roadway are on the right-hand side

Disadvantages of diamond interchanges include:

- Turning movement conflicts exist at the crossroad ramp terminals, e.g., left-turns off of the crossroad onto the ramps are in conflict with through movements on the crossroad. Capacity of the ramp is limited to that provided by the intersection at the ramp terminal with the crossroad.
- High-volume direct turning movements may result in poor service levels. All turning movements must go through the ramp terminals, thus limiting capacity.
- Heavy movements at the ramp terminals usually require traffic signals. These signals must be coordinated at the interchange and with other nearby signals.

A diamond interchange would "fit" within the existing right-of-way. However, a diamond interchange may not be the most preferable solution where both crossing roadways have high volumes, or where heavy direct turning movements occur. The Hana Highway/Airport Access Road intersection traffic movements present one situation that may only be marginally serviced by a diamond configuration, namely the high-volume westbound-to-southbound left-turn movement. However, the diamond interchange was advanced for further consideration due to its low costs and no need for additional right-of-way.

Single Point Diamond Interchange

A major variation of the diamond interchange was developed in recent years which eliminated some of the conflicts associated with conventional diamond interchanges. The configuration, as shown in Figure 5-1, allows left-turning traffic to pass through a single point at the center of the interchange. Thus, conflicting traffic volumes are reduced significantly where heavy left-turn volumes are projected.

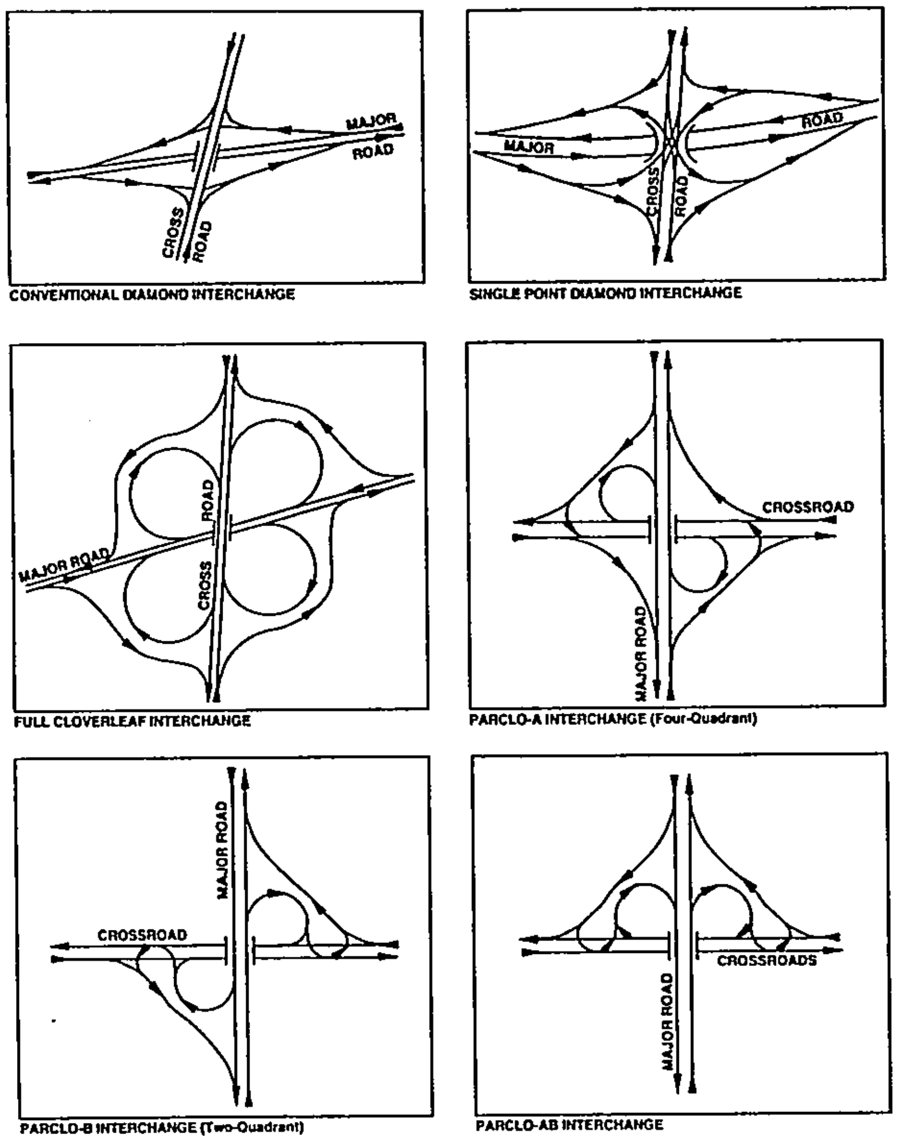

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Figure 5-1
TYPICAL INTERCHANGE TYPES

The primary advantages associated with the single point diamond interchange are as follows:

- Greater capacity than that provided by a conventional diamond interchange.
- Usually requires only slightly more right-of-way than the conventional diamond interchange.
- Only one traffic signal-controlled ramp junction is needed on the cross-street.

Disadvantages include:

- High construction costs, particularly as related to a much larger bridge structure.
- If right-of-way is confined, retaining walls may be required, thus increasing construction costs.
- The configuration is not flexible for modification in the future to meet further traffic increases.
- The configuration is not commonly used in northern states, making it unfamiliar to visitors from those areas of the country.

Because the configuration of the single point diamond interchange appears to mitigate some of the left-turn conflicts at the Hana Highway/Airport Access Road intersection, it was considered a candidate interchange type and was evaluated in further detail.

Full Cloverleaf Interchange

Full cloverleaf interchanges have loop ramps in all four quadrants to accommodate left-turn movements. They are one of the very earliest interchange configurations.

The primary advantage of the full cloverleaf interchange is that all movements can be accommodated via a non-stop connection via right-turn movements onto and off of all ramps (see Figure 5-1). However, full cloverleaf interchanges have several disadvantages:

- Extensive right-of-way is required in all four quadrants.
- Extra travel distance is required to accommodate left turns via loop ramps.
- Traffic entering the highway via a loop ramp has to weave with traffic leaving the highway via a loop ramp. Generally, weaving distances are very short. The weaving problem can be mitigated by construction of collector-distributor roads, but these add substantially to the construction cost and right-of-way requirements.

The applicability of the full cloverleaf was reviewed with respect to the Hana Highway/Airport Access Road intersection. Although the heavy left-turn movements would benefit from the provision of loop ramps, several minor movements would be served by a loop ramp. Given the construction cost of each ramp, and the cost of the additional right-of-way to accommodate the ramp in the southwest quadrant, a full cloverleaf interchange may not be warranted. However, the full cloverleaf interchange configuration is proposed for further assessment relative to the cost of these additional low-volume ramps.

Partial Cloverleaf Interchanges

Several types of partial cloverleaf interchanges have been used throughout the country. Among the most common have been given the nomenclature Parclo-A, Parclo-B and Parclo-AB. These are illustrated in Figure 5-1.

The Parclo-A interchange gets its nomenclature from the fact that the ramps from the major roadway exit "ahead" of the structure. It can occupy four quadrants as shown in the figure, or it can occupy only two quadrants (see figure for the Parclo-B interchange). The Parclo-A has an advantage over many other interchange types since it eliminates left-turn movements from the crossroad. When the crossroad is a heavily-traveled arterial, or where the crossroad itself is a major highway, the Parclo-A is generally advantageous.

The Parclo-B configuration is the opposite of the Parclo-A. In the Parclo-B, the exit from the major roadway is "beyond" the structure. It is a very workable interchange type when the directional left-turn movements accommodated by the loop ramps are heavy. The Parclo-B interchange illustrated occupies only two quadrants. It can be constructed as a four-quadrant interchange (see Figure 5-1 for the Parclo-A interchange), but it would require two exits from the main roadway for the right and left movements. This two-exit design may not be desirable in some instances from the perspective of driver expectancy.

The Parclo-AB is a combination of the two other parclo interchange configurations. It is used in instances where the traffic served by the two loop ramps is high, or where physical restrictions exist on one side of the major roadway or crossroad. As with the full cloverleaf interchange, a disadvantage of a Parclo-AB interchange is the relatively short weaving section between the two loop ramps. This can be mitigated by the use of a collector-distributor road. However, this increases the construction cost.

For the Hana Highway/Airport Access Road intersection, partial cloverleaf interchanges offer relatively good solutions. Alternative types of partial cloverleaf interchanges were investigated that appear to properly accommodate the various movements. Loop ramps were considered in all but the southwest quadrant.

Directional and Semi-Directional Interchanges

Directional and semi-directional interchanges provide additional bridge structures to accommodate a direct "flyover"-type ramp to accommodate a high-volume movement between two roadways. These interchanges are generally the most effective when very high-volume turning movement (such as 1,000 vehicles per hour) needs to be accommodated. The 1994 AASHTO policy states the use of these interchange types very well:

> *"Direct or semidirect connections are used for important turning movements to reduce travel distance, increase speed and capacity, eliminate weaving, and avoid the indirection in driving on a loop. Higher levels of service can be realized on direct connections, and, in some instances, on semidirect ramps, than on loops because of relatively high speed and the likelihood of more adequate terminal design."*

The obvious disadvantage of directional interchanges is the cost of construction. Depending on the type of directional interchange used, the height and complexity of structures can be great. In the vicinity of an airport, such as the Kahului Airport, care must be taken in design not to encroach on the glide path (approach surface) or transition surface for aircraft.

In reviewing the volumes associated with the Hana Highway/Airport Access Road intersection, two movements in particular may warrant a fully-directional ramp:

- The westbound Hana Highway to southbound Airport Access Road (Kuhelani Highway) left-turn movement.
- The opposite northbound Airport Access Road (Kuhelani Highway) to eastbound Hana Highway right-turn movement.

Accordingly, a semi-directional interchange configuration was further investigated relative to construction cost and right-of-way requirements.

INTERSECTION CONFIGURATIONS FOR FURTHER EVALUATION

For all of the interchange types, it was assumed that Hana Highway would remain in its current horizontal alignment and profile. The Airport Access Road was assumed to cross over Hana Highway.

Six interchange configurations were developed in conceptual form for further evaluation. These configurations include the proposed two-loop partial cloverleaf interchange, as described in the Preferred Plan, and five alternative configurations.

1. A conventional diamond interchange;
2. A single point diamond interchange;
3. A single-loop partial cloverleaf interchange, with the loop ramp serving the high-volume westbound-to-southbound movement;
4. A full cloverleaf interchange; and
5. A semi-directional interchange with a direct "flyover" type ramp to serve the westbound-to-southbound movement.

These six interchange configurations are depicted in Figure 5-2. Note that the Single-Point Diamond Interchange layout would require a very wide bridge structure for the Airport Access Road overpass in order to accommodate the signal-controlled intersection on Airport Access Road. The turning movements could be accommodated at ground level, but this would result in the introduction of signal controls on Hana Highway, or the construction of an Hana Highway overpass above the Airport Access Road.

YEAR 2020 TRAFFIC ASSESSMENT OF KAHULUI AIRPORT ACCESS ROAD

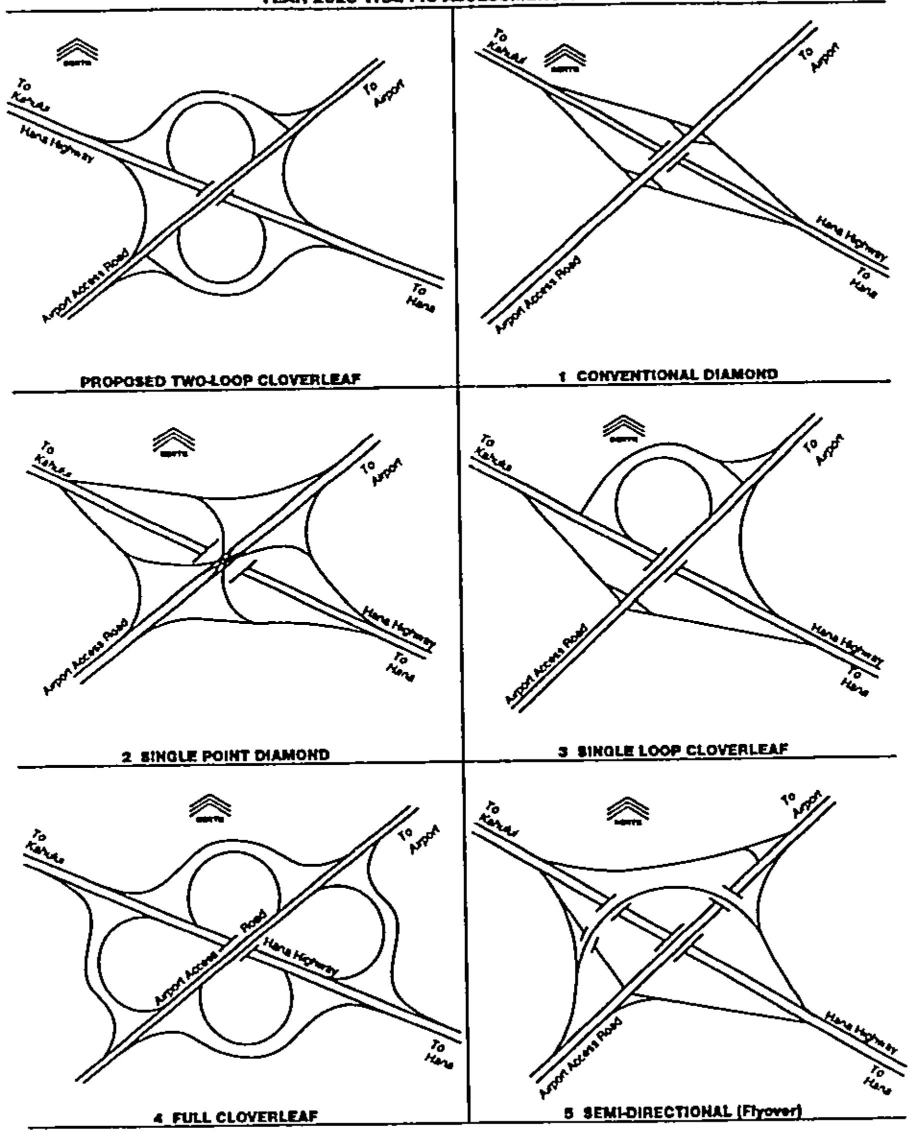

Figure 5-2
PROPOSED AND ALTERNATIVE INTERCHANGE CONFIGURATIONS
HANA HIGHWAY AT AIRPORT ACCESS ROAD

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6. ASSESSMENT OF INTERCHANGE ALTERNATIVES

Each of the six interchange alternatives, as identified in Chapter 5, was further defined to a concept design level. An assessment was made of each alternative relative to:

- Traffic requirements
- Layout and right-of-way requirements
- Costs
- Impacts on Bicycles
- Safety Implications
- Construction Impacts

This assessment was used to identify several alternatives for more detailed evaluation of traffic operations and cost effectiveness as compared to construction of an at-grade intersection (Chapter 7).

DESIGN ASSUMPTIONS

Each of the alternative interchange layouts was developed to reflect design criteria and features similar to those represented in the present preliminary design plans for the two-loop partial cloverleaf interchange included in the Preferred Plan for Kahului Airport. The preliminary design plans for the partial cloverleaf interchange, as used in this study, were developed by Fukunaga & Associates, Inc., dated October 1, 1990. The design plans reflect criteria and standards set forth in the *Hawaii Statewide Uniform Design Manual for Streets and Highways.*

The following layout features are reflected in each of the alternatives:

- Hana Highway remains a four-lane roadway along its present alignment.
- Airport Access Road would be a four-lane roadway with a design speed of 60 mph.
- Airport Access Road would cross over Hana Highway.
- Ramp grades would not exceed 8.0 percent.
- Radii of ramp curves would be in the 300- to 400-foot range, similar to the Preferred Plan design, with design speeds of at least 30 mph.
- The interchange alternatives would provide uninterrupted flow (no traffic signal controls) along Hana Highway.

Representative features of the Airport Access Road and ramp roadways are depicted by the typical cross-sections in Figures 6-1.

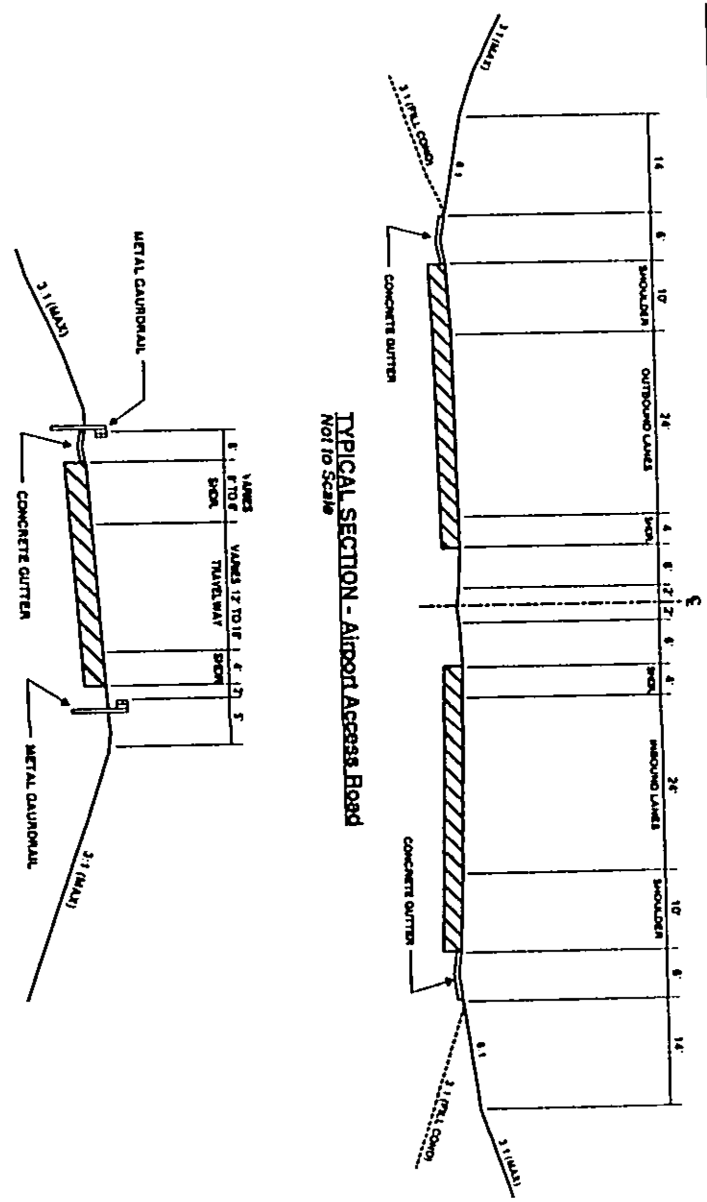

Figure 6-1
TYPICAL ROADWAY FEATURES
AIRPORT ACCESS ROAD - HANA HIGHWAY INTERCHANGE

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TRAFFIC VOLUMES AND TRAFFIC CONTROL NEEDS

The morning and afternoon peak hour volumes estimated for an average weekday in Year 2020 are depicted for each interchange alternative in Figures 6-2 and 6-3, respectively. The estimated traffic volumes reflect the existing and committed highway system (see Chapter 3).

Each interchange configuration would provide traffic flow along Hana Highway without interruption by traffic signals. The alternatives differ in how the turning traffic movements would be accommodated, and the effects of these turning movements on traffic flow along Airport Access Road. The key traffic features are summarized in the following paragraphs, and the probable implications are further discussed in the next section on *Interchange Layout and Right-of-Way Needs*.

Proposed Two-Loop Partial Cloverleaf - The proposed two-loop cloverleaf interchange would provide loop ramps in the southeast and northwest quadrants of the roadway junction. These loop ramps would serve the "left-turn" movements from eastbound and westbound Hana Highway onto Airport Access Road. The other turning movements at the junction of the two roadways would be accommodated via the four direct ramps, one in each quadrant. Key aspects of the configuration, with the forecast volumes, are as follows:

- The two loop ramps eliminate the left-turns onto Airport Access Road, and thus avoid any traffic movements that would be in conflict with both directions of traffic on Airport Access Road.
- The Airport-to Hana and Lahaina-to-Wailuku movements would be made via a left-turn maneuver from Airport Access Road onto one of the direct ramps, with each left-turn traffic movement in conflict with (crossing) one direction of Airport Access Road traffic. Left-turn storage lanes would be provided in the median area for any vehicles waiting to turn left, so as not to delay through traffic and for safety reasons.
- With the forecast 2020 peak hour traffic, no traffic signal controls would be needed. The combined volumes of the left-turn movement and the conflicting through traffic would result in acceptable conditions (LOS C or better) for the left-turn movement with a YIELD condition.
- With the 2020 forecasts, all ramp volumes would be 1,000 vehicles per hour or less. The highest volume would occur on the northwest loop ramp with 985 vehicles estimated in the morning peak hour, versus a capacity of 1,200 or more vehicles.

Conventional Diamond (Alternative 1) - The diamond interchange would provide one off-ramp and one on-ramp in each travel-direction along Hana Highway. Two intersections would be created along Airport Access Road at the junction points with the eastbound on/off ramps and the westbound on/off ramps. With the forecast traffic, key items would include:

- Traffic signal controls would be required on Airport Access Road at each of the two ramp intersections to accommodate the traffic turning left from the off-ramps. Both intersections would operate at LOS C or better.

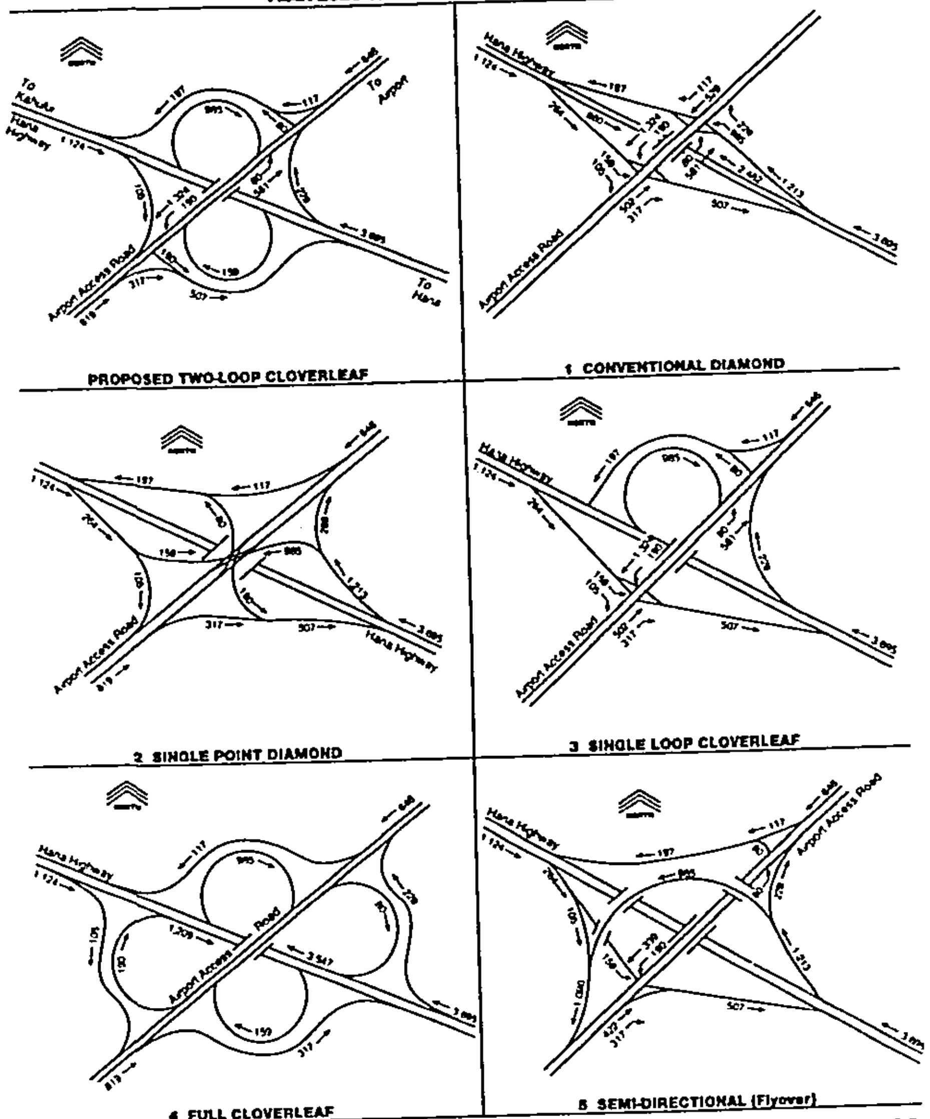

Figure 6-2
2020 MORNING PEAK HOUR TRAFFIC VOLUMES
PROPOSED AND ALTERNATIVE INTERCHANGE CONFIGURATIONS
HANA HIGHWAY AT AIRPORT ACCESS ROAD

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YEAR 2020 TRAFFIC ASSESSMENT OF KAHULUI AIRPORT ACCESS ROAD

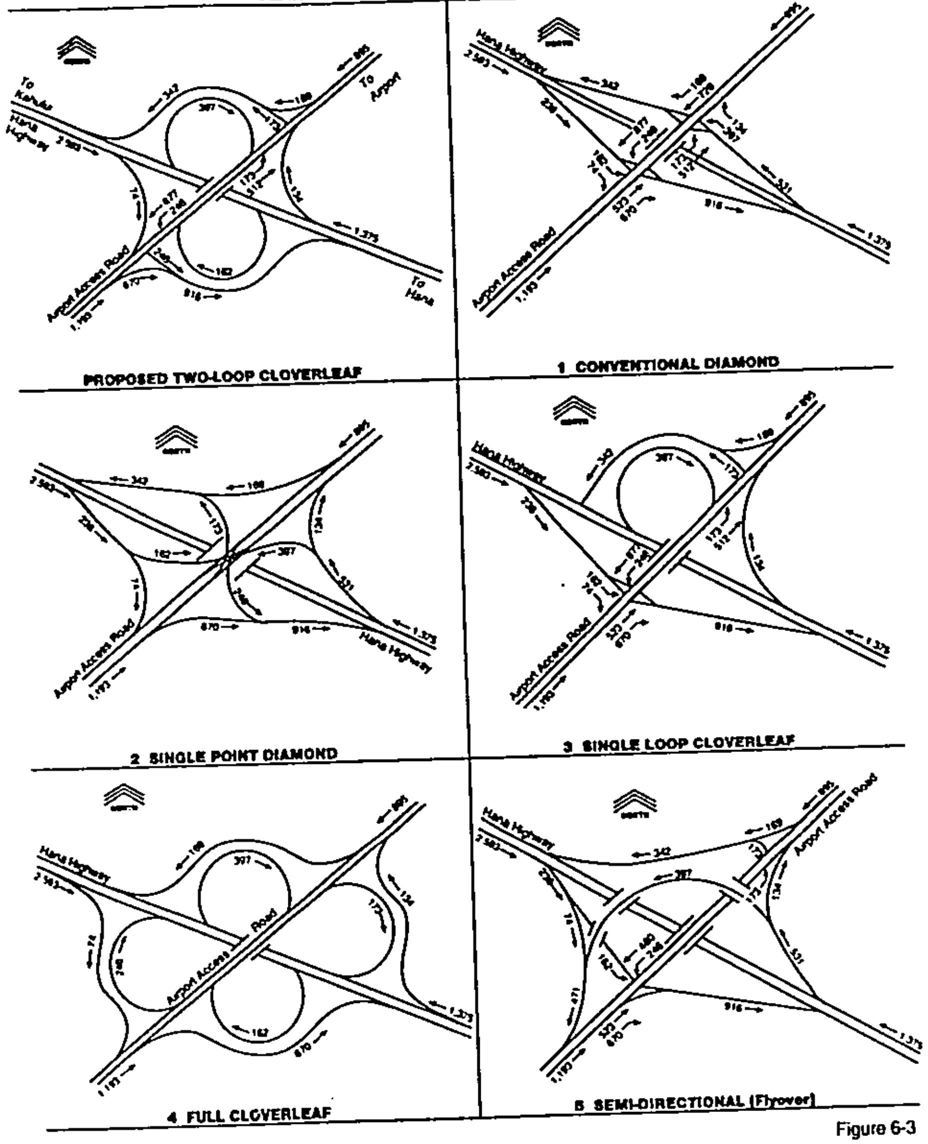

Figure 6-3
2020 AFTERNOON PEAK HOUR TRAFFIC VOLUMES
PROPOSED AND ALTERNATIVE INTERCHANGE CONFIGURATIONS
HANA HIGHWAY AT AIRPORT ACCESS ROAD

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- Double left-turn lanes would be required on the westbound off-ramp approach to Airport Access Road to accommodate the high volumes of Hana-to-Lahaima direction traffic.
- During the morning peak hour, the westbound off-ramp would accommodate an estimated 1,200 or more vehicles. This would be within the ramp capacity, but would result in some congestion.
- The smaller radii/sharper turns between the ramps and Airport Access Road would result in slower traffic speeds than with the partial cloverleaf interchange ramps.

Single Point Diamond (Alternative 2) - This variation of a diamond interchange provides large ramp curve radii to locate all left-turn movements onto and off of the ramps at a single intersection on the cross road (Airport Access Road), rather than at two locations as with the conventional diamond interchange. This permits more efficient traffic signal controls at the single intersection, and avoids the coordination problem between the two signals needed with the conventional diamond interchange. Key aspects are:

- Traffic signal controls would be required at the single junction of the on- and off-ramps with Airport Access Road.
- Double left-turn lanes would be required for the westbound off-ramp.
- The westbound off-ramp would accommodate a high volume of traffic during the morning peak hour.

Single-Loop Cloverleaf (Alternative 3) - This configuration would provide a loop ramp for the Hana-to-Lahaina direction movement. The eastbound on and off movements would be accommodated by diamond-type ramps. Key aspects include:

- The high volume of traffic travelling in the Hana-to-Lahaina direction would be afforded use of the loop ramp and a merging movement onto southbound Airport Access Road, and would thus not be required to stop.
- A traffic signal would be required at the intersection of the eastbound ramps with Airport Access Road to accommodate the left-turn movement from the off-ramp towards the Airport.
- No traffic signal would be required at the northbound left-turn from Airport Access Road onto the westbound on-ramp (Lahaina-to-Wailuku movement).

Full Cloverleaf (Alternative 4) - This configuration would provide a loop ramp in each quadrant to accommodate the "left-turn" movements between the two roadways. The right-turn movements would be accommodated on the direct ramps in each quadrant. Key aspects of the full cloverleaf include:

- All movements would be made via diverge and merge maneuvers; no STOP or traffic signal controls would be necessary.
- The short weaving distance for traffic using the loop ramps in the northeast and northwest quadrants would result in disruptive conditions to westbound traffic along Hana Highway.
- This option results in the lowest volumes on individual ramps, several of which may not warrant the cost of construction.

Semi-Directional (Alternative 5) - This option would provide a semi-direct ramp connection for the Hana-to-Lahaina direction movement. Portions of this ramp would also serve the Hana-to-Airport and Wailuku-to-Lahaina movements. Diamond-type ramps would serve the eastbound on and off movements to/from Hana Highway. Key aspects of this configuration are:

- This layout would provide the highest speed connection to serve the high-volume Hana-to-Lahaina traffic.
- With the forecast traffic volumes, traffic signals would be required at the Airport Access Road intersection with the westbound ramp junction.
- This alternative would result in 1,200 vehicles or more using a portion of the westbound off-ramp in the morning peak hour.

INTERCHANGE LAYOUT AND RIGHT-OF-WAY NEEDS

Right-of-way has already been acquired to accommodate the proposed two-loop partial cloverleaf interchange. A conceptual layout plan was also prepared for each of the alternative interchanges to assess the adequacy of the available right-of-way (or need for additional right-of-way), and as input to the estimation of construction costs for each alternative.

Proposed Two-Loop Partial Cloverleaf - The layout of the proposed interchange, as depicted in Figure 6-4, indicates both the proposed roadways and ramps, and the boundary of the present rights-of-way as acquired to accommodate the interchange. The layout reflects the following:

- The layout of the ramps allow for diverge and merge maneuvers without significantly reducing and increasing speeds below the ramp speed limit (25 to 35 mph), with the exception of the westbound on-ramp intersection with Hana Highway. The westbound on-ramp provides a low speed YIELD-type junction due to the proximity to the Dairy Road intersection (located at northwest limit of Figure 6-4, about 900 feet from the on-ramp junction).
- Left-turn storage lanes are provided in the median of Airport Access Road to accommodate vehicles stopped while awaiting a gap in oncoming through traffic in which to turn left onto the eastbound and westbound on-ramps.
- All ramps are single lane.

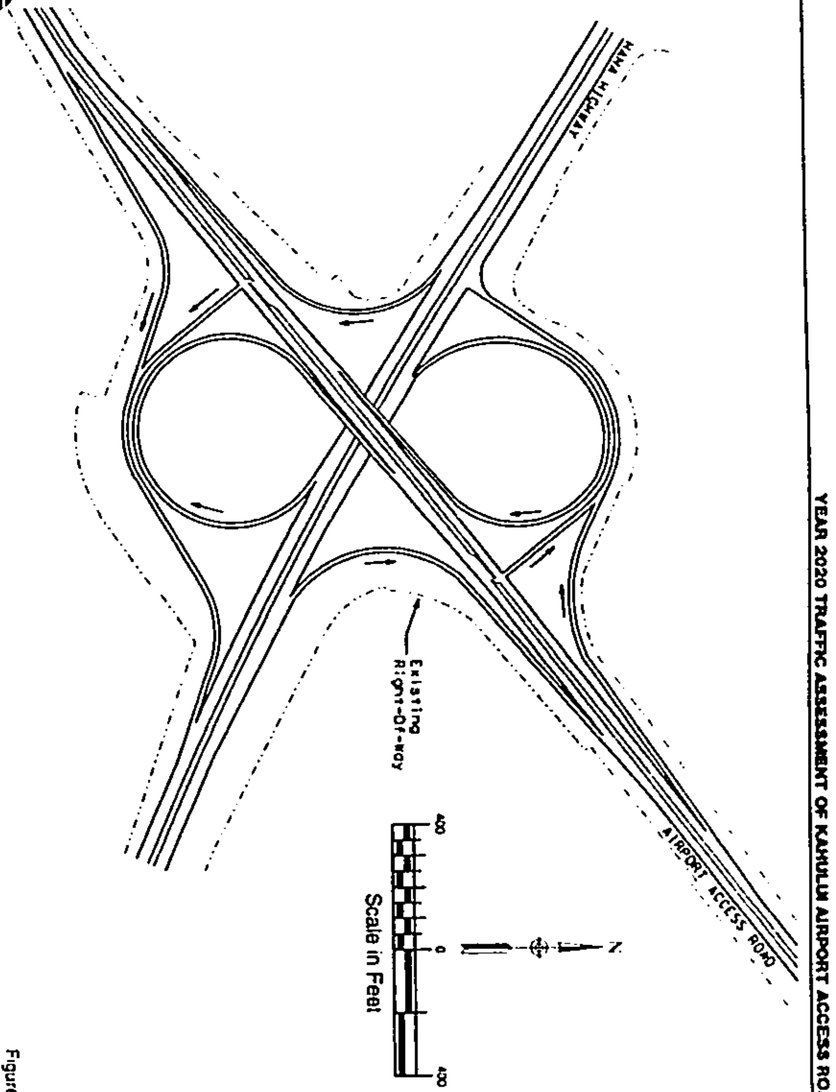

Figure 6-4
PROPOSED INTERCHANGE - TWO-LOOP CLOVERLEAF CONFIGURATION

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- The Airport Access Road overpass and most of the ramp segments are located on fill sections of 5 to 20 feet above the existing terrain. Most ramp grades are in the range of one to three percent with the steepest at five percent.

- The rights-of-way boundary is located to accommodate fill (and cut) slopes for the ramps, and for drainage.

Conventional Diamond (Alternative 1) - The layout of the conventional diamond interchange is depicted in Figure 6-5.

- The diamond-type ramps can be accommodated within the present right-of-way. However, this would likely require a retaining wall along portions of the eastbound off-ramp located closest to the Kahului Industrial Park boundary.

- The two traffic signal-controlled intersections on Airport Access Road would be located about 400 feet apart. This short distance would adversely affect the efficiency of the signal operations.

- The ramps would be located on fill sections, generally 5 to 30 feet above the existing terrain. Grades would be slightly steeper than for the cloverleaf interchange, with a typical ramp grade of about one to two percentage points above that for the cloverleaf.

- The eastbound off-ramp would begin as a single-lane ramp, but then widen to three lanes to provide two left-turn lanes for the high-volume Hana-to-Lahaina movement and a right-turn lane to allow airport-bound vehicles to bypass the waiting left-turn queue.

Single Point Diamond (Alternative 2) - The single point diamond interchange locates all four left-turn movements at a single traffic-signal controlled intersection on Airport Access Road, as depicted in Figure 6-6.

- Additional right-of-way acquisition would be required in the southwest quadrant (Kahului Industrial Park site). The ramp curvature needed to align the eastbound on-ramp into the single-point intersection would locate that ramp beyond the current right-of-way boundary. Approximately 27,500 sq. ft. of additional property acquisition would be needed.

- This alternative would require a very large and/or irregularly shaped bridge structure to accommodate the single point intersection on the Airport Access Road overpass. Either an "X" shaped structure or a conventional bridge with a width of 270 feet (versus 120 feet width for the partial cloverleaf) would be required to accommodate the ramp curvature. Alternatively, Airport Access Road and the ramps could be located at ground level with Hana Highway reconstructed as the overpass. This would require construction of a temporary bypass roadway, approximately three-quarters of a mile in length, to divert Hana Highway traffic around the construction area while Hana Highway is reconstructed to cross over the Airport Access Road.

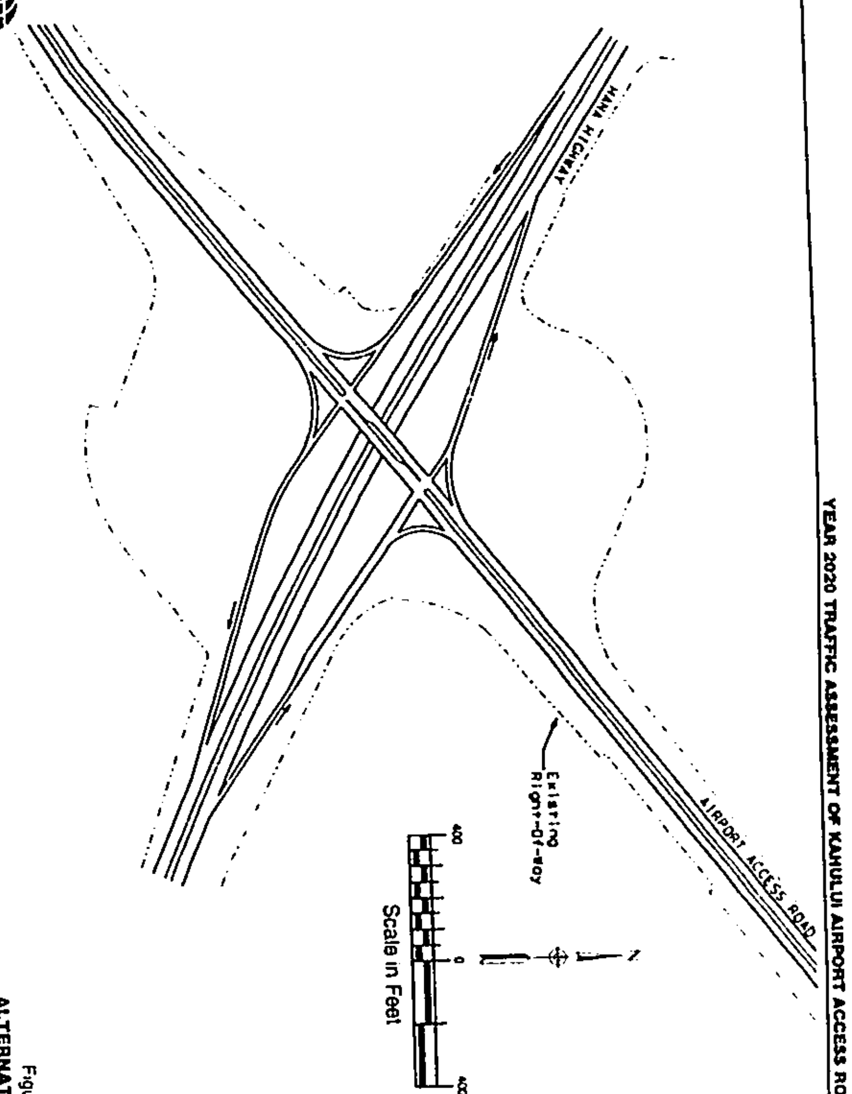

Figure 6-5
ALTERNATIVE 1
CONVENTIONAL DIAMOND INTERCHANGE

- A two-lane segment would be needed for the westbound off-ramp approach to the single point intersection.
- Ramp grades would be similar to those for the conventional diamond interchange.

Single Loop Partial Cloverleaf (Alternative 3) - The layout of this interchange option (Figure 6-7) have the same westbound ramps (north side of Hana Highway) as the two-loop partial cloverleaf, and the same eastbound ramps as the conventional diamond interchange.

- The present right-of-way would be sufficient.
- Only one traffic signal, at the intersection of the eastbound ramps, would be needed on Airport Access Road.

Full Cloverleaf (Alternative 4) - The full cloverleaf interchange would include a loop ramp and a direct ramp in each of four quadrants (Figure 6-8).

- Additional right-of-way would be needed in the southwest quadrant. Approximately 675,000 sq. ft. of land would have to be acquired from the Kahului Industrial Park site.
- An additional 275,000 sq. ft. of land would be needed in the northeast quadrant. This area is part of Kahului Airport and would represent a transfer of property between divisions of the State DOT.
- All ramps would be single lane, with grades similar to those for the two-loop partial cloverleaf.

Semi-Directional Interchange (Alternative 5) - This option would provide a semi-direct "flyover" ramp for the Hana-to-Lahaina movement (Figure 6-9). Diamond-type or direct ramps would be provided for the other movements.

- Additional right-of-way would be needed in the southwest quadrant. Approximately 210,000 sq. ft. of land would have to be acquired from the Kahului Industrial Park site.
- An additional 112,000 sq. ft. of land would be needed in the northeast quadrant. This area is part of Kahului Airport.
- All ramps would be single lane.
- The "flyover" ramp would require bridge structures to cross Airport Access Road, Hana Highway, and the Wailuku-to-Airport off-ramp.
- The highest level of the ramp would be approximately 55 feet above ground level, versus about 28 feet for the other alternatives.

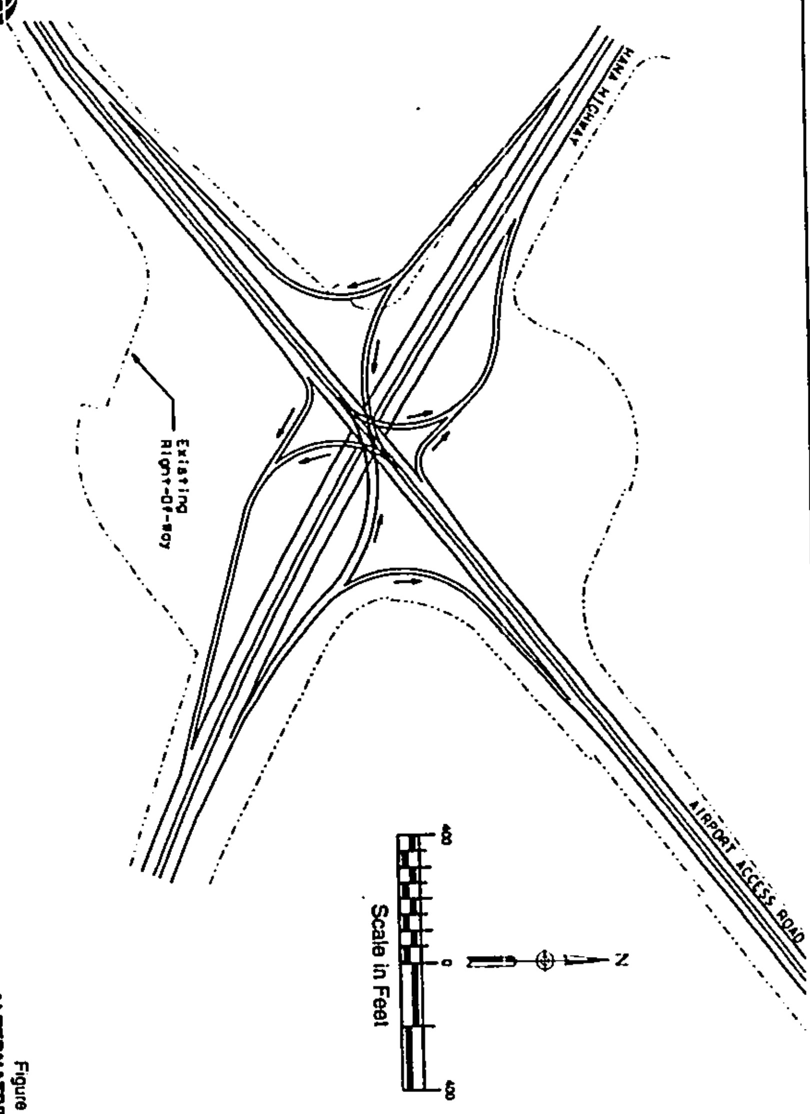

Figure 6-6
ALTERNATIVE 2
SINGLE POINT DIAMOND INTERCHANGE (Turning Movements On The Structure)

WILBUR SMITH ASSOCIATES

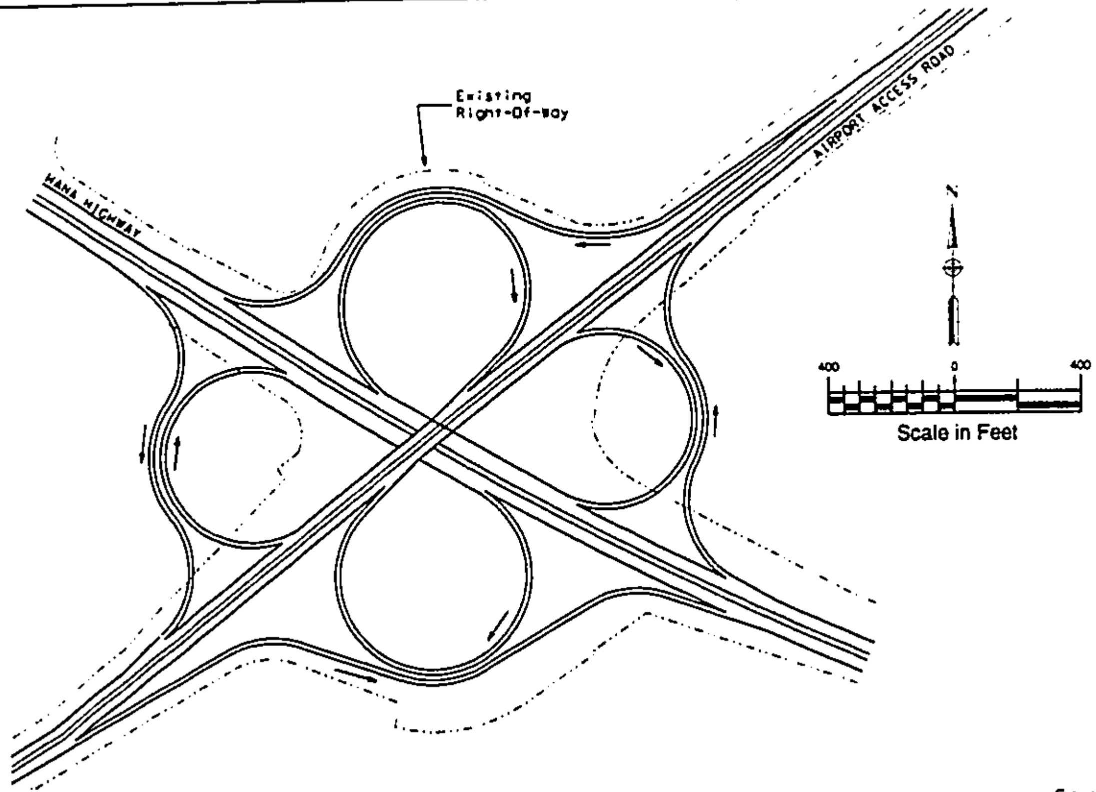

Figure 6-8
ALTERNATIVE 4
FULL CLOVERLEAF INTERCHANGE

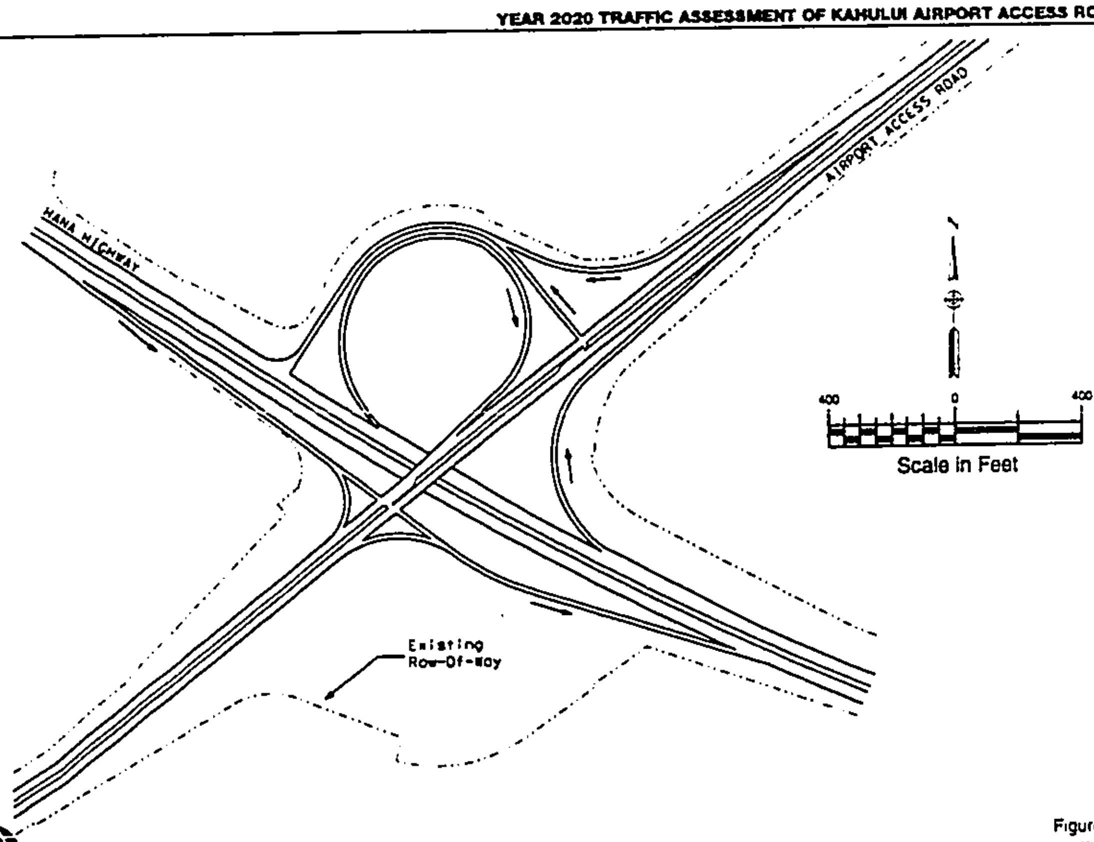

Figure 6-7
ALTERNATIVE 3
SINGLE-LOOP CLOVERLEAF INTERCHANGE

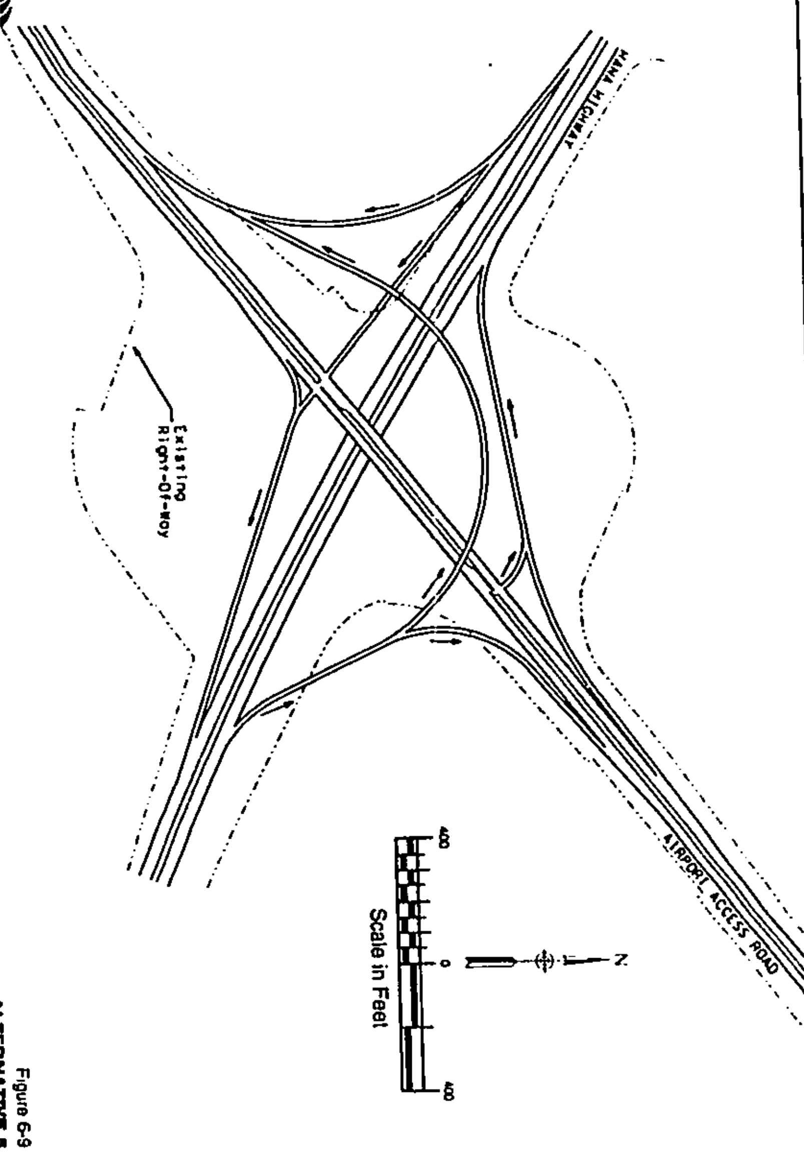

Figure 6-9
ALTERNATIVE 5
SEMI-DIRECTIONAL INTERCHANGE (Flyover)

IMPLEMENTATION COSTS

The alternative interchange types represent a wide range of implementation costs. These implementation costs include right-of-way acquisition, construction, and related design, and construction administration, and construction management costs. Estimation of these costs reflect the following inputs:

- The construction costs reflect mid-year 1995 costs. Unit costs were primarily obtained from the cost estimate prepared for the proposed partial cloverleaf interchange, as developed by Fukunaga & Associates. The costs were increased to mid-1995 levels by use of the First Hawaiian Bank Construction Cost Index for Honolulu. Key unit cost elements are presented in Appendix Table A-1.
- The construction costs encompass construction of a 0.6-mile long section of Airport Access Road, the overpass structure, the interchange ramps, and any reconstruction for the ramp connections to Hana Highway. The 0.6-mile long segment represents the length most directly affected by variations in interchange configurations.
- The construction units were estimated based on the design plans for the proposed two-loop partial cloverleaf interchange, and the variations in ramp configurations and bridge structure for the alternative interchanges.
- Right-of-way costs are based on an estimated commercial value of $35 per square foot for industrial park land. No cost was included for use of Kahului Airport property.
- Only 60 percent of full design costs were included for the proposed two-loop partial cloverleaf interchange. The design plans are about 95 percent complete, but will require some minor modifications.

In addition to the interchange alternatives, costs were also estimated for an at-grade intersection at the junction of Hana Highway and Airport Access Road. This cost is provided for comparative purposes, and for use in the economic evaluation of an interchange (Chapter 7).

The cost for the proposed two-loop cloverleaf interchange and adjacent segment of the Airport Access Road roadway is estimated as $24,901,000 (see Table 6-1). Of this amount, about 25 percent would be for construction of the bridge structure, about 35 percent for the 0.6-mile segment of Airport Access Road, and the remaining 40 percent for the ramps.

The at-grade intersection would result in a cost of about $6,530,000. The alternative interchange configurations would range in costs from $21,258,000 to $51,595,000. The comparison of each, relative to the proposed interchange, is as follows:

Alternative	1995 Cost (millions)	Increase/Decrease Compared to Proposed (millions)	Cost as Percent of Proposed
At-Grade Intersection	$ 6.53	+18.37	26.2%
Proposed Interchange	24.90	---	---
1. Conventional Diamond	21.26	-3.64	85.4%
2. Single Point Diamond	28.08	+3.18	112.8%
3. Single Loop Cloverleaf	23.79	-1.11	95.5%
4. Full Cloverleaf	51.60	+26.70	207.2%
5. Semi-Directional	42.78	+17.88	171.8%

The cost of the at-grade intersection is approximately one-quarter of that estimated for the proposed partial cloverleaf interchange. The at-grade intersection avoids the earthwork needed to elevate the Airport Access Road above the Hana Highway, as well as avoiding the bridge and ramp costs.

The Conventional Diamond (#1) and Single-Loop Cloverleaf (#3) would each result in costs slightly below the proposed interchange. The lower costs would result from a slightly narrower bridge structure for the overpass, and shorter total length of ramps.

The Single Point Diamond (#2) would cost about 10 percent more than the proposed interchange, and about 25 percent more than the Conventional diamond Interchange. This higher cost is primarily attributable to a much higher bridge cost, as well as right-of-way acquisition.

The Full Cloverleaf (#4) would be the highest cost configuration, about double the cost of the proposed two-loop cloverleaf. The construction-related costs would be only about 10 percent more, but the ramps in the southwest quadrant would require acquisition of a substantial amount of property.

The Semi-Directional Interchange (#5) would require a major increase in bridge construction costs for the flyover ramp structures, as well as additional right-of-way in the southwest quadrant to accommodate the ramp. The additional structural costs and property acquisition would each account for about one-half of the increase over the costs for the proposed interchange.

COMPATIBILITY WITH BICYCLE USE

Hana Highway has a wide paved shoulder area along the segment through the airport area. The paved shoulder facilitates and attracts use by bicyclists. The State's bicycle master plan[1] includes future designation of Hana Highway as a bike route.

(1) *Bike Plan Hawaii*, prepared for State DOT Highway Division by R.M. Towill Corporation, April 1994.

Table 6-1

COST COMPARISONS FOR AT-GRADE AND INTERCHANGE ALTERNATIVES[1]
JUNCTION OF HANA HIGHWAY AND AIRPORT ACCESS ROAD
Year 2020 Traffic Assessment of Kahului Airport Access Road

Cost Item	At-Grade Intersection Alternative	Proposed Two-Loop Clover Leaf Interchange	Alternative Interchanges				
			#1 Conventional Diamond	#2 Single Point Diamond	#3 Single-Loop Cloverleaf	#4 Full Cloverleaf	#5 Semi-Directional
Right-of-Way[2]	-0-	-0-	-0-	$ 963,000	-0-	$23,625,000	$ 7,350,000
Construction[3]	$4,946,000	$19,348,000	$16,104,000	20,540,000	$18,025,000	21,190,000	26,642,000
Engineering & Const. Management[4]	989,000	3,289,000	3,221,000	4,108,000	3,605,000	4,238,000	5,368,000
Contingency[5]	595,000	2,264,000	1,933,000	2,465,000	2,163,000	2,542,000	3,221,000
Total	$6,530,000	$24,901,000	$21,258,000	$28,078,000	$23,793,000	$51,595,000	$42,781,000

(1) Costs include construction of a 0.6 mile segment of Airport Access Road, the overpass (except for the at-grade intersection), and the interchange ramps.
(2) Includes cost of additional right-of-way needed beyond that already acquired for the Proposed Two-Loop Cloverleaf Interchange.
(3) Reflects mid-1995 construction costs.
(4) Based on 20 percent of construction costs (10% for administration, testing, and inspection; 5% force account; and 5% for design).
(5) Based on 10% of construction and engineering costs.

Wilbur Smith Associates; November 1995

T-10/303

The Airport Access Road interchange would have eastbound and westbound ramp connections to Hana Highway, which would result in vehicles crossing the shoulder bicycle lane to enter or exit the ramps. These conflicts would create safety concerns and delays to motorists and bicyclists with each of the alternative interchanges. The number of conflict points varies with the number of ramp crossings. However, fewer ramp crossings (conflict points) also increases the number of vehicles using each ramp, thus resulting in shorter gaps between vehicles entering/exiting the ramps. The number of ramp conflict points would be as follows:

	Eastbound	Westbound
Proposed Two-Loop Partial Cloverleaf	2	3
#1 Conventional Diamond	2	2
#2 Single Point Diamond	2	2
#3 Single Loop Cloverleaf	2	3
#4 Full Cloverleaf	4	4
#5 Semi-Directional	2	2

For the Conventional Diamond Interchange, the bicycle route could be marked onto the shoulder of the off-ramp, across Airport Access Road at the traffic signal-controlled intersection at the ramp junction, and then down the shoulder of the on-ramp to return to Hana Highway. During "busy" traffic periods, bicyclists may use the ramps; but during off-peak periods, most bicyclists may choose to continue along the main highway and cross the ramp junctions.

For the other configurations, or for the Conventional Diamond, bicyclists could be routed onto the ramp for a distance, and then cross the ramp at a right-angle, and return to the shoulder lane via a connecting bicycle lane segment. This approach would not change the number of conflicts, but only the relative position of the vehicle and bicycle at the point of conflict (increased visibility).

A bicycle "tunnel" could be provided under each ramp. The bicycles would be routed up the off-ramp, then cross via a tunnel through the fill section of the ramp. This might attract use during "busy" traffic periods. These tunnels would be expensive to construct, and would provide a security concern.

For each alternative, the bicycle route designation could be deleted for this segment of Hana Highway, and bicyclists routed through the area on the planned Northshore Greenway bicycle facility.

SAFETY CONSIDERATIONS

Each of the alternatives would be designed in conformance with established standards and practices, and, therefore, should provide a reasonable level of safety. All interchange alternatives should experience fewer and less severe accidents than an at-grade intersection at this location.

CONSTRUCTION IMPACTS

Construction activities for each of the interchanges would affect traffic operations along Hana Highway. Each involves construction work in the median to place foundations and columns to support the Airport Access Road bridge, and construction work above the Hana Highway traffic lanes to build the bridge deck. The Semi-Directional alternative would also require construction of a second bridge crossing for the flyover ramp. Construction of the ramp junctions and acceleration/deceleration lanes along Hana Highway would be needed for each interchange type, but should result in minor impacts.

The primary factors affecting the degree of construction impacts between alternatives would be the duration of the work and the potential for providing temporary lanes or detours. The construction impacts have been rated least to worst as follows:

Least: Full Cloverleaf (#4) and Proposed Two-Loop Partial Cloverleaf

- Each includes additional width for vehicle weaving movements under the bridge structure. These could be constructed first to provide additional pavement width at the bridge site.
- During the median work phases, traffic could be shifted outward onto the widened weaving sections to provide the necessary work area in the median. This should allow maintenance of two lanes in each direction.
- During the bridge deck construction, both directions of the traffic could be routed onto the three lanes on one side of the median while work occurs on the other during off-peak hours. During peak traffic hours, all lanes could be opened.

Moderate: Conventional Diamond

- The earthwork and pavement for the Airport Access Road and ramps could be constructed initially.
- Construction work on the bridge could occur during off-peak hours, at which time traffic could be diverted onto the diamond ramps to bypass the bridge site.

Moderate: Single Loop Partial Cloverleaf

- This could combine the approaches for the preceding interchange types.

Bad: Semi-Directional

- This alternative includes no widening at the bridges, and requires construction of two separate bridge structures over Hana Highway.
- Temporary widenings could be needed.
- The duration of construction and traffic disruptions could be longer than the preceding alternatives.

Worst: Single Point Diamond

- Due to the large, and possibility irregular-shaped, bridge structure, this alternative could result in a far longer period of construction work on the bridge structure.

INTERCHANGE CONFIGURATIONS SELECTED FOR ECONOMIC ANALYSIS

The proposed Two-Loop Partial Cloverleaf Interchange and the Conventional Diamond Interchange (#1) were selected for further analyses. The highway user benefits and costs of each plan were evaluated, and compared to the costs with an at-grade intersection at the junction of Hana Highway and the Airport Access Road to identify their relative cost-effectiveness (Chapter 7).

The proposed Two-Loop Partial Cloverleaf was selected for further study since it is the configuration included in the Preferred Plan of airport improvements. Design plans are near completion and the necessary right-of-way already acquired. The layout represents a median cost option, that is well suited to serve the forecast traffic volumes.

The Conventional Diamond was selected for further study since it represents the lowest cost interchange option. It is a standard, familiar configuration that should provide adequate, though not optimal, service to the forecast traffic volumes.

The Single-Loop Partial Cloverleaf (#3) was not proposed for further, detailed study since it represents only a minimal cost differential with the Two-Loop Partial Cloverleaf, and requires a traffic signal on Airport Access Road.

The Single Point Diamond Interchange (#2) was not advanced for detailed study due to its higher construction cost relative to limited operational advantages over the Convention Diamond. The Single Point Diamond would also introduce a non-standard type interchange as the first interchange to be constructed on Maui.

The Full Cloverleaf (#4) was not selected for further study since a very large additional cost may be needed to acquire property in the southwest quadrant, relative to the comparatively low volumes that would use this ramp. This configuration would also likely result in weaving problems for westbound traffic volumes.

The Semi-Directional Interchange (#5) was also not selected for further study due to its very high cost.

7. ECONOMIC EVALUATION OF KAHULUI AIRPORT INTERCHANGE

A benefit-cost analysis was made for the development of an interchange at the junction of the Airport Access Road with Hana Highway. This analysis was used to estimate the economic value of the various benefits that would accrue from a highway project, and then to compare these benefits to the costs of the project to determine if the project would provide a net positive return for the investment.

Such analyses usually compare the benefits and costs of a proposed highway project (or project alternatives) to the existing conditions. This study is focused on whether an interchange is justified at the junction of the planned Airport Access Road with Hana Highway. Therefore, the construction of Airport Access Road with an at-grade intersection at Hana Highway is used as the "base condition" for this analysis. The benefits and costs of an interchange are thus the incremental increase in costs and benefits as compared to constructing Airport Access Road with an at-grade intersection. The analyses were made for the proposed two-loop partial cloverleaf interchange, and for a conventional diamond interchange (lowest cost interchange, Chapter 6).

BENEFIT-COST CONCEPT AND METHODOLOGY

The project or project alternative that requires the lowest implementation costs (cost minimization) or those that yield the best traffic operations (benefit maximization) may not necessarily represent economically desirable projects. Instead, a "benefit-cost analysis" is provided to compare overall economic benefits to the costs needed to create these benefits. The benefit-cost analysis is intended to identify and analyze these economic costs and benefits over the "lifespan" of the project. This is necessary to reflect the effect of future traffic increases on traffic conditions.

The assessment of benefits for this project addresses the direct transportation efficiency improvements expected with the interchange. These include:

- The value of travel time savings
- Vehicle operating cost savings
- Accident cost savings.

Project costs encompass the right-of-way, construction, and related costs of building the facility, as well as future costs to maintain the facility.

The methodology for conducting the economic analysis of highway project costs and user benefits is provided in *A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements.*[1] The manual is primarily oriented to evaluating alternative projects through a corridor, or comparing at-grade and grade-separated projects. The specific tables of values and nomographs in the manual

(1) *A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements*, by the American Association of State Highway and Transportation Officials, 1977.

do not provide sufficient detail for the evaluation of differences between two interchange configurations.

This analysis has followed the general methodology and procedures outlined by the manual for an economic analysis of highway projects. However, this study has modified the procedures to provide the level of detail needed for an assessment of the at-grade intersection, partial cloverleaf interchange, and diamond interchange alternatives. This study has also augmented the procedure with more recent user cost factors, more detailed accident factors, and other information needed to analyze the differences attributable to the ramp configurations of the two interchanges.

Those assumptions and methodology relating to the overall benefit-cost analysis procedure are discussed in the following paragraphs. Further discussions of methodology are included in the individual sections regarding travel time savings, vehicle operating costs, accident costs, and roadway costs.

Discounting of Future Costs and Benefits

The project costs and the "stream" of future user benefits would occur over a number of years. For purposes of a benefit-cost analysis, these yearly costs and benefits must be translated into a single amount in one particular year, usually the present (1995). This present value is derived by applying an appropriate discount factor to each cost or benefit in the yearly series, which converts each cost or benefit to its present value in 1995.

The discount rate for highway projects represents the opportunity cost of capital to the taxpayer (i.e. estimated market rate of return). The analyses is based on use of constant 1995 dollars; so the future inflation portion of interest rates is excluded from the discount rate.

A discount rate of 7 percent is used for the analyses. This is the rate presently specified in Federal guidelines[2] for conducting benefit-cost analyses for projects that would receive Federal funding.

Selection of Analysis Period

Some elements of a highway project should last a very long period, up to 100 years or more. However, since all costs and benefits are discounted, benefit-cost analyses generally address a period of no more than 30 years. The discounted present value of costs and benefits beyond a 30-year horizon become very small.

An approximately 30-year analysis period was selected for this assessment of costs and benefits for the interchange. Thus, the analysis reflects the following:

- Construction .... January 1997 - mid-1998
- Traffic Service . Mid-1998 - Yearend 2027

(2) *Circular No. A-94 Revised, Benefit-Cost Analysis of Federal Programs; Guidelines and Discounts*, Office of Management and Budget, October 29, 1992.

Since several elements of the highway project would have a useful life beyond Year 2027, the remaining "residual value" of these elements is taken as a benefit for Year 2028.

Use of 1994 and 2020 As Analysis Years

Usually, traffic and economic benefits are analyzed for two years, one at or near the beginning and one nearer the end of the analysis period (1998 to 2027). Economic benefits for the other years are estimated by interpolation and extrapolation of these results.

Year 1994 and 2020 are used for this analysis. Most of the existing traffic counts and characteristics represent 1994 conditions, and thus provide a reliable initial analysis year. Year 2020 is the furtherest year into the analysis period for which traffic forecast data are available.

The annual highway user benefits were estimated for each of these two years. The benefits for each year from 1998 to 2019 were estimated by interpolation between the 1994 and 2020 analysis results. The benefits for 2021 to 2027 were developed by extrapolation of the results. Both the interpolation and extrapolation were made on a straight-line basis.

Analysis Year Benefits

For 1994 and 2020, the estimation of annual benefits was based on an assessment of traffic conditions at the junction of the Airport Access Road and Hana Highway with the at-grade intersection, a conventional diamond interchange, and the two-loop partial cloverleaf interchange. The analysis was made for the morning peak hour, afternoon peak hour, and an average non-peak hour for an average weekday in each year. The results for these three hourly analyses were then factored to an annual total.

Development of Hourly Traffic Volumes - The traffic volumes at the project site were developed for the three time periods as follows:

- **Morning Peak Hour**
  1. The Year 2020 morning peak hour volumes at the junction were used as identified in Chapter 4 for an average weekday.
  2. The Year 1994 average weekday morning peak hour volumes were estimated by a reassignment of the existing average weekday traffic volumes to a roadway network that included the planned Airport Access Road, as well as the other Airport Project roadway modifications that would affect traffic flow through the junction.
  3. The same vehicle movements were assumed to occur with either the at-grade intersection, conventional diamond interchange, or proposed two-loop partial cloverleaf interchange.
- **Afternoon Peak Hour**
  1. The same process was used as for the morning peak hour.

- **Average Non-Peak Hour**
  1. The peak traffic conditions were assumed to encompass a 90-minute period in the morning commute peak and a 90-minute period in the afternoon commute peak.
  2. To eliminate the effects of the extremely low-volume six-hour period between 11:00 PM and 5:00 AM, and to simplify the analyses, the remaining average weekday traffic volume (that not occurring in the two 90-minute peaks) was assumed to occur in 15 hours of the day.
  3. The traffic volumes in the two 90-minute peak periods were subtracted from the average weekday total, and this non-peak volume was divided by 15 hours to estimate traffic during the average non-peak hour of the day.

Development of Factors to Annualize Hourly Results - The results from the analyses of the three one-hour periods were expanded to an annual total as follows:

1. Each year was assumed to include the following:

   248 Normal weekdays (non holidays)
   52 Saturdays
   52 Sundays
   13 Holiday weekdays

2. Traffic conditions on a weekday holiday were assumed to be similar to those on a Sunday.
3. Based on the year-round counts made at the State DOT research station (CC-3) on Honoapiilani Highway just south of Kaanapali Road, the counts for 1993-1994 indicate:
   - Average Saturday traffic volumes approximate 93% of average weekday volume;
   - Average Sunday traffic volumes approximate 87% of average weekday volume.
4. The average normal weekday was assumed to consist of 1-1/2 hours of morning peak traffic, 1-1/2 hours of afternoon peak traffic, and an equivalent of 15 hours of average off-peak traffic.
5. An average Saturday was assumed to consist of 1 hour of afternoon peak traffic and 17 hours of off-peak traffic, with the off-peak hours equivalent to the weekday average off-peak hour adjusted by a factor of 0.93 to reflect lower Saturday volumes as compared to weekdays.
6. An average Sunday or holiday weekday was assumed to consist of 1 hour of afternoon peak traffic and 17 hours of off-peak traffic, with the off-peak hours equivalent to the weekday average off-peak hour adjusted by a factor of 0.87 to reflect the lower Sunday and holiday volumes as compared to weekdays.

With this methodology, the annual total benefits for each year were calculated by the summation of the following:

372 times the average morning peak hour results, plus
548 times the average afternoon peak hour results, plus
5,504 times the average off-peak hour results.

The derivation of these multipliers for the hourly results is summarized in Table 7-1.

Study Area

The analyses of benefits and costs extends to the approximate limits of construction for the interchange configurations. The study area thus includes an approximately 0.6-mile long segment of Hana Highway and a similar length along the planned Airport Access Road, with these study segments centered on the junction point of the two roads. The analyses of construction costs and roadway travel encompass these roadway sections, plus the ramps included within the two interchange configurations.

1994 AND 2020 TRAFFIC VOLUMES AND CONDITIONS

Years 1994 and 2020 peak hour and average off-peak hour volumes were estimated for input to the analyses of highway user benefits. The general methodology used in these forecasts is described in the preceding sections. These estimated volumes were then used to analyze traffic conditions with each of the three alternatives for the junction of the Airport Access Road with Hana Highway.

Peak and Off-Peak Traffic Volumes

The Year 2020 morning and afternoon peak hour traffic volumes at the junction of Airport Access Road and Hana Highway are presented in Figures 4-1 and 4-2, respectively. These two figures depict the volume for each traffic movement at the junction, as the volumes would appear for an at-grade intersection. Figures 6-2 and 6-3 depict the 2020 peak hour volumes for the two-loop partial cloverleaf and conventional diamond interchanges.

The 1994 morning and afternoon peak hour traffic volumes at the junction of Airport Access Road and Hana Highway are depicted in Figure 7-1. These hypothetical traffic volumes represent the estimated diversion of traffic to Airport Access Road and to Hana Highway, if the proposed airport roadway projects had been completed in 1994.

Figure 7-2 depicts the estimated average off-peak hour traffic for 1994 and 2020 at the junction of Airport Access Road and Hana Highway. These estimated volumes reflect typical levels of traffic that would occur during the midday and evening hours. The estimated off-peak hourly volumes generally range between 45 and 65 percent of the peak hour peak direction volumes estimated for the two roadways.

Traffic Conditions with At-Grade Intersection

Both Airport Access Road and Hana Highway are assumed to provide two through lanes in each direction through Year 2020. With an at-grade intersection, each approach is assumed to provide a separate left-turn lane and a separate right-turn lane to accommodate turning traffic and increase

Table 7-1

DERIVATION OF MULTIPLIERS TO ANNUALIZE RESULTS OF PEAK HOUR AND OFF-PEAK HOURS RESULTS
Year 2020 Traffic Assessment of Kahului Airport Access Road

Time Period	Hours per Day	Days per Year	Volume Factor	Equivalent Hours per Year
Morning Peak Hour				
▸ Weekday	1.5	248	1.00	372
Afternoon Peak Hour				
▸ Weekday	1.5	248	1.00	372
▸ Saturday	1.0	52	1.00	52
▸ Sunday	1.0	52	1.00	52
▸ Holiday	1.0	13	1.00	13
			Total	489
Off-Peak Hours				
▸ Weekday	15	249	1.00	3,720
▸ Saturday	17	52	0.93	822
▸ Sunday	17	52	0.87	769
▸ Holiday	17	13	0.87	193
			Total	5,504

Wilbur Smith Associates; November 1995

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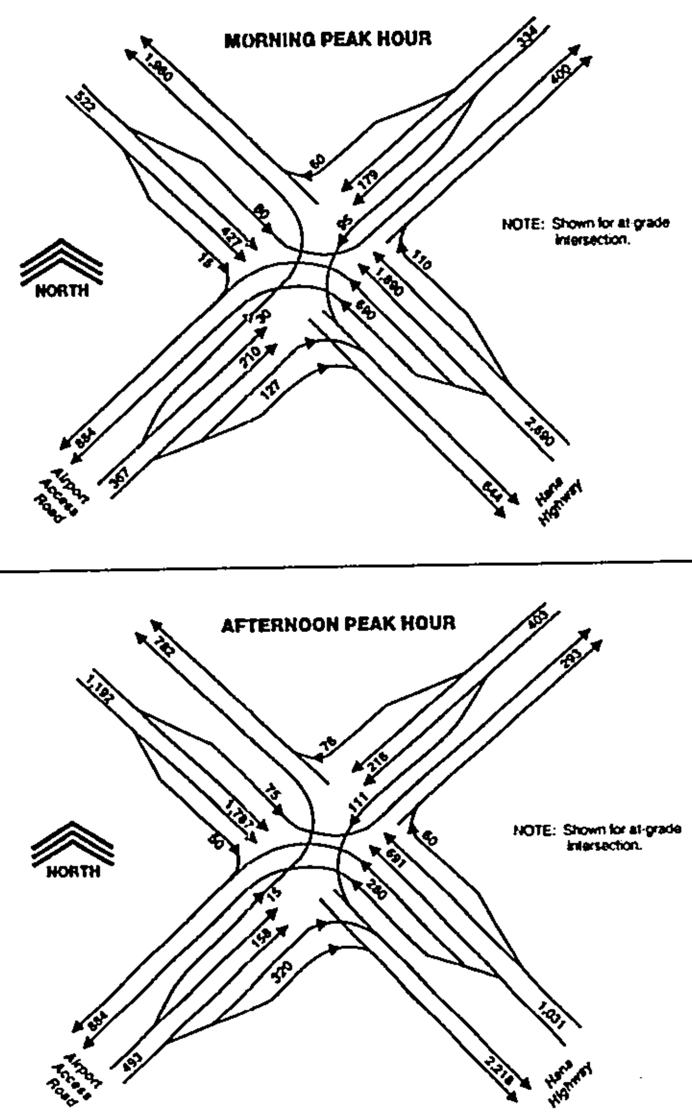

Figure 7-1
1994 PEAK HOUR TRAFFIC VOLUMES
HANA HIGHWAY AND AIRPORT ACCESS ROAD

YEAR 2020 TRAFFIC ASSESSMENT OF KAHULUI AIRPORT ACCESS ROAD

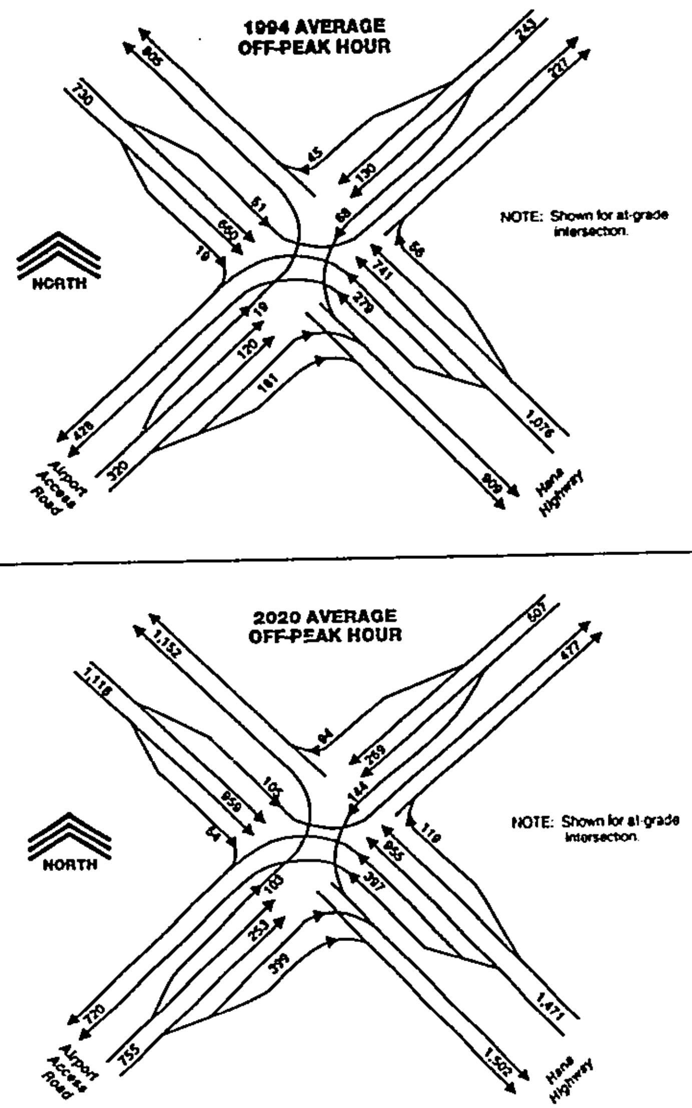

Figure 7-2
AVERAGE OFF-PEAK HOUR TRAFFIC VOLUMES
HANA HIGHWAY AND AIRPORT ACCESS ROAD

intersection capacity. A second (double) left-turn lane is assumed for the westbound Hana Highway approach, and a second right-turn lane for the northbound Airport Access Road approach in order to better accommodate the very high volume of traffic making these turns.

An at-grade intersection, with traffic signal control and these numbers of lanes, would provide acceptable traffic conditions for the peak hour and off-peak hour, traffic volumes estimated for 1994. As summarized in Table 7-2, the intersection would operate at LOS D conditions during the 1994 peak hours, and LOS C during the off-peak. Traffic would approximate 92 percent of capacity during the afternoon peak hour.

The traffic increases forecast for Year 2020 would result in a substantial worsening of conditions with the at-grade intersection. The traffic volumes would exceed the estimated capacity of the intersection during both peak hours, with resultant long traffic delays (LOS F). However, marginally acceptable traffic conditions (LOS D) would occur with the average off-peak traffic volumes.

Traffic Conditions with Diamond Interchange

Traffic signal controls would be provided at the Airport Access Road intersections with the eastbound on- and off-ramps, and with the westbound on- and off-ramps.

Both intersections would provide very acceptable service levels with both the 1994 and 2020 forecast traffic movements. As summarized in Table 7-2, the estimated hourly volumes approximate 17 to 36 percent of capacity in 1994, and 30 to 58 percent of capacity in 2020. The average vehicle delays would be at very acceptable levels (LOS A or B).

Traffic conditions at the ramp junctions with Hana Highway are summarized for Year 2020 in Table 7-3. Poor service levels are projected for the westbound off-ramp during the morning peak hour (LOS F), and for the eastbound on-ramp during the afternoon peak hour (LOS E). Some slowing would result at the junction of those ramps with Hana Highway during these two peak hour periods. Year 1994 conditions are not listed in Table 7-3. Traffic conditions are estimated at LOS A to C with 1994 volumes.

Traffic Conditions with Two-Loop Partial Cloverleaf Interchange

This interchange configuration would not require any traffic signal controls with the traffic levels forecast for 2020. However, the left-turn movements from Airport Access Road onto the eastbound and westbound on-ramps would be required to yield to on-coming through traffic along Airport Access Road. The analysis of these yield conditions indicate that the left-turn vehicles should experience very short average delays. As summarized in Table 7-2, the left-turn vehicles would average a delay between 2.7 and 7.2 seconds (LOS A to B) for the various analyses periods.

Traffic conditions at most ramp junctions with Hana Highway would also be at LOS A or B conditions (Table 7-3). However, poor service levels are projected for the exit of the westbound loop and direct ramps during the morning peak hour, and for the entry from the eastbound on-ramp during the afternoon peak hour. The morning conditions for the westbound exit is slightly worse than for the diamond interchange due to the complicating factor of two exits located in close proximity.

Table 7-2

INTERSECTION TRAFFIC CONDITIONS - AIRPORT ACCESS ROAD AT HANA HIGHWAY
Year 2020 Traffic Assessment of Kahului Airport Access Road

Scenario/ Location	Year	Morning Peak Hour			Average Off-Peak Hour			Afternoon Peak Hour		
		V/C	AD	LOS	V/C	AD	LOS	V/C	AD	LOS
At-Grade Intersection										
▸ Airport Access Road at Hana Highway*	1994	0.83	25.8	D	0.45	22.2	C	0.92	29.4	D
	2020	1.11	75.5	F	0.73	29.1	D	1.18	92.0	F
Diamond Interchange										
▸ Airport Access Road at Eastbound Ramps*	1994	0.35	5.0	A	0.17	5.9	B	0.22	6.9	B
	2020	0.56	7.0	B	0.30	7.6	B	0.46	8.7	B
▸ Airport Access Road at Westbound Ramps*	1994	0.36	9.6	B	0.18	9.3	B	0.22	8.7	B
	2020	0.58	11.9	B	0.35	10.3	B	0.50	10.3	B
Two-Loop Cloverleaf Interchange										
▸ Northbound Left-Turn from Airport Access Road to Westbound On-Ramp**	1994	—	3.0	A	—	2.7	A	—	3.2	A
	2020	—	4.5	A	—	4.0	A	—	7.2	B
▸ Southbound Left-Turn from Airport Access Road to Eastbound On-Ramp**	1994	—	3.1	A	—	2.6	A	—	2.9	A
	2020	—	5.1	B	—	3.8	A	—	5.9	B

V/C = Ratio of estimated traffic volume to theoretical capacity of the intersection.
AD = Average delay per vehicle, in seconds.
LOS = Level-of-Service
* = Controlled by traffic signal.
** = YIELD condition.

Wilbur Smith Associates; November 1995

T-123020

TRAVEL TIME SAVINGS

One of the principal benefits of most highway improvements is the "saving" of travel time for the highway user. This time is not "saved", rather only the ability to use time differently is changed. Sometimes this travel time is very important, such as during a business call or trip, making a truck delivery, travelling to work, or rushing to catch a flight. At other times, travel time has less or little value, such as during a leisure drive.

The value of travel time varies from person to person, and situation to situation. What is generally accepted is that most persons, collectively, are willing to pay something to reduce the amount of time spent on travel. It is the average monetary value that people would place on this time that is used in estimating the value of "travel time savings."

This benefit-cost analysis included an assessment of the cumulative hours of travel time needed by the estimated traffic volumes to traverse the junction of Airport Access Road and Hana Highway with the at-grade intersection, and with the two interchange configurations. Values were placed upon these cumulative travel times. The differential values between the three options represent the "savings" or benefits.

Methodology

The analysis of travel time benefits among the three options included the following steps:

1. Travel times through the junction was estimated for each traffic movement for each of the three options. This analysis was made for the two peak hours and the off-peak hour for both 1994 and 2020.

2. The values that persons would likely place on travel time and/or savings of travel time was estimated for different types of trips.

3. The composition of vehicle trips (by type of value) was estimated for traffic on each roadway.

4. The travel times, time values, and vehicular volumes were aggregated to identify the total annual travel costs for all traffic passing through the junction in 1994 and 2020 with the:
   - At-grade intersection
   - Diamond interchange
   - Two-loop partial cloverleaf interchange.

The assessment includes the estimated time elapsed between when the approaching vehicle is within 0.3 mile of the center of the junction, to the time when it is 0.3 mile from the junction during its departure.

Estimation of Travel Times - The estimated travel times include both the vehicle running time and any vehicle delay time, e.g. stopped time at traffic signals. The travel times were estimated for each vehicle path through each of the three intersection/interchange options. The estimated travel times were computed for each of the time periods.

Table 7-3

YEAR 2020 LEVEL-OF-SERVICE AT RAMP TERMINI - DIAMOND AND PARTIAL CLOVERLEAF INTERCHANGES
HANA HIGHWAY AT AIRPORT ACCESS ROAD
Year 2020 Traffic Assessment of Kahului Airport Access Road

	Morning Peak Hour		Average Off-Peak Hour		Afternoon Peak Hour	
	Hana Highway Lanes	Ramp Traffic	Hana Highway Lanes	Ramp Traffic	Hana Highway Lanes	Ramp Traffic
Diamond Interchange						
▸ Eastbound Off-Ramp	A	B	A	B	A	B
▸ Eastbound On-Ramp	B	B	B	C	D	E
▸ Westbound Off-Ramp	E	F	B	B	B	B
▸ Westbound On-Ramp	C	C	A	B	A	B
Partial Cloverleaf Interchange						
Eastbound Hana Highway						
▸ Lahaina Off-Ramp	A	B	A	B	C	C
▸ Airport Loop Off-Ramp	A	B	A	B	C	C
▸ Eastbound On-Ramp	B	B	B	B	D	E
Westbound Hana Highway						
▸ Airport Off-Ramp	E	F	B	B	B	B
▸ Lahaina Loop Off-Ramp	F	F	B	B	B	B
▸ Westbound On-Ramp	C	C	A	B	A	B

Wilbur Smith Associates; November 1995

T-13/302b

The travel times are based on a 45 mph speed limit for both Airport Access Road and Hana Highway through this junction.

The speed limits and average "free flow" speeds used in the analysis are as follows:

Roadway	Options	Speed Limit	Average Free Flow Speed
Hana Highway	At-Grade Intersection	45 mph	35 mph
	Interchanges	45 mph	40 mph
Airport Access Road	At-Grade Intersection, Diamond	45 mph	35 mph
	Partial Cloverleaf	45 mph	40 mph
Loop Ramps	---	25 mph	20 mph
Direct Ramps	---	35 mph	25-30 mph
Diamond Ramps	---	35 mph	20-25 mph

Delay times at traffic signals and at YIELDS signs were added to each vehicle path, as appropriate.

Unit Value of Travel Time - The value of travel time per vehicle reflects several factors:

- Purpose of the trip;
- Vehicle type (for trucks); and
- Number of persons per vehicle.

For this study, vehicles types/trip purposes were grouped into five categories. These categories and the value per hour of vehicle travel time, in 1995 dollars, were as follows:

1. Semi/tractor-trailer trucks: .... $25.00 per vehicle hour
2. Standard-size trucks: .... 21.00 per vehicle hour
3. Small vehicles, business or commute trips: ... 16.50 per vehicle hour
4. Small vehicles, recreation or tourist trips: .... 6.90 per vehicle hour
5. Small vehicles, other trip purposes: .... 6.90 per vehicle hour

The unit values of travel time were developed as follows:

1. **Semi/Tractor-Trailer Trucks** - Union pay scale and benefits for drivers of tractor-trailer rigs, tankers, and other large trucks on Maui range from about $25.50 to $27.50 per hour, dependent upon driver seniority.[3] An average value at the low end of the scale was used since some non-union drivers may receive lower pay and benefits. The value is likely conservative since it reflects only the driver, and many vehicles may have more than one worker on board.

(3) Source: Teamsters Union

2. **Standard Size Trucks** - Union pay scale and benefits for drivers of standard size trucks is generally $21 to $22 per hour or more, dependent upon seniority.[4] Only the driver wage and benefits are included, although many vehicles may have additional workers on board.

3. **Small Vehicles Used for Business or Commute Trips** - In 1993, the average annual wage for Maui was $23,251.[5] Conversion to an hourly rate (2,080 hours per year), plus adding 3 percent to convert to mid-1995 values, yields an average pay rate approximating $11.50 per hour. Fringe benefits equalling 20 percent of the pay were added to the hourly rate. The value per vehicle hour reflects 1.2 workers per vehicle, the average for commuting trips on Maui.

4. **Small Vehicles Used by Tourists or for Resident Recreation Trips** - Persons travelling for recreational purposes would likely value their travel time at a lesser rate than those travelling for work-related purposes. Various studies have indicated a value for non-work trips generally ranging between 40 to 80 percent of work-related trips. For this study, the value of recreation and tourist trips was assumed at 50 percent of the average pay rate, not including benefits, times 1.2 persons per vehicle. The actual average vehicle occupancy is over 1.5 persons per vehicle, so this reflects an exclusion of most passengers, many being children.

5. **Small Vehicles Used for Other Purposes** - These vehicles would encompass school, shopping, medical, and personal business trips by residents. The same value per vehicle is used as in Item 4.

Composition of Vehicle Trips - The composition of vehicle trips was estimated for each approach at the junction of Hana Highway and Airport Access Road, both for the peak traffic hours and for the off-peak periods. Information from three sources was used by WSA to estimate the types of vehicles and trips:

1. **State Highway Vehicle Classification Counts** - The State DOT has made classification counts of vehicle traffic along Hana Highway west of Dairy Road (Station C-2-E, counted June 1993) and along Dairy Road south of Hana Highway (Station C-2-H, counted August 1995). These counts record the types and size of vehicles by time of day. These counts were used to estimate the percentage of semi-trailer and standard trucks (includes buses) on the Hana Highway approaches and on northbound Dairy Road.

2. **Maui Roadside Survey** - Kaku Associates conducted a roadside interview survey at six locations on Maui during June 1994. The surveys were made to update travel patterns for input to the new *Maui Islandwide Long-Range Transportation Plan Study*. The surveys recorded the following information concerning the trip being made at the time of interview:
   - Resident or visitor
   - Purpose of this vehicle trip

(4) Ibid.

(5) *1993 Employment and Payroll in Hawaii*, prepared by the State Department of Labor and Industrial Relations, October 1994.

- Number of persons in vehicle
- Time of day

Survey results[4] for four stations were used in estimating trip purposes at the Hana Highway-Airport Access Road junction:
#1 - Kaahumanu Avenue, west of Kahului Beach Road
#2 - Hana Highway, east of Haleakala Highway
#3 - Haleakala Highway, south of Hana Highway
#4 - Kuihelani Highway, south of Puunene Avenue

3. **Airport Vehicle Classification Counts** - Results from a Wilbur Smith Associates classification count of vehicles on Keolani Place near the entrance to Kahului Airport, made on September 14, 1994, was used to estimate trip purposes on the north leg of Airport Access Road.

The estimated composition of vehicle trips is presented in Table 7-4. This composition is assumed to apply to both 1994 and 2020 traffic.

Estimated Travel Times Through Junction

With the At-Grade Intersection, average travel times for most of the vehicle movements through the study area would require between 1.3 and 2.0 minutes in 1994. Peak hour travel times would be slightly longer than off-peak travel times for most individual travel paths. The increased traffic volumes in 2020, and the resulting congestion, would substantially increase average travel times during the peak hours, with times along the individual travel paths mostly ranging between 1.8 to 4.0 minutes. Travel times during the off-peak periods would also increase, but the increase would be smaller, with an added 0.2 to 0.3 minutes typical. Travel times along the individual travel paths are summarized in Appendix B.

Average travel times along most individual travel paths would be slightly shorter in 1994 with the interchange configurations, than those for the At-Grade Intersection. However, the increased traffic congestion and delay at the At-Grade Intersection in 2020 would increase the travel time differential with the interchanges, which are less affected by the level of traffic increases.

With the increased traffic volumes and congestion, the annual vehicle hours of travel through the At-Grade Intersection would increase by 93 percent between the 1994 and 2020 analyses years; the annual hours of travel would increase from 376,661 in 1994 to 728,085 in 2020 (see Table 7-5). Two-thirds of the increase would result from higher traffic volumes and one-third from increased congestion.

The Partial Cloverleaf and Diamond Interchanges would each result in substantially fewer travel hours than the At-Grade Intersection in both years. The proportional reduction would increase in 2020 over 1994 since the At-Grade Intersection is more adversely affected by traffic congestion. The

(4) Technical Memorandum, *Maui Islandwide Long-Range Transportation Plan Study*, prepared by Kaku Associates, August 19, 1994.

Table 7-4
TRAFFIC COMPOSITION AND TRIP PURPOSES(1)
HANA HIGHWAY - AIRPORT ACCESS ROAD JUNCTION

Roadway Approach	Vehicle	Trip Type	Percent of Traffic: Morning Peak Hour	Afternoon Peak Hour	Off-Peak Hours
Westbound Hana Highway	Trucks	Semi Trailer	0.5%	1.4%	0.6%
		Standard	2.0	1.5	3.5
	Small Vehicles(2)	Work	75.0	37.0	33.5
		Tourist/Recreational	5.0	38.8	29.9
		Other	17.5	21.3	32.5
		Total	100.0%	100.0%	100.0%
Eastbound Hana Highway	Trucks	Semi Trailer	0.4	0.3	0.2
		Standard	8.0	1.5	4.2
	Small Vehicles(2)	Work	51.3	55.0	28.0
		Tourist/Recreational	3.0	6.0	3.6
		Other	37.3	37.2	64.0
		Total	100.0%	100.0%	100.0%
Southbound Airport Access Road	Trucks	Semi Trailer	0.2	0.2	0.2
		Standard	4.0	4.0	4.0
	Small Vehicles(2)	Work	50.0	50.0	33.3
		Tourist/Recreational	45.8	45.8	62.5
		Other	0.0	0.0	0.0
		Total	100.0%	100.0%	100.0%
Northbound Airport Access Road	Trucks	Semi Trailer	0.0	0.3	0.2
		Standard	4.1	1.3	3.3
	Small Vehicles(2)	Work	35.5	71.8	26.0
		Tourist/Recreational	46.0	16.6	46.0
		Other	14.4	10.0	24.5
		Total	100.0%	100.0%	100.0%

(1) Source: Wilbur Smith Associates, based on the following:
- Vehicle classification count conducted by State DOT on Hana Highway near Dairy Road on June 10, 1993, and on Dairy Road on August 22, 1995.
- Vehicle classification count conducted by WSA on Keolani Place on September 14, 1994
- June 1994 roadway surveys conducted in Wailuku-Kahului area by Kaku Associates (*Maui Island-Wide Long Range Transportation Plan*, Technical Memorandum, August 19, 1994.

(2) Small vehicles include cars, pick-up trucks, and vans.

Wilbur Smith Associates; November 1995.

T-14502b

Table 7-5

ESTIMATED TRAVEL TIME AND TRAVEL TIME VALUE
AIRPORT ACCESS ROAD-HANA HIGHWAY
Year 2020 Traffic Assessment of Kahului Airport Access Road

Item	Autos, Vans & Pickups			Trucks		All Vehicles
	Work & Business Trips	Tourist & Recreation Trips	Other Trips	Midsize	Large	
Total Travel Hours[1]						
Year 1994:						
▸ At-Grade Intersection	136,744	96,410	126,027	12,972	1,499	376,661
▸ Diamond Interchange	109,836	84,524	97,843	10,529	1,200	303,931
▸ Partial Cloverleaf Interchange	111,671	80,132	102,428	10,634	1,293	306,058
Year 2020:						
▸ At-Grade Intersection	279,173	190,406	226,219	24,565	2,722	726,085
▸ Diamond Interchange	185,541	158,255	156,214	19,177	1,878	520,066
▸ Partial Cloverleaf Interchange	181,532	143,123	160,067	17,547	1,952	504,221
Value of Travel Time[2]						
Year 1994:						
▸ At-Grade Intersection	$2,256,274	$ 679,027	$ 869,585	$272,411	$37,476	$4,114,773
▸ Diamond Interchange	1,812,248	583,215	676,114	221,092	29,999	3,321,718
▸ Partial Cloverleaf Interchange	1,842,569	552,913	706,752	221,208	32,323	3,355,765
Year 2020:						
▸ At-Grade Intersection	$4,606,352	$1,355,204	$1,554,011	$515,864	$68,040	$8,099,471
▸ Diamond Interchange	3,061,428	1,091,962	1,077,877	381,719	46,944	5,659,930
▸ Partial Cloverleaf Interchange	2,995,263	987,549	1,104,465	368,489	48,782	5,504,569

(1) Vehicle hours of travel time.
(2) Value of time only for those occupants included in the economic analysis.

Wilbur Smith Associates; November 1995

T-17/5072

reduction in annual travel time for each interchange, relative to the At-Grade Intersection is estimated as follows:

Year	Partial Cloverleaf	Diamond Interchange
1994	-18.7%	-19.3%
2020	-30.7%	-28.6%

The Diamond Interchange would result in a slightly larger time saving in 1994, but the Partial Cloverleaf Interchange results in a slightly larger time saving in 2020 with the increased traffic loads.

Estimated Value of Travel Time

The estimated annual value of travel time through the junction is also presented in Table 7-5 for the At-Grade Intersection and the two interchange configurations. The comparison between the three generally parallels that for the number of travel hours.

The value of travel time for the At-Grade Intersection is estimated as $4.1 million and $8.1 million in 1994 and 2020, respectively. The value with the two interchanges approximates $3.3 million in 1994, with the Diamond Interchange lower than the Partial Cloverleaf by about $34,000. In 2020, the Partial Cloverleaf Interchange is estimated at about $155,000 less than travel time through the Diamond Interchange. The contributors to the travel time "costs", by trip type, are:

Trucks	7%
Work and Business Trips	57
Tourist and Recreation Trips	17
Other Resident Trips	19
Total	100%

VEHICLE OPERATING COSTS

Vehicle operating costs encompass such expenses as gasoline, tires, oil, maintenance, and vehicle depreciation. For the most part, these costs are more related to travel distance than to travel time. However, these operating costs are also affected by an array of other factors, such as travel speed, the need to decelerate/reaccelerate, idling costs while stopped, and roadway grades and curves.

Overview of Methodology

The three configurations of the roadway junction would differ in the travel paths, speeds, and stops for most vehicles passing through the junction. The respective features of each would affect vehicle operating costs.

The evaluation of the vehicle operating costs for the three options followed the following steps:

1. The travel path for each traffic movement through each configuration was defined as to distance, speeds, change in speeds, stop times, roadway grades, etc.

2. Unit cost factors were identified for each element of the travel path, by type of vehicle.

3. The vehicular volumes for each travel path were multiplied by the unit cost factors, and the results aggregated to estimate the costs for 1994 and 2020.

Travel Paths - Each configuration presents a total of 12 travel paths, one each for the through, left-turn, and right-turn movements for each of the four roadway approaches. The travel paths also differ between 1994 and 2020 due to changes in traffic conditions and delays. Each travel path was described as follows:

1. Each travel path was divided into component segments which shared the same general features of travel speed and roadway grades. The length of each segment was identified.

2. The major changes in speed necessary along each route were identified as to the magnitude of the change, and increase or decrease.

3. Average vehicle idling time was calculated for each path:
   - The proportion of vehicles stopping at a traffic signal was estimated using the split between red and green phases for each movement; and
   - The length of the stop time was based on the average delay time calculated for each movement in the analysis of intersection conditions.

Unit Operating costs - Unit vehicle operating costs were derived from *Vehicle Operating Costs, Fuel Consumption, and Pavement Type and Condition Features.*[7] The values presented in the document were increased to 1995 using the Consumer Price Index.

To simplify the calculations, the large number of vehicle types in the document were consolidated into three categories. These categories and the unit cost rates used to represent each category are:

Tractor-Trailer and other Large Trucks • 2-52 Semi Truck
Standard Trucks • 3A SU Truck
All sizes of Cars, Vans and Pick-Ups • Medium Automobile

Unit operating costs were obtained from the document as needed for the speed/roadway grade combinations along each path. Unit costs for changes in speed were obtained from "Excess Cost for Speed Change Cycles" tables. Unit costs for idling time was identified for the three vehicle categories.

The resultant costs along each travel path are identified in Appendix C.

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(7) *Vehicle Operating Costs, Fuel Consumption, and Pavement Type and Condition Factors*, U.S. Department of Transportation, Federal Highway Administration, June 1982.

Estimated Vehicle Operating Costs

The estimated vehicle operating costs for Years 1994 and 2020 are summarized in Table 7-6. These costs represent travel through the 0.6-mile long section of roadway at the junction of the Airport Access Road and Hana Highway.

With the At-Grade Intersection, vehicle operating costs are estimated to increase from about $2.76 million in 1994, to $4.70 million in 2020, an increase of 70 percent. The vehicle operating costs are less sensitive to congestion than the travel time costs; approximately 90 percent of the increased annual vehicle operating costs between 1994 and 2020 is attributed to the higher volume of vehicles (more vehicles miles of travel), with about 10 percent due increased congestion and delays.

Both interchanges are estimated to reduce annual vehicle operating costs with 1994 and 2020 traffic, although the decreases amount to only 3 to 6 percent less than the At-Grade Intersection costs. This reduction is much smaller than the reduction in travel times since the vehicle operating costs are more affected by travel distance than travel speeds. Although the interchanges reduce much of the vehicle operating costs related to congestion, much of this "savings" is offset by the longer distances that vehicles turning between the two roads must travel on the ramps of the interchanges. The reduction of vehicle operating costs with Partial Cloverleaf Interchange is less than that for the Diamond Interchange due to the longer travel distances for vehicles using the two loop ramps.

ACCIDENT COST SAVINGS

Whether an at-grade intersection or one of the interchange configurations is constructed at the junction of Hana Highway and the Airport Access Road, it would be designed to be safe. It would provide adequate sight distances, controlled access, clean shoulder areas, wide lanes, and other safety features. Regardless of how safe the design, motorists will have accidents—through driver inattention to the roadway, driving too fast for conditions, and other reasons.

Different roadway configurations and features do result in different accident experiences. The number and nature of conflict points between vehicle flows, and the decision-making required of drivers by a configuration affect the occurrence and severity of accidents. Each of the three options was analyzed relative to the potential rates and severity of accidents, and the valuation of the accidents for input to the comparative economic analysis of these options.

Overview of Methodology

The analysis of accident costs required three types of factors and information:

1. Accident rates, or frequency of occurrence, for the different features of the three roadway configurations.

2. A unit value per accident.

3. A measure of exposure to accidents (roadway usage).

Table 7-6

ESTIMATED VEHICLE OPERATING COSTS
AIRPORT ACCESS ROAD-HANA HIGHWAY
Year 2020 Traffic Assessment of Kahului Airport Access Road

Item	Vehicle Operating Costs With		
	At-Grade Intersection	Diamond Interchange	Partial Cloverleaf Interchange
1994			
▸ Cars, Vans, Pickups	$2,422,685	$2,319,828	$2,364,529
▸ Mid-Size Trucks	308,551	299,188	292,321
▸ Tractor-Trailer Trucks	31,153	30,124	29,443
Totals	$2,762,389	$2,649,140	$2,686,294
Savings as Compared to At-Grade Intersection	—	$ 113,449	$ 76,295
		4.1%	2.8%
2020			
▸ Cars, Vans, Pickups	$4,127,478	$3,853,087	$3,897,203
▸ Mid-Size Trucks	524,412	509,507	494,644
▸ Tractor-Trailer Trucks	48,831	46,617	45,189
Total	$4,700,721	$4,409,211	$4,437,036
Savings as compared to At-Grade Intersection	—	$ 291,509	$ 263,684
		6.2%	5.6%

Wilbur Smith Associates; March 1996

T-18502b

The accident rate is expressed as the number of accidents per million vehicles passing through the junction of the two roadways. Thus, the roadway usage, or exposure level, is the number of vehicles passing through the junction in 1994 and 2020, as estimated using the hourly traffic volumes and annualization factors discussed in preceding sections of the report.

The accident rates and value per accident are categorized in terms of severity: property damage only, accidents with one or more injuries, and accidents with one or more fatalities.

Accident Rates - The accident rates used in this analysis are from *Safety Evaluation* guidelines developed by the State of California.[1] The guidelines provide average or "typical" accident rates for different types of roadways, ramps, and ramp junctions. (These guidelines are used to identify locations with higher than "normal" accident rates and to evaluate the feasibility of safety improvements.) The accident rates used in this study are present in Appendix Table D-1.

Value of Accidents - Whenever alternative highway projects are considered, safety impacts are valuated either implicitly or explicitly (have no value). The difficulty in valuating safety benefits is the placement of a value on human deaths. Two general approaches have been used: 1) valuating the years lost plus direct costs of the death, and 2) placing a value on society's willingness to pay additional costs to avoid fatal injuries. The large number of studies of these two approaches have resulted in a broad range for the value of a fatality, extending from about $500,000 to $3,000,000 or more. The higher values result from the "willingness to pay" approach.

This study uses values from a 1983 research report[2] on evaluating the cost-effectiveness of highway safety improvements, with the values increased to 1995, based on increases to the Consumer Price Index. This valuation of a fatality reflects the "willingness to pay" approach, but at a value closer to rates based on the "years lost" approach. The resultant value per accident, by level of severity are:

Property Damage Only Accident: $ 1,600
Injury Accident: 16,700
Fatal Accident: 1,090,000

Estimated Number of Accidents

The At-Grade Intersection is estimated to result in a larger number of accidents than either of the two interchange configurations. The Diamond Interchange is estimated to result in a larger number of accidents than the Partial Cloverleaf Interchange. The numbers of accidents estimated for Years 1994 and 2020 with each option are listed in Table 7-7, and in Appendix D.

(1) *Safety Evaluation*, California Department of Transportation, November 1982.

(2) *Cost-Effectiveness Techniques for Highway Safety, Volume III: Accident Costs*, prepared by W.F. McFarland and J.B. Rollins, Texas Transportation Institute, 1983.

Table 7-7

ESTIMATED ACCIDENTS
AT AIRPORT ACCESS ROAD-HANA HIGHWAY JUNCTION
Year 2020 Traffic Assessment of Kahului Airport Access Road

Year	Item	Option		
		At-Grade Intersection	Diamond Interchange	Partial Cloverleaf Interchange
1994	Number of Accidents[1]			
	▸ With Property Damage Only	10.95	6.22	4.16
	▸ With Injury	5.91	3.38	1.97
	▸ With Fatality	0.07	0.05	0.04
	Total	16.93	9.65	6.17
	Value of Accidents[2]			
	▸ With Property Damage Only	$ 17,287	$ 9,844	$ 6,581
	▸ With Injury	97,329	55,854	32,503
	▸ With Fatality	72,809	50,117	43,520
	Total	$187,425	$115,815	$82,604
2020	Number of Accidents[1]			
	▸ With Property Damage Only	17.71	11.90	7.74
	▸ With Injury	9.55	6.45	3.74
	▸ With Fatality	0.11	0.09	0.08
	Total	27.37	18.44	11.56
	Value of Accidents[2]			
	▸ With Property Damage Only	27,976	$ 18,812	$ 12,239
	▸ With Injury	157,509	106,391	61,786
	▸ With Fatality	117,828	95,314	85,044
	Total	$303,313	$220,517	$159,068

(1) Fractional numbers of accidents represent average yearly numbers.
(2) Value of accidents based on $1,600 per property damage only accident, $16,700 per injury accident, and $1,090,000 per fatal accident.

Wilbur Smith Associates; November 1995

T-15507b

The At-Grade Intersection is estimated to experience about 17 accidents per year at current traffic levels, with an increase to 27 accidents per year with 2020 traffic levels. The Diamond Interchange should result in about one-third fewer accidents, while the Partial Cloverleaf Interchange should result in about two-thirds fewer accidents.

Injury accidents are estimated to account for about one-third of total yearly accidents for each of the three configurations. The estimated frequency of fatal accidents, at Year 2020 traffic levels, ranges from a low of one fatal accident per 12 years for the Partial Cloverleaf Interchange, to one fatal accident over nine years for the At-Grade Intersection.

Estimated Value of Accidents

The estimated value of accidents at the roadway junction in 1994 and 2020 is presented in Table 7-7 for each of the three roadway configurations. These values represent an average of a period of several years since part of the accident value is attributable to a fractional portion of a fatality accident. Also note that the monetary value used for a fatal accident in this analysis represents an amount society is willing to pay to avoid a fatal accident, rather than the "costs" of a fatality as measured in terms of expenses and lost years of life.

The At-Grade Intersection results in the highest estimated accident "costs," at $187,425 in 1994 and $303,313 in 2020. The Diamond Interchange is estimated to reduce the annual value of these accidents by about 38 percent in 1994 and 27 percent in 2020. The Partial Cloverleaf Interchange is estimated to result in the lowest accident values, about 56 and 48 percent less than the At-Grade Intersection in 1994 and 2020, respectively.

ROADWAY COSTS

The roadway costs used in the analysis included both the costs to implement the intersection or interchange, and the costs to maintain the roadway facilities. A residual value was also estimated to reflect the remaining value of the roadway at the end of the 30-year analysis period.

Roadway Capital Costs

The estimates of the initial costs of developing the At-Grade Intersection and the two interchanges included construction costs as well as those design, engineering administration, and construction management costs associated with construction of the roadway junction. These costs, as described in Chapter 6, are as follows:

- At-Grade Intersection: .... $ 6,530,000
- Convention Diamond Interchange: 21,258,000
- Two-Loop Partial Cloverleaf Interchange: ... 24,901,000

The estimated costs reflect the "financial costs," or funds that the State would expend to build each project. The actual "economic costs" of the projects would be less due to the following:

- The At-Grade Intersection and Diamond Interchange would not need all of the land already acquired for the planned project. The unneeded property in the southeast quadrant could be sold with these two options. However, if sold as agricultural land (the present designation), this property would provide only $5,000 to $10,000 to credit towards the project.

- All three project costs include the 4.17 percent General Excise Tax, with these tax revenues returning to the State. The excise tax amounts to approximately $260,000 for the At-Grade Intersection, $850,000 for the Diamond Interchange, and $1,000,000 for the Partial Cloverleaf Interchange. The construction work would also generate other tax revenues for the State.

The "financial costs," rather than "economic costs," have been used in these analyses, both to simplify the analyses and to provide a more conservative evaluation of the economic justification of the higher-cost interchange projects.

Maintenance Costs

Statewide, annual maintenance costs for State highways currently average $8,000 per route mile.[19] No maintenance cost information is available for interchanges or ramps.

The annual maintenance costs for each intersection/interchange configuration was estimated by multiplying the $8,000 per route mile times the length of Hana Highway (0.30 miles), Airport Access Road (0.30 miles), and the interchange ramps. The resultant costs are:

Type of Interchange	Annual Costs	Increase Over At-Grade Intersection
At-Grade Intersection	$ 9,700	—
Diamond Interchange	20,900	$11,200
Two-Loop Partial Cloverleaf Interchange	23,100	13,400

Residual Value of Costs

The economic evaluation is conducted for a 30-year period. At the end of 30 years, some cost elements of the roadway projects would be fully depreciated (used all of its useful life) while other elements have longer useful lives. To account for the useful lives of some project cost elements beyond the 30-year period, a residual value is estimated and included as a "benefit" in the final year of the economic analysis.

The residual values for the intersection and interchange projects was based on the following useful lifespan for each major project element:

[19] Telephone conversation with Mr. Charles Yamamine, State DOT Highways Division, September 14, 1995.

Cost Element	Useful Life	Percent of Value Remaining After 30 Years
Earthwork	100 years	70%
Bridges and Structures	60 years	50%
Road Base	50 years	40%
Road Pavement, Shoulders	30 years	-0-

The estimated residual value for the three roadway projects is:

Project	Residual Value	Percent of Original Costs
At-Grade Intersection	$1,700,000	26%
Diamond Interchange	6,069,000	33
Partial Cloverleaf Interchange	8,067,000	32

The two interchanges have a higher proportional residual value than the At-Grade Intersection since most of the cost differential above the At-Grade Intersection is attributable to bridge and earthwork costs, two cost elements with long useful lifespans.

ANALYSIS OF ECONOMIC FEASIBILITY

To assess whether a highway investment is economically feasible, the costs of constructing and maintaining the improvements are compared with the economic benefits estimated to be attributable to the highway improvements. The cost and benefit comparison yields three indicators of economic feasibility:

- **Net Present Value** - All costs and benefits in future years are discounted back to the base year using the adopted discount rate. The future stream of discounted costs are subtracted from the future stream of discounted benefits. If the sum of the discounted benefits is greater than the sum of the discounted costs, the "net present value" is positive and the highway improvement is deemed to be "economically feasible", at the adopted discount rate.

- **Discounted Benefit/Cost Ratio** - After the future streams of costs and benefits are discounted, the sum of the discounted benefits are divided by the sum of the discounted costs. If the result is 1.0 or greater, the highway improvement is "economically feasible" at the selected discount rate.

- **Internal Rate of Return** - This calculation determines that discount rate at which the net present value difference between costs and benefits is zero. If the rate of return, expressed as a percentage, is equal to or greater than the adopted discount rate, then the highway improvement is deemed to be "economically feasible".

The purpose of this study is to analyze the economic feasibility of providing an interchange, as opposed to an at-grade intersection, at the junction of the Airport Access Road with Hana Highway. Therefore, the construction of the new roadway with an at-grade intersection serves as the baseline or "without project" condition. The proposed Two-Loop Partial Cloverleaf Interchange and the alternative Conventional Diamond Interchange each represent alternative "projects" for the purpose of this analysis.

The "project costs" are the increment of additional costs necessary to construct and maintain each interchange as compared to those costs for the At-Grade Intersection. The "project benefits" are any reduction or "savings" in travel time, vehicle operating, and accident costs as compared to the levels anticipated with an at-grade intersection. Thus, the net present value, discounted benefit/cost ratio, and internal rate of return for the Partial Cloverleaf Interchange and the Diamond Interchange indicate whether the additional costs of these facilities are warranted by the anticipated benefits relative to the At-Grade Intersection.

Methodology

The methodology and assumptions used in structuring and preparing inputs to this analysis have been discussed in the preceding sections of this chapter. The following are key elements:

1. The interchange "project" costs and benefits represent the net change as compared to those with an at-grade intersection.
2. The project construction expenditures occur between January 1997 and mid-1998.
3. The analysis encompasses those benefits anticipated within the 30-year period after construction.
4. A residual value is included as a benefit in the last year of the analysis period to reflect remaining useful life of several roadway elements.
5. The analysis is based on valuing all costs and benefits in 1995 dollars.
6. The economic analysis reflects the discounting of all costs and benefits to a baseline year (1995). A discount rate of 7 percent per year is used to reflect the minimum real rate of return desired for the investment of highway monies, exclusive of inflation.

The analysis was made using standard Wilbur Smith Associates computer spreadsheet software to calculate the economic indicators.

1994 and 2020 Benefits

The combined values of the travel time, vehicle operating costs, and accidents is presented in Table 7-8 for the At-Grade Intersection and the two interchanges. The net "benefit" of each interchange, as compared to the At-Grade Intersection is also included.

The Diamond Interchange provides the larger "benefit" in 1994, about $38,000 more than with the Partial Cloverleaf Interchange. This results from the larger savings in vehicle operating costs and travel time value at present traffic levels.

With increased traffic volumes, the Partial Cloverleaf Interchange provides the larger "benefit" in 2020, about $189,000 more than with the Diamond Interchange. This change results from a larger "savings" in travel time as delays increase with the At-Grade Intersection and Diamond Interchange.

Economic Feasibility

The results of the feasibility analyses is presented in Table 7-9 for the Proposed Two-Loop Partial Cloverleaf Interchange, and in Table 7-10 for the Conventional Diamond Interchange. Each table includes a yearly listing of the incremental costs (construction, maintenance) and benefits (travel time value, vehicle operating costs, and accident value) of that interchange configuration, as compared to the At-Grade Intersection. Only the benefits in Years 1998 through 2027 are included in the analysis, plus the residual value in Year 2028.

The feasibility results indicate that an investment in the Partial Cloverleaf Interchange is economically justified, based on the methodology and assumptions used in the analysis.

- Based on the 7 percent discount rate, the project would result in a net present value of $6,350,909. That is, the present value of the benefits would exceed the present value of the costs by that amount.
- The present value of the benefits would equal 1.42 times the present value of the costs.
- The benefits would yield a 9.9 percent per year return on the invested costs. This exceeds the 7 percent established as the minimum desired rate of return by Federal guidelines.

The feasibility analyses indicate that the Conventional diamond Interchange is also economically justified. It also provides an investment return above that for the planned Partial Cloverleaf Interchange:

- The net present value is $8,488,113.
- The present value of the benefits would equal 1.70 times the present value of the costs.
- The project would produce an 11.7 percent annual return on the investment.

Table 7-9
ECONOMIC FEASIBILITY INPUTS AND RESULTS
TWO-LOOP PARTIAL CLOVERLEAF INTERCHANGE

INPUTS

Total Project Cost	$18,371,000
Year 1994 Time	$759,007
Year 1994 V O C	$76,295
Year 1994 Accident	$104,820
Year 2020 Time	$2,594,902
Year 2020 V O C	$263,684
Year 2020 Accident	$144,245
Residual Value	$6,367,000
Annual Maintenance	$13,400
Discount Rate	7.00%

FEASIBILITY RESULTS	
Net Present Value =	$6,350,909
Internal Rate of Return =	9.9%
Benefit/Cost Ratio =	1.42

LIFE CYCLE ANALYSIS
(BEFORE DISCOUNTING)

	Costs	TIME	VOC	ACC	Total Benefits	NET
1994		759,007	76,295	104,820		
1995		829,619	83,503	106,337		0
1996		900,230	90,710	107,853		0
1997	12,247,333	970,842	97,917	109,369		(12,247,333)
1998	6,123,667	1,041,453	105,124	110,886	628,731	(5,494,935)
1999	13,400	1,112,064	112,332	112,402	1,336,798	1,323,398
2000	13,400	1,182,676	119,539	113,918	1,416,133	1,402,733
2001	13,400	1,253,287	126,746	115,435	1,495,468	1,482,068
2002	13,400	1,323,898	133,953	116,951	1,574,803	1,561,403
2003	13,400	1,394,510	141,161	118,467	1,654,138	1,640,738
2004	13,400	1,465,121	148,368	119,984	1,733,473	1,720,073
2005	13,400	1,535,732	155,575	121,500	1,812,808	1,799,408
2006	13,400	1,606,344	162,783	123,016	1,892,143	1,878,743
2007	13,400	1,676,955	169,990	124,533	1,971,477	1,958,077
2008	13,400	1,747,566	177,197	126,049	2,050,812	2,037,412
2009	13,400	1,818,178	184,404	127,565	2,130,147	2,116,747
2010	13,400	1,888,789	191,612	129,082	2,209,482	2,196,082
2011	13,400	1,959,400	198,819	130,598	2,288,817	2,275,417
2012	13,400	2,030,012	206,026	132,114	2,368,152	2,354,752
2013	13,400	2,100,623	213,233	133,631	2,447,487	2,434,087
2014	13,400	2,171,234	220,441	135,147	2,526,822	2,513,422
2015	13,400	2,241,846	227,648	136,663	2,606,157	2,592,757
2016	13,400	2,312,457	234,855	138,180	2,685,492	2,672,092
2017	13,400	2,383,068	242,063	139,696	2,764,827	2,751,427
2018	13,400	2,453,680	249,270	141,212	2,844,162	2,830,762
2019	13,400	2,524,291	256,477	142,729	2,923,497	2,910,097
2020	13,400	2,594,902	263,684	144,245	3,002,832	2,989,432
2021	13,400	2,665,514	270,892	145,761	3,082,167	3,068,767
2022	13,400	2,736,125	278,099	147,278	3,161,502	3,148,102
2023	13,400	2,806,736	285,306	148,794	3,240,837	3,227,437
2024	13,400	2,877,348	292,513	150,310	3,320,172	3,306,772
2025	13,400	2,947,959	299,721	151,827	3,399,507	3,386,107
2026	13,400	3,018,570	306,928	153,343	3,478,842	3,465,442
2027	13,400	3,089,182	314,135	154,859	3,558,177	3,544,777
2028	(6,367,000)					6,367,000

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Table 7-8
SUMMARY OF BENEFITS
Year 2020 Traffic Assessment of Kahului Airport Access Road

Item	At-Grade Intersection	Diamond Interchange		Partial Cloverleaf	
		Total Amount	Net Benefit[1]	Total Amount	Net Benefit[1]
1994					
• Value of Travel Time	$4,114,773	$3,321,718	$793,055	$3,355,765	$759,008
• Vehicle Operating Costs	2,782,589	2,649,140	113,449	2,686,294	76,295
• Value of Accidents	187,425	115,815	71,610	82,604	104,821
Total	$7,064,787	6,086,674	$978,114	$6,124,663	$940,124
Savings as Percent of At-Grade Value			13.8%		13.3%
2020					
• Value of Travel Time	$ 8,099,471	$ 5,659,930	$2,439,541	$ 5,504,569	$2,594,902
• Vehicle Operating Costs	4,700,720	4,409,211	291,509	4,437,036	263,684
• Value of Accidents	303,313	220,517	82,796	159,068	144,245
Total	$13,103,505	$10,289,658	$2,813,846	$10,100,673	$3,002,831
Savings as Percent of At-Grade Value			21.5%		22.9%

(1) Net benefit represents the lower value of travel time, vehicle operating costs, and accidents for each interchange as compared to the at-grade intersection.

Wilbur Smith Associates; November 1995

Table 7-10
ECONOMIC FEASIBILITY INPUTS AND RESULTS
CONVENTIONAL DIAMOND INTERCHANGE

INPUTS		FEASIBILITY RESULTS	
Total Project Cost	$14,728,000		
Year 1994 Time	$793,055		
Year 1994 V.O.C.	$113,449	Net Present Value =	$8,488,113
Year 1994 Accident	$71,810	Internal Rate of Return =	11.7%
Year 2020 Time	$2,439,541	Benefit/Cost Ratio =	1.70
Year 2020 V.O.C.	$291,509		
Year 2020 Accident	$82,796		
Residual Value	$5,369,000		
Annual Maintenance	$11,200		
Discount Rate	7.00%		

LIFE CYCLE ANALYSIS
(BEFORE DISCOUNTING)

	Costs	TIME	VOC	ACC	Total Benefits	NET
1994		793,055	113,449	71,610		
1995		856,381	120,297	72,040		0
1996		919,707	127,146	72,470		0
1997	9,818,667	983,034	133,994	72,900		(9,818,667)
1998	4,909,333	1,046,360	140,843	73,331	630,267	(4,279,067)
1999	11,200	1,109,687	147,691	73,761	1,331,139	1,319,939
2000	11,200	1,173,013	154,540	74,191	1,401,744	1,390,544
2001	11,200	1,236,340	161,388	74,621	1,472,349	1,461,149
2002	11,200	1,299,666	168,237	75,052	1,542,954	1,531,754
2003	11,200	1,362,992	175,085	75,482	1,613,559	1,602,359
2004	11,200	1,426,319	181,934	75,912	1,684,165	1,672,965
2005	11,200	1,489,645	188,782	76,343	1,754,770	1,743,570
2006	11,200	1,552,972	195,631	76,773	1,825,375	1,814,175
2007	11,200	1,616,298	202,479	77,203	1,895,980	1,884,780
2008	11,200	1,679,624	209,327	77,633	1,966,585	1,955,385
2009	11,200	1,742,951	216,176	78,064	2,037,190	2,025,990
2010	11,200	1,806,277	223,024	78,494	2,107,796	2,096,596
2011	11,200	1,869,604	229,873	78,924	2,178,401	2,167,201
2012	11,200	1,932,930	236,721	79,354	2,249,006	2,237,806
2013	11,200	1,996,256	243,570	79,785	2,319,611	2,308,411
2014	11,200	2,059,583	250,418	80,215	2,390,216	2,379,016
2015	11,200	2,122,909	257,267	80,645	2,460,821	2,449,621
2016	11,200	2,186,236	264,115	81,075	2,531,427	2,520,227
2017	11,200	2,249,562	270,964	81,506	2,602,032	2,590,832
2018	11,200	2,312,889	277,812	81,936	2,672,637	2,661,437
2019	11,200	2,376,215	284,661	82,366	2,743,242	2,732,042
2020	11,200	2,439,541	291,509	82,796	2,813,847	2,802,647
2021	11,200	2,502,868	298,358	83,227	2,884,452	2,873,252
2022	11,200	2,566,194	305,206	83,657	2,955,057	2,943,857
2023	11,200	2,629,521	312,055	84,087	3,025,663	3,014,463
2024	11,200	2,692,847	318,903	84,518	3,096,268	3,085,068
2025	11,200	2,756,173	325,752	84,948	3,166,873	3,155,673
2026	11,200	2,819,500	332,600	85,378	3,237,478	3,226,278
2027	11,200	2,882,826	339,449	85,808	3,308,083	3,296,883
2028	(5,369,000)					5,369,000

WSA - 11/14/95

Sensitivity of Feasibility Results

Uncertainty is inherent in highway project analyses. Estimates of costs, traffic volumes, benefits, and the underlying parameters used to estimate these items are approximate for the present, and the uncertainty increases for the estimation of future values.

Sensitivity analyses provide a method of determining how sensitive the net present value is to changes in the values or assumptions. Net present value was recalculated to assess the sensitivity of the economic justification to several of the inputs. The results of these sensitivity tests are presented in Table 7-11 and Appendix E, and discussed in the following paragraphs.

1. **Assume No Time Value for Tourists and Recreation Trips** - The value of travel time savings accounts for most of the benefits for both interchanges. Tourist and recreation trips account for 25-30 percent of travel time savings and about 15 percent of the value of travel time savings.

   Elimination of travel time value for tourist and recreation trips reduces the feasibility indicators, but each interchange still provides an adequate rate of return (see Table 7-11).

2. **Assume No Time Value for Tourists and Recreation Trips and No Accident Savings** - Proportionally, the interchanges provide a large reduction in the estimated value of accidents at the junction.

   Elimination of the travel time value for tourist/recreation trips, and all accident savings, results in a further decline in the feasibility indicators (Table 7-11), but all remain above the threshold values for economic justification.

3. **Assume No Time Value Except for Work, Business, and Truck Trips** - This eliminates any valuing of travel time savings, except for those trips associated with income-producing activities.

   This assumption reduces the discounted benefits for the Partial Cloverleaf Interchange to a level just above a "break even" against project costs.

   The Diamond Interchange benefits exceed the costs by about 24 percent with this assumption.

FACTORS NOT REFLECTED IN THE ECONOMIC ASSESSMENT

Several factors are not reflected in the quantitative analysis that should be considered in the selection of a preferred project.

1. **Increasing Benefits Over Time with Partial Cloverleaf Interchange** - During the initial years after construction, the two interchanges provide similar levels of net benefits. However, with the higher traffic volumes in future years, the Partial Cloverleaf Interchange provides increasingly higher net benefits over the Diamond Interchange. The difference should continue to widen beyond the 30-year time frame.

The economic analysis, through the annual discount rate, places a value 5 to 7 times higher on benefits during the initial years (when the two interchanges provide similar benefits) than on benefits farther out (when the Partial Cloverleaf Interchange provides increasingly higher benefits). Although this provides an accurate portrayal for an economic analysis, it does not reflect the increasing differential in traffic operations between the two interchanges over a long period of time.

Also, if traffic volumes increase at a faster rate than the present forecasts, the economic attractiveness of the Partial Cloverleaf Interchange would improve relative to the Diamond Interchange, and both interchanges would improve relative to the At-Grade Intersection.

2. **Traffic Signals with Diamond Interchange** - With the forecast Year 2020 volumes, the Diamond Interchange would require traffic signals at the ramp junction on Airport Access Ramp, while the Partial Cloverleaf Interchange would not require signals controls. Although the delay times at the signals are reflected in the economic analysis, there is also a psychological effect on drivers. Many economic studies use an additional weighting or time penalty to reflect the intangible effect upon the driver of adding signal controls. No additional weighting has been used in this study. However, the traffic signal controls would likely have an effect on drivers, especially since the controls would be located at the entrance to an airport and many travellers will be sensitive to a stopped delay.

3 - **Diamond Interchange Westbound On-Ramp** - The westbound on-ramp has been laid out in a standard configuration, which locates the ramp entry to Hana Highway only about 400 feet from the Dairy Road intersection. At this location, traffic exiting the ramp may be blocked by the traffic queue stopped for the Dairy Road traffic signal. When the traffic signal is green, the ramp traffic may experience delays while awaiting the Hana Highway queue to clear the ramp exit. Such delays have not been included in the economic analysis. Redesign of the ramp would lessen the delays, but may not eliminate such delays.

Table 7-11

SUMMARY OF SENSITIVITY TESTS
Year 2020 Traffic Assessment of Kahului Airport Access Road

Scenario	Interchange	Net Present Value	Benefit-Cost Ratio	Internal Rate of Return
Initial Assessment	Partial Cloverleaf Interchange	$6,350,909	1.42	9.9%
	Diamond Interchange	8,458,113	1.70	11.7
1. No Time Value for Tourist and Recreation Trips	Partial Cloverleaf Interchange	3,665,300	1.24	8.7
	Diamond Interchange	6,539,867	1.54	10.7
2. No Time Value for Tourist and Recreation Trips; No Accident Savings	Partial Cloverleaf Interchange	2,349,500	1.16	8.1
	Diamond Interchange	5,729,337	1.47	10.2
3. No Time Value Except Trips Associated with Income Producing Activities	Partial Cloverleaf Interchange	342,633	1.02	7.2
	Diamond Interchange	2,914,630	1.24	8.7

Wilbur Smith Associates; March 1996

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APPENDIX A

CONSTRUCTION UNIT COSTS

Table A-1

KEY UNIT COST FACTORS USED IN COST ESTIMATES
Year 2020 Traffic Assessment of Kahului Airport Access Road

Cost Item	Unit	1995 Unit Cost
Bridge		
▸ Foundation, Support, Deck	Square Feet of Bridge Deck	$ 215.00
Roadway		
▸ Pavement (includes sub-base)	Square Feet	48.00
▸ Concrete Barrier	Linear Feet	172.00
▸ Sidewalk	Square Feet	5.50
▸ Gutter	Linear Feet	20.50
▸ Guard Rail	Linear Feet	34.50
Drainage		
▸ Culverts (24 to 48 inch)	Linear Feet	220.00
▸ Inlets, Outlets	Each	11,500.00
Earthwork		
▸ Clearing & Grubbing	Acre	4,600.00
▸ Excavation	Cubic Yard	35.00
▸ Fill, Borrow	Cubic Yard	17.00
Miscellaneous		
▸ Landscaping	Acre	22,000.00
▸ Traffic Signal	Each	172,000.00
▸ Inertial Barrier	Each	8,000.00
▸ Signing, Striping	Lump Sum	$515,000.00

Wilbur Smith Associates; November 1995

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APPENDIX B

TRAVEL TIME VALUE COMPUTATIONS

TRAVEL TIME VALUE FOR AT-GRADE INTERSECTION - 1994
Kahului Airport EIS 2020 Analysis

	HOURS/YEAR	HOURLY VOLUME	TRAVEL TIME PER VEHICLE	TOTAL VEHICLES	AUTO-WORK	AUTO-TOURIST	AUTO OTHER	TRUCK	[illegible]	TOTAL
					TOTAL TRAVEL TIME (IN HOURS)					
AM PEAK										
1 NB Left	372	30	1.713	318.7	113.1	146.6	45.9	13.1	0.0	
2 NB Through	372	210	1.774	2309.3	819.8	1062.3	332.5	94.7	0.0	
3 NB Right	372	127	1.670	1315.2	466.9	605.0	189.4	53.9	0.0	
4 SB Left	372	95	2.076	1223.0	611.5	560.1	0.0	48.9	2.4	
5 SB Through	372	179	1.664	1868.4	934.2	855.7	0.0	74.7	3.7	
6 SB Right	372	60	1.655	615.5	307.7	281.9	0.0	24.6	1.2	
7 EB Left	372	80	2.134	1058.5	543.0	31.6	394.8	84.7	4.2	
8 EB Through	372	427	1.234	3265.6	1675.3	98.0	1218.1	261.3	13.1	
9 EB Right	372	15	1.211	112.6	57.8	3.4	42.0	9.0	0.5	
10 WB Left	372	690	1.628	6966.1	5224.6	348.3	1219.1	139.3	34.8	
11 WB Through	372	1890	1.199	14050.2	10537.6	702.5	2458.8	281.0	70.3	
12 WB Right	372	110	1.106	754.4	565.8	37.7	132.0	15.1	3.8	
TOTAL HOURS					21857.3	4733.3	6032.6	1100.3	134.0	33857.5
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$360,646	$32,659	$41,625	$23,106	$3,350	$461,387
PM PEAK										
1 NB Left	489	15	1.701	207.9	149.3	34.5	20.8	2.7	0.6	
2 NB Through	489	158	1.554	2001.1	1436.8	332.2	200.1	26.0	6.0	
3 NB Right	489	320	1.870	4876.6	3501.4	809.5	487.7	63.4	14.6	
4 SB Left	489	111	2.387	2159.7	1079.9	989.2	0.0	66.4	4.3	
5 SB Through	489	216	1.569	2762.7	1381.3	1265.3	0.0	110.5	5.5	
6 SB Right	489	76	1.562	967.4	483.7	443.1	0.0	38.7	1.9	
7 EB Left	489	75	1.721	1051.7	578.4	63.1	391.2	15.8	3.2	
8 EB Through	489	1787	1.358	19783.2	10880.7	1187.0	7359.3	296.7	59.3	
9 EB Right	489	50	1.181	473.2	260.3	28.4	176.0	7.1	1.4	
10 WB Left	489	280	2.078	4742.1	1754.6	1839.9	1010.1	71.1	66.4	
11 WB Through	489	691	1.168	6689.6	2475.2	2595.5	1424.9	100.3	93.7	
12 WB Right	489	60	1.162	568.1	210.2	220.4	121.0	8.5	8.0	
TOTAL HOURS					24191.72	9808.15	11191.11	827.32	264.96	46283.3
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$399,163	$67,676	$77,219	$17,374	$6,624	$568,056
OFF-PEAK										
1 NB Left	5504	19	1.671	2913.1	757.4	1340.0	713.7	96.1	5.8	
2 NB Through	5504	120	1.516	16686.6	4338.5	7675.5	4068.2	550.7	33.4	
3 NB Right	5504	181	1.538	25542.5	6641.0	11749.5	6257.9	842.9	51.1	
4 SB Left	5504	68	1.710	10683.8	3551.0	6664.9	0.0	426.6	21.3	
5 SB Through	5504	130	1.518	18099.0	6027.0	11311.9	0.0	724.0	36.2	
6 SB Right	5504	45	1.513	6247.1	2060.3	3904.5	0.0	249.9	12.5	
7 EB Left	5504	51	1.743	8152.2	2282.6	293.5	5217.4	342.4	16.3	
8 EB Through	5504	660	1.265	77790.4	21781.3	2800.5	49785.9	3267.2	155.6	
9 EB Right	5504	19	1.238	2158.1	604.3	77.7	1381.2	90.6	4.3	
10 WB Left	5504	279	1.581	40451.3	13551.2	12094.9	13146.7	1415.8	242.7	
11 WB Through	5504	741	1.189	80845.8	27083.4	24172.9	26274.9	2829.6	485.1	
12 WB Right	5504	56	1.160	5960.8	1996.9	1782.3	1937.3	208.6	35.8	
TOTAL HOURS					90694.85	83868.33	108803.10	11044.34	1100.05	295510.6
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$1,496,465	$578,691	$750,741	$231,931	$27,601	$3,085,330
TOTAL YEAR										
1 NB Left	-	-	-	3439.6	1019.8	1521.1	780.4	111.9	6.4	
2 NB Through	-	-	-	20997.0	6595.1	9070.3	4620.9	671.4	39.4	
3 NB Right	-	-	-	31734.3	10609.3	13164.1	6935.0	960.2	65.7	
4 SB Left	-	-	-	14046.5	5242.4	8214.1	0.0	561.9	28.1	
5 SB Through	-	-	-	22730.0	8342.5	13432.9	0.0	909.2	45.5	
6 SB Right	-	-	-	7830.0	2871.7	4629.4	0.0	313.2	15.7	
7 EB Left	-	-	-	10262.4	3404.0	388.3	6003.5	442.8	23.7	
8 EB Through	-	-	-	100839.2	34337.3	4085.4	58363.3	3825.2	228.0	
9 EB Right	-	-	-	2743.9	922.3	109.5	1599.2	106.7	6.2	
10 WB Left	-	-	-	52159.5	20530.3	14263.2	15375.8	1626.2	343.9	
11 WB Through	-	-	-	101585.6	40096.1	27471.0	30158.6	3211.0	649.0	
12 WB Right	-	-	-	7283.4	2772.9	2040.5	2190.3	232.2	47.5	
TOTAL HOURS					136743.9	98409.7	126026.8	12972.0	1499.0	375651.4
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$2,256,274	$679,027	$869,585	$272,411	$37,476	$4,114,773

TRAVEL TIME VALUE FOR DIAMOND INTERSECTION - 1994
Kahului Airport EIS 2020 Analysis

	HOURS/YEAR	HOURLY VOLUME	TRAVEL TIME PER VEHICLE	TOTAL VEHICLES	AUTO-WORK	AUTO-TOURIST	AUTO OTHER	TRUCK	[illegible]	TOTAL
					TOTAL TRAVEL TIME (IN HOURS)					
AM PEAK										
1 NB Left	372	30	1.947	362.2	128.6	166.6	52.2	14.8	0.0	
2 NB Through	372	210	1.366	1777.9	631.2	817.8	256.0	72.9	0.0	
3 NB Right	372	127	1.424	1121.0	398.0	515.7	161.4	46.0	0.0	
4 SB Left	372	95	2.100	1236.6	618.3	566.4	0.0	49.5	2.5	
5 SB Through	372	179	1.354	1502.5	751.3	688.1	0.0	60.1	3.0	
6 SB Right	372	60	1.312	487.9	244.0	223.5	0.0	19.5	1.0	
7 EB Left	372	80	1.758	872.1	447.4	26.2	325.3	69.8	3.5	
8 EB Through	372	427	0.909	2406.5	1234.5	72.2	897.6	192.5	9.6	
9 EB Right	372	15	1.116	103.8	53.3	3.1	38.7	8.3	0.4	
10 WB Left	372	690	1.366	5843.6	4382.7	292.2	1022.6	116.9	29.2	
11 WB Through	372	1890	0.909	10651.7	7988.7	532.6	1864.0	213.0	53.3	
12 WB Right	372	110	1.079	736.2	552.1	36.8	128.8	14.7	3.7	
TOTAL HOURS					17430.0	3941.2	4746.7	878.0	106.1	27102.1
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$287,595	$27,194	$32,763	$18,438	$2,654	$368,634
PM PEAK										
1 NB Left	489	15	2.021	247.0	177.4	41.0	24.7	3.2	0.7	
2 NB Through	489	158	1.349	1736.9	1247.1	288.3	173.7	22.6	5.2	
3 NB Right	489	320	1.424	3713.0	2666.0	616.4	371.3	48.3	11.1	
4 SB Left	489	111	1.895	1713.9	857.0	785.0	0.0	68.6	3.4	
5 SB Through	489	216	1.251	2201.4	1100.7	1008.3	0.0	88.1	4.4	
6 SB Right	489	76	1.312	812.4	406.2	372.1	0.0	32.5	1.6	
7 EB Left	489	75	1.597	976.0	536.8	58.6	363.1	14.6	2.9	
8 EB Through	489	1787	0.909	13238.7	7281.3	794.3	4924.8	198.6	39.7	
9 EB Right	489	50	1.116	454.9	250.2	27.3	169.2	6.8	1.4	
10 WB Left	489	280	1.446	3299.7	1220.9	1280.3	702.8	49.5	46.2	
11 WB Through	489	691	0.909	5119.2	1894.1	1986.2	1090.4	76.8	71.7	
12 WB Right	489	60	1.079	527.8	195.3	204.8	112.4	7.9	7.4	
TOTAL HOURS					17832.85	7462.62	7932.42	617.42	195.81	34041.0
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$294,242	$51,491	$54,734	$12,966	$4,895	$418,328
OFF-PEAK										
1 NB Left	5504	19	1.956	3408.3	886.2	1567.8	835.0	112.5	6.8	
2 NB Through	5504	120	1.341	14756.5	3836.7	6788.0	3615.3	487.0	29.5	
3 NB Right	5504	181	1.424	23639.0	6146.1	10873.9	5791.5	780.1	47.3	
4 SB Left	5504	68	1.980	12348.3	4112.0	7717.7	0.0	433.9	24.7	
5 SB Through	5504	130	1.292	15409.8	5131.5	9631.1	0.0	615.4	30.8	
6 SB Right	5504	45	1.312	5414.5	1803.0	3384.0	0.0	216.6	10.8	
7 EB Left	5504	51	1.652	7727.1	2163.6	278.2	4945.4	324.5	15.5	
8 EB Through	5504	660	0.909	55034.5	15409.7	1981.2	35222.1	2311.4	110.1	
9 EB Right	5504	19	1.116	1945.5	544.7	70.0	1245.1	81.7	3.9	
10 WB Left	5504	279	1.398	35770.5	11983.1	10695.4	11625.4	1252.0	214.6	
11 WB Through	5504	741	0.909	61788.7	20699.2	18474.8	20081.3	2162.6	370.7	
12 WB Right	5504	56	1.079	5545.2	1857.6	1658.0	1802.2	194.1	33.3	
TOTAL HOURS					74573.40	73120.25	85163.40	9032.78	897.99	242787.8
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$1,230,461	$504,530	$587,627	$189,688	$22,450	$2,534,766
TOTAL YEAR										
1 NB Left	-	-	-	4017.5	1192.1	1775.4	911.9	130.5	7.6	
2 NB Through	-	-	-	18271.3	5715.0	7894.2	4045.1	582.4	34.7	
3 NB Right	-	-	-	28473.1	9210.1	12006.0	6324.3	874.3	58.4	
4 SB Left	-	-	-	15298.9	5587.3	9063.1	0.0	612.0	30.6	
5 SB Through	-	-	-	19113.7	6983.4	11327.5	0.0	764.5	38.2	
6 SB Right	-	-	-	6714.8	2453.2	3979.6	0.0	268.6	13.4	
7 EB Left	-	-	-	9575.2	3147.8	362.9	5633.7	408.9	21.9	
8 EB Through	-	-	-	70679.7	23925.5	2847.8	41044.5	2702.5	159.4	
9 EB Right	-	-	-	2504.2	848.2	100.4	1453.0	96.8	5.7	
10 WB Left	-	-	-	44913.8	17586.7	12267.8	13350.9	1418.3	290.0	
11 WB Through	-	-	-	77559.6	30582.1	20993.7	23035.8	2452.4	495.7	
12 WB Right	-	-	-	6809.2	2605.1	1899.6	2043.4	216.7	44.3	
TOTAL HOURS					109836.3	84523.9	97842.6	10528.2	1199.9	303930.9
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$1,812,298	$583,215	$675,114	$221,092	$29,999	$3,321,718

TRAVEL TIME VALUE FOR PARCLO INTERSECTION - 1994
Kahului Airport EIS 2020 Analysis

	HOURS/YEAR	HOURLY VOLUME	TRAVEL TIME PER VEHICLE	TOTAL TRAVEL TIME (IN HOURS): TOTAL VEHICLES	AUTO-WORK	AUTO-TOURIST	AUTO OTHER	TRUCK	BUS	TOTAL
AM PEAK										
1 NB Left	372	30	1.594	296.4	105.2	136.3	42.7	12.2	0.0	
2 NB Through	372	210	0.909	1183.5	420.1	544.4	170.4	48.5	0.0	
3 NB Right	372	127	1.246	981.3	348.3	451.4	141.3	40.2	0.0	
4 SB Left	372	95	1.578	929.7	464.8	425.8	0.0	37.2	1.9	
5 SB Through	372	179	0.909	1008.8	504.4	462.0	0.0	40.4	2.0	
6 SB Right	372	60	1.230	457.4	228.7	209.5	0.0	18.3	0.9	
7 EB Left	372	80	2.001	992.5	509.2	29.8	370.2	79.4	4.0	
8 EB Through	372	427	0.909	2406.5	1234.5	72.2	897.6	192.5	9.6	
9 EB Right	372	15	0.901	83.7	43.0	2.5	31.2	6.7	0.3	
10 WB Left	372	690	2.061	8817.0	6612.7	440.8	1543.0	176.3	44.1	
11 WB Through	372	1690	0.909	10651.7	7988.7	532.6	1864.0	213.0	53.3	
12 WB Right	372	110	0.875	596.4	447.3	29.8	104.4	11.9	3.0	
TOTAL HOURS					18907.1	3337.2	5164.8	876.7	119.0	28404.8
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$311,967	$23,027	$35,637	$18,410	$2,976	$392,017
PM PEAK										
1 NB Left	489	15	1.597	195.2	140.2	32.4	19.5	2.5	0.6	
2 NB Through	489	158	0.909	1170.5	840.4	194.3	117.1	15.2	3.5	
3 NB Right	489	320	1.246	3250.1	2333.6	539.5	325.0	42.3	9.8	
4 SB Left	489	111	1.575	1424.9	712.4	652.6	0.0	57.0	2.8	
5 SB Through	489	218	0.909	1600.2	800.1	732.9	0.0	64.0	3.2	
6 SB Right	489	78	1.230	761.7	380.8	348.8	0.0	30.5	1.5	
7 EB Left	489	75	2.001	1223.1	672.7	73.4	455.0	18.3	3.7	
8 EB Through	489	1787	0.909	13238.7	7281.3	794.3	4924.8	198.6	39.7	
9 EB Right	489	50	0.901	367.0	201.8	22.0	136.5	5.5	1.1	
10 WB Left	489	280	2.061	4703.2	1740.2	1824.8	1001.8	70.5	65.8	
11 WB Through	489	691	0.909	5119.2	1894.1	1988.2	1090.4	76.8	71.7	
12 WB Right	489	60	0.875	427.6	158.2	165.9	91.1	6.4	6.0	
TOTAL HOURS					17155.86	7367.28	8161.14	587.66	209.41	33481.3
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$283,072	$50,834	$56,312	$12,341	$5,235	$407,794
OFF-PEAK										
1 NB Left	5504	19	1.589	2768.6	719.8	1273.6	678.3	91.4	5.5	
2 NB Through	5504	120	0.909	10006.3	2601.6	4602.9	2451.5	330.2	20.0	
3 NB Right	5504	181	1.246	20691.6	5379.8	9518.1	5069.4	682.8	41.4	
4 SB Left	5504	68	1.570	9793.7	3261.3	6121.0	0.0	391.7	19.6	
5 SB Through	5504	130	0.909	10840.1	3609.6	6775.1	0.0	433.6	21.7	
6 SB Right	5504	45	1.230	5076.2	1690.4	3172.6	0.0	203.0	10.2	
7 EB Left	5504	51	2.001	9361.5	2621.2	337.0	5991.3	393.2	18.7	
8 EB Through	5504	660	0.909	55034.5	15409.7	1981.2	35222.1	2311.4	110.1	
9 EB Right	5504	19	0.901	1569.5	439.5	56.5	1004.5	65.9	3.1	
10 WB Left	5504	279	2.061	52748.4	17670.7	15771.8	17143.2	1846.2	316.5	
11 WB Through	5504	741	0.909	61788.7	20699.2	18474.8	20081.3	2162.6	370.7	
12 WB Right	5504	58	0.875	4492.4	1504.9	1343.2	1460.0	157.2	27.0	
TOTAL HOURS					75607.93	69427.81	89101.78	9069.38	964.46	244171.4
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$1,247,531	$479,053	$614,802	$190,457	$24,112	$2,555,954
TOTAL YEAR										
1 NB Left	-	-	-	3260.3	965.2	1442.3	740.5	106.1	6.1	
2 NB Through	-	-	-	12360.3	3862.2	5341.6	2739.0	393.9	23.5	
3 NB Right	-	-	-	24922.9	8061.7	10509.0	5535.7	765.3	51.1	
4 SB Left	-	-	-	12148.2	4438.5	7199.4	0.0	485.9	24.3	
5 SB Through	-	-	-	13449.1	4914.3	7970.0	0.0	538.0	26.9	
6 SB Right	-	-	-	6295.3	2299.9	3731.0	0.0	251.8	12.6	
7 EB Left	-	-	-	11577.1	3803.1	440.2	6816.5	490.9	26.4	
8 EB Through	-	-	-	70679.7	23925.5	2847.8	41044.5	2702.5	159.4	
9 EB Right	-	-	-	2020.2	684.2	81.0	1172.2	78.1	4.6	
10 WB Left	-	-	-	66268.6	26023.0	18037.5	19688.0	2093.1	426.4	
11 WB Through	-	-	-	77559.6	30582.1	20993.7	23035.8	2452.4	495.7	
12 WB Right	-	-	-	5516.4	2110.5	1539.0	1655.5	175.6	35.9	
TOTAL HOURS					111670.9	80132.4	102427.8	10533.7	1292.9	306057.7
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$1,842,569	$552,913	$706,752	$221,208	$32,323	$3,355,765

TRAVEL TIME VALUE FOR AT-GRADE INTERSECTION - 2020
Kahului Airport EIS 2020 Analysis

	HOURS/YEAR	HOURLY VOLUME	TRAVEL TIME PER VEHICLE	TOTAL TRAVEL TIME (IN HOURS): TOTAL VEHICLES	AUTO-WORK	AUTO-TOURIST	AUTO OTHER	TRUCK	BUS	TOTAL
AM PEAK										
1 NB Left	372	80	2.029	1006.3	357.2	462.9	144.9	41.3	0.0	
2 NB Through	372	422	2.932	7671.8	2723.5	3529.0	1104.7	314.5	0.0	
3 NB Right	372	317	1.827	3591.2	1274.9	1651.9	517.1	147.2	0.0	
4 SB Left	372	190	3.629	4274.8	2137.4	1957.9	0.0	171.0	8.5	
5 SB Through	372	339	2.092	4397.4	2198.7	2014.0	0.0	175.9	8.8	
6 SB Right	372	117	1.841	1335.1	667.6	611.5	0.0	53.4	2.7	
7 EB Left	372	159	3.748	3692.3	1894.2	110.8	1377.2	295.4	14.8	
8 EB Through	372	860	1.426	7600.9	3899.3	228.0	2835.1	608.1	30.4	
9 EB Right	372	105	1.337	870.5	446.6	26.1	324.7	69.6	3.5	
10 WB Left	372	985	2.922	17845.8	13384.4	892.3	3123.0	356.9	89.2	
11 WB Through	372	2482	2.218	34093.4	25570.0	1704.7	5966.3	681.9	170.5	
12 WB Right	372	228	1.182	1671.1	1253.4	83.6	292.5	33.4	8.4	
TOTAL HOURS					55807.0	13272.6	15685.7	2948.6	336.7	88050.6
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$920,815	$91,581	$108,231	$61,921	$8,418	$1,190,966
PM PEAK										
1 NB Left	489	173	2.264	3191.9	2291.8	529.9	319.2	41.5	9.6	
2 NB Through	489	350	2.024	5773.1	4145.1	958.3	577.3	75.0	17.3	
3 NB Right	489	670	2.051	11196.9	8039.4	1858.7	1119.7	145.6	33.6	
4 SB Left	489	246	4.122	8264.6	4132.3	3785.2	0.0	330.6	16.5	
5 SB Through	489	480	3.421	13381.1	6690.5	6128.5	0.0	535.2	26.8	
6 SB Right	489	169	1.857	2558.0	1279.0	1171.6	0.0	102.3	5.1	
7 EB Left	489	162	2.492	3290.4	1809.7	197.4	1224.0	49.4	9.9	
8 EB Through	489	2357	2.854	54821.3	30151.7	3289.3	20393.5	822.3	164.5	
9 EB Right	489	74	1.227	740.1	407.1	44.4	275.3	11.1	2.2	
10 WB Left	489	397	3.936	12733.6	4711.4	4940.6	2712.3	191.0	178.3	
11 WB Through	489	844	1.264	8831.1	3267.5	3426.5	1881.0	132.5	123.6	
12 WB Right	489	134	1.264	1380.3	510.7	535.5	294.0	20.7	19.3	
TOTAL HOURS					67436.22	26865.92	28796.36	2457.20	606.68	126162.4
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$1,112,698	$185,376	$198,695	$51,601	$15,167	$1,563,536
OFF-PEAK										
1 NB Left	5504	103	1.693	15999.7	4159.9	7359.9	3919.9	528.0	32.0	
2 NB Through	5504	253	1.477	34283.4	8913.7	15770.4	8399.4	1131.4	68.6	
3 NB Right	5504	399	1.553	56849.3	14780.8	26150.7	13928.1	1876.0	113.7	
4 SB Left	5504	144	1.802	23799.6	7925.3	14874.6	0.0	952.0	47.6	
5 SB Through	5504	269	1.480	36517.3	12160.3	22823.3	0.0	1460.7	73.0	
6 SB Right	5504	94	1.472	12691.7	4226.3	7932.3	0.0	507.7	25.4	
7 EB Left	5504	105	1.871	18016.9	5044.7	648.6	11530.8	756.7	36.0	
8 EB Through	5504	959	1.384	121741.0	34087.5	4382.7	77914.3	5113.1	243.5	
9 EB Right	5504	54	1.284	6359.7	1780.7	228.9	4070.2	267.1	12.7	
10 WB Left	5504	397	1.682	61244.0	20516.7	18312.0	19904.3	2143.5	367.5	
11 WB Through	5504	955	1.289	112940.0	37834.9	33769.0	36705.5	3952.9	677.6	
12 WB Right	5504	119	1.230	13429.1	4498.7	4015.3	4364.5	470.0	80.6	
TOTAL HOURS					155929.64	156267.83	180736.99	19159.12	1778.20	513871.8
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$2,572,839	$1,078,248	$1,247,085	$402,341	$44,455	$5,344,969
TOTAL YEAR										
1 NB Left	-	-	-	20198.0	6809.0	8352.6	4384.0	610.7	41.6	
2 NB Through	-	-	-	47728.3	15782.2	20257.7	10081.5	1520.9	85.9	
3 NB Right	-	-	-	71637.3	24095.0	29661.3	15564.9	2168.8	147.3	
4 SB Left	-	-	-	36339.0	14195.0	20617.8	0.0	1453.6	72.7	
5 SB Through	-	-	-	54295.8	21049.5	30965.9	0.0	2171.8	108.6	
6 SB Right	-	-	-	16584.8	6172.9	9715.4	0.0	663.4	33.2	
7 EB Left	-	-	-	24999.7	8748.6	956.8	14132.1	1101.5	60.7	
8 EB Through	-	-	-	184163.3	68138.5	7900.0	101142.9	6543.5	438.3	
9 EB Right	-	-	-	7970.3	2634.4	299.5	4670.2	347.9	18.4	
10 WB Left	-	-	-	91823.4	38612.5	24144.9	25739.6	2691.5	635.0	
11 WB Through	-	-	-	155864.5	66672.4	38900.2	44552.9	4767.2	971.7	
12 WB Right	-	-	-	16490.5	6262.8	4634.4	4950.9	524.1	108.3	
TOTAL HOURS					279172.8	196406.4	225219.0	24565.0	2721.6	728084.8
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$4,606,352	$1,355,204	$1,554,011	$515,864	$68,040	$8,099,471

TRAVEL TIME VALUE FOR DIAMOND INTERSECTION - 2020
Kahului Airport EIS 2020 Analysis

	HOURS/ YEAR	HOURLY VOLUME	TRAVEL TIME PER VEHICLE	TOTAL VEHICLES	TOTAL TRAVEL TIME (IN HOURS) AUTO WORK	AUTO TOURIST	AUTO OTHER	TRUCK	SEMI	TOTAL
AM PEAK										
1 NB Left	372	80	2.079	1031.1	366.0	474.3	148.5	42.3	0.0	
2 NB Through	372	422	1.392	3642.5	1293.1	1675.6	524.5	149.3	0.0	
3 NB Right	372	317	1.424	2798.2	993.3	1287.2	402.9	114.7	0.0	
4 SB Left	372	190	2.118	2494.9	1247.4	1142.7	0.0	99.8	5.0	
5 SB Through	372	339	1.392	2926.1	1463.1	1340.2	0.0	117.0	5.9	
6 SB Right	372	117	1.312	951.5	475.7	435.6	0.0	38.1	1.9	
7 EB Left	372	159	1.742	1716.9	880.8	51.5	640.4	137.4	6.9	
8 EB Through	372	860	0.909	4846.8	2486.4	145.4	1807.9	387.7	19.4	
9 EB Right	372	105	1.116	726.7	372.8	21.8	271.0	58.1	2.9	
10 WB Left	372	985	1.434	8759.3	6569.5	438.0	1532.9	175.2	43.8	
11 WB Through	372	2482	0.909	13988.1	10491.0	699.4	2447.9	279.8	69.9	
12 WB Right	372	228	1.079	1525.9	1144.4	76.3	267.0	30.5	7.6	
TOTAL HOURS					27783.6	7788.0	8043.1	1629.9	163.3	45407.9
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$458,429	$53,737	$55,497	$34,228	$4,082	$605,974
PM PEAK										
1 NB Left	489	173	1.987	2801.8	2011.7	465.1	280.2	36.4	8.4	
2 NB Through	489	350	1.321	3766.8	2704.6	625.3	376.7	49.0	11.3	
3 NB Right	489	670	1.424	7774.2	5581.9	1290.5	777.4	101.1	23.3	
4 SB Left	489	246	1.943	3895.3	1947.7	1784.1	0.0	155.8	7.8	
5 SB Through	489	460	1.286	5029.0	2514.5	2303.3	0.0	201.2	10.1	
6 SB Right	489	169	1.312	1806.6	903.3	827.4	0.0	72.3	3.6	
7 EB Left	489	162	1.560	2059.7	1132.8	123.6	766.2	30.9	6.2	
8 EB Through	489	2357	0.909	17461.5	9603.8	1047.7	6495.7	261.9	52.4	
9 EB Right	489	74	1.116	673.2	370.3	40.4	250.4	10.1	2.0	
10 WB Left	489	397	1.553	5023.6	1858.7	1949.2	1070.0	75.4	70.3	
11 WB Through	489	844	0.909	6252.6	2313.5	2428.0	1331.8	93.8	87.5	
12 WB Right	489	134	1.079	1178.9	436.2	457.4	251.1	17.7	16.5	
TOTAL HOURS					31378.85	13339.90	11599.51	1105.43	299.44	57723.1
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$517,751	$92,045	$80,037	$23,214	$7,486	$720,533
OFF-PEAK										
1 NB Left	5504	103	1.954	18460.9	4799.8	8492.0	4522.9	609.2	36.9	
2 NB Through	5504	253	1.334	30956.9	8048.8	14240.2	7584.4	1021.6	61.9	
3 NB Right	5504	399	1.424	52110.2	13548.7	23970.7	12767.0	1719.6	104.2	
4 SB Left	5504	144	1.960	25885.2	8619.8	16178.2	0.0	1035.4	51.8	
5 SB Through	5504	269	1.304	32174.3	10714.1	20109.0	0.0	1287.0	64.3	
6 SB Right	5504	94	1.312	11310.2	3766.3	7068.9	0.0	452.4	22.6	
7 EB Left	5504	105	1.583	15250.6	4270.2	549.0	9760.4	640.5	30.5	
8 EB Through	5504	959	0.909	79966.8	22390.7	2878.8	51178.7	3358.6	159.9	
9 EB Right	5504	54	1.116	5529.3	1548.2	199.1	3538.7	232.2	11.1	
10 WB Left	5504	397	1.479	53873.3	18047.6	16108.1	17508.8	1885.6	323.2	
11 WB Through	5504	955	0.909	79633.2	26677.1	23810.3	25880.8	2787.2	477.8	
12 WB Right	5504	119	1.079	11783.5	3947.5	3523.3	3829.6	412.4	70.7	
TOTAL HOURS					126378.52	137127.63	136571.50	15441.72	1416.03	415934.4
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$2,085,247	$946,180	$942,343	$324,276	$35,376	$4,333,423
TOTAL YEAR										
1 NB Left	-	-	-	22293.8	7177.6	9431.4	4951.6	687.9	45.3	
2 NB Through	-	-	-	38368.2	12046.4	16541.0	8485.6	1219.9	73.2	
3 NB Right	-	-	-	62682.6	20123.9	26548.4	13947.4	1935.4	127.5	
4 SB Left	-	-	-	32275.4	11814.9	19104.9	0.0	1291.0	64.6	
5 SB Through	-	-	-	40129.4	14091.6	23752.4	0.0	1605.2	80.3	
6 SB Right	-	-	-	14068.3	5145.3	8332.1	0.0	562.7	28.1	
7 EB Left	-	-	-	19027.2	6283.8	724.1	11167.0	808.8	43.5	
8 EB Through	-	-	-	102275.1	34450.9	4071.9	59482.3	4008.3	231.7	
9 EB Right	-	-	-	6929.1	2291.2	261.2	4060.2	300.5	16.0	
10 WB Left	-	-	-	67656.2	26475.8	18495.3	20111.7	2136.1	437.4	
11 WB Through	-	-	-	99874.0	39481.7	26935.8	29660.5	3160.7	635.3	
12 WB Right	-	-	-	14488.2	5528.1	4057.0	4347.8	460.6	94.8	
TOTAL HOURS					185541.1	158255.4	156214.1	18177.1	1877.7	520065.4
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$3,061,428	$1,091,962	$1,077,877	$381,719	$46,944	$5,659,930

TRAVEL TIME VALUE FOR PARCLO INTERSECTION - 2020
Kahului Airport EIS 2020 Analysis

	HOURS/ YEAR	HOURLY VOLUME	TRAVEL TIME PER VEHICLE	TOTAL VEHICLES	TOTAL TRAVEL TIME (IN HOURS) AUTO WORK	AUTO TOURIST	AUTO OTHER	TRUCK	SEMI	TOTAL
AM PEAK										
1 NB Left	372	80	1.619	802.8	285.0	369.3	115.6	32.9	0.0	
2 NB Through	372	422	0.909	2378.3	844.3	1094.0	342.5	97.5	0.0	
3 NB Right	372	317	1.246	2449.3	869.5	1126.7	352.7	100.4	0.0	
4 SB Left	372	190	1.612	1898.6	949.3	869.6	0.0	75.9	3.8	
5 SB Through	372	339	0.909	1910.5	955.3	875.0	0.0	76.4	3.8	
6 SB Right	372	117	1.230	892.0	446.0	408.5	0.0	35.7	1.8	
7 EB Left	372	159	2.001	1972.6	1011.9	59.2	735.8	157.8	7.9	
8 EB Through	372	860	0.909	4846.8	2486.4	145.4	1807.9	387.7	19.4	
9 EB Right	372	105	0.901	586.2	300.7	17.6	218.7	46.9	2.3	
10 WB Left	372	985	2.061	12586.5	9439.9	629.3	2202.6	251.7	62.9	
11 WB Through	372	2482	0.909	13988.1	10491.0	699.4	2447.9	279.8	69.9	
12 WB Right	372	228	0.875	1236.2	927.1	61.8	216.3	24.7	6.2	
TOTAL HOURS					29006.5	6355.8	8439.9	1567.6	178.1	45547.9
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$478,607	$43,855	$58,236	$32,919	$4,452	$618,069
PM PEAK										
1 NB Left	489	173	1.664	2345.5	1684.0	389.3	234.5	30.5	7.0	
2 NB Through	489	350	0.909	2592.9	1661.7	430.4	259.3	33.7	7.8	
3 NB Right	489	670	1.246	6804.9	4885.9	1129.6	680.5	88.5	20.4	
4 SB Left	489	246	1.625	3258.0	1629.0	1492.2	0.0	130.3	6.5	
5 SB Through	489	480	0.909	3556.0	1778.0	1628.7	0.0	142.2	7.1	
6 SB Right	489	169	1.230	1693.7	846.9	775.7	0.0	67.7	3.4	
7 EB Left	489	162	2.001	2641.9	1453.1	158.5	982.8	39.6	7.9	
8 EB Through	489	2357	0.909	17461.5	9603.8	1047.7	6495.7	261.9	52.4	
9 EB Right	489	74	0.901	543.1	298.7	32.6	202.0	8.1	1.6	
10 WB Left	489	397	2.061	6668.5	2467.3	2587.4	1420.4	100.0	93.4	
11 WB Through	489	844	0.909	6252.6	2313.5	2426.0	1331.8	93.8	87.5	
12 WB Right	489	134	0.875	955.0	353.4	370.6	203.4	14.3	13.4	
TOTAL HOURS					29175.28	12468.67	11810.44	1010.81	308.45	54773.7
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$481,392	$86,034	$81,492	$21,227	$7,711	$677,856
OFF-PEAK										
1 NB Left	5504	103	1.610	15213.7	3955.6	6998.3	3727.4	502.1	30.4	
2 NB Through	5504	253	0.909	21096.6	5485.1	9704.4	5168.7	696.2	42.2	
3 NB Right	5504	399	1.246	45612.9	11859.4	20981.9	11175.2	1505.2	91.2	
4 SB Left	5504	144	1.590	21003.7	6994.2	13127.3	0.0	840.1	42.0	
5 SB Through	5504	269	0.909	22430.7	7469.4	14019.2	0.0	897.2	44.9	
6 SB Right	5504	94	1.230	10603.6	3531.0	6627.3	0.0	424.1	21.2	
7 EB Left	5504	105	2.001	19273.6	5396.6	693.9	12335.1	809.5	38.5	
8 EB Through	5504	959	0.909	79966.8	22390.7	2878.6	51178.7	3358.6	159.9	
9 EB Right	5504	54	0.901	4460.7	1249.0	160.6	2854.9	187.4	6.9	
10 WB Left	5504	397	2.061	75057.8	25144.4	22442.3	24393.8	2627.0	450.3	
11 WB Through	5504	955	0.909	79633.2	26677.1	23810.3	25880.8	2787.2	477.8	
12 WB Right	5504	119	0.875	9546.3	3198.0	2854.3	3102.5	334.1	57.3	
TOTAL HOURS					123350.51	124298.64	139817.03	14968.74	1464.76	403899.7
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$2,035,283	$857,661	$964,738	$314,344	$36,619	$4,208,644
TOTAL YEAR										
1 NB Left	-	-	-	18361.9	5924.6	7756.9	4077.5	565.5	37.5	
2 NB Through	-	-	-	26067.8	8191.1	11228.9	5770.4	827.4	50.0	
3 NB Right	-	-	-	54867.1	17614.8	23238.2	12208.3	1694.1	111.6	
4 SB Left	-	-	-	26160.3	9572.5	15489.0	0.0	1046.4	52.3	
5 SB Through	-	-	-	27897.3	10202.7	16522.9	0.0	1115.9	55.8	
6 SB Right	-	-	-	13189.4	4823.9	7811.5	0.0	527.6	26.4	
7 EB Left	-	-	-	23888.1	7861.6	911.5	14053.7	1006.9	54.4	
8 EB Through	-	-	-	102275.1	34480.9	4071.9	59482.3	4008.3	231.7	
9 EB Right	-	-	-	5590.0	1848.4	210.8	3275.6	247.4	12.9	
10 WB Left	-	-	-	94312.8	37051.6	25659.0	28016.8	2978.8	606.6	
11 WB Through	-	-	-	99874.0	39481.7	26935.8	29660.5	3160.7	635.3	
12 WB Right	-	-	-	11737.5	4478.5	3295.7	3522.3	373.2	76.8	
TOTAL HOURS					181532.3	143123.1	160067.4	17547.1	1951.3	504221.2
COST PER HOUR					$16.50	$6.90	$6.90	$21.00	$25.00	-
TOTAL TIME COST					$2,995,283	$987,549	$1,104,465	$368,489	$48,782	$5,504,569

CONSTANT SPEED UNIT OPERATING COSTS
Kahului Airport EIS 2020 Analysis

	CONSTANT SPEED COST PER 1000 VEHICLES								
	AT-GRADE			DIAMOND			PARCLO		
	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS
1 NB Left	74.24	253.61	213.62	89.96	314.93	253.98	115.79	419.03	345.49
2 NB Through	77.57	281.18	244.82	76.96	268.94	226.95	77.87	267.25	219.98
3 NB Right	74.24	253.61	213.62	81.57	293.25	238.26	73.40	255.68	212.48
4 SB Left	68.48	198.77	152.41	87.78	298.75	237.61	106.33	374.54	306.57
5 SB Through	66.05	171.50	122.41	66.96	211.49	159.38	66.36	207.86	146.77
6 SB Right	68.48	198.77	152.41	69.99	215.42	156.63	68.87	205.94	153.99
7 EB Left	74.24	253.61	213.62	80.40	273.18	233.33	120.37	393.32	310.72
8 EB Through	70.90	226.04	182.41	70.30	224.22	183.01	70.30	224.22	183.01
9 EB Right	68.48	198.77	152.41	57.17	150.25	82.39	61.69	203.66	172.61
10 WB Left	68.48	198.77	152.41	79.17	253.67	210.37	119.69	398.23	315.53
11 WB Through	70.90	226.04	182.41	70.30	224.22	183.01	70.30	224.22	183.01
12 WB Right	74.24	253.61	213.62	72.26	227.32	239.12	60.92	200.63	172.32

SPEED CHANGE UNIT OPERATING COSTS
Kahului Airport EIS 2020 Analysis

1994

	SPEED CHANGE COST PER 1000 VEHICLES								
	AT-GRADE			DIAMOND			PARCLO		
	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS
1 NB Left	13.55	104.03	122.23	20.18	154.52	181.81	17.20	134.00	155.00
2 NB Through	12.88	98.44	115.92	17.08	130.54	153.72	0.00	0.00	0.00
3 NB Right	13.78	105.76	124.32	7.60	64.60	72.20	8.70	72.50	77.90
4 SB Left	13.55	104.03	122.23	24.11	185.39	217.65	17.20	134.00	155.00
5 SB Through	12.88	98.44	115.92	15.26	116.63	137.34	0.00	0.00	0.00
6 SB Right	13.78	105.76	124.32	7.60	64.60	72.20	8.70	72.50	77.90
7 EB Left	13.62	104.46	122.77	29.33	229.44	264.54	10.90	91.30	99.90
8 EB Through	7.14	54.57	64.26	0.00	0.00	0.00	0.00	0.00	0.00
9 EB Right	12.68	99.41	115.71	8.70	72.50	77.90	6.20	49.50	52.20
10 WB Left	12.53	97.25	113.63	18.28	146.39	165.79	10.90	91.30	99.90
11 WB Through	4.76	36.38	42.84	0.00	0.00	0.00	0.00	0.00	0.00
12 WB Right	12.22	96.77	112.14	8.70	72.50	77.90	6.20	49.50	52.20

2020

	SPEED CHANGE COST PER 1000 VEHICLES								
	AT-GRADE			DIAMOND			PARCLO		
	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS
1 NB Left	13.36	102.76	120.62	20.97	160.74	189.01	17.20	134.00	155.00
2 NB Through	12.46	95.23	112.14	17.08	130.54	153.72	0.00	0.00	0.00
3 NB Right	13.70	105.30	123.69	7.60	64.60	72.20	8.70	72.50	77.90
4 SB Left	13.36	102.76	120.62	23.30	179.42	210.46	17.20	134.00	155.00
5 SB Through	12.46	95.23	112.14	13.44	102.72	120.96	0.00	0.00	0.00
6 SB Right	13.70	105.30	123.69	7.60	64.60	72.20	8.70	72.50	77.90
7 EB Left	13.42	103.18	121.16	27.87	218.35	251.48	10.90	91.30	99.90
8 EB Through	7.56	57.78	68.04	0.00	0.00	0.00	0.00	0.00	0.00
9 EB Right	12.76	99.87	116.34	8.70	72.50	77.90	6.20	49.50	52.20
10 WB Left	12.46	96.82	113.09	17.11	136.89	155.14	10.90	91.30	99.90
11 WB Through	5.46	41.73	49.14	0.00	0.00	0.00	0.00	0.00	0.00
12 WB Right	12.35	97.55	113.19	8.70	72.50	77.90	6.20	49.50	52.20

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CONSTANT SPEED OPERATING COSTS PER VEHICLE – AT GRADE INTERSECTION

AUTOS

	APPROACH				RAMP				DEPARTURE				COST/1000 VEHICLES
	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	
NBL	0.303	35	1	128	-	-	-	-	0.303	35	0	117	74 235
NBT	0.303	35	1	128	-	-	-	-	0.303	35	1	128	77 568
NBR	0.303	35	1	128	-	-	-	-	0.303	35	0	117	74 235
SBL	0.303	35	-1	109	-	-	-	-	0.303	35	0	117	68 478
SBT	0.303	35	-1	109	-	-	-	-	0.303	35	-1	109	66 054
SBR	0.303	35	-1	109	-	-	-	-	0.303	35	0	117	68 478
EBL	0.303	35	0	117	-	-	-	-	0.303	35	1	128	74 235
EBT	0.303	35	0	117	-	-	-	-	0.303	35	0	117	70 902
EBR	0.303	35	0	117	-	-	-	-	0.303	35	-1	109	68 478
WBL	0.303	35	0	117	-	-	-	-	0.303	35	-1	109	68 478
WBT	0.303	35	0	117	-	-	-	-	0.303	35	0	117	70 902
WBR	0.303	35	0	117	-	-	-	-	0.303	35	1	128	74 235

SMALL TRUCKS

	APPROACH				RAMP				DEPARTURE				COST/1000 VEHICLES
	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	
NBL	0.303	35	1	464	-	-	-	-	0.303	35	0	373	253 611
NBT	0.303	35	1	464	-	-	-	-	0.303	35	1	464	281 184
NBR	0.303	35	1	464	-	-	-	-	0.303	35	0	373	253 611
SBL	0.303	35	-1	283	-	-	-	-	0.303	35	0	373	198 768
SBT	0.303	35	-1	283	-	-	-	-	0.303	35	-1	283	171 498
SBR	0.303	35	-1	283	-	-	-	-	0.303	35	0	373	198 768
EBL	0.303	35	0	373	-	-	-	-	0.303	35	1	464	253 611
EBT	0.303	35	0	373	-	-	-	-	0.303	35	0	373	226 038
EBR	0.303	35	0	373	-	-	-	-	0.303	35	-1	283	198 768
WBL	0.303	35	0	373	-	-	-	-	0.303	35	-1	283	198 768
WBT	0.303	35	0	373	-	-	-	-	0.303	35	0	373	226 038
WBR	0.303	35	0	373	-	-	-	-	0.303	35	1	464	253 611

SEMIS

	APPROACH				RAMP				DEPARTURE				COST/1000 VEHICLES
	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	
NBL	0.303	35	1	404	-	-	-	-	0.303	35	0	301	213 615
NBT	0.303	35	1	404	-	-	-	-	0.303	35	1	404	244 824
NBR	0.303	35	1	404	-	-	-	-	0.303	35	0	301	213 615
SBL	0.303	35	-1	202	-	-	-	-	0.303	35	0	301	152 409
SBT	0.303	35	-1	202	-	-	-	-	0.303	35	-1	202	122 412
SBR	0.303	35	-1	202	-	-	-	-	0.303	35	0	301	152 409
EBL	0.303	35	0	301	-	-	-	-	0.303	35	1	404	213 615
EBT	0.303	35	0	301	-	-	-	-	0.303	35	0	301	182 406
EBR	0.303	35	0	301	-	-	-	-	0.303	35	-1	202	152 409
WBL	0.303	35	0	301	-	-	-	-	0.303	35	-1	202	152 409
WBT	0.303	35	0	301	-	-	-	-	0.303	35	0	301	182 406
WBR	0.303	35	0	301	-	-	-	-	0.303	35	1	404	213 615

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CONSTANT SPEED OPERATING COSTS PER VEHICLE – DIAMOND INTERCHANGE

AUTOS

	APPROACH				RAMP				DEPARTURE				
	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	COST/[illegible] VEHICLES
NBL	0.350	35	3.0	145	0.265	20	-3.4	123	0.057	40	0.0	116	89.957
NBT	0.303	35	3.0	145	-	-	-	-	0.303	35	-1.0	109	76.962
NBR	0.246	35	3.0	145	0.298	20	-0.3	126	0.072	40	0.0	116	81.57
SBL	0.341	35	1.0	128	0.284	20	-0.3	126	0.072	40	0.0	116	87.784
SBT	0.303	35	1.0	128	-	-	-	-	0.303	35	-3.0	93	66.963
SBR	0.227	35	1.0	128	0.279	20	-3.4	123	0.057	40	0.0	116	69.985
EBL	0.047	40	0.0	116	0.246	25	4.0	158	0.331	35	-1.0	109	80.399
EBT	0.303	40	0.0	116	-	-	-	-	0.303	40	0.0	116	70.296
EBR	0.047	40	0.0	116	0.267	25	-3.0	108	0.246	35	-3.0	93	57.166
WBL	0.049	40	0.0	116	0.242	25	2.0	146	0.350	35	-1.0	109	79.166
WBT	0.303	40	0.0	116	-	-	-	-	0.303	40	0.0	116	70.296
WBR	0.049	40	0.0	116	0.257	25	2.0	146	0.227	35	1.0	128	72.262

SMALL TRUCKS

	APPROACH				RAMP				DEPARTURE				
	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	COST/[illegible] VEHICLES
NBL	0.350	35	3.0	598	0.265	20	-3.4	319	0.057	40	0.0	370	314.925
NBT	0.303	35	3.0	598	-	-	-	-	0.303	35	-1.0	283	266.943
NBR	0.246	35	3.0	598	0.298	20	-0.3	401	0.072	40	0.0	370	293.246
SBL	0.341	35	1.0	464	0.284	20	-0.3	401	0.072	40	0.0	370	298.748
SBT	0.303	35	1.0	464	-	-	-	-	0.303	35	-3.0	234	211.494
SBR	0.227	35	1.0	464	0.279	20	-3.4	319	0.057	40	0.0	370	215.419
EBL	0.047	40	0.0	370	0.246	25	4.0	659	0.331	35	-1.0	283	273.177
EBT	0.303	40	0.0	370	-	-	-	-	0.303	40	0.0	370	224.22
EBR	0.047	40	0.0	370	0.267	25	-3.0	282	0.246	35	-3.0	234	150.248
WBL	0.049	40	0.0	370	0.242	25	2.0	564	0.350	35	-1.0	283	253.668
WBT	0.303	40	0.0	370	-	-	-	-	0.303	40	0.0	370	224.22
WBR	0.049	40	0.0	370	0.257	25	2.0	564	0.227	35	1.0	283	227.319

SEMIS

	APPROACH				RAMP				DEPARTURE				
	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	COST/[illegible] VEHICLES
NBL	0.350	35	3.0	547	0.265	20	-3.4	171	0.057	40	0.0	302	253.979
NBT	0.303	35	3.0	547	-	-	-	-	0.303	35	-1.0	202	226.947
NBR	0.246	35	3.0	547	0.298	20	-0.3	275	0.072	40	0.0	302	238.256
SBL	0.341	35	1.0	404	0.284	20	-0.3	275	0.072	40	0.0	302	237.608
SBT	0.303	35	1.0	404	-	-	-	-	0.303	35	-3.0	122	159.378
SBR	0.227	35	1.0	404	0.279	20	-3.4	171	0.057	40	0.0	302	156.631
EBL	0.047	40	0.0	302	0.246	25	4.0	619	0.331	35	-1.0	202	233.33
EBT	0.303	40	0.0	302	-	-	-	-	0.303	40	0.0	302	183.012
EBR	0.047	40	0.0	302	0.267	25	-3.0	143	0.246	35	-3.0	122	82.387
WBL	0.049	40	0.0	302	0.242	25	2.0	516	0.350	35	-1.0	202	210.37
WBT	0.303	40	0.0	302	-	-	-	-	0.303	40	0.0	302	183.012
WBR	0.049	40	0.0	302	0.257	25	2.0	516	0.227	35	1.0	404	239.118

CONSTANT SPEED OPERATING COSTS PER VEHICLE – PARCLO INTERCHANGE

AUTOS

	APPROACH				RAMP				DEPARTURE				
	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	COST/[illegible] VEHICLES
NBL	0.43	40	3	147	0.25	25	-0.7	118	0.199	40	0	116	115.754
NBT	0.303	40	3	147	-	-	-	-	0.303	40	-1	110	77.871
NBR	0.025	40	3	147	0.443	25	0.6	132	0.097	40	0	116	73.403
SBL	0.42	40	1	128	0.313	25	0.6	132	0.097	40	0	116	106.328
SBT	0.303	40	1	128	-	-	-	-	0.303	40	-3	91	66.357
SBR	-	-	-	-	0.388	25	-0.7	118	0.199	40	0	116	68.668
EBL	0.345	40	0	116	0.36	20	1	141	0.269	40	-1	110	120.37
EBT	0.303	40	0	116	-	-	-	-	0.303	40	0	116	70.296
EBR	0.199	40	0	116	0.241	30	0.9	130	0.08	40	-3	91	61.094
WBL	0.347	40	0	116	0.379	20	1.4	145	0.269	40	-3	91	119.685
WBT	0.303	40	0	116	-	-	-	-	0.303	40	0	116	70.296
WBR	0.189	40	0	116	0.245	30	0.8	129	0.066	40	-1	110	60.918

SMALL TRUCKS

	APPROACH				RAMP				DEPARTURE				
	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	COST/[illegible] VEHICLES
NBL	0.43	40	3	605	0.25	25	-0.7	341	0.199	40	0	370	419.03
NBT	0.303	40	3	605	-	-	-	-	0.303	40	-1	277	267.745
NBR	0.025	40	3	605	0.443	25	0.6	462	0.097	40	0	370	255.681
SBL	0.42	40	1	462	0.313	25	0.6	462	0.097	40	0	370	374.536
SBT	0.303	40	1	462	-	-	-	-	0.303	40	-3	224	207.658
SBR	-	-	-	-	0.388	25	-0.7	341	0.199	40	0	370	205.938
EBL	0.345	40	0	370	0.36	20	1	531	0.269	40	-1	277	393.323
EBT	0.303	40	0	370	-	-	-	-	0.303	40	0	370	224.22
EBR	0.199	40	0	370	0.241	30	0.9	466	0.08	40	-3	224	203.856
WBL	0.347	40	0	370	0.379	20	1.4	553	0.269	40	-3	224	398.233
WBY	0.303	40	0	370	-	-	-	-	0.303	40	0	370	224.22
WBR	0.189	40	0	370	0.245	30	0.8	457	0.066	40	-1	277	200.634

SEMIS

	APPROACH				RAMP				DEPARTURE				
	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	MILES	SPEED	GRADE	COST	COST/[illegible] VEHICLES
NBL	0.43	40	3	523	0.25	25	-0.7	242	0.199	40	0	302	345.488
NBT	0.303	40	3	523	-	-	-	-	0.303	40	-1	203	219.978
NBR	0.025	40	3	523	0.443	25	0.6	384	0.097	40	0	302	212.481
SBL	0.42	40	1	374	0.313	25	0.6	384	0.097	40	0	302	306.566
SBT	0.303	40	1	374	-	-	-	-	0.303	40	-3	117	148.773
SBR	-	-	-	-	0.388	25	-0.7	242	0.199	40	0	302	153.994
EBL	0.345	40	0	302	0.36	20	1	422	0.269	40	-1	203	310.717
EBT	0.303	40	0	302	-	-	-	-	0.303	40	0	302	183.012
EBR	0.199	40	0	302	0.241	30	0.9	428	0.08	40	-3	117	172.605
WBL	0.347	40	0	302	0.379	20	1.4	473	0.269	40	-3	117	315.534
WBT	0.303	40	0	302	-	-	-	-	0.303	40	0	302	183.012
WBR	0.189	40	0	302	0.245	30	0.8	414	0.066	40	-1	203	172.32

SPEED CHANGE COSTS PER VEHICLE - AT GRADE INTERSECTION

1994

	INIT SPEED	SLOW SPEED	AUTO STOP COST	AUTO SLOW COST	TRUCK STOP COST	TRUCK SLOW COST	SEMI STOP COST	SEMI SLOW COST	PERCENT STOPPING AM	PERCENT STOPPING PM	PERCENT STOPPING OFF	COST PER 1000 VEHICLES AUTOS AM	AUTOS PM	AUTOS OFF	TRUCKS AM	TRUCKS PM	TRUCKS OFF	SEMIS AM	SEMIS PM	SEMIS OFF
NBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	93	93	91	13.55	13.55	13.42	104.03	104.03	103.18	122.23	122.23	121.1
NBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	92	90	84	12.88	12.60	11.76	98.44	96.30	89.88	115.92	113.40	105.84
NBR	35	10	14.00	11.30	107.00	91.50	126.00	105.00	92	90	84	13.78	13.73	13.57	105.76	105.45	104.52	124.32	123.90	122.64
SBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	93	93	91	13.55	13.55	13.42	104.03	104.03	103.18	122.23	122.23	121.1
SBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	92	90	84	12.88	12.60	11.76	98.44	96.30	89.88	115.92	113.40	105.84
SBR	35	10	14.00	11.30	107.00	91.50	126.00	105.00	92	90	84	13.78	13.73	13.57	105.76	105.45	104.52	124.32	123.90	122.64
EBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	94	91	93	13.62	13.42	13.55	104.46	103.18	104.03	122.77	121.16	122.2
EBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	51	43	55	7.14	6.02	7.70	54.57	46.01	58.85	64.26	54.18	69.30
EBR	35	10	14.00	11.30	107.00	91.50	126.00	105.00	51	43	55	12.68	12.46	12.79	99.41	98.17	100.03	115.71	114.03	116.5
WBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	77	91	83	12.53	13.42	12.91	97.25	103.18	99.79	113.63	121.16	110.8
WBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	34	43	45	4.76	6.02	6.30	36.38	46.01	48.15	42.84	54.18	56.7
WBR	35	10	14.00	11.30	107.00	91.50	126.00	105.00	34	43	45	12.22	12.46	12.52	96.77	98.17	98.48	112.14	114.03	114.4

2020

	INIT SPEED	SLOW SPEED	AUTO STOP COST	AUTO SLOW COST	TRUCK STOP COST	TRUCK SLOW COST	SEMI STOP COST	SEMI SLOW COST	PERCENT STOPPING AM	PERCENT STOPPING PM	PERCENT STOPPING OFF	COST PER 1000 VEHICLES AUTOS AM	AUTOS PM	AUTOS OFF	TRUCKS AM	TRUCKS PM	TRUCKS OFF	SEMIS AM	SEMIS PM	SEMIS OFF
NBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	90	88	88	13.36	13.23	13.23	102.76	101.91	101.91	120.62	119.54	119.54
NBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	89	88	79	12.46	12.32	11.06	95.23	94.16	84.53	112.14	110.88	99.54
NBR	35	10	14.00	11.30	107.00	91.50	126.00	105.00	89	88	79	13.70	13.68	13.43	105.30	105.14	103.75	123.69	123.48	121.5
SBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	90	88	88	13.36	13.23	13.23	102.76	101.91	101.91	120.62	119.54	119.5
SBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	89	88	79	12.46	12.32	11.06	95.23	94.16	84.53	112.14	110.88	99.5
SBR	35	10	14.00	11.30	107.00	91.50	126.00	105.00	89	88	79	13.70	13.68	13.43	105.30	105.14	103.75	123.69	123.48	121.5
EBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	91	90	91	13.42	13.36	13.42	103.18	102.76	103.18	121.16	120.62	121.16
EBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	54	44	61	7.56	6.16	8.54	57.78	47.08	65.27	68.04	55.44	76.85
EBR	35	10	14.00	11.30	107.00	91.50	126.00	105.00	54	44	61	12.76	12.49	12.95	99.87	98.32	100.96	116.34	114.24	117.8
WBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	76	90	56	12.46	13.36	11.18	96.82	102.76	88.34	113.09	120.62	102.3
WBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	39	44	55	5.46	6.16	7.70	41.73	47.08	58.85	49.14	55.44	69.3
WBR	35	10	14.00	11.30	107.00	91.50	126.00	105.00	39	44	55	12.35	12.49	12.79	97.55	98.32	100.03	113.19	114.24	116.5

SPEED CHANGE COSTS PER VEHICLE - DIAMOND INTERCHANGE

1994

	INIT SPEED	SLOW SPEED	AUTO STOP COST	AUTO SLOW COST	TRUCK STOP COST	TRUCK SLOW COST	SEMI STOP COST	SEMI SLOW COST	PCT. STOPPING AT EB RAMPS AM	PM	OFF	PCT. STOPPING AT WB RAMPS AM	PM	OFF	COST PER 1000 VEHICLES AUTOS AM	AUTOS PM	AUTOS OFF	TRUCKS AM	TRUCKS PM	TRUCKS OFF	SEMIS AM	SEMIS PM	SEMIS OFF
NBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	46	67	57	96	90	94	20.18	23.12	21.60	154.52	176.99	165.45	181.81	208.27	194.59
NBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	46	67	57	78	57	65	17.08	17.36	17.08	130.54	132.68	130.54	153.72	156.24	153.72
NBR	35	20	0.00	7.60	0.00	64.60	0.00	72.20	0	0	0	0	0	0	7.60	7.60	7.60	64.60	64.60	64.60	72.20	72.20	72.20
SBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	83	70	78	80	60	71	24.11	20.48	22.40	185.39	158.48	172.79	217.65	185.48	202.55
SBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	29	36	33	80	60	71	15.26	13.44	14.56	116.63	102.72	111.28	137.34	120.96	131.04
SBR	35	20	0.00	7.60	0.00	64.60	0.00	72.20	0	0	0	0	0	0	7.60	7.60	7.60	64.60	64.60	64.60	72.20	72.20	72.20
EBL	40	20	17.20	10.90	134.00	91.30	155.00	99.90	85	77	80	78	57	65	29.33	25.56	27.12	229.44	200.56	212.56	264.54	230.68	244.73
EBT	40	-	17.20	0.00	134.00	0.00	155.00	0.00	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EBR	40	25	0.00	8.70	0.00	72.50	0.00	77.90	0	0	0	0	0	0	8.70	8.70	8.70	72.50	72.50	72.50	77.90	77.90	77.90
WBL	40	20	17.20	10.90	134.00	91.30	155.00	99.90	29	36	33	38	57	48	18.25	20.68	19.60	148.39	183.88	156.02	165.79	187.11	177.50
WBT	40	-	17.20	0.00	134.00	0.00	155.00	0.00	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WBR	40	25	0.00	8.70	0.00	72.50	0.00	77.90	0	0	0	0	0	0	8.70	8.70	8.70	72.50	72.50	72.50	77.90	77.90	77.90

1994

	INIT SPEED	SLOW SPEED	AUTO STOP COST	AUTO SLOW COST	TRUCK STOP COST	TRUCK SLOW COST	SEMI STOP COST	SEMI SLOW COST	PCT. STOPPING AT EB RAMPS AM	PM	OFF	PCT. STOPPING AT WB RAMPS AM	PM	OFF	COST PER 1000 VEHICLES AUTOS AM	AUTOS PM	AUTOS OFF	TRUCKS AM	TRUCKS PM	TRUCKS OFF	SEMIS AM	SEMIS PM	SEMIS OFF
NBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	53	67	65	93	81	84	20.97	22.16	22.08	160.74	170.63	169.77	189.01	200.20	199.29
NBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	53	67	65	69	41	52	17.08	15.12	16.38	130.54	115.56	125.19	153.72	136.08	147.42
NBR	35	20	0.00	7.60	0.00	64.60	0.00	72.20	0	0	0	0	0	0	7.60	7.60	7.60	64.60	64.60	64.60	72.20	72.20	72.20
SBL	35	20	14.00	7.60	107.00	64.60	126.00	72.20	79	69	72	76	60	68	23.30	20.42	21.73	179.42	158.06	167.89	210.46	184.92	196.62
SBT	35	-	14.00	0.00	107.00	0.00	126.00	0.00	20	22	37	76	60	68	13.44	11.48	14.70	102.72	87.74	112.35	120.96	103.32	132.30
SBR	35	20	0.00	7.60	0.00	64.60	0.00	72.20	0	0	0	0	0	0	7.60	7.60	7.60	64.60	64.60	64.60	72.20	72.20	72.20
EBL	40	20	17.20	10.90	134.00	91.30	155.00	99.90	81	77	77	69	41	52	27.87	22.80	24.70	218.35	179.12	193.86	251.48	205.88	222.93
EBT	40	-	17.20	0.00	134.00	0.00	155.00	0.00	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EBR	40	25	0.00	8.70	0.00	72.50	0.00	77.90	0	0	0	0	0	0	8.70	8.70	8.70	72.50	72.50	72.50	77.90	77.90	77.90
WBL	40	20	17.20	10.90	134.00	91.30	155.00	99.90	20	22	37	44	43	61	17.11	17.39	21.11	138.89	139.14	166.93	155.14	157.69	190.86
WBT	40	-	17.20	0.00	134.00	0.00	155.00	0.00	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WBR	40	25	0.00	8.70	0.00	72.50	0.00	77.90	0	0	0	0	0	0	8.70	8.70	8.70	72.50	72.50	72.50	77.90	77.90	77.90

SPEED CHANGE COSTS PER VEHICLE - PARCLO INTERCHANGE

1994			AUTO		TRUCK		SEMI		PERCENT STOPPING			COST PER 1000 VEHICLES								
												AUTOS			TRUCKS			SEMIS		
	INIT SPEED	SLOW SPEED	STOP COST	SLOW COST	STOP COST	SLOW COST	STOP COST	SLOW COST	AM	PM	OFF	AM	PM	OFF	AM	PM	OFF	AM	PM	OFF
NBL	40	25	17.20	8.70	134.00	72.50	155.00	77.90	100	100	100	17.20	17.20	17.20	134.00	134.00	134.00	155.00	155.00	155.00
NBT	40	-	-	-	-	-	-	-	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NBR	40	25	-	8.70	-	72.50	-	77.90	0	0	0	8.70	8.70	8.70	72.50	72.50	72.50	77.90	77.90	77.90
SBL	40	25	17.20	8.70	134.00	72.50	155.00	77.90	100	100	100	17.20	17.20	17.20	134.00	134.00	134.00	155.00	155.00	155.00
SBT	40	-	-	-	-	-	-	-	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SBR	40	25	-	8.70	-	72.50	-	77.90	0	0	0	8.70	8.70	8.70	72.50	72.50	72.50	77.90	77.90	77.90
EBL	40	20	-	10.90	-	91.30	-	99.90	0	0	0	10.90	10.90	10.90	91.30	91.30	91.30	99.90	99.90	99.90
EBT	40	-	-	-	-	-	-	-	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EBR	40	30	-	6.20	-	49.50	-	52.20	0	0	0	6.20	6.20	6.20	49.50	49.50	49.50	52.20	52.20	52.20
WBL	40	20	-	10.90	-	91.30	-	99.90	0	0	0	10.90	10.90	10.90	91.30	91.30	91.30	99.90	99.90	99.90
WBT	40	-	-	-	-	-	-	-	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WBR	40	30	-	6.20	-	49.50	-	52.20	0	0	0	6.20	6.20	6.20	49.50	49.50	49.50	52.20	52.20	52.20

2020			AUTO		TRUCK		SEMI		PERCENT STOPPING			COST PER 1000 VEHICLES								
												AUTOS			TRUCKS			SEMIS		
	INIT SPEED	SLOW SPEED	STOP COST	SLOW COST	STOP COST	SLOW COST	STOP COST	SLOW COST	AM	PM	OFF	AM	PM	OFF	AM	PM	OFF	AM	PM	OFF
NBL	40	25	17.20	8.70	134.00	72.50	155.00	77.90	100	100	100	17.20	17.20	17.20	134.00	134.00	134.00	155.00	155.00	155.00
NBT	40	-	-	-	-	-	-	-	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NBR	40	25	-	8.70	-	72.50	-	77.90	0	0	0	8.70	8.70	8.70	72.50	72.50	72.50	77.90	77.90	77.90
SBL	40	25	17.20	8.70	134.00	72.50	155.00	77.90	100	100	100	17.20	17.20	17.20	134.00	134.00	134.00	155.00	155.00	155.00
SBT	40	-	-	-	-	-	-	-	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SBR	40	25	-	8.70	-	72.50	-	77.90	0	0	0	8.70	8.70	8.70	72.50	72.50	72.50	77.90	77.90	77.90
EBL	40	20	-	10.90	-	91.30	-	99.90	0	0	0	10.90	10.90	10.90	91.30	91.30	91.30	99.90	99.90	99.90
EBT	40	-	-	-	-	-	-	-	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EBR	40	30	-	6.20	-	49.50	-	52.20	0	0	0	6.20	6.20	6.20	49.50	49.50	49.50	52.20	52.20	52.20
WBL	40	20	-	10.90	-	91.30	-	99.90	0	0	0	10.90	10.90	10.90	91.30	91.30	91.30	99.90	99.90	99.90
WBT	40	-	-	-	-	-	-	-	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WBR	40	30	-	6.20	-	49.50	-	52.20	0	0	0	6.20	6.20	6.20	49.50	49.50	49.50	52.20	52.20	52.20

CONSTANT SPEED OPERATING COSTS SUMMARY
Kahului Airport EIS 2020 Analysis

	CONSTANT SPEED COST PER 1000 VEHICLES								
	AT-GRADE			DIAMOND			PARCLO		
	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS
1 NB Left	74.24	253.61	213.62	89.96	314.93	253.98	115.79	419.03	345.49
2 NB Through	77.57	281.18	244.82	76.96	266.94	226.95	77.87	267.25	219.98
3 NB Right	74.24	253.61	213.62	81.57	293.25	238.26	73.40	255.68	212.48
4 SB Left	68.48	198.77	152.41	87.78	298.75	237.61	106.33	374.54	306.57
5 SB Through	66.05	171.50	122.41	66.96	211.49	159.38	68.36	207.86	146.77
6 SB Right	68.48	198.77	152.41	69.99	215.42	156.63	68.87	205.94	153.99
7 EB Left	74.24	253.61	213.62	80.40	273.18	233.33	120.37	393.32	310.72
8 EB Through	70.90	226.04	182.41	70.30	224.22	183.01	70.30	224.22	183.01
9 EB Right	68.48	198.77	152.41	57.17	150.25	82.39	61.69	203.86	172.61
10 WB Left	68.48	198.77	152.41	79.17	253.67	210.37	119.69	398.23	315.53
11 WB Through	70.90	226.04	182.41	70.30	224.22	183.01	70.30	224.22	183.01
12 WB Right	74.24	253.61	213.62	72.26	227.32	239.12	60.92	200.63	172.32

OPERATING COSTS FOR AT-GRADE INTERSECTION - 1994
Kahului Airport EIS 2020 Analysis

	HOURS/ YEAR	HOURLY VOLUME	ANNUAL VOLUME: TOTAL VEHICLES	ANNUAL VOLUME: AUTO	ANNUAL VOLUME: TRUCK	ANNUAL VOLUME: SEMI	OPERATING COSTS: AUTO	OPERATING COSTS: TRUCK	OPERATING COSTS: SEMI	OPERATING COSTS: TOTAL
AM PEAK										
1 NB Left	372	30	11160	10702	458	0 0	1026	168	0	1,194
2 NB Through	372	210	78120	74917	3203	0 0	7434	1251	0	8,685
3 NB Right	372	127	47244	45307	1937	0 0	4330	714	0	5,044
4 SB Left	372	95	35340	33858	1414	70 7	3197	450	20	3,667
5 SB Through	372	179	66588	63791	2664	133 2	5527	744	33	6,304
6 SB Right	372	60	22320	21383	893	44 6	1916	280	13	2,209
7 EB Left	372	80	29760	27260	2381	119 0	2752	891	41	3,684
8 EB Through	372	427	158844	145501	12708	635 4	11694	3603	158	15,454
9 EB Right	372	15	5580	5111	446	22 3	425	134	6	566
10 WB Left	372	690	256680	250263	5134	1283 4	22036	1565	349	23,950
11 WB Through	372	1890	703080	685503	14062	3515 4	53179	3723	798	57,700
12 WB Right	372	110	40920	39897	818	204 6	3481	288	67	3,836
TOTAL COST (1980 DOLLARS)			-	-	-	-	$118,896	$13,811	$1,485	$132,292
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$214,068	$25,377	$2,729	$243,074
PM PEAK										
1 NB Left	489	15	7335	7218	95	22 0	691	35	8	733
2 NB Through	489	158	77262	76026	1004	231 8	7344	389	85	7,818
3 NB Right	489	320	156480	153976	2034	469 4	15082	756	163	16,001
4 SB Left	439	111	54279	51999	2171	108 6	5103	701	31	5,836
5 SB Through	489	216	105624	101186	4225	211 2	8629	1174	52	9,854
6 SB Right	489	76	37164	35603	1487	74 3	3151	464	21	3,637
7 EB Left	489	75	36675	36015	550	110 0	3457	203	38	3,698
8 EB Through	489	1787	873843	858114	13108	2621 5	70245	3740	656	74 641
9 EB Right	489	50	24450	24010	367	73 4	1664	110	20	2,113
10 WB Left	489	280	136920	132949	2054	1916 9	12421	640	531	13,592
11 WB Through	489	691	337899	328100	5068	4730 6	25409	1341	1073	27,823
12 WB Right	489	60	29340	28489	440	410 8	2505	155	134	2,794
TOTAL COST (1980 DOLLARS)			-	-	-	-	$156,021	$9,708	$2,811	$168,540
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$286,673	$17,837	$5,165	$309,676
OFF-PEAK										
1 NB Left	5504	19	104576	100916	3451	209 2	9622	1267	72	10,960
2 NB Through	5504	120	660480	637363	21796	1321 0	61281	8429	483	70,193
3 NB Right	5504	181	996224	961356	32875	1992 4	90356	12058	684	103,098
4 SB Left	5504	68	374272	358563	14971	748 5	32286	4682	211	37,179
5 SB Through	5504	130	715520	685468	28621	1431 0	58029	7929	348	66,307
6 SB Right	5504	45	247680	237277	9907	495 4	20864	3087	140	24,091
7 EB Left	5504	51	280704	268363	11790	561 4	25832	4345	193	30,369
8 EB Through	5504	660	3632640	3472804	152571	7265 3	281234	43370	1811	326,415
9 EB Right	5504	19	104576	99975	4392	209 2	8352	1323	57	9,731
10 WB Left	5504	279	1535616	1472658	53747	9213 7	128826	16342	2504	147,673
11 WD Through	5504	741	4078464	3911247	142746	24470 8	302967	37778	5551	346 296
12 WB Right	5504	56	308224	295587	10788	1849 3	25964	3799	605	30,368
TOTAL COST (1980 DOLLARS)			-	-	-	-	$1,048,632	$144,409	$12,669	$1,202,790
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$1,921,244	$268,337	$23,260	$2,209,841
TOTAL YEAR										
1 NB Left	-	-	123071	118836	4004	231 2	11338	1470	79	12887 4
2 NB Through	-	-	815862	788306	26003	1552 7	76060	10068	568	86696 3
3 NB Right	-	-	1199948	1160639	36847	2461 9	109768	13529	847	124143 1
4 SB Left	-	-	463891	444406	18556	927 8	40586	5833	263	46681 6
5 SB Through	-	-	887732	850447	35509	1775 5	72184	9648	433	82264 6
6 SB Right	-	-	307164	294263	12287	614 3	25932	3831	173	29936 3
7 EB Left	-	-	347139	331628	14720	790 5	32041	5438	272	37751 2
8 EB Through	-	-	4665327	4476419	178386	10522 2	363172	50713	2625	416510 1
9 EB Right	-	-	134606	129096	5205	304 6	10761	1567	82	12409 7
10 WB Left	-	-	1929216	1855868	60934	12414 0	163283	18546	3385	185214 3
11 WB Through	-	-	5119443	4924850	161876	32716 8	381555	42843	7422	431819 6
12 WB Right	-	-	378484	363973	12046	2464 7	31970	4242	806	37017 6
TOTAL COST (1980 DOLLARS)			-	-	-	-	$1,318,649	$167,928	$16,966	$1,503,532
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$2,422,885	$308,551	$31,163	$2,762,599

SPEED CHANGE OPERATING COSTS SUMMARY
Kahului Airport EIS 2020 Analysis

1994

	SPEED CHANGE COST PER 1000 VEHICLES								
	AT-GRADE			DIAMOND			PARCLO		
	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS
1 NB Left	13.55	104.03	122.23	20.18	154.52	181.81	17.20	134.00	155.00
2 NB Through	12.88	98.44	115.92	17.08	130.54	153.72	0.00	0.00	0.00
3 NB Right	13.78	105.76	124.32	7.60	64.60	72.20	8.70	72.50	77.90
4 SB Left	13.55	104.03	122.23	24.11	185.39	217.65	17.20	134.00	155.00
5 SB Through	12.88	98.44	115.92	15.26	116.63	137.34	0.00	0.00	0.00
6 SB Right	13.78	105.76	124.32	7.60	64.60	72.20	8.70	72.50	77.90
7 EB Left	13.62	104.46	122.77	29.33	229.44	264.54	10.90	91.30	99.90
8 EB Through	7.14	54.57	64.26	0.00	0.00	0.00	0.00	0.00	0.00
9 EB Right	12.68	99.41	115.71	8.70	72.50	77.90	6.20	49.50	52.20
10 WB Left	12.53	97.25	113.63	18.28	146.39	165.79	10.90	91.30	99.90
11 WB Through	4.76	36.38	42.84	0.00	0.00	0.00	0.00	0.00	0.00
12 WB Right	12.22	96.77	112.14	8.70	72.50	77.90	6.20	49.50	52.20

2020

	SPEED CHANGE COST PER 1000 VEHICLES								
	AT-GRADE			DIAMOND			PARCLO		
	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS	AUTOS	TRUCKS	SEMIS
1 NB Left	13.36	102.76	120.62	20.97	160.74	189.01	17.20	134.00	155.00
2 NB Through	12.46	95.23	112.14	17.08	130.54	153.72	0.00	0.00	0.00
3 NB Right	13.70	105.30	123.69	7.60	64.60	72.20	8.70	72.50	77.90
4 SB Left	13.36	102.76	120.62	23.30	179.42	210.46	17.20	134.00	155.00
5 SB Through	12.46	95.23	112.14	13.44	102.72	120.96	0.00	0.00	0.00
6 SB Right	13.70	105.30	123.69	7.60	64.60	72.20	8.70	72.50	77.90
7 EB Left	13.42	103.18	121.18	27.67	218.35	251.48	10.90	91.30	99.90
8 EB Through	7.56	57.78	68.04	0.00	0.00	0.00	0.00	0.00	0.00
9 EB Right	12.76	99.87	116.34	8.70	72.50	77.90	6.20	49.50	52.20
10 WB Left	12.46	96.82	113.09	17.11	136.89	155.14	10.90	91.30	99.90
11 WB Through	5.46	41.73	49.14	0.00	0.00	0.00	0.00	0.00	0.00
12 WB Right	12.35	97.55	113.19	8.70	72.50	77.90	6.20	49 50	52.20

OPERATING COSTS FOR DIAMOND INTERCHANGE - 1994
Kahului Airport EIS 2020 Analysis

			ANNUAL VOLUME				OPERATING COSTS			
	HOURS/YEAR	HOURLY VOLUME	TOTAL VEHICLES	AUTO	TRUCK	SEMI	AUTO	TRUCK	SEMI	TOTAL
AM PEAK										
1 NB Left	372	30	11160	10702	458	0.0	1238	218	0	1,456
2 NB Through	372	210	78120	74917	3203	0.0	7338	1289	0	8,626
3 NB Right	372	127	47244	45307	1937	0.0	4040	693	0	4,733
4 SB Left	372	95	35340	33856	1414	70.7	4013	696	33	4,741
5 SB Through	372	179	66588	63791	2664	133.2	5485	886	40	6,412
6 SB Right	372	60	22320	21383	893	44.6	1659	250	10	1,919
7 EB Left	372	80	29760	27260	2381	119.0	3164	1215	60	4,439
8 EB Through	372	427	158844	145501	12708	635.4	10228	2849	116	13,194
9 EB Right	372	15	5580	5111	446	22.3	337	99	4	440
10 WB Left	372	690	256680	250263	5134	1283.4	24722	2062	484	27,268
11 WB Through	372	1890	703080	685503	14062	3515.4	48188	3153	643	51,984
12 WB Right	372	110	40920	39697	818	204.6	3230	245	65	3,540
TOTAL COST (1980 DOLLARS)			-	-	-	-	$113,642	$13,657	$1,466	$128,764
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$208,806	$25,093	$2,674	$236,572
PM PEAK										
1 NB Left	489	15	7335	7218	95	22.0	842	45	10	897
2 NB Through	489	158	77262	70026	1004	231.8	7431	403	89	7,923
3 NB Right	489	320	156480	153976	2034	469.4	13730	726	146	14,604
4 SB Left	489	111	54279	51999	2171	108.6	6036	1060	50	7,146
5 SB Through	489	216	105624	101188	4225	211.2	8576	1397	63	10,036
6 SB Right	489	76	37164	35603	1487	74.3	2762	416	17	3,196
7 EB Left	489	75	36675	36015	550	110.0	4110	279	55	4,444
8 EB Through	489	1787	873843	858114	13108	2621.5	60322	2939	480	63,741
9 EB Right	489	50	24450	24010	367	73.4	1581	82	12	1,675
10 WB Left	489	280	136920	132949	2054	1916.9	13260	826	725	14,812
11 WB Through	489	691	337899	328100	5068	4730.6	23064	1136	866	25,066
12 WB Right	489	60	29340	28489	440	410.8	2307	132	130	2,569
TOTAL COST (1980 DOLLARS)			-	-	-	-	$144,022	$9,444	$2,643	$156,109
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$264,626	$17,353	$4,856	$286,834
OFF-PEAK										
1 NB Left	5504	19	104576	100916	3451	209.2	11688	1640	92	13,420
2 NB Through	5504	120	660480	637363	21796	1321.0	62237	8742	508	71,486
3 NB Right	5504	181	996224	961356	32875	1992.4	85724	11764	619	98,107
4 SB Left	5504	68	374272	358553	14971	748.5	41984	7326	345	49,655
5 SB Through	5504	130	715520	685468	28621	1431.0	58436	9478	429	68,343
6 SB Right	5504	45	247680	237277	9907	495.4	18409	2774	113	21,297
7 EB Left	5504	51	280704	268353	11790	561.4	30803	5985	282	37,070
8 EB Through	5504	660	3632640	3472804	152571	7265.3	244124	34209	1330	279,663
9 EB Right	5504	19	104576	99975	4392	209.2	6585	978	34	7,597
10 WB Left	5504	279	1535616	1472656	53747	9213.7	146030	21594	3482	171,105
11 WB Through	5504	741	4078464	3911247	142746	24470.8	274945	32007	4478	311,430
12 WB Right	5504	56	308224	295587	10788	1649.3	23931	3234	586	27,752
TOTAL COST (1980 DOLLARS)			-	-	-	-	$1,004,897	$139,731	$12,297	$1,156,925
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$1,846,397	$256,743	$22,595	$2,125,735
TOTAL YEAR										
1 NB Left	-	-	123071	118836	4004	231.2	13768	1903	102	15772.9
2 NB Through	-	-	815862	788306	26003	1552.7	77006	10434	597	88036.0
3 NB Right	-	-	1199948	1160639	36847	2461.9	103494	13185	764	117444.0
4 SB Left	-	-	463891	444408	18556	927.8	52033	9082	427	61542.5
5 SB Through	-	-	887732	850447	35509	1775.5	72498	11761	532	84790.9
6 SB Right	-	-	307164	294263	12287	614.3	22830	3440	141	26411.5
7 EB Left	-	-	347139	331628	14720	790.5	38077	7479	398	45954.0
8 EB Through	-	-	4665327	4476419	178386	10522.2	314674	39996	1926	356597.7
9 EB Right	-	-	134606	129096	5205	304.8	8503	1159	49	9711.4
10 WB Left	-	-	1929216	1855868	60934	12414.0	184012	24482	4691	213185.0
11 WB Through	-	-	5119443	4924850	161876	32716.8	346197	36296	5988	388480.7
12 WB Right	-	-	378484	363973	12046	2464.7	29468	3612	781	33861.1
TOTAL COST (1980 DOLLARS)			-	-	-	-	$1,262,560	$162,832	$16,396	$1,441,788
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$2,319,828	$299,188	$30,125	$2,649,140

OPERATING COSTS FOR PARCLO INTERCHANGE - 1994
Kahului Airport EIS 2020 Analysis

			ANNUAL VOLUME				OPERATING COSTS			
	HOURS/YEAR	HOURLY VOLUME	TOTAL VEHICLES	AUTO	TRUCK	SEMI	AUTO	TRUCK	SEMI	TOTAL
AM PEAK										
1 NB Left	372	30	11160	10702	458	0.0	1430	253	0	1,683
2 NB Through	372	210	78120	74917	3203	0.0	5834	856	0	6,690
3 NB Right	372	127	47244	45307	1937	0.0	3720	636	0	4,356
4 SB Left	372	95	35340	33856	1414	70.7	4203	720	33	4,956
5 SB Through	372	179	66588	63791	2664	133.2	4233	554	20	4,806
6 SB Right	372	60	22320	21383	893	44.6	1659	249	10	1,918
7 EB Left	372	80	29760	27260	2381	119.0	3578	1154	49	4,781
8 EB Through	372	427	158844	145501	12708	635.4	10228	2849	116	13,194
9 EB Right	372	15	5580	5111	446	22.3	347	113	5	465
10 WB Left	372	690	256680	250263	5134	1283.4	32681	2513	533	35,727
11 WB Through	372	1890	703080	685503	14062	3515.4	48188	3153	643	51,984
12 WB Right	372	110	40920	39697	818	204.6	2678	205	46	2,928
TOTAL COST (1980 DOLLARS)			-	-	-	-	$118,778	$13,254	$1,456	$133,488
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$218,244	$24,353	$2,674	$245,271
PM PEAK										
1 NB Left	489	15	7335	7218	95	22.0	965	53	11	1,028
2 NB Through	489	158	77262	76026	1004	231.8	5920	268	51	6,240
3 NB Right	489	320	156480	153976	2034	439.4	12642	668	136	13,446
4 SB Left	489	111	54279	51999	2171	108.6	6453	1105	50	7,609
5 SB Through	489	216	105624	101188	4225	211.2	6715	878	31	7,624
6 SB Right	489	76	37164	35603	1487	74.3	2762	414	17	3,193
7 EB Left	489	75	36675	36015	550	110.0	4726	267	45	5,039
8 EB Through	489	1787	873843	858114	13108	2621.5	60322	2939	480	63,741
9 EB Right	489	50	24450	24010	367	73.4	1630	93	16	1,740
10 WB Left	489	280	136920	132949	2054	1916.9	17361	1005	796	19,163
11 WB Through	489	691	337899	328100	5068	4730.6	23064	1136	866	25,066
12 WB Right	489	60	29340	28489	440	410.8	1912	110	92	2,114
TOTAL COST (1980 DOLLARS)			-	-	-	-	$144,474	$8,937	$2,593	$156,003
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$265,456	$16,420	$4,764	$286,640
OFF-PEAK										
1 NB Left	5504	19	104576	100916	3451	209.2	13475	1910	105	15,491
2 NB Through	5504	120	660480	637363	21796	1321.0	49632	5825	291	55,748
3 NB Right	5504	181	996224	961356	32875	1992.4	78930	10789	579	90,298
4 SB Left	5504	68	374272	358553	14971	748.5	44477	7621	346	52,444
5 SB Through	5504	130	715520	685468	28621	1431.0	45486	5949	213	51,648
6 SB Right	5504	45	247680	237277	9907	495.4	18405	2759	115	21,279
7 EB Left	5504	51	280704	268353	11790	581.4	35227	5713	231	41,171
8 EB Through	5504	660	3632640	3472804	152571	7265.3	244124	34209	1330	279,663
9 EB Right	5504	19	104576	99975	4392	209.2	6788	1113	47	7,947
10 WB Left	5504	279	1535616	1472656	53747	9213.7	192308	26311	3828	222,447
11 WB Through	5504	741	4078464	3911247	142746	24470.8	274945	32007	4478	311,430
12 WB Right	5504	56	308224	295587	10788	1849.3	19839	2698	415	22,953
TOTAL COST (1980 DOLLARS)			-	-	-	-	$1,023,637	$136,904	$11,976	$1,172,517
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$1,880,830	$251,548	$22,005	$2,154,383
TOTAL YEAR										
1 NB Left	-	-	123071	118836	4004	231.2	15870	2217	116	18202.1
2 NB Through	-	-	815862	788306	25003	1552.7	61386	6949	342	68677.0
3 NB Right	-	-	1199948	1160639	36847	2461.9	95292	12092	715	108099.2
4 SB Left	-	-	463891	444408	18556	927.8	55133	9446	429	65008.4
5 SB Through	-	-	887732	850447	35509	1775.5	56433	7381	264	64078.2
6 SB Right	-	-	307164	294263	12287	614.3	22825	3421	142	26388.9
7 EB Left	-	-	347139	331628	14720	790.5	43533	7134	325	50991.3
8 EB Through	-	-	4665327	4476419	178366	10522.2	314674	39996	1926	356597.7
9 EB Right	-	-	134606	129096	5205	304.8	8765	1319	69	10152.2
10 WB Left	-	-	1929216	1855868	60934	12414.0	242350	29829	5157	277336.8
11 WB Through	-	-	5119443	4924850	161876	32716.8	346197	36295	5988	388480.7
12 WB Right	-	-	378484	363973	12046	2464.7	24429	3013	553	27995.7
TOTAL COST (1980 DOLLARS)			-	-	-	-	$1,286,889	$159,095	$16,025	$1,462,008
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$2,364,529	$292,321	$29,443	$2,686,294

OPERATING COSTS FOR AT-GRADE INTERSECTION - 2020
Kahului Airport EIS 2020 Analysis

	Hours/Year	Hourly Volume	Annual Volume: Total Vehicles	Annual Volume: Auto	Annual Volume: Truck	Annual Volume: Bus	Operating Costs: Auto	Operating Costs: Truck	Operating Costs: Bus	Operating Costs: Total
AM PEAK										
1 NB Left	372	80	29760	28540	1220	0.0	2838	453	0	3,290
2 NB Through	372	422	156984	150548	6436	0.0	16960	2604	0	19,563
3 NB Right	372	317	117924	113089	4835	0.0	11010	1792	0	12,802
4 SB Left	372	190	70680	67711	2827	141.4	7637	961	43	8,641
5 SB Through	372	339	126108	120311	5044	252.2	11006	1424	62	12,492
6 SB Right	372	117	43524	41696	1741	87.0	3826	550	25	4,401
7 EB Left	372	159	59148	54180	4732	236.6	6502	1878	86	8,466
8 EB Through	372	860	319920	293047	25594	1279.7	24347	7411	326	32,084
9 EB Right	372	105	39060	35779	3125	156.2	3034	947	42	4,024
10 WB Left	372	985	366420	357280	7328	1832.1	36958	2371	523	39,852
11 WB Through	372	2482	923304	900221	18466	4616.5	61401	5267	1127	67,795
12 WB Right	372	228	84816	82698	1696	424.1	7302	599	139	8,041
TOTAL COST (1980 DOLLARS)			-	-	-	-	$212,820	$26,258	$2,373	$241,451
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$391,036	$48,247	$4,360	$443,643
PM PEAK										
1 NB Left	489	173	84597	83243	1100	253.8	8510	412	88	9,010
2 NB Through	489	350	171150	168412	2225	513.5	17144	870	189	18,203
3 NB Right	489	670	327630	322388	4259	982.9	32248	1593	342	34,182
4 SB Left	489	246	120294	115242	4812	240.6	13677	1671	74	15,422
5 SB Through	489	480	234720	224862	9389	469.4	24055	2836	122	27,013
6 SB Right	489	169	82641	79170	3306	165.3	7280	1045	47	8,373
7 EB Left	489	162	79218	77792	1188	237.7	8170	450	83	8,703
8 EB Through	489	2357	1152573	1131827	17289	3457.7	113354	5373	933	119,660
9 EB Right	489	74	36186	35535	543	108.6	2967	164	29	3,160
10 WB Left	489	397	194133	188503	2912	2717.9	21783	986	806	23,574
11 WB Through	489	844	412716	400747	6191	5778.0	31775	1680	1353	34,808
12 WB Right	489	134	65526	63626	983	917.4	5680	348	302	6,331
TOTAL COST (1980 DOLLARS)			-	-	-	-	$286,643	$17,428	$4,368	$308,439
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$526,679	$32,022	$8,026	$566,726
OFF-PEAK										
1 NB Left	5504	103	566912	547070	18708	1133.8	52199	6849	387	59,435
2 NB Through	5504	253	1392512	1343774	45953	2785.0	128016	17596	1007	146,620
3 NB Right	5504	399	2196096	2119233	72471	4392.2	199386	26564	1506	227,456
4 SB Left	5504	144	792576	757288	31703	1585.2	69060	9918	446	79,424
5 SB Through	5504	269	1480576	1418392	59223	2961.2	118838	16184	708	135,731
6 SB Right	5504	94	517376	495646	20695	1034.8	43297	6426	290	50,013
7 EB Left	5504	105	577920	552492	24273	1155.6	53922	8960	397	63,279
8 EB Through	5504	959	5278336	5043089	221690	10656.7	416730	64055	2683	483,468
9 EB Right	5504	54	297216	284138	12483	594.4	23914	3773	161	27,849
10 WB Left	5504	397	2185088	2095499	76478	13110.5	185711	23336	3571	212,618
11 WB Through	5504	955	5256320	5040811	183971	31537.9	400006	49946	7387	457,338
12 WB Right	5504	119	654976	628122	22924	3929.9	55824	6115	1292	65,231
TOTAL COST (1980 DOLLARS)			-	-	-	-	$1,746,905	$241,723	$19,836	$2,008,464
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$3,209,763	$444,143	$36,445	$3,690,351
TOTAL YEAR										
1 NB Left	-	-	681269	658853	21028	1387.6	63547	7714	475	71735.8
2 NB Through	-	-	1720646	1662733	54614	3298.5	162120	21070	1196	184385.9
3 NB Right	-	-	2641650	2554710	81565	5375.1	242644	29948	1848	274440.4
4 SB Left	-	-	983550	942241	39342	1967.1	90375	12551	562	103487.2
5 SB Through	-	-	1841404	1764065	73656	3682.8	153899	20445	892	175236.6
6 SB Right	-	-	643541	616512	25742	1287.1	54404	8021	362	62787.3
7 EB Left	-	-	716286	684463	30193	1630.1	68594	11288	566	80448.4
8 EB Through	-	-	6750829	6470963	264572	15294.1	554431	76839	3941	635211.5
9 EB Right	-	-	372462	355452	16151	859.2	29915	4884	233	35032.1
10 WB Left	-	-	2745641	2641282	86718	17660.5	244452	26094	4899	276044.9
11 WB Through	-	-	6592340	6341780	208628	41932.5	513182	56893	9867	579941.5
12 WB Right	-	-	805318	774443	25603	5271.3	68808	9063	1734	79602.7
TOTAL COST (1980 DOLLARS)			-	-	-	-	$2,246,369	$285,410	$26,576	$2,558,354
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$4,127,478	$524,412	$48,831	$4,700,720

OPERATING COSTS FOR DIAMOND INTERCHANGE - 2020
Kahului Airport EIS 2020 Analysis

	Hours/Year	Hourly Volume	Annual Volume: Total Vehicles	Annual Volume: Auto	Annual Volume: Truck	Annual Volume: Bus	Operating Costs: Auto	Operating Costs: Truck	Operating Costs: Bus	Operating Costs: Total
AM PEAK										
1 NB Left	372	80	29760	28540	1220	0.0	3370	591	0	3,961
2 NB Through	372	422	156984	150548	6436	0.0	14793	2592	0	17,386
3 NB Right	372	317	117924	113089	4835	0.0	10084	1730	0	11,814
4 SB Left	372	190	70680	67711	2827	141.4	7985	1376	64	9,425
5 SB Through	372	339	126108	120811	5044	252.2	10224	1611	72	11,907
6 SB Right	372	117	43524	41696	1741	87.0	3235	486	20	3,742
7 EB Left	372	159	59148	54180	4732	236.6	6198	2362	116	8,676
8 EB Through	372	860	319920	293047	25594	1279.7	20600	5739	234	26,573
9 EB Right	372	105	39060	35779	3125	156.2	2357	696	25	3,078
10 WB Left	372	985	366420	357280	7328	1832.1	35165	2882	673	38,720
11 WB Through	372	2482	923304	900221	18466	4616.5	63282	4140	845	68,267
12 WB Right	372	228	84816	82696	1696	424.1	6695	509	134	7,338
TOTAL COST (1980 DOLLARS)			-	-	-	-	$183,988	$24,716	$2,184	$210,888
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$338,060	$45,413	$4,012	$387,486
PM PEAK										
1 NB Left	489	173	84597	83243	1100	253.8	9738	530	114	10,382
2 NB Through	489	350	171150	168412	2225	513.5	16405	892	197	17,494
3 NB Right	489	670	327630	322368	4259	982.9	28747	1524	305	30,577
4 SB Left	489	246	120294	115242	4812	240.6	13350	2324	108	15,782
5 SB Through	489	480	234720	224862	9389	469.4	18742	2978	133	21,853
6 SB Right	489	169	82641	79170	3306	165.3	6142	926	38	7,106
7 EB Left	489	162	79218	77792	1188	237.7	8731	589	116	9,436
8 EB Through	489	2357	1152573	1131827	17289	3457.7	79563	3876	633	84,072
9 EB Right	489	74	36186	35535	543	108.6	2341	121	17	2,479
10 WB Left	489	397	194133	188503	2912	2717.9	18821	1148	1003	20,972
11 WB Through	489	844	412716	400747	6191	5778.0	28171	1388	1057	30,616
12 WB Right	489	134	65526	63626	983	917.4	5151	295	291	5,737
TOTAL COST (1980 DOLLARS)			-	-	-	-	$236,902	$16,589	$4,014	$256,505
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$433,446	$30,482	$7,376	$471,302
OFF-PEAK										
1 NB Left	5504	103	566912	547070	18708	1133.8	63780	9005	509	73,294
2 NB Through	5504	253	1392512	1343774	45953	2785.0	131108	18427	1070	150,606
3 NB Right	5504	399	2196096	2119233	72471	4392.2	188972	25934	1364	216,269
4 SB Left	5504	144	792576	759268	31703	1585.2	88107	15316	718	104,142
5 SB Through	5504	269	1480576	1418392	59223	2961.2	118535	18796	840	138,170
6 SB Right	5504	94	517376	495646	20695	1034.8	38455	5795	237	44,486
7 EB Left	5504	105	577920	552492	24273	1155.8	62162	12034	565	74,761
8 EB Through	5504	959	5278336	5046089	221690	10658.7	354720	49707	1932	406,359
9 EB Right	5504	54	297216	284138	12483	594.4	18715	2781	95	21,591
10 WB Left	5504	397	2185088	2095499	76478	13110.5	207385	30075	4827	242,287
11 WB Through	5504	955	5256320	5040811	183971	31537.9	354349	41250	5772	401,371
12 WB Right	5504	119	654976	628122	22924	3929.9	50854	6873	1246	58,973
TOTAL COST (1980 DOLLARS)			-	-	-	-	$1,677,142	$235,993	$19,174	$1,932,309
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$3,081,580	$433,613	$35,231	$3,550,424
TOTAL YEAR										
1 NB Left	-	-	681269	658853	21028	1387.6	76888	10126	623	87636.7
2 NB Through	-	-	1720646	1662733	54614	3298.5	162305	21911	1267	185485.1
3 NB Right	-	-	2641650	2554710	81565	5375.1	227803	29188	1669	258660.0
4 SB Left	-	-	983550	942241	39342	1967.1	109442	19016	891	129349.5
5 SB Through	-	-	1841404	1764065	73656	3682.8	147501	23385	1044	171930.4
6 SB Right	-	-	643541	616512	25742	1287.1	47832	7208	295	55334.6
7 EB Left	-	-	716265	684463	30193	1630.1	77091	14964	797	92872.9
8 EB Through	-	-	6750829	6470963	264572	15294.1	454883	59322	2799	517004.2
9 EB Right	-	-	372462	355452	16151	859.2	23412	3598	138	27147.5
10 WB Left	-	-	2745641	2641262	86718	17660.5	261370	34104	6504	301977.8
11 WB Through	-	-	6592340	6341780	208628	41932.5	445802	46779	7674	500254.5
12 WB Right	-	-	805318	774443	25603	5271.3	62700	7676	1671	72048.0
TOTAL COST (1980 DOLLARS)			-	-	-	-	$2,097,032	$277,298	$25,371	$2,399,701
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$3,853,087	$509,507	$46,618	$4,409,211

OPERATING COSTS FOR PARCLO INTERCHANGE - 2020
Kahului Airport EIS 2020 Analysis

	HOURS/YEAR	HOURLY VOLUME	ANNUAL VOLUME TOTAL VEHICLES	AUTO	TRUCK	[illegible]	OPERATING COSTS AUTO	TRUCK	[illegible]	TOTAL
AM PEAK										
1 NB Left	372	80	29760	28540	1220	0.0	3821	676	0	4,497
2 NB Through	372	422	156984	150548	6436	0.0	11723	1720	0	13,443
3 NB Right	372	317	117924	113089	4835	0.0	9285	1587	0	10,872
4 SB Left	372	190	70680	67711	2827	141.4	8433	1441	65	9,940
5 SB Through	372	339	126108	120811	5044	252.2	8017	1049	38	9,103
6 SB Right	372	117	43524	41696	1741	87.0	3234	485	20	3,739
7 EB Left	372	159	59148	54180	4732	236.6	7112	2293	97	9,502
8 EB Through	372	860	319920	293047	25594	1279.7	20600	5739	234	26,573
9 EB Right	372	105	39060	35779	3125	156.2	2429	792	35	3,256
10 WB Left	372	985	366420	357260	7328	1832.1	46653	3587	761	51,002
11 WB Through	372	2482	923304	900221	18466	4616.5	63282	4140	845	68,267
12 WB Right	372	228	84816	82696	1695	424.1	5550	424	95	6,070
TOTAL COST (1980 DOLLARS)			-	-	-	-	$190,140	$23,833	$2,191	$216,264
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$349,364	$43,976	$4,026	$397,364
PM PEAK										
1 NB Left	489	173	84597	83243	1100	253.8	11190	610	127	11,927
2 NB Through	489	350	171150	168412	2225	513.5	13114	595	113	13,822
3 NB Right	489	670	327630	322388	4259	982.9	26469	1398	285	28,152
4 SB Left	489	246	120294	115242	4612	240.6	14371	2453	111	16,935
5 SB Through	489	480	234720	224862	9389	469.4	14921	1952	70	16,943
6 SB Right	489	169	82641	79170	3306	165.3	6141	920	38	7,100
7 EB Left	489	162	79218	77792	1188	237.7	10212	576	98	10,885
8 EB Through	489	2357	1152573	1131827	17289	3457.7	79563	3876	633	84,072
9 EB Right	489	74	36186	35535	543	108.6	2413	138	24	2,575
10 WB Left	489	397	194133	188503	2912	2717.9	24616	1426	1129	27,170
11 WB Through	489	844	412716	400747	6191	5778.0	28171	1388	1057	30,616
12 WB Right	489	134	65526	63626	983	917.4	4270	246	206	4,722
TOTAL COST (1980 DOLLARS)			-	-	-	-	$235,451	$15,676	$3,893	$254,920
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$432,618	$28,619	$7,152	$468,390
OFF-PEAK										
1 NB Left	5504	103	566912	547070	18708	1133.8	73193	10361	568	84,122
2 NB Through	5504	253	1392512	1343774	45953	2785.0	104641	12281	613	117,534
3 NB Right	5504	399	2196096	2119233	72471	4392.2	173995	23784	1275	199,054
4 SB Left	5504	144	792576	759288	31703	1585.2	94368	16146	733	111,247
5 SB Through	5504	269	1480576	1418392	59223	2961.2	94120	12310	441	106,871
6 SB Right	5504	94	517376	495640	20695	1034.8	38446	5762	240	44,449
7 EB Left	5504	105	577920	552492	24273	1155.6	72526	11763	475	84,763
8 EB Through	5504	959	5278336	5046080	221690	10556.7	354720	49707	1932	406,359
9 EB Right	5504	54	297216	284130	12483	594.4	19291	3163	134	22,588
10 WB Left	5504	397	2185088	2095493	76478	13110.5	273643	37439	5447	316,528
11 WB Through	5504	955	5256320	5040811	183971	31537.9	354349	41250	5772	401,371
12 WB Right	5504	119	654976	628122	22924	3929.9	42158	5734	882	48,775
TOTAL COST (1980 DOLLARS)			-	-	-	-	$1,695,450	$229,700	$18,511	$1,943,661
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$3,115,221	$422,050	$34,012	$3,571,282
TOTAL YEAR										
1 NB Left	-	-	681269	658853	21028	1387.6	88204	11647	696	100547.0
2 NB Through	-	-	1720646	1662733	54614	3298.5	129479	14595	726	144799.7
3 NB Right	-	-	2641650	2554710	81565	5375.1	209749	26768	1561	238078.3
4 SB Left	-	-	983550	942241	39342	1967.1	117172	20040	910	138121.6
5 SB Through	-	-	1841404	1764065	73656	3682.8	117058	15310	548	132916.0
6 SB Right	-	-	643541	616512	25742	1287.1	47822	7167	298	55287.5
7 EB Left	-	-	716286	684463	30193	1630.1	89649	14632	669	105150.9
8 EB Through	-	-	6750829	6470963	264572	15294.1	454883	59322	2799	517004.2
9 EB Right	-	-	372462	355452	16151	859.2	24133	4092	193	28418.1
10 WB Left	-	-	2745641	2641202	86718	17660.5	344912	42452	7337	394700.2
11 WB Through	-	-	6592340	6341780	208628	41932.5	445802	46779	7674	500254.5
12 WB Right	-	-	805318	774443	25603	5271.3	51979	6404	1184	59566.9
TOTAL COST (1980 DOLLARS)			-	-	-	-	$2,121,042	$269,209	$24,594	$2,414,845
1980-1995 INDEX			-	-	-	-	1.8374	1.8374	1.8374	1.8374
TOTAL COST (1994 DOLLARS			-	-	-	-	$3,897,203	$494,644	$45,189	$4,437,036

APPENDIX D

ACCIDENT RATES AND COMPUTATIONS

ACCIDENT VALUES FOR AT-GRADE, DIAMOND AND PARCLO INTERSECTION - 1994
Kahului Airport EIS 2020 Analysis

	Hourly Volume: AM Peak	Hourly Volume: PM Peak	Hourly Volume: Off Peak	Millions of Annual Veh (Ent)	Annual Accidents per MVM	Accident Type (%): Property Damage	Accident Type (%): Injury	Accident Type (%): Fatal	Annual Accidents: Property Damage	Annual Accidents: Injury	Annual Accidents: Fatal	Annual Accidents: Total
AT GRADE												
1 NB Left	30	15	19	0.123	1.02	0.647	0.349	0.004	0.081	0.044	0.001	0.126
2 NB Through	210	158	120	0.818	1.02	0.647	0.349	0.004	0.538	0.290	0.003	0.832
3 NB Right	127	320	181	1.200	1.02	0.647	0.349	0.004	0.792	0.427	0.005	1.224
4 SB Left	95	111	68	0.464	1.02	0.647	0.349	0.004	0.306	0.165	0.002	0.473
5 SB Through	179	216	130	0.888	1.02	0.647	0.349	0.004	0.586	0.316	0.004	0.905
6 SB Right	60	76	45	0.307	1.02	0.647	0.349	0.004	0.203	0.109	0.001	0.313
7 EB Left	80	75	51	0.347	1.02	0.647	0.349	0.004	0.229	0.124	0.001	0.354
8 EB Through	427	1787	860	4.665	1.02	0.647	0.349	0.004	3.079	1.661	0.019	4.759
9 EB Right	15	50	19	0.135	1.02	0.647	0.349	0.004	0.089	0.048	0.001	0.137
10 WB Left	690	280	279	1.929	1.02	0.647	0.349	0.004	1.273	0.687	0.008	1.968
11 WB Through	1890	691	741	5.119	1.02	0.647	0.349	0.004	3.379	1.822	0.021	5.222
12 WB Right	110	80	56	0.378	1.02	0.647	0.349	0.004	0.250	0.135	0.002	0.386
TOTAL ACCIDENTS									10.904	5.828	0.067	16.689
AVERAGE VALUE									$1,600	$16,700	$1,090,000	-
TOTAL VALUE									$17,287	$97,329	$72,809	$187,425
DIAMOND												
1 NB Left	30	15	19	0.123	1.09	0.652	0.343	0.005	0.087	0.046	0.001	0.134
2 NB Through	210	158	120	0.816	1.02	0.647	0.349	0.004	0.538	0.290	0.003	0.832
3 NB Right	127	320	181	1.200	1.09	0.652	0.343	0.005	0.853	0.449	0.007	1.306
4 SB Left	95	111	68	0.464	1.09	0.652	0.343	0.005	0.330	0.173	0.003	0.506
5 SB Through	179	216	130	0.888	1.02	0.647	0.349	0.004	0.586	0.316	0.004	0.905
6 SB Right	60	76	45	0.307	1.09	0.652	0.343	0.005	0.218	0.115	0.002	0.335
7 EB Left	80	75	51	0.347	1.98	0.641	0.354	0.005	0.441	0.243	0.003	0.687
8 EB Through	427	1787	860	4.665	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9 EB Right	15	50	19	0.135	1.98	0.641	0.354	0.005	0.171	0.094	0.001	0.267
10 WB Left	690	280	279	1.929	1.98	0.641	0.354	0.005	2.449	1.352	0.019	3.820
11 WB Through	1890	691	741	5.119	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12 WB Right	110	60	56	0.378	1.98	0.641	0.354	0.005	0.480	0.265	0.004	0.749
TOTAL ACCIDENTS									6.153	3.348	0.046	9.543
AVERAGE VALUE									$1,600	$16,700	$1,090,000	-
TOTAL VALUE									$9,844	$55,854	$50,117	$115,815
PARCLO												
1 NB Left	30	15	19	0.123	1.09	0.652	0.343	0.005	0.087	0.048	0.001	0.134
2 NB Through	210	158	120	0.816	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3 NB Right	127	320	181	1.200	0.87	0.657	0.333	0.010	0.686	0.348	0.010	1.044
4 SB Left	95	111	68	0.464	1.09	0.652	0.343	0.005	0.330	0.173	0.003	0.506
5 SB Through	179	216	130	0.888	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 SB Right	60	76	45	0.307	0.87	0.657	0.333	0.010	0.176	0.089	0.003	0.267
7 EB Left	80	75	51	0.347	1.57	0.693	0.302	0.005	0.378	0.165	0.003	0.545
8 EB Through	427	1787	860	4.665	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9 EB Right	15	50	19	0.135	1.12	0.623	0.367	0.010	0.094	0.055	0.002	0.151
10 WB Left	690	280	279	1.929	1.57	0.693	0.302	0.005	2.099	0.915	0.015	3.029
11 WB Through	1890	691	741	5.119	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12 WB Right	110	60	56	0.378	1.12	0.623	0.367	0.010	0.264	0.156	0.004	0.424
TOTAL ACCIDENTS									4.113	1.946	0.040	6.100
AVERAGE VALUE									$1,600	$16,700	$1,090,000	-
TOTAL VALUE									$6,581	$32,503	$43,620	$82,604

KAHULUI2 WB1

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Appendix Table D-1

EXPECTED ACCIDENT RATES[1]
Year 2020 Traffic Assessment of Kahului Airport Access Road

Roadway Type	Accident Rate per Million Vehicles	Percent of Accidents: With a Fatality	Percent of Accidents: With an Injury	Percent of Accidents: Property Damage Only
Suburban Intersection with Signal Controls	1.02	0.4%	34.9%	64.7%
Diamond On-Ramp, Urban Interchange with Left-Turns	1.09	0.5%	34.3%	65.2%
Diamond Off-Ramp, Urban Interchange with Left-Turns	1.98	0.5%	35.4%	64.1%
Direct/Semi-Direct On-Ramp, Urban Interchange (Right-Turn Only)	0.87	1.0%	33.3%	65.7%
Direct/Semi-Direct Off-Ramp, Urban Interchange (Right-Turn Only)	1.12	1.0%	36.7%	62.3%
Loop On-Ramp, Urban Interchange	0.91	0.5%	30.2%	69.3%
Loop Off-Ramp, Urban Interchange	1.57	0.5%	30.2%	69.3%

(1) Source: *Safety Evaluation*, California Department of Transportation, November 1982.

Wilbur Smith Associates; November 1995

ACCIDENT VALUES FOR AT-GRADE, DIAMOND AND PARCLO INTERSECTION - 2020
Kahului Airport EIS 2020 Analysis

	HOURLY VOLUME			MILLIONS OF ANNUAL VEH (MVM)	ANNUAL ACCIDENTS PER MEV	ACCIDENT TYPE (%)			ANNUAL ACCIDENTS			
	AM PEAK	PM PEAK	OFF-PEAK			PROPERTY DAMAGE	INJURY	FATAL	PROPERTY DAMAGE	INJURY	FATAL	TOTAL
AT GRADE												
1 NB Left	80	173	103	0.681	1.02	0.647	0.349	0.004	0.450	0.243	0.003	0.695
2 NB Throu	422	350	253	1.721	1.02	0.647	0.349	0.004	1.136	0.613	0.007	1.755
3 NB Right	317	670	399	2.642	1.02	0.647	0.349	0.004	1.743	0.940	0.011	2.694
4 SB Left	190	246	144	0.984	1.02	0.647	0.349	0.004	0.649	0.350	0.004	1.003
5 SB Throu	339	480	269	1.841	1.02	0.647	0.349	0.004	1.215	0.656	0.008	1.878
6 SB Right	117	169	94	0.644	1.02	0.647	0.349	0.004	0.425	0.229	0.003	0.656
7 EB Left	159	162	105	0.716	1.02	0.647	0.349	0.004	0.473	0.255	0.003	0.731
8 EB Throu	860	2357	959	6.751	1.02	0.647	0.349	0.004	4.455	2.403	0.028	6.886
9 EB Right	105	74	54	0.372	1.02	0.647	0.349	0.004	0.246	0.133	0.002	0.380
10 WB Left	985	397	397	2.746	1.02	0.647	0.349	0.004	1.812	0.977	0.011	2.801
11 WB Throu	2482	844	955	6.592	1.02	0.647	0.349	0.004	4.351	2.347	0.027	6.724
12 WB Right	228	134	119	0.805	1.02	0.647	0.349	0.004	0.531	0.287	0.003	0.821
TOTAL ACCIDENTS									17.486	9.432	0.108	27.025
AVERAGE VALUE				-					$1,600	$18,700	$1,090,000	-
TOTAL VALUE									$27,976	$157,509	$117,828	$303,313
DIAMOND												
1 NB Left	80	173	103	0.681	1.09	0.652	0.343	0.005	0.484	0.255	0.004	0.743
2 NB Throu	422	350	253	1.721	1.02	0.647	0.349	0.004	1.136	0.613	0.007	1.755
3 NB Right	317	670	399	2.642	1.09	0.652	0.343	0.005	1.877	0.968	0.014	2.879
4 SB Left	190	246	144	0.984	1.09	0.652	0.343	0.005	0.699	0.368	0.005	1.072
5 SB Throu	339	480	269	1.841	1.02	0.647	0.349	0.004	1.215	0.656	0.008	1.878
6 SB Right	117	169	94	0.644	1.09	0.652	0.343	0.005	0.457	0.241	0.004	0.701
7 EB Left	159	162	105	0.716	1.98	0.641	0.354	0.005	0.909	0.502	0.007	1.418
8 EB Throu	860	2357	959	6.751	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9 EB Right	105	74	54	0.372	1.98	0.641	0.354	0.005	0.473	0.261	0.004	0.737
10 WB Left	985	397	397	2.746	1.98	0.641	0.354	0.005	3.485	1.924	0.027	5.436
11 WB Throu	2482	844	955	6.592	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12 WB Right	228	134	119	0.805	1.98	0.641	0.354	0.005	1.022	0.564	0.008	1.595
TOTAL ACCIDENTS									11.767	6.371	0.087	18.216
AVERAGE VALUE									$1,600	$16,700	$1,090,000	-
TOTAL VALUE									$18,812	$106,391	$95,314	$220,517
PARCLO												
1 NB Left	80	173	103	0.681	1.09	0.652	0.343	0.005	0.484	0.255	0.004	0.743
2 NB Throu	422	350	253	1.721	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3 NB Right	317	670	399	2.642	0.87	0.657	0.333	0.010	1.510	0.765	0.023	2.298
4 SB Left	190	246	144	0.984	1.09	0.652	0.343	0.005	0.699	0.368	0.005	1.072
5 SB Throu	339	480	269	1.841	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 SB Right	117	169	94	0.644	0.87	0.657	0.333	0.010	0.368	0.186	0.006	0.560
7 EB Left	159	162	105	0.716	1.57	0.693	0.302	0.005	0.779	0.340	0.006	1.125
8 EB Throu	860	2357	959	6.751	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9 EB Right	105	74	54	0.372	1.12	0.623	0.367	0.010	0.260	0.153	0.004	0.417
10 WB Left	985	397	397	2.746	1.57	0.693	0.302	0.005	2.987	1.302	0.022	4.311
11 WB Throu	2482	844	955	6.592	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12 WB Right	228	134	119	0.805	1.12	0.623	0.367	0.010	0.562	0.331	0.009	0.902
TOTAL ACCIDENTS									7.649	3.700	0.078	11.427
AVERAGE VALUE									$1,600	$16,700	$1,090,000	-
TOTAL VALUE									$12,239	$61,786	$85,044	$159,068

APPENDIX E

SENSITIVITY ASSESSMENT OF FEASIBILITY RESULTS

SENSITIVITY ASSESSMENT
NO VALUE OF TIME FOR TOURIST AND RECREATION TRIPS
PARTIAL CLOVERLEAF INTERCHANGE

INPUTS

Total Project Cost	$18,371,000
Year 1994 Time	$632,894
Year 1994 V.O.C	$76,295
Year 1994 Accident	$104,820
Year 2020 Time	$2,227,248
Year 2020 V.O.C.	$263,684
Year 2020 Accident	$144,245
Residual Value	$6,367,000
Annual Maintenance	$13,400
Discount Rate	7.00%

FEASIBILITY RESULTS

Net Present Value =	$3,666,300
Internal Rate of Return =	8.7%
Benefit/Cost Ratio =	1.24

LIFE CYCLE ANALYSIS
(BEFORE DISCOUNTING)

	Costs	TIME	VOC	ACC	Total Benefits	NET
1994		632,894	76,295	104,820		
1995		694,215	83,503	106,337		0
1996		755,537	90,710	107,853		0
1997	12,247,333	816,858	97,917	109,369		(12,247,333)
1998	6,123,667	878,179	105,124	110,886	547,095	(5,576,572)
1999	13,400	939,500	112,332	112,402	1,164,234	1,150,834
2000	13,400	1,000,822	119,539	113,918	1,234,279	1,220,879
2001	13,400	1,062,143	126,746	115,435	1,304,324	1,290,924
2002	13,400	1,123,464	133,953	116,951	1,374,369	1,360,969
2003	13,400	1,184,786	141,161	118,467	1,444,414	1,431,014
2004	13,400	1,246,107	148,368	119,984	1,514,459	1,501,059
2005	13,400	1,307,428	155,575	121,500	1,584,504	1,571,104
2006	13,400	1,368,749	162,783	123,016	1,654,548	1,641,148
2007	13,400	1,430,071	169,990	124,533	1,724,593	1,711,193
2008	13,400	1,491,392	177,197	126,049	1,794,638	1,781,238
2009	13,400	1,552,713	184,404	127,565	1,864,683	1,851,283
2010	13,400	1,614,035	191,612	129,082	1,934,728	1,921,328
2011	13,400	1,675,356	198,819	130,598	2,004,773	1,991,373
2012	13,400	1,736,677	206,026	132,114	2,074,818	2,061,418
2013	13,400	1,797,999	213,233	133,631	2,144,863	2,131,463
2014	13,400	1,859,320	220,441	135,147	2,214,908	2,201,508
2015	13,400	1,920,641	227,648	136,663	2,284,953	2,271,553
2016	13,400	1,981,962	234,855	138,180	2,354,997	2,341,597
2017	13,400	2,043,284	242,063	139,696	2,425,042	2,411,642
2018	13,400	2,104,605	249,270	141,212	2,495,087	2,481,687
2019	13,400	2,165,926	256,477	142,729	2,565,132	2,551,732
2020	13,400	2,227,248	263,684	144,245	2,635,177	2,621,777
2021	13,400	2,288,569	270,892	145,761	2,705,222	2,691,822
2022	13,400	2,349,890	278,099	147,278	2,775,267	2,761,867
2023	13,400	2,411,211	285,306	148,794	2,845,312	2,831,912
2024	13,400	2,472,533	292,513	150,310	2,915,357	2,901,957
2025	13,400	2,533,854	299,721	151,827	2,985,402	2,972,002
2026	13,400	2,595,175	306,928	153,343	3,055,446	3,042,046
2027	13,400	2,656,497	314,135	154,859	3,125,491	3,112,091
2028	(6,367,000)					6,367,000

SENSITIVITY ASSESSMENT
NO VALUE OF TIME FOR TOURIST AND RECREATION TRIPS AND NO ACCIDENT COSTS
PARTIAL CLOVERLEAF INTERCHANGE

INPUTS

Total Project Cost	$18,371,000
Year 1994 Time	$632,894
Year 1994 V.O.C.	$76,295
Year 1994 Accident	$0
Year 2020 Time	$2,227,248
Year 2020 V.O.C.	$263,684
Year 2020 Accident	$0
Residual Value	$6,367,000
Annual Maintenance	$13,400
Discount Rate	7.00%

FEASIBILITY RESULTS

Net Present Value =	$2,349,500
Internal Rate of Return =	8.1%
Benefit/Cost Ratio =	1.16

LIFE CYCLE ANALYSIS
(BEFORE DISCOUNTING)

	Costs	TIME	VOC	ACC	Total Benefits	NET
1994		632,894	76,295	0		
1995		694,215	83,503	0		0
1996		755,537	90,710	0		0
1997	12,247,333	816,858	97,917	0		(12,247,333)
1998	6,123,667	878,179	105,124	0	491,652	(5,632,015)
1999	13,400	939,500	112,332	0	1,051,832	1,038,432
2000	13,400	1,000,822	119,539	0	1,120,361	1,106,961
2001	13,400	1,062,143	126,746	0	1,188,889	1,175,489
2002	13,400	1,123,464	133,953	0	1,257,418	1,244,018
2003	13,400	1,184,786	141,161	0	1,325,946	1,312,546
2004	13,400	1,246,107	148,368	0	1,394,475	1,381,075
2005	13,400	1,307,428	155,575	0	1,463,003	1,449,603
2006	13,400	1,368,749	162,783	0	1,531,532	1,518,132
2007	13,400	1,430,071	169,990	0	1,600,061	1,586,661
2008	13,400	1,491,392	177,197	0	1,668,589	1,655,189
2009	13,400	1,552,713	184,404	0	1,737,118	1,723,718
2010	13,400	1,614,035	191,612	0	1,805,646	1,792,246
2011	13,400	1,675,356	198,819	0	1,874,175	1,860,775
2012	13,400	1,736,677	206,026	0	1,942,703	1,929,303
2013	13,400	1,797,999	213,233	0	2,011,232	1,997,832
2014	13,400	1,859,320	220,441	0	2,079,761	2,066,361
2015	13,400	1,920,641	227,648	0	2,148,289	2,134,889
2016	13,400	1,981,962	234,855	0	2,216,818	2,203,418
2017	13,400	2,043,284	242,063	0	2,285,346	2,271,946
2018	13,400	2,104,605	249,270	0	2,353,875	2,340,475
2019	13,400	2,165,926	256,477	0	2,422,403	2,409,003
2020	13,400	2,227,248	263,684	0	2,490,932	2,477,532
2021	13,400	2,288,569	270,892	0	2,559,460	2,546,060
2022	13,400	2,349,890	278,099	0	2,627,989	2,614,589
2023	13,400	2,411,211	285,306	0	2,696,518	2,683,118
2024	13,400	2,472,533	292,513	0	2,765,046	2,751,646
2025	13,400	2,533,854	299,721	0	2,833,575	2,820,175
2026	13,400	2,595,175	306,928	0	2,902,103	2,888,703
2027	13,400	2,656,497	314,135	0	2,970,632	2,957,232
2028	(6,367,000)					6,367,000

SENSITIVITY ASSESSMENT
NO VALUE OF TIME FOR NON WORK-RELATED TRIPS
PARTIAL CLOVERLEAF INTERCHANGE

INPUTS

Total Project Cost	$18,371,000
Year 1994 Time	$470,061
Year 1994 V.O.C.	$76,295
Year 1994 Accident	$104,820
Year 2020 Time	$1,777,702
Year 2020 V.O.C.	$263,684
Year 2020 Accident	$144,245
Residual Value	$6,367,000
Annual Maintenance	$13,400
Discount Rate	7.00%

FEASIBILITY RESULTS

Net Present Value =	$342,633
Internal Rate of Return =	7.2%
Benefit/Cost Ratio =	1.02

LIFE CYCLE ANALYSIS
(BEFORE DISCOUNTING)

	Costs	TIME	VOC	ACC	Total Benefits	NET
1994		470,061	76,295	104,820		
1995		520,355	83,503	106,337		0
1996		570,649	90,710	107,853		0
1997	12,247,333	620,942	97,917	109,369		(12,247,333)
1998	6,123,667	671,236	105,124	110,886	443,623	(5,680,043)
1999	13,400	721,530	112,332	112,402	946,264	932,864
2000	13,400	771,824	119,539	113,918	1,005,281	991,881
2001	13,400	822,118	126,746	115,435	1,064,299	1,050,899
2002	13,400	872,412	133,953	116,951	1,123,316	1,109,916
2003	13,400	922,706	141,161	118,467	1,182,334	1,168,934
2004	13,400	973,000	148,368	119,984	1,241,351	1,227,951
2005	13,400	1,023,293	155,575	121,500	1,300,369	1,286,969
2006	13,400	1,073,587	162,783	123,016	1,359,386	1,345,986
2007	13,400	1,123,881	169,990	124,533	1,418,404	1,405,004
2008	13,400	1,174,175	177,197	126,049	1,477,421	1,464,021
2009	13,400	1,224,469	184,404	127,565	1,536,439	1,523,039
2010	13,400	1,274,763	191,612	129,082	1,595,456	1,582,056
2011	13,400	1,325,057	198,819	130,598	1,654,474	1,641,074
2012	13,400	1,375,351	206,026	132,114	1,713,491	1,700,091
2013	13,400	1,425,644	213,233	133,631	1,772,509	1,759,109
2014	13,400	1,475,938	220,441	135,147	1,831,526	1,818,126
2015	13,400	1,526,232	227,648	136,663	1,890,544	1,877,144
2016	13,400	1,576,526	234,855	138,180	1,949,561	1,936,161
2017	13,400	1,626,820	242,063	139,696	2,008,579	1,995,179
2018	13,400	1,677,114	249,270	141,212	2,067,596	2,054,196
2019	13,400	1,727,408	256,477	142,729	2,126,614	2,113,214
2020	13,400	1,777,702	263,684	144,245	2,185,631	2,172,231
2021	13,400	1,827,995	270,892	145,761	2,244,649	2,231,249
2022	13,400	1,878,289	278,099	147,278	2,303,666	2,290,266
2023	13,400	1,928,583	285,306	148,794	2,362,684	2,349,284
2024	13,400	1,978,877	292,513	150,310	2,421,701	2,408,301
2025	13,400	2,029,171	299,721	151,827	2,480,718	2,467,318
2026	13,400	2,079,465	306,928	153,343	2,539,736	2,526,336
2027	13,400	2,129,759	314,135	154,859	2,598,753	2,585,353
2028	(6,367,000)					6,367,000

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SENSITIVITY ASSESSMENT
NO VALUE OF TIME FOR TOURIST AND RECREATION TRIPS
DIAMOND INTERCHANGE

INPUTS

Total Project Cost	$14,728,000
Year 1994 Time	$697,243
Year 1994 V.O.C.	$113,449
Year 1994 Accident	$71,610
Year 2020 Time	$2,176,299
Year 2020 V.O.C.	$291,509
Year 2020 Accident	$82,796
Residual Value	$5,369,000
Annual Maintenance	$11,200
Discount Rate	7.00%

FEASIBILITY RESULTS

Net Present Value =	$6,539,667
Internal Rate of Return =	10.7%
Benefit/Cost Ratio =	1.54

LIFE CYCLE ANALYSIS
(BEFORE DISCOUNTING)

	Costs	TIME	VOC	ACC	Total Benefits	NET
1994		697,243	113,449	71,610		
1995		754,130	120,297	72,040		0
1996		811,016	127,146	72,470		0
1997	9,818,667	867,903	133,994	72,900		(9,818,667)
1998	4,909,333	924,790	140,843	73,331	569,482	(4,339,852)
1999	11,200	981,677	147,691	73,761	1,203,129	1,191,929
2000	11,200	1,038,564	154,540	74,191	1,267,294	1,256,094
2001	11,200	1,095,450	161,388	74,621	1,331,460	1,320,260
2002	11,200	1,152,337	168,237	75,052	1,395,625	1,384,425
2003	11,200	1,209,224	175,085	75,482	1,459,791	1,448,591
2004	11,200	1,266,111	181,934	75,912	1,523,957	1,512,757
2005	11,200	1,322,998	188,782	76,343	1,588,122	1,576,922
2006	11,200	1,379,884	195,631	76,773	1,652,288	1,641,088
2007	11,200	1,436,771	202,479	77,203	1,716,453	1,705,253
2008	11,200	1,493,658	209,327	77,633	1,780,619	1,769,419
2009	11,200	1,550,545	216,176	78,064	1,844,784	1,833,584
2010	11,200	1,607,432	223,024	78,494	1,908,950	1,897,750
2011	11,200	1,664,318	229,873	78,924	1,973,115	1,961,915
2012	11,200	1,721,205	236,721	79,354	2,037,281	2,026,081
2013	11,200	1,778,092	243,570	79,785	2,101,446	2,090,246
2014	11,200	1,834,979	250,418	80,215	2,165,612	2,154,412
2015	11,200	1,891,865	257,267	80,645	2,229,778	2,218,578
2016	11,200	1,948,752	264,115	81,075	2,293,943	2,282,743
2017	11,200	2,005,639	270,964	81,506	2,358,109	2,346,909
2018	11,200	2,062,526	277,812	81,936	2,422,274	2,411,074
2019	11,200	2,119,413	284,661	82,366	2,486,440	2,475,240
2020	11,200	2,176,299	291,509	82,796	2,550,605	2,539,405
2021	11,200	2,233,186	298,358	83,227	2,614,771	2,603,571
2022	11,200	2,290,073	305,206	83,657	2,678,936	2,667,736
2023	11,200	2,346,960	312,055	84,087	2,743,102	2,731,902
2024	11,200	2,403,847	318,903	84,518	2,807,267	2,796,067
2025	11,200	2,460,733	325,752	84,948	2,871,433	2,860,233
2026	11,200	2,517,620	332,600	85,378	2,935,598	2,924,398
2027	11,200	2,574,507	339,449	85,808	2,999,764	2,988,564
2028	(5,369,000)					5,369,000

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SENSITIVITY ASSESSMENT
NO VALUE OF TIME FOR TOURIST AND RECREATION TRIPS AND NO ACCIDENT COSTS
DIAMOND INTERCHANGE

INPUTS

Total Project Cost	$14,728,000
Year 1994 Time	$697,243
Year 1994 V.O.C.	$113,449
Year 1994 Accident	$0
Year 2020 Time	$2,176,299
Year 2020 V.O.C.	$291,509
Year 2020 Accident	$0
Residual Value	$5,369,000
Annual Maintenance	$11,200
Discount Rate	7.00%

FEASIBILITY RESULTS

Net Present Value =	$5,729,337
Internal Rate of Return =	10.2%
Benefit/Cost Ratio =	1.47

LIFE CYCLE ANALYSIS
(BEFORE DISCOUNTING)

	Costs	TIME	VOC	ACC	Total Benefits	NET
1994		697,243	113,449	0		
1995		754,130	120,297	0		0
1996		811,016	127,146	0		0
1997	9,818,667	867,903	133,994	0		(9,818,667)
1998	4,909,333	924,790	140,843	0	532,816	(4,376,517)
1999	11,200	981,677	147,691	0	1,129,368	1,118,168
2000	11,200	1,038,564	154,540	0	1,193,103	1,181,903
2001	11,200	1,095,450	161,388	0	1,256,838	1,245,638
2002	11,200	1,152,337	168,237	0	1,320,574	1,309,374
2003	11,200	1,209,224	175,085	0	1,384,309	1,373,109
2004	11,200	1,266,111	181,934	0	1,448,044	1,436,844
2005	11,200	1,322,998	188,782	0	1,511,780	1,500,580
2006	11,200	1,379,884	195,631	0	1,575,515	1,564,315
2007	11,200	1,436,771	202,479	0	1,639,250	1,628,050
2008	11,200	1,493,658	209,327	0	1,702,985	1,691,785
2009	11,200	1,550,545	216,176	0	1,766,721	1,755,521
2010	11,200	1,607,432	223,024	0	1,830,456	1,819,256
2011	11,200	1,664,318	229,873	0	1,894,191	1,882,991
2012	11,200	1,721,205	236,721	0	1,957,926	1,946,726
2013	11,200	1,778,092	243,570	0	2,021,662	2,010,462
2014	11,200	1,834,979	250,418	0	2,085,397	2,074,197
2015	11,200	1,891,865	257,267	0	2,149,132	2,137,932
2016	11,200	1,948,752	264,115	0	2,212,868	2,201,668
2017	11,200	2,005,639	270,964	0	2,276,603	2,265,403
2018	11,200	2,062,526	277,812	0	2,340,338	2,329,138
2019	11,200	2,119,413	284,661	0	2,404,073	2,392,873
2020	11,200	2,176,299	291,509	0	2,467,809	2,456,609
2021	11,200	2,233,186	298,358	0	2,531,544	2,520,344
2022	11,200	2,290,073	305,206	0	2,595,279	2,584,079
2023	11,200	2,346,960	312,055	0	2,659,015	2,647,815
2024	11,200	2,403,847	318,903	0	2,722,750	2,711,550
2025	11,200	2,460,733	325,752	0	2,786,485	2,775,285
2026	11,200	2,517,620	332,600	0	2,850,220	2,839,020
2027	11,200	2,574,507	339,449	0	2,913,956	2,902,756
2028	(5,369,000)					5,369,000

SENSITIVITY ASSESSMENT
NO VALUE OF TIME FOR NON WORK-RELATED TRIPS
DIAMOND INTERCHANGE

INPUTS

Total Project Cost	$14,728,000
Year 1994 Time	$502,772
Year 1994 V.O.C.	$113,449
Year 1994 Accident	$71,610
Year 2020 Time	$1,700,165
Year 2020 V.O.C.	$291,509
Year 2020 Accident	$82,796
Residual Value	$5,369,000
Annual Maintenance	$11,200
Discount Rate	7.00%

FEASIBILITY RESULTS

Net Present Value =	$2,914,630
Internal Rate of Return =	8.7%
Benefit/Cost Ratio =	1.24

LIFE CYCLE ANALYSIS
(BEFORE DISCOUNTING)

	Costs	TIME	VOC	ACC	Total Benefits	NET
1994		502,772	113,449	71,610		
1995		548,825	120,297	72,040		0
1996		594,879	127,146	72,470		0
1997	9,818,667	640,932	133,994	72,900		(9,818,667)
1998	4,909,333	686,986	140,843	73,331	450,580	(4,458,754)
1999	11,200	733,040	147,691	73,761	954,492	943,292
2000	11,200	779,093	154,540	74,191	1,007,824	996,624
2001	11,200	825,147	161,388	74,621	1,061,156	1,049,956
2002	11,200	871,200	168,237	75,052	1,114,489	1,103,289
2003	11,200	917,254	175,085	75,482	1,167,821	1,156,621
2004	11,200	963,308	181,934	75,912	1,221,154	1,209,954
2005	11,200	1,009,361	188,782	76,343	1,274,486	1,263,286
2006	11,200	1,055,415	195,631	76,773	1,327,818	1,316,618
2007	11,200	1,101,469	202,479	77,203	1,381,151	1,369,951
2008	11,200	1,147,522	209,327	77,633	1,434,483	1,423,283
2009	11,200	1,193,576	216,176	78,064	1,487,815	1,476,615
2010	11,200	1,239,629	223,024	78,494	1,541,148	1,529,948
2011	11,200	1,285,683	229,873	78,924	1,594,480	1,583,280
2012	11,200	1,331,737	236,721	79,354	1,647,812	1,636,612
2013	11,200	1,377,790	243,570	79,785	1,701,145	1,689,945
2014	11,200	1,423,844	250,418	80,215	1,754,477	1,743,277
2015	11,200	1,469,897	257,267	80,645	1,807,809	1,796,609
2016	11,200	1,515,951	264,115	81,075	1,861,142	1,849,942
2017	11,200	1,562,005	270,964	81,506	1,914,474	1,903,274
2018	11,200	1,608,058	277,812	81,936	1,967,806	1,956,606
2019	11,200	1,654,112	284,661	82,366	2,021,139	2,009,939
2020	11,200	1,700,165	291,509	82,796	2,074,471	2,063,271
2021	11,200	1,746,219	298,358	83,227	2,127,804	2,116,604
2022	11,200	1,792,273	305,206	83,657	2,181,136	2,169,936
2023	11,200	1,838,326	312,055	84,087	2,234,468	2,223,268
2024	11,200	1,884,380	318,903	84,518	2,287,801	2,276,601
2025	11,200	1,930,433	325,752	84,948	2,341,133	2,329,933
2026	11,200	1,976,487	332,600	85,378	2,394,465	2,383,265
2027	11,200	2,022,541	339,449	85,808	2,447,798	2,436,598
2028	(5,369,000)					5,369,000

NOISE ASSESSMENT FOR

KAHULUI AIRPORT EXPANSION

YEAR 2020 HIGHWAY NOISE STANDARDS ANALYSIS

WAILUKU, MAUI, HAWAII

February 28, 1996
Report #95-174a

Prepared for:

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Revised: January 15, 1996
Report #95-174a

MESTRE GREVE ASSOCIATES
NOISE ASSESSMENT FOR KAHULUI AIRPORT EXPANSION
FEDERAL/STATE NOISE STANDARDS ANALYSIS

1.0 INTRODUCTION

The purpose of this report is to assess the potential noise impacts for the realignment and expansion of the roadways as a result of the expansion of the Kahului Airport, with respect to federal/state community noise assessment criteria. The roadway analysis for the project extends from Puunene Avenue on the west to Hana Highway on the east. A vicinity map is presented in Exhibit 1. The purpose of the roadway expansion project is to improve the traffic flow to, from and around the airport. Presently, there are three areas which include noise-sensitive land uses including single family residences adjacent to the effected roadways. The major existing noise sources in the vicinity of the project are Hana Highway, Haleakala Highway, Puunene Avenue and Dairy Road.

This noise study will determine the existing noise levels local to the project site, predict the noise levels that would exist with the proposed project, and analyze the noise impact of the project on adjacent land uses. These levels will then be compared with applicable federal/state noise criteria and, if necessary, potential mitigation measures will be suggested.

1.1 Land Uses in the Project Vicinity

An important part of a noise analysis is the identification of noise-sensitive land uses that may be impacted by the proposed project. This would include any residential properties, schools, or other noise-sensitive land uses adjacent to the project or situated along roadways that may be affected by project-related traffic. In the case of the Kahului Airport proposed expansion project, the existing land use along most of the effected roadways is comprised primarily of undeveloped open space. Residential land uses are located along portions of the roadways and these include single and multi-family homes.

1.2 Noise Definitions

The noise standard used by the Federal Highway Administration (FHWA) is related to the peak one hour noise level. It is described in terms of the Equivalent Noise Level (LEQ). LEQ is based on the A-weighted decibel. A-weighting is a frequency correction that correlates overall sound pressure levels with the frequency response of the human ear. LEQ is the sound level corresponding to a steady-state sound level containing the same total energy as a time-varying signal over a given sample period. LEQ is the "energy" average noise level and can be viewed as the level of a continuous noise which has the same energy content as the actual fluctuating noise level.

1.3 Assessment Criteria

The Federal Highway Administration (FHWA) has adopted and published noise abatement criteria for highway construction projects. These standards are published in the "Federal Aid Policy Guide, 23 CFR 772, entitled "Procedures for Abatement of Highway Traffic Noise and Construction Noise," December 9, 1991. The following noise standards are taken from the FAPG 23 CFR 772:

"NOISE STANDARDS. The highway traffic noise prediction requirements, noise analyses, noise abatement criteria, and requirements for informing local officials in this directive constitute the noise standards mandated by 23 U.S.C. 109(i). All highway projects which are developed in conformance with this directive shall be deemed to be in conformance with the Federal Highway Administration (FHWA) noise standards."

The noise abatement criteria specified by the FHWA are presented in Exhibit 2 in terms of the maximum one hour Noise Equivalent Level (LEQ). The FHWA noise abatement criteria basically establishes an exterior noise goal for residential land uses of 67 LEQ and an interior goal for residences of 52 LEQ. The noise abatement criteria applies to private yard areas.

2.0 EXISTING NOISE ENVIRONMENT

The existing noise environment was determined through a comprehensive computer modeling effort. The existing noise levels were determined for the roadways around the project site, and at noise-sensitive land uses adjacent to existing roadways that may be affected by the proposed project. The existing environment was modeled in order to establish a baseline noise level to which the proposed project can be compared and impacts due to project related traffic increases can be determined.

The existing traffic noise levels in the vicinity of the project were established in terms of the Peak Hour LEQ index by modeling the roadways for the current traffic and speed characteristics. The noise levels projected in the next sections of this report were computed using the Highway Noise Model published by the Federal Highway Administration ("FHWA Highway Traffic Noise Prediction Model," FHWA-RD-77-108, December 1978). The FHWA Model uses traffic volume, vehicle mix, vehicle speed, and roadway geometry to compute the LEQ noise level.

Traffic data used to calculate the existing, future no-project, and future with-project noise levels during the morning peak traffic hour are listed in Table 1. The traffic data used to calculate the noise levels for the same three cases during the evening peak traffic hour are listed in Table 2. This data represents two way peak volumes. The traffic mix in terms of truck percentages assumed in the analysis was obtained from the traffic engineer. All of the roadways within the study were assumed to have 2% medium trucks and 1% heavy trucks.

Tables 3 and 4 list the distances to the existing 67 dBA LEQ contours for the morning and evening peak traffic hours respectively in both meters and feet. These represent the distance from the centerline of the road to the contour value shown. Note that these tables do not include the mitigating effect of the topography. This is discussed in the Potential Noise Impacts section in terms of the sensitive receptor analysis (Section 3). Also note, that for the future cases, the centerline of the roadway was assumed to remain where it is now. It actually depends on the final design of the widening project near the residences. The centerline may move farther from the homes and produce lower noise levels than predicted here.

The peak hour noise levels expressed in LEQ require some explanation. The peak noise hour may not coincide with the peak traffic hour. While it is true that for constant speed, traffic noise increases with increasing traffic volume, this does not hold true unless the speed does not change. Along most roadways, the vehicle speeds decrease from design speeds during peak traffic hours. The maximum hour of noise occurs at some optimum combination of speed and traffic volume, i.e., when traffic is at its highest level without too severe a degradation of speed. This condition occurs whenever each travel lane is carrying its highest Level of Service (LOS) C traffic. Therefore, for all LEQ levels shown in this report, the LEQ represents the highest LEQ during any 24 hour period whether or not it occurs during the peak traffic hour.

TABLE 1
A.M. EXISTING AND FUTURE TRAFFIC VOLUMES

ROADWAY SEGMENT	PEAK HOUR TRAFFIC VOLUME Existing	Future w/o Proj.	Future w/ Proj.	SPEED (mph)
Aalele Street.				
Keolani Place to Haleakala Hwy.	168	0	0	30
Haleakala Hwy.				
Hana Hwy. to Hanakai St.	524	761	518	30
Hanakai St. to Keolani Place	574	803	544	30
Keolani Place to Aalele St.	132	213	100	30
Aalele St. to Hana Hwy.	225	434	0	30
East of Hana Hwy.	2404	3765	3754	55
Hana Highway				
Harbor Ave. to Haleakala Hwy.	2795	2009	3311	30
Haleakala Hwy. to Hanakai St.	2271	3538	3793	30
Hanakai St. to Dairy Road	2332	3522	3749	30
Dairy Road to Pulehu Road (Airport Access Rd.)	3093	4781	3803	55
Pulehu Road (Airport Access Rd.) to Hansen Road	2972	4683	5062	55
Hansen Road to Haleakala Hwy.	3296	5199	5410	55
East of Haleakala Hwy.	1122	1794	1786	55
Pulehu Road				
Hana Hwy. to Hansen Road	60	93	0	55
South of Hansen Road	119	186	186	55
Puunene Avenue				
E. Kamehameha Ave. to Dairy Road	1761	2641	2641	30
South of Dairy Road	1532	2474	2487	55
Hanakai Street				
Haleakala Hwy. to Hana Hwy.	40	51	51	30
South of Hana Hwy.	211	266	146	30
Keolani Place				
Aalele St. to Haleakala Hwy.	962	1931	726	30
Dairy Road				
Haleakala Hwy. to Hana Hwy.	472	1521	455	30
South of Hana Hwy.	1406	2975	1112	30
Airport Access Rd.				
Keolani Pl. to Hana Hwy.	0	0	1455	55
Hana Hwy. to Dairy Road	0	0	2248	55
Dairy Road to Puunene Ave.	0	0	2988	55
Kuihelani Hwy.				
West of Puunene Ave.	729	1892	1889	55
Hansen Road				
North of Hana Hwy.	0	0	615	55
Hana Hwy. to Pulehu Road	358	522	615	55
Pulehu Road to Puunene Ave.	391	595	595	55

TABLE 2
P.M. EXISTING AND FUTURE TRAFFIC VOLUMES

ROADWAY SEGMENT	PEAK HOUR TRAFFIC VOLUME Existing	Future w/o Proj.	Future w/ Proj.	SPEED (mph)
Aalele Street.				
Keolani Place to Haleakala Hwy.	163	0	0	30
Haleakala Hwy.				
Hana Hwy. to Hanakai St.	756	969	631	30
Hanakai St. to Keolani Place	782	1095	730	30
Keolani Place to Aalele St.	174	630	500	30
Aalele St. to Hana Hwy.	345	465	0	30
East of Hana Hwy.	2218	3112	3096	55
Hana Highway				
Harbor Ave. to Haleakala Hwy.	3054	4436	4437	30
Haleakala Hwy. to Hanakai St.	2348	3477	3856	30
Hanakai St. to Dairy Road	2417	3668	3827	30
Dairy Road to Pulehu Road (Airport Access Rd.)	3013	3406	3779	55
Pulehu Road (Airport Access Rd.) to Hansen Road	2918	4300	4648	55
Hansen Road to Haleakala Hwy.	3198	4745	4070	55
East of Haleakala Hwy.	1335	2028	2019	55
Pulehu Road				
Hana Hwy. to Hansen Road	95	128	0	55
South of Hansen Road	154	241	241	55
Puunene Avenue				
E. Kamehameha Ave. to Dairy Road	1617	2435	2435	30
South of Dairy Road	1783	2931	2938	55
Hanakai Street				
Haleakala Hwy. to Hana Hwy.	36	46	46	30
South of Hana Hwy.	269	282	282	30
Keolani Place				
Aalele St. to Haleakala Hwy.	1219	1259	916	30
Dairy Road				
Haleakala Hwy. to Hana Hwy.	874	2104	1231	30
South of Hana Hwy.	1643	3561	1589	30
Airport Access Rd.				
Keolani Pl. to Hana Hwy.	0	0	1541	55
Hana Hwy. to Dairy Road	0	0	2144	55
Dairy Road to Puunene Ave.	0	0	3553	55
Kuihelani Hwy.				
West of Puunene Ave.	983	1420	2354	55
Hansen Road				
North of Hana Hwy.	0	0	100	55
Hana Hwy. to Pulehu Road	308	485	613	55
Pulehu Road to Puunene Ave.	359	556	556	55

TABLE 3
DISTANCE TO FEDERAL PEAK HOUR LEQ NOISE STANDARD (EXISTING A.M.)

ROADWAY SEGMENT	DISTANCE TO 67 dB LEQ CONTOUR FROM ROADWAY CENTERLINE Meters (feet)
Aalele Street.	
Keolani Place to Haleakala Hwy.	2.6 (8)
Haleakala Hwy.	
Hana Hwy. to Hanakai St.	5.5 (18)
Hanakai St. to Keolani Place	5.9 (19)
Keolani Place to Aalele St.	2.2 (7)
Aalele St. to Hana Hwy.	3.1 (10)
East of Hana Hwy.	40.0 (131)
Hana Highway	
Harbor Ave. to Haleakala Hwy.	16.8 (55)
Haleakala Hwy. to Hanakai St.	14.7 (48)
Hanakai St. to Dairy Road	14.9 (49)
Dairy Road to Pulehu Road (Airport Access Rd.)	47.3 (155)
Pulehu Road (Airport Access Rd.) to Hansen Road	46.0 (151)
Hansen Road to Haleakala Hwy.	49.3 (162)
East of Haleakala Hwy.	24.0 (79)
Pulehu Road	
Hana Hwy. to Hansen Road	3.4 (11)
South of Hansen Road	5.4 (18)
Puunene Avenue	
E. Kamehameha Ave. to Dairy Road	12.4 (41)
South of Dairy Road	29.6 (97)
Hanakai Street	
Haleakala Hwy. to Hana Hwy.	1.0 (3)
South of Hana Hwy.	3.0 (10)
Keolani Place	
Aalele St. to Haleakala Hwy.	8.3 (27)
Dairy Road	
Haleakala Hwy. to Hana Hwy.	5.1 (17)
South of Hana Hwy.	10.6 (35)
Airport Access Rd.	
Keolani Pl. to Hana Hwy.	0.0 (0)
Hana Hwy. to Dairy Road	0.0 (0)
Dairy Road to Puunene Ave.	0.0 (0)
Kuihelani Hwy.	
West of Puunene Ave.	18.0 (59)
Hansen Road	
North of Hana Hwy.	0.0 (0)
Hana Hwy. to Pulehu Road	11.2 (37)
Pulehu Road to Puunene Ave.	11.9 (39)

TABLE 4
DISTANCE TO FEDERAL PEAK HOUR LEQ NOISE STANDARD (EXISTING P.M.)

ROADWAY SEGMENT	DISTANCE TO 67 dB LEQ CONTOUR FROM ROADWAY CENTERLINE Meters (feet)	
Aalele Street		
Keolani Place to Haleakala Hwy.	2.5	(8)
Haleakala Hwy.		
Hana Hwy. to Hanakai St.	7.0	(23)
Hanakai St. to Keolani Place	7.2	(24)
Keolani Place to Aalele St.	2.6	(9)
Aalele St. to Hana Hwy.	4.2	(14)
East of Hana Hwy.	37.9	(124)
Hana Highway		
Harbor Ave. to Haleakala Hwy.	17.9	(59)
Haleakala Hwy. to Hanakai St.	15.0	(49)
Hanakai St. to Dairy Road	15.3	(50)
Dairy Road to Pulehu Road (Airport Access Rd.)	46.5	(152)
Pulehu Road (Airport Access Rd.) to Hansen Road	45.5	(149)
Hansen Road to Haleakala Hwy.	48.3	(159)
East of Haleakala Hwy.	27.0	(89)
Pulehu Road		
Hana Hwy. to Hansen Road	4.6	(15)
South of Hansen Road	6.4	(21)
Puunene Avenue		
E. Kamehameha Ave. to Dairy Road	11.7	(38)
South of Dairy Road	32.7	(107)
Hanakai Street		
Haleakala Hwy. to Hana Hwy.	0.9	(3)
South of Hana Hwy.	3.0	(10)
Keolani Place		
Aalele St. to Haleakala Hwy.	9.7	(32)
Dairy Road		
Haleakala Hwy. to Hana Hwy.	7.8	(25)
South of Hana Hwy.	11.8	(39)
Airport Access Rd.		
Keolani Pl. to Hana Hwy.	0.0	(0)
Hana Hwy. to Dairy Road	0.0	(0)
Dairy Road to Puunene Ave.	0.0	(0)
Kuihelani Hwy.		
West of Puunene Ave.	22.0	(72)
Hansen Road		
North of Hana Hwy.	0.0	(0)
Hana Hwy. to Pulehu Road	10.2	(33)
Pulehu Road to Puunene Ave.	11.2	(37)

3.0 POTENTIAL NOISE IMPACTS

An important part of a noise analysis is the identification of noise-sensitive land uses that may be impacted by the proposed project. This would include any residential properties, schools, or other noise-sensitive land uses adjacent to the existing or projected roadways that will carry project generated traffic. There are no existing residential or other noise-sensitive land uses adjacent to the project, however, there are residential and other noise-sensitive land uses along the roadways which will be effected by the project. These land uses may need some form of noise mitigation due to project related increases in traffic noise.

Representative noise sensitive receptors have also been identified in the vicinity of the project site, and will be used to assess the potential noise impacts. Sensitive receptors are considered residential or other noise sensitive land uses that may be affected by the proposed project. The noise sensitive receptors include existing residential land uses along the roadways which will accommodate project related traffic. The representative noise sensitive receptors are shown in Exhibit 3. The residential tract located at the first noise sensitive receptor location is shown in detail on Exhibit 3a.

Two types of potential noise impacts may arise from the project: (1) construction noise may impact adjacent residential land uses, and (2) the project will increase traffic and will increase the noise environment at the adjacent areas.

3.1 Construction Noise

Construction noise will occur as a result of the development of the proposed project and its potential noise impacts must be considered. Construction noise represents a short-term impact on ambient noise levels. Every effort must be made to ensure that during construction excessive noise is not produced. Noise generated by construction equipment and construction activities can reach high levels. Construction equipment noise comes under the control of the Environmental Protection Agency's Noise Control Program (Part 204 of Title 40, Code of Federal Regulations). Presently, air compressors are the only equipment under strict regulation, and no new regulations are currently under consideration. Exhibit 4 presents the noise levels (referenced to 50 feet) generated by typical construction equipment. At 200 feet, the noise levels shown in Exhibit 4 are approximately 12 dBA less; at 1000 feet, the levels are 25 dBA less.

The only potential impact construction noise will have on existing residential land uses is along the proposed new Airport Access Road east of Puunene Avenue. If noise problems caused by construction activities do arise, the most effective method of controlling construction noise is through local control of construction hours. Most cities and counties have adopted as part of their Noise Ordinance limits on the hours of construction and excavation work.

3.2 Long Term Impacts

3.2.1 Future Noise Levels

Long Term impacts are determined by comparing noise levels for future conditions with and without the project with existing noise levels that were determined in the Existing Noise Environment section.

Future traffic noise levels around the project site were determined from volumes obtained from the traffic engineer and the FHWA Highway Traffic Noise Prediction Model (described in the Existing Noise Environment section). The traffic data used to project future noise levels were shown in Tables 1 & 2. Traffic mix assumptions remain the same as for existing conditions.

The distances to the Peak Hour LEQ contours for each of the roadways around the project site (both with and without the project) are given in Tables 5 & 6. They represent the distance from the centerline of the road to the 67 dB LEQ contour, listed in meters as well as in feet. Note that the values given in Tables 5 & 6 do not take into account the effects of any noise barriers, topography, or intervening buildings that will alter the noise level projections. These effects are included in the subsequent section.

3.2.2 Representative Receptor Analysis

The noise impacts were also analyzed in terms of the changes to the noise levels on potential future residential and other noise sensitive land uses adjacent to the project. In order to quantify the noise impacts, representative locations were selected for determining the noise levels that are estimated for both with and without the proposed project. They are listed below and are the same locations identified in Exhibit 3.

- #1 Kuihelani Hwy. east of Puunene Ave. - Single family residential
- #2 Puunene Ave. south of Kuihelani Hwy. - Sugar cane museum
- #3 Hana Hwy. east of Old Stable Rd. - Low density residential

The first receptor is located about 115 feet from the centerline of Kuihelani Highway and represents the greatest potential for noise impacts. The second receptor is about 400 feet east of the centerline of Puunene Ave., while the third is in excess of 400 from the centerline of Hana Hwy..

Tables 7 & 8 depicts the Peak Hour LEQ noise levels for each of these representative locations for the morning and evening peak hours respectively. The exterior noise level exposure at each of these locations was determined for existing and future traffic conditions for both with and without the expansion of the airport. The results of the analysis show that at some locations, without mitigation, future noise levels without the project will be are greater than the 67 Peak Hour LEQ criteria for residential land uses.

TABLE 5
DISTANCE TO FEDERAL PEAK HOUR LEQ NOISE STANDARD
(A.M. FUTURE - 2020)

ROADWAY SEGMENT	DISTANCE TO 67 LEQ FROM CENTERLINE Without Project Meters (feet)		With Project Meters (feet)	
Aalele Street				
Keolani Place to Haleakala Hwy.	0.0	(0)	0.0	(0)
Haleakala Hwy.				
Hana Hwy. to Hanakai St.	7.1	(23)	5.5	(18)
Hanakai St. to Keolani Place	7.3	(24)	5.7	(19)
Keolani Place to Aalele St.	3.0	(10)	1.8	(6)
Aalele St. to Hana Hwy.	4.9	(16)	0.0	(0)
East of Hana Hwy.	53.9	(177)	53.8	(176)
Hana Highway				
Harbor Ave. to Haleakala Hwy.	13.5	(44)	18.8	(62)
Haleakala Hwy. to Hanakai St.	19.7	(65)	20.6	(68)
Hanakai St. to Dairy Road	19.6	(64)	20.5	(67)
Dairy Road to Pulehu Road (Airport Access Rd.)	63.2	(207)	54.3	(178)
Pulehu Road (Airport Access Rd.) to Hansen Road	62.3	(204)	65.7	(215)
Hansen Road to Haleakala Hwy.	66.8	(219)	68.6	(225)
East of Haleakala Hwy.	32.9	(108)	32.8	(108)
Pulehu Road				
Hana Hwy. to Hansen Road	4.6	(15)	0.0	(0)
South of Hansen Road	7.3	(24)	7.3	(24)
Puunene Avenue				
E. Kamehameha Ave. to Dairy Road	16.2	(53)	16.2	(53)
South of Dairy Road	40.7	(134)	40.9	(134)
Hanakai Street				
Haleakala Hwy. to Hana Hwy.	1.2	(4)	1.2	(4)
South of Hana Hwy.	3.5	(12)	2.4	(8)
Keolani Place				
Aalele St. to Haleakala Hwy.	13.2	(43)	6.9	(22)
Dairy Road				
Haleakala Hwy. to Hana Hwy.	11.2	(37)	5.0	(16)
South of Hana Hwy.	17.5	(58)	9.1	(30)
Airport Access Rd.				
Keolani Pl. to Hana Hwy.	0.0	(0)	28.6	(94)
Hana Hwy. to Dairy Road	0.0	(0)	38.2	(125)
Dairy Road to Puunene Ave.	0.0	(0)	46.2	(152)
Kuihelani Hwy.				
West of Puunene Ave.	34.1	(112)	34.0	(112)
Hansen Road				
North of Hana Hwy.	0.0	(0)	16.1	(53)
Hana Hwy. to Pulehu Road	14.4	(47)	16.1	(53)
Pulehu Road to Puunene Ave.	15.8	(52)	15.8	(52)

TABLE 6
DISTANCE TO FEDERAL PEAK HOUR LEQ NOISE STANDARD
(P.M. FUTURE - 2020)

ROADWAY SEGMENT	DISTANCE TO 67 LEQ FROM CENTERLINE Without Project Meters (feet)		With Project Meters (feet)	
Aalele Street				
Keolani Place to Haleakala Hwy.	0.0	(0)	0.0	(0)
Haleakala Hwy.				
Hana Hwy. to Hanakai St.	8.3	(27)	6.2	(20)
Hanakai St. to Keolani Place	9.0	(30)	6.9	(23)
Keolani Place to Aalele St.	6.2	(20)	5.3	(18)
Aalele St. to Hana Hwy.	5.1	(17)	0.0	(0)
East of Hana Hwy.	47.5	(156)	47.3	(155)
Hana Highway				
Harbor Ave. to Haleakala Hwy.	22.9	(75)	22.9	(75)
Haleakala Hwy. to Hanakai St.	19.5	(64)	20.9	(68)
Hanakai St. to Dairy Road	20.2	(66)	20.8	(68)
Dairy Road to Pulehu Road (Airport Access Rd.)	50.4	(165)	54.0	(177)
Pulehu Road (Airport Access Rd.) to Hansen Road	58.9	(193)	62.0	(203)
Hansen Road to Haleakala Hwy.	62.9	(206)	56.8	(186)
East of Haleakala Hwy.	35.7	(117)	35.6	(117)
Pulehu Road				
Hana Hwy. to Hansen Road	5.7	(19)	0.0	(0)
South of Hansen Road	8.6	(28)	8.6	(28)
Puunene Avenue				
E. Kamehameha Ave. to Dairy Road	15.4	(50)	15.4	(50)
South of Dairy Road	45.6	(150)	45.7	(150)
Hanakai Street				
Haleakala Hwy. to Hana Hwy.	1.1	(4)	1.1	(4)
South of Hana Hwy.	3.6	(12)	3.6	(12)
Keolani Place				
Aalele St. to Haleakala Hwy.	9.9	(32)	8.0	(26)
Dairy Road				
Haleakala Hwy. to Hana Hwy.	13.9	(46)	9.7	(32)
South of Hana Hwy.	19.8	(65)	11.5	(38)
Airport Access Rd.				
Keolani Pl. to Hana Hwy.	0.0	(0)	29.7	(97)
Hana Hwy. to Dairy Road	0.0	(0)	37.0	(121)
Dairy Road to Puunene Ave.	0.0	(0)	51.9	(170)
Kuihelani Hwy.				
West of Puunene Ave.	28.1	(92)	39.4	(129)
Hansen Road				
North of Hana Hwy.	0.0	(0)	4.8	(16)
Hana Hwy. to Pulehu Road	13.7	(45)	16.1	(53)
Pulehu Road to Puunene Ave.	15.1	(49)	15.1	(49)

TABLE 7
MORNING PEAK HOUR LEQ NOISE LEVELS
AT REPRESENTATIVE RECEPTOR LOCATIONS

Site	Existing	Peak Hour LEQ Noise Level Future No Project	Future With Project.
1A	65.6	68.8	68.8
1B	65.6	68.8	68.8
1C	65.9	69.1	68.6
1D	67.0	70.3	66.3
1E	69.4	72.6	67.0
1F	73.1	76.4	72.5
2	57.8	59.9	59.9
3	56.5	58.5	58.5

TABLE 8
EVENING PEAK HOUR LEQ NOISE LEVELS
AT REPRESENTATIVE RECEPTOR LOCATIONS

Site	Existing	Peak Hour LEQ Noise Level Future No Project	Future With Project.
1A	66.2	69.6	69.6
1B	66.2	69.6	69.6
1C	66.5	69.9	69.3
1D	67.7	71.1	67.0
1E	70.1	73.4	68.2
1F	73.8	77.2	74.0
2	58.5	60.6	60.6
3	57.2	59.0	59.0

The analysis shows that there will be some increase in the noise levels due to the project. These increases range from ·2.4 to 3.4 dB compared to existing, and from -5.6 to 0 dB compared to the future no-project case. The reason the noise level decreased, is partly because the peak noise hour for that stretch of roadway decreased about 4 percent. The realignment of the roadways in this area (Dairy Road and Airport Access Road) also account for the decrease in future noise levels.

Generally, it takes a 1 to 3 dB increase in the community noise level to be distinguished by the human ear. FHWA in its "Highway Traffic Noise Analysis and Abatement Policy and Guidance," June 1995 the following descriptions of changes of noise levels:

Sound Level Change	Relative Loudness
3 dBA	Barely perceptible change
5 dBA	Readily Perceptible change

Increase (dBA)	Subjective Descriptor
0 - 5	No increase
5 - 10	Minor Increase
10 - 15	Moderate Increase
> 15	Substantial Increase

Thus, the project does result some perceptible increases in the noise environment, but it is not a substantial increase.

With the project, the increase in future noise levels exceeds the 67 dB LEQ noise criteria at one area of residential receptor locations. FAPG 23 CFR 772 defines a *Traffic Noise Impact* as "Impacts which occur when the predicted traffic noise levels approach or exceed the noise abatement criteria, or when the predicted traffic noise levels substantially exceed the existing noise levels." Because future traffic noise levels approach and exceed the noise abatement criteria, mitigation that is reasonable and feasible will be considered for this residential area.

4.0 MITIGATION MEASURES

The noise sensitive land uses that are located adjacent to roadways affected by the project will exceed FHWA noise criteria. Therefore, measures should be considered that will reduce noise a reasonable amount. For purposes of considering a noise barrier design a reasonable amount is considered to be a noise reduction of 5 to 10 dBA.

Analysis indicates that at the worst case location, Site 1F, a noise barrier 6.5 feet in height relative to the pad elevation will reduce the peak noise level to about 65.6 dBA LEQ, a reduction in excess of 8 dBA. This wall height is based on the assumption that the topography between the houses and the roadway is essentially flat. If the pad elevation of the homes is higher than the roadway, then the wall will need to be located at the top of the slope by the residential property line. If the roadway elevation is higher, then the wall will need to be located at the top of the slope adjacent to the roadway. If the wall cannot be located at highest of either elevation, pad or roadway, then the wall height may have to be increased in order to provide the required mitigation.

Mitigation through the design and construction of a noise barrier (wall, berm, or combination wall/berm) is the most common way of alleviating traffic noise impacts. The effect of a noise barrier is critically dependent on the geometry between the noise source and the receiver. A noise barrier effect occurs when the "line of sight" between the source and receiver is broken by the barrier. The greater the distance the sound must travel around the barrier in order to reach the receiver, the greater the noise reduction of the barrier. A barrier which does not break the line-of-sight is not an effective barrier, while one which just interrupts the line-of-sight achieves a 5 dB reduction in noise.

As part of the widening project for Airport Access Road north of Puunene Ave., and design engineering is finalized, a noise barrier consisting of a 6.5 foot high block or other solid wall adjacent to the residential tract should be evaluated as part of the project. Final design of a noise barrier should be based on detailed elevation data for the roadway and the adjacent homes. Such a barrier should be considered along the rear of the homes between Puunene Avenue and Hukilike Street.

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Exhibit 1
Kahului Airport Vicinity Map

ACTIVITY CATEGORY	DESIGN NOISE LEVEL - LEQ	DESCRIPTION OF ACTIVITY CATEGORY
A	57 (Exterior)	Tracts of land in which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of open spaces, or historic districts which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas and parks which are not included in category A and residences, motels, hotels, public meeting rooms, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Category A or B above.
D	-	Undeveloped Lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: Code of Federal Regulations (23 CFR 772)

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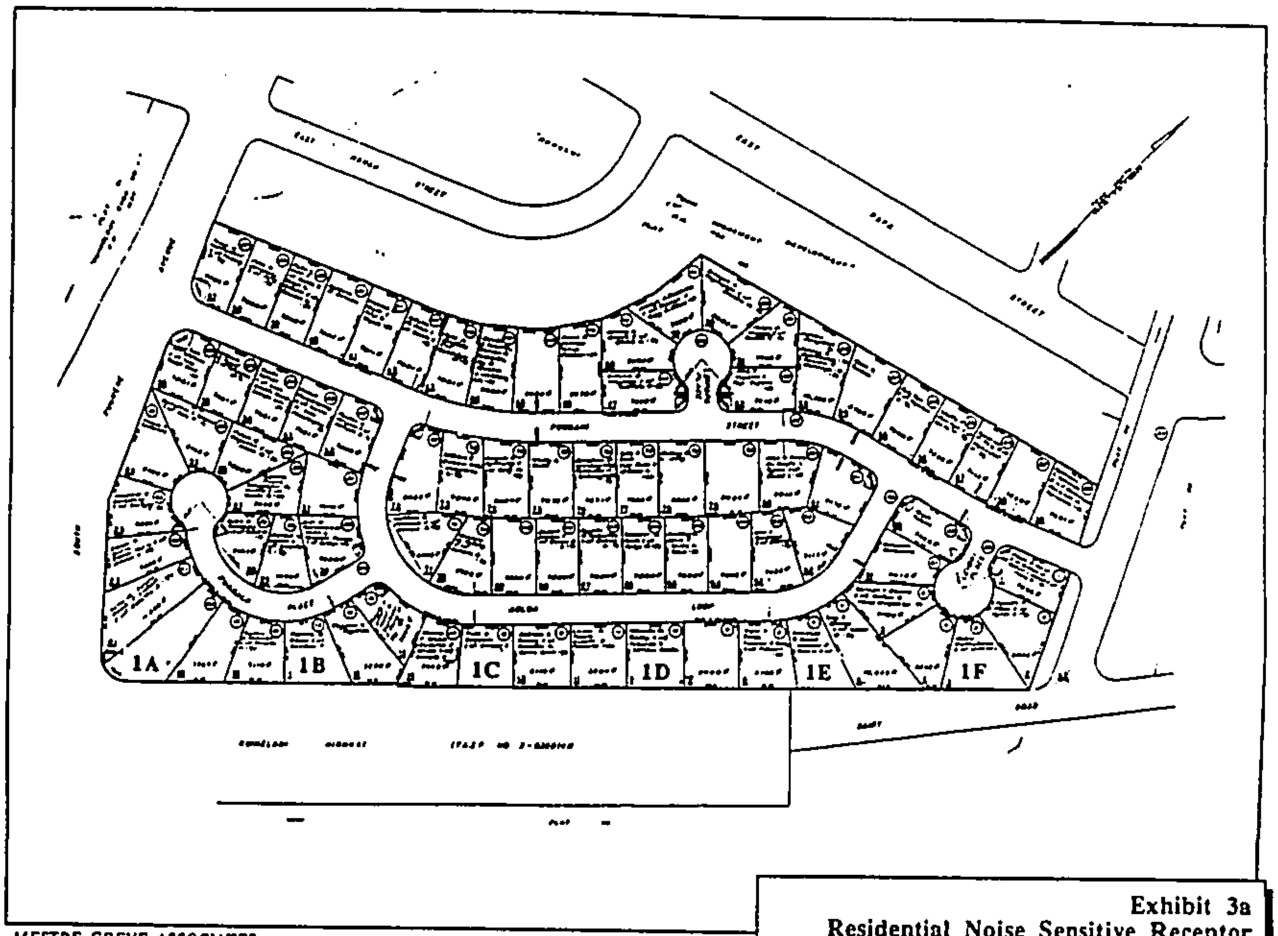
Exhibit 2
FHWA Noise Abatement Criteria



MESTRE GREVE ASSOCIATES

Exhibit 3a
Residential Noise Sensitive Receptor

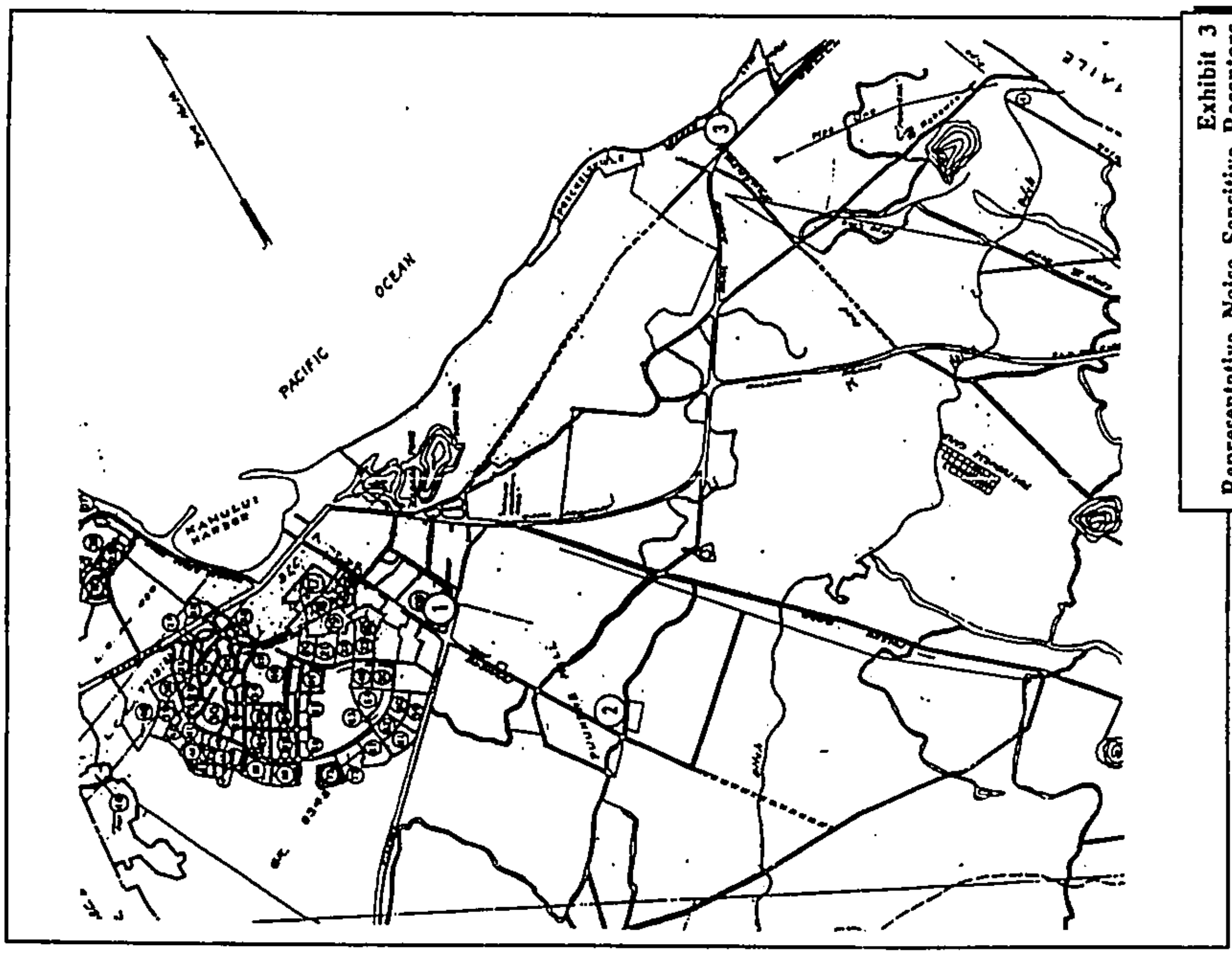
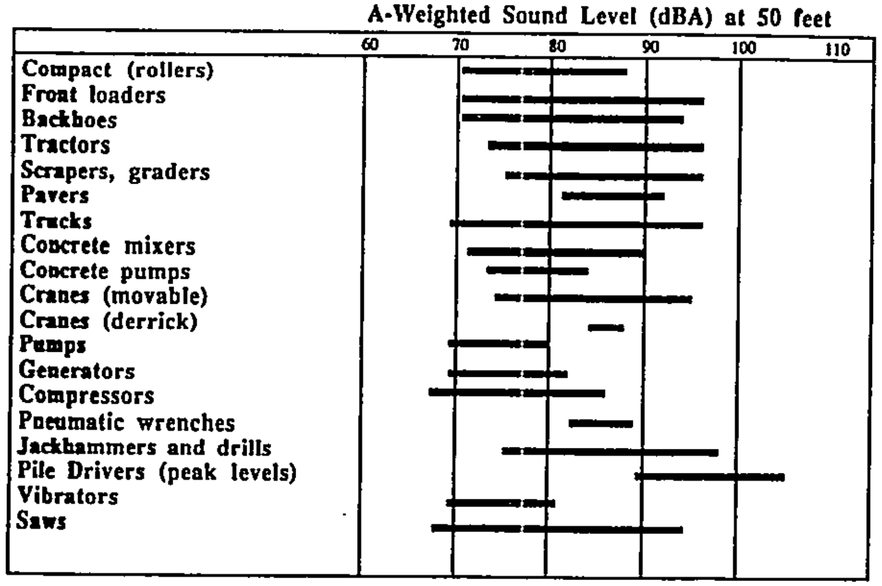


Exhibit 3
Representative Noise Sensitive Receptors

MESTRE GREVE ASSOCIATES



Source: "Handbook of Noise Control," by Cyril Harris, 1979.

MESTRE GREVE ASSOCIATES

Exhibit 4
Typical Construction Noise Levels

AIR QUALITY STUDY
FOR THE YEAR 2020 TRAFFIC
IN THE VICINITY OF KAHULUI AIRPORT

KAHULUI, MAUI

Prepared for:

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November 10, 1995

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1.0 SUMMARY

The State of Hawaii (State) Department of Transportation is proposing to provide improvements at Kahului Airport to accommodate forecast aviation demand and to optimize airport operations. Major elements of the improvement plan include extension of Runway 2-20, the possible addition of a parallel runway, construction of a new airport access road and major changes to the area roadway system adjacent to and within the airport. The project is intended to provide needed facilities through the year 2010. An air quality study has previously been prepared to assess air quality impacts of the project, including those due to both aircraft operations and roadway traffic, through that year. This air quality study augments the previous 2010 study and examines the potential short- and long-term air quality impacts related to roadway traffic that would occur with or without the proposed project to the year 2020. Mitigative measures to lessen traffic-related project impacts are suggested where possible and appropriate.

At the present time, air quality standards have been established by both federal and State governments which limit ambient concentrations of particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. In addition, a State standard has been established for hydrogen sulfide. The Hawaii air quality standards are more stringent than the comparable national limits except for the standards for sulfur dioxide, particulate matter and lead, which are set at the same levels.

In areas that do not meet national ambient air quality standards, Conformity Rules apply. Conformity Rules were issued by the federal Environmental Protection Agency in response to Section 176 of the Clean Air Act. Conformity Rules prohibit any federal agency from engaging in any actions that do not conform to any state's

plan to correct nonattainment situations. The entire State of Hawaii is considered to be an attainment area for all air quality standards. Thus, Conformity Rules are currently not applicable.

Before assessing potential air quality impacts from the roadway portion of the proposed project, the existing environment was characterized. Kahului Airport is located along the north shore of the island of Maui in the valley between the two large mountain masses that form the island. The predominant land uses around the airport are industrial or agricultural with some small residential and preservation areas. The climate is very equitable year-round with little variation in temperature range. Winds from the northeast have a high frequency of occurrence, and mean wind speeds are relatively high providing good ventilation much of the time. Rainfall is relatively low and occurs mostly during the winter months.

The major sources of manmade air pollution on the island are power plants, motor vehicles and agricultural activities. Aircraft emissions represent a relatively small percentage of total emissions. Natural sources of air pollution that may affect the air quality of the island include the ocean, plants, wind-blown dust and distant volcanoes. Air quality monitoring data for Maui suggest that background ambient air pollution is very low except possibly for concentrations of ozone and particulate matter. All data collected indicate that both State and national ambient air quality standards are currently being achieved.

If the proposed project is given the necessary approvals to proceed, it is probably inevitable that short-term impacts from fugitive dust will occur during roadway construction projects. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions beyond the construction site boundary. Hence, an effective dust control plan must be implemented to ensure compliance with State regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied haul trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Landscaping of project areas early in the construction schedule will also reduce dust emissions. Exhaust emissions can be mitigated by minimizing road closures during peak-traffic hours and by moving construction equipment and workers to and from construction areas during off-peak traffic periods.

To assess the potential long-term impacts of roadway traffic associated with the project, an air quality modeling study was undertaken to estimate both current and future (year 2020) worst-case concentrations of carbon monoxide in the vicinity of the airport. The study focused on carbon monoxide because this is the parameter most likely to exceed ambient air quality standards when intersections become congested with traffic. Several intersections (both existing and future) were studied. These included: Hana Highway at Dairy Road, Hana Highway at Haleakala Highway, Puunene Avenue at Kuihelani Highway, the proposed airport access road at iry Road, Hana Highway at Hansen-Spine Road, and the proposed airport access road at Hana Highway. The proposed airport access road intersection at Hana Highway was studied both as an at-grade intersection and as a highway interchange, and both two-loop cloverleaf and conventional diamond interchange configurations were considered.

The results of the air quality modeling study indicated that worst-case carbon monoxide concentrations could currently exceed air quality standards in the vicinity of high-volume, congested intersections such as Hana Highway at Haleakala Highway, Hana Highway at Dairy Road, and Puunene Avenue at Kuihelani Highway. In the year 2020 without the project, even with planned roadway improvements at some locations, worst-case concentrations at these intersections would likely increase substantially and further exceed air quality standards.

Due to project-related roadway improvements, worst-case concentrations in the year 2020 with the project compared to without it were predicted to decrease substantially near the three existing intersections mentioned above, but concentrations would still potentially exceed air quality standards. Worst-case concentrations near the new intersections of the airport access road at Dairy Road and Hana Highway at Hansen-Spine Road were predicted to meet the national standards but to exceed the more stringent State standards. If an at-grade intersection is constructed at the intersection of Hana Highway and the new airport access road, the air quality model results indicate that both State and national standards could potentially be exceeded. If a conventional diamond interchange were constructed at this location instead, maximum concentrations would be appreciably reduced but would still potentially exceed both State and national standards. If a two-loop cloverleaf interchange were built, maximum concentrations would be substantially lower than the conventional diamond configuration and would be well within both State and national standards. In comparing the predicted worst-case concentrations to the State standards, it should be noted that with the standards set at such stringent levels, it is likely that they are currently exceeded at many locations in the State where there are even moderate volumes of traffic.

While air quality problems are indicated at some locations in the airport vicinity, it may be concluded that project-related traffic would not be a significant contributor if the traffic mitigation measures proposed in the project traffic study are implemented. This is particularly so if the two-loop cloverleaf interchange alternative is selected for the intersection of the new airport access road and Hana Highway.

Although the proposed project would not significantly affect air quality at offsite roadway intersections where potential problems may occur and the proposed development may not have any control over these locations, some mitigation measures can be suggested: (1) roadway capacity could be added at those locations where the traffic level of service is poor; (2) roadway speed limits could be reduced at those locations where the high speed limits, above 35 mph (56 kph), cause excessive acceleration emissions; (3) traffic signals could be optimized and/or coordinated to reduce traffic queuing; (4) buffer zones could be provided between sidewalks and roadways; (5) bus service could be promoted for arriving and departing airport passengers; and (6) if feasible, air carrier schedules could be coordinated to minimize airport-related traffic during peak commute hours.

INTRODUCTION AND PROJECT DESCRIPTION

The Airports Division of the State of Hawaii Department of Transportation (HDOT-A) is proposing a Master Plan Update for Kahului Airport [Ref. 1] to provide the improvements necessary to ensure safe, efficient, economical and convenient air transportation facilities for residents of and visitors to the State and the island of Maui through the year 2010. As indicated in Figure 1, Kahului Airport is situated along the north central coast of Maui Island near the urban areas of Kahului and Wailuku. Presently, the

airport is comprised of two runways and associated taxiways and aircraft parking aprons. The preferred plan for airport improvements as detailed in the Master Plan Update calls for the extension of the main runway, the relocation of helicopter operations to an offsite location, the eventual construction of a new parallel runway, the construction of a new airport access road, and other airport improvements.

An air quality study has previously been prepared to assess air quality impacts of the project, including those due to both aircraft operations and roadway traffic, through the year 2010 [Ref. 2]. The purpose of this study was to augment the preceding 2010 study and examine the potential short- and long-term air quality impacts of roadway traffic that could occur with or without the project to the year 2020. It should be noted, however, that the results of this current study and the previous 2010 study cannot be considered strictly comparable because of the different underlying traffic assumptions made in the two cases. All references in this report to "project" refer collectively to both airport improvements and associated roadway improvements to the year 2020. Traffic data for this study were provided by Wilbur Smith Associates in its Year 2020 Traffic Assessment of Kahului Airport Access Road, October 1995 (Draft) [Ref. 3].

Another purpose of this study was to recommend mitigative measures, if possible and appropriate, to reduce or eliminate any degradation of air quality in the project area. Before examining the potential air quality impacts of roadway traffic associated with the proposed project and any potential mitigation measures, a discussion of regulatory requirements and ambient air quality standards is presented and background information is provided concerning the existing physical environment of the project.

3.0 REGULATORY REQUIREMENTS

With respect to air pollution emissions from roadway traffic, the proposed project must not contribute to the exceedance of State and national ambient air quality standards. In addition, federal actions in any given state must conform to the federally mandated State Implementation Plan in areas that do not currently meet national ambient air quality standards.

3.1 Ambient Air Quality Standards

Ambient concentrations of air pollution are regulated by both national and State ambient air quality standards (AAQS). National AAQS are specified in Title 40, Part 50 of the Code of Federal Regulations, while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the State AAQS that are specified in the cited documents. As indicated in the table, national and State AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The State has also set a standard for hydrogen sulfide. National AAQS are stated in terms of primary and secondary standards. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and State standards allow one exceedance per year.

State of Hawaii AAQS are in some cases considerably more stringent than comparable national AAQS. In particular, the State of Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit, and the State 1-hour limit for ozone is less than one-half of the federal standard.

Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the State standards essentially the same as the national limits. In 1993, the State also revised its particulate standards to follow those set by the federal government. It has been proposed in various forums that the State also relax its carbon monoxide standards to the national levels, but at present there are no indications that such a change is being considered.

3.2 Air Quality Conformity

Section 176 of the Clean Air Act and subsequent rules issued by EPA require that federal agencies must demonstrate projects which they fund, approve, permit or authorize do not cause new violations of federal air quality standards, aggravate existing violations of air quality standards or delay timely attainment. More specifically, federal agencies are prohibited from engaging in or supporting in any way actions or activities that do not conform to an applicable State Implementation Plan (SIP). Each state's SIP is meant to ensure that national ambient air quality standards will be achieved and maintained.

Currently, conformity rules as issued by EPA only pertain to areas that are classified as nonattainment, i.e., those areas that do not meet federal air quality standards. The entire State of Hawaii is considered to be an attainment area for all federal air quality standards. Thus, the conformity rules pertaining to federal actions are not currently applicable. However, some interpretations of Section 176 of the Clean Air Act have suggested that Congress meant to extend conformity requirements to both attainment and nonattainment areas. EPA has recently been sued on this issue and may be required to promulgate conformity rules that include attainment areas.

4.0 EXISTING ENVIRONMENT

4.1 Location and Topography

Kahului Airport is located on the north central coast of the island of Maui near Kahului Bay. The Pacific Ocean lies within 1000 ft (305 m) of the airport's northern perimeter. The topography of this general area of Maui is probably best characterized as a broad valley which connects East and West Maui. East Maui is essentially comprised of the huge volcanic mountain, Haleakala. Haleakala rises gradually to the southeast of the airport to an elevation of approximately 10,000 ft (3048 m) within about 17 mi (27 km). The West Maui Mountains, about 5 mi (8 km) directly to the west, rise abruptly to an elevation of about 5800 ft (1768 m). The valley formed between the two mountain ranges has a relatively flat floor

and is about 10 mi (16 km) wide between the mountains and about 7 mi (11 km) across at the narrowest point between the north and south shores. Elevation at the airport is about 53 ft (16 m) above mean sea level.

4.2 Land Use

Land uses surrounding the airport include a mixture of developed and undeveloped areas. The immediate areas to the west within the airport boundaries include mostly industrial and light-industrial/commercial developments. Beyond this, about 1 mile (1.6 km) from the main terminal, is the Kanaha Pond and Wildlife Sanctuary. The urban center of Kahului town is located adjacent to Kanaha Pond less than 2 mi (3.2 km) west of the terminal. The coastline and Kanaha Beach Park lie immediately to the north, while the small residential community of Spreckelsville is situated about 1 mile (1.6 km) to the northeast. The immediate areas to the east and south of the airport are predominantly in agricultural use and planted in sugar cane. Puunene, a small residential/industrial area, is located about 2 mi (3.2 km) to the southwest.

4.3 Climatology and Meteorology

Regional and local climatology significantly affect the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the State, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the State are caused by the mountainous topography.

Climatic normals, means and extremes for the Kahului Airport based on long-term data collected by the National Weather Service are summarized in Table 2. The outstanding features of the climate of the Kahului area are the equable temperature regime, the marked seasonal variation in rainfall, the persistent surface winds from the northeast quadrant, and the rarity of severe storms. The extremely equable temperatures at Kahului are illustrated by the relatively small range in normal temperature between the warmest month, August, at 79.2°F (26.2°C) and the coldest month, January, at 71.5°F (21.9°C). Annual average temperature is 75.5°F (24.2°C). Rainfall is normally relatively light and occurs mostly during the w . season which extends from November through April. Annual rainfall normally amounts to about 20 in. (51 cm). Humidity at Kahului is usually moderate to high throughout the year.

The large Pacific semipermanent high pressure cell, which is usually centered north of the Hawaiian Islands, is responsible for the persistent northeasterly trade winds which dominant the wind pattern at Kahului and give the area a well-ventilated characteristic. The tradewind flow is most prevalent during the dry season. Winds are more variable during the wet season although, on the average, the trades still blow more than 50 percent of the time during this period. The normal trade winds, accentuated by the funneling effect between Haleakala and the West Maui Mountains, as well as by the daytime thermally induced low pressure in the valley, often attain speeds of 40 to 45 mph (64 to 72 kph) at the airport. Occasional strong winds from the south (Kona winds) occur with the passage of storms during the winter months. Figure 2 is a wind rose for Kahului Airport which graphically depicts the annual frequency of wind speeds and directions based on hourly weather data collected during 1983. These data are also shown in tabular format in Table 3.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is oftentimes measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Kahului area, stability class 5 or 6 is generally the highest stability class that occurs, developing during clear, calm nighttime or early morning hours when temperature inversions form due to radiational cooling or when drainage winds from the mountains force warmer air aloft. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of sea breeze conditions.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in Hawaii typically are above 3000 ft (1000 m).

4.4 Air Quality

The air quality of a given location is a function of both the local meteorology and the types and amounts of air pollutants emitted from sources in the area. Present air quality in the project area is mostly affected by air pollution emissions from vehicular, industrial, natural and/or agricultural sources. Table 4 presents an air pollutant emission inventory by source category for Maui County that was compiled for 1980 by the State Department of Health. This is the latest emission inventory available from the Department of Health for Maui County. In 1980, as suggested in the table, agriculture was the most significant source category for emissions of particulate matter. Sulfur dioxide emissions originated mainly from electric power plants, while motor vehicles accounted for much of the emissions of nitrogen oxides, carbon monoxide and hydrocarbons. Agricultural field burning also contributed relatively large amounts of carbon monoxide and hydrocarbons. Emissions from aircraft were relatively small compared to emissions attributable to other source categories on the island.

Due to the long period of time that has elapsed since the Department of Health emission inventory was prepared, an attempt has been made specifically for this study to prepare a more current Maui emission inventory. Table 5 is an estimated emission inventory for Maui Island for 1992. This was compiled based on source information on file at the Department of Health, U.S. Environmental Protection Agency emission factors, and statistics given in the State of Hawaii Data Book 1992. As indicated in the table, agriculture continues to be the major source of particulate emissions on the island, and the level of emissions has increased by about 25 percent since 1980. Similar to 1980, electric power plants accounted for most of the sulfur oxides emissions, showing an increase of more than 50 percent compared to 1980. Note,

however, that the 1980 source category is indicated as "steam" electric power plants while the 1992 estimate includes all electric power plant emissions.

Emission estimates for 1992 indicate that electric power plants (all types) is the most significant nitrogen oxides source category on Maui and that emissions are about four times higher compared to the 1980 steam electric estimates. This is because most of the new generation units added since 1980 are non-steam units (i.e., diesel or combustion turbine units) which mainly emit nitrogen oxides. As in 1980, motor vehicles and the agriculture industry account for most of the carbon monoxide emissions on the island. This is despite the fact that compared to 1980 motor vehicle emissions of carbon monoxide are estimated to have decreased by about 15 percent even though traffic volumes have increased substantially since that time. This is due to the improved emission control devices that are present on late-model vehicles. Carbon monoxide emissions from agricultural field burning have increased by about 25 percent. Hydrocarbon emissions in 1992 were estimated to originate primarily from motor vehicles and from agricultural field burning. Aircraft emissions of nitrogen oxides and hyrdocarbons during 1992 increased by about a factor of about two to three compared to 1980 while carbon monoxide emissions may have decreased slightly. The decrease in carbon monoxide emissions is probably due to the increased usage of jet turbine aircraft which emit relatively low amounts of this pollutant. Aircraft emissions during 1992 continued to represent a relatively small percentage of total emissions for Maui Island.

The emission estimates given in Tables 4 and 5 include only manmade sources of air pollution. Natural sources of air pollution emissions that also could affect the project area but cannot be c·antified very accurately include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and distant volcanoes on the island of Hawaii.

The Hawaii State Department of Health operates a network of air quality stations at various locations around the State to monitor ambient concentrations of air pollution. Each station, however, typically does not monitor the full complement of air quality parameters. Table 6 shows annual summaries of air quality measurements that were made on Maui by the Department of Health for the period 1985 through 1990. These are the most recent data available.

Sulfur dioxide was monitored by the State Department of Health at an air quality station located at the county sewage treatment plant in Kihei, approximately 8 mi (13 km) south of Kahului on the leeward side of Maui. Monitoring consisted of measurements of 24-hour average sulfur dioxide concentration every six to 12 days between 1987 and 1990. There were no exceedances of the State/national 24-hour AAQS for sulfur dioxide during the 4-year period. Concentrations monitored were consistently low with daily mean values at or below 5 $\mu g/m^3$.

The Department of Health also collects data for particulate matter with an aerodynamic diameter of less than 10 microns (PM-10). It operated a PM-10 monitor at the Kihei site between 1987 and 1990. Twenty-four hour average PM-10 concentrations monitored at this location ranged from 6 to 107 $\mu g/m^3$. Average daily concentrations were approximately 26 $\mu g/m^3$. All values reported were within the State/national AAQS.

PM-10 concentrations were also monitored by the Department of Health at the Lahaina Intermediate School, approximately 23 mi (37 km) southeast of Kahului on the leeward coast of Maui. Twenty-four hour average PM-10 concentrations monitored at this location ranged from 5 to 34 $\mu g/m^3$ between 1987 and 1990. Average daily concentrations were approximately 16 $\mu g/m^3$. All values reported were within the State/national AAQS.

Until October 1985, the Department of Health operated an air quality monitoring station at the Kahului Shopping Center, about one-half mile (0.8 km) from the Kahului Harbor and the Kahului Power Plant. This station measured total suspended particulate (TSP) and sulfur dioxide concentrations. During 1985, twenty-four hour average sulfur dioxide concentrations ranged between about 5 and 31 $\mu g/m^3$, while 24-hour average TSP concentrations ranged from 26 to 105 $\mu g/m^3$. At the time, one exceedance of the State TSP air quality standard was logged, but the State TSP standard has since been relaxed and then subsequently eliminated in favor of the federal PM-10 standard.

The Department of Health has not monitored carbon monoxide, ozone or lead concentrations anywhere on Maui. Nitrogen dioxide measurements have not been made since the mid-1970's when monitoring was discontinued at Kahului. Nitrogen dioxide concentrations at that time averaged about 18 $\mu g/m^3$, well within the State and national AAQS.

Maui Electric Company (MECO) has collected ambient air quality data during recent years at several locations on Maui to support expansion projects. Table 7 is a summary of air quality data collected 7 mi (11 km) south of Kahului at Maalaea between June and December 1989. As noted in the table, these data are considered representative of background concentrations, i.e., uninfluenced by local sources. The monitoring station was located approximately 1 mile (1.6 km) north of Maalaea Generating Station, and as such, was upwind of the power plant most of the time due to the prevailing northerly wind pattern. Periods of power plant impacts on the monitoring station occurring with south winds (which occur relatively infrequently) have been eliminated from the data. The sulfur dioxide and particulate matter data collected by MECO are comparable to that reported by the Department of Health. The MECO data indicate that maximum background concentrations are relatively low for all parameters except possibly for particulate matter and for ozone. As indicated in the table, background particulate concentrations were 37 percent of the State/national 24-hour standard and 28 percent of the annual State/national limit. One-hour ozone levels were 86 percent of the State standard and 37 percent of the national standard.

Based on the data and discussion presented above, it appears likely that the State of Hawaii and the national AAQS for sulfur dioxide and for nitrogen dioxide are currently being met in the project area. Based on the data reported by MECO, it appears that while the national standard for ozone is probably being achieved, the more stringent State ozone standard may be exceeded on occasion due to the high background values. Background carbon monoxide concentrations appear to be almost nil, although concentrations near traffic-congested locations or close to agricultural field burning operations could be higher. Background particulate concentrations are currently at moderate levels. Sugar cane operations in the project vicinity likely cause occasional elevated levels of both carbon monoxide and particulate. No data are available to ascertain the present levels of ambient lead concentrations, but this pollutant is not considered to be a problem anywhere in the State.

5.0 SHORT-TERM IMPACTS

Short-term direct and indirect impacts on air quality could potentially occur during construction of roadway improvement projects. For projects of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts related to slow-moving construction equipment traveling to and from the project sites and from the disruption of normal traffic flow caused by roadway closures.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [Ref. 4] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons (1.1 MT) per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions in the project area would likely be higher because the P/E index for the Kahului area is less than 50 due to the relatively dry climate and because the soil silt content in the area is probably greater than 30 percent. Also, as discussed previously, the project area is a relatively windy location, and this may exacerbate uncontrolled dust emissions.

State of Hawaii Air Pollution Control Regulations [Ref. 5] prohibit visible emissions of fugitive dust from construction activities. Thus, an effective dust control plan for roadway construction projects is essential. Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that openbodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is oftentimes a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Project construction activities could also obstruct the normal flow of traffic to such an extent that overall vehicular emissions in the project area are increased. The only means to alleviate this problem will be to attempt to keep roadways open during peak

traffic hours and to move heavy construction equipment to and from construction areas during periods of low traffic volume.

6.0 LONG-TERM IMPACTS

Motor vehicles coming to and from the airport may potentially impact air quality at offsite locations. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide and to a lesser extent nitrogen oxides. As a relative measure compared to airport emissions, approximately 25 motor vehicles at idle emit carbon monoxide at about the same rate as one Boeing 737 jet aircraft queued for takeoff.

To evaluate the potential long-term indirect ambient air quality impact of increased roadway traffic associated with a project such as this, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways leading to and from the project. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles, and it is the pollutant most likely to exceed AAQS. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas nitrogen oxides air pollution most often is a regional issue that cannot be addressed by a single new development.

Three scenarios were selected for the assessment of carbon monoxide concentrations at roadway intersections: (1) year 1994 with present conditions, (2) year 2020 without the project, and (3) year 2020 with the project. The 2020 with project alternative pertains to the preferred project alternative which includes extending the existing main runway to 9600 ft (2926 m) and adding a parallel runway.

To begin the modeling study, critical intersections in the vicinity of the airport were identified for analysis based on the project traffic report. Critical intersections were taken to include high-volume, signalized intersections located in the vicinity of the airport and identified in the traffic study as being potentially affected by airport traffic. These included the following existing at-grade intersections (indicated in Figure 1): Hana Highway at Dairy Road, Hana Highway at Haleakala Highway, and Puunene Avenue at Dairy Road/Kuihelani Highway. These same intersections were studied for the 2020 with and without project cases. In the 2020 with project case, assessments were also made at signalized at-grade intersections that would be created at Dairy Road and the new airport access road, at Hana Highway and Hansen-Spine Road, and at Hana Highway and the new airport access road. The assumption that the new airport access road would form either a grade-separated partial cloverleaf or a grade-separated conventional diamond interchange at Hana Highway and, thereby, avoid the need for an at-grade intersection at this location was also modeled. The traffic impact report for the project [Ref. 3] describes both the present and future traffic conditions and laneage configurations of these intersections in detail.

The main objective of the air quality modeling study was to estimate maximum 1-hour average carbon monoxide concentrations for each of the three scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario can then be made. Comparison of the

estimated concentrations to the national and State AAQS will provide another measure of significance.

In preparing the assessment of potential long-term impacts, it was assumed that maximum 1-hour carbon monoxide concentrations near the roadway intersections studied would coincide with peak hour traffic. The traffic impact assessment report indicates that traffic volumes peak in the morning between 7:30 and 8:30 am and again in the afternoon between 4:30 and 5:30 pm. Afternoon peak-hour traffic volumes generally are or will be higher than during the morning peak period. However, worst-case emission and worst-case meteorological dispersion conditions typically occur during the morning hours at most locations. Thus, both morning and afternoon peak-traffic hours were examined to ensure that worst-case concentrations were identified.

EPA air quality modeling guidelines [Ref. 6] currently recommend that CAL3QHC [Ref. 7] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [Ref. 8]. CALINE4 has been used extensively in Hawaii to assess air quality impacts at roadway intersections. Each of these two computer models offers advantages and disadvantages. CAL3QHC has the capability to make vehicle queuing estimates, but it does not simulate modal emissions. CALINE4 has the capability to simulate modal emissions, but it does not have the capacity to make queuing estimates.

Since the use of CALINE4 has previously been established in Hawaii, CALINE4 was used to perform the analyses for the Kahului Airport project. However, all vehicle queuing estimates were made based on the queuing algorithms included in the CAL3QHC model. This approach takes advantage of the best features of both models.

CALINE4 was developed by the California Transportation Department to simulate vehicular movement and atmospheric dispersion of vehicular emissions. The model is designed to predict 1-hour average pollutant concentrations along roadways based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Input peak-hour traffic data were obtained from the traffic study cited previously. As discussed above, traffic queuing estimates were made based on the methodology used by CAL3QHC. Vehicle speeds were input as the posted speed limits reported in the project traffic study. Average deceleration and acceleration times were assumed to be equivalent and were calculated as recommended by the California Department of Transportation by assuming an acceleration rate of 2.0 mph (3.2 kph) per second.

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Presently, there are no pedestrian walkways along several of the roadways within the project area. In the 2020 with and without project cases, sidewalks may or may not exist. Concentrations predicted by air quality models generally are not considered valid within the roadway mixing zone. The roadway mixing zone is taken to include 10 ft (3 m) on either side of the traveled portion of the roadway and the turbulent area within 30 ft (10 m) of a cross street. For this study, model receptor sites were located at the edges of the mixing zones where the maximum concentrations would likely occur, whether or not sidewalks currently exist. All receptor heights were placed at 6 ft (1.8 m) above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. Worst-case wind conditions were defined as a wind speed of 2 mph (1 mps) with a wind direction resulting in the highest predicted concentration. For groundlevel sources, worst-case dispersion typically occurs during the highest possible stability class and the lowest possible wind speed. Table 8 shows the stability class frequency for the Kahului Airport area for the morning and afternoon peak-traffic periods. During the morning commute hour, stability class 6 occurs approximately 1.9 percent of the time while stability class 5 occurs about 10.7 percent of the time. Stability class 6 and wind speeds of 2 mph (1 mps) occur even less frequently. It is further unlikely that stability class 6 and a wind speed of 2 mph (1 mps) will coincide with the worst wind direction. Thus, stability class 5 was assumed for the morning scenarios. As shown in Table 8, stability class 4 has a very high frequency of occurrence during the afternoon commute hour and is the highest stability class that occurs. Hence, stability category 4 was assumed for afternoon cases.

Other meteorological inputs include surface roughness length and mixing height. A surface roughness length of 40 in. (100 cm) was assumed both for the present scenario and for the future cases. This is characteristic of either residential or tall-crop agricultural areas. A worst-case mixing height of 1000 ft (300 m) was used in all cases. Average mixing heights in Hawaii are generally above 3000 ft (1000 m).

Background contributions of carbon monoxide from sources or distant roadways not directly considered in the analysis were accounted for by adding a background concentration of 1 mg/m^3 to all predicted concentrations for both the 1994 and the 2020 scenarios. This is a conservatively high estimate of background concentration based on the data reported in Section 4.

In addition to providing inputs for vehicle volume and queuing, CALINE4 requires the user to input vehicle carbon monoxide emission rates at idle and at a cruise speed of 16 mph (26 kph). Vehicle carbon monoxide emission rates were calculated for each year studied using EPA's MOBILE5A computer model [Ref. 9]. Key inputs to MOBILE5A include: emission year, vehicle mix, cold/hot-start fractions, ambient temperature, vehicle speed and type of vehicle inspection and maintenance program.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the President signed into law the Clean Air Act Amendments. This new legislation requires further emission reductions be phased in beginning in 1994. The combination of current and new restrictions on emissions from new motor vehicles will lower average emissions each year as more and more older vehicles leave the State's roadways. Carbon monoxide emissions, for example, will go down by about 15 percent on the average during the next 10 years due to the replacement of older vehicles with newer models. Thus, MOBILE5A predicts lower emissions for future years than for the current year. The Kahului Airport analysis was based on MOBILE5A emission estimates for 1994 and for 2020.

Based on recent vehicle registration figures, the present and projected vehicle mix in the project area is estimated to be 91.9 percent light-duty gasoline-powered vehicles, 5 percent light-duty gasoline-powered trucks and vans, 0.5 percent heavy-duty gasoline-powered vehicles, 0.6 percent light-duty diesel-powered vehicles, 1 percent heavy-duty diesel-powered trucks and buses, and 1 percent motorcycles.

Motor vehicles operating in a cold- or hot-start mode emit excess air pollution. Typically, motor vehicles reach stabilized operating temperatures after about 4 mi (6 km) of driving. For traffic operating within the project area, it was assumed that during both the morning and the afternoon peak-traffic hours about 25 percent of all vehicles would be operating in the cold-start mode and that about 5 percent would be operating in the hot-start mode. These operational mode values were estimated based on a report from the California Department of Transportation [Ref. 10] and taking into consideration the likely origin of traffic in the project area.

Ambient temperatures of 59 and 68°F (15 and 20°C) were used for morning and afternoon peak-hour emission computations, respectively. These are conservative assumptions since morning/afternoon ambient temperatures will generally be warmer than this, and emission estimates given by MOBILE5A are inversely proportional to the ambient temperature.

Emission estimates provided by MOBILE5A are inversely proportional to vehicle speed. As required by CALINE4, all vehicle cruise emission estimates were based on a vehicle speed of 16 mph (26 kph). Vehicle idle emissions were derived from the emission estimates pertaining to 2.5 mph (4 kph) as recommended by EPA.

Hawaii currently has no vehicle inspection and maintenance program and none is planned for the foreseeable future. Thus, both existing and future emission estimates were made assuming no inspection and maintenance program.

Predicted Worst-Case 1-Hour Concentrations

Table 9 summarizes the final results of the roadway intersection study. The results are given in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations for each of the three scenarios considered at each of the intersections studied. These results can be compared directly to the State and the national AAQS. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the existing morning and afternoon worst-case concentrations at the Hana Highway/Dairy Road intersection were estimated to be 42.8 and 48.8 mg/m^3, respectively. With or without the project, roadway improvements are planned for this intersection by 2020, and the analyses for 2020 assumed that the improvements would be implemented. Without the project in 2020, the morning worst-case concentration was estimated to increase to 62.1 mg/m^3, while the afternoon value increased to 56.1 mg/m^3. With the project in 2020, worst-case concentrations were forecast to decrease compared to both the without project case and the existing case to 33.1 mg/m^3 during the morning and 34.3 mg/m^3 during the afternoon. This is a result of the diversion of traffic from Dairy Road onto the new airport access road. Worst-case concentrations at this location were predicted to potentially exceed the State standard in all three scenarios and the national standard in all but the 2020 with project case.

Existing worst-case concentrations at the intersection of Hana Highway and Haleakala Highway were predicted to reach 51.6 mg/m^3 during the morning and 32.5 mg/m^3 during the afternoon. Without the project in 2020, worst-case concentrations were estimated to increase to 73.6 mg/m^3 during the morning and 44.6 mg/m^3 during the

afternoon. These increases in the morning and afternoon concentrations occur in spite of the assumed new highway between Pukalani and Kihei. With the project, the southbound approach to this intersection will be eliminated, creating a T-intersection and more green-time for the other approaches. Compared to the without project case, the worst-case concentration during the morning for the 2020 with project scenario was predicted to fall to 63.1 mg/m^3, while the afternoon value was estimated to decrease to 25.5 mg/m^3. Worst-case concentrations at this location were predicted to potentially exceed both State and national standards in all three scenarios.

Worst-case concentrations at the Puunene Avenue/Kuihelani Highway intersection for the existing case were predicted to reach 28.6 mg/m^3 during the morning and 23.2 mg/m^3 during the afternoon. Without the project in 2020, worst-case concentrations were forecast to increase to 48.2 mg/m^3 during the morning and 32.1 mg/m^3 during the afternoon. Worst-case concentrations in 2020 with the project compared to without it were estimated to decrease to 36.1 mg/m^3 during the morning and to decrease slightly to 31.5 mg/m^3 during the afternoon. This is the result of the new airport access road. All scenarios were predicted to potentially exceed the State standard, while only the future without project case was forecast to potentially exceed the national standard.

The new airport access road intersection with Dairy Road would only exist in the with project scenario. Worst-case concentrations at this intersection were predicted to be 17.6 mg/m^3 and 19.6 mg/m^3 during the morning and the afternoon commute hours, respectively, assuming added capacity is provided as suggested in the project traffic study. This is within the national standard but exceeds the more stringent State standard.

Hana Highway at Hansen-Spine Road would only become a signalized intersection in the with project case. Hence, only the 2020 with project scenario was examined at this location. During the morning, a worst-case concentration of 31.2 mg/m^3 was forecast. During the afternoon, a worst-case value of 27.7 mg/m^3 was predicted. These concentrations are within the national standard but exceed the more stringent State standard.

The intersection of Hana Highway and the new airport access road was modeled in three different configurations for the future with project case. Modeled first as an at-grade intersection, it produced predicted worst-case concentrations of 43.7 mg/m^3 in the morning and 32.8 mg/m^3 in the afternoon. Both concentrations exceed the State standard, while only the morning estimate exceeds the national standard.

In its proposed configuration as an unsignalized partial (two-loop) cloverleaf interchange, the intersection of Hana Highway and the airport access road was modeled at the two locations where the need for left turns would disrupt the smooth flow of traffic allowed by the cloverleaf design. First, at the airport access road and the eastbound ramp to Hana Highway, the morning worst-case concentration was found to be 5.1 mg/m^3 and the afternoon result was 4.8 mg/m^3. Both are significantly below the at-grade predictions and both are well within State and national standards. Next, at the airport access road and the westbound ramp to Hana Highway, predicted concentrations of 3.5 and 3.9 mg/m^3 were obtained for the morning and afternoon peak hours, respectively. These, again, are well below the at-grade worst-case results and within State and national standards.

Also under consideration for this intersection is a signalized conventional diamond interchange. As with the partial cloverleaf, modeling was done at the two locations of the interchange where turning movements and traffic queuing would occur. The airport access road and the eastbound ramp to Hana Highway yielded morning and afternoon worst-case concentrations of 25.4 and 26.7 mg/m^3, respectively. Both exceed the State standard but are within the national standard. At the airport access road and the westbound ramp to Hana Highway, the morning worst-case concentration was predicted to be 29.4 mg/m^3 and in the afternoon a result of 18.2 mg/m^3 was obtained. These concentrations once again exceed the State standard but are within the national standard.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a locally-derived 1-hour to 8-hour conversion factor of 0.35. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) wind speed averaged over eight hours is higher than for the worst-case hour. Lower 8-hour traffic volumes and higher 8-hour wind speeds both serve to reduce maximum 8-hour concentrations compared to the worst-case 1-hour value.

Specific 8-hour averages of traffic volumes were not available, but it was assumed that hourly traffic volumes during the highest 8-hour period would average no higher than 0.9 of the peak-hour value. Concentrations predicted by CALINE4 are proportional to input traffic volumes.

It was further assumed that the highest 8-hour concentrations would occur during the daytime when 8-hour average traffic volumes are highest. As noted in the previous air quality study [Ref. 2], the lowest 8-hour wind speed at Kahului Airport between 6 am and 10 pm based on hourly weather observations for 1983 was 2.6 mps. It was assumed that this was representative of daytime periods at intersection locations near the airport. Given that concentrations predicted by CALINE4 are inversely proportional to wind speed and that worst-case 1-hour estimates are based on a wind speed of 1 mps, this yields a 1-hour to 8-hour wind speed correction factor of 1/2.6 or 0.38.

The combined effect of a 1-hour to 8-hour traffic correction factor of 0.9 and a 1-hour to 8-hour wind speed correction factor of 0.38 produces a 1-hour to 8-hour conversion factor of 0.35. Note that traffic queuing is a nonlinear function of traffic volume and that the variability of wind direction and other meteorological variables over an 8-hour period will further reduce the maximum 8-hour concentration. Thus, the locally-derived 1-hour to 8-hour conversion factor can be expected to result in conservatively high estimates of worst-case 8-hour concentrations.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 10. For the 1994 scenario, the highest estimated worst-case 8-hour carbon monoxide concentration within the project area was 18.1 mg/m^3. This was estimated to occur near the intersection of Hana Highway and Haleakala Highway. Estimated worst-case concentrations at other intersections studied were 17.1 mg/m^3 at Hana Highway and Dairy Road and 10.0 mg/m^3 at Puunene Avenue and Kuihelani Highway. Worst-case concentrations at all locations studied were forecast to equal or exceed both State and national standards.

Without the project in 2020, the predicted maximum values near the intersections studied were 16.9 mg/m^3 at Puunene Avenue and Kuihelani Highway, 21.7 mg/m^3 at Hana Highway and Dairy Road, and 25.8 mg/m^3 at Hana Highway and Haleakala Highway. Compared to the 1994 case, air quality in the vicinity of Hana Highway and Haleakala Highway would experience the most degradation with the areas around the other two intersections being negatively impacted as well. Worst-case concentrations at all locations studied were forecast to exceed both State and national standards.

With the project in 2020, worst-case 8-hour concentrations were predicted to either improve significantly, in the case of the Hana Highway at Dairy Road intersection, or improve moderately compared to the without project case. At the intersections studied for this scenario, worst-case 8-hour concentrations were predicted to range from 1.4 mg/m^3 near the westbound ramp of Hana Highway at the airport access road cloverleaf interchange to 22.1 mg/m^3 near Hana Highway at Haleakala Highway. Worst-case concentrations at all locations studied, with the exception of Hana Highway at the airport access road cloverleaf interchange, were forecast to equal or exceed both State and national standards.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing analysis, it is concluded that:

1. Based on air quality monitoring data, it appears likely that State and national ambient air quality standards are currently being met at most locations on Maui. Background concentrations of ozone and of particulate matter are at moderate to high levels, while concentrations of other pollutants are nil except possibly in areas close to air pollution sources.

2. Short-term fugitive dust impacts will likely occur during roadway construction projects associated with the airport improvement.

3. The disruption of traffic during roadway construction may also cause increased emissions from motor vehicle traffic which could also result in temporary impacts on air quality.

4. Based on air quality modeling results, long-term impacts from project-related traffic would be minimal if the proposed roadway improvements are implemented, but several locations around the airport in the vicinity of high-volume, congested intersections may not meet air quality standards.

5. Of the three possible configurations examined for the intersection of Hana Highway and the new airport access road, it appears that only the partial cloverleaf interchange would provide for air pollution levels that would meet both State and national standards.

Based on the conclusions given above, the following recommendations are made:

1. Fugitive dust emissions from construction activities should be controlled by watering active work areas at least twice daily on days without rainfall. Some means to prevent or control fugitive dust resulting from trucks tracking dirt onto paved roadways in the project area should also be provided.

2. Increased vehicular emissions due to the disruption of traffic by construction activities should be mitigated by moving equipment and personnel to the site during off-peak traffic hours and by minimizing road closures during peak-traffic periods.

3. Although the proposed project would not significantly affect air quality at offsite roadway intersections where potential problems are indicated and the proposed development may not have any control over these locations, some mitigation measures can be suggested:

   a) Roadway capacity could be added at those locations where the traffic level of service is poor;

   b) Roadway speed limits could be reduced at those locations where the speed limits are set above 35 mph (56 kph). This would reduce acceleration emissions and reduce predicted concentrations significantly. (A test-case modeling run was undertaken for the future with project case at the Hana Highway/Haleakala Highway intersection. This revealed that a speed reduction to 35 mph (56 kph) would reduce worst-case carbon monoxide concentrations by about one-half.)

   c) Traffic signals could be optimized and/or coordinated to reduce traffic queuing;

   d) Buffer zones could be provided between sidewalks and roadways;

   e) Bus service could be promoted for arriving and departing airport passengers;

   f) If feasible, air carrier schedules could be coordinated to minimize airport-related traffic during peak commute hours.

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Appendix A

AIR POLLUTION CONVERSION FACTORS

Parameter	Units Given	Conversion Units	Conversion Factor
Sulfur Dioxide	$\mu g/m^3$	ppb	0.38
Carbon Monoxide	mg/m^3	ppm	0.87
Nitrogen Dioxide	$\mu g/m^3$	ppb	0.53
Ozone	$\mu g/m^3$	ppb	0.51

Note: All conversions assume 25°C and 760 mm Hg.

Appendix B

ABBREVIATIONS

AAQS	ambient air quality standards
°C	degrees Celsius
cm	centimeters
EPA	Environmental Protection Agency
°F	degrees Fahrenheit
ft	feet
Hg	mercury
in.	inches
km	kilometers
kph	kilometers per hour
m	meters
mi	miles
$\mu g/m^3$	micrograms per cubic meter
mg/m^3	milligrams per cubic meter
MECO	Maui Electric Company
mm	millimeters
mph	miles per hour
mps	meters per second
MT	metric tons
P/E	precipitation/evaporation
PM-10	particulate matter of less than 10 microns aerodynamic diameter
ppb	parts per billion
ppm	parts per million
SIP	State Implementation Plan
TSP	total suspended particulate

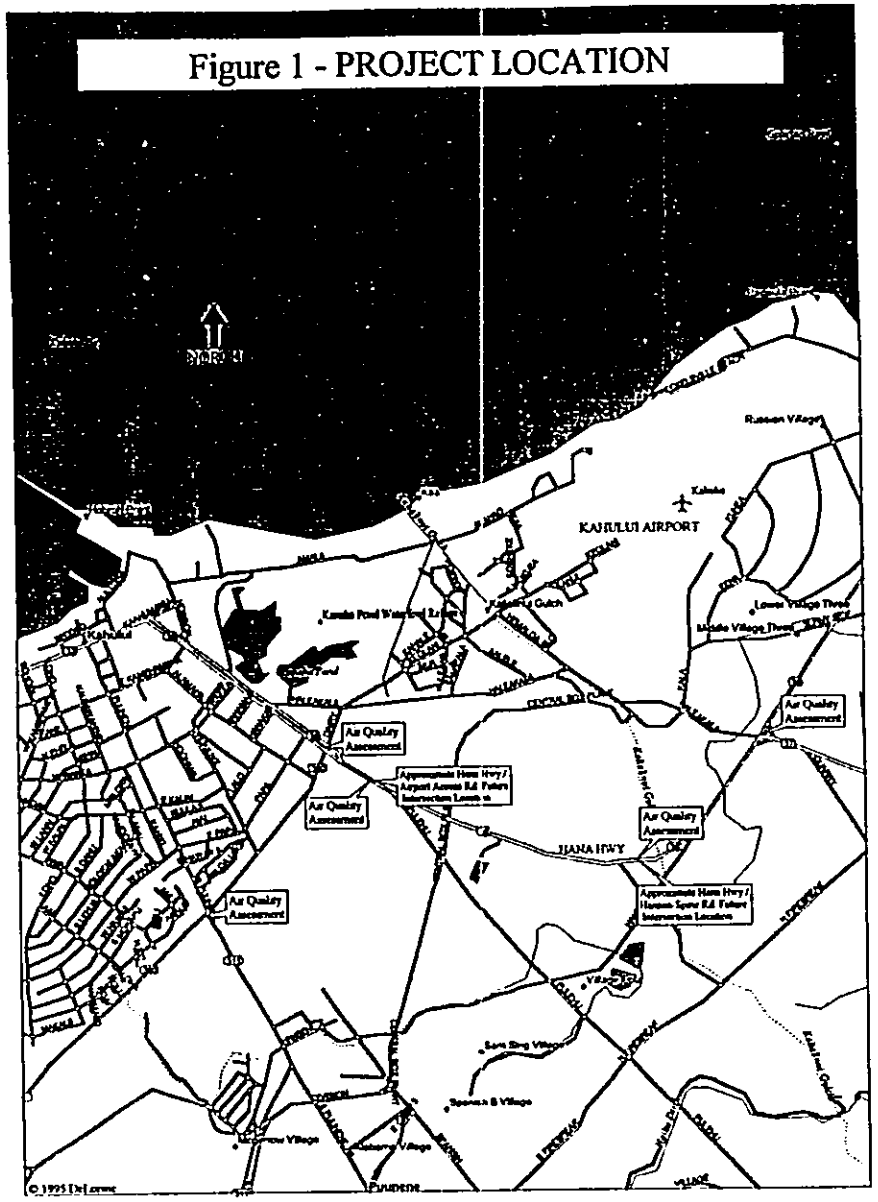

Figure 1 - PROJECT LOCATION

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter[a]	$\mu g/m^3$	Annual	50	50	50
		24 Hours	150^b	150^b	150^b
Sulfur Dioxide	$\mu g/m^3$	Annual	80	-	80
		24 Hours	365^b	-	365^b
		3 Hours	-	1300^b	1300^b
Nitrogen Dioxide	$\mu g/m^3$	Annual	100	100	70
Carbon Monoxide	mg/m^3	8 Hours	10^b	-	5^b
		1 Hour	40^b	-	10^b
Ozone	$\mu g/m^3$	1 Hour	235^b	235^b	100^b
Lead	$\mu g/m^3$	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	$\mu g/m^3$	1 Hour	-	-	35^b

[a]Particles less than or equal to 10 microns aerodynamic diameter

[b]Not to be exceeded more than once per year

Table 3

WIND FREQUENCY TABLE FOR KAHULUI AIRPORT, JAN-DEC 1983

FREQUENCY OF OCCURRENCE (HOURS)

WIND DIRECTION FROM

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	229
1.0 - 4.0	5	7	19	10	20	20	33	36	63	14	22	17	6	2	7	4	285
4.0 - 8.0	55	111	244	128	99	91	233	300	230	57	42	37	24	20	26	30	1727
8.0 - 12.0	164	358	950	274	75	30	28	39	106	37	26	5	4	4	19	48	2167
12.0 - 19.0	104	378	1437	706	88	4	1	9	93	118	46	2	0	0	2	18	3006
19.0 - 25.0	11	103	576	407	30	0	0	2	16	21	20	0	0	0	0	10	1196
25.0 - 99.0	0	9	71	54	6	0	0	0	0	10	2	0	0	0	0	0	152
TOTALS	339	966	3297	1577	318	145	295	386	508	257	158	61	34	26	54	110	8760

RELATIVE FREQUENCY (%)

WIND DIRECTION FROM

SPEED (MPH)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	2.61
1.0 - 4.0	.06	.08	.22	.11	.23	.23	.38	.41	.72	.16	.25	.19	.07	.02	.08	.05	3.25
4.0 - 8.0	.63	1.27	2.79	1.46	1.13	1.04	2.66	3.42	2.63	.65	.48	.42	.27	.23	.30	.34	19.71
8.0 - 12.0	1.87	4.09	10.84	3.13	.86	.34	.32	.45	1.21	.42	.30	.06	.05	.05	.22	.55	24.74
12.0 - 19.0	1.19	4.32	16.40	8.06	1.00	.05	.01	.10	1.06	1.35	.53	.02	.00	.00	.02	.21	34.29
19.0 - 25.0	.13	1.18	6.58	4.65	.34	.00	.00	.02	.18	.24	.23	.00	.00	.00	.00	.11	13.65
25.0 - 99.0	.00	.10	.81	.62	.07	.00	.00	.00	.00	.11	.02	.00	.00	.00	.00	.00	1.74
TOTALS	3.87	11.03	37.64	18.00	3.63	1.66	3.37	4.41	5.80	2.93	1.80	.70	.39	.30	.62	1.26	100.00

Table 2

CLIMATOLOGICAL SUMMARY FOR KAHULUI AIRPORT

	Record (years)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (Deg F)														
Normals														
-Daily Max		79.5	79.7	81.1	82.2	84.5	85.9	86.5	87.4	87.6	86.4	83.5	81.0	83.8
-Daily Min		63.4	63.4	64.8	66.2	67.0	68.7	70.4	70.9	69.8	69.1	67.5	65.3	67.2
-Monthly		71.5	71.6	73.0	74.2	75.8	77.3	78.5	79.2	78.7	77.8	75.5	73.2	75.5
Extremes														
-Record Highest	28	89	88	90	91	92	93	94	96	95	96	93	90	96
-Year		1981	1981	1984	1981	1992	1981	1984	1983	1992	1973	1990	1992	Aug 83
-Record Lowest	28	48	50	55	54	57	58	58	61	60	58	55	52	48
-Year		1969	1987	1990	1985	1985	1985	1965	1976	1975	1964	1985	1983	Jan 69
% of Possible Sunshine	30	64	65	64	62	68	72	71	71	72	67	63	63	67
Mean Sky Cover (tenths) Sunrise - Sunset	34	4.8	4.9	5.4	6.0	5.4	4.9	4.7	4.7	4.7	5.2	5.2	5.0	5.1
Mean Number of Days:														
Sunrise - Sunset														
-Clear	34	12.9	11.5	10.7	7.6	9.3	10.6	11.1	12.3	11.7	10.7	10.9	11.9	131.5
-Partly Cloudy	34	9.9	9.5	11.2	11.6	13.6	13.3	14.7	13.2	12.6	12.4	10.5	11.0	143.5
-Cloudy	34	8.2	7.3	9.1	10.8	8.1	6.2	5.1	5.5	5.7	7.9	8.6	8.1	90.5
Precipitation 0.01 inch or more	34	10.6	9.9	10.8	10.3	6.2	5.1	6.4	6.0	5.6	7.3	10.2	11.1	99.6
Thunderstorms	34	0.9	0.6	0.5	0.5	0.2	0.0	0.1	0.1	0.1	0.4	0.4	0.5	4.3
Temperature														
-Maximum > 90 F	28	0.0	0.0	0.1	0.1	1.2	2.0	5.4	5.8	7.1	4.4	1.2	0.1	25.3
-Minimum < 32 F	28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avg. Station Pressure (mb)	11	1012.4	1013.6	1014.9	1014.9	1014.7	1014.2	1013.6	1013.2	1013.4	1012.8	1012.9	1013.2	1013.6
Relative Humidity (%)														
Hour 02 (Local Time)	10	85	83	81	81	82	80	80	79	80	80	81	82	81
Hour 08	28	82	81	77	75	71	70	71	71	71	73	76	80	75
Hour 14	28	62	61	59	58	56	55	55	56	55	57	60	61	58
Hour 20	28	77	75	74	73	72	71	71	72	71	73	75	76	73
Precipitation (inches):														
Normal		4.21	3.27	3.00	1.18	0.66	0.28	0.41	0.50	0.36	0.87	2.26	2.85	19.85
Maximum Monthly	38	14.46	8.31	10.90	14.29	4.36	2.50	1.65	1.54	1.43	5.66	9.27	10.19	14.46
Year		1980	1972	1967	1989	1987	1967	1989	1982	1987	1985	1965	1988	Jan 80
Minimum Monthly	38	0.12	0.07	0.09	0.06	T	0.00	0.02	0.02	0.02	T	0.14	0.01	0.00
Year		1977	1983	1957	1990	1972	1957	1973	1973	1972	1984	1980	1975	Jun 57
Wind:														
Mean Speed (mph)	23	10.8	11.1	12.3	13.3	13.2	14.7	15.6	14.8	12.9	12.0	11.8	11.3	12.8
Prevailing Direction	23	SSW	S	NE	NE	NE	ENE	NE	NE	NE	NE	NE	NE	NE
Peak Gust														
-Direction	9	S	NE	E	NE	NE	NE	E	NE	SW	NE	S	E	S
-Speed (mph)	9	54	46	49	45	43	44	46	45	44	46	51	54	54
-Date		1991	1990	1985	1987	1991	1990	1989	1991	1992	1985	1988	1988	Jan 91

Source: Local Climatological Data, 1992 Annual Summary with Comparative Data, Kahului, Hawaii, National Oceanic and Atmospheric Administration

Table 4

AIR POLLUTION EMISSIONS INVENTORY FOR COUNTY OF MAUI, 1980

Source Category	Emissions (tons/year)*				
	Particulate	Sulfur Oxides	Nitrogen Oxides	Carbon Monoxide	Hydrocarbons
Steam Electric Power Plants	131	2,892	1,353	367	73
Gas Utilities	0	0	5	0	0
Fuel Combustion in Agricultural Industry	1,866	354	677	0	7
Mineral Products Industry	158	36	61	0	0
Municipal Incineration	0	0	0	0	0
Motor Vehicles	212	143	2,483	34,422	3,676
Construction, Farm and Industrial Vehicles	23	21	300	796	139
Aircraft	5	14	137	1,286	159
Vessels	14	114	71	61	26
Agricultural Field Burning	2,110	0	0	24,316	2,228
Total:	4,519	3,575	5,088	61,250	6,307

*For metric tons, multiply by 0.9078.

Source: State of Hawaii, Department of Health

Table 5

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF MAUI, 1992

Source Category	Emissions (tons/year)*				
	Particulate	Sulfur Oxides	Nitrogen Oxides	Carbon Monoxide	Hydrocarbons
Electric Power Plants	480	4,525	5,039	1,160	271
Gas Utilities	NA	NA	NA	NA	NA
Fuel Combustion in Agricultural Industry	2,925	1,837	1,877	1,005	32
Mineral Products Industry	600	NA	NA	NA	NA
Petroleum Storage/Refueling	0	0	0	0	388
Municipal Incineration	0	0	0	0	0
Motor Vehicles	NA	NA	1,971	29,397	3,629
Construction, Farm and Industrial Vehicles	NA	NA	NA	NA	NA
Aircraft	3	18	359	1,090	200
Vessels		2	18	835	213
Agricultural Field Burning	2,628	0	0	30,570	3,886
Total:	6,636	6,382	9,264	64,057	8,619

*For metric tons, multiply by 0.9078.

Table 6

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR
DEPARTMENT OF HEALTH MONITORING STATIONS LOCATED ON MAUI ISLAND, 1985-1990

Parameter / Location	1985	1986	1987	1988	1989	1990
Sulfur Dioxide / Kahului						
No. of 24-Hr Samples	32	-	-	-	-	
Range of 24-Hr Values (µg/m3)	<5-31	-	-	-	-	
Average Daily Value (µg/m3)	7	-	-	-	-	
No. of State AAQS Exceedances	0	-	-	-	-	
Sulfur Dioxide / Kihei						
No. of 24-Hr Samples	-	-	36	30	39	8
Range of 24-Hr Values (µg/m3)	-	-	<5-13	<5-5	<5-5	<5-5
Average Daily Value (µg/m3)	-	-	<5	<5	<5	<5
No. of State AAQS Exceedances	-	-	0	0	0	0
PM-10 / Kihei						
No. of 24-Hr Samples	-	-	38	33	37	9
Range of 24-Hr Values (µg/m3)	-	-	11-107	17-46	9-51	6-42
Average Daily Value (µg/m3)	-	-	28	28	24	22
No. of State AAQS Exceedances	-	-	NA	NA	NA	NA
PM-10 / Lahaina						
No. of 24-Hr Samples	-	-	8	22	39	42
Range of 24-Hr Values (µg/m3)	-	-	8-19	9-34	6-25	5-31
Average Daily Value (µg/m3)	-	-	14	19	15	17
No. of State AAQS Exceedances	-	-	NA	NA	NA	NA
TSP / Kahului						
No. of 24-Hr Samples	36	-	-	-	-	-
Range of 24-Hr Values (µg/m3)	26-105	-	-	-	-	-
Average Daily Value (µg/m3)	57	-	-	-	-	-
No. of State AAQS Exceedances	1	-	-	-	-	-

Source: State of Hawaii Department of Health

Table 7

AMBIENT BACKGROUND AIR QUALITY DATA FOR
MAALAEA, MAUI - JUNE 1989 THROUGH DECEMBER 1989

Pollutant	Averaging Period	Concentration (ppb)	Concentration ($\mu g/m^3$)	Percentage of Standard: State	Percentage of Standard: National
Sulfur Dioxide	3-hour 24-hour Annual	13 5 1	34 13 3	3 4 4	3 4 4
Nitrogen Dioxide	Annual	3	6	9	6
Ozone	1-hour Annual	44 16	86 31	86 -	37 -
Carbon Monoxide	1-hour 8-hour	12 5	14 6	<1 <1	<1 <1
Particulate Matter	24-hour Annual	- -	56 14	37 28	37 28

Notes:

1. The data given in the table were obtained by Maui Electric Company at Site No. 233 located approximately 1 mile (1.6 kilometers) north of Maalaea Power Plant. Concentrations shown in the table for averaging times shorter than annual are the highest concentrations recorded during the period June 10, 1989 through December 31, 1989. Annual average concentrations for all pollutants are based on the 7-month period.

2. Concentrations shown in the table for averaging times shorter than annual do not include periods when the on-shore flow (southerly flow between 130 and 230 degrees) persists, as this would include the Maalaea Generating Station emissions.

Source: Prevention of Significant Deterioration Permit Application for Maalaea Combined Cycle Project, Maui Electric Co., Revised, August 1990.

Table 8

STABILITY CLASS FREQUENCY DURING MORNING AND AFTERNOON PEAK COMMUTE HOURS

Stability Class	Frequency of Occurrence (%)	
	Morning	Afternoon
1	0.0	0.0
2	0.0	0.0
3	11.5	2.7
4	75.9	97.3
5	10.7	0.0
6	1.9	0.0

Note: Based on weather observations at Kahului Airport for 1983. Morning frequency based on 8 am observations. Afternoon frequency based on 5 pm observations.

Table 9

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR KAHULUI AIRPORT IMPROVEMENT PROJECT (milligrams per cubic meter)

Roadway Intersection	Year/Scenario					
	1994/ Existing Case		2020/ Without Project		2020/ With Project	
	AM	PM	AM	PM	AM	PM
Hana Highway at Dairy Road	42.8	48.8	62.1	56.1	33.1	34.3
Hana Highway at Haleakala Highway	51.6	32.5	73.6	44.6	63.1	25.5
Puunene Avenue at Kuihelani Highway	28.6	23.2	48.2	32.1	36.1	31.5
Airport Access Road at Dairy Road	-	-	-	-	17.6	19.6
Hana Highway at Hansen-Spine Road	-	-	-	-	31.2	27.7
Hana Highway at Airport Access Road (At grade intersection)	-	-	-	-	43.7	32.8
Hana Highway at Airport Access Road (2-Loop Cloverleaf, Eastbound Ramp)	-	-	-	-	5.1	4.8
Hana Highway at Airport Access Road (2-Loop Cloverleaf, Westbound Ramp)	-	-	-	-	3.5	3.9
Hana Highway at Airport Access Road (Conventional Diamond, Eastbound Ramp)	-	-	-	-	25.4	26.7
Hana Highway at Airport Access Road (Conventional Diamond, Westbound Ramp)	-	-	-	-	29.4	18.2

Hawaii State AAQS: 10
National AAQS: 40

Note: To convert table values to parts per million, multiply by 0.87.

Table 10

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR KAHULUI AIRPORT IMPROVEMENT PROJECT (milligrams per cubic meter)

Roadway Intersection	Year/Scenario		
	1994/ Existing Case	2020/ Without Project	2020/ With Project
Hana Highway at Dairy Road	17.1	21.7	12.0
Hana Highway at Haleakala Highway	18.1	25.8	22.1
Puunene Avenue at Kuihelani Highway	10.0	16.9	12.6
Airport Access Road at Dairy Road	-	-	6.9
Hana Highway at Hansen-Spine Road	-	-	10.9
Hana Highway at Airport Access Road (At grade intersection)	-	-	15.3
Hana Highway at Airport Access Road (2-Loop Clover-leaf, Eastbound Ramp)	-	-	1.8
Hana Highway at Airport Access Road (2-Loop Clover-leaf, Westbound Ramp)	-	-	1.4
Hana Highway at Airport Access Road (Conventional Diamond, Eastbound Ramp)	-	-	9.3
Hana Highway at Airport Access Road (Conventional Diamond, Westbound Ramp)	-	-	10.3

Hawaii State AAQS: 5
National AAQS: 10

Note: To convert table values to parts per million, multiply by 0.87.

DRAINAGE SYSTEM REQUIREMENTS

FOR

DIFFERENT INTERSECTION IMPROVEMENTS

AT

HANA HIGHWAY AND AIRPORT ACCESS ROAD

PREPARED FOR:

EDWARD K. NODA & ASSOCIATES, INC.
615 PIIKOI STREET, SUITE 300
HONOLULU, HAWAII - 96814-3116

PREPARED BY:

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WAILUKU, MAUI, HAWAII - 96793

NOVEMBER 14, 1995

REVISED: JANUARY 1996

REVISED: FEBRUARY 1996

I. PURPOSE:

The purpose of this study is to present the drainage requirements for different intersection improvements at Hana Highway and Airport Access Road. The scenarios considered in this investigation are:

1. Scheme A:
   Proposed Two-Loop Cloverleaf;
2. Scheme B:
   Conventional Diamond Interchange;
3. Scheme C:
   Single-Loop Cloverleaf; and
4. Scheme D:
   At-Grade Intersection.

II. BASIS OF STUDY

The development of the drainage systems for the various alternatives was based on the completed plans and drainage report of "Airport Access Road" project, State Project No. Am 1061-11.

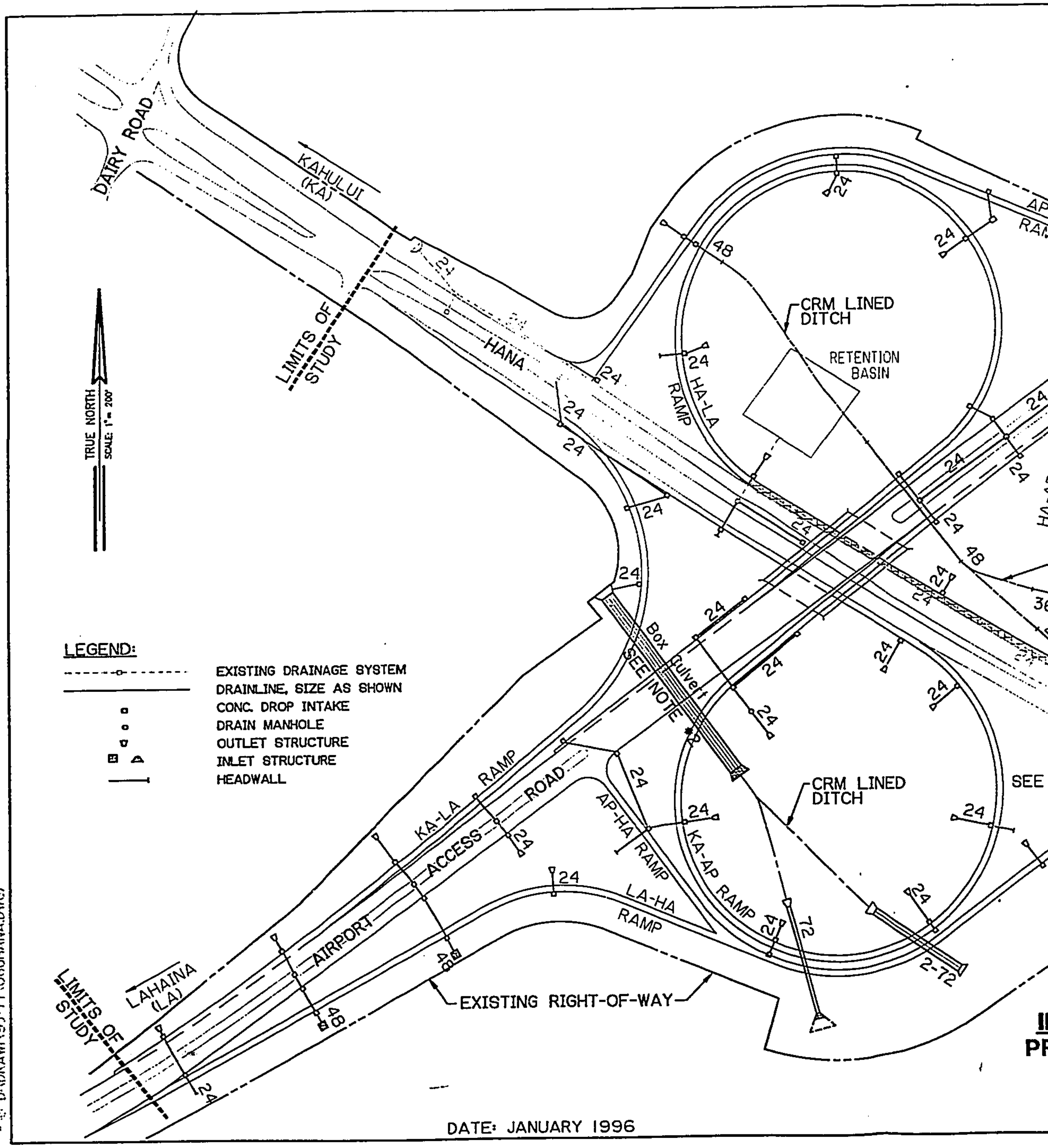
III. PROPOSED DRAINAGE SYSTEMS:

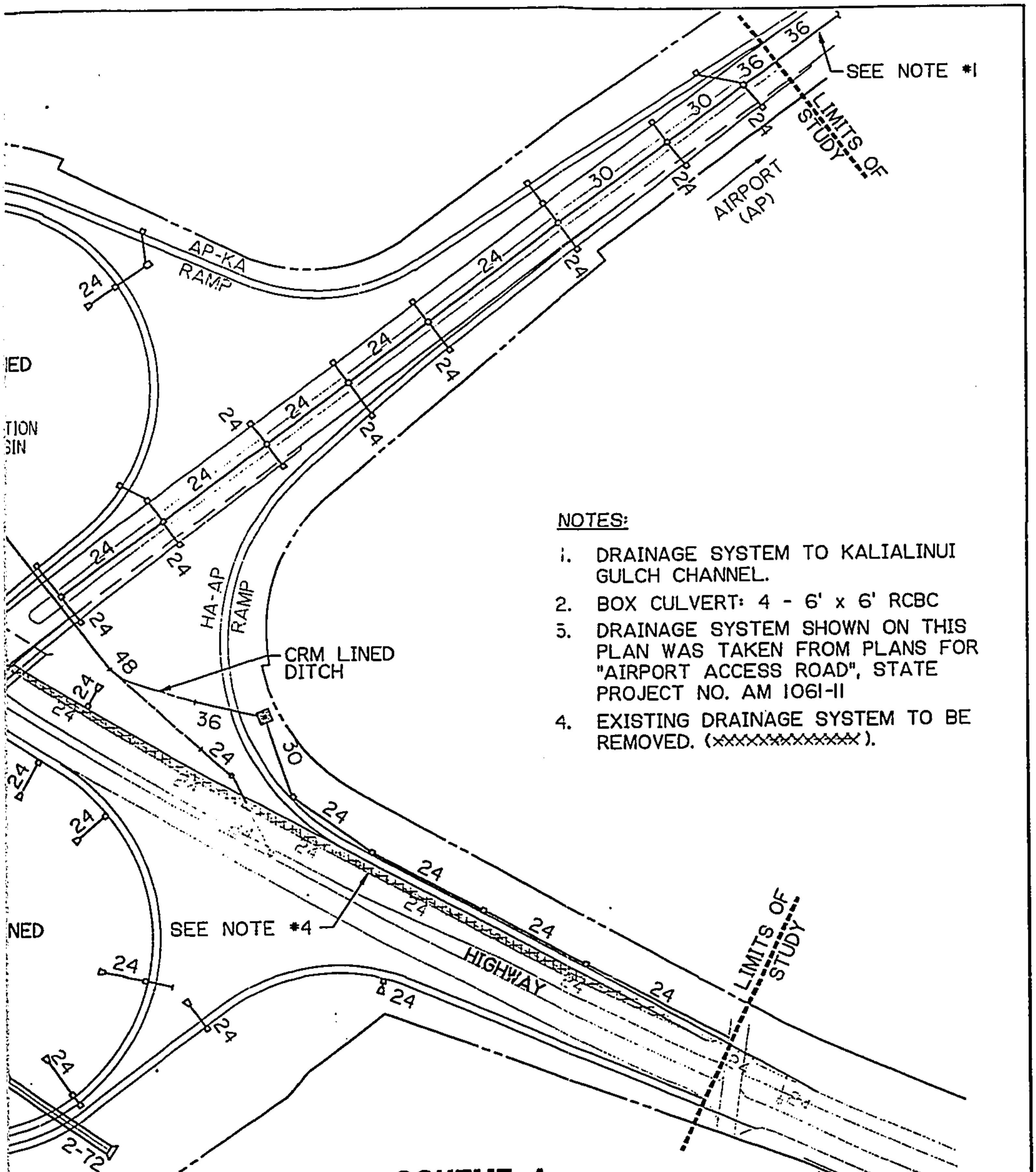
The drainage system for the different alternatives is shown on Figures A, B, C and D. The drainage system for the proposed two-loop cloverleaf (Scheme A) was taken from the completed plans of the above referenced project. Subsequently, the drainage systems shown for the other schemes are modified systems of Scheme A; whereby, culverts and inlets were added or deleted to suit

the intersection geometrics. The proposed drainage system for Schemes B & D includes a new and expanded retention basin, respectively, to handle runoff from the east side of the intersection. On Schemes A, B and C, roadway runoff from the east leg of the interchange will be discharged to Kalialinui Gulch via underground culverts.

IV. PROJECTED DRAINAGE SYSTEM COST:

Comparatively, the projected costs for Schemes B and C are about 20% and 15%, respectively, lower than the cost for Scheme A. Whereas, Scheme D has a projected cost of approximately 40% lower than Scheme A.


DAIRY ROAD
KAHULUI (KA)
HANA
LIMITS OF STUDY
TRUE NORTH
SCALE: 1" = 200'
CRM LINED DITCH
RETENTION BASIN
HA-LA RAMP
AP RAMP
Box Culvert SEE NOTE
CRM LINED DITCH
SEE
LEGEND:
EXISTING DRAINAGE SYSTEM
DRAINLINE, SIZE AS SHOWN
CONC. DROP INTAKE
DRAIN MANHOLE
OUTLET STRUCTURE
INLET STRUCTURE
HEADWALL
KA-LA RAMP
AIRPORT ACCESS ROAD
AP-HA RAMP
KA-AP RAMP
LA-HA RAMP
LAHAINA (LA)
LIMITS OF STUDY
EXISTING RIGHT-OF-WAY
DATE: JANUARY 1996



SCHEME A

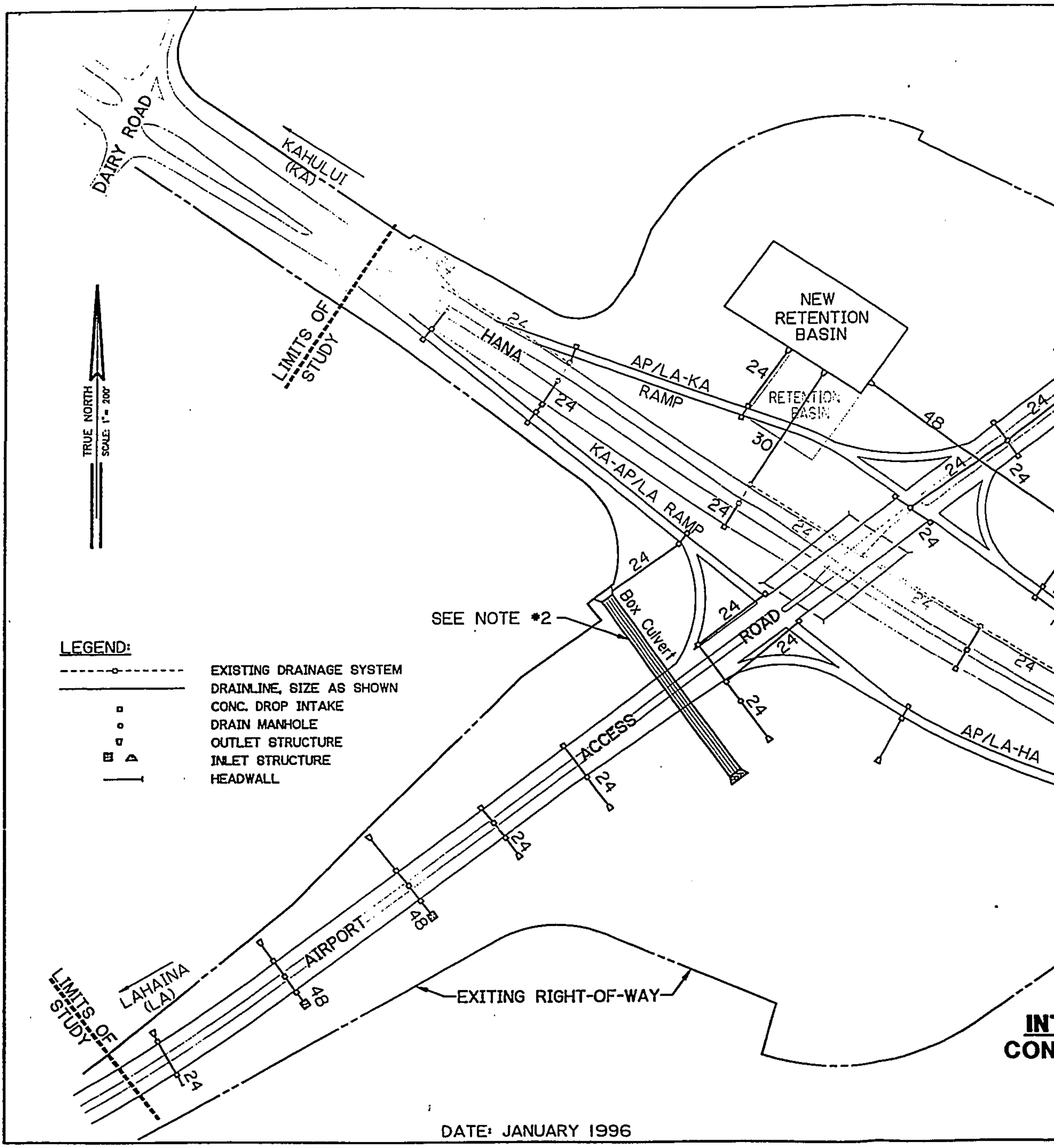
INTERSECTION DRAINAGE SYSTEM

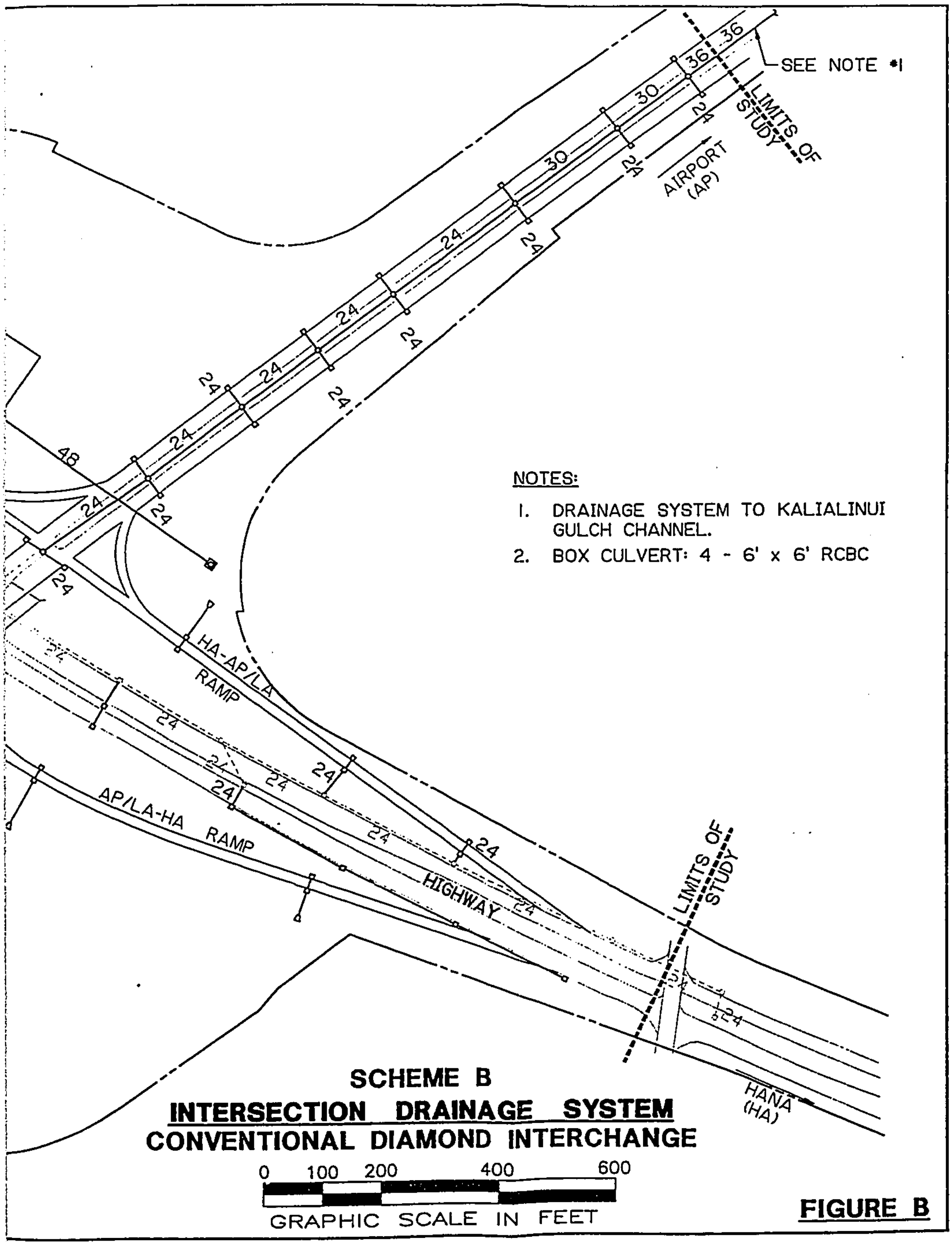
PROPOSED TWO - LOOP CLOVERLEAF

0 100 200 400 600

GRAPHIC SCALE IN FEET

FIGURE A


DAIRY ROAD
KAHULUI (KA)
LIMITS OF STUDY
TRUE NORTH
SCALE: 1" = 200'
NEW RETENTION BASIN
RETENTION BASIN
HANA
AP/LA-KA RAMP
KA-AP/LA RAMP
SEE NOTE #2
Box Culvert
ROAD
ACCESS
AIRPORT
AP/LA-HA
LAHAINA (LA)
LIMITS OF STUDY
EXITING RIGHT-OF-WAY
LEGEND:
EXISTING DRAINAGE SYSTEM
DRAINLINE, SIZE AS SHOWN
CONC. DROP INTAKE
DRAIN MANHOLE
OUTLET STRUCTURE
INLET STRUCTURE
HEADWALL
DATE: JANUARY 1996

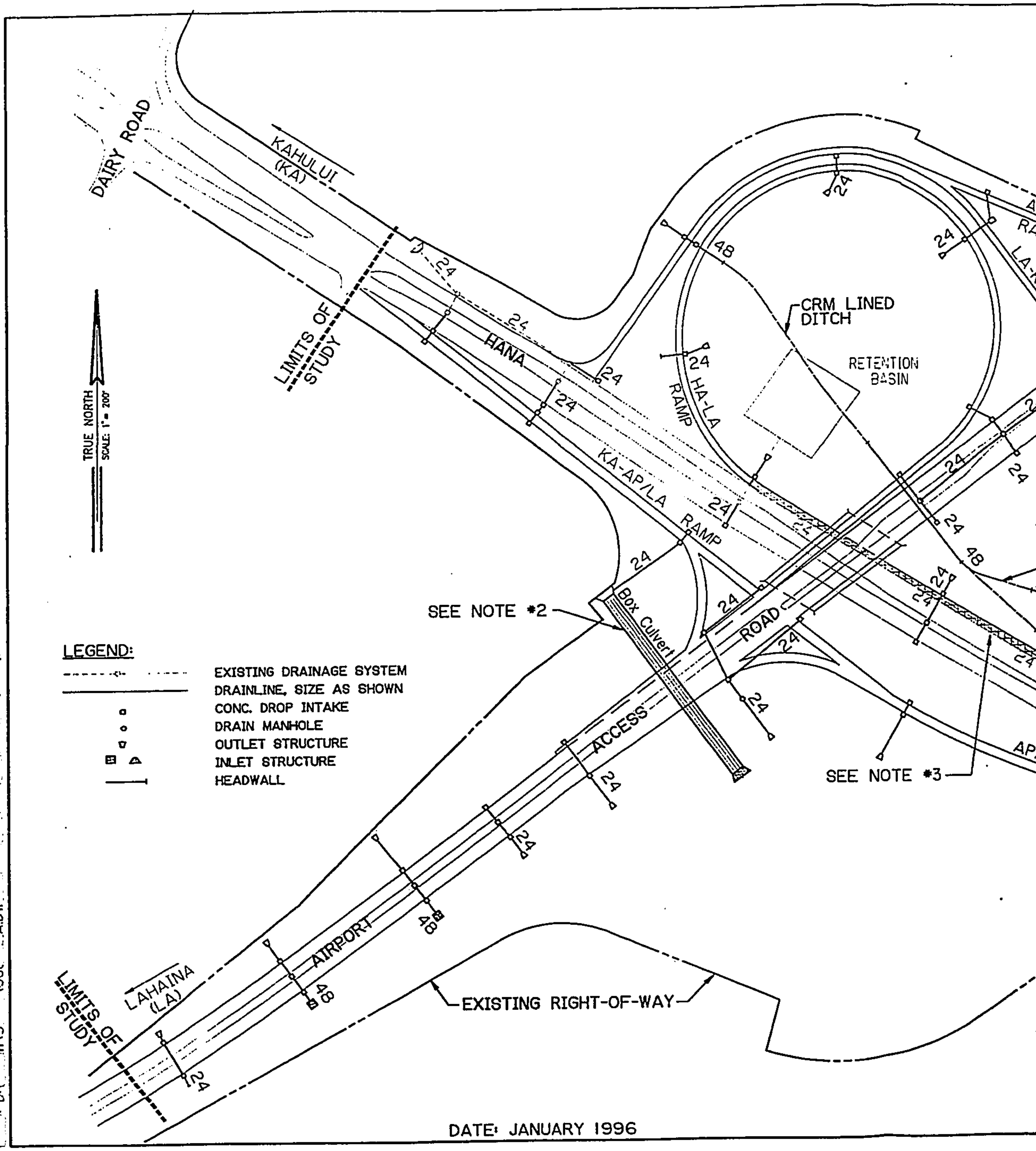


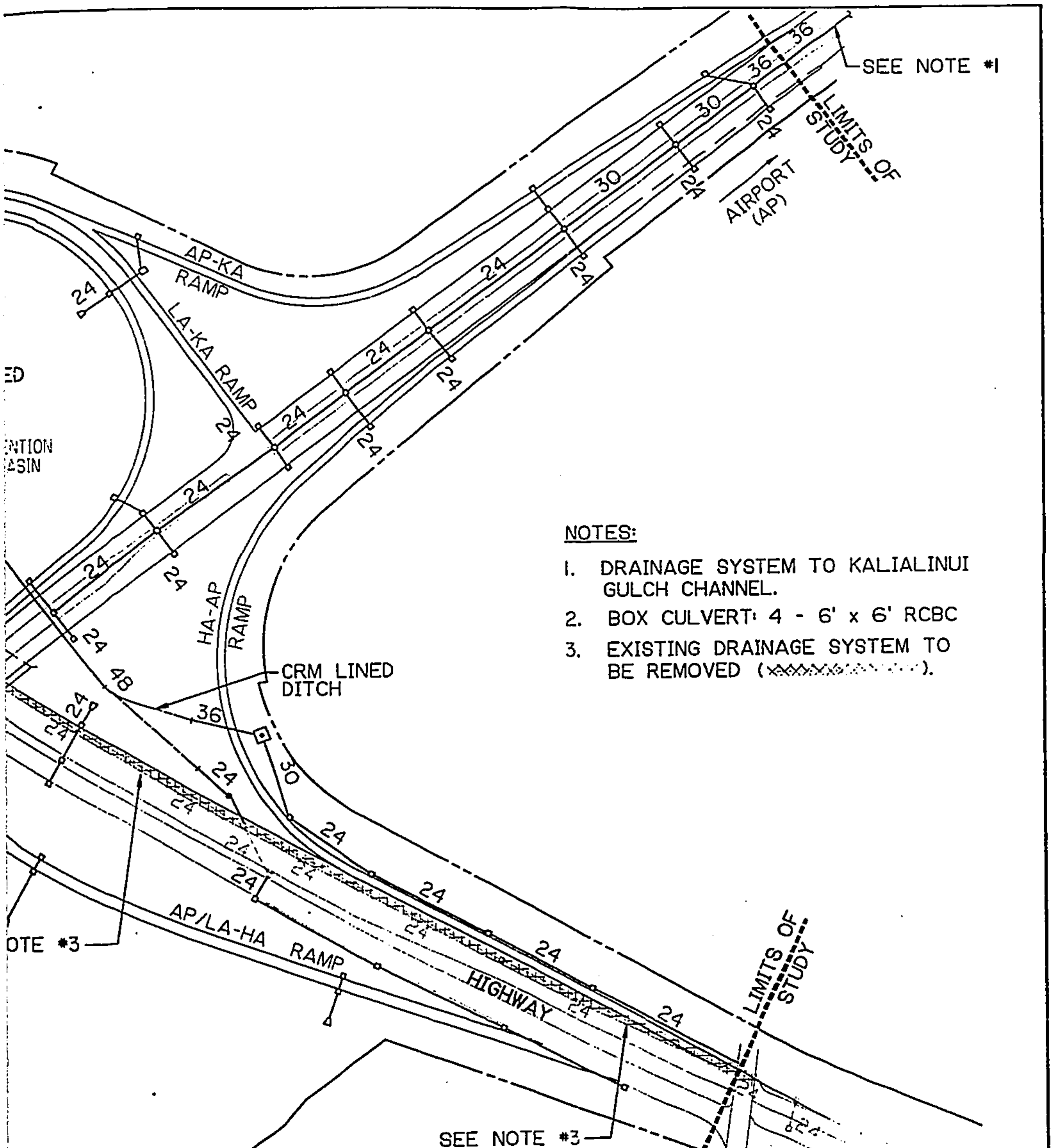
SCHEME B

INTERSECTION DRAINAGE SYSTEM

CONVENTIONAL DIAMOND INTERCHANGE

FIGURE B


DAIRY ROAD
KAHULUI (KA)
LIMITS OF STUDY
HANA
KA-AP/LA RAMP
HA-LA RAMP
CRM LINED DITCH
RETENTION BASIN
TRUE NORTH
SCALE: 1" = 200'
SEE NOTE #2
Box Culvert
ACCESS ROAD
AIRPORT
SEE NOTE #3
LAHAINA (LA)
LIMITS OF STUDY
EXISTING RIGHT-OF-WAY
LEGEND:
EXISTING DRAINAGE SYSTEM
DRAINLINE, SIZE AS SHOWN
CONC. DROP INTAKE
DRAIN MANHOLE
OUTLET STRUCTURE
INLET STRUCTURE
HEADWALL
24
48
DATE: JANUARY 1996



SCHEME C

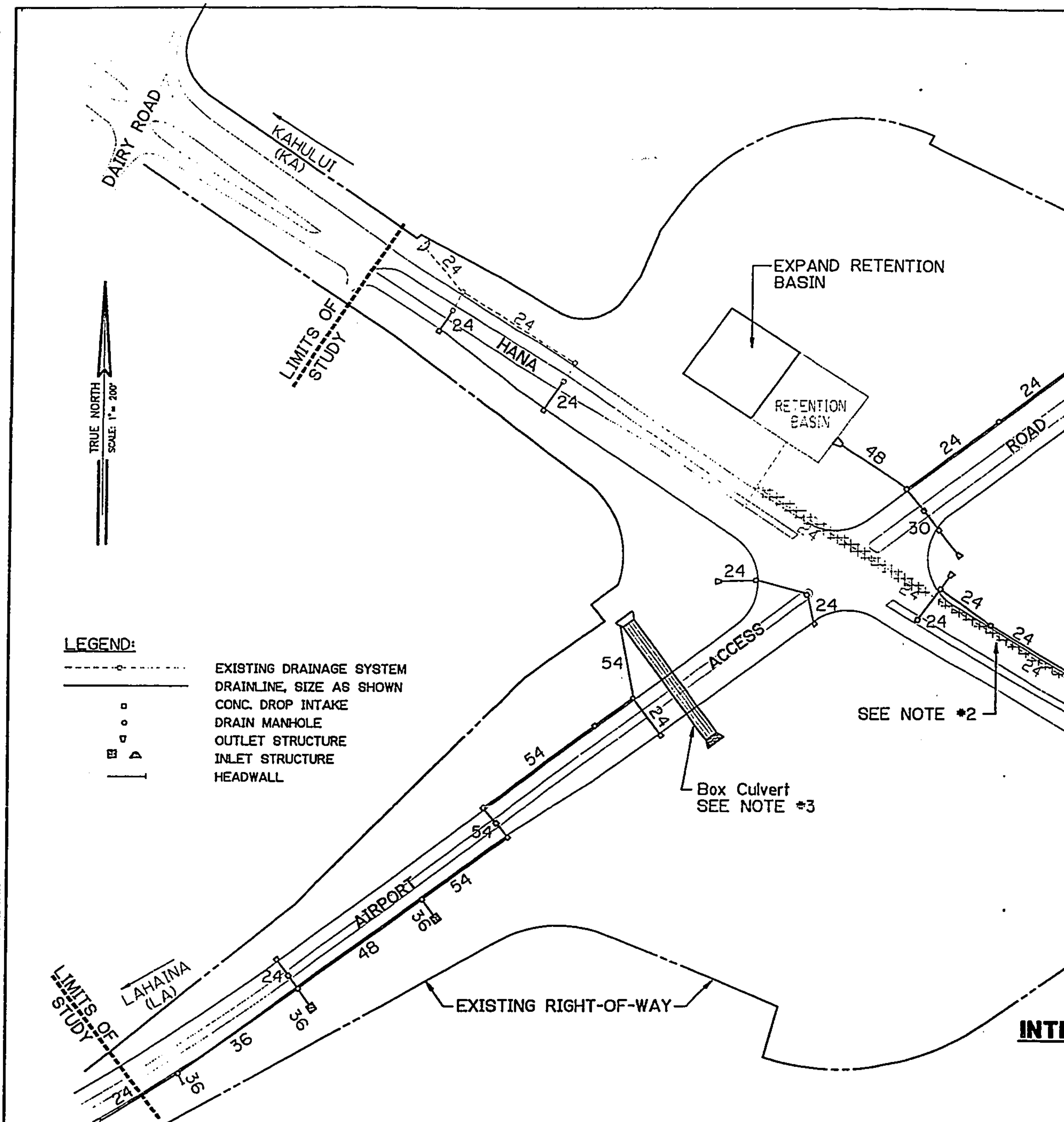
INTERSECTION DRAINAGE SYSTEM

SINGLE-LOOP CLOVERLEAF

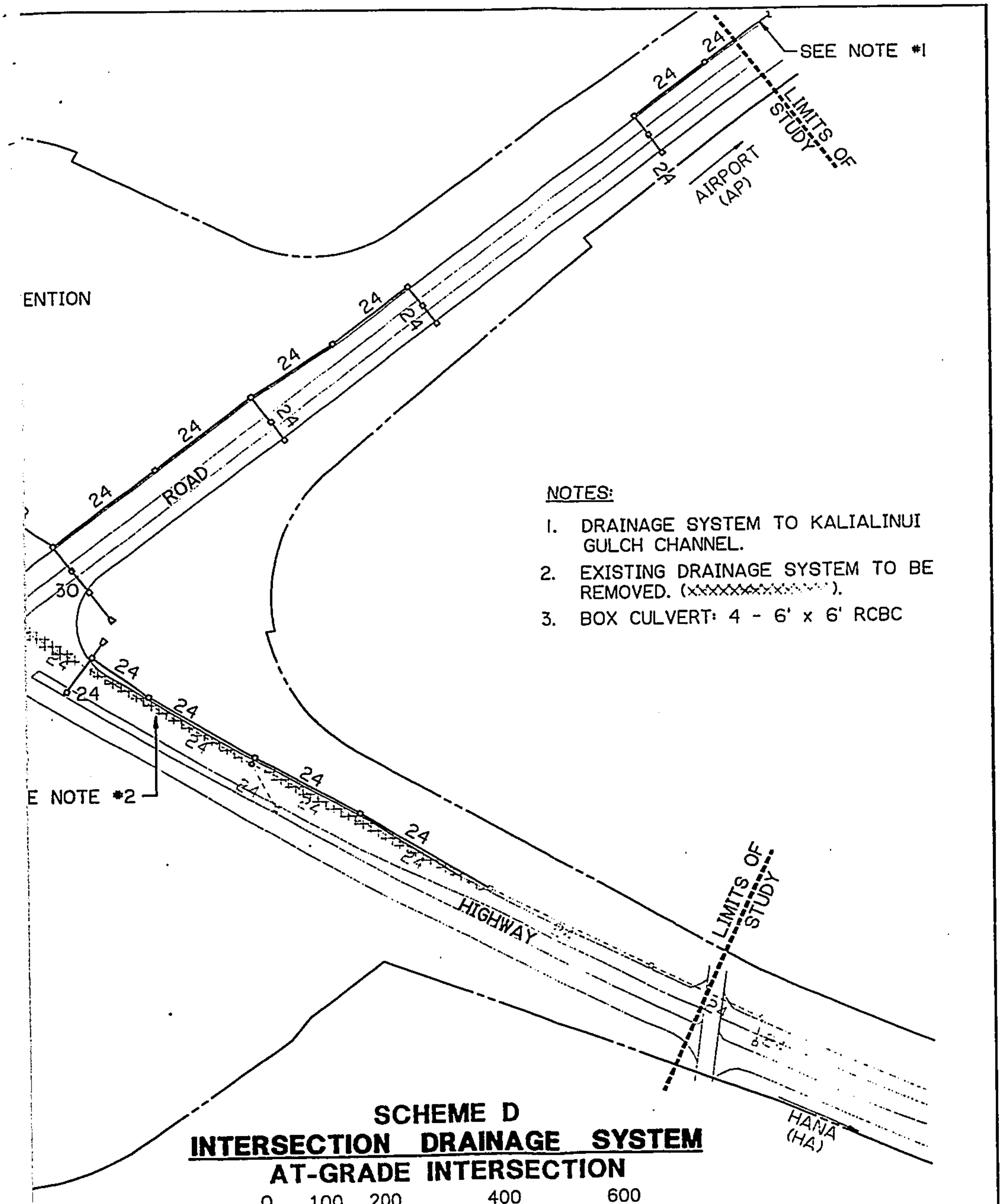
0 100 200 400 600

GRAPHIC SCALE IN FEET

FIGURE C



DATE: JANUARY 1996



SCHEME D
INTERSECTION DRAINAGE SYSTEM
AT-GRADE INTERSECTION

FIGURE D

APPENDIX Q

ALIEN SPECIES ACTION PLAN

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HAWAII ALIEN SPECIES ACTION PLAN
A Multi-Agency Commitment
October 19, 1994

The silent invasion of Hawaii by harmful alien species--disease organisms, weeds, predators, pest insects, etc.--has far-reaching consequences for the State's people, economy, and natural environment. Pest species already established in Hawaii are responsible for large losses of agricultural and horticultural crops. These pests thwart the shipment of local produce to mainland markets, damage native forests, streams, and watersheds, compete with and cause extinctions of native flora and fauna, and carry diseases that affect native species, agricultural crops, livestock and humans.

Hawaii has been actively involved in alien pest prevention and control for a century. Today, at least 20 state, federal, and private organizations spend over $50 million each year to address this complex and growing problem. In spite of this effort, new pests continue to invade Hawaii at an alarming and increasing rate, and control efforts for established pests are often insufficient to prevent localized pest problems from expanding. The damage caused by pests greatly exceeds the current costs of prevention and control programs. As this problem grows, additional sectors of Hawaii's ecology and economy are increasingly vulnerable. This is especially true for Hawaii's visitor industry, which is founded on the state's international image as a paradise free of venomous snakes, tropical diseases, and other threats.

The ASAP Project

For the past seven months, over 80 professionals from government, non-profit, and private agencies, organizations, and businesses have collaborated as the Alien Species Action Plan (ASAP) Working Group to produce a strategy to strengthen Hawaii's protection against this pest invasion. This Working Group was supported with funding provided by the State legislature through the Governor's Agriculture Coordinating Committee (GACC), together with donated staff support from The Nature Conservancy of Hawaii (TNCH), the Natural Resources Defense Council (NRDC), and the University of Hawaii Department of Urban and Regional Planning. A 1992 report prepared by The Nature Conservancy of Hawaii (TNCH) and the Natural Resources Defense Council (NRDC) and entitled The Alien Pest Species Invasion in Hawaii: Background Study and Recommendations for Interagency Planning provided a starting point for the ASAP Group's work.

The ASAP Working Group is composed of three parts. The majority of its members served on one of four Topic Groups, which are multi-interest teams focused on particular aspects of the alien pest problem (e.g., port-of-entry inspections). A smaller Oversight Committee is made up of leaders of key agencies and organizations involved in the project, and served as the decision-making body for the actions that appear in this final plan. Finally, the day-to-day operations of the project were coordinated by the Steering Committee. A full list of the participants in each of these parts of the Working Group team is provided in Attachment 1.

Between April and July of 1994, ASAP Working Group members met in four Topic Groups to identify problem areas and develop specific actions to address them. A plenary session in April launched the project and organized the Topic Groups. Each group then met separately for at least four work sessions, and individual members or subcommittees devoted additional hours to refine a set of recommended actions within each topic area. These were then reviewed by all Topic Groups, and refined further into a set of 31 recommended actions.

A subcommittee of the Oversight Committee then met for three half-day sessions to recommend a first set of actions which all parties to the Working Group will undertake to improve pest prevention and control for Hawaii. These recommendations were adopted by the Oversight Committee and are presented in this plan.

Many other ideas and proposed actions were discussed by the Working Group via the Topic Group sessions; those presented in this plan mark the beginning of a multiagency, collaborative effort that is expected to address a larger scope of work in the coming years. All of the ideas generated by the Topic Groups have been documented and will serve as fuel for the ongoing work described below.

Key Findings

1. The Working Group confirms that the alien pest problem is growing rapidly, and that existing programs for prevention and control will fail to protect Hawaii without significant improvements.

2. Working Group members acknowledge that significant improvements depend, in large part, on improving the coordination among public and private organizations. No one organization can solve this problem; we must work together to devise a more complete and integrated protection system. The actions in this plan reflect a multi-layered protection system, from prevention of pests before they reach Hawaii, through effective control operations for those pests that are already well-established here.

3. Although many improvements will require additional funding and/or strengthened authorities, the Working Group agrees that important progress can be made through innovation and teamwork within existing resources and mandates. No body currently

exists to direct this collaborative effort, and the Working Group regards formation of such a body as its first priority.

4. The Working Group recognizes that significant improvements in pest prevention and control will require widespread public support and political leadership of the highest order. These do not exist at this time. It is a central strategy of the Group to develop this public and political support by a) launching a multi-agency public awareness campaign and b) undertaking a first set of actions that demonstrates the Group's ability to make the best possible use of any resources given them by lawmakers.

5. The Working Group recognizes that its work to date is only a beginning, and that additional actions will be planned each year toward the ultimate goal of providing Hawaii with the best pest protection possible in balance with other societal needs. However, because of the severity of the present problem and the high opportunity costs of delayed action, the Group agrees that slow, incremental improvements will not suffice; dramatic gains must be made during the next four years.

Immediate Priorities

The Working Group will undertake the following actions immediately, attempting to accomplish them without additional funding or legal authority.

1. FORM A COORDINATING GROUP ON ALIEN PEST SPECIES.

Problem Statement
Many of the current difficulties in implementing pest prevention and control strategies are compounded by the lack of interagency coordination, lack of consensus on priorities, and lack of an effective mechanism to set priorities, respond to contingency or emergency situations or to address and resolve jurisdictional disputes and questions. This is the single greatest obstacle to improving the effectiveness of pest programs.

Proposed Action
A Coordinating Group on Alien Pest Species will be formed effective immediately. At least initially, it will be held together and driven by the voluntary efforts and "enlightened self-interest" of its members rather than by any formal authority.

It will not be an additional layer of review or "hoop" for approval of alien species actions, although it may be used to replace or do away with review or approval functions currently conducted by other entities if the Coordinating Group is found to be a more efficient mechanism for this work. The Group will serve to expedite communications, problem-solving, and decision-making for more effective implementation of pest prevention and control work.

Its members will include representatives of any agency or organization which wishes to contribute to the above purpose; each representative will be someone who will advocate within their agency or organization on matters of resource allocation, work priorities, etc. For agencies, these will typically be career leaders (e.g., State division or branch heads) rather than political appointees or elected officials to ensure continuity through changes of political administration.

The group will adopt its own operating procedures and structure. It will meet quarterly, with additional meetings as needed, especially at the outset, to meet its goals.

Resources Needed
During calendar 1995, Coordinating Group meetings will include staff from The Nature Conservancy of Hawaii and its partners in the ASAP Project. Projects of the Group will be funded out of existing budgets. A major goal of the Group will be to develop coordinated funding requests for priorities requiring new resources.

Lead Responsiblity
The Chairman's office of the Hawaii Department of Agriculture will host the Coordinating Group for administrative purposes. Staff from participating agencies, organizations and private enterprises will work with the Chairman's office.

Milestones
All organizations represented on the ASAP Oversight Committee commit to full participation on the Coordinating Group by November 16, 1994.

Group adopts a detailed workplan for improvement of rapid response systems by June 30, 1995.

Group oversees implementation of other priority actions (below).

2. IMPROVE EFFECTIVENESS OF INSPECTIONS THROUGH COORDINATION OF U.S. DEPARTMENT OF AGRICULTURE, U.S. FISH AND WILDLIFE SERVICE, U.S. POSTAL INSPECTION SERVICE, U.S. CUSTOMS SERVICE, HAWAII DEPARTMENT OF AGRICULTURE, AND MILITARY CUSTOMS INSPECTION PROGRAM INSPECTORS.

Problem Statement
Inspectors are unable to check all passengers and material entering Hawaii for possible pest species. They must be highly selective, and must, therefore, target their inspections based on the best available information. The effectiveness of inspections of incoming

cargo, vessels, and visitors can be enhanced by interagency sharing of inspection findings and profiles of suspect materials, and coordination of staffing, planning, and sample inspections. No reliable mechanism currently exists for this coordination.

Proposed Action
Ernest Mayer of USFWS-LE will convene a first meeting of inspectors from the above-named agencies. This group will establish goals and a workplan, and will determine how/if it should function as part of the Coordinating Group on Alien Pest Species (item 1 above) or as an independent group.

Lead Responsibility
USFWS-LE.

Milestones
First meeting held to establish goals by January 1, 1995.

Workplan completed by March 1, 1995.

3. MAKE FULL USE OF THE EXISTING AIRLINE VIDEO ON ALIEN SPECIES.

Problem Statement
Although an excellent video has been completed to make incoming airline passengers aware of the importance of complying with pest prevention regulations, it is screened only on a small portion of incoming flights. Some airlines have been reluctant to make use of the video in a way that will maximize its benefit to Hawaii.

Proposed Action
Oversight Committee will prepare a letter for signature by the new Governor and all members of the Hawaii Congressional delegation to the CEO's of all relevant airlines, requesting their help in showing the video.

Lead Responsibility
Mike Buck of DOFAW, with assistance from Glenn Hinsdale of USDA-APHIS, Larry Nakahara from HDOA-PQ, and Alan Holt of TNCH.

Milestones
Letter signed and delivered by January 31, 1995.

Meeting with airline representatives to identify any obstacles to viewing the video by April 1, 1995.

Full use of the video for English-speaking flights by June 30, 1995.

Full use for all incoming flights (includes foreign language editing) by June 30, 1996.

4. RESOLVE THE USE OF PROHIBITED/ALLOWABLE LISTS AS A PRINCIPAL REGULATORY STRATEGY.

Problem Statement
A central element of any pest prevention or control strategy is defining which species are to be treated as pests or potential pests. In Hawaii and the U.S., government agencies are generally allowed to take action only on species officially listed as pests, in spite of the fact that the pest potential of most species is currently unknown. On the one hand, this system minimizes regulatory impact on commerce and travel and could be used further to reduce the paperwork load of agencies mandated with permit processing duties. On the other hand, some feel that the use of these lists invites new problems by stifling proactive prevention measures. This issue has not been adequately discussed in the ASAP Working Group.

HDOA will propose changes in the regulations regarding prohibited and allowable non-domestic animals and microorganisms which would allow species which are not now known to have pest potential to enter the state through a simplified import review process. This is being proposed to free limited technical staff of a burdensome permit review task in order to dedicate their time to work that has a greater chance of stopping pest species.

Proposed Action
All interested groups will take advantage of the legislative hearings and public review process for the HDOA proposals to debate and resolve the issue of the best strategy for listing of pest species. The Coordinating Group will track these discussions and facilitate decision-making where appropriate.

Lead Responsibility
HDOA-PQ will submit the proposed listing changes and administer the legislative and public review process. All interested parties will take responsibility for engaging in this important debate.

Milestones
HDOA proposal submitted for legislature by January 1, 1995.

Discussions completed by June 30, 1995.

5. **MAP PRIORITY PESTS.**

Problem Statement
No alien pest species in Hawaii is adequately mapped. Many species are not mapped at all. There is no systematic effort to gather, compile or map information on pest infestations, threatened resource values, and threat levels on an island or statewide scale. The existing, localized mapping and data compilation efforts are not well-coordinated. This, in turn, prevents good planning, priority-setting, and implementation of effective containment or eradication strategies.

Proposed Action
Promote the timely and well-organized completion of the funded National Biological Survey (NBS) Ecosystem Initiative project on alien pest mapping. Encourage the use of the State Geographic Information System (GIS) as the computer "platform" for this project and future mapping of pest species in Hawaii. Develop the highest level of compatibility and data sharing between this platform and the relevant databases and GIS of The Nature Conservancy's Heritage system and the U.S. Fish and Wildlife Service. Encourage agencies to gather infestation location data in a uniform and compatible manner for a priority list of to-be-mapped species. Design into the NBS project a process to allow re-mapping of pests for monitoring purposes, and the ability to overlay resource values and other economic, social, and physical values as an aid for decision-making.

Lead Responsibility
National Biological Survey, with focused support from the Coordinating Group described in Action #1 above.

Milestones
Establish a special task force of the Coordinating Group to support the NBS project by January 30, 1995.

Complete the project's first (1-2 year) phase according to the schedule developed by NBS and in a fashion that garners continued funding by the Secretary of the Interior for successive phases.

6. **ASSESS THE IMPACT OF FEDERAL INTERNATIONAL TRADE "PRE-EMPTION PROVISION" ON HAWAII PROTECTION FROM ALIEN PEST SPECIES.**

Problem Statement
As an adjunct to the North American Free Trade Act and the impending expansions of other global trade agreements, the federal government has adopted provisions to prevent state laws from pre-empting these international pacts. These provisions have already

been invoked to override State of Hawaii complaints against the importation of ivy gourd (Coccinea grandis), a known pest, into the U.S.. Promotion of trade is expected to expose Hawaii to further pest traffic from international sources.

Proposed Action
With assistance from our Congressional delegation, we will investigate this issue and adopt appropriate responses via the Coordinating Group.

Lead Responsibility
Susan Miller, former NRDC staff member, will request the assistance of Senator Akaka's office.

Milestones
Assessment completed by January 1, 1995.

Coordinating Group determines appropriate next steps by March 1, 1995.

7. **RETAIN MILITARY CUSTOMS INSPECTION INVOLVEMENT IN GUAM BROWN TREE SNAKE CONTROL.**

Problem Statement
The Brown Tree Snake is one of the most serious threats to Hawaii. Its most likely avenue of introduction to Hawaii is via aircraft from Guam where it has severely impacted the island's economy and ecology. Military Customs Inspection Program (MCIP) officers are a major part of current programs on Guam to pre-inspect cargo for snakes before loading onto outbound flights. As part of the Department of Defense budget reductions, MCIP may be abolished or severely reduced in the immediate future. This would significantly increase the threat to Hawaii of Brown Tree Snake invasion from Guam unless these inspectors are retained for this special purpose or replaced somehow.

Proposed Action
Secure the continuation of inspection activities by the military on Guam through the actions of our Congressional delegation and Governor.

Lead Responsibility
HDOA-PQ (Larry Nakahara) will draft a letter to the Governor and our Congressional delegation for signature by the Oversight Committee members. Members will follow up with the Congressional offices and the military as necessary to secure continued military inspections on Guam.

Milestones
Letter signed by November 16, 1994.

Military confirms uninterrupted snake control operations on Guam.

8. ENSURE CONTINUED INSPECTION OF INCOMING FOREIGN MAIL BY THE U.S. CUSTOMS SERVICE.

Problem Statement
Foreign mail arriving in Honolulu is currently examined by Customs inspectors to assess dutiability and to check for possible contraband or pest traffic. (The mail is one of the primary avenues of pest introduction to Hawaii and the U.S.) A recent raising of the exemptions on collection of duty significantly reduces the percentage of parcels requiring written entries for duty charges. The percentage of parcels requiring examination, however, remains the same, and it is important that the Customs Service be aware of this to avoid any reductions in inspection staff at the Honolulu mail facility.

Proposed Action
Alan Holt of The Nature Conservancy of Hawaii will draft a letter for signature by selected members of the Oversight Committee requesting the assistance of our Congressional delegation in ensuring the continuation of current inspection staffing at the Honolulu mail facility of the U.S. Customs Service. The Coordinating Group will track this issue.

Lead Responsibility
Alan Holt (TNCH).

Milestones
Letter ready for signature by November 16, 1994.

U.S. Customs confirms continued inspections.

9. ESTABLISH THE FOUNDATION OF A CENTRAL PEST REPORTING SYSTEM.

Problem Statement
There is no clear mechanism for the public to report new pest infestations. Several information lines or "hot lines" exist, but these do not provide consistent or comprehensive service for pest reports, and there is incomplete information on how much

or how effectively these lines are used. Rather than reports being handled for the caller with prompt response by the appropriate agency, most calls are referred to another number.

The public is generally inadequately informed about which pests to report and how to report them. Most agencies have not developed this information, and are not currently prepared to handle the anticipated increase in reporting traffic that would occur if a central reporting mechanism was established.

Proposed Action
Complete the assessment of needs and design of a central reporting system (perhaps a limited, first phase system to be expanded to a broader range of pests later) in coordination with the ASK-2000 public information program.

Lead Responsibility
Subcommittee of the Coordinating Group, to be appointed.

Milestones
Subcommittee appointed and funds for assessment and design identified by Coordinating Groups by March 1, 1995.

Workplan for assessment and design completed by May 1, 1995.

Assessment and design completed and implementation scheduled by July 1, 1995.

10. LAUNCH PUBLIC AWARENESS/TARGETTED EDUCATION CAMPAIGN.

Problem Statement
The general public and community leaders are largely unaware of the severity of the alien pest problem. This includes some groups who, if better informed, could greatly aid the overall improvement of pest prevention and control programs by assisting in surveillance for pests (e.g., stevedores, airline employees) or supporting critical legislation. Existing public awareness efforts are uncoordinated and incomplete, and no agency has significant funds available for a major information campaign.

Proposed Action
Take fullest advantage of existing capabilities in public education to 1) heighten general public awareness of the need to protect Hawaii against pests, and 2) enlist targetted groups. Public information specialists from Oversight Committee organizations will recruit other private sector professionals to work on this project with them as a community service. This group will develop a campaign plan and assist the Coordinating Group in launching it within available resources.

Lead Responsibility
The Nature Conservancy of Hawaii (Maria Nachu) and HDOA (Tish Uyehara).

Milestones
Campaign strategy completed by December 1, 1994.

Strategy implemented according to its own timetable.

Priorities Requiring New Resources and/or Authorities

The ASAP Working Group developed problem statements and proposed actions for 20 topics in addition to those listed above. Many of these describe needs for significant new funding, personnel, equipment, facilities, or regulatory authorities. Others require further problem identification before solutions can be formulated. The Coordinating Group described in the priority actions above will use these materials to help guide their work.

Among the major needs described by the Working Group are five which merit highlighting as priorities:

a. First Class Mail inspection
In spite of an act of Congress calling for a two-year trial inspection of Hawaii-bound domestic First Class Mail for potential pests, a special task force convened to implement the act has encountered jurisdictional and legal obstacles which have brought this important work to a halt. No mail has been inspected, and quarantine officials continue to believe that this pathway accounts for as much as 20 percent of the alien species entering the state each year. The ASAP Working Group was unable to reach consensus on a solution to this problem. It merits the highest attention of Senator Akaka's staff and the designated First Class Mail task force agencies.

b. Surveillance and monitoring systems
It was the Working Group's desire to establish a quantifiable goal for improvement of pest prevention and control systems (e.g., "Reduce the number of pest species entering Hawaii by 50 percent by the year 2000"). The Group failed to do this, largely because 1) there is no reliable measure of the current total number of pest species entering the state, and 2) surveillance and monitoring systems for detecting and tracking pest infestations are woefully inadequate. Reliable surveillance and monitoring are essential to the long-term success of prevention and control programs, and will be a priority topic for the new Coordinating Group as they develop plans for future improvements.

c. Inspection and quarantine facilities
The current configuration of airports, harbor warehouses, and pest control research facilities is a significant impediment to improved pest prevention and control. More thorough cargo inspections, for example, are thwarted by the lack of adequate staging areas at the harbor and a general trend toward getting cargo out of the limited dock space quickly. This and other facilities problems will require a commitment to an overarching policy of state and federal government that places pest prevention and control as a top priority.

d. Permanent staffing for agency coordination and public education
The Coordinating Group described above as the hub of agency problem-solving will require a small but permanent staff and discretionary resources beyond current agency budgets in order to address the greatest needs of the state for pest prevention and control. The Coordinating Group will get underway with volunteer and shared resources, and will build its case for increased support through its track record of accomplishment.

e. Conflicting federal-state regulations and policies
As implied in the priority item on preemption of state obstacles to international trade, and in the First Class Mail inspection issue, there is a growing set of issues where Hawaii may need special recognition by the federal government. The Coordinating Group will work on the idea of packaging these into a comprehensive proposal for Congressional consideration.

Attachment 1:
ASAP Working Group Participants

The Hawaii Alien Species Action Plan is the product of the two committees and four topic groups of the ASAP Working Group:

- Oversight Committee
- Steering Committee
- Pre-Entry Prevention Strategies
- Port-of-Entry Sampling & Inspection
- Statewide Control Strategies for Selected Established Pests
- Rapid Response Strategy

This collaborative effort is the first of its kind involving the following agencies, organizations, and private enterprises, represented by individuals who gave their time and expertise to form its conclusions and who are committed to its implementation.

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APPENDIX R

GENERAL AVIATION SITE SELECTION STUDY

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MAUI GENERAL AVIATION STUDY

VOLUME 1: AIRPORT SITE SELECTION REPORT

Prepared for:

STATE OF HAWAII
Department of Transportation
Airports Division

DECEMBER 1995

The Edward K. Noda and Associates, Inc. Team

Edward K. Noda and Associates, Inc. • P&D Aviation • R.T. Tanaka Engineers, Inc.

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Section 1
INTRODUCTION

Edward K. Noda and Associates, Inc. • P&D Aviation • R.T. Tanaka Engineers, Inc.

SECTION 1
INTRODUCTION

BACKGROUND

A joint federal and State of Hawaii Environmental Impact Statement (EIS) is being p...ared to address improvements to Kahului Airport recommended in the Kahului Airport Master Plan prepared for the State of Hawaii in June 1993. On March 11, 1991, the Circuit Court of the Second Circuit, State of Hawaii, stipulated that the State of Hawaii "shall investigate, in the EIS and otherwise, the feasibility of reactivating the Puunene Airport on a permanent basis for general aviation, as a reliever airport and for night cargo operation... [and shall] also consider reactivation of Puunene Airport on a temporary basis for night aircraft use during the period of time required to implement the [Kahului Airport] runway strengthening project."

The former Puunene Airport is located five miles south of Kahului adjacent to Mokulele Highway (State Highway 35) connecting Kahului and Kihei. The former airport served as Maui's commercial airport before World War II, when it became a U.S. Naval Air Station. The airport has not existed for many years and the site now is used for a variety of activities, including a drag strip, a crop dusting base (used for one single-engine aircraft), and a helicopter practice area.

The requirement to study additional options for Kahului Airport presented the opportunity for the State to assess the long-term general aviation needs for Maui and consider a broad range of options for meeting those needs. Consequently, the State initiated an island-wide general aviation study. The Maui General Aviation Study addressed the requirements for general aviation facilities on Maui over the next 20 years and considered a number of alternatives to accommodate these requirements, such as utilizing the two existing general aviation/light-aircraft airports (Kapalua-West Maui Airport and Hana Airport), former airport sites such as the former Puunene Airport, and new airport sites.

This study is being funded largely by the Federal Aviation Administration through a grant under the Airport Improvement Program.

PROJECT OBJECTIVES

The overall goal of this study is to develop a comprehensive general aviation airport system plan that meets the long-term needs of general aviation users and provides relief of air traffic congestion and operating delays at Kahului Airport. Specifically, this study has the following objectives:

- Provide adequate facilities for the long-term (20-year) needs of general aviation, including private flying, training, corporate aviation and helicopter operators.
- Relieve Kahului Airport of airspace and airfield congestion and associated delays, and possibly postpone the need for increased airfield capacity at Kahului Airport.
- Study the potential for relocating fixed-wing general aviation activity, helicopter operations and air cargo operations from Kahului Airport to the former Puunene Airport or other suitable site.
- Achieve and maintain compatibility between general aviation activity and (a) the environment and (b) affected communities and community plans.

SCOPE OF STUDY

The work program for this study contains eleven work elements (Table 1-1). The primary issues addressed in the work program are:

- Operational feasibility of reactivating the former Puunene Airport, considering the potential airspace conflicts with Kahului Airport.
- Availability of new airport sites that could serve general aviation needs but have less potential airspace conflict with Kahului Airport.
- Identification of the long-term roles of the Kapalua-West Maui and Hana Airports.
- Impact on Kahului Airport of relocating a portion of the activity to another site.
- Environmental consequences of developing a former airport site or establishing a new airport site.
- Economic feasibility of developing a new airport.

PUBLIC INPUT AND PROJECT COORDINATION

Public input in the planning process has been facilitated through a series of public information meetings held on Maui to discuss the project and the findings. Meetings were held on:

- May 19, 1994
- July 27, 1994
- December 15, 1994

In addition, a Technical Advisory Committee was established to coordinate the project with aviation operators, organizations and public agencies. The Technical Advisory Committee, whose members are listed in Appendix C, consists of representatives from: general aviation operators, tour helicopter operators, commuter airlines, Airline Pilots Association, County of Maui, Federal Aviation Administration, Department of the Navy, Hawaii Air National Guard, U.S. Department of Agriculture, U.S. National Weather Service and State of Hawaii, Department of Transportation, Airports Division.

STUDY DOCUMENTS

The Maui General Aviation Study will be documented in three volumes, with the following contents:

- Volume 1: Site Selection Study
  - Existing conditions
  - General aviation forecasts
  - Facility requirements
  - Site selection criteria
  - Site alternatives
  - Alternatives analysis
  - Recommended alternative
- Volume 2: Master Plan Study
  - Airport demand forecasts
  - Airport facility requirements
  - Airport development plan
  - Financial feasibility
- Volume 3: Environmental Analysis
  - Proposed action
  - Existing environmental conditions
  - Impacts and potential mitigation

Volumes 2 and 3 will be prepared for the recommended new site alternative.

PLANNING TEAM

The planning team led by Edward K. Noda and Associates, Inc. consists of three firms which are listed below with their responsibilities:

TABLE 1-1
MAUI GENERAL AVIATION STUDY TASKS

Work Element and Task	Description
WORK ELEMENT 1	EXISTING CONDITIONS
Task 1.1	Inventory Air Traffic Activity and Forecasts
Task 1.2	Inventory Airspace, Air Traffic Control and Noise Abatement Procedures
Task 1.3	Inventory Environmental Conditions and Concerns for the Island of Maui
Task 1.4	Inventory Airport Management, Policy, Legal and Regulatory Information
Task 1.5	Review Existing Airport Facilities and Development Proposals
Task 1.6	Inventory Existing Land Use Regulations, Zoning and General Plans for the Island of Maui
Task 1.7	Summarize Existing Conditions, Limitations, Opportunities and Concerns
WORK ELEMENT 2	CANDIDATE SITE SELECTION CRITERIA
WORK ELEMENT 3	SITE SURVEY
WORK ELEMENT 4	AVIATION DEMAND FORECASTS
WORK ELEMENT 5	FACILITY REQUIREMENTS
WORK ELEMENT 6	ALTERNATIVES
WORK ELEMENT 7	RECOMMENDED ALTERNATIVE
WORK ELEMENT 8	DEVELOPMENT PLAN
WORK ELEMENT 9	FINANCIAL FEASIBILITY
WORK ELEMENT 10	ENVIRONMENTAL ANALYSIS
WORK ELEMENT 11	ORGANIZATION, SUBMITTAL AND PRINTING OF DOCUMENTS

- Edward K. Noda and Associates, Inc.
  - Project Administration
  - Coordination with Hawaii DOT
- P&D Aviation
  - Aviation Planning
  - Environmental Analysis
- R.T. Tanaka Engineers, Inc.
  - Engineering Considerations
  - Development Cost Estimates

CONTENTS OF THIS REPORT

The Airport Site Selection Report, Volume 1, contains the following sections: Introduction (Section 1), Executive Summary (Section 2), Environmental Setting (Section 3), Existing General Aviation Airport System (Section 4), Aviation Demand Forecasts (Section 5), Facility Requirements (Section 6), Site Evaluation Criteria and Methodology (Section 7), Airport Site Alternatives (Section 8), Evaluation of Alternatives (Section 9), and Recommended Airport System (Section 10).

Section 2
EXECUTIVE SUMMARY

SECTION 2
EXECUTIVE SUMMARY

The Executive Summary summarizes the important findings and conclusions of the Maui General Aviation Study. The material in this section is arranged according to the remaining sections of the report, with section numbers given for reference. The key tables and figures in the remaining sections are also referenced, with their page numbers.

ENVIRONMENTAL SETTING (Section 3)

- ***Primary Study Area.*** Although the airport site selection analysis has considered the entire island, it has focused primarily [illegible] the central valley and isthmus area [illegible] by the lava flows of the two volcanos on each end of the island. This area is referred to in this document as the "primary study area" or "study area" (Figure 3-2, page 3-3).
- ***Vegetation.*** Of the 146 plant species which have been inventoried in the past within the study area, nineteen are native to the Hawaiian Islands. None of the native plant species are officially listed as threatened or endangered, nor are any of them candidates for such status.
- ***Animal Life.*** The Nature Conservancy of Hawaii has identified thirteen locations in the study area where known endangered animal species have been sighted. One additional species listed as possibly endangered or threatened has been sighted within the study area (Figure 3-4, page 3-12).
- ***Archeological Sites.*** No known sites of archeological significance are known to exist in conflict with any of the airport alternatives considered in this study. However, the site of the former Puunene Airport (also know as the former Naval Air Station Puunene) contains several structures which are possibly noteworthy, namely, a series of aircraft revetments (protective earthen barriers) and ammunition storage bunkers. These structures could be candidates for consideration as historical resources.
- ***Community Plans.*** Four community planning areas lie within the study area: the Wailuku-Kahului, Kihei-Makena, Paia-Haiku and Makawao-Pukalani-Kula areas.

EXISTING GENERAL AVIATION AIRPORT SYSTEM (Section 4)

- ***Based Aircraft.*** In the five year period between 1989 and 1994, the number of based aircraft on the island has increased from 51 to 86 aircraft, with all aircraft based at either Kahului or Hana. There were no aircraft based at Kapalua-West Maui or Hana in 1994. In 1994, the following aircraft were based at Kahului Airport:

Type Aircraft	Number
Fixed-wing Piston	
Single Engine	41
Multi Engine	9
Helicopters	36
Total	86

- ***Aircraft Operations.*** In 1994, Kahului Airport had 179,227 aircraft operations (takeoffs or landings). Sightseeing helicopter operations accounted for approximately 69,000 operations in 1993, forty percent of Kahului Airport operations. There were 33,292 general aviation aircraft

operations at Kahului Airport in 1994, nineteen percent of the total. (Table 4-1, page 4-2).

- ***Existing Airports.*** There are presently three active State-operated airports on Maui: Kahului, Hana, and Kapalua-West Maui Airports (Figure 3-1, page 3-2). Kahului Airport is the major airport on the island, containing two intersecting runways on 1,391 acres. The airport serves air carrier, commuter, general aviation and military activity. Hana Airport has a single runway on 119 acres and serves commuter and general aviation users. The Kapalua-West Maui Airport has a single runway on approximately 50 acres and serves only scheduled commuter operations.
- ***Airspace System.*** Much of the airspace over the study area is controlled by the FAA Air Traffic Control tower at Kahului Airport (Figure 4-4, page 4-9). The other two airports on the island of Maui do not have control towers. The Kahului Airport is equipped with an instrument landing system (ILS) on Runway 2 for precision instrument landings. Other navigational aids and procedures provide for non-precision instrument approaches to Kahului Airport. A commonly-used visual approach procedure has been published for Runway 2, referred to as the "Smoke-stack Visual Runway 2 Approach." Aircraft on this approach fly over the KNUI radio tower near Kihei and intercept the Runway 2 extended centerline at or prior to the Puunene Sugarmill smoke stacks.
- ***Constraints and Opportunities for New Airport Development.*** New airport development within the study area is constrained by:
  - Threatened and endangered species and wildlife habitat areas
  - Proximity to urban development
  - Runway 2 approach corridor
  - Topography

In spite of the constraints described above opportunities exist for the potential location of a new airport and/or heliport within the study area, south of Hana Highway and east of Mokulele Highway (Figure 4-5, page 4-17).

AVIATION ACTIVITY AND FORECASTS (Section 5)

- ***Baseline Forecasts for Maui Airports.*** According to the 1994 State aviation forecasts, activity at all three airports is expected to experience continued growth over the next two decades (Table 5-1, page 5-2). Aircraft operations at Kahului Airport are expected to increase from 179,227 in 1994 to 274,800 in 2015. By 2015, it is estimated that 45 percent of operations will be flown by commuter/air taxi aircraft, mostly tour helicopters. The number of general aviation aircraft and helicopters based at Kahului Airport is expected to increase to 111 by the year 2015. In the same year, there are projected to be 26,700 operations at the Kapalua-West Maui Airport and 10,700 operations at Hana.
- ***Helicopter Tour Projections.*** Refinements to the State aviation forecasts were made in the Maui General Aviation Study to identify activity projections related to helicopter tour activity. Annual helicopter tour operations are projected to increase from 69,000 in 1994 to 99,400 in 2015. Over the same period, the number of tour helicopters based on Maui is projected to increase from 27 in 1994 to 39 in 2015 (Table 5-4, page 5-7).

- **Activity Which Could Potentially Relocate to a New Site.** The activities and number of annual aircraft operations which could potentially be relocated in the year 2015 from Kahului Airport to a new site are as follows (Table 5-5, page 5-9):
  - Helicopter tour operations, 99,400
  - Fixed-wing piston general aviation operations, 41,800
  - General aviation helicopter operations, 5,700
  - Fixed-wing general aviation turbine operations, 1,300
  - All-cargo operations, 5,800

FACILITY REQUIREMENTS (Section 6)

- **Requirements for Hana and Kapalua-West Maui Airports.** Facility requirements for the Hana and Kapalua-West Maui Airports were identified in the 1990 Hawaii Statewide Airport System Plan. No significant changes to the facility requirements contained in the Statewide Airport Plan are projected for the two airports. Future requirements for Hana Airport include: a full-length parallel taxiway, an additional commuter aircraft parking position, a terminal building addition of 800 square feet and 10 additional vehicle parking spaces. No significant facility improvements are planned for the Kapalua-West Maui Airport.

- **Facility Requirements for New Airport/Heliport Sites.** Facility requirements for the year 2015 were developed for the following categories of new airport/heliport sites (Tables 6-5 through 6-9, pages 6-12 through 6-18):
  - Limited Service Heliport: 12 acres, 2 final approach and take-off areas
  - Full Service Heliport: 60 acres, 4 final approach and take-off areas
  - Utility Airport: 390 acres, 3,550-foot runway
  - Utility/Heliport: 510 acres, 4 final approach and take-off areas, 3,550-foot runway
  - Transport Airport/Heliport: 710 acres, 4 final approach and take-off areas, 6,000-foot runway

Facility requirements include airfield facilities, administration/terminal facilities, based aircraft facilities, operator lease areas, vehicle access and parking, support facilities and the ultimate land area requirement.

SITE EVALUATION CRITERIA AND METHODOLOGY (Section 7)

- **Site Evaluation Criteria.** The criteria for identifying and evaluating alternative airport/heliport sites were developed on the basis of airport siting issues contained in FAA guidelines and identified in public information meetings held on Maui during May and July of 1994. Important issues were grouped under the six categories described below.

- ***Physical Site Constraints***
  - Accommodation of required facilities
  - Availability and capacity of infrastructure
  - Availability of land for expansion
  - Topography and other physical constraints

- ***Air Service Considerations***
  - Restrictions on air service
  - Proximity to demand
  - Attractiveness to tenant businesses
- ***Aeronautical Considerations***
  - Airspace constraints
  - Meteorological impacts
  - Obstructions
- ***Environmental and Land Use Impacts***
  - Vegetation and wildlife
  - Aircraft noise and land use compatibility
  - Surface transportation
  - Other environmental impacts
- ***Development Costs***
  - Site acquisition, construction and mitigation costs
  - Costs not eligible for FAA funding
- ***Effect on Capacity of Kahului Airport***
  - Reduction in operations at Kahului Airport
  - Demand-capacity and delays at Kahului Airport
  - Areas at Kahului Airport made available for other uses

AIRPORT SITE ALTERNATIVES (Section 8)

- **Potential Locations for Relocation of Activity from Kahului Airport.** Four categories of airports or sites were considered for the transfer of activity from Kahului Airport: existing airports, locations where airports existed in the past, sites proposed for new airports in previous studies, and new site locations.

- **Evaluation of Existing Airports.** The Kapalua-West Maui Airport can not accommodate the helicopter and general aviation activities at Kahului Airport because the Kapalua-West Maui Airport is restricted to commuter aircraft flights. The Kapalua-West Maui Airport will continue to fulfill the role of providing only commuter passenger service for visitors to the West Maui resort area. Hana Airport is not considered a viable reliever for helicopter or general aviation activity at Kahului Airport due to the two and one half hour driving time from Kahului. Hana Airport will continue in its present role of serving the commuter, sightseeing and general aviation needs of the Hana area.

- **Evaluation of Former Airport Locations.** Four sites were identified where former airports were located on the Island of Maui. The former Puunene Airport site, the former Kaanapali Airport site, former Maalaea Airport site, and a former airport located southeast of Kahului Airport. Each of these sites was investigated for its potential to provide helicopter and/or general aviation relief of Kahului Airport.

The only one of these sites which would be a potential candidate for a new fixed-wing airport and/or heliport would be the former Puunene Airport site. The Puunene site was considered a potential candidate because of its previous use as an airport, relative flat terrain, availability of state-owned property and the accessibility to the existing highway system.

- ***Evaluation of Previously Proposed Sites.*** In airport site selection studies conducted in the 1970's, two airport sites were evaluated and proposed for airport development in the Lahaina area. These two sites are not now considered to be viable airport sites due to development that has occurred in the West Maui area since the 1970's (Figure 8-1, page 8-4).

- ***Identification of Potential New Airport/Heliport Sites.*** Ten airport/heliport site alternatives were identified for the relocation of activity from Kahului Airport. These alternatives consist of various combinations of heliports, utility airports, and a transport airport (Figures 8-3 through 8-18, pages 8-12 through 8-29):

  - Alternative 1A, relocation of Kahului helicopter facilities to the east
  - Alternative 1B, new limited service heliport at an unspecified West Maui location and/or Puunene site
  - Alternative 2, new heliport at the south end of the former Puunene Airport site
  - Alternative 3, new heliport located on the east side of the Puunene site
  - Alternative 4, utility airport/heliport at the Puunene site
  - Alternative 4A, new utility airport at the Puunene site
  - Alternative 5, new utility airport/heliport north of Kihei
  - Alternative 6, new utility airport/heliport east of Kahului Airport
  - Alternative 7, new heliport and new utility airport in separate locations at the Puunene site
  - Alternative 8, new transport airport/heliport at the Puunene site

EVALUATION OF ALTERNATIVES (Section 9)

- ***Site Alternative Evaluations.*** Each of the airport/heliport site alternatives was evaluated according to the criteria developed for this study. Pertinent results of this evaluation are described below (Table 9-15, page 9-68).

- ***Physical Site Constraints.*** Alternatives 4, 4A, 7, and 8 were found to have major physical site constraints. A radio and a television tower would potentially have to be relocated to accommodate Alternatives 4, 4A, 7 and 8. A waterway which can carry substantial volumes of water, the Kolaloa Gulch, would intersect the runway in Alternatives 4, 4A, and 8. The Kolaloa Gulch in this area would have to be bridged or relocated.

- ***Aeronautical Constraints.*** Five sites were found to have significant aeronautical constraints: Alternatives 4, 4A, 6, 7, and 8. The Alternative 6 site is within the Kahului inner Class C airspace. The four fixed-wing airport alternative sites in the former Puunene Airport area would have major flight path conflicts with Kahului Airport. Commercial jet aircraft on approach to Runway 2 at Kahului Airport overfly the Puunene Airport site at an altitude which would allow only 800 feet of vertical separation with the traffic pattern altitude of a new airport.

- ***Noise Impacts.*** None of the airport site alternatives would produce noise levels which would result in residential or other

sensitive land uses being located within a noise level of 55 Ldn or greater.

- ***Land Use Impacts.*** The only alternative projected to have significant land use impacts would be Alternative 7. Under this alternative the airport's traffic pattern would overfly developed areas of Kihei.

- ***Vehicle Traffic.*** Alternative 1B would result in an estimated reduction of 620 daily vehicle trips. Other site alternatives are not projected to have major impacts on vehicle traffic on the island.

- ***New Site Development Costs.*** The total estimated development cost of alternatives involving a new site are (Tables 9-2 through 9-10, pages 9-42 through 9-59):

Alternative	Cost (Millions of 1994 dollars)
1B	6.42
2	9.59
3	10.88
4	35.87
4A	29.28
5	45.96
6	43.28
7	27.08
8	54.68

Alternative 1A does not involve a new airport site since it would be an expansion of Kahului Airport. For this reason, development costs were not evaluated for Alternative 1A.

- ***Relief of Congestion at Kahului Airport.*** In the year 2015, the ratio of annual fixed-wing operations to annual airfield capacity at Kahului Airport is projected to be 0.91. This demand-capacity ratio at Kahului is expected to result in an annual delay cost of $5.9 million (Table 9-14, page 9-65). Alternatives 1A, 1B, 2 and 3 would not reduce the fixed-wing operations demand-capacity ratio. Alternatives 4, 4A, 5, 6, and 7 would reduce the fixed-wing operations demand-capacity ratio at Kahului Airport to 0.68 and result in an annual delay savings of $3.2 million in the year 2015. Alternative 8 would reduce the fixed-wing operations demand-capacity ratio to 0.65 and produce a $3.7 million savings in annual delay in the year 2015.

- ***Conclusions from Evaluation of Alternative Sites.*** It is concluded that Alternative 1B should not be pursued further in light of the limited relief it would provide Kahului Airport, the duplication of existing facilities, and the relatively high cost of constructing a new limited-service public-use heliport compared with the other alternatives considered. It is also concluded that Alternatives 4, 4A, 7 and 8 should not be pursued further because of physical site constraints and flight path conflicts with aircraft approaching Kahului Airport. Alternatives 1A, 2, 3, 5 and 6 were not eliminated during this stage of evaluation.

RECOMMENDED AIRPORT SYSTEM (Section 10)

- ***Airport System Considerations Regarding Fixed-wing Aircraft Operations.*** According to projections prepared for the State, fixed-wing aircraft demand at Kahului Airport will increase from approximately 114,000 operations per year in 1993 to about 170,000 annual operations in 2015. The airfield capacity of Kahului Airport (for the mix of aircraft forecast in the year 2010) was estimated in the 1993 Airport Master Plan to be 193,000 operations per year. Therefore in the year 2015 the number of fixed-wing aircraft operations would be about 80 percent of the operations capacity of the airport (Figure 9-18, page 9-67). There are two basic options for expanding airfield capacity: building a new general aviation airport or constructing a third runway at Kahului Airport.

A new general aviation airport would shift fixed-wing demand from Kahului Airport to the new site. The new site would serve 42,000 general aviation operations in the year 2015. With a new general aviation airport, the fixed-wing aircraft demand at Kahului would reach airfield capacity well beyond the year 2015. Prior to airfield demand reaching capacity, a third runway would be needed at Kahului. The capital costs of a new general aviation airport at a feasible site would be approximately $43 to $46 million.

The second option to relieve the future demand-capacity shortfall is to add a new general aviation runway at Kahului Airport after 2010. This would increase the capacity of Kahului Airport to approximately 285,000 operations per year. With the new runway, the airfield capacity would exceed demand substantially beyond 2015 (Figure 9-18, page 9-67). The new runway would initially serve general aviation and commuter activity.

Eventually however, the capacity of the main runway would be incapable of handling all air carrier demands, and the general aviation runway would need to be upgraded to accommodate at least commercial jet service by interisland flights. A runway length of 8,500 is recommended in the 1993 Kahului Airport Master Plan. It is estimated that the general aviation runway development would cost approximately $25 million including land acquisition on the southeast side of the airport west of Hana Highway. It is estimated that the development cost to widen and extend the runway to 8,500 feet would be approximately $100 million, based on cost estimates contained in the 1993 Master Plan.

- ***Airport System Considerations Regarding Helicopter Issues.*** The recent concerns of fixed-wing aircraft operators with the proximity of helicopter flights result largely from the close proximity of the helipads and helicopter operating area to the Runway 2-20 centerline as well as the large number of helicopter operations. The two helipads in the tour helicopter operating area are located approximately 450 feet and 700 feet from the Runway 2-20 centerline. FAA standards establish a separation of 700 feet for runways used by aircraft over 300,000 pounds maximum takeoff weight, such as the DC10 and L1011 currently operating at Kahului Airport. A separation between helicopters and fixed-wing aircraft which exceeds FAA standards can be achieved by relocating the helicopter operating area to a new site (Alternatives 2 and 3) or relocating the helicopter operating area to the east of its present location (Alternative 1A).

- ***Airport Site/System Conclusions.*** It is concluded from the airport site and system evaluations that airport improvements relating to fixed-wing general aviation activity should consist of phased improvements to Kahului Airport. If fixed-wing general aviation activities were to remain at Kahului Airport: capital improvement costs would be lower in the long run, added runway capacity at Kahului Airport could be shared by airline and general aviation users, no airspace conflicts would be created, all flight activity would remain under a single air traffic control tower, and airport security and fire protection services would be enhanced.

  It is further concluded that there are two long-term options for satisfying the helicopter demand and providing adequate separation with fixed-wing aircraft operations: relocating helicopter activity to the Puunene site, or keeping helicopter

operations at Kahului Airport but moving them farther east of the existing location. Under both of these options the relocation of helicopter activity would be conducted in stages to provide maximum flexibility to helicopter tour operators and to allow them to recover their investments at Kahului Airport. Although both options have merit, it is recommended that the helicopter activity be relocated ultimately to a new heliport at the Puunene site (Alternatives 2 or 3). Relocation to this site would allow for the expansion of tour helicopter activity, eliminate airspace conflicts at Kahului Airport, minimize helicopter noise impacts, be consistent with the County of Maui plans for the Puunene area, reduce operational conflicts when a parallel runway is built at Kahului Airport, and enhance the overall safety of helicopter activity.

- ***Phasing Plan.*** The following phasing plan is recommended:

  - Phase 1 (1995 to 2000): Relocate the helicopter operating area immediately east of the current location to provide a separation from the Runway 2-20 centerline of about 1,500 feet. Set aside land at the Puunene site for the development of a new heliport.

  - Phase 2 (2000 to 2010): Re-evaluate the time frame for the development of a new heliport. The initial phase of development could occur in either Phases 1 or 2.

  - Phase 3 (2010 to 2020): Construct a parallel runway (of approximately 4,000 feet in length) at Kahului Airport for use by general aviation and commuter operators. Move all remaining helicopter tour activity to the new heliport at the Puunene site.

  - Phase 4 (after 2020): Widen and extend the new runway at Kahului Airport to 8,500 feet for air carrier use.

- ***Recommended Future Airport System.*** The recommended future airport system for Maui Island is:

  - Kahului Airport (air carrier and commuter passenger service, air cargo, fixed-wing general aviation).

  - Kapalua-West Maui Airport (commuter service by propeller-driven, fixed-wing aircraft).

  - Hana Airport (commuter service, general aviation).

  - New Heliport at Puunene Site (helicopter tour operators and other helicopter users).

Section 3
ENVIRONMENTAL SETTING

SECTION 3
ENVIRONMENTAL SETTING

This section includes a description of the primary study area for the project and discussions of the natural and human environmental settings within this primary study area.

DESCRIPTION OF PRIMARY STUDY AREA

This study encompasses the entire Island of Maui (Figure 3-1). Although the airport site selection analysis has considered the entire island, it has focussed primarily on the central portion of the island. This area illustrated on Figure 3-2 will be referred to in this document as the "primary study area" or "study area". Important characteristics of Maui Island and the study area in particular, relevant to aviation planning, are described below.

Climatology and Meteorology

The major climatic features influencing the study area include the buffering effect of the Pacific Ocean, the constant level of solar energy and the semipermanent high pressure cell centered north of the Hawaiian Islands. These features produce consistent year-round temperatures, pronounced seasonal variations in rainfall, a rarity of severe storms and relatively constant winds from the northeast.

Average monthly temperature (°F) are in the 70s throughout the year. The temperature variation between the coldest month, February, and the warmest month, August, is slightly greater than 7 degrees. The Pacific Ocean and the constant level of solar heating contribute to the uniform temperatures.

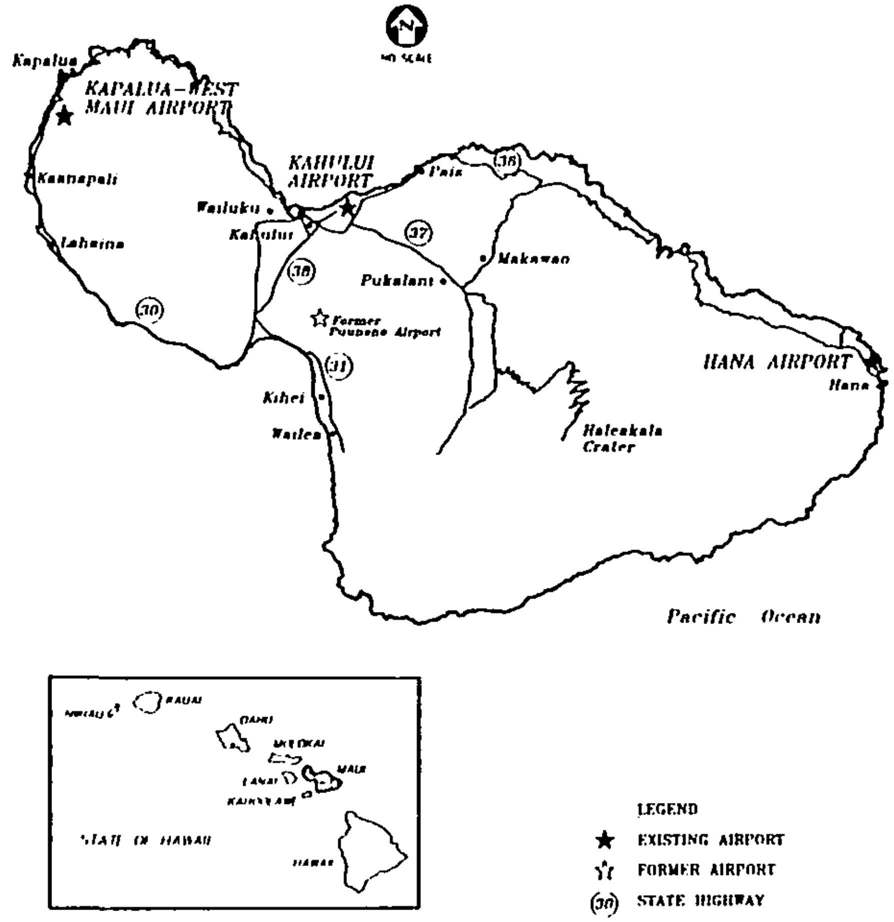
Average annual rainfall at Kahului Airport and much of the lowland portion of the study area is approximately 19 inches. Over 80 percent of the rainfall occurs during the six-month wet season of November through April. Short, light showers constitute the greatest of rainfall occurrence. Severe storm systems are rare. However, the occasional severe weather system may include thunderstorms, damaging winds and torrential rains. Occasionally a month during the dry season passes with no measurable amount precipitation.

In general, the study area experiences surface winds predominantly from the northeast. These winds, often attaining speeds of 40 to 45 mph in Kahului, result from the funnelling effect of the surrounding mountains and the air circulation pattern established by the semipermanent high pressure system over the region. This pressure system produces a persistent air flow from the northeast known as the Northeast Trades. The trade-wind flow is most prevalent during the dry season, with variable occurrence (50%) during the wet season.

Terrain

Optimum airport sites (flat land, and good surface accessibility) are extremely limited and occur mostly in the Central Valley and in the west and south coastal areas of Maui Island.
As depicted in Figure 3-1, two large shield volcanoes and a connecting isthmus form the island of Maui. The West Maui Mountains are the remains of the older shield volcano, and are characterized by numerous deep stream-eroded valleys. The highest peak on this side of the island is Puu Kukui at 5,788 feet. Massive Haleakala, much younger, rises 10,023 feet at Puu Ulaula. Lava flows from the two volcanoes have formed the isthmus between them which is considered the Central Valley. On this plain are some of the island's most productive soils and its largest concentration of population.

FIGURE 3-1
MAUI ISLAND AND EXISTING AIRPORTS



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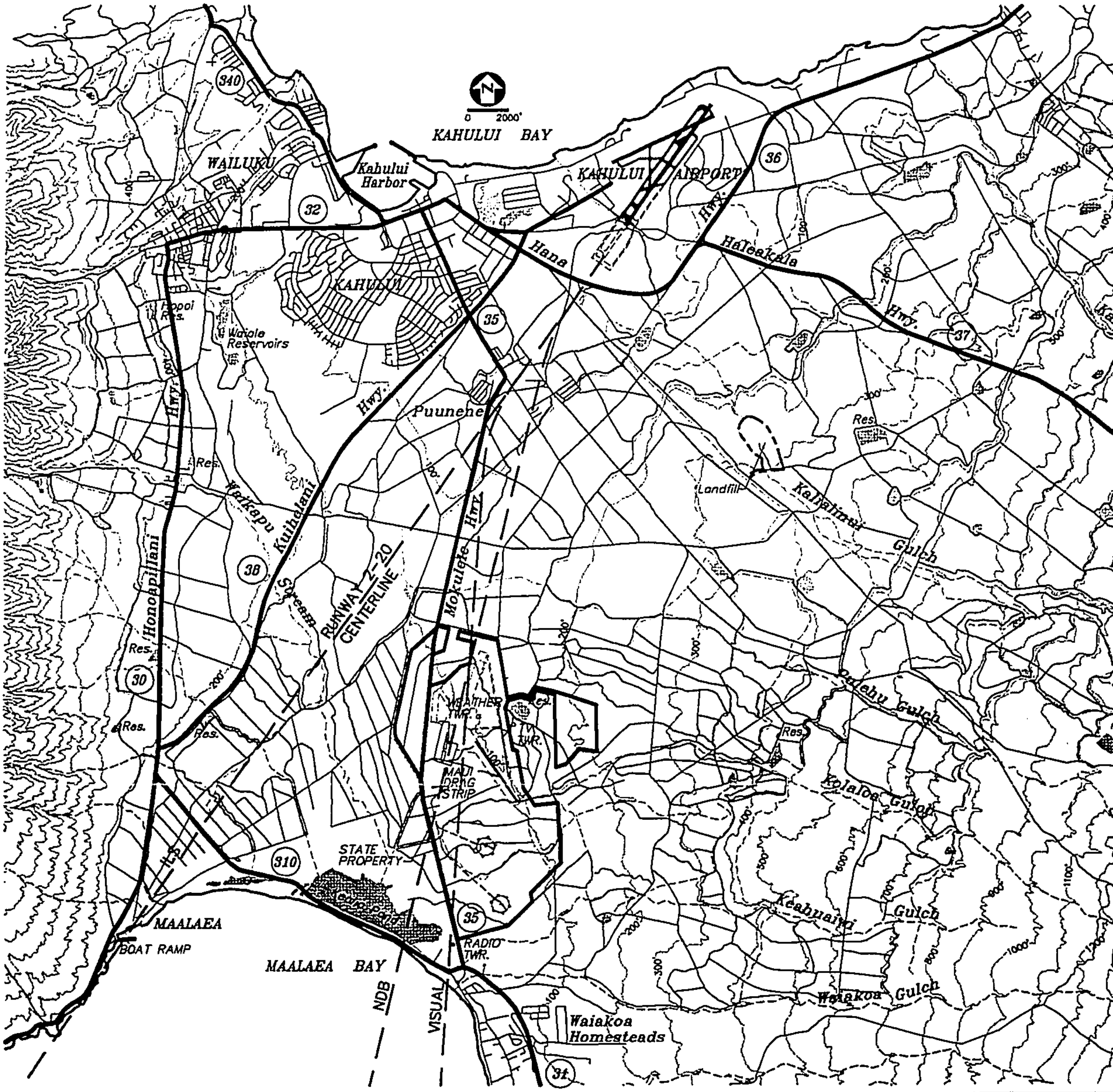
KAHULUI BAY
0 2000'
WAILUKU
Kahului Harbor
KAHULUI AIRPORT
Hana
Haleakala
Hwy.
KAHULUI
Waiale Reservoirs
Puunene
Kuihelani
Hwy.
Waikapu
Stream
Honoapiilani
Hwy.
RUNWAY 2-20 CENTERLINE
Mokulele Hwy.
Landfill
Kalialinui
Gulch
Pulehu Gulch
Kolaloa Gulch
Keahuaiwi
Gulch
Waiakoa Gulch
WEATHER TWR.'s
ATC TWR.
MAUI DRAG STRIP
STATE PROPERTY
RADIO TWR.
MAALAEA
BOAT RAMP
MAALAEA BAY
NDB
VISUAL
Waiakoa Homesteads
340
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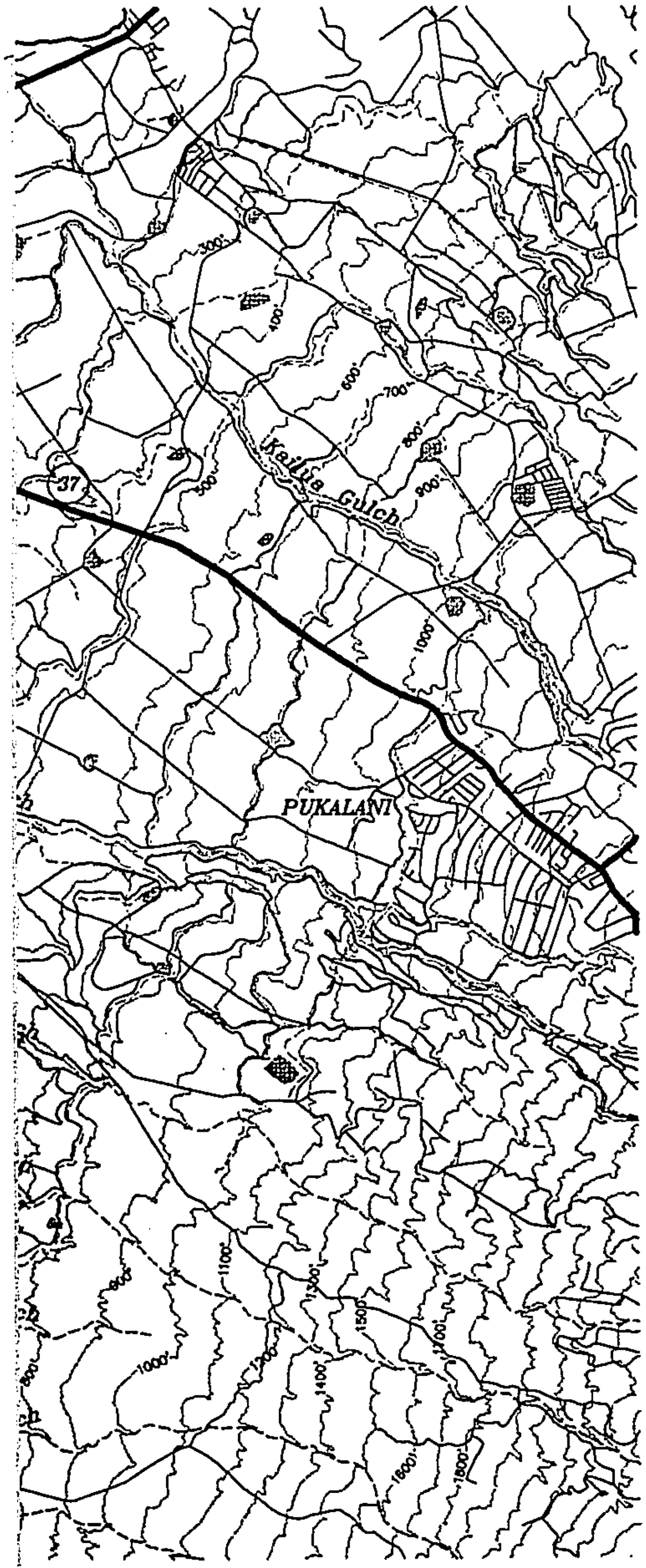


LEGEND

- PRINCIPAL HIGHWAY
- OTHER ROAD (PAVED, GRAVEL, GRADED DIRT)
- (30) STATE HIGHWAY NUMBER
- STATE-OWNED PROPERTY (FORMER PUUNENE AIRPORT)
- APPROACH FLIGHT TRACK TO KAHULUI AIRPORT RUNWAY 2

FIGURE 3-2
PRIMARY STUDY AREA

Population

Maui County constituted nine percent of the estimated 1.1 million residents in the State of Hawaii in 1990. This four-island county had an estimated resident population of 100,504 persons. Maui Island, with an estimated resident population of 91,361 persons, accounted for 91 percent of this. The County's population grew by 54 percent from 1970 to 1980, and 42 percent from 1980 to 1990.

The de facto population is defined as the number of persons physically present in the area, regardless of usual place of residence. It includes visitors, but excludes residents temporarily absent. The de facto population of Maui County in 1990 was 137,300, with approximately one quarter of that total being visitors.

Visitor population trends are important, because tourism is the county's largest industry. In the past, most of Maui's visitors have been from the mainland U.S. and Canada. However during the past several years, the number of visitors to Maui from these countries has declined. Growth from Far East countries, especially Japan, has helped compensate for the westbound decline as the trend for international visitors appears to be increasing.

It is relevant to this study to note the distribution of population by urban center for a number of reasons. Firstly, aviation demand is most likely the greatest near population centers. The population centers can also represent potential areas impacted by an airport and its operations, therefore the location of the centers can constrain a search for a new airport site. There are two urban centers on Maui Island, Kahului and Wailuku, where the population exceeds 10,000 (Table 3-1). The resort areas, which accommodate the majority of the visitor population, are located on the west side of Maui Island and include Napili, Lahaina, Kihei and Wailea. Table 3-1 lists the population distribution per urban center.

Economy

Maui's economy is highly reliant on four key industries - tourism, agriculture, construction and high technology. The majority of its residents are occupied in the tourism, agricultural and hotel industries, which pay relatively low wages. Therefore, the livelihoods of a majority of Maui residents are very dependent on the growth of the tourism, agriculture and construction industries.

The tourism industry in all its many forms is the largest industry on Maui. Approximately 45% of Maui residents are directly employed in tourism, and this estimate could be much higher if all those employed in businesses indirectly involved in tourism are counted.

The Bank of Hawaii developed data that can be used to estimate Maui County's gross product by industry segment, similar to the Gross National Product (GNP) for the U.S., as shown in Figure 3-3. Gross county product is the value of all final goods and services produced within the County subtracting out all of the things that were imported into Maui and remanufactured or sold. Examining gross county product is useful because it focuses on only revenues Maui generated, and it can be divided into revenues by industry segment. The relative size of each industry segment can then be compared.

If the segments that are generally recognized as directly involved in tourism are added together (i.e., hotels, and at least a portion of those hatched with diagonal lines: transportation/communications/utilities, retail, wholesale and other services) a total of at least 30% to 40% would result.

A grouping of financial institutions, insurance and real estate is the next largest grossing industry sector on Maui, however this industry

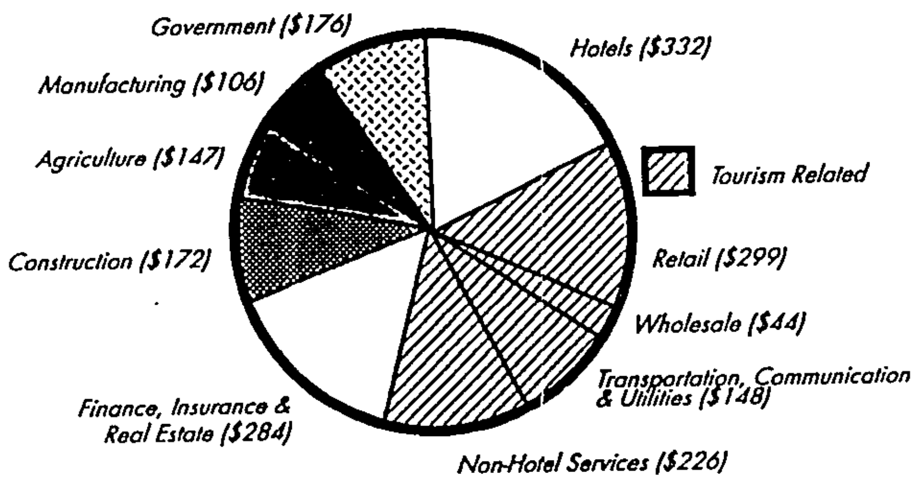
TABLE 3-1
MAUI COUNTY POPULATION DISTRIBUTION [a]

Urban Center/Resort	Population	Percentage of Total Population [b]
Wailuku	Over 10,000	Over 10%
Kahului	Over 10,000	Over 10%
Makawao	2,500 - 9,999	2.5% - 10%
Pukalani	2,500 - 9,999	2.5% - 10%
Lahaina	2,500 - 9,999	2.5% - 10%
Kihei	2,500 - 9,999	2.5% - 10%
Puunene	1,000 - 2,499	1.0% - 2.5%
Paia	1,000 - 2,499	1.0% - 2.5%
Napili-Honokowai	1,000 - 2,499	1.0% - 2.5%
Wailea	1,000 - 2,499	1.0% - 2.5%
Kaunakakai	1,000 - 2,499	1.0% - 2.5%
Lanai City	1,000 - 2,499	1.0% - 2.5%

[a] Source: _Hawaii Statewide Airport System Plan. Population for 1980._

[b] Based on total county resident population of 100,504 persons. Source: _Final Environmental Impact Statement. Kahului Airport Master Plan Update._

FIGURE 3-3
GROSS COUNTY PRODUCT BY INDUSTRY, 1989
(Total Estimate: $1.8 billion)



NOTE: Dollars in Millions

Source: Bank of Hawaii Economics Department

grouping is largely dependent on the level of activity of other industries most of which are tourism related. Manufacturing represented 7% of Maui's gross product in 1986. Much of this is related to processing of agricultural products, and therefore is affected by air transportation in much the same way as the agricultural industry.

High technology is one of the more important emerging industry segments on Maui. Data for this industry, however, is not available, but it's known to have been steadily gaining ground in the last several years.

ENVIRONMENTAL CRITERIA FOR EVALUATION OF SITE ALTERNATIVES

In conformance with requirements set forth in the National Environmental Policy Act (NEPA) (P.L. 91-190, 42 U.S.C. 4321-4347), the environmental analysis is intended to describe the environment of the site study areas which may be affected by a decision to operate a public use general aviation or commercial service airport. The affected environment discussion is geared toward brevity with the intent of conveying the character of the human and natural environments which might be affected by study alternatives. The discussion supporting specific impact categories has been scaled to reflect the relative importance of project impacts in those categories.

The information provided in the remainder of this section is designed to conform with guidelines published by the State of Hawaii Office of Environmental Quality Control (OEQC) (State of Hawaii Office of Environmental Control, A Guidebook for the Hawaii State Environmental Review Process, July 1991).

The following elements of the affected environment are described in the remainder of this section:

- Natural environmental setting
  - Vegetation and wildlife
  - Historical and archaeological resources
  - Energy supply and natural resources
- Human environmental setting
  - Land use
  - Noise
  - Air quality
  - Surface transportation
  - Hydrology, drainage and water quality
  - Public facilities and services
  - Aesthetics

NATURAL ENVIRONMENTAL SETTING

This discussion of environmental setting is focused on that portion of the Island of Maui herein referred to as the primary study area. The limits of the study area are illustrated on Figure 3-2.

Vegetation and Wildlife

The most comprehensive, recent source of information regarding botanical species within the study area was compiled from a botanical survey undertaken in 1990 for the Kahului Airport Master Plan (Char & Associates, Botanical Survey - Kahului Airport Master Plan Update, August 1990). The most recent source of information regarding animal species within the study area was also compiled from a survey undertaken for the Kahului Airport Master Plan (Prof. Philip L. Bruner, Survey of the Avifauna and Feral Mammals at Kahului Airport Property and Adjacent Lands, Maui, July 16, 1990; EIS Appendices H and I). Although focused on the environs of Kahului Airport, native and imported plant and animal species are also expected to be found throughout the study area.

In addition, information regarding threatened and endangered plant and animal species was extracted from an inventory prepared by the

Nature Conservancy of Hawaii, specially commissioned for this site selection study.

Terrestrial Flora. This section discusses the potential impacts to existing vegetation, and the presence of any threatened and endangered plants within the primary study area.

Field studies to assess the botanical resources at Kahului Airport were conducted on July 10 and 11, 1990. The primary objectives of the field studies were to: (1) provide a general description of the major vegetation types; (2) inventory the terrestrial, vascular flora; and (3) search for threatened and endangered plant species protected by federal and state laws.

A walk-through survey method was employed. Notes were made on plant associations and distribution, substrate types, topography, exposure, etc. Species were identified in the field; plants which could not be positively determined were collected for later identification in the herbarium or for comparison with the most recent taxonomic treatment. The species recorded are indicative of the season ("rainy" vs. "dry") and the environmental conditions under which the survey was conducted. A survey taken at a different time of year and under varying environmental conditions would no doubt yield slight variations in the species checklist, however, there is no evidence the variations would be significant.

Four major vegetation types were recognized on the project site and described in more detail below. Landscaped and developed areas were not surveyed as such places are not likely to harbor sensitive native plant communities or rare native species. Common landscaping materials used around the airport facility include: coconut (Cocos nucifera), tiger's claw (Erythrina variegata), autograph tree (Clusia rosea), pink tecoma (Tabebuia pentaphylla), and various Bougainvillea and Hibiscus hybrids.

- Cane Fields. Actively cultivated fields of sugar cane (Saccharum officinarum) are found in the areas between Kahului Airport and the Hana Highway as well as in the vicinity of the Maui Dragstrip near Puunene. Along the margins of fields, where they abut koa-haole shrublands, roadways, drainage ditches, and old concrete foundations (next to Kahului Airport), weedy species are more numerous and varied. Within the cane fields themselves, only the Nutgrass (Cyperus rotundus) is occasional; the fast-growing cane tends to shard-out most of the other weedy species.

- Koa-haole shrubland. This vegetation type is composed of koa-haole (Leucaena leucocephala) shrubs with a dense cover of buffel grass (Cenchrus ciliaris), green panic grass, or Guinea grass (Panicum maximum) among the shrubs. At least four variants of this shrubland, usually representing various stages of succession, can be recognized on the Kahului Airport site. In the southern runway protection zone, the shrubland consists of scattered short koa-haole, from 1 to 3 feet tall. This area has only recently been taken out of sugar cane cultivation. In the runway protection zone fronting Spreckelsville Beach Road and near Runway 5-23, the koa-haole shrubs become denser and taller. In the area between the helicopter facility and the FAA Air Traffic Control Tower, the shrubland consists of koa-haole shrubs from 5 to 7 feet tall and with 50 to as much as 80 percent cover. The shrubland becomes very dense and tall (from 12 to 15 feet) on the area east of the planned transient apron and along the perimeter fence facing Kanaha Beach Park.

- Kiawe Forest. This vegetation type is found primarily in the area between the Airport and the beaches - Spreckelsville Beach lot residential area and Kanaha Beach Park. The forest behind the residential area is characterized by closed

canopy stands of kiawe trees, from 30 to 35 feet tall. Along the Kanaha Beach boundary and adjacent to the Kanaha Pond refuge, the kiawe forest is open (canopy cover less the 60 percent) and somewhat shorter, 18 to 25 feet tall.

- Mixed Coastal Shrubland. This vegetation type is characterized by a varied assortment of different tree and shrub species occurring in scattered localized patches or clumps. Among the most frequently encountered plants are beach naupaka (Scaevola sericea), hau, milo, the three pluchea species, beach heliotrope (Tournefortia argentea), vitex (Vitex trifolia var. subtrisecta), and ironwood.

Of a total 146 plant species inventoried during the survey, 125 (86 percent) are introduced; two (1.4 percent), including sugar cane, are originally of Polynesian introduction; and 19 (12.6 percent) are native. Of the natives, 18 are indigenous, that is, they are found in the Hawaiian Islands and elsewhere throughout the Pacific; only one, the 'aheahea' or 'aweoweo' (Chenopodium oahuense), is endemic, that is, native only to the islands. None of the native species are officially listed threatened and endangered plants; nor are any proposed or candidate for such status (U.S. Fish and Wildlife Service 1989, 1990). An earlier biological survey of the existing airport property (AECOS, Inc. 1981) also recorded similar findings.

Terrestrial Fauna. This section discusses the potential impacts to avifauna and feral mammals at Kahului Airport as well as the remainder of the primary study area and the presence of any species that are considered to be endangered or threatened.

A bird and mammal field survey of Kahului Airport lands was conducted on July 10-11, 1990. The objectives of the field survey were to:

- Document what bird and mammal species occur on the property or may likely occur given the type of habitats available.
- Provide baseline data on the relative abundance of each species.
- Determine the presence or likely occurrence of any native fauna particularly any that are considered "Endangered" or "Threatened." If any occur or may likely be found on the property identify what if any features of the habitat may be essential for these species.
- Determine if the property contains any special habitats that if lost or altered by development might result in a significant impact on the fauna in this region of the island.
- Note which aspects of the projects pose the most significant concerns for wildlife and suggest what measures should be considered to avoid these problems.

Wildlife counts were taken at sites in the environs of Kahului Airport. The Kanaha Pond Wildlife Refuge and surrounding wetlands comprise the most important bird habitat in the study area. The lands currently in use by the Airport provide a mixture of habitat types varying from open grassy fields and airfields to second growth brush covered lands and developed areas such a parking lots and passenger terminal. Sugar cane fields and a narrow strip coastal forest dominated by Kiawe (Prosopis pallida) and other exotic plants along with the typical native coastal vegetation make up additional terrestrial habitats available for wildlife. Parklands and residential yards are also present along this coast. The exposed beach and rocky intertidal zone fronting the entire length of the property also provides foraging opportunities for migratory shorebirds.

Field observations were made with the aid of binoculars and by listening for vocalizations.

At various locations, and in all representative habitats, counts were made of all birds seen or heard. Between these count stations, walking tallies of birds seen or heard were also kept. Observations of feral mammals were limited to visual sightings and evidence in the form of scats and tracks.

- Resident Endemic (Native) Birds. Two endemic species were recorded: the Hawaiian Stilt (Himantopus mexicanus knudseni) and the Hawaiian Coot (Fulica americana alai). These two birds and possibly the Hawaiian Duck (Koloa) are endangered birds living at Kanaha Pond Wildlife Refuge. No other endemic birds were recorded on the survey. One possible specie which may occasionally occur on Kahului Airport property is the Hawaiian Owl or Pueo (Asio flammeus sandwichensis). Pueos are considered to be r··sonably common in grassland and ranch ·· habitat on Maui but are seen less frequently in more urban habitat (Hawaii Audubon Society 1989).

  The State Department of Land and Natural Resources (DLNR) has actively managed Kanaha Pond since the 1970s. A Kanaha Pond Management Committee has recently been formed to formulate a Management ··n for the Pond. The Hawaiian Stilt has been observed feeding in Kalialinui Gulch and could be using the makai side of the mid-section of Runway 5-23 during periodic periods of ponding as a seasonal feeding area.

- Migratory Indigenous (Native) Birds. Migratory shorebirds winter in Hawaii between the months of August through May. Of all the shorebirds species which winter in Hawaii, the Pacific Golden Plover (Pluvialis fulva) is most abundant. Plovers prefer open areas such as mud flats, lawns, pastures, plowed fields and roadsides. A total of only four plovers were recorded at the east end of Runway 5-23. This result was expected since the majority of plovers are at breeding grounds in the Arctic during this time of the year. During the months of August through April several hundred plovers are likely to occur in this area (Bruner 1981).

  Ruddy Turnstone (Arenaria interpres) is another common migrant that utilizes fields and lawns as well as intertidal habitat. Although the majority of the Turnstone population are in the Arctic during this time of the year, a total of 36 Turnstones have been sighted on grassy fields within the airport complex and along the shoreline during the two day survey. Two other common species which might be expected to occur in this area during the "winter" include Wandering Tattle (Heteroscelus incanus) and Sanderling (Calidris alba). Occasionally other migratory shorebirds turn up at Kanaha Pond (State of Hawaii 1990).

  Migratory waterfowl (ducks) also utilize Kanaha Pond. The two most common migratory ducks are Northern Pintail (Anas acuta) and Northern Shoveler (Anas clypeata). Three female and one male shoveler were seen at Kanaha Pond during the first day of the survey.

- Resident Indigenous (Native) Birds. This category includes those species which are native but not endemic such as the Black-crowned Night Heron (Nycticorax). Night heron are common at Kanaha Pond (State of Hawaii 1990).

- Resident Indigenous (Native) Seabirds. None were observed on the property. Seabirds can be seen off shore and some species such as the Great Frigatebird (Fregata minor) do come in over land. This species will often use ponds such as Kanaha to get access to drinking water.

- Exotic (Introduced) Birds. A total of 14 species of exotic birds were recorded during the field survey. In addition to these species, other exotic birds which potentially could occur on the property include: Common Barn Owl (Tyto alba), Northern Mockingbird (Mimus polyglottus) and Eurasian Skylark (Alauda arvensis) (Bruner 1981; Pratt et al. 1987; Hawaii Audubon Society 1989).

- Feral Mammals. Wild (feral) cats were seen at Kanaha Pond. Small Indian Mongoose (Herpestes auropunctatus) were also observed especially in the coastal patches of forest. No rats or mice were recorded, however, it would be highly unusual if these ubiquitous animals did not occur on the property. Maui records of the endemic and endangered Hawaiian Hoary Bat (Lasiurus cinerus semotus) are sketchy (Kepler and Scott 1990). None were observed during the field survey despite late evening observations.

The data presented above show that the areas that would be affected by possible improvements to Kahului Airport contain a fairly diverse range of habitats, and that these are utilized by the typical array of exotic species of birds one would expect in these types of second-growth disturbed environments in Hawaii. No unusual concentration of any exotic species were discovered. Native birds, endemic and indigenous residents, as well as migrants utilize the Kanaha Pond and wetlands, coastal shoreline and grass covered margins around the runways. These environments provide essential habitat for nesting, foraging and resting. Data on feral mammals on the property were limited to observations.

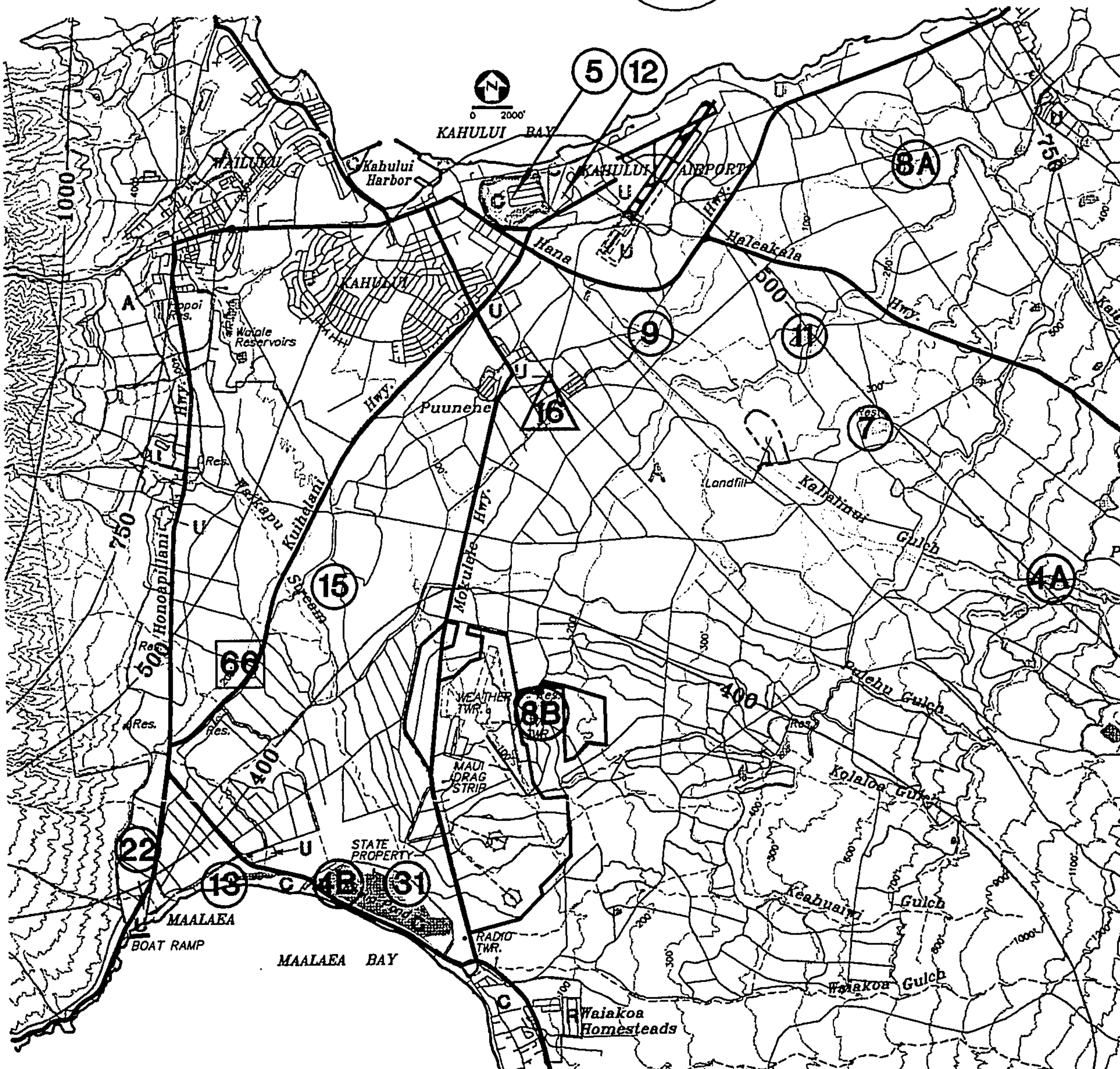
Rare and Endangered Species. The Nature Conservancy of Hawaii has identified 13 locations where known endangered animal species have been sighted. One additional species listed as possibly endangered or threatened has been sighted within the primary study area. The locations of these sightings are illustrated on Figure 3-4. Table 3-2 sets forth the common name, federal status and location of each of the referenced sightings.

Historical and Archaeological Resources

The following is a summary of the archaeological surveys conducted by Cultural Surveys Hawaii (CSH) in connection with the 1992 Kahului Airport Master Plan. This survey is suggestive of the potential for possible sites of historic or archaeological significance within the study area.

Scope of Surveys. In July 1990, a survey scope of work was developed in coordination with the State's Historic Preservation Office (SHPO) which included lands bounded on the north by Alahao Street, on the west by Kalialinui Drainage Channel, on the east by an unmarked north-south line near Kanaha Beach Park parking lots, and on the south by Kahului Airport Runway 5-23 and west Runway Protection Zone. SHPO reviewed aerial photos along with prior surveys and determined that archaeological studies for the parallel runway and adjacent facilities areas were not needed. It concluded that "based upon this negative finding (no significant historic sites were previously identified) and the extensive ground disturbance due to sugarcane cultivation, we believe that the proposed project will have 'no effect' on significant historic sites."

Based on the July 1990 survey results, it was recommended that the Runway Protection Zone northeast of Runway 2-20 be subjected to subsurface backhoe testing for buried cultural deposits. The scope of work was further developed in coordination with SHPO and required a program of subsurface testing on both sides of the Spreckelsville Beach Road, including the Runway Protection Zone on the north side. Excavation and documentation of a series of backhoe trenches averaging 10 linear


KAHULUI BAY
0 2000'
KAHULUI AIRPORT
Kahului Harbor
WAILUKU
KAHULUI
Hana
Haleakala
Hwy.
Waiale Reservoirs
Puunene
Kuihelani
Hwy.
Waikapu
Stream
Honoapiilani
Hwy.
Mokulele
Hwy.
Landfill
Kailalinui
Gulch
Pulehu Gulch
Kolaloa Gulch
Keahuaiwi
Gulch
Waiakoa Gulch
Waiakoa Homesteads
WEATHER TWR.
MAUI DRAG STRIP
STATE PROPERTY
RADIO TWR.
MAALAEA
BOAT RAMP
MAALAEA BAY
5
12
8A
9
11
16
7
4A
15
66
8B
22
13
4B
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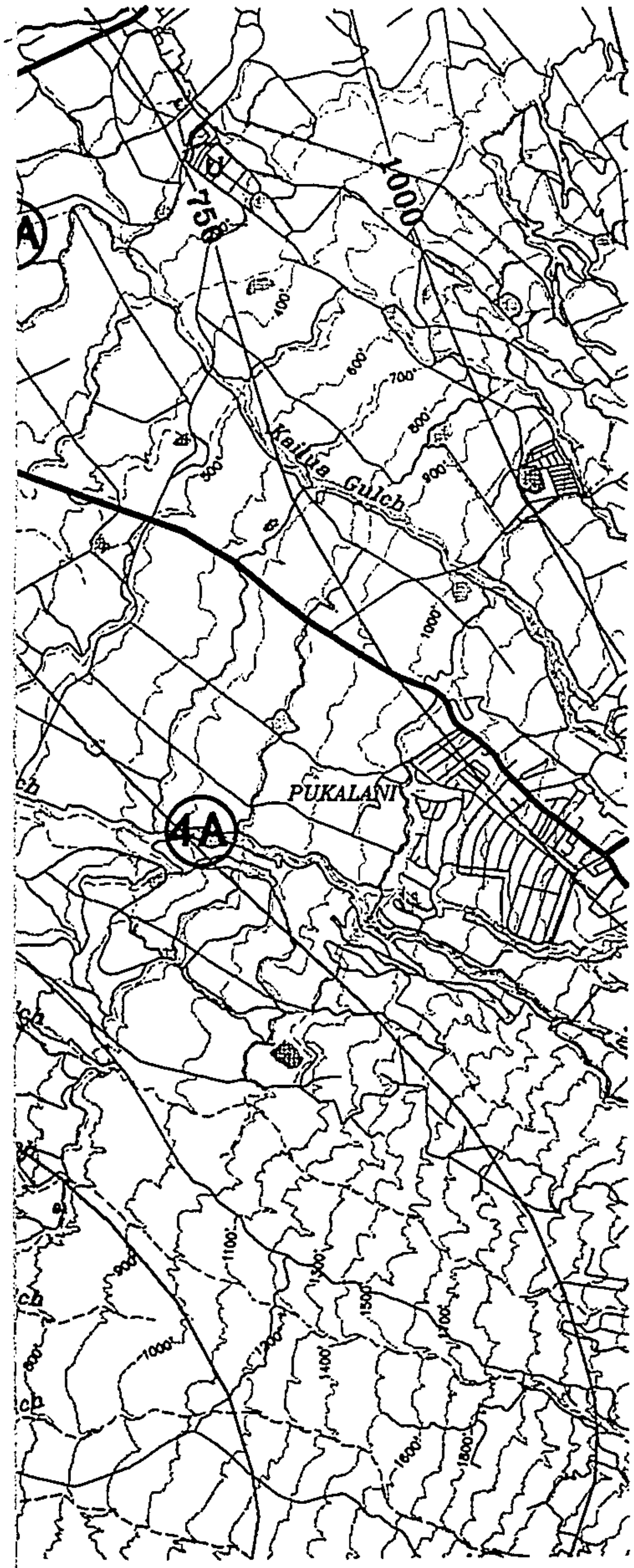


LEGEND

Land Use District Boundary
A Agriculture
C Conservation
R Rural
U Urban

Annual Rainfall (mm./yr.)

Stream

Managed Area – Kanaha Pond Wildlife Sanctuary

Threatened/Endangered Species Hawaii Natural Heritage Program (See Table 3–2 for Identification of species.)

within 0.3 mile range

within 1.5 mile range

within 5 mile range

STATE–OWNED PROPERTY (FORMER PUUNENE AIRPORT)

FIGURE 3–4
LAND USE DISTRICT BOUNDARIES, ANNUAL RAINFALL, MANAGED AREAS AND THREATENED / ENDANGERED SPECIES

TABLE 3-2
KEY TO MAP REFERENCE NUMBERS FOR THREATENED OR ENDANGERED SPECIES

Reference No.	Common Name	Fed Status [a]	Quad Map
4A	Ko'Oloa'Ula	LE	PAIA
4B	'Alae Ke'Oke'O (Hawaiian Coot)	LE	MAALAEA
5	Hawaiian Duck (Koloa) Hawaiian Stilt (Ae'O) 'Alae Ke'Oke'O (Hawaiian Coot)	LE LE LE	PAIA
7	Hawaiian Stilt (Ae'O)	LE	PAIA
8A	Hawaiian Stilt (Ae'O)	LE	PAIA
8B	'Alae Ke'Oke'O (Hawaiian Coot)	LE	PUU O KALI
9	Hawaiian Stilt (Ae'O)	LE	PAIA
11	Hawaiian Stilt (Ae'O) 'Alae Ke'Oke'O (Hawaiian Coot)	LE LE	PAIA
12	'Alae Ke'Oke'O (Hawaiian Coot)	LE	PAIA
13	Hawksbill Sea Turtle Leatherback Sea Turtle	LE LE	MAALAEA
15	Hawaiian Stilt (Ae'O) 'Alae Ke'Oke'O (Hawaiian Coot)	LE LE	WAILUKU
16	Nene, Hawaiian Goose 'Ope'Ape'A Hawaiian Hoary Bat	LE LE	PAIA
22	Schiedea Menziesii (Element Name)	C2	MAALAEA
31	Hawaiian Continuous Perennial Steam	None	MAALAEA
66	'Awiwi	LE	WAILUKU

[a] LE = Taxa formally listed as endangered.
C2 = Category 2 - Taxa for which the USFWS has information indicating they are possibly endangered or threatened.

feet per acre was proposed and accepted as an adequate sampling measure. Subsequently, a series of subsurface tests were performed in the runway protection zone area between April 22 and May 11, 1991.

This survey area consisted of approximately 180 acres along the coast west of Spreckelsville. Approximately 60 acres at the east end of the survey area were occupied by private beachlot homes and active pasturage and were therefore excluded from the survey. One archaeological site, BPBM-50-Ma-C9-37, has been recorded in this area (Archaeological Monitoring of Sewer Line Construction from Spreckelsville to Kuau, Maui, State of Hawaii, Clark and Toenjes, 1987).

Previous Archaeological Research. The survey area is remarkable from an archaeological point of view because of its lack of sites. The most recent archaeological studies near Kahului Airport have found no archaeological sites, except for an undetermined number of burials, and a possible house site and grindstone located between Kanaha Beach Park and the western extent of the study area (Connolly, 1981; Welch, 1988 a & b and 1990). Both sites are located by Connolly just northwest of the intersection of existing Runways 5-23 and 2-20.

The most comprehensive and informative archaeological study to date along the northern shoreline of the isthmus between East Maui and West Maui is the monitoring of a sewer line project by Clark and Toenjes (1987). Their study area extends from near Spreckelsville, just east of the Airport to Kuau. Although the area of excavation was restricted to narrow trenches for the pipeline and shallow bulldozing for access roads, significant archaeological sites related to traditional Hawaiian occupation and fishing were unearthed as were burials.

Study Area Archaeological Sites. No known sites of archaeological significance are known to exist in conflict with any of the airport alternatives being considered at this time (See further discussion of airport alternatives in Section 8, Interim Report No. 2). One proposed site, however, possesses relic World War II construction which may be a candidate for consideration (and mitigation) as a historical resource.

The site of the former Puunene Airport (also known as Old Maui Airport and NAS Puunene) contains several structures of possible note, namely, a series of aircraft revetments (protective earthen barriers) and ammunition storage bunkers. The significance of these structures is explored more fully in Section 9 which discusses the environmental effects associated with each of several potential airport development alternatives.

Procedure for Consideration of Candidate Historical/Archaeological Sites. A procedure for consideration of potential candidate historic or archaeological sites has been established by the State of Hawaii Office of State Planning. This procedure, overseen by a State archaeologist, applies to any structure greater than 50 years in age. The procedure involves the following basic steps:

1. Recognize potential resource.
2. Determine date and circumstances of construction.
3. Determine who initiated construction.
4. Determine purpose of structure or candidate resource.
5. Determine current ownership of or responsibility for disposition of resource.
6. Determine if the candidate resource is unique in any way.

An assessment should also include a determination of possible social or historic value of the candidate resource and a determination of whether the potential value (or need) may be provided by another similar resource situated elsewhere. More importantly, a mitigation program should be developed which, at a minimum, should include a written record including:

- Photography
- Plan drawings
- A description of construction material and details

Further consideration of potential resources in connection with the former Puunene Airport development alternatives is provided in an associated report.

Energy Supply and Natural Resources

The day-to-day operation of the primary study sites requires the consumption of energy and natural resources. Electrical energy is required to heat, cool, and light airport facilities. Electrical energy is also required to operate airport navigational aids and air traffic control equipment. The principal consumers of natural resources are the aircraft, airport support vehicles, and passenger vehicles which require fossil fuels for their operation. Ongoing airport development and maintenance would require the use of water and construction materials, including sand and gravel, cement, lumber, and other building materials.

HUMAN ENVIRONMENTAL SETTING

This discussion focuses on environmental characteristics which affect human populations. In accordance with Hawaii OEQC Guidelines, principal categories of effects include aesthetics, air pollution, traffic congestion, noise, water quality or "any other aspect of the environment which may be affected by the proposed action."

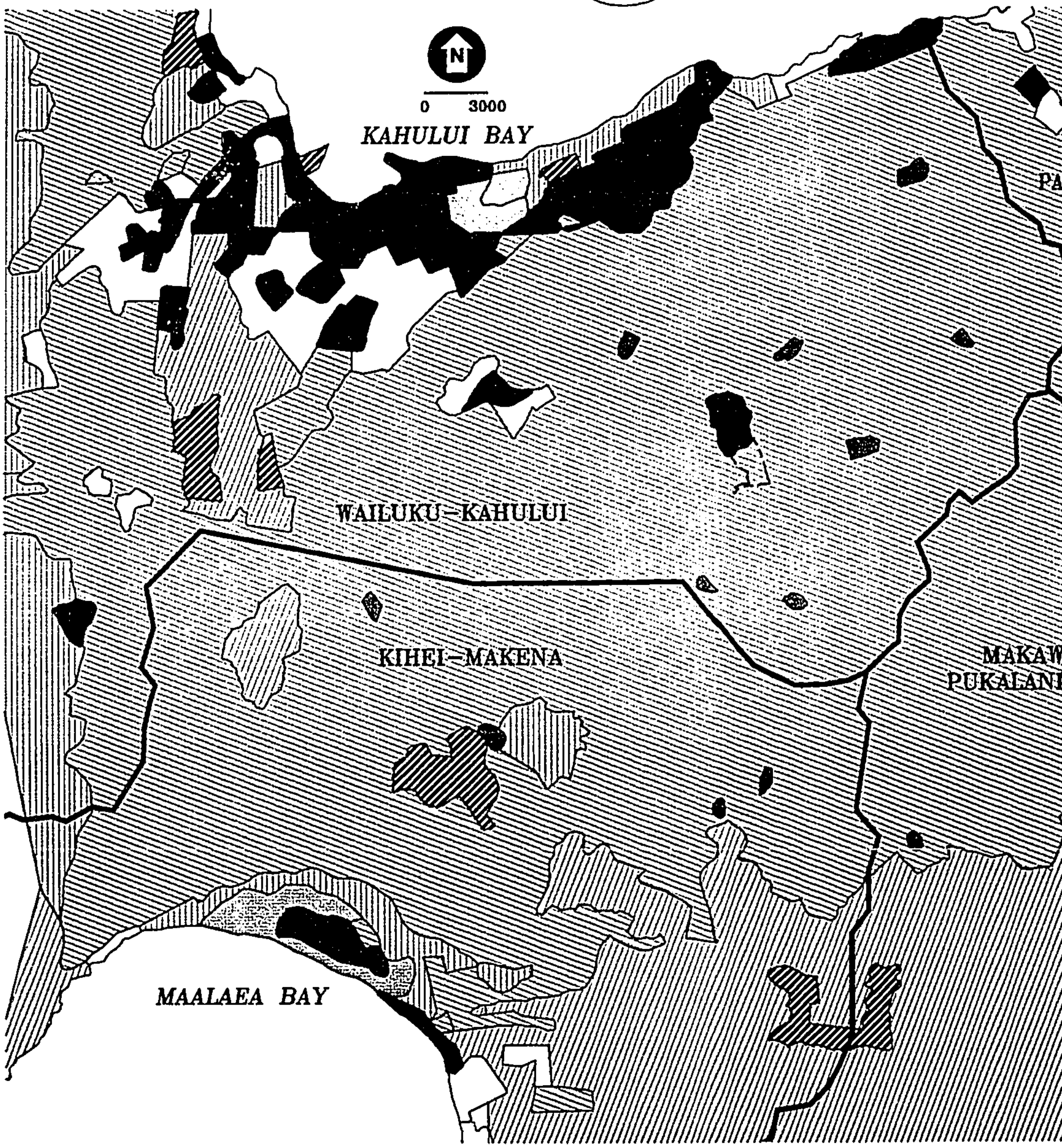
Land Use

Local Setting. The primary study area encompasses the major portion of the lowland isthmus dividing East and West Maui and includes established communities within which the majority of the Island's full-time, year-round population reside.

The principal communities within the primary study area are Wailuku, Kahului, Kihei, Makena, Makawao, Pukalani, Kula, Paia and Haiku. The County of Maui has prepared long range plans to guide the orderly development of these areas. Figure 3-5 illustrates the locations of the areas for which the County has developed formal community plans. The major airport development alternatives which form the subject of this assessment lie within these four development/community planning areas. The following discussions of plan purpose and planning area descriptions are excerpted from the published community plans of the respective planning areas.

The Community Plans are mandated by the Charter of Maui County (1977) and the Maui County General Plan which was adopted on June 24, 1980 as Ordinance No. 1052. The Maui County General Plan, in turn, is guided by the Hawaii State Plan formulated under the provisions of Chapter 226, Hawaii Revised Statutes (HRS).

The County General Plan sets forth the broad objectives and policies for the long-range development of the County. The purpose of the Community Plans is to provide a relatively detailed scheme for implementing these objectives and policies relative to each region. Contained in the plans are the desired sequence, patterns and characteristics of future developments for each region as well as statements of standards and principles with respect to development and statements indicating the sequence in which future development is to occur. Also included are maps identifying the


0 3000
KAHULUI BAY
WAILUKU–KAHULUI
KIHEI–MAKENA
MAKAW
PUKALANI
MAALAEA BAY

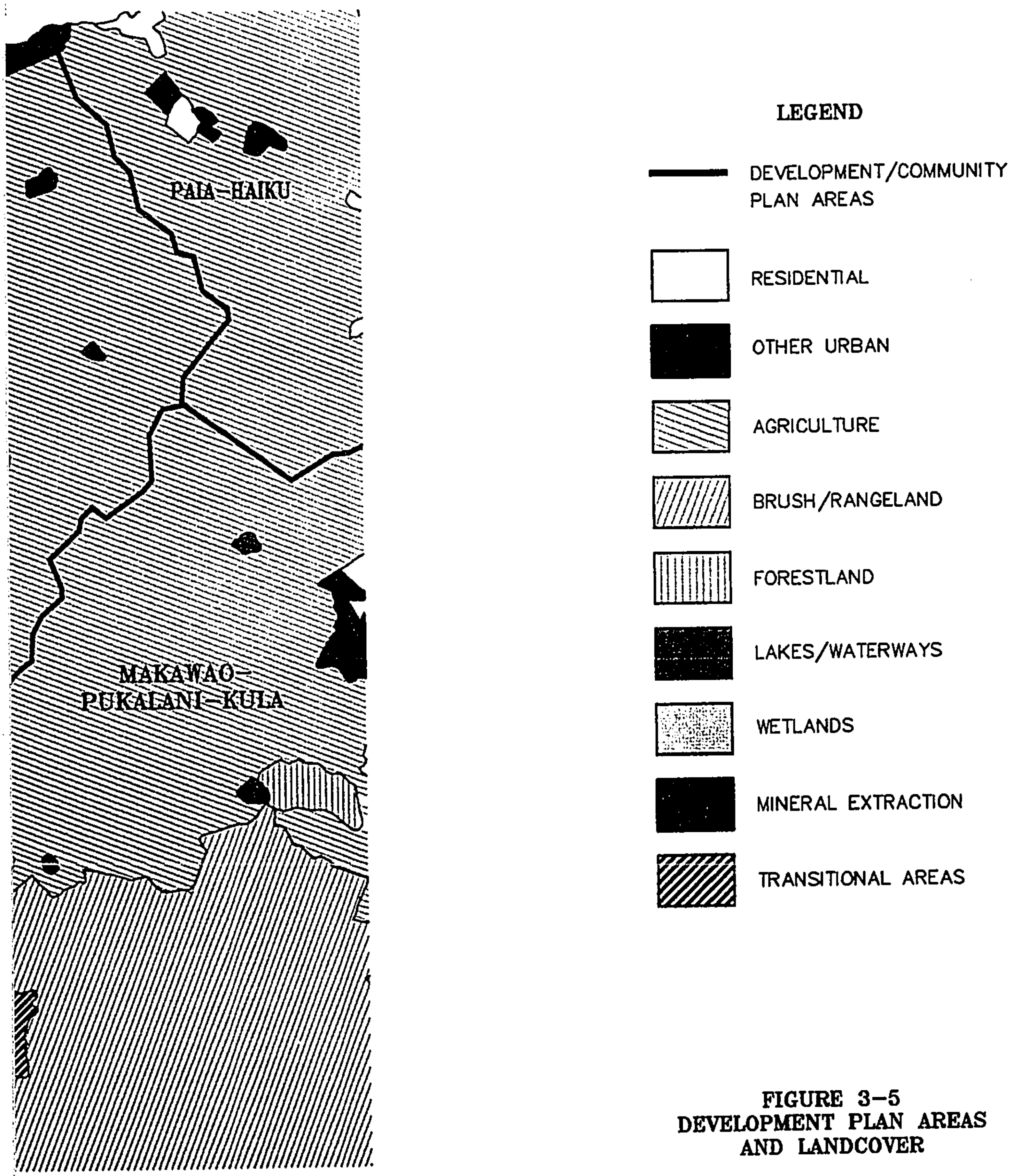


FIGURE 3-5
DEVELOPMENT PLAN AREAS AND LANDCOVER

planned distribution and intensity of land uses and public facilities. The Community Plans are guides to making decisions regarding the development in each region until the year 2000. Updates will occur at least every ten years to incorporate new data and analysis. The plan elements are organized according to the General Plan objectives and policies. The Technical Report which accompanies each plan provides background information for further interpretation of the summary discussions and recommendations.

The Wailuku-Kahului Community Plan. The Wailuku-Kahului region is located on the north shore of Maui Island. It encompasses the civic and business centers of Wailuku and Kahului, and the major seaport and airport. The surrounding agricultural lands of Central Maui, and the eastern half of the West Maui Mountains are also within this region. The boundaries of the Wailuku-Kahului region are the northern shoreline from Poelua Bay to Baldwin Park on the north, Kailua Gulch and Lowrie Ditch on the east, Spanish Road to Waikapu to Honoapiilani Highway to Pohakea Gulch on the south, and the Wailuku Judicial District boundary on the west.

Population is concentrated in the urban centers of the region. Wailuku has maintained its role as the civic-financial-cultural center while Kahului has strengthened its role in recent years as the business and industrial center. The residential districts surrounding these two centers are significantly different in character. Kahului residential areas are newer, with wide curvilinear streets. Wailuku, however, is composed of older residential areas, intermixed with business uses, varying lot sizes, and more haphazard street pattern representative of older su 'vision practices.

In addition to the urban centers of Wailuku-Kahului, the region also includes the more rural settlements of Waihee to the north and Waikapu and Puunene to the southeast. Agricultural lands are adjacent of the lower slopes of the West Maui Mountains and in the central plain south and east of Kahului. This green border is a significant part of the settlement pattern because of its open space and economic value. Kahului Harbor and Airport are major land users along the Kahului shoreline. As major ports of entry for people and goods, they serve as an important center of jobs and economic activity.

Wailuku-Kahului is also cultural center of Maui Island. Major facilities include Maui Community College, the War Memorial Center, community theater, major sports facilities, and the developing Maui Central Park.

The portion of the planning area which lies within the primary alternative site study area is illustrated on Figure 3-5.

The Kihei-Makena Community Plan. The Kihei-Makena Region extends along the western shoreline of east Maui at the foot of Haleakala. The boundaries of the Kihei-Makena planning region begin at the shore where Kapuni Gulch enters the ocean. Starting at this point the boundary travels Mauka to the Kahikinui forest reserve, then in a westerly direction along the unimproved Piilani Highway to the Kula Highway at Ulupalakua, then along the highway to the jeep trail running through the center of the Kamaole Ahupuaas, then makai along the jeep trail to the unimproved portion of Waiakoa Road, then is a northerly direction along the unimproved and improved portions of Waiakoa road to its intersection with Spanish Road north of Pulehu Gulch. The boundary then extends along Spanish and Waikapu Roads which traverse the length of the island's isthmus to a point just eat of Waikapu at Waikapu Stream, then is a southwesterly direction to Honoapiilani Highway, and finally along the highway to Pohakea Gulch. The boundary then goes mauka along the centerline of the gulch to the ridgeline, and then makai along the centerline of Manawainui Gulch to the shoreline.

The region is comprised of four communities: Maalaea, Kihei, Wailea, and Makena. Community form in the planning region consists of a small shoreline-oriented community at Maalaea and a linear pattern of urbanization extending from the south end of Kealia Pond to Makena. This consists of Kihei proper, extending from Kilohana Drive, and the planned resort destination areas at Wailea and Makena.

The portion of the planning area which lies within the primary alternative site study area is illustrated on Figure 3-5.

Historically, an important aviation feature of this planning area was the location of the former U.S. Naval Air Station, Puunene (and later the Puunene Airport), which is shown as it appeared in 1945 in Figure 3-6. This site, located as shown in Figure 3-1, is now largely devoted to sugar cane production and open space. The site is further described in Section 8.

The County of Maui has developed a plan setting forth land use and development recommendations for the Puunene Airport area. (Helber Hastert & Fee, <u>Puunene Airport Area Master Plan/MEO Transportation Facility</u>, May 1995.) The plan considered six alternative concepts which were developed upon conducting interviews and correspondence with existing and proposed users at the Puunene site. In addition to the potential retention/reactivation of aeronautical uses at the Puunene site, a variety of uses were considered which could affect aircraft operations.

Among proposed uses are a National Guard Armory, County and State baseyards, Police and Fire Departments, County Fairgrounds, Maui Economic Opportunity Transportation facility, and a recreational complex for motorized sporting activity.

The Puunene Airport Area Master Plan does not propose development in the southern section of the site, and the development of aviation facilities in the southern portion of the site could be compatible with the County's plan.

Specific issues which should be resolved include:

1. potential vertical and horizontal separation requirements of potential uses,
2. creation of obstructions to air navigation,
3. potential effects of residential development within approach or departure corridors associated with a new heliport.

It is recommended that the possible need for a State-operated heliport be incorporated into the final plan.

The Makawao-Pukalani-Kula Community Plan. The Makawao-Pukalani-Kula region is located on the western slopes of Haleakala and includes portions of the Haleakala National Park. It is the only County planning region without any shoreline resources.

The boundaries of the Makawao-Pukalani-Kula region are Waiakoa Road to Lowrie Ditch to Kailua Gulch on the west; Haleakala Highway to Haliimaile Road, including Haliimaile to Hahakapao Gulch on the north; then generally following the Haleakala National Park boundary to Kaupo Trail on the west, then along the Kahikinui Forest Reserve boundary to Kapuni Gulch, then along Piilani Highway to Kula Highway to a jeep trail in the Kamaole Ahapua'a on the south.

Population is concentrated in two main settlement areas; Makawao and Pukalani are a mixture of suburban and rural land uses. The Kula area is characterized by a mixture and rural and agricultural uses. The region has become famous for the quality of vegetables and flowers exported to Hawaiian and international markets.

FIGURE 3-6
1945 AERIAL VIEW OF FORMER U.S. NAVAL AIR STATION PUUNENE

SOURCE: U.S. Navy, Photographic Laboratory, File No. NA-24249-A, August 3, 1945

The region is referred to as "Up-Country", reflecting first its location and elevation on Haleakala and secondly the social qualities of its small agricultural villages. These are close-knit communities with values placed on open space and rural characteristics. This value is to be preserved even as certain areas are changing to a more suburban form of settlement.

The portion of the planning area which lies within the primary alternative site study area is illustrated on Figure 3-5.

Land Use/Land Coverage. Land use designations within each of the planning areas are described below.

- Residential Land Use. These land use designations include detached homes, duplexes, multi-family residences and mobile homes. Densities ranged from one to twenty or more dwelling units per acre and may include multi-story structures. In low-density areas, this land use designation included large yards and open space. Single-family dwellings uses, in part, for commercial uses (child day care, churches, or other business enterprises) and surrounded by other single-family dwellings were mapped as single-family dwellings. Multiple-family dwellings include apartments and group housing for senior citizens. Mobile homes include both mobile homes and associated surrounding open space.

- Other Urban Land Uses. This land use designation includes commercial, industrial, public facility, educational, health care and places of worship.

  Commercial land use designations include neighborhood commercial, general commercial, highway/strip commercial, and commercial/industrial uses. Commercial uses typically include retail, office and business parks that have a unified character and that support a mix of office, research and development and light industrial uses. Industrial land use designations include light industry and heavy industry and include industrial uses such as warehouses, manufacturing, auto wrecking, and outside storage.

  Schools include both primary and secondary child development centers. Where a church site included a school, the entire property was mapped as a school. Hospitals include clinics and emergency care facilities. Churches include all structures used for religious worship and affiliated uses. Public facilities include government buildings (city hall, county office), fire stations, community centers, libraries, etc. Transportation/Utility uses include major streets and highways, electrical substations, water tanks, power lines, and solid waste transfer stations.

- Agricultural Land Use. This land use designation includes cultivated lands and associated rural/agricultural residential uses. Typical uses include cane fields, greenhouses, nurseries, and open land adjacent to these agricultural uses. This land use designation also includes detached homes associated with farms, orchards, plantations and other agricultural uses. Densities are typically less than one dwelling unit per acre.

- Brush and Rangelands. This land use designation includes uncultivated and uninhabited open areas that adjoin developed or cultivated lands.

- Forested Lands. This land use designation includes both public, reserved lands and commercial, cultivated lands covered by indigenous and imported stock.

- Lakes and Waterways. This land use designation includes year-round bodies of water.

- Wetlands. This land use designation includes transient, tidal and seasonal bodies of water.
- Mineral Extraction. These uses include extraction of Portland cement, aggregates and other commercial substances.
- Transitional Areas. This land use designation includes areas that are either unoccupied and available for potential development or areas undergoing conversion from one use to another (such as rangeland being converted to productive farmland).

Noise

Evaluation and assessment of aircraft noise impacts resulting from development of any of the alternative sites has been based on forecast aircraft activity as set forth in Section 5 and weighed against prevailing land uses as discussed earlier. Existing noise conditions are described below.

Existing Airport Noise Conditions. The Kahului Airport is currently the only functional airport within the primary study area. Existing aircraft noise levels are controlled by jet aircraft departures with maximum noise levels from Runway 2 typically greater than 80 dBA at East Spreckelsville and exceeding 90 dBA at some locations in West Spreckelsville. Existing aircraft noise levels are incompatible with noise sensitive land uses in Puunene, East and West Spreckelsville.

Existing and forecast noise exposure from operations at Kahului Airport are further documented in the on-going Kahului EIS process.

Existing Surface Vehicular Noise Conditions. Existing vehicular noise levels are greatest along the major highways which traverse the primary study area. Within the Wailuku/Kahului environs, noise levels classified generally as "Significant Exposure, Normally Unacceptable" occur within a 50-foot setback distance from roadway centerlines. The highest levels are generated by truck, construction and service vehicle traffic. Noise levels on rural highways and local rural thoroughfares, dominated by automobile traffic, are expected to be lower.

The Maui drag strip near Puunene represents an additional source of community noise with the potential to intrude upon typical indoor residential activities for nearby residents.

Air Quality

The primary airport alternative site study area is located on the isthmus dividing east and West Maui. This isthmus is the location of the highest concentration of year-round population and includes Kahului and Wailuku and the smaller communities of Kihei and Paia.

The study area is bordered by Kahului Bay on the north and Maalaea Bay to the south. The isthmus forms a relatively broad, flat valley. To the southeast the terrain rises gradually, reaching a maximum elevation of 10,000 feet at the summit of Haleakala Crater. Bordering the study area on the west, the mountains of western Maui rise abruptly from the valley floor.

Air Quality. The primary study area is located within the State of Hawaii Air Quality Control Region. The control region is an attainment area for nitrogen dioxide, carbon monoxide, sulfur dioxide, ozone, particulate matter and lead. Ambient concentrations of these criteria pollutants are below the corresponding State of Hawaii and federal ambient air quality standards which are set forth in Table 3-3.

The nearest stations monitoring ambient air

TABLE 3-3
SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT OF AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter [a]	μg/m^3	Annual 24 hours	50 150 [b]	50 150 [b]	50 150 [b]
Sulfur Dioxide	μg/m^3	Annual 24 hours 3 hours	80 365 [b] -	- - 1,300 [b]	80 365 [b] 1,300 [b]
Nitrogen Dioxide	μg/m^3	Annual	100	100	70
Carbon Monoxide	μg/m^3	8 hours 1 hour	10 [b] 40 [b]	- -	5 [b] 10 [b]
Ozone	μg/m^3	1 hour	235 [b]	235 [b]	100 [b]
Lead	μg/m^3	Calendar Quarter	1.5	1.5	1.5

[a] Particles less than or equal to 10 microns aerodynamic diameter.

[b] Not to be exceeded more than once per year.

quality are located in Kahului for particulate matter, sulfur dioxide and nitrogen dioxide; in Sand Island, Oahu for ozone; and in Honolulu, Oahu for carbon monoxide. Monitoring at the Kahului site was discontinued on October 1, 1985.

Air quality within the primary study area may be influenced by numerous sources of emissions such as burning of sugar cane, power generating facilities, and agricultural and industrial activities on the island, as well as by surface and airport traffic. Burning of sugar cane to harvest fields can be significant contributor of particulates, CO and other pollutants. The majority of the study area, being agricultural in nature, may be affected by seasonal burning of sugar cane. Ambient particulates may also be prevalent in areas where bare soils are exposed to winds and mechanical disturbances. Table 3-4 sets forth an emissions inventory for the County of Maui.

Surface Transportation

Figure 3-2 depicts the primary highway network serving the primary study area. Major intersections are also depicted.

Intersection Levels of Service. Level of service (LOS) is a qualitative description of an intersection's operation. LOS can range from Level A (free flow conditions with little or no delay) to Level F (representing jammed conditions with intolerable delay). As the study area is largely defined by the isthmus wherein the greater part of the island's year-round population is resident, it is assumed that an acceptable LOS is D or better.

Existing Highway Network. The highway network on Maui extends radially from Wailuku-Kahului, the urban and commercial center of the island. Puunene is located less than five miles away (Figure 3-2). Because of this central location, the Puunene site has excellent accessibility from all major origins and destinations. The roadway system leading to Puunene consists of two-lane highways, some with paved shoulders.

A new airfield at the former Puunene Airport would be located adjacent to Mokulele Highway. Mokulele is currently a two-lane arterial with a 45 mph speed limit. Current plans are for a widening to four lanes.

Distances and Travel Times to Major Destinations. In the travel time survey below, all measurements were started at milepost 4.4 on Mokulele Highway approximately at the entrance to Maui Drag Strip. Travel times were taken during mid-day which is when most tourist users need to access the airfield. Based on information from the current heliport parking lot facility at Kahului, nearly 70% of current patrons arrived between 8 a.m. and 1 p.m. Less than 6% are using the roads during the PM peak. Close to 160 helicopter tour employees use the facility. These are more likely to travel during peak periods.

- Kahului - Four miles, 12 minutes

  Via Mokulele Highway to Puunene Road (Route 350), A&B Sugar Mill, turn onto Puunene Road, a two-lane urban arterial with third lane for turning at intersection.

- Kihei - Wailea - Makena Resort Complex

  Via Mokulele Highway to Piilani Highway (Route 31)

  - to Kihei, four miles, 5 minutes
  - to Wailea, eight miles, 10 minutes
  - to Makena, twelve miles, 15 minutes

- Lahaina - Kaanapali - Kapalua

  Via Mokulele Highway to Kihei Road (Route 310), and Honoapiilani Highway (route 30). Mostly a two-lane road with median turning lanes at selective

TABLE 3-4
AIR POLLUTION EMISSIONS INVENTORY FOR COUNTY OF MAUI, 1980 [a]

Source Category	Emission (tons/year) Particulate	Sulfur Oxide	Nitrogen Oxide	Carbon Monoxide	Hydro-Carbons
Steam Electric Power Plants	131	2,892	1,353	367	73
Gas Utilities	0	0	5	0	0
Fuel Combustion in Agricultural Industry	1,866	354	677	0	7
Mineral Products Industry	158	36	61	0	0
Municipal Incineration	0	0	0	0	0
Motor Vehicles	212	143	2,483	34,422	3,676
Construction, Farm and Industrial Vehicles	23	21	300	796	139
Aircraft	5	14	137	1,286	159
Vessels	14	114	71	61	26
Agricultural Field Burning	2,110	0	0	24,316	2,228
Total	4,519	3,575	5,088	61,250	6,307

[a] Source: State of Hawaii, Department of Health.

intersections and with paved shoulders. Four lanes between Lahaina and Kaanapali.

- to Lahaina, nineteen miles, 29 minutes
- to Kaanapali, 23 miles, 34 minutes
- to Kapalua, 27 miles, 39 minutes

■ To Wailuku - Five miles, 8 minutes

Via Mokulele Highway to Kihei Road (Route 310) to Honoapiilani Highway (Route 30).

■ To Makawao - Pukalani - Kula - Haleakala

Via Puunene Road and Mokulele Highway to intersection with Hansen Road (Route 370) (A&B Sugar Mill). Travel on Hana Highway (Route 36) and then to Haleakala Highway (Route 37) (mostly a three-lane highway).

- to Pukalani/Makawao, 9 miles, 12 minutes
- to Kula (Kula Lodge), 14 miles, 21 minutes
- to Haleakala Summit, 26 miles, 80-100 minutes

■ To Paia - Hana

Via Mokulele Highway to Hansen Road (Route 370)

- to Hana Highway (Route 36)
- to Paia, 7 miles, 10 minutes
- to Hana, 55 miles, 180 minutes

Existing Roadway Conditions. The following sample of 24 hour counts were taken in 1993 (State of Hawaii, Department of Transportation, Traffic Survey Data, Island of Maui, 1993).

TRAFFIC VOLUMES

	Inbound	Outbound
Honoapiilani Hwy. at Kihei Rd.		
North Leg	6,150	6,350
South Leg	11,651	11,448
Piilani Hwy. at Mokulele Hwy.	10,866	11,227
Mokulele Hwy. at Piilani Hwy.	10,604	10,685
Kula Hwy. at Kekauilike	1,633	1,472

The 1991 Long Range Highway Plan for Maui identifies roadway deficiencies along roads used to access Puunene including:

■ Hana Highway and Haleakala Highway which operate at LOS F conditions inbound in AM peak and outbound in PM peak.

■ Honoapiilani Highway and Kuihelani Highway experience LOS F during both AM and PM peaks. Because of peak period problems in Honoapiilani Highway, North Kihei Road also operates at LOS F during peak.

■ Honoapiilani Highway in the three-lane section between Lahaina and Kaanapali operates at LOS F during most of the afternoon, and the two-lane section south of Lahaina operates at LOS E.

Anticipated Growth by the Year 2020. Maui is expected to almost double in size between 1987 and 2010 for most key variables. These trends will affect all areas of the island and will strain the capacity on existing roads. Typically, the response to such growth on Maui has been to add turning movement and intersection improvements in the short-term and bypass roads or widening over the long term.

DEMOGRAPHIC CHARACTERISTICS

	1987	2010
Islandwide Population	81,000	149,000
- Wailuku	30,000	54,000
- Kihei/Makena	11,500	26,000
- Lahaina	13,800	33,600
- Upcountry	7,000	22,500
Employment (Jobs)		+40,000
Trip Ends (All TAZs)	614,500	1,229,000

Proposed Improvements. The 1991 Long Range Highway Plan includes the following committed projects:

1. Lahaina Bypass (Launiupoko State Park past Lahaina and Kaanapali to Honokowai).
2. Piilani Highway Extension.
3. Airport area - Extend and widen Kuihelani Highway with a grade separated interchange at Hana Highway.
4. Pukalani Bypass (completed).
5. Haleakala Highway - Widen for truck lanes from Hana Highway to Haliimaile (completed).
6. Kihei Traffic Plan.
7. Honoapiilani Highway widening to four lanes divided (Maalaea Harbor entrance to Kuihelani Highway and the Maalaea triangle area).

   Other improvements recommended include:

8. Puunene Bypass (new road).
9. Widen Mokulele Highway to four lanes from Piilani Highway to Puunene Bypass.
10. Kuihelani Highway widening to four lanes divided.
11. Haleakala Highway from 3 to 4 lanes between Haliimaile Road and Hana Highway.
12. Honoapiilani Highway widening Lahaina to Maalaea.
13. North Kihei Road widening to four lanes.
14. North Shore Belt Highway
15. Pukalani to Kihei new road.
16. Piilani Highway extensions to Hana.
17. Kula Highway extension.

Each of these improvements will affect some portion of travelers to Puunene. Perhaps the two projects of greatest significance would be:

■ Mokulele Highway - widening to four lanes. This project is in the planning phase and would be 4 to 5 years away.

■ Upcountry/Kihei Highway - this proposed road could extend from Pulehu Road and Kula Highway toward Piilani Highway and Mokulele. The new road would connect residential areas upcountry to the hotels in the Kihei area. If built, this would be the faster road to Puunene by perhaps half the time. As regards to an airfield at Puunene, this new road would primarily benefit employees and residents over visitors.

Mode of Travel. Several of the helicopter operators were interviewed by telephone to determine customer arrival modes. None of the helicopter operators regularly provides ground transportation service for passengers; the occasional exception is a day-tripper who comes in and out of Kahului Airport. Passengers arrive by rent-a-car, generally two per vehicle, or by shuttle vans arranged for privately. The average stay is about 1-1/2 hours. Busiest hours are 8:00 a.m. to 1:00 p.m.

Hydrology, Drainage and Water Quality

This section discusses the potential impacts on ground and surface water and drainage within the primary study area and was adapted from work undertaken for the 1992 Kahului Airport Master Plan.

Based on one-time water quality measurements (AECOS, 1981) taken off of Kahului Airport, landside activities appear to influence existing water quality conditions, as State Water Quality Standards for both dry and wet seasons are exceeded to some degree. Groundwater influx and discharge from Kalialinui Drainage Channel, as well as phytoplankton populations and suspended fine materials as a result of wave action, appear to be the principle causes of the exceedences.

Existing Conditions. The locations of streams, reservoirs, Kanaha Pond and other notable aquatic features are illustrated on Figure 3-4.

- Nearshore Environment. The marine environment off the Kahului Airport is a reef flat of considerable areal extent referred to as "Spartan Reef". The outer edge of this reef is over one-half mile from shore. At a distance of over one mile from shore, the submerged reef platform reaches a depth of only 30 feet. Offshore, the low-relief limestone bottom is cut by surge channels, the bottoms of which are thinly covered by sand (AECOS, 1979). This reef extends from near Kahului Harbor eastward to Lower Paia, where the reef narrows substantially then disappears as a distinct feature. The reef flat itself is not of the classically shallow form, rising to shoal depths near the outer edge. Instead, the bottom drops away to about 10 feet depth a short distance offshore then gradually deepens seaward.

  Coral is abundant on Spartan Reef far from shore. At depths of 15 to 30 feet, coral cover approaches 85% and is dominated by Porites lobata and Montipora flabellata. The distribution of algae is patchy--cover is generally less than 5%, although it reaches 15% off Papaula Point. Asparagopsis taxiformis is most conspicuous. Tubinaria ornata, Galaxaura sp., and Amansia glomerata are also present. The sea urchin, Tripeustes gratilla, is abundant. The soft coral, Palythoa turberculosa, is common. Acathurus nigrofuscus and Abudefduf abdominalis are the most common of a generally sparse fish fauna.

  Spreckelsville Beach on the makai side of the Airport was studied by Moberly and Chamberlain (1968; also Gerritsen, 1972). Moberly and Chamberlain noted (for the area off Kanaha Beach Park): "An alongshore current to the west prevails, causing thick masses of seaweed to be deposited on the beach during early summer. However, with southerly storms, an alongshore current is produced to the east." Presumably, the onshore wind and nutrient enriched groundwater are primarily responsible for the masses of seaweed deposited on the shore near Kanaha Beach Park. Moberly and Chamberlain also noted that Spreckelsville Beach "...appears to undergo erosion only during the early spring."

  Spreckelsville Beach continues to experience erosion problems noted several decades ago (Stearns and MacDonald, 1942). Beach sand volume and width are

significantly reduced from the early 1960s (Campbell, 1972). Numerous groins have been built along this coast, particularly in the vicinity of Kanaha Beach Park. These groins tend to accumulate sand on the east side and promote erosion on the west side, although the erosion is not great.

- Surface Runoff. Drainage from the east side of the Airport is directed into low areas behind the coastal dunes and percolates into the ground. No drainage outlets exist at the shoreline opposite the Airport east of Kalialinui Gulch. Lands west of the airport drain into Kanaha Pond; Kalialinui Gulch effectively isolates the airport surface drainage from it.

  Flow in Kalialinui Gulch is intermittent, and during the summer dry season, very little, if any, water reaches the coast through it. Kalialinui Gulch is the only ocean outlet for storm water originating on the Airport and for extensive agricultural areas (primarily sugarcane) south and west of the airport. At the time of the water quality survey in 1990, the drainage system was undergoing construction to increase its flow capacity.

- Existing Water Quality. A single series of water samples were collected on August 20, 1992 from along the coastline between Spreckelsville Beach and the Kahului wastewater treatment plant (WWTP). These samples were analyzed for nutrients, turbidity, Ph, and total petroleum hydrocarbons (TPH) to provide an indication of the existing water quality of the shoreline opposite the Kahului Airport. These exceedances do not necessarily represent violations. However, the comparison suggests that the quality of the coastal waters near the Kahului Airport is already influenced by landside activities.

  The only visible human activity influencing the water quality at the time of sampling was the construction of the Kalialinui Gulch drainage channel. Work at the shoreline produced the high turbidity value at Station 5 (a plume was evident and the sample was collected in this plume). Despite the construction activity, water quality along the Spreckelsville coast was generally better at the west end (closest to Kahului Harbor) than at the east end of the area sampled.

  The generally poorer water quality to the east seems to be related to nutrients from groundwater influx along this section of the coast as evidenced by the particularly high nitrate values. The low ammonia, low phosphate, and high chlorophyll a measured at Station 1 indicate a phytoplankton bloom occurring at the time of the sampling within the cove off this beach. The high density of phytoplankton may be contributing to the high turbidity value. Here, as elsewhere along this coast, wave action suspending fine material also contributes to the turbidity of the water close to shore.

  The absence of detectable amounts of petroleum residue in nearshore waters indicates there is not chronic petroleum contamination from the Airport.

  Samples of the coastal waters in this same area were collected previously in March, 1981 (AECOS, 1981) and the results of this earlier survey were reviewed for comparative purposes. The water quality in 1981 was very similar to the condition measured in 1990. Although less stringent, wet season criteria (DOH, 1989) apply to these March samples, the water quality standards appear to be exceeded to about the same degree as in 1990. The station locations in 1981 were not the same as those used in 1990. Combining the results for all stations and calculating mean values allows for a ready comparison of the two survey results. From this comparison, only nitrate plus nitrite, Ph, and turbidity show any substantial differences between 1981 and 1990. Generally, higher nitrate values (as measured in 1990) can be attributed to influence from the land, very probably from groundwater influx given that surface runoff (drainage systems and streams) was not present at the time of the sampling.

Public Facilities and Services

Potable water service to the airport area is provided by County of Maui pipelines, many of which are old and are planned to be abandoned. They will be replaced by new water lines as part of the Kahului Airport improvements.

Wastewater collection for the terminal area, ground transportation subdivision and light industrial areas near the airport is via the airport sewage system. Wastewater is collected, conveyed to a pump station near the east boundary of Kanaha Pond and pumped to the Wailuku-Kahului Wastewater Treatment Plant. The T-hangars and helicopter facility are served by cesspools.

Electrical power to the airport is provided by Maui Electric Company (MECO). Two 12.47 kV, 3-phase overhead transmission lines from the Kahului substation and one 4.16 Kv 3-phase overhead transmission line from the Paia substation serve the airport area.

Crash/fire/rescue and police services are provided at the airport by the DOTA. These services are augmented by corresponding County services in Kahului.

Aesthetics

The primary airport characteristics with a potential to affect local aesthetic characteristics are airport illumination and visual effects.

Light Emissions. The principal sources of illumination at an airport include lighting systems associated with aircraft operating areas. These include runway edge lights, runway end/threshold lights, taxiway lights and apron floodlighting. All airfield lighting must conform with FAA specifications.

Runway and taxiway edge lights are elevated, omni-directional, steady burning white and blue lights which delineate the runway and associated taxiways. They are spaced at a uniform interval along both edges of the usable runway or taxiway surfaces.

Runway end/threshold lights are identical to edge lights except that a two-color (typically red/green) lens is used. The green half of the lens faces the approaching airplane, indicating the beginning of the usable runway. The red half of the lens faces the airplane on roll-out or takeoff, indicating the end of the usable portion of the runway. End/threshold lights consist of a minimum of six lights, and are located at each end of the runway.

Visual. The primary study sites are located in an area devoted primarily to agricultural and open-space uses. It has long been the policy of the State of Hawaii to apply recognized principles of good design, art, and architecture to development projects within the designated airport site study areas, and it is intended that this policy will be followed for any future airport development at the principal study alternative sites.

Section 4
EXISTING GENERAL AVIATION AIRPORT SYSTEM

Edward K. Noda and Associates, Inc. • P&D Aviation • R.T. Tanaka Engineers, Inc

SECTION 4
EXISTING GENERAL AVIATION AIRPORT SYSTEM

AVIATION ACTIVITY

Knowledge of past trends and traffic characteristics is useful for understanding the prospects for future growth and change during .... forecast period. In terms of this study, the historical demand parameters of most relevance are the number of based general aviation aircraft at Maui airports and aircraft operations (takeoffs and landings), with particular emphasis on the number of operations conducted by general aviation aircraft, helicopters and all-cargo aircraft. Since an objective of the study is to evaluate the impacts of relocating certain activities from Kahului Airport, it is important to define the extent of the activities being considered for relocation.

Based Aircraft

In the five year period between 1989 and 1994 the number of based aircraft on the island has increased from 51 to 86 aircraft with all aircraft based at either Kahului or Hana. There were no aircraft based at Kapalua-West Maui or Hana Airports in 1994.

In 1994, the following aircraft were based at Kahului Airport:

Type Aircraft	Number
Fixed-Wing Piston	
Single Engine	41
Multi-Engine	9
Helicopters	36
Total	86

The based fixed wing aircraft (single and multi-engine) are all small aircraft, which are defined by FAA as aircraft of 12,500 pounds or less maximum certificated takeoff weight.

Aircraft Operations

An aircraft operation is defined as either a takeoff or landing. Table 4-1 presents the historical operations, by type of user, at Kahului Airport since 1970. Sightseeing helicopter operations are included in the table as air taxi and accounted for approximately 40 percent of total aircraft operations in 1994. As seen in Table 4-1, total annual operations peaked in 1990, but have decreased in each succeeding year. The annual operations for 1994 are two percent less than the 1990 peak. The operations of prime concern are general aviation, helicopter and air cargo, as these operations could potentially be relocated from Kahului.

General Aviation Operations. General aviation operations accounted for 19 percent of the air traffic activity at Kahului Airport in 1994 and have averaged approximately 31,000 operations per year since 1970. From 1955 to 1978 the general aviation industry experienced tremendous growth. Since 1978 there has been a sharp decline in the number of aircraft shipments by manufacturers and this trend has been reflective of general aviation activity in general, and reflected in the sharp decline in general aviation operations at Kahului after 1979. The decline of the industry is the result of three economic recessions, two fuel crises, and legislative actions - namely Airline Deregulation in 1979, repeal of the G.I. Bill of Rights in 1979, and repeal of the investment tax credit in 1986. Additionally, high interest rates in the 1970s and 1980s together with the overall high costs of purchasing and operating a general aviation aircraft contributed to the downward trend. General aviation activity began to increase at Kahului in 1988 and remained at

TABLE 4-1
AIRCRAFT OPERATIONS BY TYPE
AT KAHULUI AIRPORT, 1970 TO 1994 [a]

Year	Air Carrier	Air Taxi	General Aviation	Military	Total
1970	38,680	[b]	23,508	15,263	77,451
1971	32,781	3,919 [b]	22,964	17,104	76,768
1972	33,957	11,007	16,773	13,745	75,482
1973	35,103	12,703	12,219	14,418	74,443
1974	33,010	14,063	15,898	11,912	74,883
1975	35,135	18,120	14,488	9,319	77,062
1976	37,568	23,036	19,098	10,753	90,455
1977	40,365	26,231	25,117	8,942	100,655
1978	43,052	37,441	37,119	7,679	125,291
1979	41,400	35,503	44,096	6,478	127,477
1980	40,708	28,866	34,701	7,298	111,573
1981	42,348	28,641	24,984	6,787	102,760
1982	49,494	28,350	24,538	10,046	112,428
1983	57,425	28,588	28,172	10,103	124,288
1984	67,230	37,128	26,333	11,620	142,311
1985	71,745	43,777	30,558	11,151	157,231
1986	78,820	56,361	30,338	9,041	174,560
1987	76,368	54,845	26,534	8,173	165,920
1988	61,990	60,385	43,792	6,886	173,053
1989	56,981	63,444	49,823	7,555	177,803
1990	56,532	75,923	44,209	6,022	182,686
1991	51,668	74,410	49,717	5,062	180,857
1992	57,159	68,832	47,281	5,480	178,752
1993	51,648	77,212	37,097	6,308	172,265
1994	56,393	85,373	33,292	4,169	179,227

[a] Source: State of Hawaii, Department of Transportation, Airports Division, Airport Activity Statistics, Calendar Year 1992.

[b] Air Taxi operations were combined with General Aviation operations until July 1971 when they were separated.

relatively high levels until tapering off in 1993.

The prevalence of local general aviation operations has increased over time, and currently, 72 percent of all fixed-wing piston general aviation operations are local. An aircraft operation, or movement, is defined as either a takeoff or landing with each operation being categorized as either local or itinerant. A local operation is one that is performed by aircraft that: 1) operate in the local traffic pattern or within sight of the airport; 2) are known to be departing for or arriving from flights in local practice areas located within a 20-mile radius of the airport; or 3) execute simulated instrument approaches or low passes at the airport. Itinerant operations are all operations other than local.

Helicopter Operations. While helicopter operations are often included in the general aviation category, at Kahului most helicopter operations are counted as air taxi operations as the flights are performed on a "for hire" basis for sightseeing aerial tours. As stated in the Kahului Airport Master Plan, in 1989 helicopter operations totalled 37,400 and accounted for 20 percent of all aircraft operations at the airport. In 1990, these increased to 56,030 operations, or 30 percent of total operations. A recent two-month survey (July and August, 1994) conducted by the Kahului Air Traffic Control Tower indicates that helicopter traffic accounts for 40 percent of total traffic at the airport. Fixed-wing aircraft operations accounted for approximately 112,000 annual operations in 1993. This is a significant statistic, in that fixed-wing aircraft drive the need for runway capacity as helicopters are capable of operating from areas other than the runway.

Air Cargo Operations. Air cargo activity at Kahului has experienced a four-fold increase since 1970, from 10,404 tons to 40,271 tons in 1992. However, cargo shipments were sharply down in 1993 (35,322 tons). Kapalua also serves a small air cargo market and processed 694 tons in 1993. Cargo activity at Hana is minimal and amounted to 2 tons (all deplaned) in 1993.

At Kahului, air cargo is carried on both passenger aircraft (as belly hold cargo) and on all-cargo (freighter) aircraft. The all-cargo aircraft operations are of specific interest in this study of alternative airport systems, as they have been suggested as potential candidates for relocation from Kahului.

In 1994, scheduled all-cargo operations were conducted only by Aloha Airlines. Aloha operates B737 freighters with 4 to 5 flights daily. Federal Express also operates three daily flights (six operations) five days a week using Cessna 208 and Shorts SD330 aircraft. Additionally, cargo service is being provided by Genvasco which uses a DC-3 and primarily carries cargo for local hotels. Genvasco flies one flight a day, five days a week. All of the all-cargo flights are to and from Honolulu.

The current all-cargo operations consist of the above referenced flights. The current schedule translates into an annual number of approximately 4,500 all-cargo aircraft operations. It is noteworthy that over one-half of these (operated by Aloha) are conducted during off-peak periods between approximately 9:30 PM and 5:00 AM. Federal Express operates one morning flight, one midday flight and one in the afternoon. Genvasco operates in the morning.

EXISTING AIRPORTS

There are presently three active State-operated airports on Maui -- Kahului, Hana, and Kapalua-West Maui Airports. These are graphically presented on Figure 3-1. The existing airfield and landside facilities related solely to the accommodation of general aviation activities are described in this subsection. The inventory of existing conditions is based largely on data contained in the Hawaii Statewide

Airport System Plan (SASP) and current FAA Form 5010-1, Airport Master Record. The description of existing airports focuses on general aviation facilities, and those airside facilities whose use is shared by general aviation and non-general aviation users (i.e., runways, navaids, etc.).

Kahului Airport

Airside Facilities. Figure 4-1 presents a layout of Kahului Airport which is the major airport on the island. The Airport encompasses 1,391 acres and the airfield consists of two intersecting runways designated as 2-20 and 5-23. Runway 2-20 is 7,000 feet long and 150 feet wide and Runway 5-23 is 4,990 feet long and 150 feet wide. Both runways are asphalt paved and have the following weight bearing capacities: 130,000 pounds for single wheel landing gear loads; 170,000 for dual wheel landing gear loads; and, 270,000 pounds for dual tandem landing gear loads. The runway pavements are grooved and reported in good condition. Each runway is served by full parallel taxiways and a network of exit taxiways. Both runways are lighted for night time operations. Runway 2-20 is equipped with high intensity runway edge lights and Runway 5-23 is equipped with medium intensity runway edge lights. The annual capacity (annual service volume) of the existing runway is estimated at 193,000 operations (State of Hawaii, Kahului Airport Master Plan, June 1993).

Runway 2 is equipped with an instrument landing system (ILS) which includes middle and outer markers and an approach light system (Medium Intensity Approach Light System with Runway Alignment Indicators [MALSR]). The Airport is also served by a VHF/Omni-Directional Range/Tactical Air Navigation (VORTAC), nondirectional radiobeacons, rotating beacon. Visual Approach Slope Indicator (VASI) systems are installed on Runways 2, 20 and 5.

The Airport is a controlled airport since an Air Traffic Control Tower is operated by FAA. The Airport is also served by an Airport Surveillance Radar (ASR).

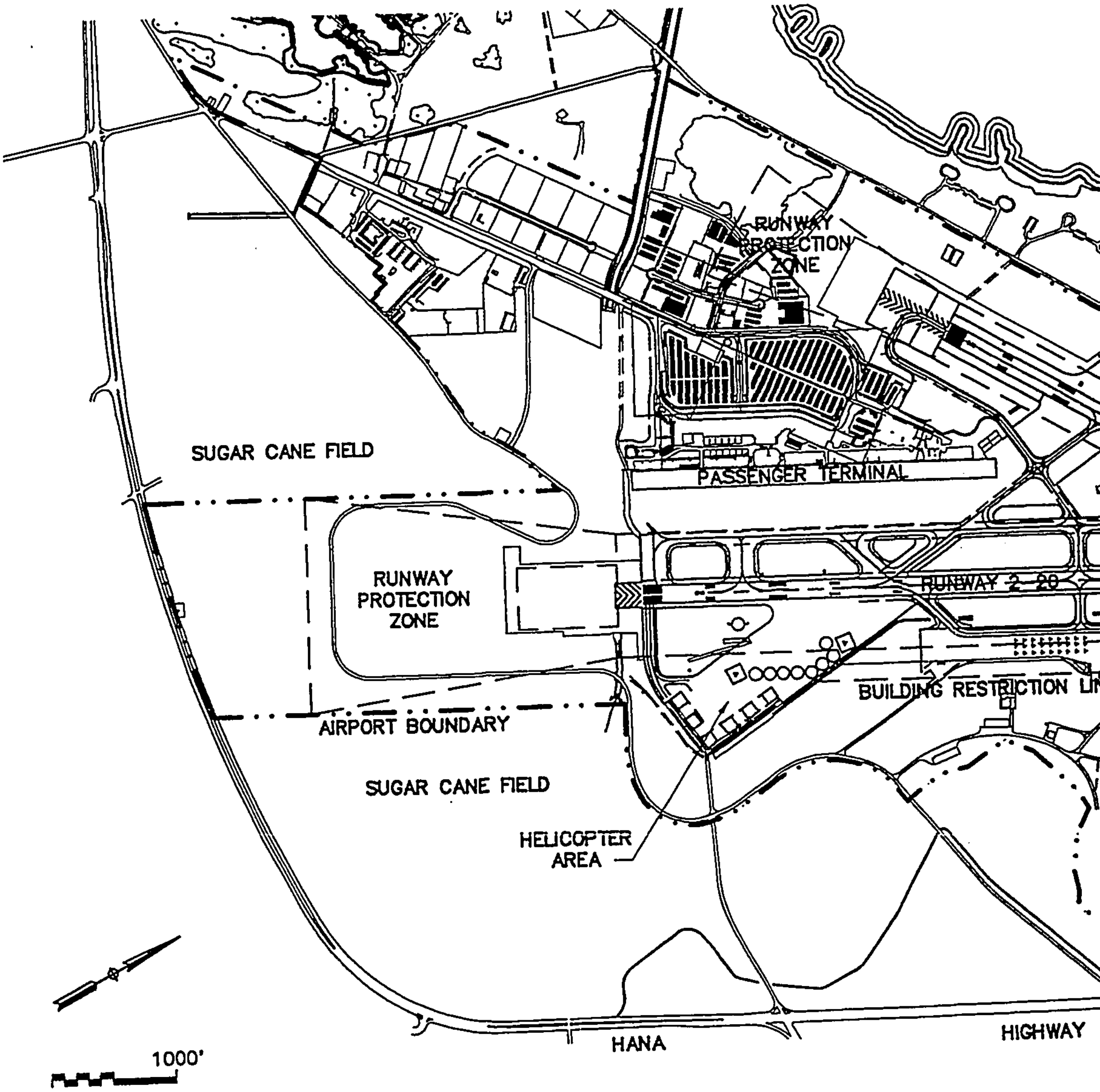
General Aviation Aircraft Storage Facilities. General aviation apron at Kahului is located on the East Ramp and consists of two areas encompassing approximately 128,900 square yards. One area consists of approximately 53,300 square yards of pavement of an abandoned runway (17-35) and is used for helicopter operations. The second area totals 75,600 square yards east of Runway 2-20 and is used for general aviation and air taxi aircraft parking. A total of 34 tie-downs occupy a 17,800 square yards area adjacent to existing T-hangars and are available for based and itinerant aircraft.

There are a total of 30 T-hangar spaces (in three buildings) which are owned by the State and leased to individual aircraft owners.

Fuel and maintenance services are available at the Airport for based and itinerant aircraft. A total storage capacity of 51,000 gallons (in two tanks) for jet fuel and 10,000 gallons (in one tank) for Avgas is available. An additional 8,000 gallons of unused capacity also exists. Two helicopter operators also maintain two small storage tanks.

Hana Airport

Hana Airport (Figure 4-2) encompasses 119 acres and consists of a single runway oriented east-west (8-26). The runway is asphalt paved and is 3,605 feet long and 100 feet wide. The airport elevation is 77 feet above mean sea level. The runway is marked with basic runway markings and is lighted with medium intensity runway edge lights (MIRL) for night operations. Runway pavement is rated for the following loads: 34,000 single wheel landing gears; 48,000 dual wheel landing gears; and 80,000 pounds dual tandem wheel landing gears. Three


RUNWAY
PROTECTION
ZONE
PASSENGER TERMINAL
SUGAR CANE FIELD
RUNWAY
PROTECTION
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RUNWAY 2-20
BUILDING RESTRICTION LI
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HELICOPTER
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HANA
HIGHWAY
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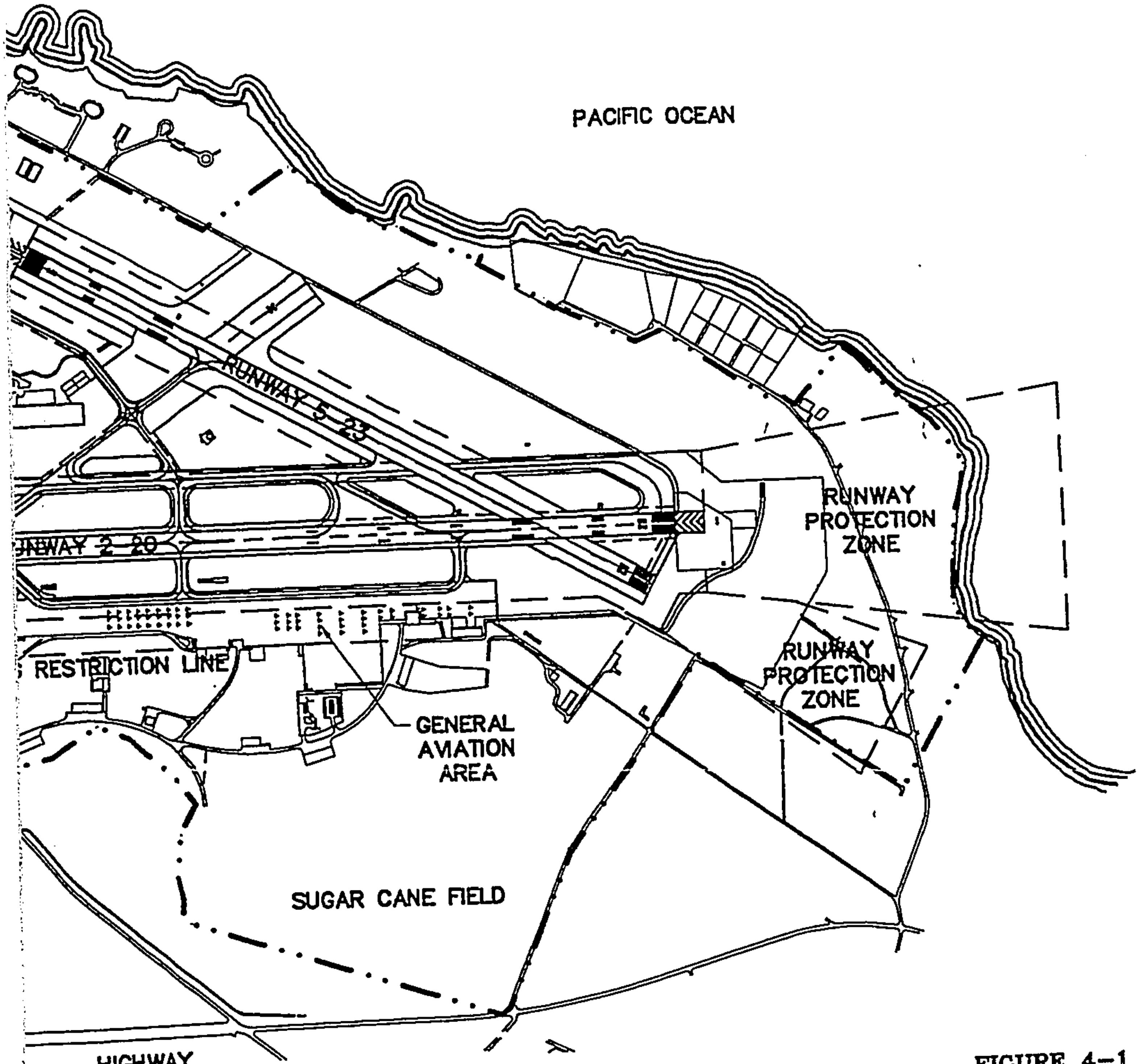
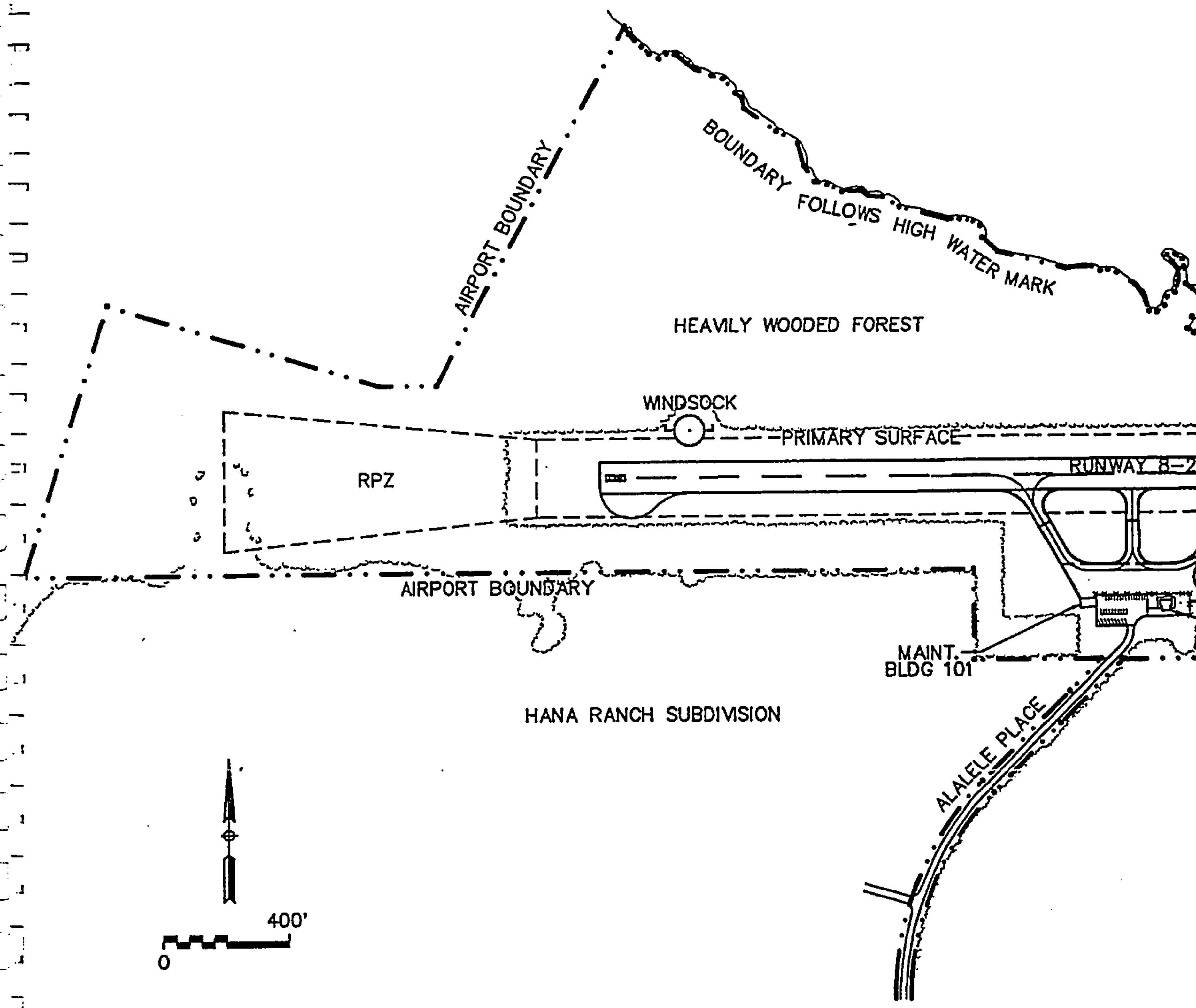


FIGURE 4-1
EXISTING LAYOUT
OF KAHULUI AIRPORT


AIRPORT BOUNDARY
BOUNDARY FOLLOWS HIGH WATER MARK
HEAVILY WOODED FOREST
WINDSOCK
PRIMARY SURFACE
RPZ
RUNWAY 8-2
AIRPORT BOUNDARY
MAINT.
BLDG 101
HANA RANCH SUBDIVISION
ALALELE PLACE
400'
0

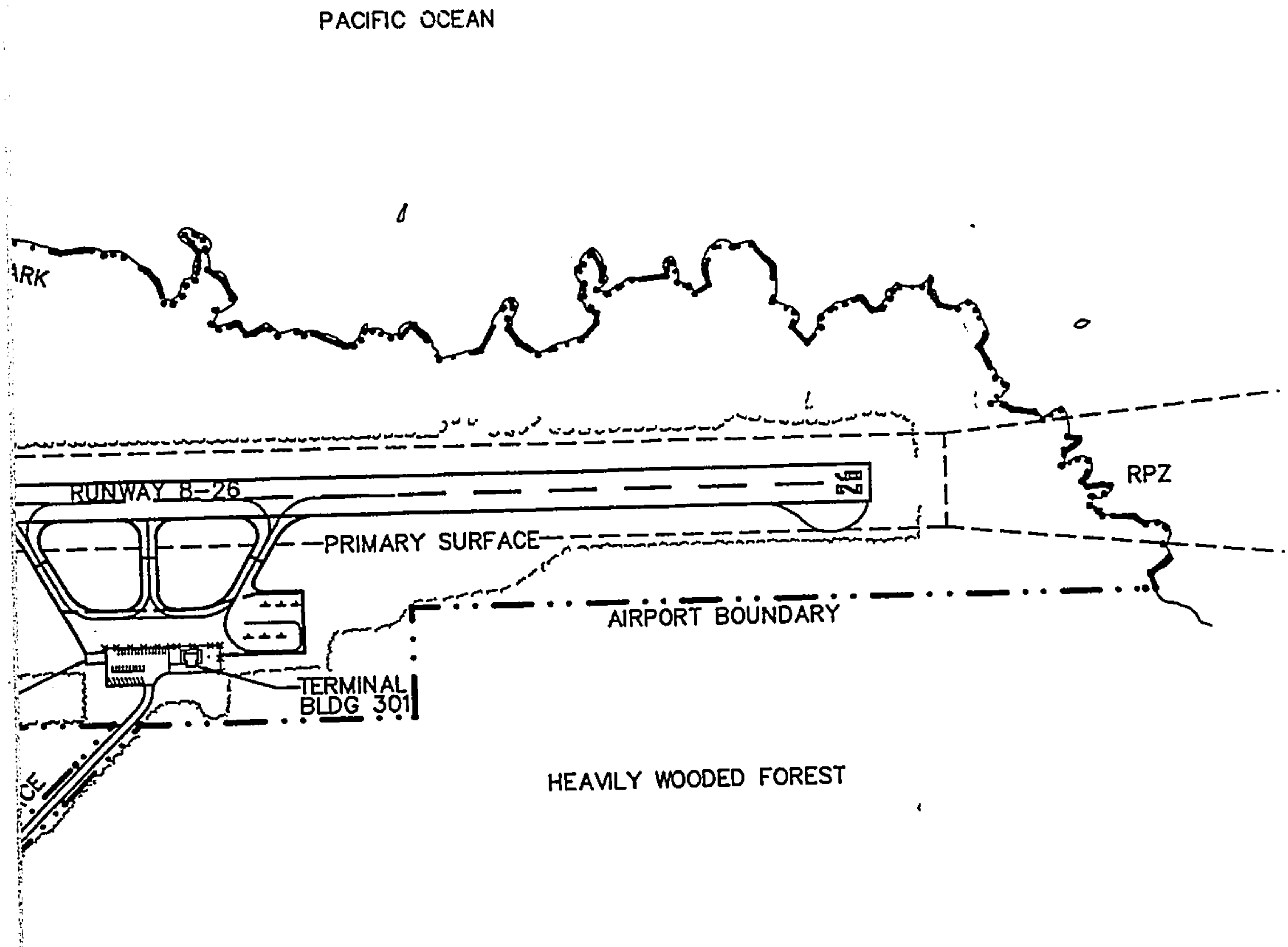


FIGURE 4-2
HANA AIRPORT

taxiways, each 50 feet wide, connect the runway with the 65,340 square foot terminal parking apron.

The terminal building encompasses 2,208 square feet and contains ticket counters, a waiting area, baggage handling area, and commuter/air taxi facilities. An aircraft rescue and fire fighting (ARFF) building is located east of the terminal building and encompasses 240 square feet. ARFF equipment is manned by volunteers and includes a single vehicle with a capacity of 100 gal ns of water.

The airport is uncontrolled as there is no air traffic control tower. Other facilities located on the airport include a small maintenance building, an rotating airport beacon, lighted wind indicator, segmented circle and wind sock.

General Aviation Aircraft Storage Facilities. General aviation storage facilities are limited at L · Airport. A general aviation ramp is located adjacent to and east of the terminal parking apron. The general aviation ramp is marked with 6 tie-down spots. No enclosed hangars or covered aircraft storage is available at the airport.

Kapalua - West Maui Airport

The Kapalua-West Maui Airport (Figure 4-3) encompasses approximately 50 acres and consists of a single runway generally oriented north south (2-20). The runway is asphalt paved and is 3,000 feet long and 100 feet wide. The airport elevation is 256 feet above mean sea level. The runway is marked with basic runway markings and is not lighted. Runway pavement is for 44,000 pound dual wheel landing gears. Two taxiways, each 50 feet wide, connect the runway with the terminal parking apron. The terminal apron is approximately 123,000 square feet and is designed to accommodate either 3 DHC-7 aircraft or 6 Cessna 401/Piper 31 commuter aircraft.

The terminal building contains 15,000 square feet on two floors. Facilities include ticket counters, waiting areas and baggage handling facilities.

General Aviation Aircraft Storage Facilities. There are no facilities to accommodate general aviation traffic at the airport. The airport was initially developed under an agreement between Hawaiian Airlines, Maui Land & Pineapple Company and Maui County that limits operations and prohibits night operations. In addition the agreement prohibits the expansion of any facilities at the airport. Helicopter activities at the airport are not permitted.

AIRSPACE SYSTEM

This subsection contains a description of the existing airspace structure, air traffic control (ATC) facilities, and navigational aids within the Maui area. Figure 4-4 depicts the airports, airspace structure, and navigational aid system for the Maui terminal airspace area.

Airspace Structure

The Federal Aviation Administration (FAA) regulates the operation and use of the airspace over the Maui area. For air traffic control (ATC) purposes, the airspace is divided into two main jurisdictions:

- Combined Center/Radar Approach Control (Honolulu CERAP)
- Airport Traffic Control Tower (ATCT or, "Tower," – Kahului Tower)

Honolulu CERAP. For air traffic control (ATC) purposes within the Maui area, the Honolulu CERAP has designated the Maui Tower Area at 17,000 feet above mean sea level (MSL) and below. The airspace within the Maui Tower Area at 10,000 feet and below, is subdivided into the Maui South (R9) and Maui North (R10) airspace areas. Air traffic

controllers at the R9 and R10 radar approach control positions located at the Honolulu CERAP are responsible for radar approach control of air traffic within these two airspace areas, except for traffic operating within the airspace delegated to the Maui Airport Traffic Tower described below. In radio communications between pilots and controllers at the R9 and R10 positions, the Honolulu CERAP is referred to as, "Honolulu Center," "Maui Approach Control," or Maui Departure Control," depending on the phase of flight.

Airport Traffic Control Tower (ATCT or "Tower") Airspace. Unless authorized or required by ATC, no person may operate an aircraft at an airport with an operational airport traffic control tower, except to land or takeoff from that airport. Kahului Airport is served by the Maui control tower located on the Airport. Arriving, departing, and taxiing aircraft are controlled by the Maui control tower to permit the safe, orderly, and expeditious flow of air traffic. The Maui Tower operates between the hours of 6:00 a.m. and 10:00 p.m.

The Honolulu CERAP has delegated limited approach control authority to Maui Tower within certain airspace referred to as "Maui ATCT Airspace." The Maui ATCT airspace area is shown on Figure 4-4 and includes airspace from 2,500 feet above MSL and below, except between the Maui VORTAC 220 and 300 radials (southwest through northwest), where the airspace ceiling is 3,000 feet above MSL.

The other two airports on the Island of Maui (Kapalua-West Maui and Hana) do not have control towers.

Other Airspace Areas. Within the airspace jurisdictional categories described above, other stratifications of airspace referred to as Class C, D, or E are defined in addition to Low Altitude ("Victor") airways, Restricted Areas, and the Hawaiian Coastal Air Defense Identification Zone (ADIZ).

- Class C Airspace. Within Class C airspace, ATC separation is provided between aircraft operating on instrument flight rules (IFR) flight plans, under special visual flight rules (SVFR), and runway operations. In addition, ATC provides conflict resolution services between IFR and VFR aircraft within Class C airspace. For approval to enter Class C airspace, aircraft must be equipped with a transponder and establish radio contact with ATC.

  The boundaries and altitudes of the Maui Class C airspace are depicted on Figure 4-4. As shown on Figure 4-4, Class C airspace exists within a 5-statute mile radius of the Kahului Airport, extending from the surface upward to 4,100 feet above MSL, and within two wedge-shaped segments north and south of the Airport, extending from 2,000 to 4,100 feet above MSL between a 5 and 10-mile radius of the Airport.

- Class D Airspace. Class D airspace is defined as that airspace from the surface to 2,500 feet above the airport elevation surrounding airports with operational control towers. The purpose of Class D airspace is to provide airspace within which a control tower can control the movement of aircraft on and in the vicinity of an airport. Prior radio contact and ATC clearance is required for entry into Class D airspace.

- Class E Airspace. Class E airspace is controlled airspace extending from the surface or designated altitude up to the base of the overlying controlled airspace. Class E airspace designated for Kahului, Kapalua-West Maui, and Lanai Airports is depicted on Figure 4-4 and extends to a 5-mile radius of these airports. As shown on Figure 4-4, the Class E airspace for Kahului Airport also has rectangular

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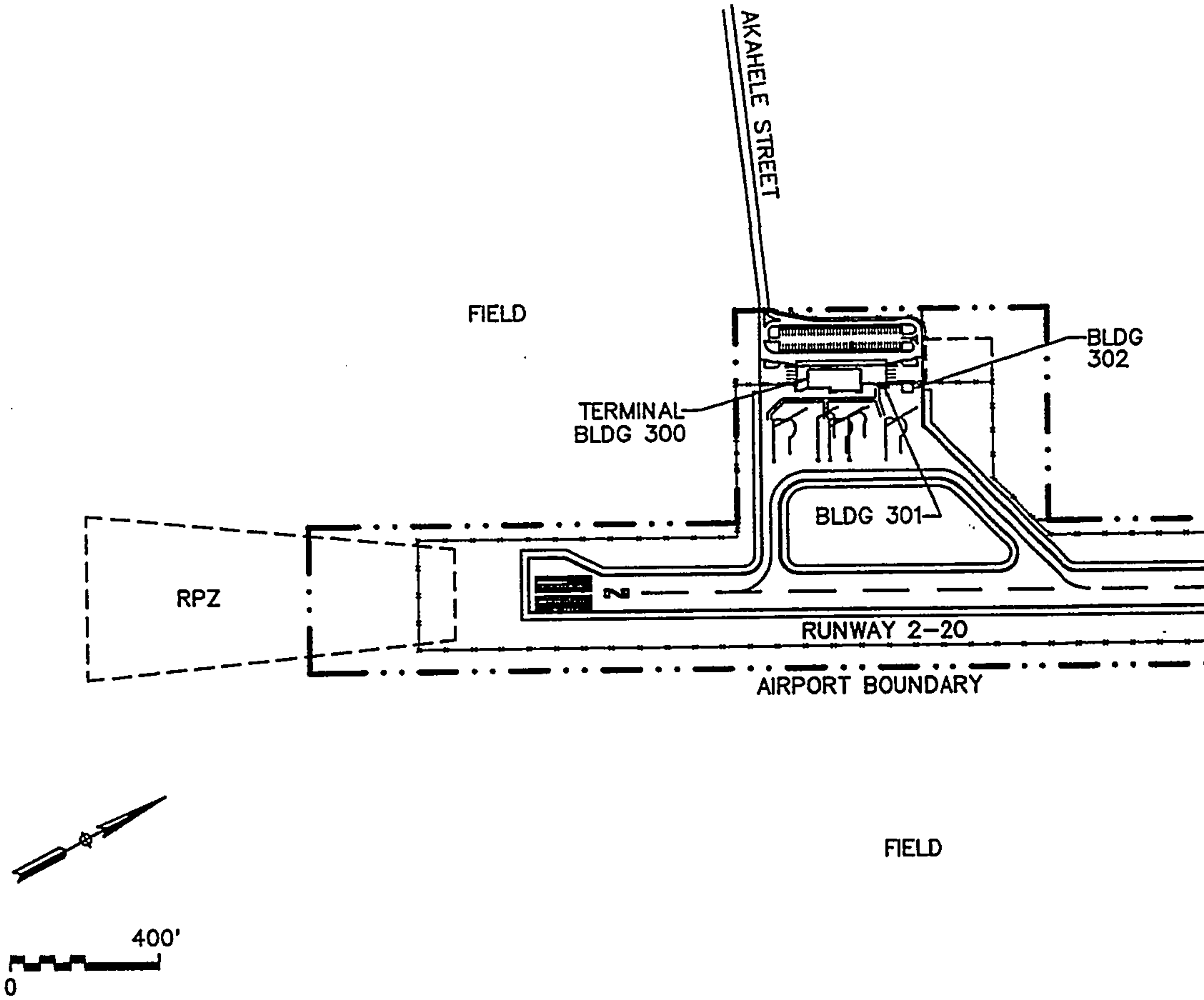

AKAHELE STREET
FIELD
BLDG
302
TERMINAL
BLDG 300
BLDG 301
RPZ
RUNWAY 2-20
AIRPORT BOUNDARY
FIELD
400'
0

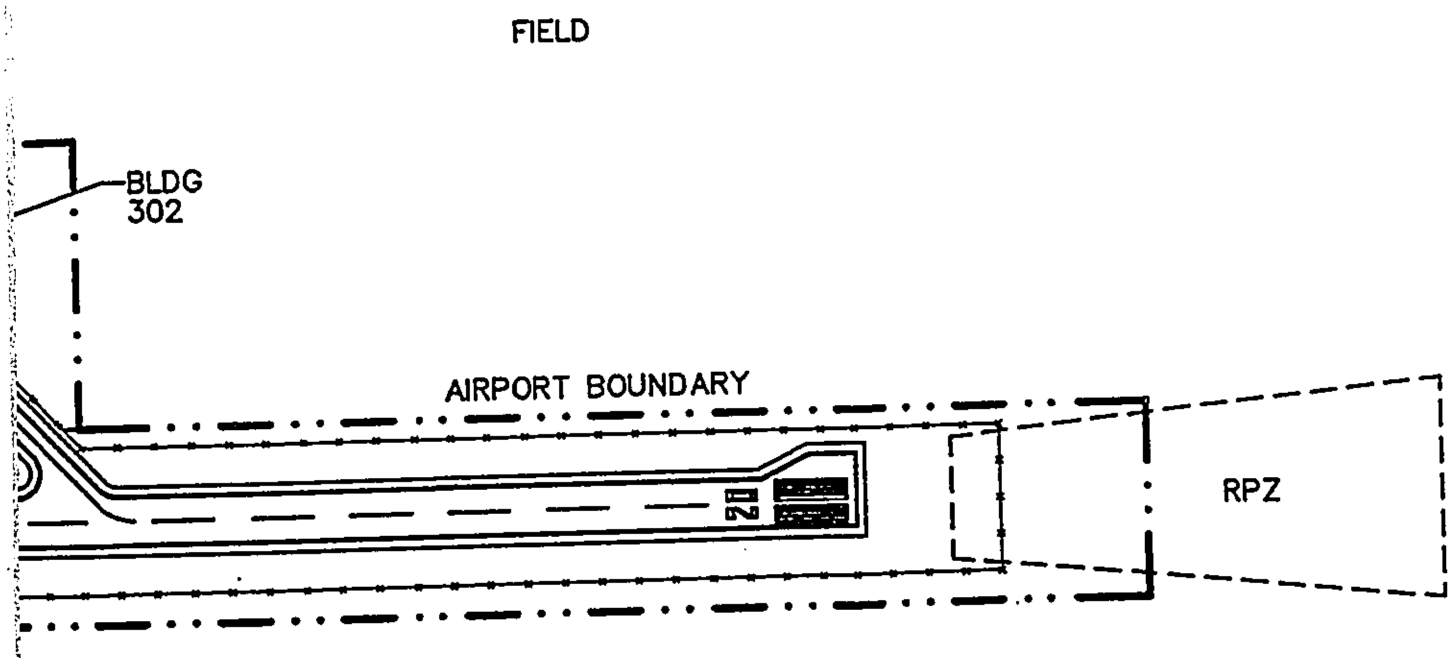
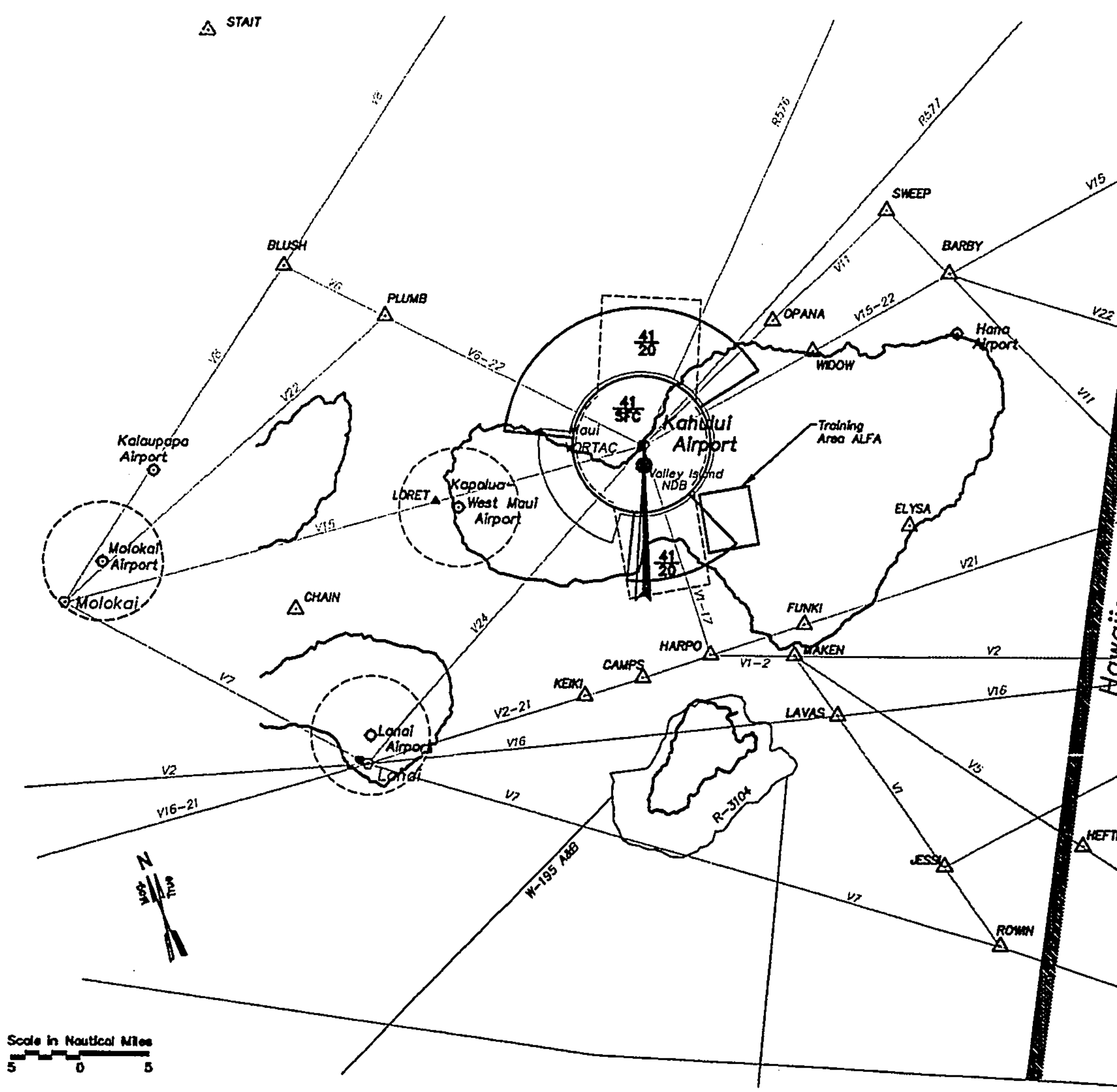


FIGURE 4-3
KAPALUA – WEST MAUI AIRPORT


STAIT
BLUSH
PLUMB
V6-22
V22
V8
V15
Kalaupapa Airport
Molokai Airport
Molokai
LORET
Kapalua-West Maui Airport
CHAIN
Lanai Airport
Lanai
V7
V2
V16-21
V16
V2-21
V24
KEIKI
CAMPS
HARPO
V1-2
V1-17
Maui VORTAC
Kahului Airport
Valley Island NDB
41 20
41 SFC
Training Area ALFA
OPANA
WIDOW
SWEEP
BARBY
Hana Airport
V15-22
V11
R576
R577
ELYSA
FUNKI
MAKEN
LAVAS
V21
V5
JESSI
ROWN
HEFTI
R-3104
W-195 A&B
Scale in Nautical Miles
5 0 5

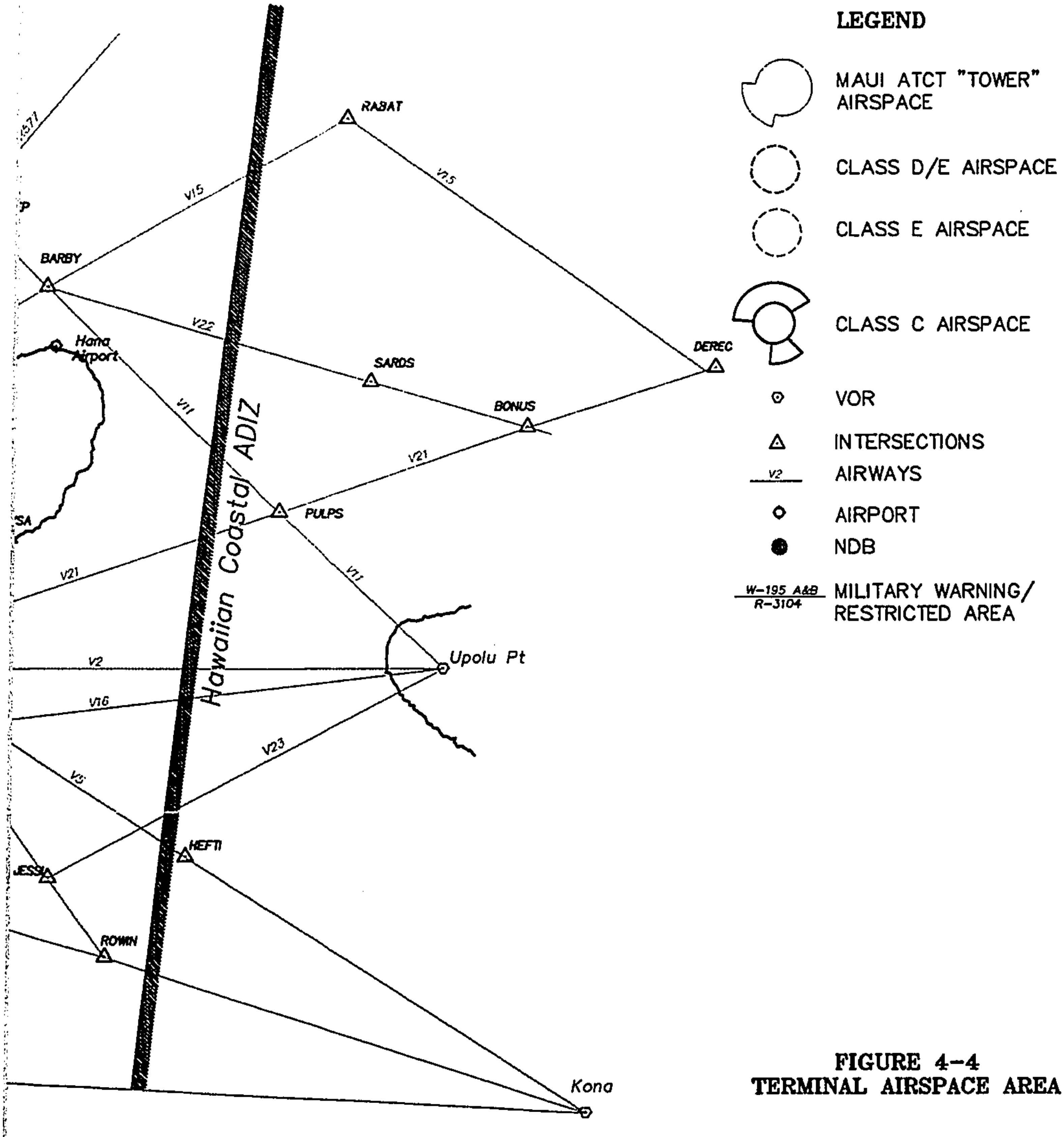
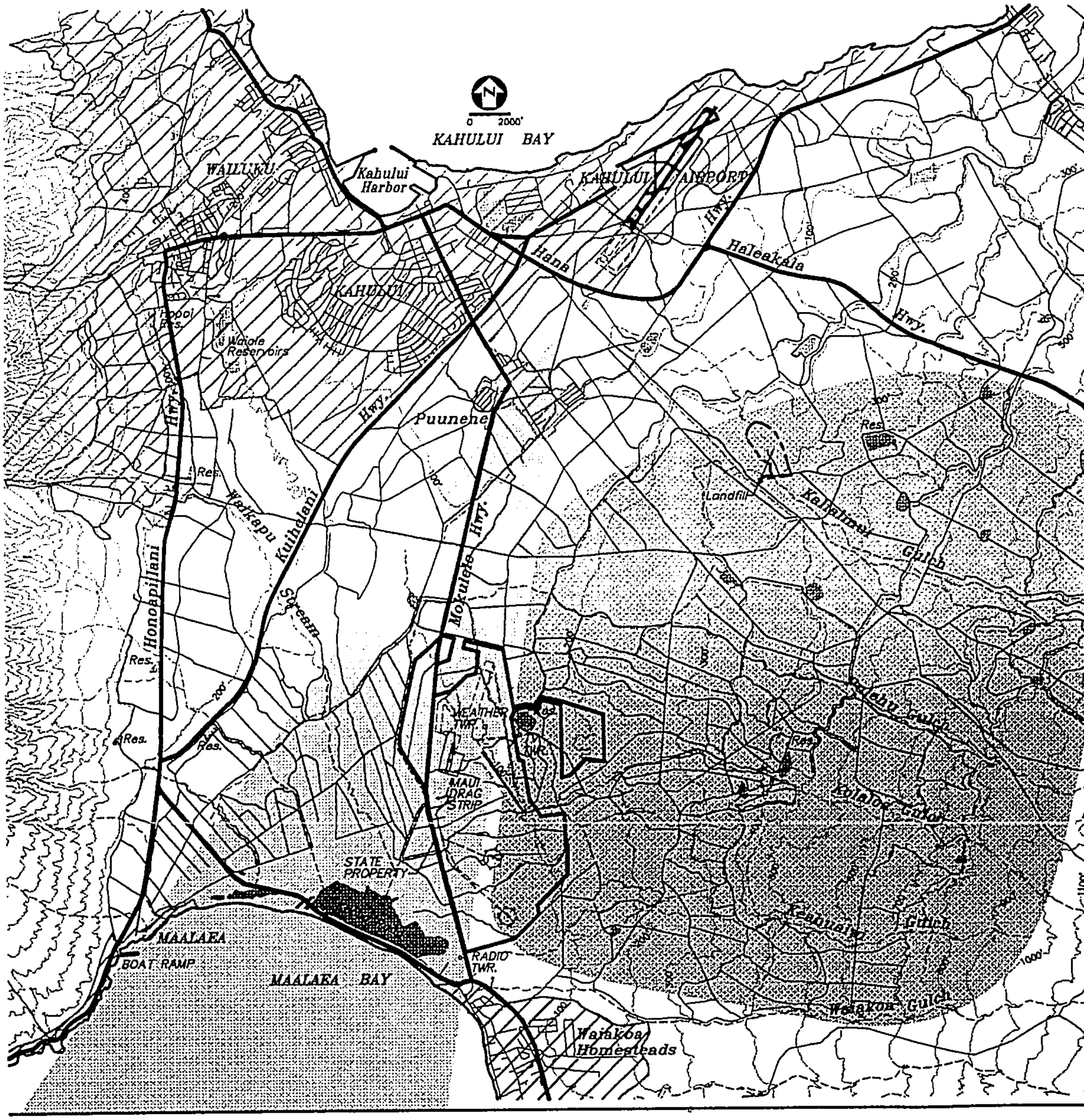
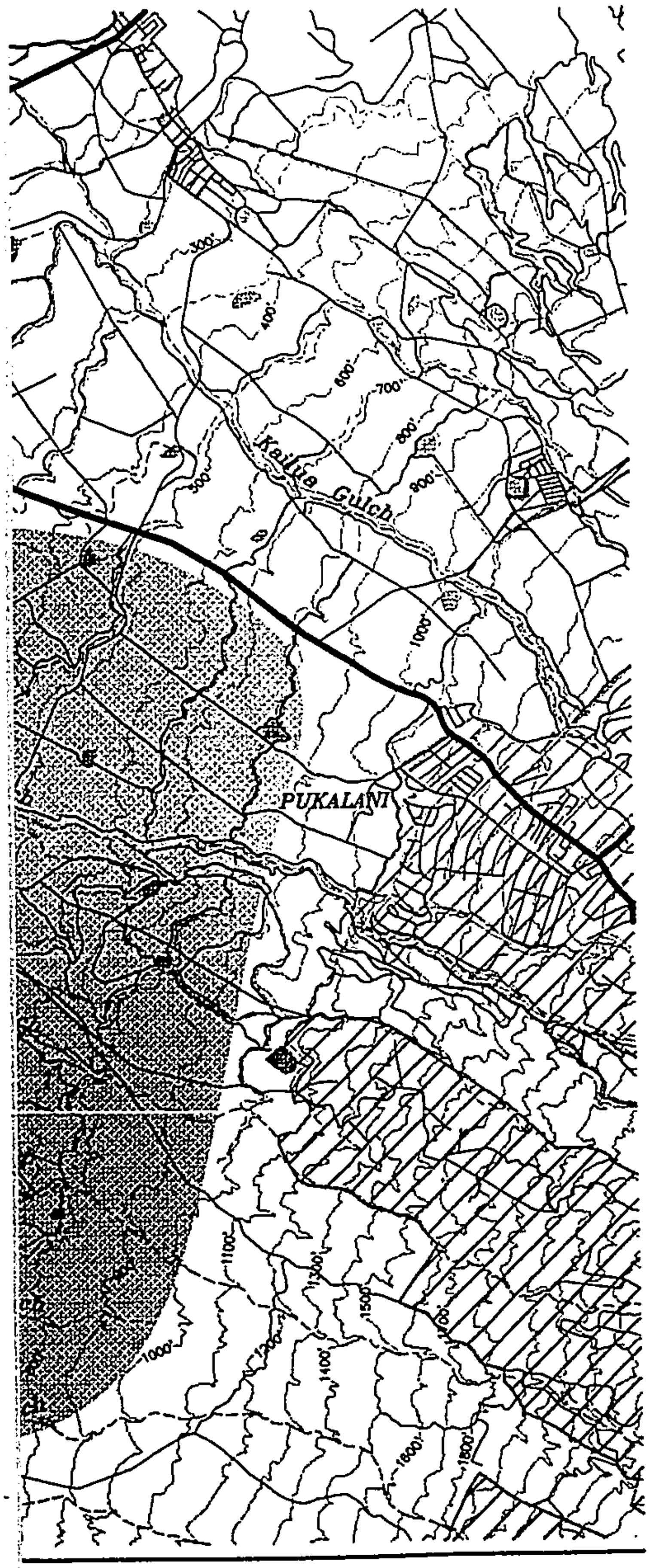


FIGURE 4-4
TERMINAL AIRSPACE AREA


KAHULUI BAY
0 2000'
Kahului Harbor
WAILUKU
KAHULUI AIRPORT
KAHULUI
Hana
Hwy.
Haleakala
Hwy.
Waiale Reservoirs
Puunene
Kuihelani
Hwy.
Res.
Landfill
Kalialinui
Gulch
Waikapu
Stream
Honoapiilani
Mokulele
Hwy.
Res.
WEATHER TWR.
TWR.
MAUI DRAG STRIP
STATE PROPERTY
Res.
Kolaloa Gulch
Kaonoulu
Gulch
MAALAEA
BOAT RAMP
MAALAEA BAY
RADIO TWR.
Waiakoa Homesteads
Waiakoa Gulch



LEGEND

CONSTRAINTS

EXISTING AND PLANNED URBAN AREAS

APPROACH AREA TO KAHULUI AIRPORT RUNWAY 2

OPPORTUNITIES

POTENTIAL AREA FOR NEW AIRPORT/HELIPORT

STATE-OWNED PROPERTY (FORMER PUUNENE AIRPORT)

FIGURE 4-5
EXISTING CONSTRAINTS AND OPPORTUNITIES FOR NEW AIRPORT/HELIPORT SITE SELECTION

extensions to the north and south for instrument approaches.

- Low Altitude Airways. A low-altitude airway, known as a Victor airway, is represented with a "V" preceding its identification number. Regional airways, represented by the letter "R" followed by and identification number, have also been defined for the Maui area. Both Victor and Regional airways are defined by radio signals from very high-frequency omni-directional range tactical air navigation equipment (VORTAC). As shown on Figure 4-4, the Maui VORTAC is located on Kahului Airport, resulting in a radial configuration of airways around the VORTAC.

Restricted and Warning Areas. Restricted Areas are controlled airspace areas within which hazardous activities such as artillery, aerial gunnery, or guided missiles may occur. Warning Areas also consist of airspace within which such activities may occur. However, Warning Areas cannot legally be designated Restricted Areas because they are over International waters (i.e., beyond the 3-mile offshore limit). Penetration of Restricted or Warning Areas without authorization from the using or controlling agency may be extremely hazardous to nonparticipating aircraft.

As shown on Figure 4-4, Restricted Area R-3104 and Warning Areas W-195A and W-195B have been designated around and to the south of the Island of Kahoolawe. The controlling agency for these areas is the Honolulu CERAP. Restricted Area R-3104 includes airspace from the surface up to 18,000 feet above MSL. Warning Area W-195A includes airspace from the surface up, to but not including 9,000 feet above MSL; Warning Area W-195B includes airspace from 9,000 to 18,000 feet above MSL.

- Air Defense Identification Zone (ADIZ). An ADIZ is an area of airspace in which the ready identification, location, and control of aircraft is required in the interest of national security. Rules for operating into, within, or out of an ADIZ are specified in Federal Aviation Regulation (FAR) Part 99. Unless authorized by ATC, no person may operate an aircraft into, within, or across an ADIZ unless that person has filed a flight plan with an appropriate aeronautical facility. A portion of the easterly inner boundary of the Hawaiian Coastal ADIZ is shown on Figure 4-4 (the Island of Maui is located within the inner ADIZ boundary).

- Training Area ALFA. Training Area ALFA, shown on Figure 4-4, is a designated flight training area used by general aviation. It is located northeast of the Kihei area.

Navigational Aids

The Kahului Airport is equipped with the navigational aids described below. These "navaids" provide pilots with electronic guidance to and from the Airport, as well as en route guidance in some cases, to pilots overflying the area.

- Bright Radar Indicator Tower Equipment (BRITE). The BRITE consists of a radar display located in the Maui Control Tower which is a remote "repeater" from the Honolulu CERAP's radar equipment. The BRITE is used by air traffic controllers in the Tower to sequence, separate, and provide navigational guidance to aircraft within the delegated Maui ATCT area airspace.

- Distance Measuring Equipment (DME). The Maui VORTAC (Very high frequency omnidirectional range collocated with tactical air navigation (equipment)) is

equipped with DME, which provides pilots with electronic distance information.

- Global Positioning System (GPS). The VOR/DME, and TACAN approaches to Runway 20 and the NDB/DME approach procedure to Runway 2 at Kahului Airport also have been approved for GPS "overlay" approaches. Under FAA Regulation 14 CFR Part 97 Amendment 1996, effective June 23, 1994, GPS-equipped aircraft are authorized to fly the above procedures using GPS equipment, instead of the associated ground-based navigational aids.

- Instrument Landing System (ILS). Runway 2 at Kahului Airport is equipped with an ILS Category I approach. The published minimums for the ILS approach to Runway 2 are a cloud ceiling of 200 feet and a visibility of one statute mile. The ILS consists of various components including a localizer transmitter which provides pilots with electronic horizontal guidance, and a glideslope transmitter, which provides electronic vertical guidance to Runway 2. The back course of the Runway 2 ILS localizer, in conjunction with the DME associated with the Maui VORTAC, serves as an instrument approach aid to Runway 20.

- Nondirectional (radio) Beacon (NDB). The Valley Island NDB is collocated with the middle marker which is a components of the ILS approach to Runway 2. When used in conjunction with the ILS, the Valley Island NDB is referred to as "Middle Compass Locater (LMM)." The NDB provides directional guidance to pilots and serves as a tertiary instrument approach aid to Runways 2 and 20.

- Outer and Middle Markers (OM and MM). The markers are components of the ILS and provide pilots with an electronic indication of their specific location when they are overflown on the final approach course.

- High Frequency Omnidirectional Range Collocated with Tactical Air Navigation (VORTAC). The Maui VORTAC is located on the Kahului Airport between the runways. Along with other VORTACS in the national airspace system, the Maui VORTAC provides en route navigational guidance to pilots. The Maui VORTAC also serves as a secondary instrument approach aid to Runway 20 at the Kahului Airport.

Instrument Approach Procedures. There are two basic types of instrument approach procedures -- precision and nonprecision. So-called "precision" instrument approach procedures provide electronic vertical as well as horizontal, or "lateral" guidance. Whereas, "nonprecision" instrument approach procedures provide only lateral guidance and do not provide electronic vertical guidance. Published instrument approach procedures for the Kahului Airport and their respective categories are as follows:

Procedure [a]	Runway	Category
ILS	2	Precision
Localizer/DME Back Course	20	Nonprecision
VOR/DME, TACAN or GPS	20	Nonprecision
VOR	20	Nonprecision
NDB/DME or GPS	20	Nonprecision
NDB	20	Nonprecision

[a] DME = distance measuring equipment; ILS = instrument landing system.

GPS = global positioning system;
NDB = nondirectional beacon;
TACAN = tactical air navigation;
VOR = very high frequency omnidirectional range.

Charted Visual Approach Procedure. A charted visual approach procedure has been published for Runway 2 at the Kahului Airport referred to as the, "Smoke Stack Visual Runway 2" as follows:

- Aircraft Inbound Via Lanai. Proceed to mid-Maalaea Bay via a route on or south of the Lanai VORTAC 085 radial, thence direct to the KNUI radio tower. Intercept the Runway 2 extended centerline at or prior to the sugar mill smoke stacks and proceed to the Airport.

- Aircraft Inbound Via Makena. Proceed to the KNUI radio tower, thence intercept the Runway 2 extended centerline at or prior to the sugar mill smoke stacks and proceed to the Airport.

The weather minimums for the Smoke Stack Vis. Approach procedure are a cloud ceiling of 3,000 feet and visibility of a least 3 miles.

The Smoke Stack Visual Approach brings the arriving aircraft over the former Puunene Airport site. The Smoke Stack Visual Approach is located to the east of the straight-in approach to Runway 2 to reduce the effects of turbulence on approach, which often occurs because of the wind patterns over the West Maui Mountains. Turbulence is usually stronger nearer the mountains. Therefore, the straight-in approach is often subject to greater turbulence.

Terminal Routes. Standard Terminal Arrival Routes (STARs) and Standard Instrument Departure (SID) procedures have been established for the Kahului Airport. STARs and SIDs consist of coded flight procedures designed to reduce pilot/controller workload and verbiage on ATC radio frequencies. STARs and SIDs for the Maui Region are listed in Table 4-2.

According to procedures spelled out in a Letter of Agreement between Maui Tower and the Honolulu CERAP, when Maui Tower's BRITE is operational, the Tower is authorized to release aircraft departures in accordance with instructions summarized in Table 4-3.

Aircraft on instrument departure procedures must comply with the assigned SID or radar "vectors" (headings) assigned by ATC, or as follows:

- Runways 2 and 5. Aircraft departing on V6-22 to the northwest or V11, R576,or R577, are to climb to 1,000 feet via the Maui VORTAC 030 radial, then climb on course. Aircraft on all other routes are to climb north via Maui VORTAC 010 radial, then make a climbing left turn direct to the Maui VORTAC to cross the VORTAC at or above 5,500 feet.

  Commercial aircraft departing Runway 2 may be subject to weight restrictions imposed by Federal Aviation Regulations Part 121 if there is a tall ship in the departure area north of the airport. The Part 121 regulations specify the clearance requirements for objects in the event of a one-engine-out condition on departure.

- Runways 20 and 23. Climb on heading of 215° to 500 feet, then make a climbing left turn direct to the Maui VORTAC, thence aircraft departing on V6-22, V11, R576, or V577, climb on course. All other routes, climb north via Maui VORTAC 0101 radial, then make a climbing left turn direct to Maui VORTAC and cross the VORTAC at or above 5,500 feet.

Informal Runway Use Program. To help mitigate aircraft noise concerns, an informal runway use program has been developed for the

TABLE 4-2
STANDARD INSTRUMENT ARRIVAL AND DEPARTURE ROUTES FOR KAHULUI AIRPORT

Procedure	Description
Camps One Arrival	Lanai Transition – From over Lanai VORTAC via Lanai radial 095 to Camps intersection, thence via the Kahului Runway 2 localizer course to the Airport. Maken Transition – From over Maken intersection via Upolu Point VORTAC radial 294 and Lanai VORTAC radial 095 to Camps intersection, thence via the Kahului Runway 2 localizer course to the Airport.
Beach One Departure	Runways 2, 5, and 20 – Maintain flight in visual conditions until intercepting Maui VORTAC 190 radial to Beach intersection. Runway 20 – Turn left, climb southbound via Maui VORTAC 190 radial to Beach intersection. Harpo Transition – Cross beach intersection at or above 5,500 feet, turn left, continue climb southbound. Lanai Transition – Cross Beach intersection at or above 3,000 feet (requires 200 feet per nautical mile (NM) climb rate) turn right, continue climb to 5,000 feet or above via Lanai radial 090 to Lanai VORTAC.
Maui Four Departure	Runways 2 and 5 – After takeoff, all aircraft fly heading 360°, expect radar vectors west of Maui Island to assigned fix/route. Cross the Lanai VORTAC 322 radial at assigned altitude. When assigned above 14,000 feet, cross Lanai 322 radial at or above 14,000 feet.
Opana One Departure	Runway 2 – Climb northeastbound via Maui VORTAC 030 radial until reaching at least 2,000 feet, turn right to heading 100° to intercept Victor Airway V11 at or above 4,400 feet. Runways 5 and 20 – Turn left, thence climb northeastbound via Maui VORTAC 030 radial until reaching at least 2,000 feet, turn right to heading 100° to intercept Victor Airway V11 at or above 4,400 feet. Runway 23 – Maintain flight in visual conditions until intercepting the Maui VORTAC 030 radial, thence climb northeastbound via Maui VORTAC 030 radial until reaching at least 2,000 feet, turn right to heading 100° to intercept Victor Airway V11 at or above 4,400 feet. Sweep Transition – Continue climb via Victor Airway V11.

TABLE 4-3
DEPARTURE HEADINGS AT KAHULUI AIRPORT

Type Operation [a]	Direction	Departure Instruction
	Runways 2 and 5	
IFR	Northwest	Heading 360°
VFR	Northwest	Heading 320°, maintain 2,000 feet
IFR	Northeast	Interisland aircraft -- Opana SID All other aircraft -- heading 020°
VFR	Northeast	Remain offshore, maintain 1,500 feet
VFR	South	Heading 165°, maintain 1,000 feet
IFR	South	Heading 020°
	Runways 20 and 23	
IFR	South	Beach SID
VFR	South	Heading 165°, maintain 1,000 feet
VFR	Northwest	Follow shoreline, maintain 1,000 feet
VFR	Northeast	Pilot's own navigation, maintain 1,500 feet
IFR	North	Opana SID Sweep Transition, Tower to contact Sector 10 for release

[a] IFR = instrument flight rules; VFR = visual flight rules

Airport. The program specifies preferential noise abatement runways and routes and recommended altitudes for arriving and departing aircraft to avoid overflights of populated areas to the extent possible.

To avoid the Spreckelsville Beach area located adjacent to Kahului Airport, Runway 2 has been designated the preferred noise abatement departure runway for large and turbine powered aircraft. Noise abatement departure procedures are as follows:

- Runway 2. Climb straight ahead until one mile clear of shoreline before commencing turn.
- Runway 5. If east- or westbound, turn left as soon as possible and proceed one mile clear of shoreline; is southbound, turn right as soon as possible if traffic permits, otherwise turn left.

Aircraft remaining in right traffic pattern for Runway 2, or left traffic pattern for Runway 20, are requested to cross the shoreline on downwind leg over the east end of the golf course to avoid flight over residential areas. Aircraft weighing more than 12,500 pounds inbound from the south, or flying over land from the northwest desiring Runway 5, must overfly the Airport and enter a left traffic pattern for Runway 5.

Helicopter Operations. Area E near the approach end of Runway 2 has been designated as a helicopter operations area. No fixed wing operations may operate on the helipad during operational hours between sunrise and sunset. Prior permission is required for fixed wing aircraft operations on the helipad during non-operational hours. Access to the helipad is from Taxiway C only. Military helicopter operations are restricted to the HAZMAT (hazardous materials) area north of Runway 5-23. The established traffic pattern altitude for helicopters is 500 feet above mean sea level (MSL).

SUMMARY OF EXISTING CONSTRAINTS AND OPPORTUNITIES

The existing constraints and opportunities for locating a new airport and/or heliport facility on Maui are summarized below. This summary of existing conditions includes the environmental constraints described in Section 3 as well as the aviation considerations discussed in Section 4.

Constraints

The primary constraints which limit the location of a new airport or heliport are threatened and endangered species and sensitive wildlife habitat areas, proximity to urban land uses, airspace constraints, and topography (Figure 4-5).

Threatened and Endangered Species and Wildlife Habitat Areas. Sensitive wildlife habitat areas in the primary study area include Kealia Pond adjacent to Maalaea Bay and Kanaha Pond adjacent to Kahului Bay. Other areas in which threatened or endangered species have been observed are shown on Figure 3-4. Many of these areas are located at reservoirs used for the irrigation of sugar cane fields.

Proximity to Urban Development. Much of the primary study area is developed or planned for urban land uses. Such areas should not be impacted by extensive aircraft overflights or noise from aircraft operations at a new airport site. Urban areas include the Wailuku-Kahului area, Kihei, Pukalani and Paia (Figure 4-5).

Runway 2 Approach Corridor. Figure 4-5 shows the corridor in which visual, nonprecision instrument and precision instrument approaches are made from the south to Runway 2 at Kahului Airport. Records of flight tracks recorded by the FAA Air Traffic Control Tower at Kahului Airport verify that approaches by turbojet passenger aircraft to Runway 2 are concentrated within the corridor shown on

Figure 4-5. Approach profile data collected at the Kahului Air Traffic Control Tower indicate that passenger jet aircraft are primarily at an altitude of 1,700 to 2,400 feet above ground level (AGL) as they pass the southern end of the state-owned property (shown on Figure 4-5) and at 900 to 1,400 feet AGL as they pass the northern end of the state-owned property. Currently, portions of the old Puunene Airport pavement are used for helicopter training and very limited fixed-wing aircraft activity (aerial spraying).

Topography. Steep terrain of the west Maui Mountains to the west and Haleakala Crater to the east border the study area. Therefore, areas suitable for locating a fixed-wing general aviation airport are generally limited to the study area shown in Figures 3-2 and 4-5. As discussed in Section 8, potential airport sites located along the coastal area on the west side of Maui were also investigated.

Opportunities

In spite of the constraints described above, opportunities exist for the potential location of a new airport and/or heliport on Maui.

State-Owned Land at Former Puunene Airport. The State of Hawaii owns 1,875 acres of property that encompassed portion of the former Puunene Airport. Although most of the original airport facilities no longer exist, the site is relatively flat and adjacent to Mokulele Highway (Figure 4-5). Much of the land is leased to Alexander & Baldwin, Inc. for sugar cane production. Because aircraft approaching [illegible]way 2 at Kahului Airport overfly the [illegible]ern portion of the site, its potential use as a fixed-wing airport would depend upon the outcome of site specific airspace reviews by the FAA.

Since the property is currently owned by the State of Hawaii and could accommodate most of the land area needed for a new general aviation airport, the site represents a significant opportunity.

Other Relatively Level Areas in the Central Valley. Relatively level areas in the Central Valley which would be suitable for the development of a new general aviation airport/heliport are shown in Figure 4-5. Although some individual site constraints exist within this area, potential site locations within this area avoid the primary constraints of urban areas, approaches to Kahului Airport and topography.

Other Potential Airport/Heliport Areas. Additional areas for the potential location of a new airport and/or heliport exist along the west Maui coast between the coastal development and the steeper slopes of the west Maui Mountains. The area between Lahaina and Kapalua has been studied for potential fixed-wing airport and/or heliport sites.

Section 5
AVIATION DEMAND FORECASTS

SECTION 5
AVIATION DEMAND FORECASTS

INTRODUCTION

In this section, demand forecast refinements are described for general aviation, tour helicopter and cargo activity. Projections are included for Kahului Airport, Kapalua-West Maui Airport and Hana Airport. Forecasts were prepared for annual aircraft operations, based aircraft, mix of operations by type of aircraft, average daily operations, and vehicle trips.

These forecasts were used to estimate the level of activity at a new airport/helicopter site as well as the activity remaining at Kahului Airport if a new airport site were developed. Therefore, this discussion of aviation demand forecasts focusses on activity presently at Kahului Airport, particularly activity such as general aviation, tour helicopters and cargo flights which could potentially be relocated to a new site.

Projections of activity at new airport/heliport sites were used to develop facility requirements for the site and to estimate impacts such as costs, vehicle traffic and aircraft noise.

Baseline projections for the Maui General Aviation Study were developed by the State of Hawaii (Draft Update Hawaii Aviation Demand Forecasts, prepared for the State of Hawaii, Department of Transportation, Airports Division, June 1994). These 1994 State forecasts contain projections of total activity (passengers, air cargo, aircraft operations, and based aircraft) for all Hawaii Airports. As described below, certain elements of these forecasts were refined to provide the detailed projections necessary for this Maui General Aviation Study.

BASELINE FORECASTS FOR MAUI AIRPORTS

The 1994 State forecast developed for the Maui airports is presented in Table 5-1. Activity at all three airports is expected to experience continued growth over the next two decades. Aircraft operations at Kahului Airport are expected to increase from 179,227 in 1994 to 274,800 in 2015. By 2015, it is estimated that 45 percent of operations will be flown by commuter/air taxi aircraft, mostly tour helicopters. The number of aircraft based at Kahului Airport is expected to increase from 84 to 111 by the year 2015. In the same year, there are projected to be 26,700 operations at the Kapalua-West Maui Airport and 10,700 operations at Hana Airport.

GENERAL AVIATION FORECAST REFINEMENTS

Forecast refinements were developed for general aviation operations and general aviation based aircraft.

General Aviation Operations

The general aviation operations forecast developed by the State was divided into the following elements: fixed-wing piston, fixed-wing turbine and non-tour operator helicopters.

Fixed-wing turbine operations totaled approximately 2,300 in 1993, based on estimates by P&D Aviation developed from information supplied by the FAA Air Traffic Control Tower. The turbine-powered general aviation operations are projected to increase at an annual rate of 4 percent, which is the nationwide growth rate projected by the Federal Aviation Administration (FAA Aviation Forecasts, Fiscal Years 1994 to 2005, March

TABLE 5-1
AVIATION DEMAND FORECASTS FOR MAUI AIRPORTS, 1993 TO 2015

Activity	Actual [a]		Forecast [b]			
	1993	1994	2000	2005	2010	2015
Kahului Airport						
Passengers (Millions) [c]	5.36	[e]	6.30	7.14	7.99	8.85
Cargo and Mail [c]						
Cargo (Thousand Tons)	35.3	[e]	42.0	47.2	51.6	57.0
Mail (Thousand Tons)	4.8	[e]	5.0	5.8	6.4	7.0
Total	40.1	[e]	47.0	53.0	58.0	64.0
Aircraft Operations (Thousands)						
Air Carrier	54.3	56.4	66.9	73.9	80.7	86.7
Commuter/Air Taxi	89.6	85.4	90.0	101.2	112.3	123.4
General Aviation	37.1	33.3	41.0	45.0	49.0	53.0
Military	6.3	4.2	12.0	11.7	11.7	11.7
Total	187.3	179.2	209.9	231.8	253.7	274.8
Based Aircraft [d]	86	[e]	93	99	105	111
Kapalua-West Maui Airport						
Passengers (Thousands) [c]	307.4	[e]	425.0	454.0	478.0	505.0
Cargo and Mail (Thousand Tons) [c]	0.7	[e]	1.0	1.1	1.2	1.3
Aircraft Operations (Thousands)						
Commuter/Air Taxi	[e]	[e]	31.3	29.6	27.9	26.7
Total	[e]	[e]	31.3	29.6	27.9	26.7
Based Aircraft	0	0	0	0	0	0
Hana Airport						
Passengers (Thousands) [c]	17.8	[e]	22.0	25.0	28.0	30.0
Aircraft Operations (Thousands)						
Commuter/Air Taxi	[e]	[e]	7.2	8.2	9.2	9.9
General Aviation	[e]	[e]	0.7	0.7	0.7	0.8
Total	[e]	[e]	7.9	8.9	9.9	10.7
Based Aircraft	0	0	1	1	1	2

[a] Source: State of Hawaii, Department of Transportation, Airports Division.
[b] Source: State of Hawaii, Department of Transportation, Airports Division, Update Hawaii Aviation Demand Forecasts, June 1994, "Low Passenger Forecasts."
[c] Enplaned and deplaned.
[d] The based aircraft count was taken in July 1994. The actual number of based aircraft at Kahului Airport in 1994 was understated by 11 in the source study (see footnote [b]). Therefore, based aircraft forecasts from 2000 to 2015 were increased by 11 over the numbers given in the source document.
[e] Data not available.

1994). Turbine-powered general aviation aircraft typically flying at Kahului Airport include turboprop aircraft such as the Cessna 441 and turbojet aircraft such as Gulfstreams, Falcons and Cessna Citations. This projected annual growth rate would result in 5,500 fixed-wing turbine-powered general aviation operations in 2015 (Table 5-2).

Helicopters based at Kahului Airport are used for many non-tour activities including utility inspections, construction, law enforcement, medical transport and narcotics enforcement. Operations by non-tour helicopters activities were estimated to be 4,000 in 1993. It is estimated that this activity will increase in proportion to the total general aviation operations projected in the 1994 State forecast. The resulting non-tour helicopter operations forecast in 2015 is 5,700 operations (Table 5-2).

The fixed-wing piston operations allocation was obtained by deducting the fixed-wing turbine and general aviation helicopter operations from the 1994 State forecast of general aviation operations. Accordingly, the fixed-wing piston operations are projected to increase from 30,800 in 1993 to 41,800 in 2015 (Table 5-2).

Based General Aviation Aircraft

Based general aviation aircraft consist of fixed-wing aircraft used in general aviation and helicopters used for non-tour purposes. Based general aviation aircraft exclude commuter/air taxi aircraft and tour helicopters (which are included in the commuter/air taxi category). Projections of general aviation based aircraft were developed by subtracting projections of tour helicopters from the total based aircraft forecast in the 1994 State forecast. The 1994 State forecast of based aircraft includes general aviation aircraft and tour helicopters. Commuter/air taxi aircraft, such as aircraft operated by Air Molokai, are not included in the 1994 State counts of based aircraft.

Projections of tour helicopters based at Kahului Airport are described in the next subsection. The growth of tour helicopters is expected to account for nearly half of the growth in based aircraft at the airport over the next twenty years (Table 5-2).

Non-tour helicopters are projected to increase from 9 to 11 by the year 2015. Fixed-wing piston aircraft are expected to increase from 50 in 1993 to 61 in 2015. On the basis of the current trend in growth in the number of multi-engine aircraft, multi-engine piston aircraft are projected to increase from 9 in 1993 to 14 in 2015. Over the same period, single engine fixed-wing piston aircraft are expected to increase from 41 in 1993 to 47 in 2015. There are projected to be no fixed-wing turbine powered aircraft based at the airport.

HELICOPTER TOUR ACTIVITY PROJECTIONS

Refinements to the projections of commuter/air taxi operations and based aircraft developed by the State were made in the Maui General Aviation Study to identify activity projections related to helicopter tour activity. These refinements were developed to be consistent with the 1994 State forecasts and also consistent with forecasts of visitors to Maui and existing tour helicopter activity.

Helicopter Tour Passengers

The first step in projecting the number of helicopter tour passengers was to project the total number of visitors to the island of Maui. Maui visitors were projected by applying the visitor growth rates for the State of Hawaii used in the 1994 State Forecasts. The resulting visitor growth projections are greater than projections by the U.S. Department of Commerce, Bureau of Economic Analysis, lower than the Maui County unconstrained projections and nearly equal to the Maui County constrained forecast (Table 5-3). The Maui

TABLE 5-2
FORECAST REFINEMENTS FOR KAHULUI AIRPORT,
1993 TO 2015

Activity	Actual 1993 [a]	Forecast [b] 2000	2005	2010	2015
Annual Aircraft Operations (Thousands)					
Air Carrier					
Passenger	51.3	63.4	69.9	76.1	81.9
Cargo	3.0	3.5	4.0	4.4	4.8
Total	54.3	66.9	73.9	80.7	86.7
Commuter/Air Taxi					
Fixed-Wing Passenger	19.6	18.2	19.9	21.5	23.0
Fixed-Wing Cargo	1.0	1.0	1.0	1.0	1.0
Tour Helicopters [c]	69.0	70.8	80.3	89.8	99.4
Total	89.6	90.0	101.2	112.3	123.4
General Aviation					
Fixed Wing Piston	30.8	33.2	36.1	38.9	41.8
Fixed Wing Turbine [d]	2.3	3.3	4.0	4.8	5.5
Helicopter [e]	4.0	4.5	4.9	5.3	5.7
Total	37.1	41.0	45.0	49.0	53.0
Military	6.3	12.0	11.7	11.7	11.7
Total Operations	187.3	219.9	231.8	253.7	274.8
Based Aircraft [f]					
Fixed-Wing Aircraft					
Piston					
Single Engine	41	45	47	47	47
Multi Engine	9	10	11	12	14
Subtotal Piston	50	55	58	59	61
Turbine-Powered	0	0	0	0	0
Helicopters					
Tour Operators	27	28	31	35	39
Other	9	10	10	11	11
Total	36	38	41	46	50
Total Based Aircraft	86	93	99	105	111

[a] Source: State of Hawaii, Department of Transportation, Airports Division. Breakdowns for air carrier, commuter/air taxi, and general aviation operations were estimated by P&D Aviation.
[b] Source: State of Hawaii, Department of Transportation, Airports Division, Update Hawaii Aviation Demand Forecasts, June 1994, "Low Passenger Forecasts."
[c] Helicopters used in tours and other passenger transport.
[d] Turboprop and turbojet aircraft.
[e] Helicopters in services other than passenger transport.
[f] "Actual" based aircraft data are for 1994.

TABLE 5-3
PROJECTIONS OF VISITORS TO ISLAND OF MAUI, 1990 TO 2020

Source of Projection	Visitor Arrivals (Millions)					
	Estimated [a]		Projected (Average Annual Growth Rates in Parentheses)			
	1990	1993	2000	2005	2010	2020
Bureau of Economic Analysis [b]	-	-	1.75	2.13 (4.0)	2.58 (3.9)	3.47 (3.0)
Maui County Community Plan Update Program [c] Unconstrained	2.32	2.21	2.99 (4.4)	3.31 (2.1)	3.77 (2.6)	4.28 (1.3)
Constrained	2.32	2.21	2.99 (4.4)	3.31 (2.1)	3.77 (2.6)	3.98 (0.5)
Based on Hawaii Visitor Growth Rates by Area [d]	–	–	2.54 (2.0)	2.86 (2.4)	3.22 (2.4)	3.92 (2.0)

[a] Source: Maui Visitors Bureau

[b] Source: Honolulu Planning Department adaptation of figures from the U.S. Department of Commerce, Bureau of Economic Analysis, 1994 (draft). Visitors to Maui County.

[c] Source of projections: Community Resources Inc., Maui County Community Plan Update Program Socio-economic Forecast Report, Final, January 1994. Prepared for Maui County Planning Department. Constrained projections are based on limitations on new hotel development.

[d] Projections are based on the following average annual percentage increases, which were used to project visitors to the State of Hawaii in Update Hawaii Aviation Demand Forecasts, June 1994:

1993 to 2000 2.0%
2000 to 2010 2.4%
2010 to 2020 2.0%

Island visitor projections used for the Maui General Aviation Study indicate that visitors will increase from 2.21 million in 1993 to 3.57 million in 2015.

Annual Helicopter Tour Operations

In 1994 there were approximately 190,000 enplaned helicopter tour passengers and an estimated 69,000 tour helicopter takeoffs and landings (Table 5-4). The 27 tour helicopters based on Maui average approximately 3.5 flights per day. The number of estimated tour helicopter takeoffs and landings for 1994 was estimated from a survey of helicopter and other operations taken by the FAA air traffic control tower in July and August, 1994. The estimated number of helicopter tour passengers for 1994 was developed from surveying tour operators and from the relationships of load factors, average seats per helicopters, and tour helicopter departures.

The estimated 190,000 helicopter tour passengers in 1994 represent 8.5 percent of the estimated total island visitors. It is projected that 7.9 percent of the island visitors (the average for 1993 and 1994) to the year 2015 will continue to take helicopter tours. According to this methodology, there will be 280,000 helicopter tour passengers in 2015. On the condition that the average load factor for helicopter tours remains at approximately 95 percent and the average passenger seats per helicopter will increase to 5.9, the number of helicopter tour operations will increase from 69,000 in 1994 to 99,400 in 2015 (Table 5-4). The number of projected tour helicopter operations was computed to be consistent with the projections of commuter/air taxi operations in Update Hawaii Aviation Demand Forecasts, June 1994.

In recent years, the number of commuter passenger flights at Kahului Airport have been decreasing. In 1990 there were an estimated 21,000 commuter passenger operations. This number declined to an estimated 19,600 in 1993. The decrease has primarily been the result of reduction in numbers of flights to Hana, Kamuela, Kapalua, Lanai City, and Molokai. The number of commuter passenger operations is projected to increase slowly to 23,000 in the year 2015 (Table 5-2).

Based Tour Helicopters

It is expected that the tour helicopter utilization will remain at 3.5 average flights per day per helicopter. On this basis, the number of tour helicopters based on Maui will increase from 27 in 1994 to 39 in 2015 (Tables 5-2 and 5-4).

The tour helicopter refinements described above are consistent with the overall forecast totals in the 1994 State forecast and are considered to be reasonable in light of current helicopter tour activity and projections of visitors to the island of Maui.

CARGO OPERATIONS PROJECTS

All-cargo flights at Kahului Airport are flown by Aloha Airlines using B737-200 and B737-300 freighters as well as smaller operators such as Federal Express using turboprop aircraft such as the Cessna 208B, Cessna 402B and Shorts SD330. Air carrier all-cargo operations are estimated to be proportional to the growth forecast for air freight and mail projected by the State for Kahului Airport. Cargo operations by air carrier aircraft, under this approach will increase from approximately 3,000 in 1993 to 4,800 in the year 2015 (Table 5-2).

It is estimated that commuter all-cargo operations were 1,000 in 1993. Federal Express is planning to reduce its commuter cargo activity with the introduction of air carrier cargo service within three years. Moreover, it is expected that some commuter cargo will be handled by larger commuter freighters in the future. Therefore, the number of all-cargo commuter operations is projected to remain at

TABLE 5-4
PROJECTIONS OF HELICOPTER TOUR ACTIVITY ON ISLAND OF MAUI, 1993 TO 2015 [a]

Item	Actual 1993	Estimated 1994	Projected 2000	Projected 2005	Projected 2010	Projected 2015
Maui Island Visitors (Millions) [b]	2.21	2.21	2.54	2.86	3.22	3.57
Percentage of Visitors Taking Helicopter Tour (Percent)	7.3	8.5	7.9	7.9	7.9	7.9
Helicopter Tour Passengers -- Enplaned (Thousands)	160	190	200	220	250	280
Average Load Factor for Helicopter Tour Passengers (Percent)	95	95	95	95	95	95
Average Passenger Seats per Helicopter	5.7	5.7	5.9	5.9	5.9	5.9
Helicopter Tour Operations-- Takeoffs and Landings (Thousands) [c]	69.0	69.0	70.8	80.3	89.8	99.4
Tour Helicopter Utilization (Average Flights per Day per Helicopter)	[d]	3.5	3.5	3.5	3.5	3.5
Tour Helicopters Based on Maui	[d]	27	28	31	35	39

[a] Source: P&D Aviation analysis.

[b] Projections are based on the following average annual percentage increases, which were used to project visitors to the State of Hawaii in Update Hawaii Aviation Demand Forecasts, June 1994:

1993 to 2000	2.0%
2000 to 2010	2.4%
2010 to 2020	2.0%

[c] The figure for 1993 was derived by subtracting fixed-wing scheduled and other commuter air taxi operations from total commuter/air taxi operations reported by the FAA air traffic control tower. The figure for 1994 was estimated from a survey of helicopter and other operations by the FAA air traffic control tower for July and August, 1994. The projected data were developed by subtracting projected fixed-wing commuter/air taxi operations (estimated 16,000 fixed-wing commuter/air taxi operations from 2000 to 2020) from total commuter/air taxi operations projected in Update Hawaii Aviation Demand Forecasts, June 1994.

[d] Data not available.

1,000 per year to the year 2015 (Table 5-2).

DEMAND FORECASTS FOR NEW AIRPORT/HELIPORT ALTERNATIVES

Annual Operations for New Site Alternatives

Aircraft operations forecasts were developed for each new airport/heliport alternative on the bases of the projections described above for cargo, helicopter, and fixed-wing general aviation activity (Table 5-5). New airport/heliport site alternatives are described in Section 8. For Alternatives 2 through 8, the addition of operations at the new site is estimated to result in the reduction of an equal number of operations at Kahului Airport (Table 5-6). Therefore, the number of operations estimated for a new site alternative and Kahului Airport combined in 2015, under Alternatives 2 through 8, equals the number of aircraft operations projected by the State for Kahului Airport in the year 2015 with no new airports (274,800 operations). Under this condition, activity at the new sites for Alternatives 2 through 8 is considered to be shifted from Kahului Airport, and no additional activity would be generated at the new site beyond what has been projected in the 1994 State forecast for Kahului Airport alone.

The following operations are estimated to be shifted from Kahului Airport to the new site under each alternative:

- Alternative 1B. New Limited Service Heliport(s) -- a portion of tour helicopter operations.
- Alternative 2. New Heliport-Puunene South -- All helicopter operations.
- Alternative 3. New Heliport-Puunene East -- all helicopter operations.
- Alternative 4. New Utility Airport/Heliport-Puunene -- all helicopter operations and all fixed-wing piston general aviation operations.
- Alternative 4A. New Utility Airport-Puunene -- all fixed-wing piston general aviation operations.
- Alternative 5. New Utility Airport/Heliport - North of Kihei -- all helicopter operations and all fixed-wing piston general aviation operations.
- Alternative 6. New Utility Airport/Heliport - East of Kahului -- all helicopter operations and all fixed-wing piston general aviation operations.
- Alternative 7. New Utility Airport and New Heliport -- Puunene
  - Airport -- all fixed-wing piston general aviation operations.
  - Heliport -- all helicopter operations.
- Alternative 8. New Transport Airport/Heliport - Puunene -- All helicopter operations, all air cargo operations, all fixed-wing piston general aviation operations, all turboprop fixed-wing general aviation operations, and all interisland turbojet general aviation operations (estimated to be 4% of total turbojet general aviation operations).

Alternative 1B, a new limited service heliport, is the only alternative in which the total operations at Kahului Airport and the new site would be greater than at Kahului Airport alone. Under this alternative, a limited service heliport would be developed on the west side of Maui to serve the visitors in that area. The new heliport would be used for boarding and deplaning of tour helicopter customers but would not be used to base aircraft overnight. It is assumed that the remote heliport would have fuel storage. Although refueling flights would not have to be made to the remote heliport, ferry flights would

TABLE 5-5
AIRCRAFT OPERATIONS FORECAST FOR NEW AIRPORT/ HELIPORT ALTERNATIVES, 2015 [a]

Alternative	Aircraft Operations at New Airport/Heliport in Year 2015 (Thousands)						
	Total	Cargo		Helicopter		Fixed-Wing General Aviation	
		Air Carrier	Commuter	Tour	Other	Piston	Turbine
1B. New Limited Service Heliport(s)	77.0	0	0	77.0	0	0	0
2. New Heliport-Puunene South	105.1	0	0	99.4	5.7	0	0
3. New Heliport-Puunene East	105.1	0	0	99.4	5.7	0	0
4. New Utility Airport/ Heliport-Puunene	146.9	0	0	99.4	5.7	41.8	0
4A. New Utility Airport - Puunene	41.8	0	0	0	0	41.8	0
5. New Utility Airport/ Heliport-North of Kihei	146.9	0	0	99.4	5.7	41.8	0
6. New Utility Airport/ Heliport-East of Kahului	146.9	0	0	99.4	5.7	41.8	0
7. New Utility Airport and New Heliport-Puunene							
Airport	41.8	0	0	0	0	41.8	0
Heliport	105.1	0	0	99.4	5.7	0	0
8. New Transport Airport/Heliport-Puunene	154.0	4.8	1.0	99.4	5.7	41.8	1.3

[a] Source: P&D Aviation

TABLE 5-6
FORECAST OF AIRCRAFT OPERATIONS AT KAHULUI AIRPORT FOR GENERAL AVIATION ALTERNATIVES, 2015 [a]

Alternative	Aircraft Operations at Kahului Airport in Year 2015 (Thousands)				
	Total	Air Carrier	Commuter/ Air Taxi	General Aviation	Military
1. No New Airport [b]	274.8	86.7	123.4	53.0	11.7
1A. Relocation of Kahului Helicopter Facilities East	274.8	86.7	123.4	53.0	11.7
1B. New Limited Service Heliport(s)	208.4	86.7	57.0	53.0	11.7
2. New Heliport-Puunene South	169.7	86.7	24.0	47.3	11.7
3. New Heliport-Puunene East	169.7	86.7	24.0	47.3	11.7
4. New Utility Airport/ Heliport-Puunene	127.9	86.7	24.0	5.5	11.7
4A. New Utility Airport-Puunene	233.0	86.7	123.4	11.2	11.7
5. New Utility Airport/ Heliport-North of Kihei	127.9	86.7	24.0	5.5	11.7
6. New Utility Airport/ Heliport-East of Kahului	127.9	86.7	24.0	5.5	11.7
7. New Utility Airport and New Heliport-Puunene	127.9	86.7	24.0	5.5	11.7
8. New Transport Airport/ Heliport-Puunene	120.8	81.9	23.0	4.2	11.7

[a] Source: P&D Aviation, except as noted.

[b] Source: State of Hawaii, Department of Transportation, Airports Division, Update Hawaii Aviation Demand Forecasts, June 1994, "Low Passenger Forecasts."

be necessary to bring helicopters to the new facility in the morning and return them to Kahului Airport in the evening.

Helicopter tour operators estimate that 60 to 75 percent of their customers originate from the westside of the island. These percentages assume that cruise ships will dock at Kahului. If cruise ships were docked at Lahaina, there could be an estimated five percent more from the west side. It is estimated for purposes of this analysis that 60 percent of the tour helicopter customers would board at a new limited service heliport on the west side if one were available, assuming some tour operators used only Kahului Airport and some westside customers would have other reasons for preferring to board at Kahului Airport.

Based on these conditions, tour helicopter operations at a new limited service heliport ·ıld total 77,000 in the year 2015. In ...ion, there would be 57,000 tour helicopter operations at Kahului Airport under Alternative 1B.

Aircraft Operations Mix for New Site Alternatives

In Table 5-7, estimates of aircraft operations mix for Kahului Airport activities that could potentially relocate to a new site are given for 1993 and 2015. Estimates of fixed-wing general aviation aircraft mix for 1993 were developed by P&D Aviation from data supplied by general aviation operators and the FAA air traffic control tower. The projected growth in the percentage of multi-engine piston and turbine powered aircraft operations was projected on the basis of nationwide forecasts by the FAA (FAA Aviation Forecasts, Fiscal Years 1994 to 2005, March 1994). The residual percentage was assigned to single-engine fixed-wing aircraft.

Presently, 72 percent of the fixed-wing piston general aviation aircraft operations are local (touch-and-go and other training flights within the local area). It is expected that the percentage of local operations will remain at 72 percent to the year 2015.

Currently, 85 percent of tour helicopter operations are by 6-passenger turbine powered helicopters. The remaining are by 4-passenger helicopters. By 2015, it is estimated that 95 percent of tour helicopter operations will be by 6-passenger turbine powered helicopters, due to the increased efficiency of the larger craft.

Non-tour helicopter operations are flown by a variety of turbine-powered and reciprocating engine helicopters. It is estimated that the mix of turbine powered non-tour helicopter operations will increase from an estimated 90 percent in 1993 to 95 percent in 2015. Over the same time period, reciprocating engine non-tour helicopter operations are projected to decrease from 10 percent to 5 percent.

Air carrier cargo jets presently in use at Kahului Airport are the B737-200 and B737-300. By the year 2015, some larger turbo-jet freighters could be in service at Kahului Airport. Federal Express is considering the initiation of service at Kahului Airport with the B727 freighter within three years. It is estimated that all turbo-jet freighters flown in 2015 will be Stage 3 aircraft.

Commuter/air taxi freighter operations are currently flown primarily by the Cessna 208B, Cessna 402B and Shorts SD330. It is estimated that in 2015 commuter/air taxi cargo will continue to be handled by turbo-prop aircraft similar to these. It is expected that the trend will be towards larger turbo-prop aircraft such as the Shorts SD330.

Average Daily Operations for New Site Alternatives

Table 5-8 contains estimates of average daily aircraft operations for each new site alternative. Daily operations are given for the daytime

TABLE 5-7
OPERATIONS MIX FORECAST FOR KAHULUI AIRPORT ACTIVITIES THAT COULD RELOCATE TO A NEW SITE, 1993 TO 2015 [a]

Type of Operations	Percent of Aircraft Operations	
	Estimated 1993	Forecast 2015
Fixed-Wing General Aviation		
Piston		
Single Engine	82.5	74.9
Multi Engine	10.5	13.5
Turboprop	1.4	2.3
Turbojet	5.6	9.3
Total	100.0	100.0
Tour Helicopters		
6-Passenger Turbine Powered [b]	85	95
4-Passenger Turbine Powered [c]	15	5
Total	100	100
Other Helicopters		
Turbine Powered-Under 5,000 Pounds MTW [d]	90	95
Reciprocating-Under 3,000 Pounds MTW [e]	10	5
Total	100	100
Air Carrier Cargo - Turbojet [f]	100	100
Commuter/Air Taxi Cargo - Turboprop [g]	100	100

[a] Source: P&D Aviation.
[b] Six-passenger turbine helicopters currently in use at Kahului Airport are the Eurocopter AS350 (AStar) - 74 percent of tour helicopter operations, and the Bell 206B (JetRanger) - 11 percent of tour helicopter operations.
[c] Four-passenger turbine helicopters currently in use at Kahului Airport are the McDonnell-Douglas 500 and 520N.
[d] Turbine-powered helicopters currently used at Kahului Airport for non-tour activity include the McDonnell-Douglas 500 and Bell 204. MTW = Maximum Takeoff Weight.
[e] Reciprocating engine helicopters currently used at Kahului Airport for non-tour activity include the Hughes 269C.
[f] Air carrier cargo jets presently in use at Kahului Airport are the B737-200 and B737-300. It is estimated that all aircraft flown in 2015 will be Stage III.
[g] Commuter/air taxi cargo aircraft presently in use at Kahului Airport include the Cessna 208B, Cessna 402B and Shorts SD330.

TABLE 5-8
AVERAGE DAILY AIRCRAFT OPERATIONS FOR NEW AIRPORT/ HELIPORT ALTERNATIVES, 2015 [a]

Alternative	Average Daily Aircraft Operations at New Airport/Heliport in Year 2015						
	Total	Cargo		Helicopter		Fixed-Wing General Aviation	
		Air Carrier	Commuter	Tour	Other	Piston	Turbine
TOTAL DAILY OPERATIONS							
1B. New Limited Service Heliport(s)	211	0	0	211	0	0	0
2 New Heliport-Puunene South	288	0	0	272	16	0	0
3 New Heliport-Puunene East	288	0	0	272	16	0	0
4. New Utility Airport/ Heliport-Puunene	402	0	0	272	16	114	0
4A. New Utility Airport-Puunene	114	0	0	0	0	918X114	0
5 New Utility Airport/ Heliport-Above Kihei	402	0	0	272	16	114	0
6. New Utility Airport/ Heliport East of Kahului	402	0	0	272	16	114	0
7. New Utility Airport and New Heliport-Puunene Airport Heliport	 114 288	 0 0	 0 0	 0 272	 0 16	 114 0	 0 0
8 New Transport Airport/ Heliport- Puunene	422	13	3	272	16	114	4
PERCENTAGES OF OPERATIONS IN DAYTIME AND NIGHTTIME							
Daytime (7:00 a.m. - 10:00 p.m.)	-	23.2	100.0	98.4	98.4	98.7	98.7
Nighttime (10:00 p.m. - 7:00 a.m.)	-	77.0	0	1.6	1.6	1.3	1.3

[a] Source: P&D Aviation. Average daily aircraft operations are total annual operations divided by 365.

(7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) periods. The number of average daily operations by time of day will be used to estimate aircraft noise under each alternative. Estimates of operations by time of day were developed from FAA Air Traffic Control Tower records and flight schedules of cargo carriers.

Based Aircraft for New Site Alternatives

The number of aircraft projected to be based at Kahului Airport in the year 2015 (Table 5-2) was allocated to each new site alternative according to the type of service that the new airport/heliport would accommodate. The number of based aircraft allocated for new airports/heliport alternatives is shown in Table 5-9. Under Alternative 8, all general aviation and tour helicopter aircraft forecast for Kahului Airport would be based at the new site. This would include general aviation fixed-wing piston and turbine-powered aircraft as well as all helicopters used for tours and general aviation. Lesser amounts would be based at a new site under the other alternatives according to the ype of service to be provided at a new site.

VEHICLE TRIP PROJECTIONS FOR NEW AIRPORT/HELIPORT ALTERNATIVES

The numbers of average daily trips to and from the new airport/heliport sites in the year 2015 were estimated for four categories: helicopter tours, general aviation, air cargo and support services (Table 5-10). Vehicle trips for helicopter tours were estimated on the basis of parking ticket counts supplied by Republic Parking for a one month period beginning June 15, 1994. Based on this information, it is estimated that trips by customers and other related users average 1.5 one-way trips per day per enplaned helicopter passenger. Employee trips average 0.5 one-way trips per day per enplaned passenger. Thus, helicopter tour trips average 2.0 one-way trips per passenger per day.

General aviation trip estimates were developed from trip generation data developed by the institute of Transportation Engineers (Trip Generation, Fifth Edition, January 1991). In this study, general aviation airports were found to generate an average of 6.6 one-way trips per day for each based aircraft.

The number of vehicle trips related to air cargo was estimated on the bases of data supplied by Aloha Airlines. Twenty percent of the vehicle trips related to air cargo are trips by employees. The remaining 80 percent are by shippers, receivers and other customers.

Trips for support services were estimated on the basis of the size of airport/heliport and the level of support services that would be provided.

The aviation demand forecast refinements presented in this section were used to develop airport/heliport facility requirements (Section 6) and to evaluate site alternatives (Section 9).

TABLE 5-9
BASED AIRCRAFT FORECASTS FOR NEW AIRPORT/ HELIPORT ALTERNATIVES, 2015 [a]

Alternative	Based Aircraft at New Airport/Heliport in Year 2015					
		Fixed Wing				
			Piston			
	Total Aircraft	Fixed-Wing Total	Single Engine	Multi Engine	Turbine	Helicopter
1B. New Limited Service Heliport(s)	0	0	0	0	0	0
2. New Heliport-Puunene South	50	0	0	0	0	50
3. New Heliport-Puunene East	50	0	0	0	0	50
4. New Utility Airport/ Heliport-Puunene	111	61	47	14	0	50
4A. New Utility Airport- Puunene	61	61	47	14	0	0
5. New Utility Airport/ Heliport-Above Kihei	111	61	47	14	0	50
6. New Utility Airport/ Heliport-East of Kahului	111	61	47	14	0	50
7. New Utility Airport and New Heliport-Puunene Airport Heliport	 61 50	 61 0	 47 0	 14 0	 0 0	 0 50
8. New Transport Airport/ Heliport-Puunene	111	61	47	14	0	50

Source: P&D Aviation.

TABLE 5-10
VEHICLE TRIP PROJECTIONS FOR NEW AIRPORT/ HELIPORT ALTERNATIVES, 2015 [a]

Alternative	Average Daily Trips To and From New Airport/Heliport in Year 2015				
	Total	Helicopter Tours	General Aviation	Air Cargo	Support Services
1B. New Limited Service Heliport(s)	600	600	0	0	20
2. New Heliport-Puunene South	1,570	1,530	0	0	40
3. New Heliport-Puunene East	1,570	1,530	0	0	40
4. New Utility Airport/ Heliport-Puunene	2,020	1,530	450	0	40
4A. New Utility Airport-Puunene	480	0	450	0	30
5. New Utility Airport/ Heliport-North of Kihei	2,020	1,530	450	0	40
6. New Utility Airport/ Heliport-East of Kahului	2,020	1,530	450	0	40
7. New Utility Airport and New Heliport-Puunene Airport Heliport	 480 1,560	 0 1,530	 450 0	 0 0	 30 30
8. New Transport Airport/ Heliport-Puunene	2,440	1,530	450	400	60

[a] Source: P&D Aviation.

Section 6
FACILITY REQUIREMENTS

SECTION 6
FACILITY REQUIREMENTS

INTRODUCTION

Section 5 presented forecasts of aviation activity for each of the new site alternatives. This section describes the application of airport planning standards to the aviation forecasts and identifies the facilities necessary to provide sufficient capacity to handle the anticipated demand.

Facility requirements are described first for the Hana and Kapalua-West Maui Airports. Next, airport planning standards and requirements related to new airport/heliport sites are described.

REQUIREMENTS FOR EXISTING AIRPORTS

Facility requirements for the Hana and Kapalua-West Maui Airports were identified in the Hawaii Statewide Airport System Plan, Hawaii Department of Transportation, Airports Division, December 1990. No changes to the facility requirements contained in the statewide airport plan for the two airports were found to be necessary based on a recent update of the airport forecasts by the State. The following discussion of the facility requirements of Hana and Kapalua-West Maui Airports was taken from the Hawaii Statewide Airport System Plan (HSASP). Any differences between the recommendations herein and the HSASP recommendations are identified.

Hana Airport (Figure 4-2)

The physical facilities required to serve the future needs of Hana Airport are listed in Table 6-1 and described below. Existing facilities are also listed for purposes of comparison.

Land Acquisition. The HSASP recommended the acquisition of land to protect the long-term development potential of Hana Airport if a nonprecision approach procedure is established from the west or if the runway is to be extended. The additional land was recommended to allow the airport Runway Protection Zones (RPZs) to be within the airport property line. Land has been acquired since the publication of the HSASP, as indicated in Figure 4-2, for the existing RPZs. The present land area would encompass the RPZ for an angled non-precision approach to Runway 8, as well as a non-precision approach to Runway 26, with visibility minimums not lower than one mile.

Airfield. The commuter aircraft expected to serve Hana Airport in the future are the DHC-6/Cessna 402/PA31 type aircraft. These aircraft can operate on the present 3,605-foot runway without any weight restrictions. The 3,605-foot runway length could also handle the DHC-7 type aircraft.

On the basis of the low level of aviation activity forecast for the airport, a single runway can handle the forecast operations through the year 2015. It is recommended that the existing runway length of 3,605 feet be retained which satisfies the General Utility runway length criteria in FAA Advisory Circular 150/5325-4A.

The HSASP recommends that the long-range plan should provide for a full-length parallel taxiway for Runway 8-26. The taxiway should be located at least 160 feet and ideally at 240 feet, centerline to centerline, for Airplane Design Group II (i.e., wingspans of less than 79 feet such as the DHC-6). Exit/entry taxiways should be planned for at each end of the runway. A full-length parallel taxiway would require extensive earthwork at both ends

TABLE 6-1
FACILITY REQUIREMENTS FOR HANA AIRPORT,
1994-2005 [a]

	Existing 1994	Forecast 2005
Runway 8-26 (Feet)	3,605	3,605
Passenger Terminal Commuter Aircraft Parking Positions	2	3
Terminal Building (sq ft.)	2,200	3,000
Automobile Parking Spaces	20	30
Access Road (Lanes)	1	2
General Aviation Area Tiedown (Spaces)	6	6

[a] Source: State of Hawaii, Department of Transportation, Airports Division, Hawaii Statewide Airport System Plan, 1990.

of the runway.

Airspace and Air Traffic Control. Airspace and air traffic control considerations at Hana Airport, except for the terrain conditions discussed below, do not limit aviation activity capacity in relation to demand at present, nor are they expected to in the future.

The terrain conditions to the west of Hana Airport are so severe that straight-in precision instrument approach clearances cannot be met unless a localizer-type directional aid (LDA), offset approximately 30 degrees is installed. A minimum descent altitude could be established at a reasonable height depending on the exact location of the LDA antenna. Nonprecision approaches to the Airport, with circling minimums only, might be established if an on-airport navigational aid were installed, although the approach surface criterion of 34:1 could not be met for Runway 8. The terrain to the west and south would govern in determining the missed approach point, the missed approach area and the minimum descent altitude for a nonprecision approach.

Maneuvering from the missed approach point at the minimum descent altitude to a final approach to landing could be accomplished to the east for Runway 26. However, to the west, because of terrain conditions, maneuvering would require an unusually high minimum descent altitude of approximately 1,000 feet MSL. This minimum descent altitude would apply for landings in either direction and maneuvering would have to be restricted to the north of the runway.

A visual approach path indicator should be provided for Runway 26. Because of terrain to the west, a visual approach path indicator may not be practical for Runway 8. The visual approach slope would have to be steep to clear terrain and might exceed existing criteria. Additionally, an on-airport navigational aid such as an NDB, TVOR, LDA/DME should be considered for nonprecision instrument approaches to the Airport. Taxiway lights should be provided along any new taxiways.

Passenger Terminal Complex. Three aircraft parking positions will be required for commuter aircraft by the year 2005. The HSASP recommends that the commuter aircraft parking positions should be sized to accommodate DHC-6 and Cessna 402/PA31 aircraft. The existing aircraft parking apron can accommodate commuter aircraft but may require expansion depending upon the mix of aircraft.

The gross passenger terminal building area required is estimated to be 3,000 square feet through 2005. The existing passenger terminal building is 2,200 square feet in area.

The existing passenger terminal is located 400 feet from the runway centerline. The terminal building and aircraft parking apron are set back sufficient distance from the centerline of the runway to permit development of a parallel taxiway at up to 240 feet from the runway centerline and allow aircraft to be parked on the terminal apron.

Part of the airport maintenance building serves as a cargo building. Based on the low level of cargo volume handled at the Airport there is no need seen for a separate air cargo facility in the future. The commuter/air taxi aircraft handle air cargo through the passenger terminal and existing cargo building on passenger or all-cargo flights and this is expected to continue in the future.

General Aviation. The number of general aviation aircraft based at Hana Airport is forecast to increase from none in 1994 to 2 by the year 2015. At present there are 6 tiedown positions for general aviation. Based on the forecasts, these spaces should be sufficient for based and itinerant general aviation aircraft.

Airport Access and Parking. The increase in Hana Airport vehicle traffic based on the

forecast increase in passengers and other airport activity can be accommodated by a 2-lane road. The present access road should be widened to a full 2 lanes (with a paved area approximately 24 feet wide plus unpaved shoulder area) before 2005.

The existing terminal parking lot accommodates about 20 cars. In order to accommodate future demand, a requirement for up to 30 public, employee and rental car spaces is forecast by the year 2005.

Utilities and Support Systems. Existing utilities and support systems are deemed adequate to accommodate projected aviation demand.

Kapalua-West Maui Airport (Figure 4-3)

The facilities required to serve the airport are described below.

Airfield. The interisland commuter carrier aircraft expected to serve the Airport in the future are the DHC-7 and the DHC-6/Cessna 402/Piper 31 type aircraft. These aircraft can operate on the 3,000-foot runway. There are no plans to extend the runway or add a parallel taxiway because the agreement to develop the Airport prohibits further expansion of airport facilities.

The Airport has been designed to accommodate aircraft as large as FAA Aircraft Approach Category B (approach speeds of less than 121 knots) and Airplane Design Group III (wingspans of less than 118 feet) provided that such aircraft are approved by the FAA for landing on the 3,000-foot runway.

The 3,000-foot runway length satisfies the Basic Utility Stage II runway length criteria in FAA Advisory Circular 150/5325-4A. The runway has a 600-foot by 300-foot safety area beyond both ends of the runway.

Taxiways connect the south end and the center of Runway 2-20 to the aircraft parking apron. To maximize the long-range potential of the Airport, a full-length parallel taxiway for Runway 2-20 would have to be planned for. However, a parallel taxiway could not be built within the present Airport property line. A taxiway should be located at least 250 feet, centerline to centerline, to satisfy FAA obstacle free zone criteria for Airplane Design Group III (e.g., DHC-7). Exit/entry taxiways should also be provided at each end of the runway and additional exit taxiways, as necessary, located elsewhere along the runway.

Airspace and Air Traffic Control. There are no plans for an instrument approach procedure at Kapalua-West Maui Airport.

Visual RPZs with a 20:1 approach surface are shown for both Runways 2 and 20. Part of the RPZ for both Runways 2 and 20 are outside the Airport boundary. The Hawaii Department of Transportation has avigation easements over those parts of the RPZ that extend beyond the airport property line. Ideally, the land within RPZ dimensions measured from the ends of the runway should be within the airport boundary.

The Airport is limited to VFR operations during daylight hours (i.e., 30 minutes after sunrise and 30 minutes before sunset). There are no navigational aids on the Airport. There are no plans for installing navigational aids or providing a nonprecision instrument approach capability. There are also no plans to install an airport rotating beacon or runway and taxiway lights.

Passenger Terminal Complex. The aircraft parking apron can accommodate three DHC-7 air carrier aircraft or six Cessna 402/Piper 31 commuter aircraft. There is no provision for future expansion of the aircraft parking apron.

The passenger terminal building is 15,000 square feet in area on two floors. The passenger terminal is located about 500 feet from the runway centerline. Therefore, the terminal building is not set back sufficient distance from the centerline of the runway to permit development of a parallel taxiway to satisfy recommended FAA criteria for Airplane Design Group III (i.e., DHC-7 type aircraft) which requires a 400 foot separation. Although the existing separation would permit development of a taxiway 250 from the runway, a parallel taxiway is not recommended.

There is no air cargo building and none is projected. The commuter/air taxi aircraft handle air cargo through the passenger terminal on passenger flights and this is expected to continue in the future.

General Aviation. There are no general aviation aircraft operations at Kapalua-West Maui Airport and no facilities are planned for such operations in the future. Helicopters are prohibited from using the Airport.

Airport Access and Parking. Airport access is provided by the 2-lane access road from Honoapiilani Highway. The terminal parking lot accommodates about 75 cars. On-airport parking or storage of rental cars is not permitted.

Utilities and Support Systems. Existing utilities and support systems are deemed adequate to accommodate projected aviation demand.

PLANNING STANDARDS FOR NEW AIRPORT/HELIPORT SITES

The facility requirements identified in this section were developed to conform with planning standards for airports and heliports prepared by the Federal Aviation Administration (FAA). The FAA planning standards contain guidance on dimensional standards and separations, according to the physical and operational characteristics of aircraft expected to use the airport/heliport.

Utility Airport Planning Standards

Planning standards for utility airports are contained in FAA Advisory Circular 150/5300-13, Airport Design, September 29, 1989, with subsequent revisions. For the utility airport options in the Maui General Aviation Study, the standards for Airport Reference Code B-I (approach Category B and Airplane Design Group I) were applied. Approach Category B includes aircraft with speeds of 91 knots or more but less than 121 knots. Airport Design Group I contains aircraft with wingspan less than 49 feet. These standards were applied for "small airplanes", airplanes of 12,500 pounds or less maximum certificated takeoff weight. The Airport Reference Code B-I aircraft includes essentially all general aviation single engine and twin engine piston aircraft.

The Airport Reference Code description affects the clearances, dimensions, separations and other planning standards used to plan future airport facilities. Table 6-2 presents the relevant airport planning standards used in this study for utility airports. The table contains separation criteria for runways and taxiways, recommended runway and taxiway widths, Runway Safety Area dimensions, RPZ dimensions and other relevant standards. The criteria used in this study are for precision instrument runways. Although a precision instrument approach may not be warranted in the beginning stages of airport development, the use of these standards will allow a precision instrument approach to be installed in the future while satisfying all necessary airport design standards.

Transport Airport Planning Standards

The relevant FAA planning standards for transport airports are shown in Table 6-3. These standards are also contained in FAA Advisory Circular 150/5300-13. The transport airport standards for this study are based on an

TABLE 6-2
FAA PLANNING STANDARDS FOR UTILITY AIRPORTS

Page 1 of 2

Description	Distance [a] (Feet)
Runway Dimensions	
Runway Width	75
Runway Shoulder Width	10
Runway Blast Pad Width	95
Runway Blast Pad Length	60
Runway Safety Area Width	300
Runway Safety Area Length Beyond Each Runway End or Stopway End (whichever is greater)	600
Runway Object Free Area Width	800
Runway Object Free Area Length Beyond each Runway End or Stopway End (whichever is greater)	1,000
Taxiway Dimensions	
Taxiway Width	27
Taxiway Edge Safety Margin	5
Taxiway Shoulder Width	10
Taxiway Safety Area Width	49
Taxiway Object Free Area Width	89
Taxilane Object Free Area Width	79
Taxiway Wingtip Clearance	20
Taxilane Wingtip Clearance	15
Runway Separations	
Runway Centerline to Parallel Taxiway or Taxilane Centerline	200
Runway Centerline to Edge of Aircraft Parking	400
Runway Centerline to Helicopter FATO (Final Approach and Takeoff Area)	1,000 [b]
Taxiway Separations	
Taxiway Centerline to Parallel Taxiway or Taxilane Centerline	69
Taxiway Centerline to Fixed or Movable Object	44.5
Taxilane Centerline to Parallel Taxilane Centerline	64
Taxilane Centerline to Fixed or Movable Object	39.5

TABLE 6-2
FAA PLANNING STANDARDS FOR UTILITY AIRPORTS

Description	Distance [a] (Feet)
Runway Protection Zone (Precision Approach at Both Ends)	
Length	2,500
Width 200 Feet from Runway End	1,000
Width 2,700 Feet from Runway End	1,750
Approach Surface Slope	50:1
Runway Protection Zone (Non-precision Approach at Both Ends)	
Length	1,000
Width 200 Feet from Runway End	1,000
Width 1,200 Feet from Runway End	1,200
Approach Surface Slope	34:1
Runway Protection Zone (Visual Approach at Both Ends)	
Length	1,000
Width 200 Feet from Runway End	250
Width 1,200 Feet from Runway End	450
Approach Surface Slope	20:1

[a] Sources: Federal Aviation Administration, Advisory Circular 150/5300-13, Airport Design, September 29, 1989, with subsequent changes; Federal Aviation Administration, Advisory Circular 150/5390-2A, Heliport Design, January 20, 1994. Based on Airport Reference Code B-I (small airplanes) for aircraft no larger than 12,500 pounds maximum certificated takeoff weight.

[b] For small airplanes (12,500 pounds or less) and small helicopters (6,000 pounds or less) the minimum separation required by the FAA for simultaneous same direction VFR operations is 300 feet. It is recommended that this separation be increased to 1,000 feet for alternatives considered in this study due to the large number of helicopter operations.

TABLE 6-3
FAA PLANNING STANDARDS FOR TRANSPORT AIRPORTS

Description	Distance [a] (Feet)
Runway Dimensions	
Runway Width	100
Runway Shoulder Width	20
Runway Blast Pad Width	140
Runway Blast Pad Length	200
Runway Safety Area Width	500
Runway Safety Area Length Beyond Each Runway End or Stopway End (whichever is greater)	1,000
Runway Object Free Area Width	800
Runway Object Free Area Length Beyond each Runway End or Stopway End (whichever is greater)	1,000
Taxiway Dimensions	
Taxiway Width	50
Taxiway Edge Safety Margin	10
Taxiway Shoulder Width	20
Taxiway Safety Area Width	118
Taxiway Object Free Area Width	186
Taxilane Object Free Area Width	162
Taxiway Wingtip Clearance	34
Taxilane Wingtip Clearance	22
Runway Separations	
Runway Centerline to Parallel Taxiway or Taxilane Centerline	400
Runway Centerline to Edge of Aircraft Parking	500
Runway Centerline to Helicopter FATO (Final Approach and Takeoff Area)	1,000[b]
Taxiway Separations	
Taxiway Centerline to Parallel Taxiway or Taxilane Centerline	152
Taxiway Centerline to Fixed or Movable Object	93
Taxilane Centerline to Parallel Taxilane Centerline	140
Taxilane Centerline to Fixed or Movable Object	81

TABLE 6-3
FAA PLANNING STANDARDS FOR TRANSPORT AIRPORTS

Page 2 of 2

Description	Distance [a] (Feet)
Runway Protection Zone (Precision Approach at Both Ends)	
Length	2,500
Width 200 Feet from Runway End	1,000
Width 2,700 Feet from Runway End	1,750
Approach Surface Slope (To 10,200 feet from runway end)	50:1
Runway Protection Zone (Non-precision Approach at Both Ends)	
Length	1,700
Width 200 Feet from Runway End	1,000
Width 1,900 Feet from Runway End	1,425
Approach Surface Slope	34:1
Runway Protection Zone (Visual Approach at Both Ends)	
Length	1,000
Width 200 Feet from Runway End	500
Width 1,200 Feet from Runway End	700
Approach Surface Slope	20:1

[a] Sources: Federal Aviation Administration, Advisory Circular 150/5300-13, Airport Design, September 29, 1989, with subsequent changes; Federal Aviation Administration, Advisory Circular 150/5390-2A, Heliport Design, January 20, 1994. Based on Airport Reference Code C-III.

[b] For large airplanes (12,500 pounds to 300,000 pounds) and small helicopters (6,000 pounds or less) the minimum separation required by the FAA for simultaneous same direction VFR operations is 500 feet. It is recommended that this separation be increased to 1,000 feet for alternatives considered in this study due to the large number of helicopter operations.

Airport Reference Code of C-III. Aircraft Approach Category C accommodates aircraft with speeds of 121 knots or more but less than 141 knots. Airplane Design Group III includes aircraft with wing spans of 79 feet or more but less than 118 feet. Airport Reference Code C-III encompasses aircraft as large as the Boeing 737 series aircraft. The transport airport standards used in this study must accommodate air cargo flights by aircraft of this size. This Airport Reference Code would also accommodate virtually all turbo prop and turbo jet aircraft commonly used in business and corporate aviation. The criteria shown in Table 6-3 apply to airports with a precision instrument approach system.

Heliport Planning Standards

Heliport planning and design standards are contained in Federal Aviation Administration Advisory Circular 150/5390-2A Heliport Design, January 20, 1994. The heliport standards which have been applied to the Maui General Aviation Study are shown in Table 6-4. The dimensional criteria are based on the larger of the dimensions of the American Eurocopter A-STAR350 or Bell Helicopter Jet/Long Ranger 206.

The standards related to the separation between runway centerline and helicopter final approach and takeoff area (FATO) for heliports located on airports are contained in Tables 6-2 and 6-3. The minimum separations required by the FAA for simultaneous same-direction visual flight rules (VFR) operations is 300 feet for utility airports and 500 feet for transport airports handling airplanes under 300,000 pounds. For purposes of the Maui General Aviation Study, these separations were increased to 1,000 feet because of the high volume of helicopter operations that the airports would experience.

FACILITIES REQUIREMENTS FOR NEW AIRPORT/HELIPORT SITES

Facility requirements were developed for the following categories of new airports/heliport sites (Tables 6-5 through 6-9):

- Limited service heliport
- Full service heliport
- Utility airport
- Utility airport/heliport
- Transport airport/heliport

Requirements were developed for the initial development and the year 2015. Facility requirements include airfield facilities, administration/terminal facilities, based aircraft facilities, operator lease areas, vehicle access and parking, support facilities and the ultimate land area requirement.

Airfield Facilities

Runway Length. FAA Advisory Circular 150/5325-4A, Runway Length Requirements for Airport Design, January 29, 1990, contains the criteria used in developing runway lengths required to accommodate various general aviation aircraft. The recommended runway lengths contained in the Advisory Circular are based on performance information from manufactures' flight manuals in accordance with provisions in Federal regulations. In addition to aircraft performance characteristics, site characteristics are also considered in analyzing runway length. Site characteristics affecting runway length include airport elevation, temperature, runway gradient and wind conditions. The runway length requirements described in this section are based on elevation at mean sea level, temperature of 84 degrees fahrenheit (the mean maximum temperature of the hottest month), zero runway gradient and calm winds. The affects of airport elevation and runway gradient for specific site alternatives are discussed in Section 8, Airport Site Alternatives.

TABLE 6-4
FAA PLANNING STANDARDS FOR HELIPORTS

Description	Distance [a] (Feet)
Takeoff and Landing Areas	
Final Approach and Takeoff Area (FATO) Length, Width or Diameter	65
Touchdown and Lift off Area (TLOF) Length, Width or Diameter (Load-Bearing portion of FATO)	37
FATO Edge to Center of TLOF	32.5
TLOF Edge to TLOF Edge	37
FATO Safety Area Distance from FATO Edge	20
Taxi Routes and Parking Pads	
Taxi Route Width (Hover Taxiing)	77
Parking Pad Length, Width or Diameter	43
Separation Between Parking Pads	20
FATO Protection Zones	
Length from Edge of FATO	280
Width at Edge of FATO	65
Width at Outer Edge	95.5

Source: Federal Aviation Administration, Advisory Circular 150/5390-2A, Heliport Design, January 20, 1994. Planning standards are based on the larger of the dimensions of the American Eurocopter A-Star 350 or Bell Helicopter Jet/Long Ranger 206.

TABLE 6-5
FACILITY REQUIREMENTS FOR A NEW LIMITED-SERVICE HELIPORT, 2000 TO 2015

Item	Projected Requirements [a] Initial Requirements	Year 2015 Requirements
Airfield Facilities		
Final Approach and Takeoff Areas (FATOs)		
Number	2	2
Area (SF)	8,500	8,500
Instrument Approach	None	None
Air Traffic Control Facility	No	No
Terminal Facilities		
Administration/Terminal Building (SF)	2,800	3,900
Terminal Parking Pads [b]	11	16
Terminal Apron Area (SF) [c]	105,000	152,000
Vehicle Access and Parking		
Access Road Width (Lanes)	2	2
Vehicle Parking Spaces	130	190
Support Facilities		
Fuel Storage (Gallons) - Jet-A	20,000	30,000
ARFF/Heliport Maintenance Building (SF) [d]	2,000	2,000
Number of Fire Trucks	1	1
Ultimate Land Area Requirement (Acres) [e]	12	

[a] Source: P&D Aviation.

[b] Includes parking areas for helicopters requiring maintenance and for refueling.

[c] Approximately 90% of the apron area would be light-duty pavement, used primarily for helicopter hover taxiing.

[d] ARFF = Airport Rescue and Fire Fighting.

[e] Includes FATO Protection Zones and allows for expansion of facilities beyond 2015 needs. The approximate land area needed to accommodate 2015 needs is 9 acres. It is recommended that the ultimate land area be acquired at the initial development of the facility. The ultimate land area (12 acres) would include 4 acres for the airfield (FATOs, FATO Protection Zones and helicopter taxi areas) and 8 acres for the terminal, vehicle and support facilities.

TABLE 6-6
FACILITY REQUIREMENTS FOR A NEW FULL-SERVICE HELIPORT, 2000 TO 2015

Item	Projected Requirements [a] Initial Requirements	Year 2015 Requirements
Airfield Facilities		
Final Approach and Takeoff Areas (FATOs)		
Number	2	4
Area (SF)	8,500	17,000
Instrument Approach	None	Nonprecision
Air Traffic Control Facility	No	Yes
Administration/Terminal Facilities		
Administration/Terminal Building (SF)	2,000	2,500
Transient Parking Pads	2	3
Based Helicopter Pads	32	43
Apron Area (SF) [b]	370,000	530,000
Operator Lease Area (Acres) [c]	8	11
Vehicle Access and Parking		
Access Road Width (Lanes)	2	2
Vehicle Parking Spaces	220	310
Support Facilities		
Fuel Storage (gallons) - Jet A	25,000	40,000
ARFF/Heliport Maintenance Building (SF) [d]	2,500	2,500
Number of Fire Trucks	1	1
Ultimate Land Area Requirement (Acres) [e]	60	

[a] Source: P&D Aviation.

[b] Approximately 90% of the apron area would be light-duty pavement, used primarily for helicopter hover taxiing.

[c] Excludes apron area identified above.

[d] ARFF = Airport Rescue and Fire Fighting.

[e] Includes FATO Protection Zones and allows for expansion of facilities beyond 2015 needs. The approximate land area needed to accommodate 2015 needs is 30 acres. It is recommended that the ultimate land area (60 acres) be acquired at the initial development of the facility. The ultimate land area would include 10 acres for the airfield (FATOs, FATO Protection Zones and helicopter taxi areas) and 50 acres for the terminal, vehicle and support facilities, and operator areas.

TABLE 6-7
FACILITY REQUIREMENTS FOR A NEW UTILITY AIRPORT, 2000 TO 2015

Item	Projected Requirements [a] Initial Requirements	Year 2015 Requirements
Airfield Facilities		
Runway		
Length (Feet) [b]	3,550	3,550
Width (Feet)	75	75
Parallel Taxiway	Full	Full
Instrument Approach	None	Non-Precision
Air Traffic Control Facility	Yes	Yes
Administration/Terminal Facilities		
Administration/Terminal Building (SF)	2,900	3,600
Transient Aircraft Parking		
Spaces	7	9
Apron Area (SF)	42,000	54,000
Based Aircraft Facilities		
Based Aircraft Tie-downs		
Number	5	6
Area (SF)	20,000	24,000
Based Aircraft Individual Hangars	50	55
Operator Lease Area (Acres)	10	15
Vehicle Access and Parking		
Access Road Width (Lanes)	2	2
Vehicle Parking Spaces	80	100
Support Facilities		
Fuel Storage (gallons) - Avgas	10,000	15,000
ARFF/Airport Maintenance Building (SF) [c]	2,500	2,500
Number of Fire Trucks	1	1
Ultimate Land Area Requirement (Acres) [d]	390	

[a] Source: P&D Aviation.
[b] Length required for zero runway gradient at sea level.
[c] ARFF = Airport Rescue and Fire Fighting.
[d] Includes Runway Protection Zones and allows for expansion of facilities beyond 2015 needs. The land area needed to accommodate 2015 needs is approximately 325 acres. It is recommended that the ultimate land area (390 acres) be acquired at the initial development of the facility. The ultimate land area would include 305 acres for the airfield (runway, taxiways, Runway Protection Zones) and 85 acres for administration, based aircraft, fixed-wing operator areas, vehicle access and parking, and support facilities.

TABLE 6-8
FACILITY REQUIREMENTS FOR A NEW UTILITY AIRPORT/HELIPORT, 2000 TO 2015

Item	Projected Requirements [a] Initial Requirements	Year 2015 Requirements
Airfield Facilities		
Runway		
Length (Feet) [b]	3,550	3,550
Width (Feet)	75	75
Parallel Taxiway	Full	Full
Number of FATOs	2	4
Instrument Approach	Non-Precision [c]	Precision
Air Traffic Control Facility	Yes	Yes
Administration/Terminal Facilities		
Administration/Terminal Building (SF)	2,900	3,600
Transient Parking Ramp		
Aircraft Spaces	7	9
Helicopter Pads	2	3
Area (SF)	45,000	60,000
Based Aircraft/Helicopter Facilities		
Based Aircraft Tie-downs/Helicopter Pads		
Number	37	49
Area (SF) [d]	390,000	554,000
Based Aircraft/Helicopter Individual Hangars	54	60
Operator Lease Area		
Helicopter Operator Area (Acres)	8	11
FBO Area (Acres)	10	15
Total	18	26
Vehicle Access and Parking		
Access Road Width (Lanes)	2	2
Vehicle Parking Spaces		
Heliport	220	310
Airport	80	100
Total	300	410
Support Facilities		
Fuel Storage (gallons)		
Avgas	10,000	15,000
Jet A	25,000	40,000
ARFF/Airport Maintenance Building (SF) [e]	3,600	3,600
Number of Fire Trucks	1	1
Ultimate Land Area Requirement (Acres) [f]	510	

TABLE 6-8
FACILITY REQUIREMENTS FOR A NEW UTILITY AIRPORT/HELIPORT, 2000 TO 2015

[a] Source: P&D Aviation.

[b] Length required for zero runway gradient at sea level.

[c] Airports located at the former Puunene Airport site will initially operate under visual flight rules (VFR) only and no instrument approach procedures would be provided. It is estimated that instrument flight rules (IFR) operations could potentially be accommodated by 2015 due to changes in air traffic control technology.

[d] Approximately 90% of the apron area would be light-duty pavement, used primarily for helicopter hover taxiing.

[e] ARFF = Airport Rescue and Fire Fighting.

[f] Includes FATO and Runway Protection Zones and allows for expansion of facilities beyond 2015 needs. The land area needed to accommodate 2015 needs is approximately 415 acres. It is recommended that the ultimate land area (510 acres) be acquired at the initial development of the facility. The ultimate land area would include 375 acres for the airfield (taxiways, FATOs, FATO Protection Zones and helicopter taxi areas); 85 acres for administration, based aircraft, fixed-wing operator areas, vehicle access and parking, and support facilities; and 50 acres for helicopter operator areas.

TABLE 6-9
FACILITY REQUIREMENTS FOR A NEW TRANSPORT AIRPORT/HELIPORT, 2000 TO 2015
Page 1 of 2

Item	Projected Requirements [a]	
	Initial Requirements	Year 2015 Requirements
Airfield Facilities		
Runway		
Length (Feet) [b]	6,000	6,000
Width (Feet)	100	100
Parallel Taxiway	Full	Full
Number of FATOs	2	4
Instrument Approaches	Precision and Nonprecision [c]	Precision and Nonprecision
Air Traffic Control Facility	Yes	Yes
Administration/Terminal Facilities		
Administration/Terminal Building (SF)	2,900	3,600
Transient Parking Ramp		
Aircraft Spaces	7	9
Helicopter Pads	2	3
Area (SF)	45,000	60,000
Based Aircraft/Helicopter Facilities		
Based Aircraft Tie-downs/Helicopter Pads		
Number	37	49
Area (SF) [d]	390,000	544,000
Based Aircraft/Helicopter Individual Hangars	54	60
Operator Lease Area		
Helicopter Operator Area (Acres)	8	11
FBO Area (Acres)	10	15
Cargo Area (Acres)	7	9
Total	25	35
Vehicle Access and Parking		
Access Road Width (Lanes)	2	2
Vehicle Parking Spaces		
Heliport	220	310
Airport [e]	90	110
Total	310	420
Support Facilities		
Fuel Storage (gallons)		
Avgas	10,000	15,000
Jet A	45,000	70,000
ARFF/Airport Maintenance Building (SF)	4,000	5,000
Number of Fire Trucks	1	2
Ultimate Land Area Requirement (Acres) [f]	710	

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TABLE 6-9
FACILITY REQUIREMENTS FOR A NEW TRANSPORT AIRPORT/HELIPORT, 2000 TO 2015
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[a] Source: P&D Aviation.

[b] Length required for zero runway gradient at sea level.

[c] Airports located at the former Puunene Airport site will initially operate under visual flight rules (VFR) only and no instrument approach procedures would be provided. It is estimated that instrument flight rules (IFR) operations could potentially be accommodated by 2015 due to changes in air traffic control technology.

[d] Approximately 90% of the apron area would be light-duty pavement, used primarily for helicopter hover taxiing.

[e] Excludes vehicle parking in cargo area.

[f] Includes FATO and Runway Protection Zones and allows for expansion of facilities beyond 2015 needs. The land area needed to accommodate 2015 needs is approximately 570 acres. It is recommended that the ultimate land area required be acquired at the initial development of the facility. The ultimate land area (710 acres) would include 560 acres for the airfield (taxiways, FATOs, FATO Protection Zones and helicopter taxi areas; 100 acres for administration, based aircraft, fixed-wing operator areas, vehicle access and parking, and support facilities; and 50 acres for helicopter operator areas.

On the basis of the design curves contained in the Advisory Circular referenced above, a runway length of 3,550 feet will accommodate virtually all of the general aviation single engine and twin engine piston aircraft fleet. This runway length, adjusted for elevation and runway gradient, will be used for the utility airport requirement.

The runway length requirement for the transport airport was developed on the basis of aircraft characteristic manuals for the Boeing 737-200C convertible freighter aircraft. Based on the performance curves contained in the aircraft characteristic manual, a runway length of 6,000 feet at mean sea level and zero runway gradient can accommodate full cargo loads in inter-island cargo service.

Runway Width. FAA Advisory Circular 150/5300-13 specifies a runway width of 75 feet for Airport Reference Code B-I (utility airport) and 100 feet for Airport Reference Code C-III (transport airport).

Runway Grades. For Approach Category B Aircraft (utility airport) the maximum longitudinal grade is 2.0 percent. For Approach Category C Airports (transport airport) the maximum longitudinal grade is 1.5 percent, with the longitudinal grade of the first and last quarter of the runway length not exceeding 0.8 percent.

A runway should have adequate transverse slopes to prevent the accumulation of water on the surface. The recommended range for the transverse grade of the runway is 1.0 to 2.0 percent for the utility airport and 1.0 to 1.5 percent for the transport airport.

Pavement Strength. It is recommended that the utility airport be designed to accommodate aircraft no larger than twin engine piston airplanes. A pavement strength which accommodates aircraft up to 12,500 pounds gross takeoff weight would accommodate virtually all of the general aviation piston aircraft in operation. Thus, a single-wheel landing gear load of 12,5000 pounds is recommended for the utility airport pavement strength.

The transport airport pavement should be designed to accommodate the Boeing 737-200C, which has a maximum takeoff weight of 115,500 pounds and a dual-wheel landing gear.

Runway Safety Area. A Runway Safety Area is defined as a rectangular area centered about the runway that is cleared, drained, graded and usually turfed. Under normal conditions, this area should be capable of accommodating, with no structural damage, occasional aircraft that may veer off the runway, as well as firefighting equipment. Runway Safety Area dimensions are given in Table 6-2 for the utility airport and Table 6-3 for the transport airport.

Runway Protection Zones. The RPZ (formally called Clear Zone) is an important element in the design of runways which help to ensure the safe operation of aircraft. The RPZ is an area off the end of the runway used to enhance the protection of people and property on the ground. The RPZ begins 200 feet from the end of the runway and has a size which varies with the designated use of the runway. The RPZ should be kept clear of incompatible objects and activities. No structures should be permitted nor the congregation of people allowed within the RPZ. It is recommended that the airport owner acquire adequate property interests, preferably in fee title, in the RPZ to ensure compliance with the FAA standards.

The RPZ dimensions for the utility and transport airports are shown in Tables 6-2 and 6-3 respectively. RPZ dimensions have been sized to allow a future precision instrument approach system.

Taxiways. A full length parallel taxiway is recommended for the utility and transport

airports. A full length parallel taxiway provide for the safe and efficient flow of aircraft. Because of the extensive amount of training expected at a new airport site, a parallel taxiway will be needed to handle the expected aircraft movements.

Final Approach and Takeoff Area (FATO). Because of the large volume of helicopter traffic it is recommended that final approach and takeoff areas (FATOs) be provided in pairs, one FATO for arriving helicopters and one FATO for departing helicopters. It is further recommended that all helicopter traffic arrive from a single direction and depart in a single direction. For a new site in which the heliport is co-located with an airport, the direction of helicopter arrivals and departures would be the same as for fixed-wing aircraft. The approach/departure corridor would be parallel to the runway, with a centerline separation of 1,000 feet. For a limited-service heliport, two FATOs are recommended. For full-service heliports, four FATOs are recommended by the year 2015.

Lighting and Navigational Aids. The FAA Order 7031.2C, <u>Airway Planning Standard No. 1, Terminal Air Navigation Facilities and Air Traffic Control Services</u>, November 5, 1984, with subsequent revisions, contains criteria for the installation of navigational aids (navaids) at airports. The criteria for navaids are based upon the number of annual instrument approaches. Based on FAA criteria, a general aviation airport is a candidate for one of two types of non-precision approach systems when 200 annual instrument approaches are recorded: a Localizer Direction Aid (LDA) system or a Terminal Very High Frequency Omnirange Station (TVOR). It is estimated that the utility airport will meet this criteria by 2015.

Criteria for precision approach systems are based on the number of qualified annual instrument approaches within various non-precision approach minimums. In addition, precision approach candidates are subject to benefit/cost screening. For purposes of this study, facility requirements for transport airports include a precision instrument approach system in the initial phase of operation.

It is recommended that all runways and FATOs be equipped with a visual glide path indicator. Furthermore, airports should be equipped with runway and taxiway lighting and heliports should have perimeter lights and landing direction lights to improve the visibility of the landing areas and provide for nighttime operations.

A limited service heliport is not projected to meet the criteria for a non-precision instrument approach system. A full service heliport is expected to meet the non-precision instrument approach criteria by 2015.

According to the finding of the recent FAA airspace analysis (described in a letter from the FAA to the State of Hawaii, Department of Transportation, Airports Division on August 25, 1995), a new airport at the former Puunene Airport site would be limited to visual flight rules (VFR) operations to minimize airspace conflicts with Kahului Airport. Therefore, no instrument landing aids would be provided initially for alternatives at that site. However, for purposes of this study it is assumed that instrument flight rules (IFR) operations would be allowed at a new airport there by 2015 due to advances in technology over the next 20 years.

Air Traffic Control Facility. FAA Order 7031.2C also provides criteria for the establishment of FAA air traffic control towers on airports. Criteria to establish air traffic control towers has evolved over time. The criteria established by the FAA in 1951 required a minimum number of operations to qualify as a tower candidate. From 1951 to 1974, minimum qualifying levels were 24,000 annual itinerant operations at air carrier airports and

50,000 annual itinerant operations at general aviation airports. Because of the increasing cost of tower establishment and operation, the criteria were revised in 1975 to incorporate a cost-benefit analysis. The cost-benefit criteria was subsequently revised and current criteria are contained in the FAA document Establishment and Discontinuance Criteria for Airport Traffic Control Towers, August 1990.

Current cost-benefit analysis considers the following four kinds of direct benefits:

- Safety benefits
- Reduced aircraft operating costs and reduced cost of passengers' time
- Productivity benefits
- Other non-quantifiable benefits.

Two kinds of costs are recognized:

- Tower investment costs
- Tower operations and maintenance costs.

Tower cost-benefits are estimated by the FAA for each of 15 future years and discounted to present value at an annual rate of 10 percent. The ratio of discounted benefits to discounted costs must be greater than 1.0 for an airport to meet the criteria for tower establishment.

It is uncertain whether a new airport/heliport facility would meet the FAA criteria for establishing a new air traffic control tower. Moreover, after the criteria are met, FAA funding is not guaranteed because often the number of qualifying sites is larger than the overall budget constraints will allow.

It is estimated that an air traffic control facility would be established at a full service heliport by 2015 and at a transport airport/heliport, utility airport/heliport or utility airport in the initial phase of construction. A limited service heliport is assumed not to have an air traffic control facility.

For purposes of this study it is assumed that the air traffic control facility would be constructed by the FAA. According to the findings of the FAA airspace analysis (described in a letter from the FAA to the State of Hawaii, Department of Transportation, Airports Division on August 25, 1995), an air traffic control tower (ATCT) would be required for all airport alternatives at the former Puunene Airport site.

Administration/Terminal Facilities

Administration/Terminal Building. The general aviation airport administration/terminal building typically contains space for airport administration, pilot's flight planning and weather service area, waiting lobby, rental car and other concessions, and public restrooms. The amount of space required for these functions is generally based upon the number of peak hour pilots and passengers to use the facility. An industry planning standard of 49 square feet per peak hour pilots and passengers, based on FAA studies, was used to determine the required area. An estimated 2.5 pilots and passengers are assumed per peak hour operation, based on FAA surveys. Tables 6-7 through 6-9 show the building requirements for utility and transport airports.

It is assumed that a common administration/terminal building would be provided for a limited service heliport to serve all the heliport passengers. In the common administration/terminal building, offices would be provided for airport administration functions and each tour operator would be provided space for ticket sales and check-in. A central lobby area would be provided for passenger waiting and limited concessions. The requirement for a limited service heliport administration/terminal building was based on 40 square feet per peak hour passenger, which is typical for airport passenger

terminals with a low level of passenger service. The administration/terminal facility requirements for a full service heliport are based on minimum needs for administrative functions, concessions and restrooms. The heliport administration/terminal facility requirements are reflected in Tables 6-5 and 6-6.

Transient Aircraft Parking. The number of transient parking spaces required for fixed-wing aircraft and helicopters were based on existing experience at Kahului Airport and projected needs. Projected fixed-wing transient aircraft parking spaces are 7 initially and 9 in 2015. Projected transient helicopter parking pads are 2 initially and 3 in 2015 for a full service heliport. Limited service heliport transient parking pads are included under "Terminal Parking Pads". Overall transient parking ramp requirements are estimated at 5,000 square feet per fixed-wing aircraft and helicopter parking space.

Terminal Helicopter Parking Pads. For a limited service heliport, the terminal helicopter parking pads would be shared by all users. Terminal parking pads would be used primarily for passenger loading and unloading. Pads would also be provided for helicopters requiring maintenance, for refueling and for occasional transient helicopters. Based on a 15 minute turn-around time for aircraft unloading and loading, it is estimated that the helicopter passenger pad requirement will be 6 initially and 9 in 2015. In addition, 3 fueling pads and 2 maintenance pads would be provided initially and 4 fueling pads and 3 maintenance pads would be provided in 2015. The total terminal parking requirement for a limited service heliport would be 11 parking areas initially and 16 parking areas in 2015. The total terminal apron area required is 105,000 square feet initially and 152,000 square feet in 2015. Approximately 90 percent of the apron area would be light-duty pavement used primarily for helicopter hover taxiing.

Based Aircraft Individual Hangars and Tie-downs. The requirement for individual aircraft hangars (T-hangars or small rectangular hangars, which are typically rented by the State) was determined by the percentage of based aircraft hangars desired. The number of hangars desired at Kahului Airport is the number of existing hangars (30) plus the number of aircraft on the hangar waiting list. The hangar waiting list was recently screened and now contains 13 aircraft. Therefore, the existing hangar demand is approximately 90 percent of the number of based fixed-wing aircraft (43/48). Using this percentage, individual hangar requirements for fixed-wing aircraft are 50 initially and 55 in 2015.

Individual hangar requirements for based non-tour helicopters are estimated to be 10 percent of based helicopters, or 4 hangars initially and 5 hangars in 2015. The remainder of non-tour helicopters and all tour helicopters, when not in use, would be hangared in large conventional hangars built by operators on their lease areas. The remainder of the fixed-wing based aircraft would be on tie-down spaces. Apron area for based aircraft tie-downs is estimated to be 4,000 square feet per aircraft. The based aircraft apron area for a full service heliport or airport/heliport sites consist largely of helicopter hover taxi lanes. Approximately 90 percent of the apron area at these sites would be light duty pavement used primarily for helicopter hover taxiing.

Operator Lease Areas

Helicopter Operator Area. Helicopter operator lease areas for a full service heliport or an airport/heliport site are estimated to require 8 acres initially and 11 acres in 2015, based on current helicopter operator space utilization and needs.

Fixed Base Operator (FBO) and Other Lease Areas. Lease areas for airport Fixed Base Operators (FBOs), flight schools, and other lessees are projected to total 10 acres initially and 15 acres in 2015. The Army National Guard is presently looking for a new site to locate their facilities. Their site would accommodate operations offices as well as helicopter operations and possibly some transient fixed-wing activity. The Army National Guard facilities could potentially be located at a new heliport or airport site considered in this study.

Cargo Area. Based on industry standards for air cargo facility needs, including building area, truck docks, auto parking, and hardstand areas, it is estimated that cargo lease area requirements for a transport airport will total 7 acres initially and 9 acres in 2015.

The total operator lease area for a new utility airport/heliport is estimated to be 18 acres initially and 26 acres in 2015 (Table 6-8). Lease requirements for a new transport airport/heliport are anticipated to total 25 acres initially and 35 acres in 2015 (Table 6-9).

·hicle Access and Parking

Access Road. In Section 5, Aviation Demand Forecasts, vehicle trip projections for each airport/heliport alternative were presented. Based on these average daily trip estimates for the year 2015, all alternatives will require a two-lane airport access road. The length of the access road will vary according to the site location and nearest public access road. Proposed access road locations are shown for each alternative in Section 8, Airport Site Alternatives.

Vehicle Parking Spaces. An industry standard for computing the amount of paved general aviation parking space needed is 1.3 spaces per peak hour general aviation pilot and passenger. This factor takes into account airport employees, pilots and passengers. The area required per automobile is 350 square feet, which includes circulation routes and other necessary clearances within the parking area. The projected auto parking requirements for a utility airport are 80 spaces initially and 100 spaces in 2015. Requirements for a transport airport/heliport are 90 spaces initially and 110 spaces in 2015. The transport requirements exclude vehicle parking within the cargo area which is included in the cargo operator lease area.

The vehicle parking requirement for the helicopter tour activity was estimated on the basis of the current ratio of helicopter parking spaces at Kahului Airport to the total daily helicopter passengers. This ratio in 1994 was 0.38 parking spaces per daily passenger. These parking spaces serve passengers, employees and others such as suppliers. Based on the projected number of helicopter tour passengers, vehicle parking space requirements are estimated to be 130 initially and 190 in 2015 for a limited service heliport and 220 initially and 310 in 2015 for a full service heliport.

Support Facilities

Fuel Storage. Bulk fuel storage requirements were determined on the basis of forecast fuel flowage and assuming a 15-day supply for Avgas and a 1-week supply for Jet-A fuel. These are typical requirements and are approximately the same as the supply requirements at Kahului Airport. The Jet-A fuel supply period is less than that of Avgas because of the greater quantities of fuel used by turbine-powered aircraft. The largest users of fuel are expected to be helicopter tour operators and cargo operators. Jet-A fuel storage requirements for a limited service heliport are projected to be 20,000 gallons initially and 30,000 in 2015. Jet-A requirements for a new full service heliport are estimated to be 25,000 gallons initially and 40,000 gallons in 2015. General aviation Avgas requirements would be 10,000 gallons initially and 15,000 in 2015. In addition to the general aviation fuel storage requirements, a new transport airport/heliport would

need Jet-A fuel storage requirements of 45,000 initially and 70,000 gallons in 2015.

ARFF/Airport Maintenance Building. For an airport or heliport of the size considered in the Maui General Aviation Study, the facility needed to house an airport rescue and firefighting (ARFF) vehicle and associate equipment can also house the Airport/Heliport Maintenance function. The size of the ARFF/Airport Maintenance Building will vary according to the size of the Airport/Heliport facility and the firefighting requirements, particularly the number of fire trucks. Building requirements were developed for this study from requirements at similar airports. The projected requirements for the ARFF/Maintenance Building range from 2,000 square feet for a limited service heliport to 5,000 square feet for a transport airport/heliport in 2015.

ARFF Vehicles. FAA Advisory Circular 150/5210-6C, Aircraft Fire and Rescue Facilities and Distinguishing Agents, January 28, 1985 establishes recommended levels of firefighting protection for general aviation airports.

Applicable indexes for airports served by certificated air carriers (including helicopter tour operators and cargo carriers) are:

- Index A - Airports with five or more average daily departures of aircraft less than 90 feet in length.
- Index B - Five or more average daily departures of aircraft at least 90 feet but less than 126 feet in length.

Index A airports require one vehicle carrying at least 500 pound of sodium-base dry chemical or Halon 1211, or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of AFFF to total 100 gallons, for simultaneous dry chemical and AFFF foam application. Index B airports require either (1) one vehicle carrying at least 500 pounds of sodium-based dry chemical or Halon 1211, and 1,500 gallons of water, and the commensurate quantity of AFFF for foam productions, or (2) two vehicles, with (a) one vehicle carrying the extinguishing agents as specified for Index A, and (b) one vehicle carrying an amount of water and the commensurate quantity of AFFF so that the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons.

A limited service heliport and full service heliport would each require one fire truck meeting Index A requirements.

The utility airport would be an Index 1 airport (an airport having at least 1,825 annual departures of aircraft more than 30 feet but no more than 45 feet long and less than 1,825 annual departures of aircraft more than 45 feet but not more than 60 feet long). Recommended equipment for an Index 1 airport is one fire truck with the following capacities: 190 gallons of water for AFFF foam production (or 290 gallons for protein foam) and an application rate of 150 gallons per minute for AFFF (or 230 gallons per minute for protein foam) and 300 pounds of dry chemical powders.

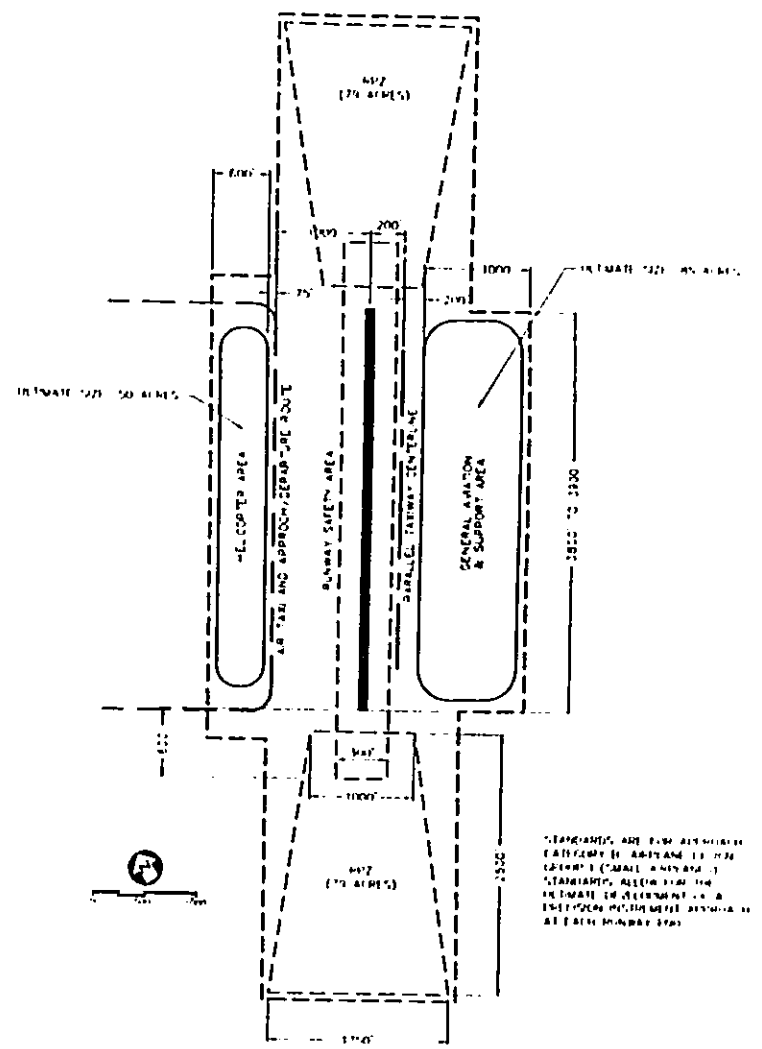
The Boeing 737-200QC and -300QC are Index B aircraft. By 2015 it is projected that the transport airport/heliport will have at least five daily departures of Index B aircraft. Therefore, a transport airport/heliport will initially require one fire truck meeting Index A requirements and two fire trucks in 2015 meeting Index B requirements.

Ultimate Land Area Requirement

The land area requirements for ultimate buildout of each type of heliport or airport alternative were developed. The land area requirement includes the Runway and FATO Protection Zones and allows for the expansion of helicopter and fixed-wind aircraft facilities beyond the year 2015 needs. It is recommended that the ultimate land area required be set aside in the initial phase of development of the facility to ensure that the ultimate development requirements are protected and the airport does not adversely impacts surrounding land uses. Ultimate land area requirements are 12 acres for a limited service heliport, 60 acres for a full service heliport, 390 acres for a utility airport, 510 acres for a utility airport/heliport and 710 acres for a transport airport/heliport. Figure 6-1 indicates an ultimate configuration of a new utility airport/heliport and gives approximate dimensions.

The alternatives for new airport/heliport sites described in Section 8, Airport Site Alternatives, were developed on the basis of the facility requirements described in this section. These facility requirements were also used to prepare the development cost estimates for each site alternative.

FIGURE 6-1
APPROXIMATE DIMENSIONS FOR
NEW UTILITY AIRPORT / HELIPORT BASED ON
ULTIMATE DEVELOPMENT REQUIREMENTS



Maui General Aviation Study

Hawaii Department of Transportation
Airports Division

Section 7
SITE EVALUATION CRITERIA AND METHODOLOGY

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SECTION 7
SITE EVALUATION CRITERIA AND METHODOLOGY

INTRODUCTION

This section outlines the specific criteria used in the evaluation of airport/heliport site alternatives. Alternative scenarios consist of airports for fixed-wing aircraft use, heliports, and combinations of these. The term "airport" is used in this section to describe any of these alternatives.

The site evaluation criteria presented here are organized according to the issues which have been identified as being important in the consideration of a new airport. The methodology for applying the criteria in the evaluation of alternatives is also presented. Public information meetings were held May 19, 1994 and July 27, 1994 on Maui to discuss the scope of work for this project and to clarify airport siting issues and the evaluation approach.

The approach under which the evaluation of airport site alternatives was conducted follows generally accepted airport site evaluation methods. The methodology is consistent with Federal Aviation Administration (FAA) guidelines as described in the following FAA Advisory Circulars: Noise Control and Compatibility Planning for Airports, AC150/5020-1, August 5, 1983; Citizen Participation in Airport Planning, AC150/5050-4, September 26, 1975; Airport Land Use Compatibility Planning, AC150/5050-6, December 30, 1977; and Airport Master Plans, AC150/5070-6A, June 1985.

AIRPORT SITING ISSUES

The airport site evaluation issues considered in this study are summarized below. Each issue c 'gory corresponds to one or more general ç ions concerning the feasibility or desirability of an airport site alternative:

- Physical Site Constraints. What are the physical limitations of an airport site? Can the required facilities be accommodate? Are infrastructure needs such as local roads, utilities, and services available?
- Air Service Considerations. What types of air transportation services will be provided? Would providing services at the site be economical for air service operators?
- Aeronautical Considerations. Is an airport site compatible with other existing airports and the air traffic control system in the region? Are weather conditions and surrounding terrain suitable?
- Environmental and Land Use Impacts. Would an airport be compatible with surrounding communities and community plans? Would the environmental conditions at the site or in its vicinity be disturbed significantly?
- Development Costs. Can an airport site be developed economically?
- Effect on Capacity of Kahului Airport. How much relief of Kahului Airport would the new site provide (i.e., diversion of operations to a new site, freeing land at Kahului Airport for other uses, or reducing potential operations conflicts)?

AIRPORT SITE EVALUATION CRITERIA AND METHODOLOGY

The criteria by which airport site alternatives were evaluated are summarized in Table 7-1. These criteria are both quantitative and qualitative. Criteria were quantified wherever

TABLE 7-1
CRITERIA BY WHICH AIRPORT SITE ALTERNATIVES FOR MAUI WILL BE EVALUATED [a]

Issue	Criteria
1. Physical Site Constraints	1.a. Accommodation of required facilities 1.b. Availability and capacity of infrastructure 1.c. Availability of land for expansion 1.d. Topography and other physical constraints
2. Air Service Considerations	2.a. Restrictions on air service 2.b. Proximity to demand 2.c. Attractiveness to tenant businesses
3. Aeronautical Considerations	3.a. Airspace constraints 3.b. Meteorological impacts 3.c. Obstructions
4. Environmental and Land Use Impacts	4.a. Vegetation and wildlife 4.b. Aircraft noise and land use compatibility 4.c. Surface transportation 4.d. Other environmental impacts
5. Development Costs	5.a. Site acquisition, construction and mitigation costs 5.b. Costs not eligible for FAA funding
6. Effect on Capacity of Kahului Airport	6.a. Reduction in operations at Kahului Airport 6.b. Demand-capacity and delays at Kahului Airport 6.c. Areas at Kahului Airport made available for other uses

[a] Source: P&D Aviation.

possible. However, quantitative measures are not appropriate for many criterion descriptions. Presented below is a description of the criteria and the methodology used to develop the criteria measures, subject to the availability of data.

Physical Site Constraints

Criterion 1.a.: Accommodation of Required Facilities. The measure of this criterion is the identification of required airport facilities which cannot be accommodated at a site. The following methodology was used:

- Develop a list of facility requirements for each alternative airport concept for the year 2015. Facility requirements include land for airport facilities and runway protection zones, runways, helipads, aircraft parking ramps, navaids, building requirements, and vehicle access, circulation and parking (see Section 6).
- Based on the facility requirements, develop a typical airport concept plan for each alternative airport concept for the year 2015. The conceptual plan shows the airport runway, terminal area, access roads, airport boundary, runway safety area, and runway protection zones (see Section 8).
- Evaluate the capability of the proposed site to accommodate the facility requirements.

Criterion 1.b.: Availability and Capacity of Infrastructure. The measure of this criterion is the identification of necessary infrastructure improvements which are not available at a site. The approach is as follows:

- Determine the availability and capacity of local access roads to serve a site.
- Identify the availability and capacity of utilities to serve a site, including electrical, water, sewer, natural gas, and telephone.
- Identify the availability of public services to serve a site, including police protection and fire protection.

Criterion 1.c.: Availability of Land for Expansion. The measure of this criterion is the determination of the availability of suitable land for airport expansion beyond 2015. The methodology is:

- Determine if suitable land exists to expand the landside (terminal, aircraft parking and vehicle access and parking) areas beyond the year-2015 requirements.

Criterion 1.d.: Topography and Other Physical Constraints. This criterion is measured by the identification of site limitations imposed by the topography of the site or other physical conditions. The approach is:

- Compute the average slope of the site.
- Identify known or suspected geological problems.
- Identify other known or suspected physical site constraints.

Air Service Considerations

Criterion 2.a.: Restrictions on Air Service. The measure of this criterion is the identification of restrictions on the use of the airport by aircraft type, type of user or other limitations. The following methodology was used:

- Determine the type of service an airport will provide by classifying the airport according to the following categories of service:
  - Helicopter
  - Fixed-wing piston aircraft

  - Fixed-wing turbine-powered aircraft, including corporate jets and airline jets in air cargo service

- Identify other restrictions on air service to be provided by an airport.

Criterion 2.b.: Proximity to Demand. The measure of this criterion is the estimation of the proximity of airport users to an airport site. The following methodology was applied:

- Compute the ground travel distance between demand centers and an airport site.

Criterion 2.c.: Attractiveness to Tenant Businesses. The measure of this criterion is the evaluation of the suitability of the site to air service operators at a new site. The following approach was used:

- Identify the operational and economic advantages of a new site to air service operators who would be tenants, such as increased airport capacity, proximity to customers.
- Identify the disadvantages of a new site to prospective air service operator tenants, such as the investment required at the new site.

Aeronautical Considerations

Criterion 3.a.: Airspace Constraints. The measures of this criterion are (a) the identification of potential conflicts between a new site and an existing airport (particularly Kahului Airport) and (b) the relief of airspace congestion at Kahului Airport. The following approach was used:

- Identify projected air traffic delays and/or conflicts created by a new airport site, including conflicts in approach and departure patterns with Kahului Airport.
- Identify constraints on the operational capacity of a new site due to airspace conflicts.
- Evaluate the potential relief of airspace congestion at Kahului Airport as a result of Kahului Airport operations being relocated to a new site.

Criterion 3.b.: Meteorological Impacts. This criterion is measured by an estimate of the wind coverage percentage for a site location and runway configuration and an identification of known adverse wind, ceiling, and visibility conditions which would impact on airport operations. The methodology used is as follows:

- Analyze the wind rose for available data most applicable to a proposed airport site.
- Estimate the percentage of wind coverage for a proposed runway configuration. The wind coverage is the percentage of time the crosswind component at an airport is within acceptable standards for aircraft operations.
- Analyze available data relating to airport ceiling and visibility conditions.
- Identify adverse wind, ceiling, and visibility conditions, such as wind turbulence, fog, or smoke which could constrain airport operations.

Criterion 3.c.: Obstructions. The measure of this criterion is the identification of operational constraints caused by FAR Part 77 and TERPS (FAA Terminal Instrument Procedures) obstructions. The following approach was used:

- Determine the location of the Federal Aviation Regulations (FAR) Part 77 imaginary surfaces and TERPS approach and departure surfaces at an airport site.

- Identify terrain and/or objects (such as towers) that would penetrate the FAR Part 77 and TERPS surfaces based on runway configuration and types of instrument approach procedures.

- Evaluate the extent of penetrations. Determine constraints which would result in constraints on operations of an airport. Constraints could include flight track restrictions or limitations in the availability of instrument approach procedures.

Environmental and Land Use Impacts

Criterion 4.a.: Vegetation and Wildlife. This criterion is measured by the identification of threatened species or habitat which could be adversely affected by the development of an airport and prime agricultural land that would be taken out of production. The methodology is as follows:

- Identify any known rare or endangered species on or near an airport site. Data were obtained from the Nature Conservancy and other available sources.

- Identify known sensitive habitat areas such as wetlands, anchialine ponds, game management areas, and bird habitat ranges. Data were obtained from the State of Hawaii GIS data base and other available sources.

- Calculate the number of acres of prime agricultural lands required for airport construction, including runway protection zones.

Criterion 4.b.: Aircraft Noise and Land Use Compatibility. This criterion is measured by the estimated number of residential units and other noise-sensitive uses within the 65, 60 and 55 Ldn aircraft noise contours. The approach is as follows:

- Estimate the average number of daily operations for an airport by time of day, takeoff and landing flight tracks, type of aircraft to use an airport, and other requirements for estimating aircraft noise.

- Develop estimated Ldn noise contours for each study alternative for the year 2015 using the FAA's Integrated Noise Model.

- Estimate the number of residential dwelling units and other noise-sensitive uses within the 55, 60 and 65 Ldn noise contours.

- Identify and examine available community plans for an airport site to determine planned land uses in an airport vicinity.

- Identify land uses which are incompatible with existing or planned land uses.

- Identify farmland that would be taken out of production and compare with community plans and the Puunene development plan being prepared by the County.

Criterion 4.c.: Surface Transportation. The measure of this criterion will be the change in level of service (LOS) of roads adjacent to a new airport site resulting from the addition of airport-related traffic. The approach is:

- Identify the volume of vehicle activity related to airport activity.

- Obtain estimates of the future LOS of roadways affected by a new airport site.

- Determine improvements needed through the year 2015 to roadways serving an airport site as a result of the addition of airport-related traffic.

- Estimate the costs of improvements to roadways serving a new airport site based on airport activity in the year 2015.

- Estimate the 2015 LOS with the addition of airport-related traffic and with the roadway improvements necessitated by a new airport site.

Criterion 4.d.: Other Environmental Impacts. Other environmental considerations evaluated included historical and archaeological resources; energy supply and natural resources; hydrology, drainage and water quality; and aesthetics.

Development Costs

Criterion 5.a.: Site Acquisition Construction, and Mitigation Costs. This criterion is measured by the total costs of site acquisition, airport construction, and mitigation of environmental impacts. The approach is as follows:

- Estimate the total site acquisition cost in 1994 dollars including an allowance for acquisition and legal expenses.

- Estimate the costs of relocations of facilities at a new airport site, if applicable.

- Estimate the total airport construction costs to the year 2015 in 1994 dollars, including:
  - Site preparation and infrastructure costs
  - Airfield
  - Terminal area
  - Access roads to site
  - Vehicle circulation and parking
  - Design costs
  - Construction management costs
  - Administrative costs

- Estimate the costs, if any, of mitigating potential environmental impacts, including off-site improvements.

- Consider the requirements to buy out existing leases at Kahului Airport if tenants are forced to move before their leases expire. Consider phasing options which do not require tenants to move before their leases expire.

- Total all airport acquisition, construction and mitigation costs.

Criterion 5.b.: Cost Not Eligible for FAA Funding. This criterion is measured by the total of costs not eligible for FAA funding, under the FAA's Airport Improvement Program (AIP). The following approach was used.

- Estimate the total airport site acquisition, development and mitigation costs which are not eligible for FAA funding, allowing for the maximum funding by the FAA on projects eligible for AIP funding.

Effect on Capacity of Kahului Airport

Criterion 6.a.: Reduction In Operations at Kahului Airport. This criterion is measured by the number of operations at Kahului Airport in the year 2015 which would be diverted to a new airport. The following approach was used:

- Estimate the number of Kahului Airport operations in the year 2015 that could be relocated to a new airport. Operations could include general aviation, helicopter sightseeing tours and/or air cargo.

Criterion 6.b.: Demand-Capacity and Delays at Kahului Airport. This criterion is measured by the reduction in the demand-capacity ratio and aircraft operational delays at Kahului Airport caused by the relocation of aviation activity to a new site. The following approach was used:

- Obtain an estimate of the annual aircraft operations capacity at Kahului Airport.

- Estimate the annual operations demand-capacity ratio of Kahului Airport in 2015 with and without the diversion of operations to a new site.

- Estimate the annual hours of delay and the cost of delays at Kahului Airport in the year 2015 under each alternative.

Criterion 6.c.: Areas at Kahului Airport Made Available for Other Uses. The measure of this criterion is the number of acres of property at Kahului Airport which would be vacated due to relocations to a new site and which would become available for other tenants. The methodology is as follows:

- Determine the number of acres leased to general aviation users and helicopter operators at Kahului Airport which would be vacated upon their relocation to a new site.

USE OF EVALUATION CRITERIA

Options were identified for the potential relocation of three types of air service presently located at Kahului Airport: (1) helicopter tour operators, (2) general aviation users and operators which fly only piston aircraft (single and twin-engine), and (3) operators of turbine-powered aircraft by corporate users and air cargo operators. From these options, airport site/system alternatives were developed (see Section 8). System alternatives include the three existing Maui airports and a new site. A potential new site could serve one or more of the types of air service described above (which would be relocated from Kahului Airport) depending on the airport site alternative.

Potential sites for new airports were identified in two stages. At the first stage, alternative sites identified in the 1979 airport site selection study, as well as sites where airports existed previously, were reviewed and evaluated. Existing airports were also considered for the relocation of activities from Kahului Airport.

The first stage of analysis included a fatal flaw analysis in which sites were identified which should be eliminated due to problems associated with a new site which would prevent its use for an airport, or issues relating to an existing airport which would make it inappropriate for relocating activities from Kahului Airport. This first stage analysis focused on the following issues: physical site constraints, air service considerations, aeronautical considerations and environmental and land use impacts.

The second level of analysis consisted of an examination of the sites remaining from the first stage of study plus any new sites which were added on the basis of the consultants' investigations. A comprehensive analysis of these sites was undertaken, including site variations. The detailed evaluation of alternative sites was performed according to the methodology and criteria described in this section.

Section 8
AIRPORT SITE ALTERNATIVES

Edward K. Noda and Associates, Inc. • P&D Aviation • R.T. Tanaka Engineers, Inc

SECTION 8
AIRPORT SITE ALTERNATIVES

INTRODUCTION

In this section the need for a new general aviation airport is evaluated and alternative sites for a potential new airport are identified.

The first step in the consideration of alternative sites was to examine the existing and future demand for general aviation activity on Maui. Demand was compared with existing airport capacities and deficiencies in facilities were noted. Next, potential options for addressing future airport facility needs were evaluated. Existing airports and former airport sites, as well as airport sites considered in previous airport site selection studies were examined. Finally, a search was conducted for potential new sites for airports, including heliports, and some new sites were identified.

COMPARISON OF PROJECTED AVIATION DEMAND WITH CAPACITY

A summary of existing and projected demand for the three Maui airports is shown in Table 8-1. The demand summary includes based aircraft, annual passengers, and annual operations.

The Kapalua-West Maui Airport and Hana Airport will both easily be able to accommodate their projected demands over the next 20 years and beyond. Due to restrictions on the airport's operations, the Kapalua-West Maui Airport serves only commuter flights. Hana Airport has sufficient capacity to handle additional demands for commuter service, helicopter operations, and general aviation based aircraft and operations through the year 2015 and beyond.

Kahului Airport is the only airport of the three in which aircraft operations activity in the year 2015 will approach capacity. At Kahului the demand for T-hangars already exceeds capacity. Currently there is a waiting list of 13 aircraft for rental of one of the 30 T-hangars operated by the State. There are plans for additional hangars at Kahului Airport in the near future.

An important demand-capacity relationship is the ratio of fixed-wing operations (take-offs and landings) demand to airfield capacity. The 1993 operations demand-capacity ratio at Kahului Airport was 0.59. By 2015 the annual operations demand-capacity ratio at Kahului Airport is expected to increase to 0.91. Currently, approximately 40 percent of the Kahului Airport operations are by helicopters and approximately 18 percent are by fixed-wing general aviation aircraft.

The 1993 Kahului Airport Master Plan recommended a third runway to the east of and parallel to Runway 2-20 to be constructed in the 2003 to 2010 time period. The third runway would increase the annual operations capacity at Kahului Airport from 187,000 to between 250,000 and 410,000 operations, depending on how the parallel runways would be used.

However, the current State forecasts for Kahului Airport project a significantly slower growth in operations over the next 20 years than forecasts used for the 1993 Airport Master Plan. According to the current projections for Kahului Airport (Tables 5-1, 5-2 and 8-1), a third runway would not be needed until after 2015.

POTENTIAL ACTIVITY TO RELOCATE FROM KAHULUI AIRPORT

A possible solution for delaying or potentially eliminating the need for additional airfield capacity at Kahului Airport is to relocate certain

TABLE 8-1
DEMAND AND CAPACITY AT EXISTING AIRPORTS, 1993 to 2015

Description	Kahului Airport	Kapalua-West Maui Airport	Hana Airport
Airport Demand [a]			
Based Aircraft Demand (Fixed-wing)			
1993	50	0	0
2015	61	0	2
Annual Passenger Demand (Thousands)			
1993	5,360	307	18
2015	8,850	505	30
Annual Operations Demand (Fixed-wing)			
1993	114,300	23,000	11,000
2015	169,700	26,700	10,700
Airport Demand-Capacity Relationships			
Based Aircraft Capacity (Fixed-wing) [a]			
T-Hangars	30	0	0
Tie-downs	40	0	6
Total	70	0	6
Based Aircraft Demand-Capacity Ratio (Fixed-wing) [b]			
1993	0.71	0	0
2015	0.87	0	0.33
Annual Operations Capacity (Fixed-wing) [c]			
1993	193,000	200,000	200,000
2015	187,000	200,000	200,000
Annual Operations Demand-Capacity Ratio (Fixed-wing) [b]			
1993	0.59	0.12	0.06
2015	0.91	0.13	0.5

[a] Source: Hawaii Department of Transportation, Airports Division.

[b] Source: P&D Aviation analysis.

[c] Sources: Kahului Airport Master Plan, 1993; data for Kapalua-West Maui, and Hana Airports are P&D estimates.

segments of the Kahului Airport demand to one or more other airports. Shifting demand from Kahului could also provide near-term relief of the air traffic congestion which is currently being experienced there. Furthermore, relocating certain elements of aviation from Kahului Airport, such as helicopters and small general aviation aircraft, which have different flight characteristics from commercial jet aircraft has the potential of enhancing the safety of operations by segregating these different classes of aircraft.

The following categories of demand are considered candidates for possible relocation to another airport:

- ***Helicopters.*** Most helicopter activity at Kahului Airport is for sightseeing tours. However, helicopters also use the airport for medical transport, search and rescue, business and industrial (heavy lift operations) uses, government uses and flight training.

- ***General Aviation Piston Aircraft.*** Single engine and twin engine general aviation piston aircraft are used for a variety of activities including flight training, charter, aircraft rental, sightseeing, personal and business uses.

- ***Turbine Powered General Aviation Aircraft.*** A variety of turbo-prop and turbo-jet aircraft are used in corporate activity. Corporate aircraft typically consist of turbo-prop and business jets under 30,000 pounds gross weight.

- ***Inter-Island Air Cargo Service.*** Inter-Island Air Cargo operators fly commercial jets such as Boeing B737 freighters as well as smaller turbo-prop and piston aircraft such as Cessna cargo models.

  Although air cargo service does not fall into the general aviation category, it is considered in this study because the option of relocating air cargo service to another airport must be examined for the current Kahului Airport Environmental Impact Statement. The relocation of cargo service by commercial aircraft larger than B737 sized aircraft will not be considered in this study.

EVALUATION OF EXISTING AND FORMER SITES

Four categories of airports or sites were considered for the transfer of activity from Kahului Airport: existing airports, locations where airports existed in the past, sites proposed for new airports in previous studies, and new site locations. The first three of these categories are described below.

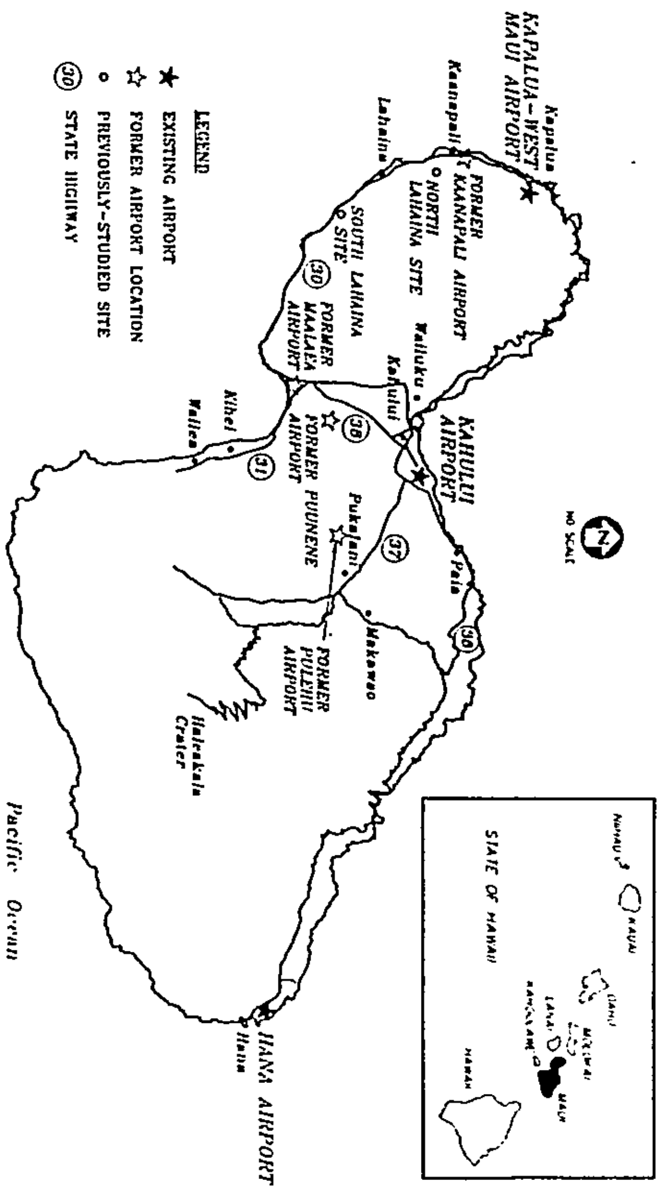
Existing Airports

In addition to Kahului Airport, Kapalua-West Maui Airport and Hana Airport are the only airports located on the island of Maui. The potential for either of these airports providing relief for Kahului Airport is described below.

Kapalua-West Maui Airport. The Kapalua-West Maui Airport, opened in 1987, was built and operated by Hawaiian Airlines (Figures 8-1 and 4-3. The airport was built to provide commuter service for visitors to the Lahaina-Kaanapali resort area. In 1993, the airport was acquired by the State, which has operated it since that time. In June 1994, there were 14 daily scheduled flights at the airport (all by Island Air).

The airport was permitted to be built and operated under the condition that certain operating restrictions would be placed on the airport. Such conditions included restrictions on expansion of the airport, hours of operation and noise level of aircraft. The zoning regulations for the airport's operation (as contained in Chapter 19.42 of the Maui County Code and

FIGURE 8-1
EXISTING AND FORMER AIRPORT LOCATIONS
AND PREVIOUSLY STUDIED SITES



Ordinance No. 1535 effective March 24, 1986) are as follows:

- "That the runway, runway apron and other facilities shall not be expanded, nor shall any portion of the runway safety area be paved or utilized for displaced landing or takeoff thresholds.
- That the concession area shall be limited to the 5,040 square feet designated in the revised plans and shall not contain more than one cocktail lounge, one snack bar, one restaurant and one newsstand.
- That the airstrip operations shall be limited to daylight hours (1/2 hour after sunrise and 1/2 hour before sunset)
- That there shall not be more than three car rental booths.
- That onsite parking or storage rental cars shall not be allowed....
- That all aircraft operated at the airstrip, including without limitation applicant's aircraft, and aircraft of licensees of applicant, shall have a current "Aircraft Type" or "Airworthiness" certificate or its equivalent issued by the Federal Aviation Administration ("FAA") certifying that such aircraft generates noise levels no greater than the following:

  (1) For propeller-driven aircraft of 12,500 pounds or less maximum FAA certificated takeoff weight only: The maximum allowable noise levels for "propeller-driven small airplanes" under Appendix F to Part 36, "Noise Standards: Aircraft Type Airworthiness Certifications," Title 14, Code of Federal Regulations (January 1, 1978), as the same may be amended from time to time, with noise levels measured and corrected as provided in such appendix, but in no event in excess of a noise level of 80 dB(A) measured pursuant to said Appendix F, and

  (2) For all other aircraft: The "Effective Perceived Noise Levels," as that term is defined in said Part 36, under conditions of "Takeoff," "sideline," and "approach," as those terms are defined in said Part 36, in units of "EPNdB," as that term is defined in said Part 36, measured as provided in said Part 36, as follows:

  (a) for takeoff: 80.5 EPNdB;
  (b) for sideline: 84 EPNdB; and
  (c) for approach: 91.6 EPNdB."

In addition to the zoning regulation outlined above, the State of Hawaii Administrative Rules (Hawaii Administration Rules, Title 19, Subtitle 2, Chapter 39, "Aircraft Operations at Kapalua Airport," March 30, 1994) impose restrictions on use of the airport. The following are the principal State limitations, not included in the zoning regulations, that restrict activity at the airport:

- "No person shall land, taxi or fly aircraft, or conduct any aircraft operations upon or from the Airport unless he or she has received permission for the operation from the director. All operation will be conducted in conformity with applicable Federal Aviation Regulations and this chapter.
- No helicopter operations shall be permitted at the Airport.
- Jet powered aircraft shall not be allowed at the Airport regardless of seating capacity or short takeoff and landing capabilities.
- Daily flights to the Airport shall not exceed thirty-five aircraft with seating capacities of twenty-five passengers or less and thirty-

five aircraft with seating capacities of between twenty-six and fifty passengers.

- Parking of aircraft on the Airport shall be limited to the loading and unloading of passengers and cargo. At no time shall parking exceed forty-five (45) minutes.
- Practice and training flights at the Airport are prohibited."

Although general aviation aircraft operations are not specifically prohibited, the provisions relating to "parking of aircraft" and "practice and training flights" effectively prohibit general aviation activity.

These Administrative Rules restrictions were, for the most part, included in the operating agreement between the Maui Land and Pineapple Company, Inc. and Hawaiian Airlines, the previous operator of the airport. The State agreed to retain these original airport restrictions that were established at the time the airport was developed.

The Kapalua-West Maui Airport continues to be used only for commuter aircraft flights. Because of the restrictions on the use of this airport, it could not accommodate the helicopter and general aviation activity at Kahului Airport which is being considered for relocation to another airport. Therefore, the Kapalua-West Maui Airport will continue to fulfill the role of providing only commuter passenger service for visitors to the west Maui resort area.

Hana Airport. The Hana Airport is located on the northeast shore of Maui, three miles west of Hana (Figures 8-1, and 4-2). The airport serves commuter passenger flights, helicopter and fixed-wing sight-seeing tours, and general aviation. In June 1994 there were four daily commuter flights (two by Island Air and two by Air Molokai) and no general aviation aircraft based at the airport.

Although Hana Airport has adequate facilities for handling some of the activity at Kahului Airport, the driving time from major demand centers to Hana Airport makes that airport impractical for relieving Kahului Airport. The 45-mile road from Kahului to Hana has a driving time of 2.5 hours. The road, which follows the shoreline along steep terrain, has numerous sharp curves and one-lane bridges. Therefore, Hana Airport is not considered a viable reliever for helicopter or general aviation activity at Kahului Airport. Hana Airport will continue in its present role of serving the commuter, sightseeing, and general aviation needs of the Hana area.

Former Airport Locations

Four sites have been identified where former airports were located on the island of Maui: the former Puunene Airport site, former Kaanapali Airport site, former Maalaea Airport site, and a former airport located southeast of Kahului Airport describes here as the former Pulehu Airport site (Figure 8-1). Each of these sites was investigated for its potential to provide helicopter and/or general aviation relief of Kahului Airport.

Former Puunene Airport. The former Puunene Airport site located approximately five miles south of Kahului was the site of Maui's commercial passenger service airport from approximately 1938 to 1952. In 1952 the former Puunene Airport was closed and Kahului Airport became the site of commercial passenger service for Maui. Aircraft operations were relocated because Kahului Airport became available when it was no longer needed by the U.S. Navy. Kahului Airport was located closer to the primary market area, which at that time was the Kahului-Wailuku area. From 1941 to 1948, the former Puunene Airport was operated by the U.S. Navy.

The State of Hawaii owns 1,875 acres of property that encompassed portions of the former Puunene Airport (Figure 8-2). Much of this land is currently leased to Alexander & Baldwin, Inc. for sugar cane production. A portion of the site is used as a drag strip and for other motorsport activities. Hawaiian Cement operates a facility on the eastern, non-contiguous portion of the State-owned property.

Some aviation activities remain at the site. Although most of the original airport facilities no longer exist, a crop dusting company operates one aircraft on a portion of pavement that remains. Additionally, helicopters commonly use the site for training activities such as landings, take-offs and low altitude hovering.

Because of its previous use as an airport, relative flat terrain, availability of state-owned property, and the accessibility to the existing highway system, the former Puunene Airport site was further examined as a site for a new airport to relieve Kahului Airport. Alternatives for the use of the former Puunene Airport site are described later in this section.

The County of Maui is currently studying future uses of the former Puunene Airport site. The intent is to promote the consolidation of various public and private facilities of an industrial nature and other compatible uses. Several uses have been considered by the County, including a regional transportation facility for the Maui Economic Opportunity, Inc., the Central Maui Sewage Treatment facility, a Maui Electric Company power generating station, U.S. Army National Guard facilities, motorsport activities (including the Maui Dragstrip), and a heliport and general aviation airport.

Former Kaanapali Airport Site. The former Kaanapali Airport was located on the beach in the Kaanapali area adjacent to Honokowa Point. The airport had a runway approximately 3,000 feet in length and an aircraft parking apron. The Kaanapali Airport provided commuter service to the Lahaina-Kaanapali area until January 1986. The Kapalua-West Maui Airport was opened in 1987.

There is now a public park at the south end of the airport site. Although there are major resorts immediately north of the airport site, the site has not been developed. Due to the park and resort development in the area the Kaanapali Airport site would not be appropriate for reactivation as an airport. Moreover, the Kaanapali Airport was replaced by the Kapalua-West Maui Airport largely because of conflicts with surrounding resort properties.

Former Maalaea Airport Site. In 1927 the territorial Legislature appropriated $15,000 for site acquisition for an airport on Maui. A site along Maalaea Bay was acquired and a dirt runway was prepared. First scheduled commercial service to Maui began on November 11, 1929. As the runway was dirt, the site was unusable in wet weather. In January of 1938 the site was condemned with interim operations being permitted until the new facility at Puunene was opened. The site has since reverted to agricultural uses.

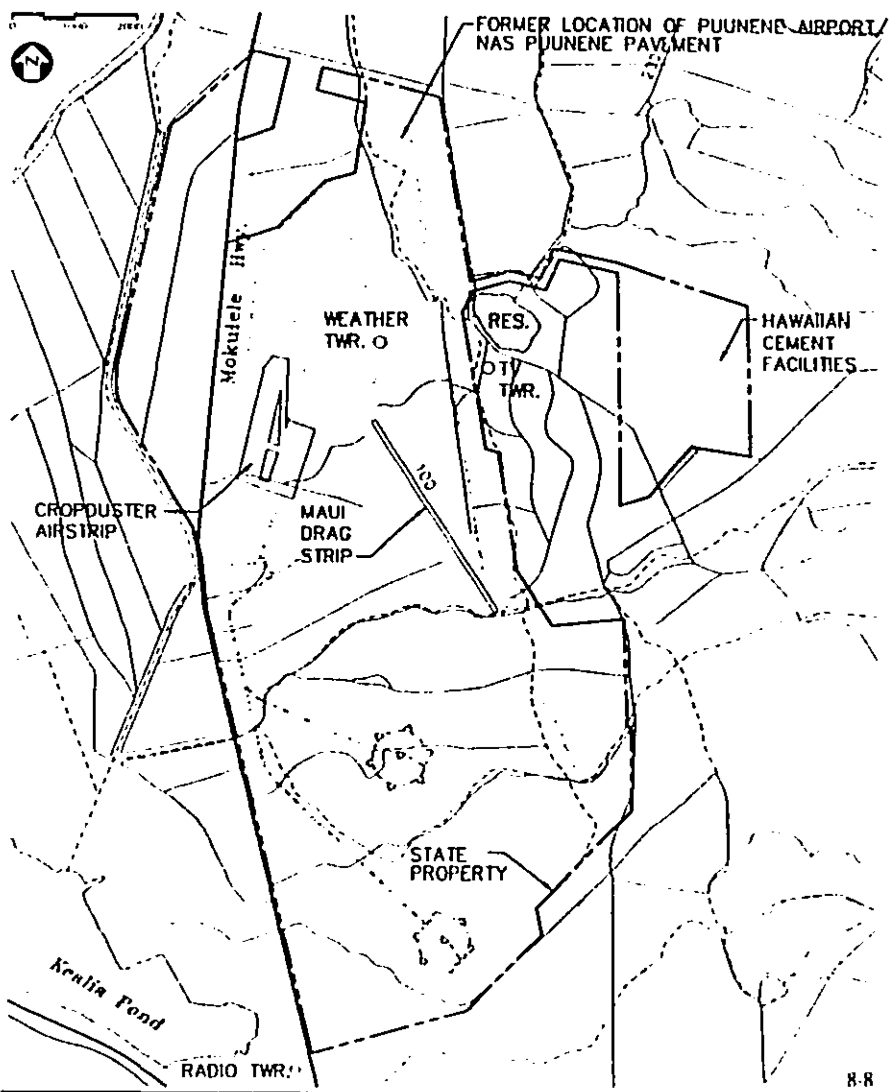
The Maalaea site would not be suitable for an airport today because of the nearness to the West Maui Mountains and the proximity to the approach paths to Kahului Airport.

Former Pulehu Airport Site. An airport was formerly located north of the intersection of Pulehu and Keahua Roads approximately 5.4 miles southeast of Kahului. The airport had two runways, the longest being approximately 1,000 feet in length. The former airport site is now entirely in sugar cane production. This site would not be suitable for the development of an airport to relieve Kahului Airport due to steep terrain and the need for a larger site than was needed for the former airport.

Previously Proposed Sites

In airport site selection studies conducted in the

FIGURE 8-2
FORMER PUUNENE AIRPORT SITE



1970s, two airport sites were evaluated and proposed for airport development in the Lahaina area.

North Lahaina Airport Site. In a 1970 general aviation study, the State of Hawaii evaluated the potential for locating a new airport above Kaanapali at approximately the 475-foot elevation (Figure 8-1). A 4,000 foot runway was investigated, which could have been extended to 6,700 feet. The airport site is currently in sugar cane and coffee production.

The north Lahaina airport site was ultimately rejected due to conflicts with resorts and other development along the coast. For this reason, the site is not considered to be practical for fixed-wing aircraft operations. Although the site could potentially serve helicopters, it is not well located with respect to the main helicopter touring areas on the east side of the island. Furthermore, the site is located far from visitors in the Kihei-Wailea area.

South Lahaina Airport Site. In 1979 a site for a new airport was proposed at the south end of Lahaina. The proposed site (Figure 8-1) was located on the east of State Route 30, across from Launiu Poko State Park. The proposed site was at an elevation of approximately 20 to 80 feet. The area is now in sugar cane production.

The site was rejected because of its proximity to development at the south end of Lahaina and concerns over disturbance of whales and other marine life. For these reasons and because Launiu Poko State Park and beaches are adjacent to the site, the south Lahaina site would not be viable as an airport site to relieve Kahului Airport.

REACTIVATION OF PUUNENE AIRPORT

A 1991 Circuit Court Stipulation required that the joint federal and State of Hawaii EIS currently being conducted "... also consider reactivation of Puunene Airport on a temporary basis for night aircraft use during the period of time required to implement the (Kahului Airport) runway strengthening project." This subsection addresses the option of "reactivating" Puunene Airport.

Current Status of Former Puunene Airport Property

The former Maui Airport at Puunene (Puunene Airport) was the site of Maui's commercial passenger service airport from approximately 1938 to 1952, except for the period from 1941 to 1948. During this period, the airport was greatly expanded and developed by the Navy and was operated as Naval Air Station (NAS) Puunene. After Puunene Airport closed in 1952, the site was essentially abandoned and facilities began to deteriorate.

Today, 1,200 acres of the original 1875-acre site are under sugar cane production. The primary airport buildings have been demolished or are not in a usable condition. The only airfield pavement that visibly remains (sections of the original pavement may have been covered with dirt) is a portion of one runway operated as a dragstrip and a portion of an apron area used as a short runway for a crop-dusting operator. The location of former facilities operated as NAS Puunene are shown in Figure 8-2. No portion of the original airfield pavement would be suitable for fixed-wing aircraft operations (including small, general aviation aircraft) on a regular basis. In essence, the Puunene Airport no longer exists except as a former airport site.

Potential for "Reactivating" the Airport

There are no facilities at the Puunene site suitable for "reactivating" for temporary use, as suggested by the 1991 Court Stipulation. However, the alternatives described below include options for constructing an airport at the Puunene site. The costs of developing a new airport (described in Section 9, Evaluation of

Alternatives) would effectively prohibit the use of the Puunene site on a temporary basis, during the period of time required for the Kahului Airport runway strengthening project.

NEW AIRPORT TYPES CONSIDERED

Three types of new airports were considered for relocating activity from Kahului Airport. The three categories differ substantially in size and the types of activity which they would accommodate. The airport types are a heliport, a utility airport and a transport airport. Each category of airport would accommodate one or more of the types of service which were identified earlier which potentially could be relocated from Kahului Airport to another site.

New Heliport

The heliport facilities at Kahului Airport consist of two take-off and landing areas and approximately 15 acres occupied by helicopter tenants and vehicle parking. The helicopter tenant area provides space for parking helicopters based at the airport, aircraft maintenance, administration and customer service areas.

The established requirements for the year 2015 for a new full-service heliport site are four take-off and landing areas, with a total of approximately 60 acres for the airfield, tenant area, vehicle parking and necessary airport support services (Table 6-6). Support services could consist of any of the following: airport rescue and fire-fighting, aircraft fueling, airport maintenance and administration, air traffic control or unicom, and airport security.

New Utility Airport/Heliport

The Utility Airport would serve virtually all general aviation single engine and twin engine piston aircraft. It would have a runway length of approximately 3,550 feet at zero elevation and no runway gradient. A total area of 390 to 510 acres (Tables 6-7 and 6-8) would be provided for the airfield, general aviation tenants, airport support services, and vehicle parking and access. An airport of this size would provide the general aviation utility aircraft needs through the year 2015.

A new utility airport could accommodate only fixed-wing aircraft, or it could also contain the heliport facilities described in the previous subsection to serve fixed-wing aircraft and helicopters. Both these options were considered.

New Transport Airport/Heliport

The transport airport would accommodate turbine-powered corporate aircraft and air cargo flights with aircraft as large as the B737, as well as all aircraft activity accommodated by the utility airport. A runway length of 6,000 feet would be required to accommodate the corporate aircraft and inter-island air cargo flights (based on zero runway gradient at sea level). The transport airport would require a total of 710 acres, including land for runway protection zones (Table 6-9).

POTENTIAL NEW AIRPORT/HELIPORT SITE ALTERNATIVES

After careful consideration of existing airports, former airport locations and previously proposed sites, the only site in these categories that emerged as a potential reliever for Kahului Airport is the former Puunene Airport site. In the discussion that follows, alternative airport sites are described including several configurations at the former Puunene Airport and two new site locations.

Alternative 1 consists of operating the existing system of airports on Maui. No new sites would be developed and existing airports would be expanded to accommodate the necessary growth.

Alternative 1A: Relocation of Kahului Helicopter Facilities to the East

Under Alternative 1A, the helicopter facilities at Kahului Airport would be relocated to the east on property adjacent to the Airport which would be acquired for the relocated facilities. The acquired property would become part of Kahului Airport, and, therefore, this option does not include a new site.

A variation of this alternative would be to relocate the helicopter facilities to existing airport property immediately east of the present heliport site. This alternative would have the advantage of not requiring the expansion of A'port property, and helicopter activity there v 1 have greater visibility by the air traffic co..rol tower.

Alternative airport sites which are being considered in this study for relieving Kahului Airport are described below. Forecasts of airport activity of each site are described in Section 5.

'ternative 1B: New Limited-Service Heliport at Unspecified West Maui and/or Puunene Sites

Alternative 1B consists of developing a new limited-service heliport at an unspecified West Maui and/or Puunene site. Under this alternative, new landing areas could be established at either or both sites as necessitated by demand and other market-driven economic forces. A limited-service heliport would be used only to enplane and deplane helicopter tour passengers. Unlike a full-service heliport, it would not have facilities to maintain helicopters or keep them overnight. In this concept, a small passenger terminal would be developed which would be shared by all tour operators using the facility.

For purposes of this study, it is assumed that, under this alternative, the limited-service heliport would be located in the west Maui area.

No specific site location has been identified.

Alternative 2: New Heliport at South End of Former Puunene Airport Site

Under Alternative 2, a new heliport would be constructed along the southeast border of state-owned property at the former Puunene Airport site (Figures 8-3 and 8-4). Four takeoff and landing areas would be located in a linear alignment with the extended center line of Runway 2-20 at Kahului Airport. The southerly takeoff and landing area would be located 5.8 miles from the proposed (extended runway) landing threshold for Runway 2-20 at Kahului Airport. The heliport would be separated from the extended centerline of Runway 2-20 by 3.0 miles. Access to the site would be from Mokulele Highway (State Highway 35).

The heliport site has the advantage of being centrally located with respect to the Kihei-Wailea and Lahaina-Kaanapali tourist areas. It is also near the Kahului-Wailuku area. The heliport site has good highway access and is entirely on State-owned property. Traffic patterns for the heliport would be east of the site, which would avoid the Kahului Airport approach paths and provide direct access to helicopter touring sites located on the east side of Maui.

Alternative 3: New Heliport Located on the East Side of the Former Puunene Airport

In Alternative 3, a new heliport would be built on the east side of the former Puunene Airport site (Figures 8-5 and 8-6). This site would be 5.0 miles south of the proposed future landing threshold to Runway 2-20 at Kahului Airport. The heliport would be 2.4 miles from the extended centerline of Runway 2-20 at Kahului Airport.

This site would have essentially the same advantages as under Alternative 2. Although

FIGURE 8-3
ALTERNATIVE 2 AREA: NEW HELIPORT
AT SOUTH END OF FORMER PUUNENE AIRPORT SITE

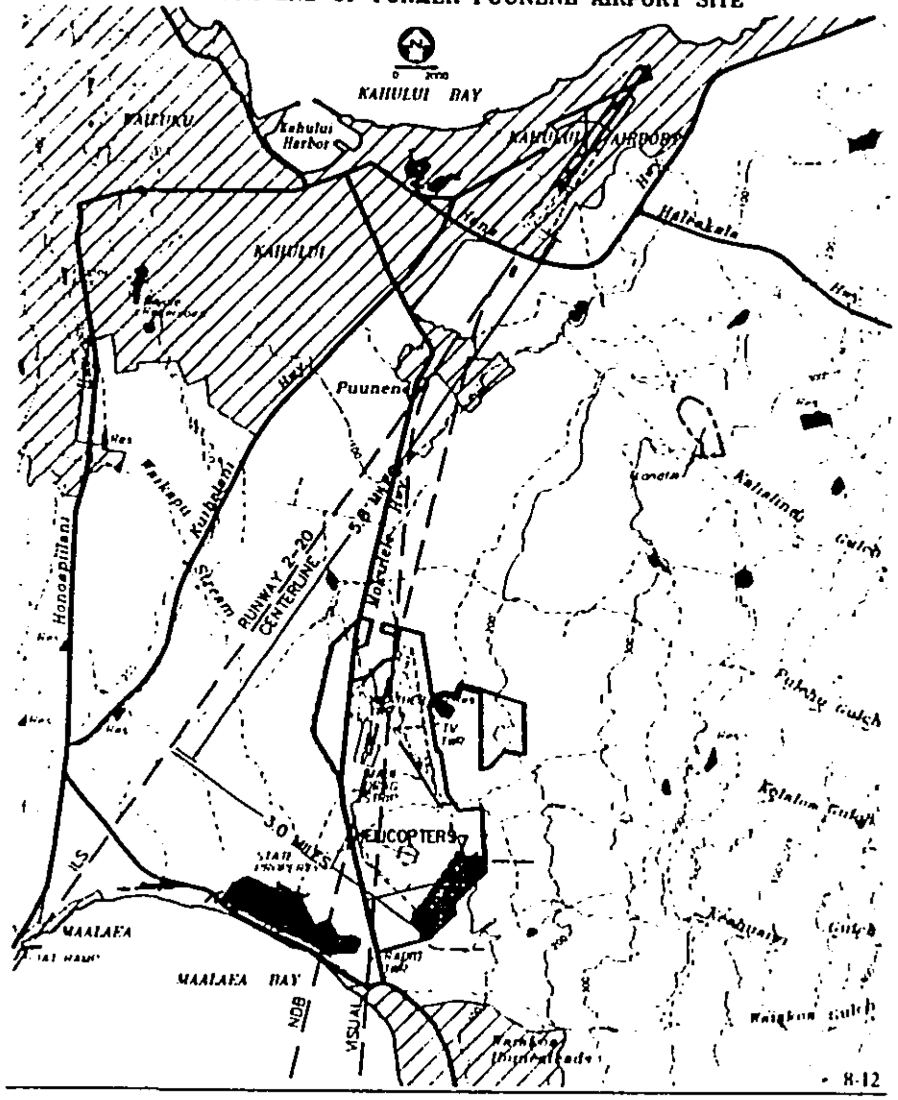


FIGURE 8-4
ALTERNATIVE 2 SITE: NEW HELIPORT
AT SOUTH END OF FORMER PUUNENE AIRPORT SITE

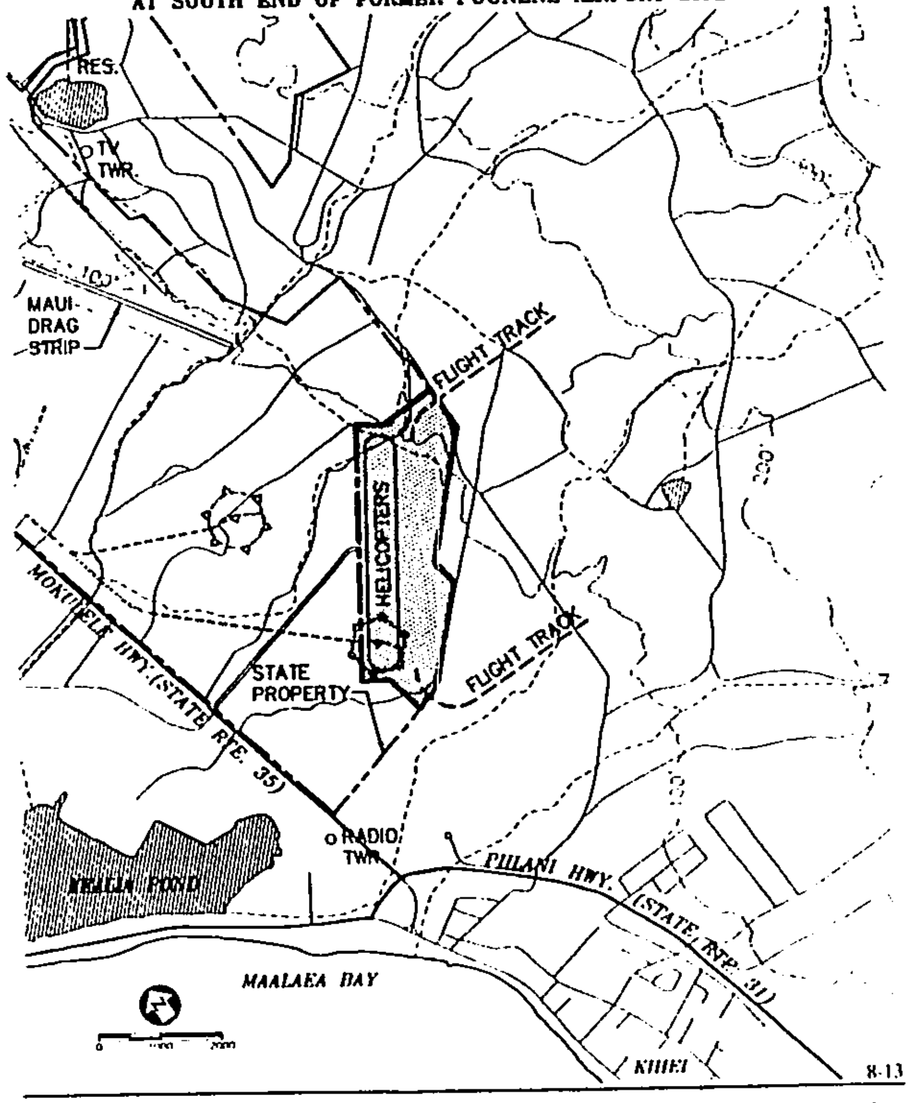


FIGURE 8-5
ALTERNATIVE 3 AREA: NEW HELIPORT
AT EAST END OF FORMER PUUNENE AIRPORT SITE

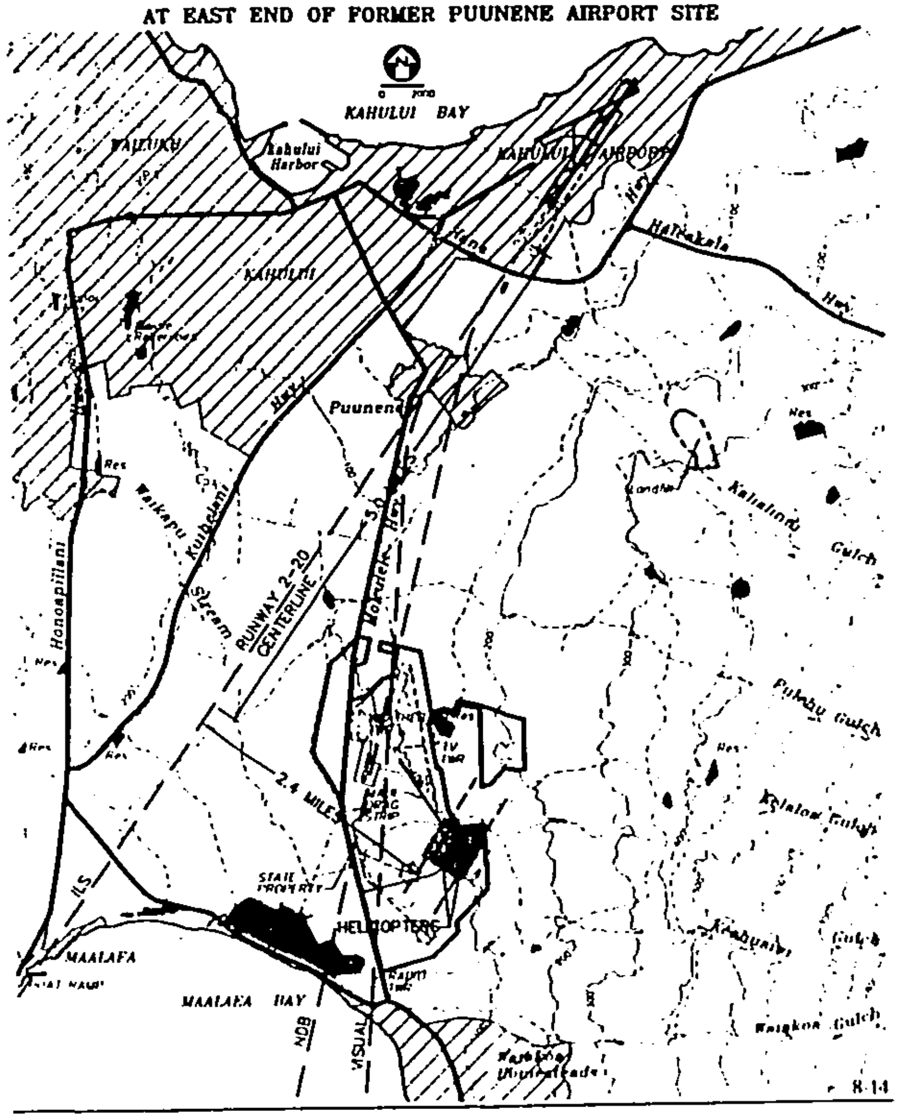
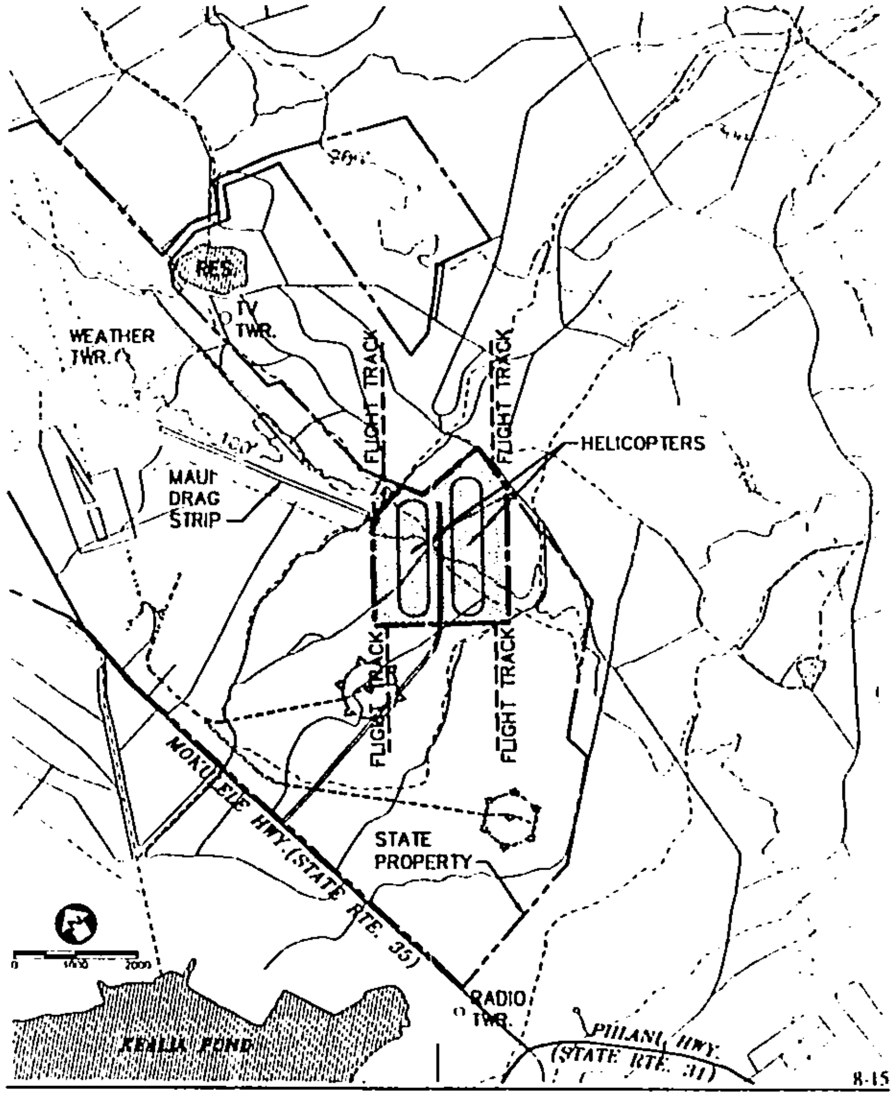


FIGURE 8-6
ALTERNATIVE 3 SITE: NEW HELIPORT
AT EAST END OF FORMER PUUNENE AIRPORT SITE



the site would have less impact on the development in the Kihei area, it would be 0.6 miles closer to the approach to Runway 2-20 at Kahului Airport. While the Alternative 3 site would be located closer to the Maui drag strip, neither operation would be expected to interfere with the other.

Alternative 4: New Utility Airport/Heliport at Former Puunene Airport Site

Alternative 4 is a new combined utility airport and heliport which would be constructed at the former Puunene Airport site (Figures 8-7 and 8-8). The airport would be located at the center of the former airport site to obtain the maximum separation from the Kahului Airport flight tracks yet not impact unfavorably on the developed areas at Kihei. Some lands outside the state-owned properties would need to be purchased, primarily for the Runway Protection Zones. The south runway threshold would be located 5.2 miles from the proposed extended south threshold of Runway 2-20 at Kahului Airport would be parallel with a centerline separation of 2.1 miles.

The Alternative 4 site has the advantage of being located mostly on state-owned property and within close proximity to Mokulele Highway (State Highway 35) connecting Kahului with Kihei. As under Alternatives 2 and 3, this site is within easy access to the primary resort areas of Kihei-Wailea and Lahaina-Kaanapali. It is also within easy access of the Kahului-Wailuku area.

The site slopes upward to the northeast and the runway, under Alternative 4, would have a gradient (slope) of 1.1 percent. A runway length of 3,800 feet would be needed, which is 250 feet longer than the nominal 3,550 foot requirement because of the runway gradient. Although the terrain to the northeast of the airport would penetrate some of the FAR Part 77 surfaces, these penetrations would not interfere with the operation of the airport. The surrounding terrain would allow precision instrument approaches to the airport from the north and the south.

The runway would intersect a stream at midfield (Kolaloa Gulch). This gulch could be bridged or relocated along the south end of the runway. The Maui drag strip must be relocated under this alternative. One approach to minimizing this relocation would be to retain the northwest portion of the drag strip and extend it to the northwest. Alternative 4 could require the relocation of a TV tower at the north end of the site and a radio tower at the south end adjacent to Mokulele Highway. Also it is likely that the cropduster activity would have to be relocated.

Alternative 4A: New Utility Airport at Former Puunene Airport Site

This alternative, a variation of Alternative 4, consists of developing a utility airport without a heliport at the former Puunene Airport site (Figures 8-9 and 8-10). All helicopter activities would remain at Kahului Airport under this concept. With the exception of the lack of helicopter facilities, the type and location of improvements for the alternative are the same as Alternative 4. Moreover, the relocations required under Alternative 4 would apply to this alternative.

Alternative 5: New Utility Airport/Heliport North of Kihei

Under this alternative a new utility airport/heliport would be built at approximately the 600 foot elevation north of the Kihei area (Figures 8-11 and 8-12). The runway would be located between Keahuaiwi and Kolaloa Gulches and would intersect Waiakoa Road. The south threshold of the Alternative 5 runway and the extended Runway 2-20 at Kahului Airport would be separated by 3.9 miles. The runway centerlines would be laterally separated by 5.2 miles.

This site has the advantage of greater separation

FIGURE 8-7
ALTERNATIVE 4 AREA: NEW UTILITY AIRPORT/HELIPORT AT FORMER PUUNENE AIRPORT SITE

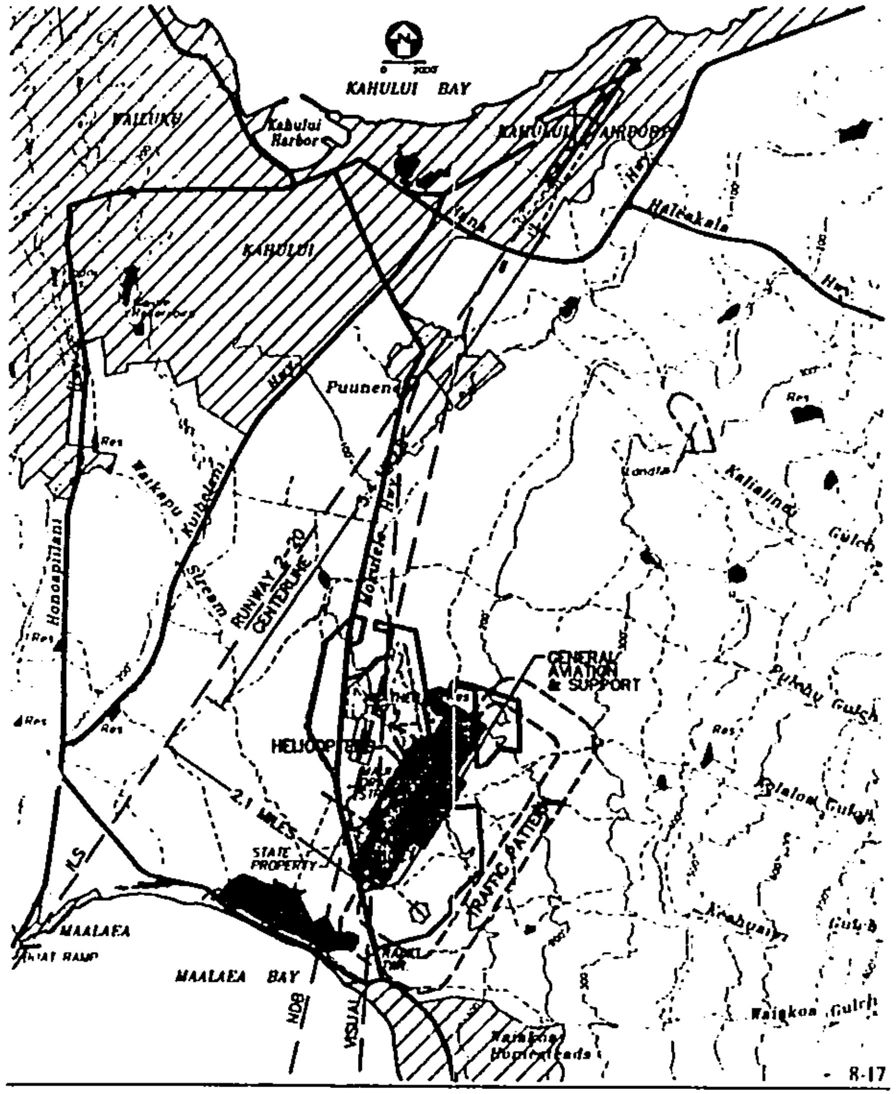


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FIGURE 8-8
ALTERNATIVE 4 SITE: NEW UTILITY AIRPORT/HELIPORT AT FORMER PUUNENE AIRPORT SITE

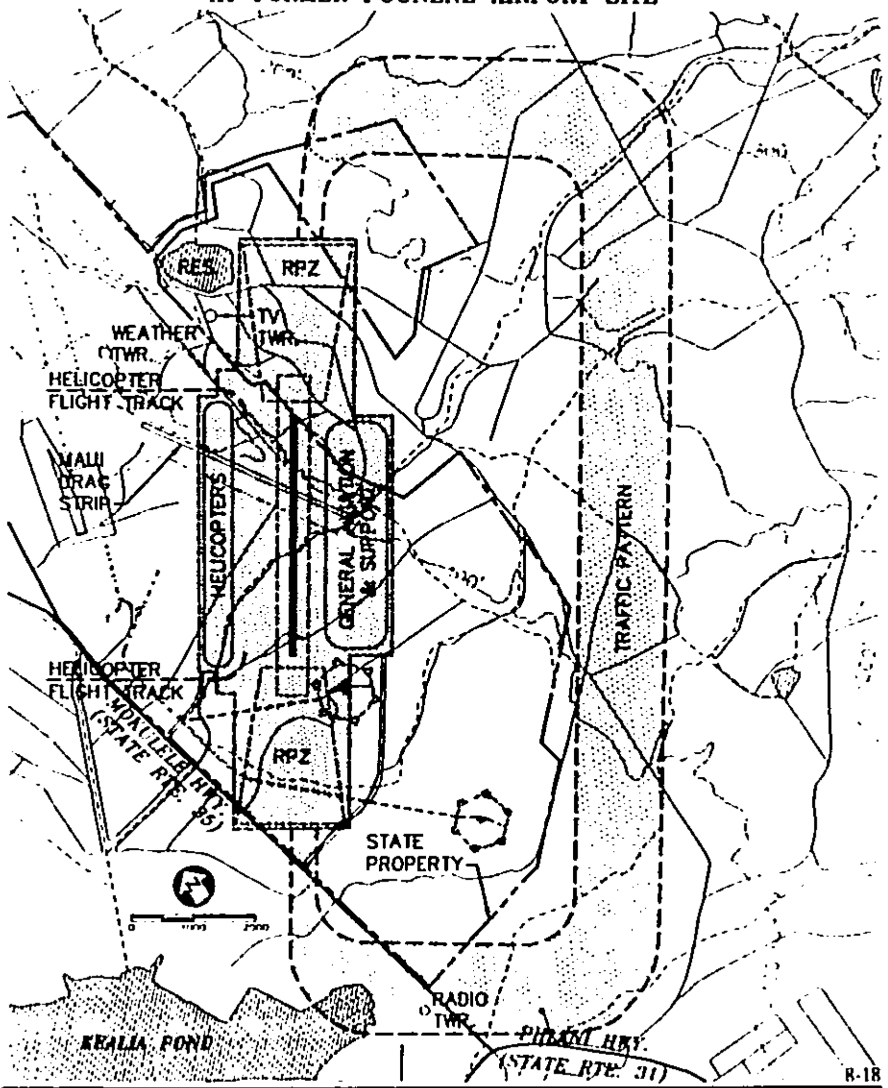

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FIGURE 8-9
ALTERNATIVE 4A AREA: NEW UTILITY AIRPORT AT FORMER PUUNENE AIRPORT SITE

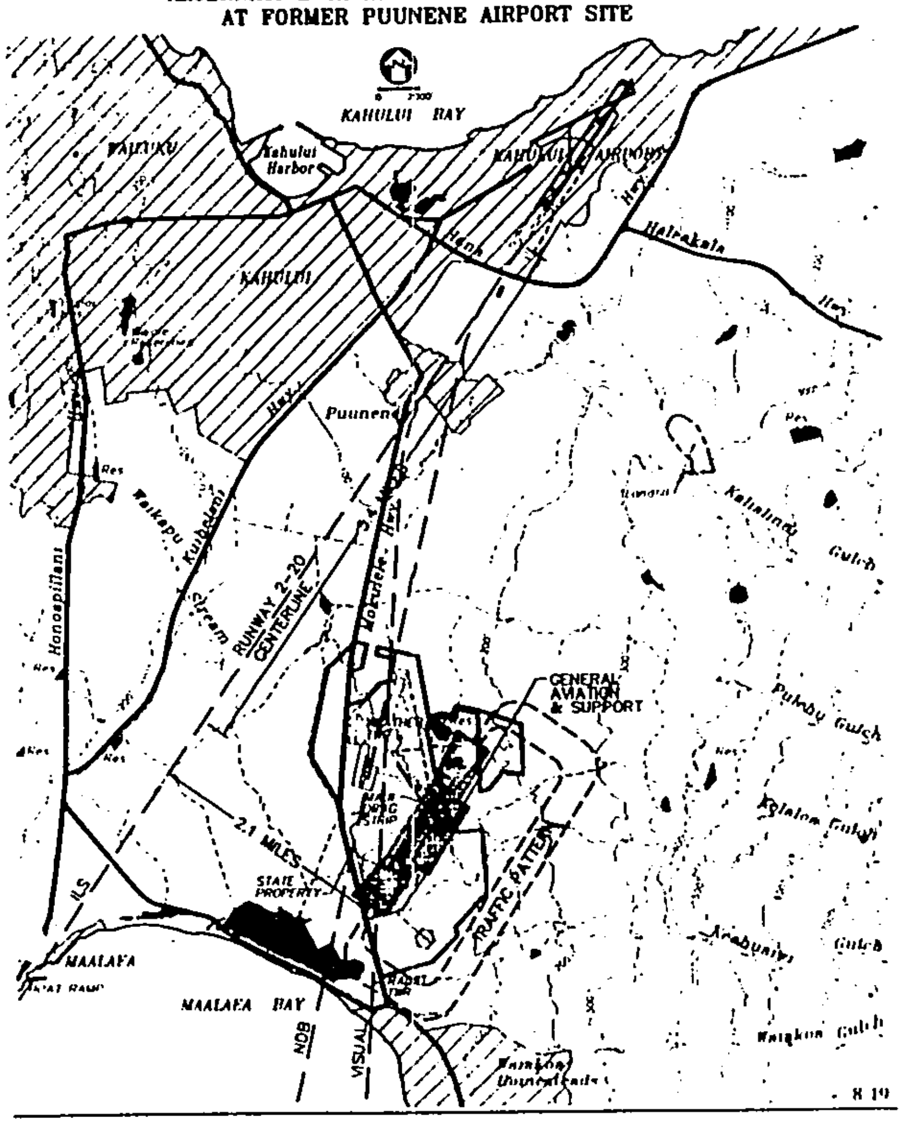

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FIGURE 8-10
ALTERNATIVE 4A SITE: NEW UTILITY AIRPORT AT FORMER PUUNENE AIRPORT SITE

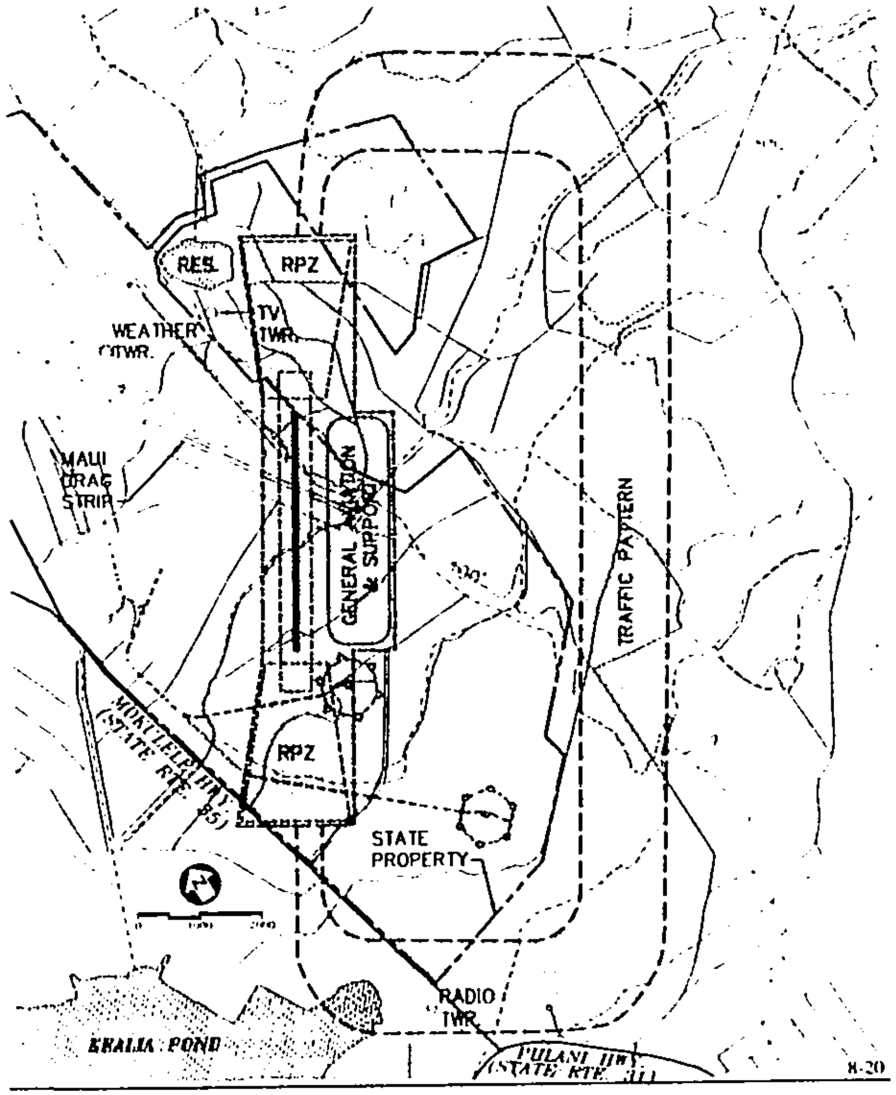
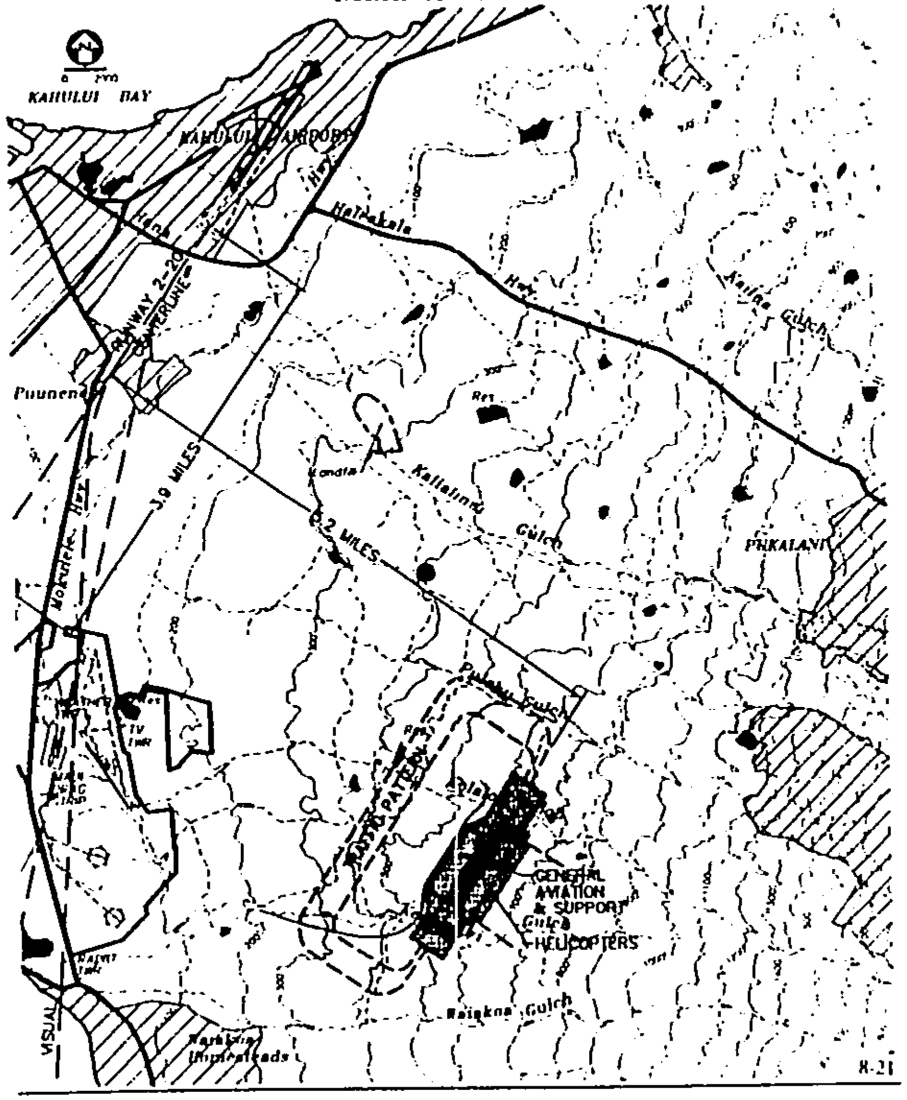
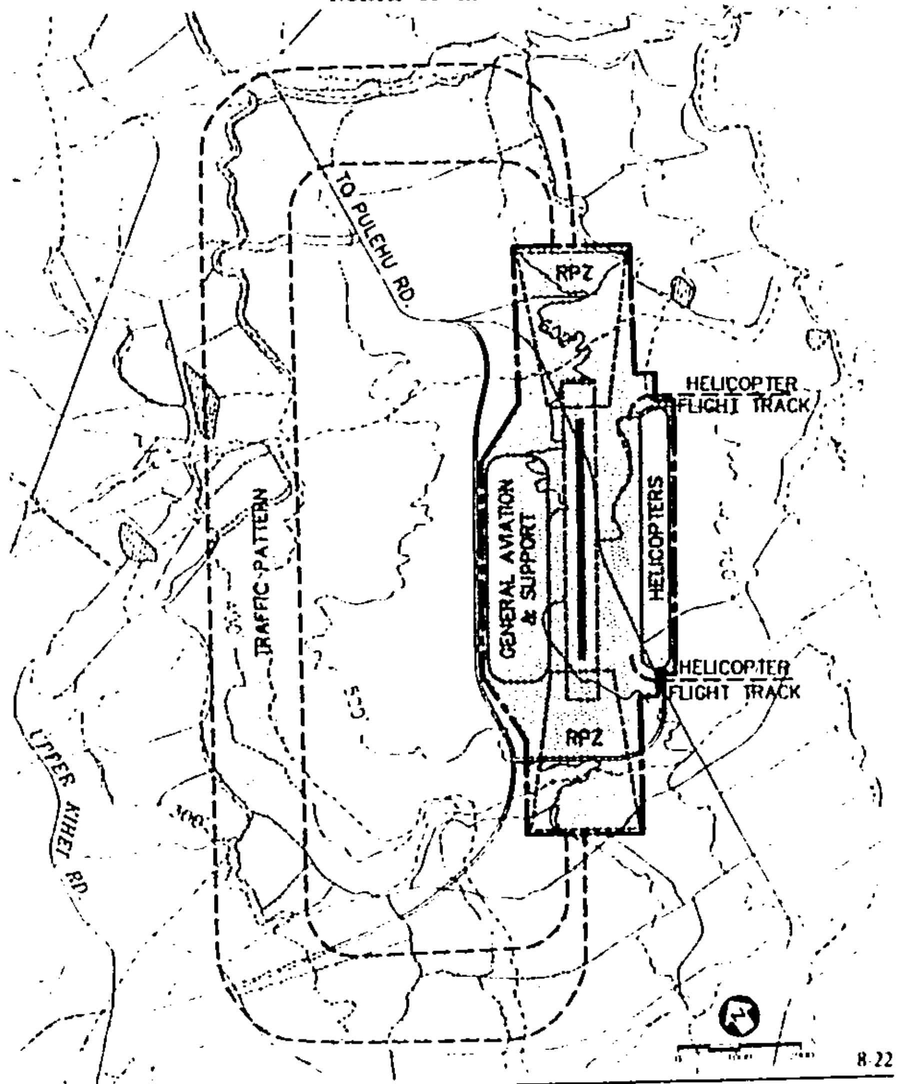


FIGURE 8-11
ALTERNATIVE 5 AREA: NEW UTILITY AIRPORT/HELIPORT
NORTH OF KIHEI



Maui General Aviation Study — Hawaii Department of Transportation, Airports Division

FIGURE 8-12
ALTERNATIVE 5 SITE: NEW UTILITY AIRPORT/HELIPORT
NORTH OF KIHEI



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from the flight paths at Kahului Airport. Furthermore, aircraft noise and overflights at the site would not impact developed area. However, the site is not served well by the existing roadway system. A new paved access road of approximately three miles would be necessary to connect the site with State Highway 31 in the Kihei area.

A new upcountry highway, which could potentially provide access to the Alternative 5 site, is under study. Although a proposed alignment for the highway has not been identified, it would generally connect the upcountry area from Pukalani to Kula with Haleakala Highway and/or Piilani Highway.

The terrain at the site rises to the southeast. There would be approximately a zero runway gradient at this site. A runway length of 3,800 feet would be required, which is slightly greater than the recommended standard due to the increase in elevation. Although the terrain rises rapidly to the east of the site, the traffic pattern would be located west of the site. This would provide better separation between helicopter and fixed-wing aircraft flight tracks. Although there would be penetrations to some FAR Part 77 surfaces the penetrations would not restrict the use of the airport and precision instrument approach systems could be located on both runway ends. All property for the airport at this site is privately owned.

Alternative 6: New Utility Airport/Heliport East of Kahului

Alternative 6 is a new utility airport/heliport located east of the Kahului-Wailuku area immediately south of the Haleakala Highway (Figures 8-13 and 8-14). This runway would be separated laterally 3.3 miles from the Runway 2-20 centerline at Kahului Airport. The south threshold of the Alternative 6 runway would be located approximately 1,200 feet north of the extended south threshold of Runway 2-20 at Kahului Airport. This site has the advantages of good accessibility from a major highway and close proximity to the Kahului-Wailuku area. Moreover, the aircraft noise and overflights at the site would not impact developed areas. All land for this site is privately owned.

The runway would be located between 360 and 380 feet in elevation. The 0.6 percent runway gradient and elevation would require a 3,800 foot runway at this site. Terrain generally rises to the south and east of the site. Although some FAR Part 77 surfaces would be penetrated by terrain, use of the airport would not be restricted and precision instrument approach systems could be provided on both runway ends.

Alternative 7: New Heliport and New Utility Airport at Former Puunene Airport Site

In this alternative, a new heliport and new utility airport would be developed at separate locations on the former Puunene Airport site (Figures 8-15 and 8-16). The heliport would be located on the east side of Mokulele Highway on State-owned property at the north end of the site. The utility airport would be located at the southern end of the site, mostly on State property. Land would need to be obtained from private parties for portions of the runway protection zones.

Alternative 7 has the advantages of being located almost entirely on State-owned property and providing maximum separation between helicopter and fixed-wind aircraft traffic. However, the traffic pattern for the airport would overfly development in the west Kihei area. The cropduster activity must be relocated under this alternative due to the proximity of the new heliport.

The utility airport site rises to the east, resulting in a runway gradient of about 1.4 percent. A general utility runway length of 3,900 feet would be needed at this site. The traffic pattern

FIGURE 8-13
ALTERNATIVE 6 AREA: NEW UTILITY AIRPORT/HELIPORT EAST OF KAHULUI

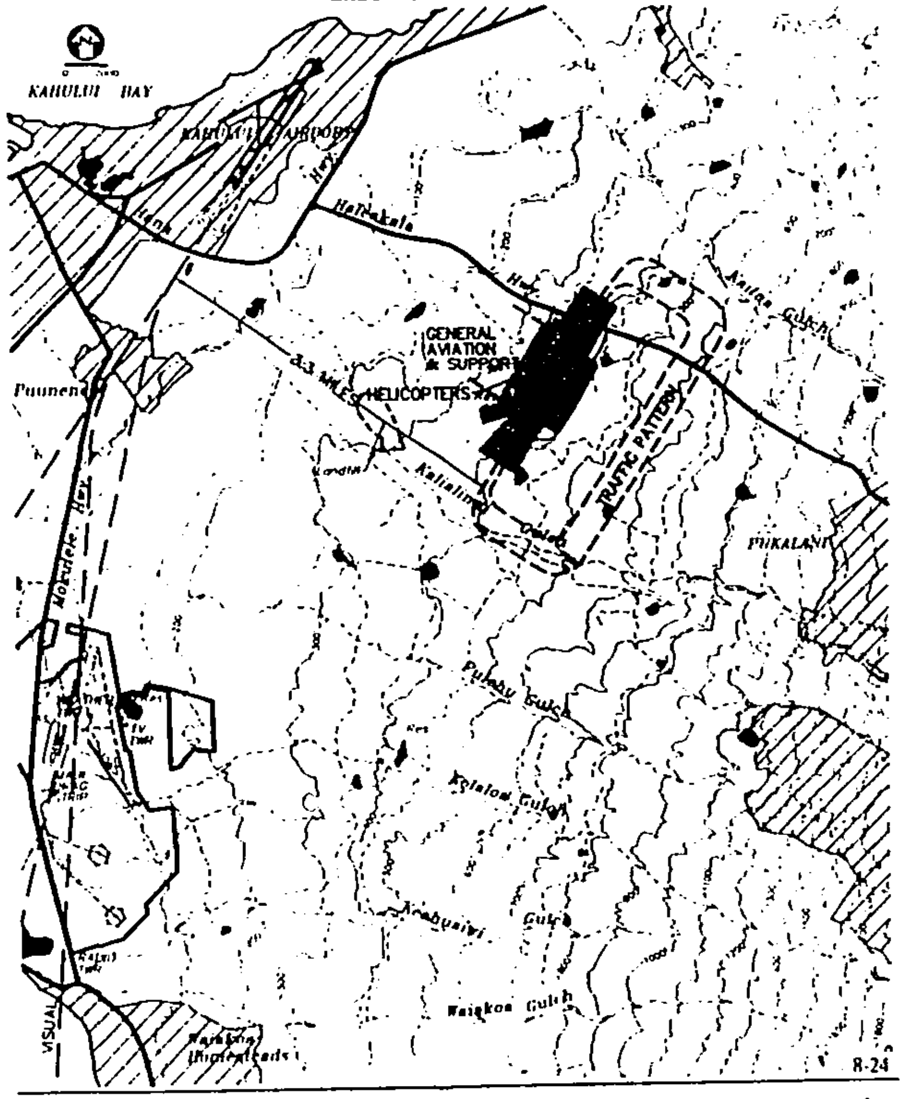

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FIGURE 8-14
ALTERNATIVE 6 SITE: NEW UTILITY AIRPORT/HELIPORT EAST OF KAHULUI

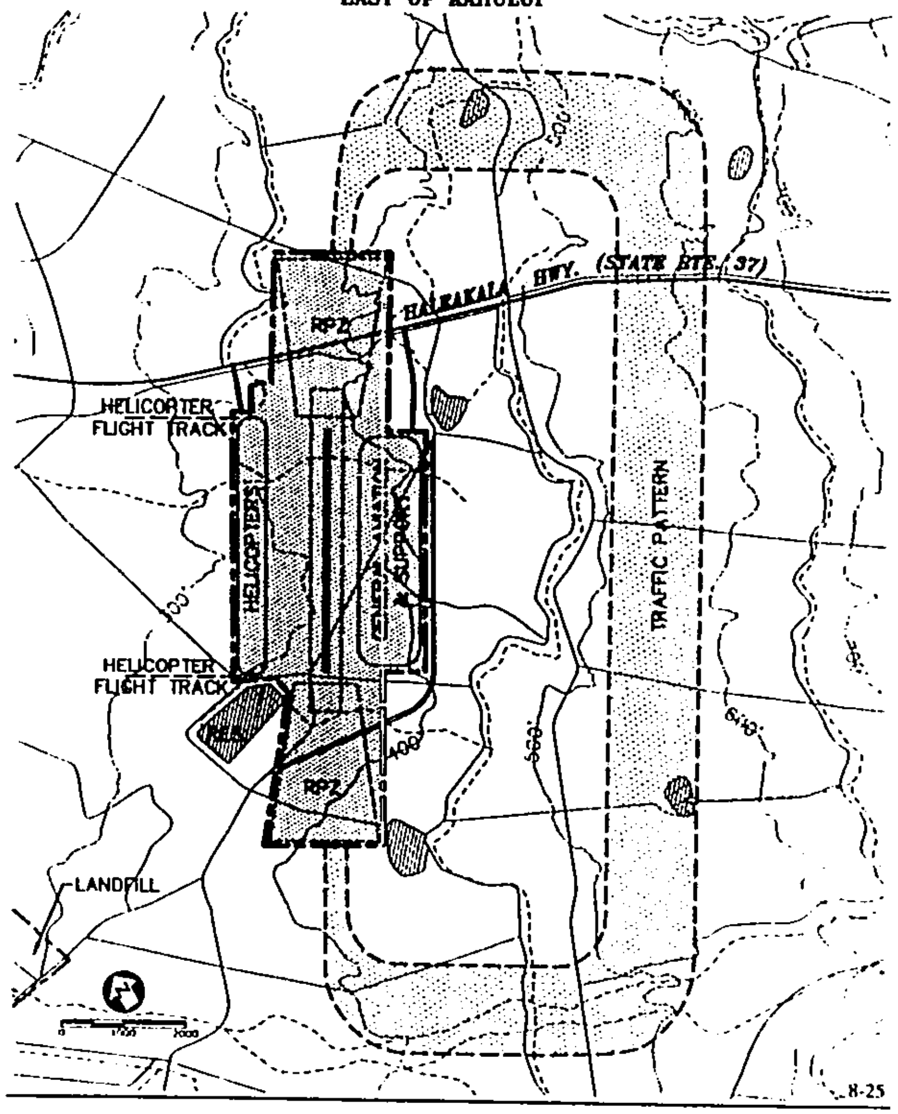

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FIGURE 8-15
ALTERNATIVE 7 AREA: NEW UTILITY AIRPORT AND NEW HELIPORT AT FORMER PUUNENE AIRPORT SITE

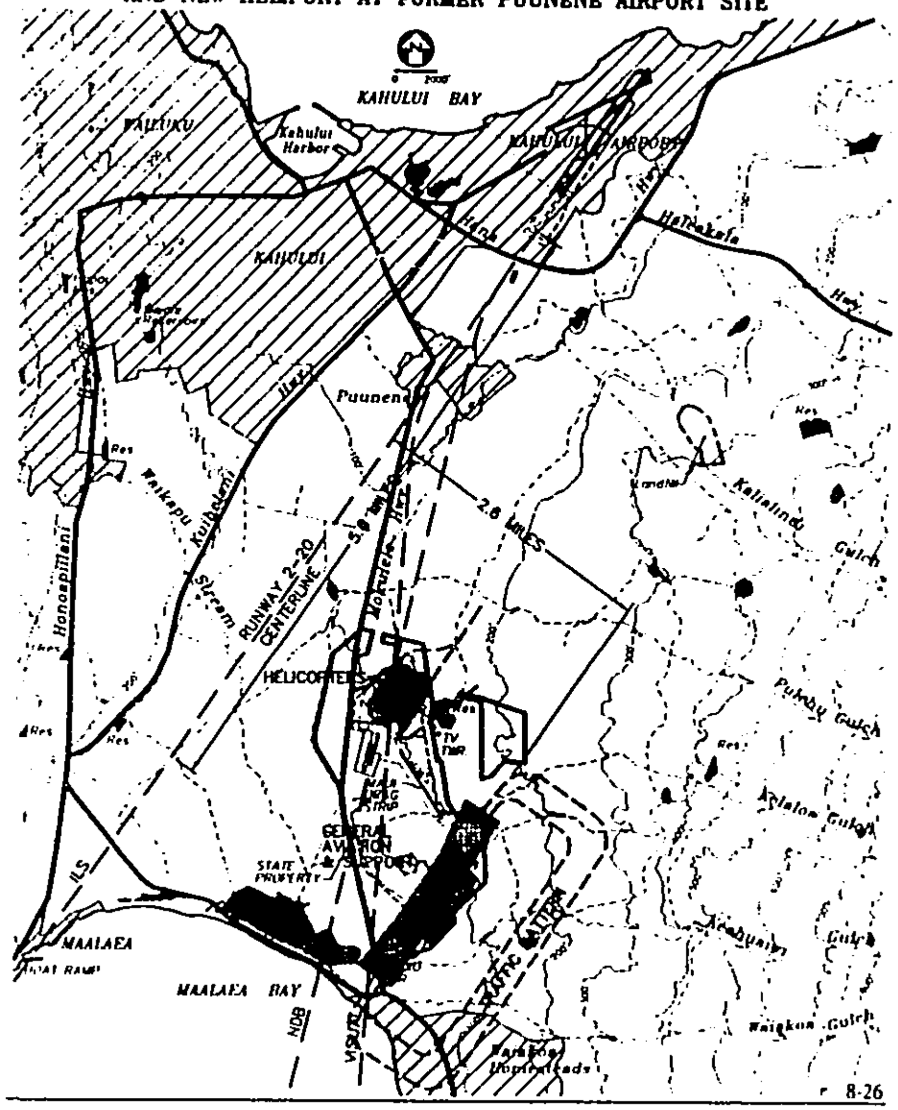
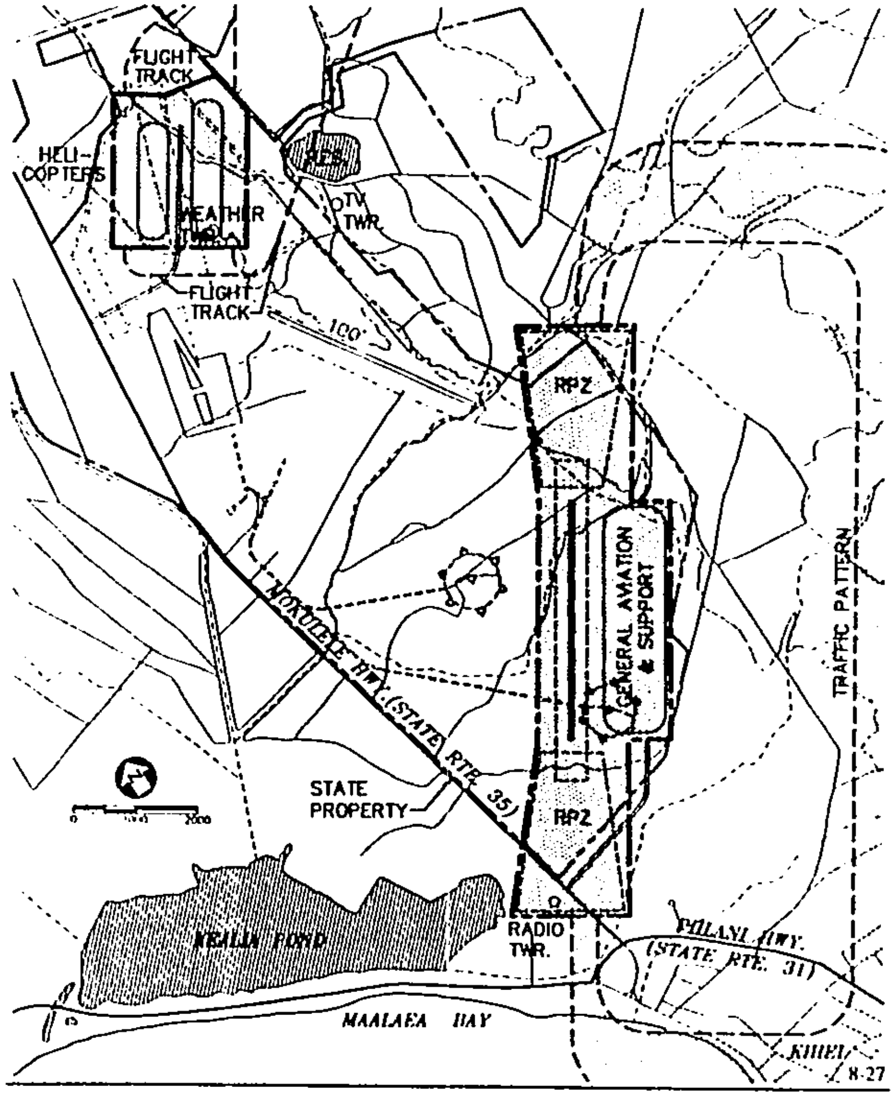


FIGURE 8-16
ALTERNATIVE 7 SITE: NEW UTILITY AIRPORT AND NEW HELIPORT AT FORMER PUUNENE AIRPORT SITE



would be located east of the site to maximize the separation from the Kahului approach path. Penetrations to FAR Part 77 surfaces would not restrict the use of the airport and precision instrument approaches could be installed at both runway ends.

Alternative 8: New Transport Airport at Former Puunene Airport Site

Under this alternative, a new transport category airport would be built on the former Puunene Airport site (Figures 8-17 and 8-18). The transport airport would accommodate turbine-powered corporate aircraft activity and air cargo flights with aircraft as large as the B737, as well as all activity accommodated by the utility airport/heliport sites. The 1991 Court Stipulation requires that this study investigate the feasibility of "night cargo operation[s]" at Puunene. The investigation of Alternative 8 satisfies this requirement. However, cargo operators fly both day and night and it would not be economically feasible for a cargo operator to maintain separate cargo handling facilities for nighttime departures only. It is therefore assumed that the airport site under Alternative 8 would be used for both day and night cargo activity.

A related issue is that transferring cargo activity to the new airport would be inefficient for carriers which operate both passenger and all-cargo service, because cargo is shipped on passenger flights as well as all-cargo flights. Although relocating cargo activity to another site, would be an economic hardship to those carriers, for purposes of this study it is assumed that such a split would be economically feasible for the airlines.

The southwest end of the Alternative 8 runway would be in the same location as the runway under Alternative 4. The transport runway would have a gradient 1.3 percent and therefore must be 6,600 feet long. Alternative 8 would require the use of more state-owned property and would necessitate greater acquisition of private property than Alternative 4.

In other respects, Alternative 8 would be similar to Alternative 4 and the discussion of relocations and other effects of Alternative 4 would generally apply to this alternative.

SUMMARY

The new site alternatives described above include three new heliport alternatives (Alternatives 1B, 2 and 3), four new utility airport alternatives (Alternatives 4, 4A, 5 and 6), one alternative with a new heliport and new utility airport at separate locations (Alternative 7), and one new transport airport alternative (Alternative 8). These alternatives were evaluated on the basis of the criteria and methodology described in Section 7. The evaluation criteria are:

- Physical Site Constraints
- Air Service Considerations
- Aeronautical Considerations
- Environmental and Land Use Impacts
- Development Costs
- Effects on Capacity of Kahului Airport

The next section describes the results and conclusions of this evaluation process.

FIGURE 8-17
ALTERNATIVE 8 AREA: NEW TRANSPORT AIRPORT/HELIPORT AT FORMER PUUNENE AIRPORT SITE

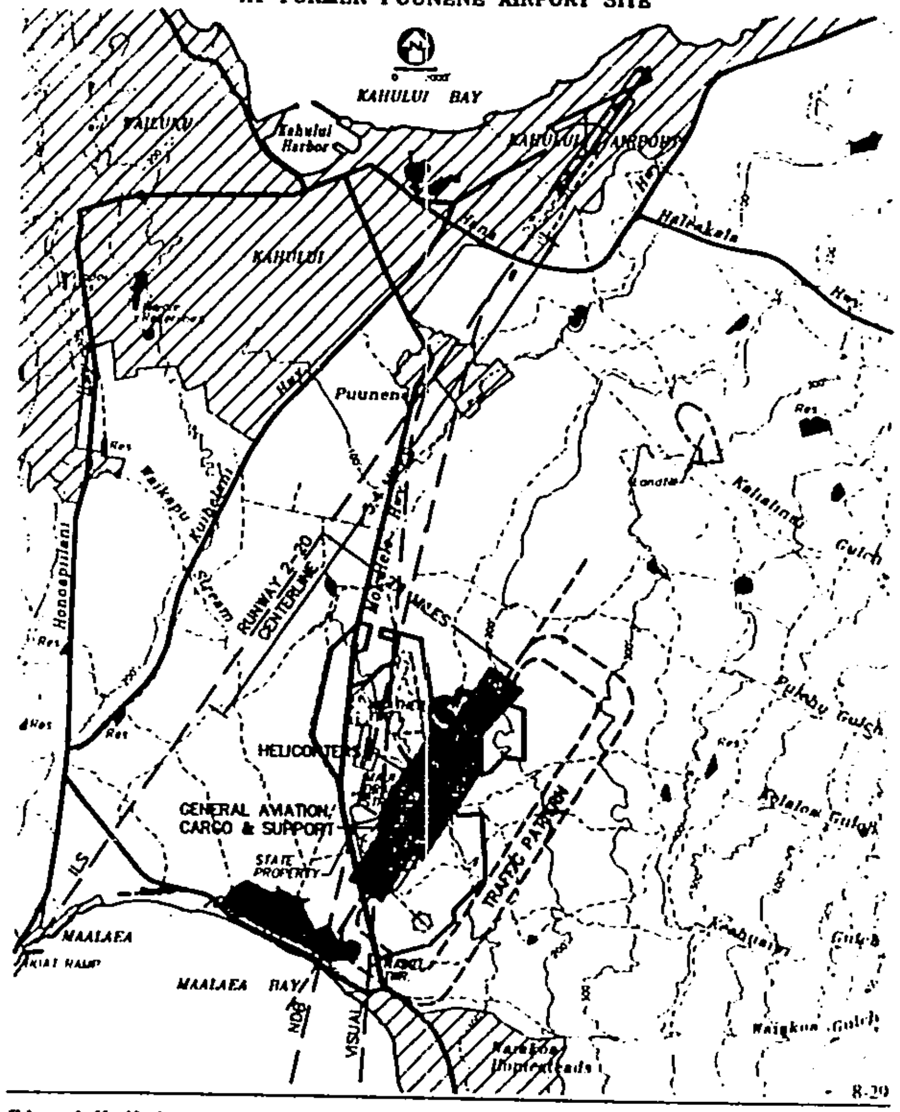
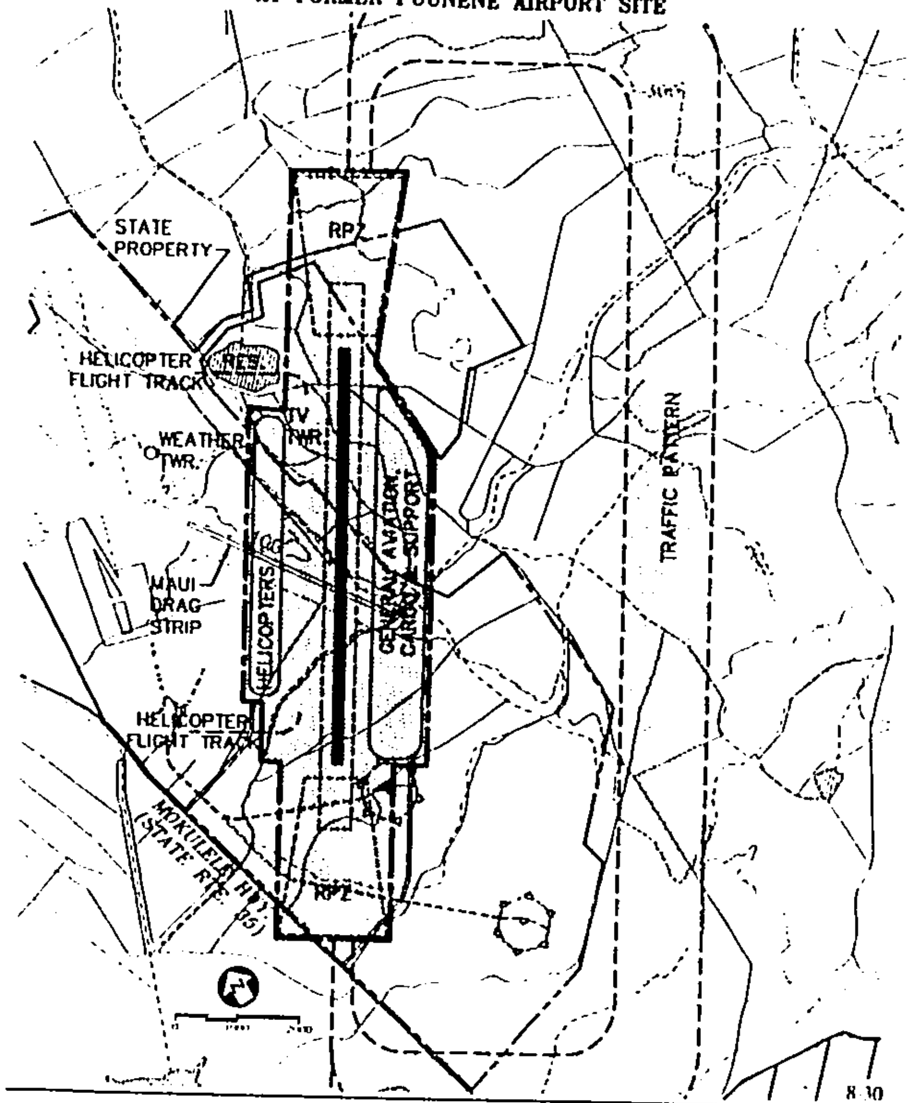


FIGURE 8-18
ALTERNATIVE 8 SITE: NEW TRANSPORT AIRPORT/HELIPORT AT FORMER PUUNENE AIRPORT SITE



Section 9
EVALUATION OF ALTERNATIVES

SECTION 9
EVALUATION OF ALTERNATIVES

INTRODUCTION

This section describes the evaluation of the site alternatives identified in Section 8. The site alternatives evaluated included site alternatives developed in this study and alternatives suggested by aviation operators and the County of Maui.

The development and evaluation of site alternatives was influenced to a large degree by comments received during public meetings held for this project in May, July and December 1994. Site alternatives consist of heliports (serving only helicopters), general utility airports (serving fixed-wind general aviation piston aircraft), airport/heliport combinations (serving helicopters and fixed-wing general aviation aircraft) and a transport airport (serving helicopters, piston and turbine power general aviation aircraft and all-cargo jets).

In addition to the site alternatives described here, Section 10 addresses airport system alternatives. System alternatives consider the system of airports on Maui and the needs and options for operating the group of airports as a whole. System alternatives are particularly concerned with the relationships between demand and capacity of Kahului Airport and any new airport and/or heliport.

The site evaluation criteria and methodology applied in this section are discussed in Section 7. The criteria are grouped according to the following categories: physically site constraints, air service considerations, aeronautical considerations, environmental and land use impacts, development costs and affects on capacity of Kahului Airport. The subsections which follow describe the results of this evaluation.

PHYSICAL SITE CONSTRAINTS

Accommodation of Required Facilities

In Section 6, Facility Requirements, a tabulation of the required facilities for each type of airport and/or heliport alternative was presented. Facility requirements were developed for the initial phase of development (assumed to be the year 2000) and the year 2015. The facility requirements include land for airport facilities and Runway Protection Zones, runways, helipads, aircraft parking ramps, navaids, building requirements, utilities, vehicle access and vehicle parking.

Based on these facility requirements, a concept plan was developed for each site alternative. These are included in Section 8, Airport Site Alternatives. The concept plans provide for the accommodation of all projected aviation activity at the site through the year 2015 and allow for expansion of aviation growth at the site well beyond 2015.

New site alternatives were selected only if the site would accommodate the requirements for 2015, allowing ample space for expansion. Therefore, all site alternatives would accommodate the required aviation facilities.

Availability and Capacity of Infrastructure

As all the alternative sites are substantially undeveloped, infrastructure improvements would have to be made to accommodate proposed development. Issues that were addressed are access roadways, public utilities, and police and fire protection.

Access Roadways. As noted all the alternative sites are substantially undeveloped and would require access roadway improvements.

All the alternatives, with the exception of Alternative 5, are located in relatively close proximity to existing major roadways, and projected access roadway lengths range from 2,400 feet to 6,700 feet. Alternative 5, due to its location northeast of Kihei, requires an access roadway length of approximately 35,000 feet in order to link to the existing roadway system.

It is anticipated, based on projected levels of surface traffic, that a 24 feet wide, two-lane roadway would provide adequate levels of service for all the alternatives.

Electricity. Electricity on Maui is provided by the Maui Electric Company. Review of existing data and consultation with the Maui Electric Company indicates that there are no significant problems supplying electricity to any of the alternative sites. While connections would have to be made to the existing electrical grid and on-site distribution systems developed, no significant barriers to service have been identified.

Water. Potable water on Maui is supplied by the County of Maui. Review of the existing distribution system and consultation with the County have indicated that serving the sites does not present any significant issues in terms of capacity. As with electrical service, a connection would have to be made to the existing water distribution system and an on-site distribution system constructed. In addition, a water storage tank for domestic use and fire protection would be constructed as a part of site development. The required size of the tank would vary but is based on a requirement for 2 hour/ 2,000 gallon per minute fire flow plus domestic flow. The provision of water storage facilities has been accounted for in the development of the various alternatives.

Sewer. Sewer service on-site would be handled by an individual treatment facility and leach field. All the proposed alternatives have adequate area to accommodate development of these facilities.

The closest Maui County sewerage system is located on Kihei Road which is approximately 8,000 feet from the closest alternative. Connection to the system does not appear to be practical.

Drainage System. The provision of drainage systems has been reviewed and each alternative includes adequate land area for the installation of a drainage collection system and, if necessary, an on-site retention basin. As such, there are no significant issues with regard to drainage for any of the alternatives.

Retention basins for the onsite runoff are recommended for the Puunene site alternatives because of possible adverse effect on Kealia Pond. The existing upstream runoff will continue to flow into Kealia Pond.

Telephone. Telephone service on Maui is provided by Hawaiian Telephone. As with other utilities, no significant issues have been identified that might inhibit service to the various sites. As with other utilities, connection to the existing system and on-site improvements would have to be made.

Police/Fire Protection. Police and fire protection on Maui are provided by the County of Maui. While the provision of police protection services is not anticipated to cause any significant impact, airfield facilities are required by the FAA to have specific levels of fire protection services based on number operations and aircraft types using the facility. Section 6 identifies facility requirements for the various alternatives and includes provisions for various levels of ARFF (Airport Rescue and Fire Fighting) facilities based on FAA requirements. As such, the provision of adequate fire protection services is not a significant issue.

Summary. In summary, there do not appear to be any significant issues with regard to the development of necessary access roadways, public utilities, and police/fire protection for any of the alternatives.

Availability of Land for Expansion

Alternative 2. This alternative places only helicopter operations at the southeasterly corner of the former Puunene Airport site. With this concept there is ample State-owned land available to the west at the old airport site to double or triple the size of facilities dedicated solely to helicopter operations.

Alternative 3. This alternative is similar to Alternative 2 in placing only helicopter operations at the site of the former Puunene Airport. The alternative places the helicopter facility along the easterly boundary of the former airport site. As with Alternative 2 there is ample State-owned land available for expansion of dedicated helicopter facilities to the south and west.

Alternatives 4 and 4A. Alternative 4 places a new utility airport designed to accommodate both general aviation and helicopter operations. Alternative 4A involves the development of a new utility airport without a helicopter facility. With the proposed runway alignment, the area of State-owned land available for runway expansion is limited to the northeast, but more than 2,000 feet are available to the southwest. There is State-owned land available to both the southeast and northwest of the proposed runway that would accommodate expansion of both general aviation and helicopter support facilities.

Alternative 5. Involving the development of a new utility airport/heliport north of Kihei, this alternative requires the use of land currently under private ownership. Any expansion of either runway area or support facilities would require the acquisition of currently privately-owned lands.

Alternative 6. Involving the development of a new utility airport/heliport east of Kahului along the Haleakala Highway, this alternative requires the use of land currently under private ownership. Any expansion of either runway area or support facilities would require the acquisition of currently privately-owned lands. In addition, the Haleakala Highway presents a physical barrier to expansion to the northeast.

Alternative 7. This Alternative involves the placement of a new utility runway for general aviation activities and a separate heliport facility at the former Puunene Airport site. The utility runway would be placed at the southerly end of the site with the heliport being placed at the north end of the site.

With regard to the possible expansion of the general aviation facility, land for minor runway extensions would be available to both the northeast and the southwest. In addition, there is ample State-owned land to the northwest of the proposed runway for the expansion of support facilities.

Significant expansion of the heliport facilities is quite feasible within the confines of State-owned land.

Alternative 8. The establishment of a combined general aviation, air cargo, and heliport facility at the site of the former Puunene Airport. With a minimum runway length of 6,600 feet, development of the runway requires acquisition of property to the northeast. This leaves approximately 2,000 feet available to the southwest for runway expansion. There appears to be adequate area to the south for the expansion of general aviation and cargo operations support facilities. There would be ample land available to the northwest for the expansion of heliport facilities.

Topography and Other Physical Constraints

Alternatives 2 and 3A. As topography in the

area of the former Puunene Airport site is generally level, there are no significant physical constraints to the establishment of a heliport facility.

Alternatives 4 and 4A. As topography in the area of the former Puunene Airport site is generally level, there are no significant physical constraints to the establishment of a utility airport and/or heliport and associated support facilities.

Alternative 5. While a certain amount of cut and fill will be required as the site is located along the westerly slope of Haleakala, there are no significant constraints to the establishment of a new utility airport/heliport facility north of Kihei. While future expansion of the runway to the northeast would follow the general topography of the site, expansion to the southwest could be limited due to downward sloping terrain.

Alternative 6. As with Alternative 5, a certain amount of cut and fill will be required to develop the site. Other than that, initial establishment of a new combined general aviation/heliport facility east of Kahului presents only one area of possible concern. At the southwest end of the site is located a reservoir which could attract bird activity which could be considered a hazard to aircraft. Due to the proximity of the reservoir to the runway threshold, further study to evaluate the potential impact of bird activity is necessary before any determination can be made.

Alternative 7. As topography in the area of the former Puunene Airport site is generally level, there are no significant physical constraints to the establishment an utility airport and a separate heliport facility.

Alternative 8. As topography in the area of the former Puunene Airport site is generally level, there are no significant physical constraints to the establishment of a combined general aviation/air cargo/heliport facility.

AIR SERVICE CONSIDERATIONS

Restrictions on Air Service

Alternatives 2 and 3. Development of these alternatives would allow service by helicopters only.

Alternatives 4, 5, 6, and 7. Development of these alternatives would allow air service by both helicopters and fixed-wing piston aircraft.

Alternative 4A. Alternative 4A would provide service for only fixed-wing piston aircraft.

Alternative 8. Development of this alternative would permit the operation of helicopters, fixed-wing piston aircraft, and fixed-wing turbine-powered aircraft, including corporate jets and airline jets in air cargo service.

Proximity to Demand

Alternatives 2, 3, 4, 5, and 7. These alternatives place tourist-oriented aviation uses, primarily helicopter operators, at a more centrally located site in reference to the Lahaina, Kaanapali, Kihei, and Kahului tourist centers. This location does place the airport approximately 8 miles farther from the Hana area. For general aviation users located in the Kahului area, the site involves an increased travel distance of approximately 6 miles.

Alternative 4A. Under this alternative tourist-oriented activities, primarily helicopter operations, would remain at the Kahului Airport. For general aviation users located in the Kahului area, the site involves an increased travel distance of approximately 6 miles.

Alternative 6. This alternative places tourist oriented aviation uses approximately three miles from the current location at the Kahului Airport. This involves an increased travel distance for helicopter users from the previously referenced tourist centers to the south and west. Travel times from the Hana area would be relatively unchanged. For general aviation users located in the Kahului area, the site involves an increased travel distance of approximately 3 miles.

Alternative 8. This alternative places tourist oriented operations in a more centrally located area and does not significantly increase travel distances for private owners and operators. It does, however, remove air cargo operations from the main residential and commercial area on the island, Kahului. This may be offset by the fact that a significant amount of the air cargo brought into Maui is destined for the resort areas.

Attractiveness to Tenant Businesses

The sites evaluated differ in respect to the appeal they have to prospective aviation tenants, general aviation users and/or helicopter tour operators. The following potential advantages and disadvantages to airport tenants are recognized.

Alternative 1A. As one option under this alternative, heliport facilities could be expanded in the area immediately east of the existing heliport at Kahului Airport. This would be advantageous to existing helicopter tour operators because they could retain the use of their existing facilities. The two marked helipads at Kahului Airport are approximately 450 to 700 feet from Runway 2-20. Relocating the helicopter activity to the east would provide greater separation between the runway and helicopter activity. Furthermore, it is believed that the area east of the existing helicopter hangars would be in line-of-sight for the air traffic control tower.

If the future helicopter expansion area were to be located immediately east of the existing helicopter operating area, the helipads could be located from 1,000 to 1,500 feet from the centerline of Runway 2-20. Helicopter area locations closer to Hana Highway on property that the Hawaii Department of Transportation would need to acquire allows the helipads to be separated by 2,000 to 4,000 feet from Runway 2-20.

Alternative 1B. Under this alternative, helicopter tenants would also be able to utilize their existing facilities. Furthermore, tenants would be required to make only small investments in new facilities at the limited-service heliport. At the new site, helicopter tour operator tenants could be responsible for a share of investment in a small passenger terminal which would be used jointly by all operators.

The limited service heliport alternative would also have the advantage to tour operators of allowing them to serve their customers more conveniently. If is assumed that the limited service heliport would be located close to the popular tourist areas.

Alternatives 2 and 3. Relocating helicopter activities from Kahului Airport to a new site at the former Puunene Airport area could have both advantages and disadvantages to tour operators. The new site would have ample space for expansion. There would be virtually no constraints on the amount of space an operator could lease for its operations. Furthermore, the new site would be closer to most customers, who typically originate from the tourist areas along the west Maui and south Maui coast.

There are potential disadvantages to these alternatives. For example, tour operators which have made extensive capital improvements at Kahului Airport are concerned that they might not be able to make full use of that investment. Substantial investments would be needed by tour operators in their facilities at the new site. Furthermore, some operators view a move to a

new site as an opportunity for increased competition. With the limited space for helicopter facilities at Kahului Airport, it is difficult for new operators to become established.

Alternatives 4, 4A, 7 and 8. For helicopter tour operators, Alternatives 4, 7 and 8 would have the same advantages and disadvantages described above. For general aviation operators, a new site would be an opportunity for leasing more space than is available at Kahului Airport. These alternatives also allow general aviation users to be separated from flight operations at Kahului Airport. Under Alternatives 4A and 7, fixed-wing general aviation activity would be separated from all other aviation activity. That situation would be more conducive to fixed-wing general aviation flight training. Nevertheless, these alternatives would all result in some airspace conflicts with Kahului Airport.

Alternatives 5 and 6. In addition to the points discussed above, Alternatives 5 and 6 are not located as conveniently to users as the other alternatives. Alternative 6 would be suitably located for helicopter tour customers in the south coast resort area but perhaps not as well located for tourist in the west coast tourist area. The travel distance to Alternative 5 for users in the Kahului-Wailuku area is greater than other alternatives and considerably more than access to Kahului Airport.

AERONAUTICAL CONSIDERATIONS

Airspace Constraints

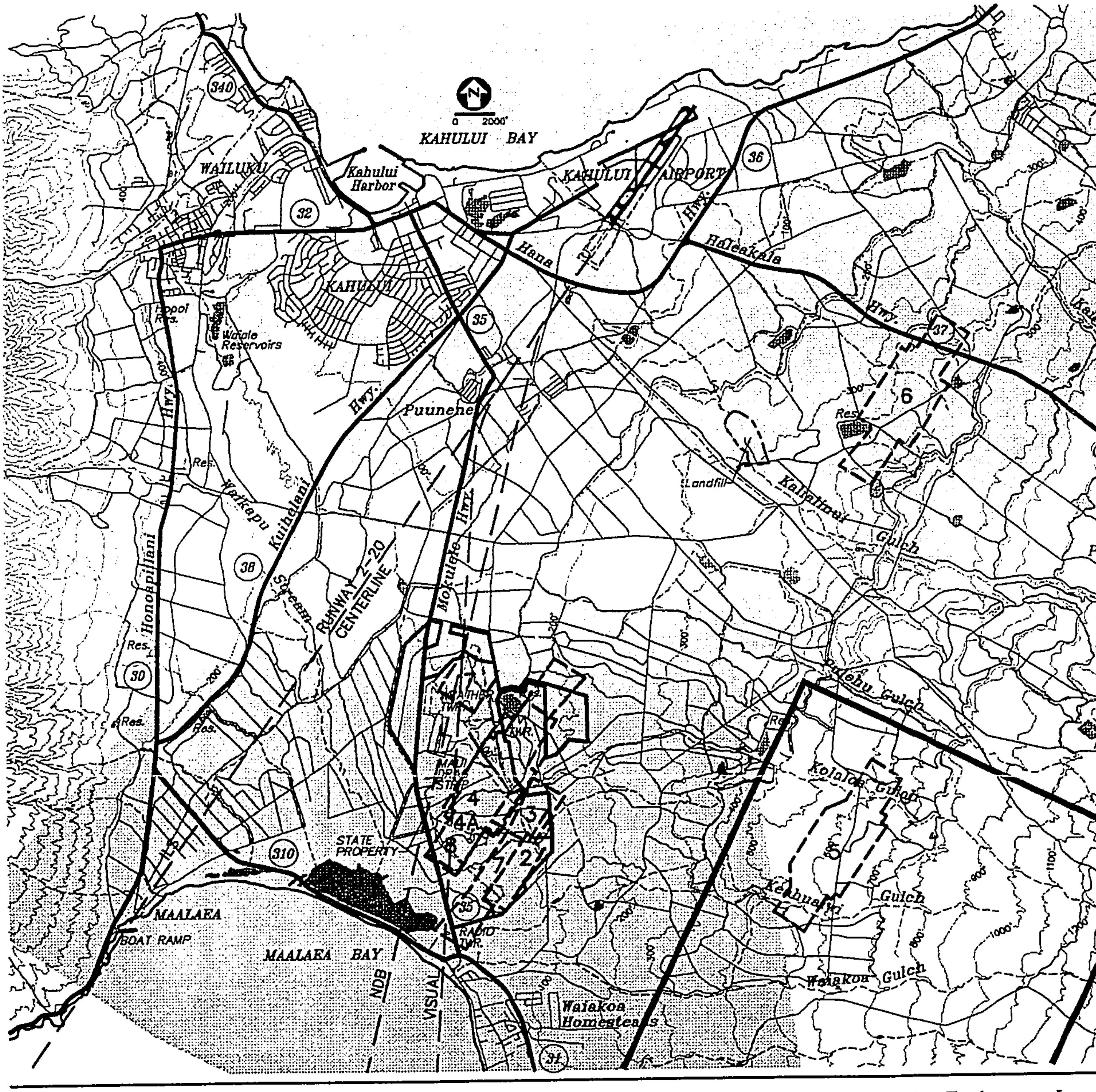
A generalized overview of airspace designations for the Maui area is presented in Section 4. Of specific localized concern on Maui is the relationship of the alternatives to Class C airspace centered on Kahului Airport, proximity to defined flight training areas, and interaction with existing flight track geometry.

Class C Airspace. FAR Part 91.130 governs aircraft operations within Class C airspace. Aircraft operating within Class C airspace are required to establish radio contact with the controlling facility (in this case Kahului tower) either prior to entering said airspace or, in the case of a satellite airport without a tower, as soon as practicable after departure. In addition, Kahului tower would also provide traffic separation between aircraft operating under IFR (Instrument Flight Rules) or SVFR (Special Visual Flight Rules). Kahului tower would also provide traffic conflict resolution between IFR and VFR operations.

Specifically, the Alternative 7 heliport is located on the edge of the inner core of Class C airspace and Alternative 6 is located within the inner core of Class C airspace and, under the FARs, would be considered a satellite airport (Figure 9-1). With respect to the Alternative 7 heliport, all departures to and arrivals from the north would penetrate Class C airspace and would thus be required to comply with FAR Part 91.130. All operations to or from Alternative 6 would be required to adhere to the requirements of FAR Part 91.130.

The remaining alternatives, 2, 3, 4, 4A, 5, 7, and 8, all lie outside the inner core of the Class C airspace and flight operations would not be subject to the requirements of FAR Part 91.130. However, all the above noted alternatives except Alternative 5 lie beneath extended Class C airspace. This airspace encompasses altitudes between 2,000 feet and 4,100 feet MSL and any operations within said airspace would also have to comply with FAR Part 91.130.

Training Area "ALFA". An additional airspace consideration is the location of the proposed alternatives with respect to "Training Area ALFA". Located northeast of Kihei, "ALFA" is an informally designated flight training area and is used for general aviation flight training activities. As "ALFA" is not formally designated airspace, it's precise location is not depicted on any published aeronautical charts.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Pulehu Gulch
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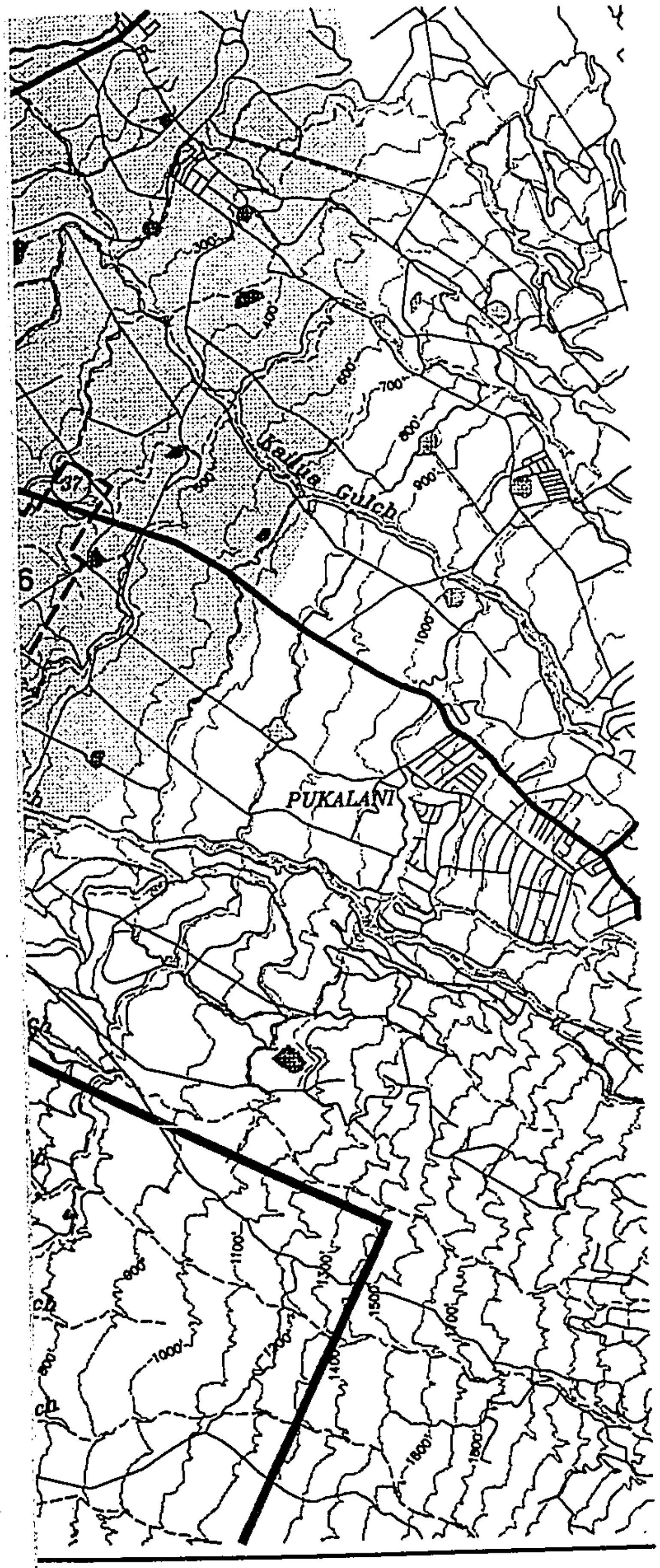

LEGEND

- PRINCIPAL HIGHWAY
- OTHER ROAD (PAVED, GRAVEL, GRADED DIRT)
- STATE HIGHWAY NUMBER (30)
- STATE-OWNED PROPERTY (FORMER PUUNENE AIRPORT)
- APPROACH FLIGHT TRACK TO KAHULUI AIRPORT RUNWAY 2
- CLASS C AIRSPACE
- TRAINING AREA ALFA
- ALTERNATIVE AIRPORT/ HELIPORT LOCATION

FIGURE 9-1
TERMINAL AIRSPACE AT KAHULUI AIRPORT IN RELATION TO ALTERNATIVE SITES

Figures 4-4 and 9-1 present the generalized location of "ALFA".

All the proposed alternatives, with the exception of Alternative 5, are located well clear of "ALFA". Alternative 5, however, is located in the same approximate area as "ALFA". As such, some modification or possible relocation of the "ALFA" training area would have to be made to accommodate the potential development of Alternative 5.

Impacts to Existing Flight Tracks (Fixed-Wing Aircraft). Due to topographical constraints, most existing airplane flight tracks tend to be aligned with the axis of the isthmus. As such, the airspace in the vicinity of the various alternatives is somewhat constrained. Therefore, all alternatives will experience some level of overflight activity from aircraft arriving/ departing Kahului Airport. The extent of the impact of these overflights on operations at any of the proposed alternatives is varied.

As a general rule during the dominant tradewind conditions, aircraft from the mainland fly a high downwind over the westerly slopes of Haleakala and then turn right towards the final approach course in the vicinity of Kihei. Aircraft arriving from the other islands tend fly to the south end of either the West Maui Mountains or the Makena area, then turn onto the final approach course. In addition, several approaches to Runway 2 at Kahului, specifically the NDB and Smoke Stack Visual, involve direct overflights of the Puunene site (Figure 9-2). The extended runway centerline for Runway 2-20 passes within approximately 2 to 2.5 miles of the Puunene site giving rise to concern regarding the adequacy of horizontal separation.

During Kona Wind conditions, with aircraft departing Kahului to the south, the Beach One Departure SID (Standard Instrument Departure) utilizes the 190 radial of the Maui VOR. This also results in direct overflights of the Puunene site. In addition, the missed approach procedures for instrument approaches to Runway 20 at Kahului all involve flying the 190 radial outbound from the Maui VOR. This again results in overflights of the Puunene site (Figure 9-3).

Operations at any of the Puunene site alternatives will be vertically restricted as aircraft inbound to Kahului descend over the isthmus. Flight geometry radar data indicates that, as Kahului-bound aircraft pass over the Puunene site, altitudes range from 1,500 feet to 2,000 feet MSL. With the traffic pattern altitudes for the various Puunene sites being approximately 1,000 feet MSL, vertical clearance between some aircraft bound for Kahului and aircraft using the Puunene site alternatives would be less than 1,000 feet (see Figure 9-4).

Aircraft departing to the south from Kahului or shooting a missed approach to Runway 20 at Kahului are generally above 2,000 feet MSL by the time they overfly the Puunene site. As such, vertical separation would be greater than with arriving aircraft, but coordination with Maui tower would still be highly desirable.

To adequately insure the safety of all aircraft in the area, fixed-wing aircraft operating at the Puunene site should be required to coordinate operations with the tower at Kahului. The most effective means of insuring such coordination would be the establishment of a new air traffic control tower (ATCT) at the Puunene site.

With respect to Alternatives 5 and 6, located northeast of Kihei and east of Kahului respectively, impacts from existing flight tracks are less severe. Alternative 5 involves an airport elevation of approximately 600 feet MSL, thus placing traffic pattern altitude at approximately 1,600 feet MSL. In this area Kahului bound aircraft are beginning their turn to the base leg of their approach at an altitude of approximately 3,000 feet MSL resulting in a vertical separation

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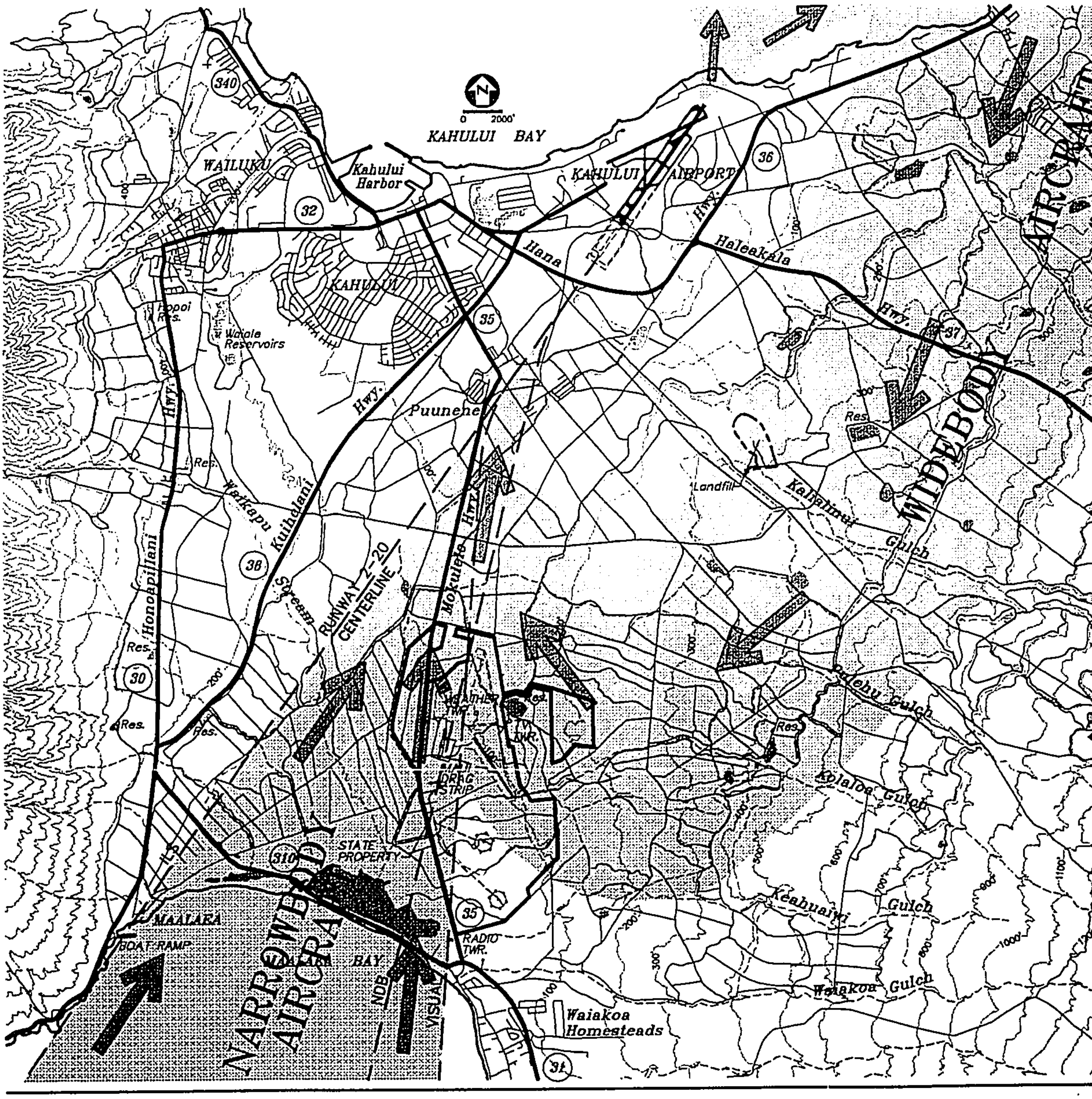
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Haleakala Hwy.
Puunene
Waiale Reservoirs
Landfill
Kahalinui Gulch
WIDEBODY
AIRCRAFT
Waikapu Stream
Kuihelani Hwy.
Honoapiilani Hwy.
Mokulele Hwy.
RUNWAY 2-20 CENTERLINE
STATE PROPERTY
RADIO TWR.
MAALAEA
BOAT RAMP
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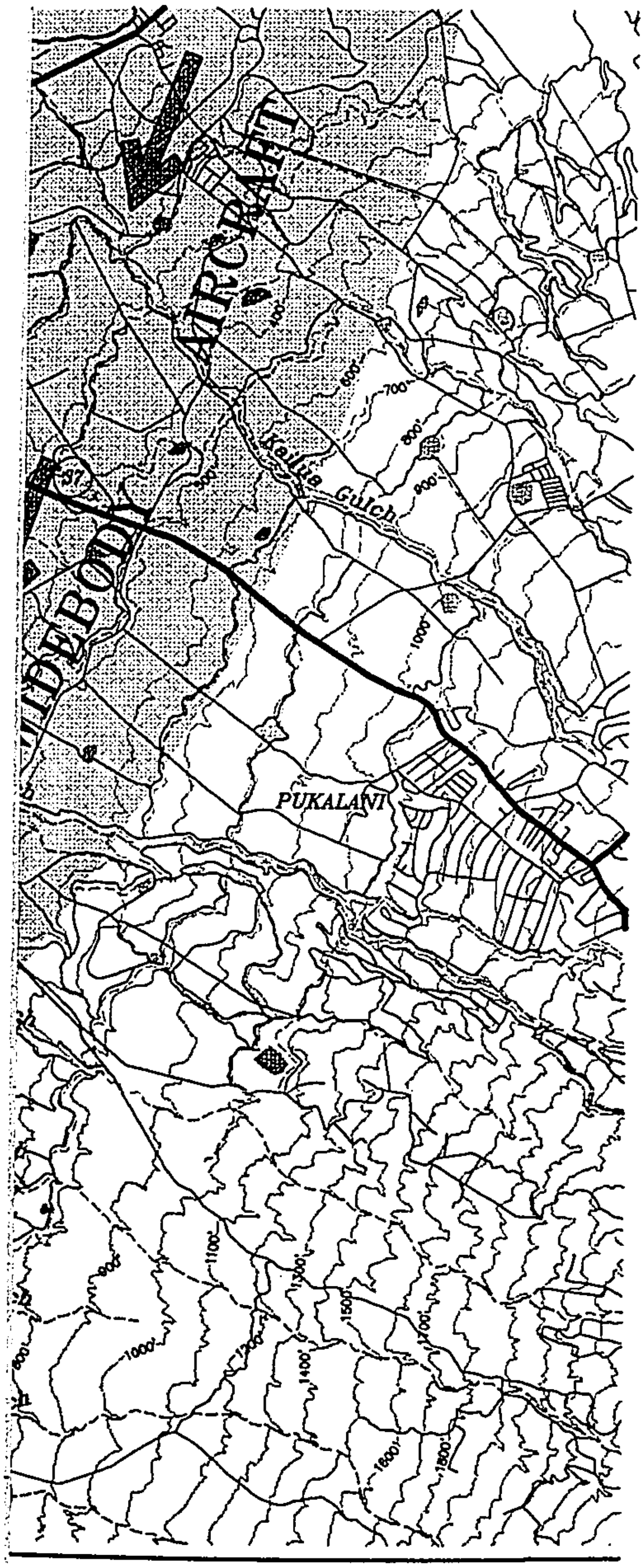
Kolaloa Gulch
Pulehu Gulch



LEGEND

JET AIRCRAFT CORRIDOR

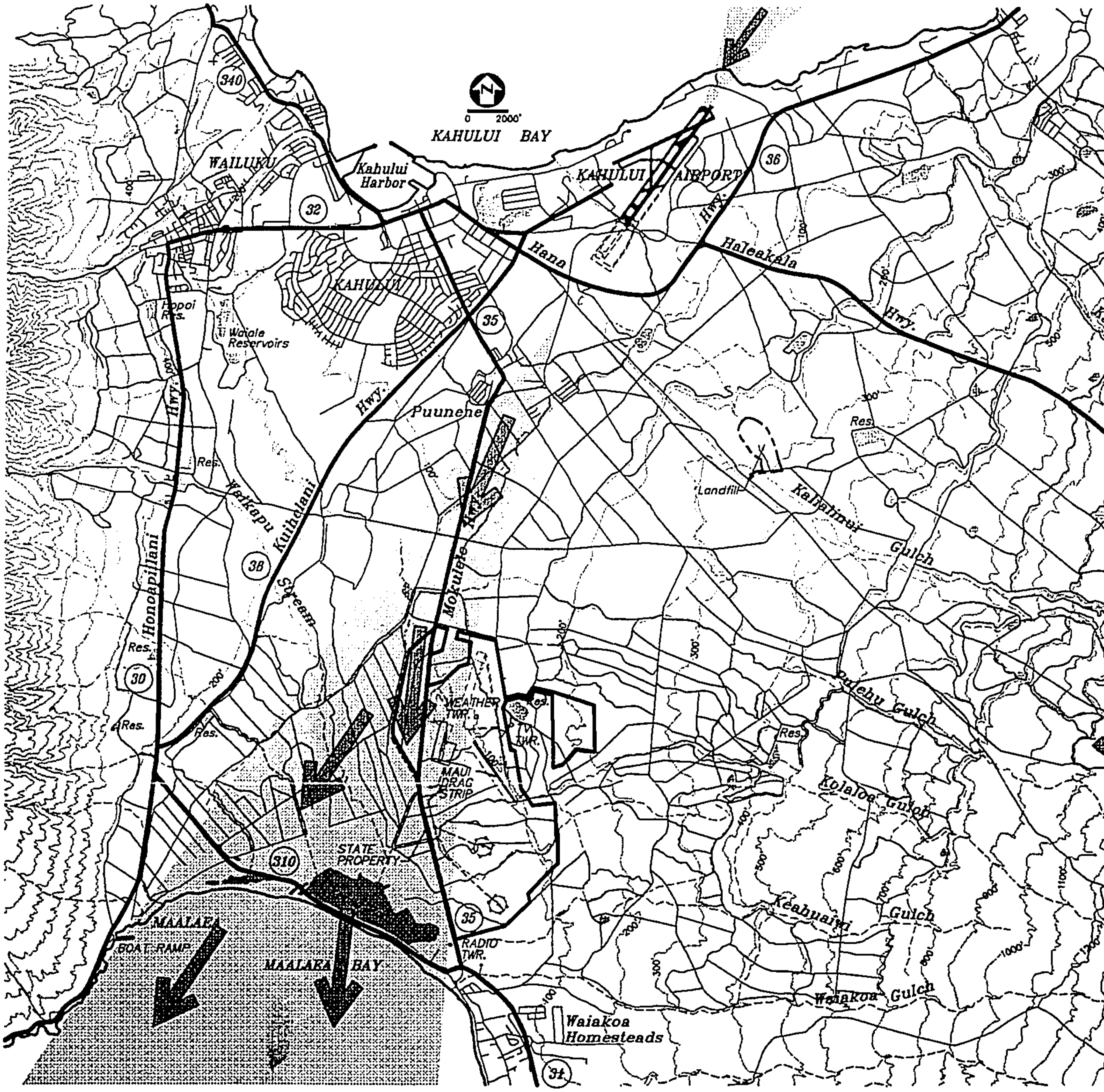
PRIMARY DIRECTION OF FLOW

APPROACH FLIGHT TRACK TO KAHULUI AIRPORT RUNWAY 2

STATE-OWNED PROPERTY (FORMER PUUNENE AIRPORT)

SOURCE : KAHULUI AIR TRAFFIC CONTROL TOWER RADAR DATA.

FIGURE 9-2
JET AIRCRAFT FLIGHT CORRIDORS AT KAHULUI AIRPORT UNDER TRADEWIND CONDITIONS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Puunene
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Waikapu Stream
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TV TWR.
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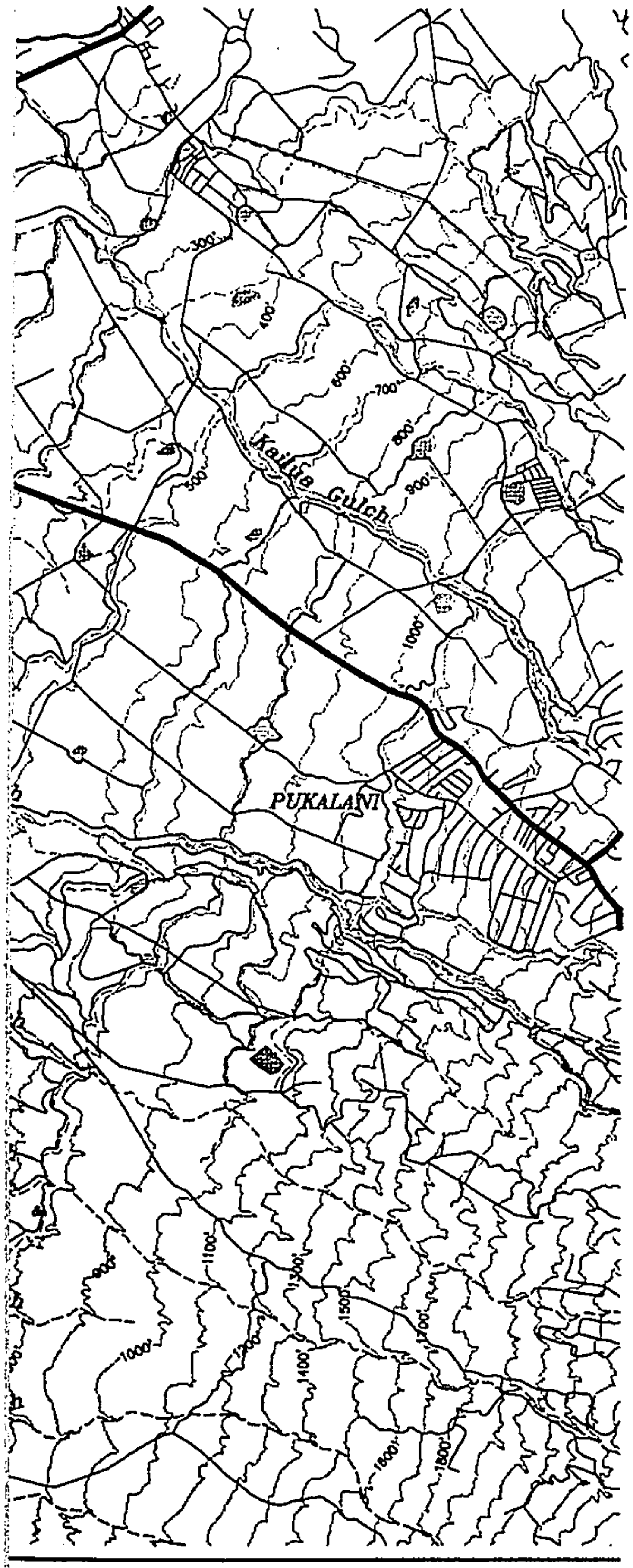
Waiakoa Homesteads



LEGEND

JET AIRCRAFT CORRIDOR

PRIMARY DIRECTION OF FLOW

STATE-OWNED PROPERTY
(FORMER PUUNENE AIRPORT)

SOURCE : KAHULUI AIR TRAFFIC CONTROL TOWER RADAR DATA.

FIGURE 9-3
JET AIRCRAFT FLIGHT CORRIDORS
AT KAHULUI AIRPORT
UNDER KONA WIND CONDITIONS

of approximately 1,400 feet between aircraft in the traffic pattern and Kahului bound aircraft. As Alternative 5 is located in excess of 5 miles from the extended Kahului runway centerline, horizontal separation is not a significant issue.

Alternative 6 presents even less of a concern with regard to vertical separation. Alternative 6 involves an airport elevation of approximately 380 feet MSL placing traffic pattern altitude at approximately 1,380 feet MSL. Kahului bound aircraft are generally on a high downwind, descending to 3,000 feet MSL before turning to the base leg of the approach. As such a vertical separation of at least 1,620 feet is provided. In addition, as Alternative 6 would be located within Class C airspace, coordination with Kahului tower is already mandated.

Impacts to Existing Flight Tracks (Rotary-Wing Aircraft). Helicopter flight tracks, due to both inherent helicopter performance capabilities and tourist-destination orientation, are more varied with departures tending to head either east or west from Kahului towards various sites of interest (see Figure 9-5). The direction of helicopter arrivals are again mixed due to the variety of locales visited.

In general, impacts to helicopter operations are not as significant as those to fixed-wing operations. This is due in large part to the performance/maneuverability characteristics of helicopters. While changes would have to be made in routings based on the various locations of the proposed alternatives, it does appear that helicopter operations at any of the proposed sites could be accommodated within the existing airspace structure without the need for any additional ATC (Air Traffic Control) facilities. Generalized helicopter corridors for a new heliport at the Puunene site are shown in Figure 9-6.

Summary. Based on the above it is apparent that, while helicopter operations can be accommodated at any of the sites with minimal impact to the existing airspace structure, the establishment of fixed-wing operations at the Puunene site presents some major concerns with regard to traffic separation. These concerns could be at least partially mitigated by the establishment of an ATCT in conjunction with fixed-wing activities.

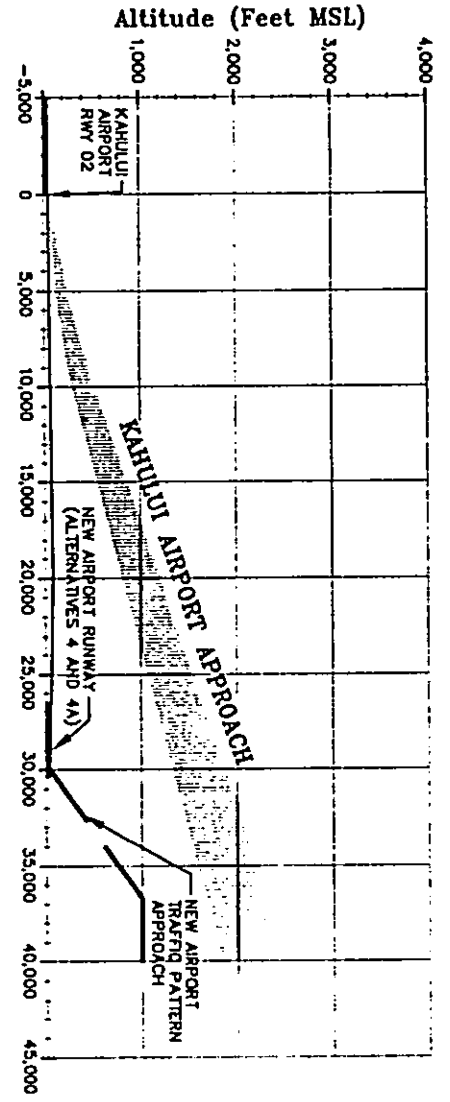
Alternatives 5 and 6 present less of a concern with regard to traffic separation. Alternative 5 is located such that operations could be accommodated without the establishment of an ATCT. Alternative 6 would result in adequate vertical separation and, as the site is located within Class C airspace, coordination with Maui tower would be required.

FAA Airspace Studies. In the analysis described above, a critical concern with the Puunene site alternatives is the potential airspace conflicts with aircraft approaching Runway 2 at Kahului Airport, which overfly the site. The preliminary conclusions described above are based on the consultant's evaluation of airspace conflicts. Because a new airport location must pass FAA airspace review and evaluation, the FAA was asked to conduct a formal airspace review to determine if a new heliport, utility airport or transport airport could be located at the Puunene site.

In order to encompass the full range of potential new airport alternatives at Puunene, the FAA was given three alternatives to evaluate: Alternative 2, a new heliport at the south end of the site; Alternative 7, a new heliport and utility airport at separate locations in the Puunene site; and Alternative 8, a new transport airport at the site. These three alternatives were selected for FAA airspace review because they include all three basic airport/heliport types considered in the study and, with respect to Alternatives 2 and 7, are more favorable than other Puunene alternatives from the standpoint of cost and physical site constraints and, with respect to Alternative 2, compatibility with County of Maui planning for the Puunene site.

Maui General Aviation Study
Hawaii Department of Transportation
Airports Division

FIGURE 9-4
PROFILES OF JET AIRCRAFT APPROACHES TO RUNWAY 02
AT KAHULUI AIRPORT AND TRAFFIC PATTERNS FOR ALTERNATIVES 4 AND 4A



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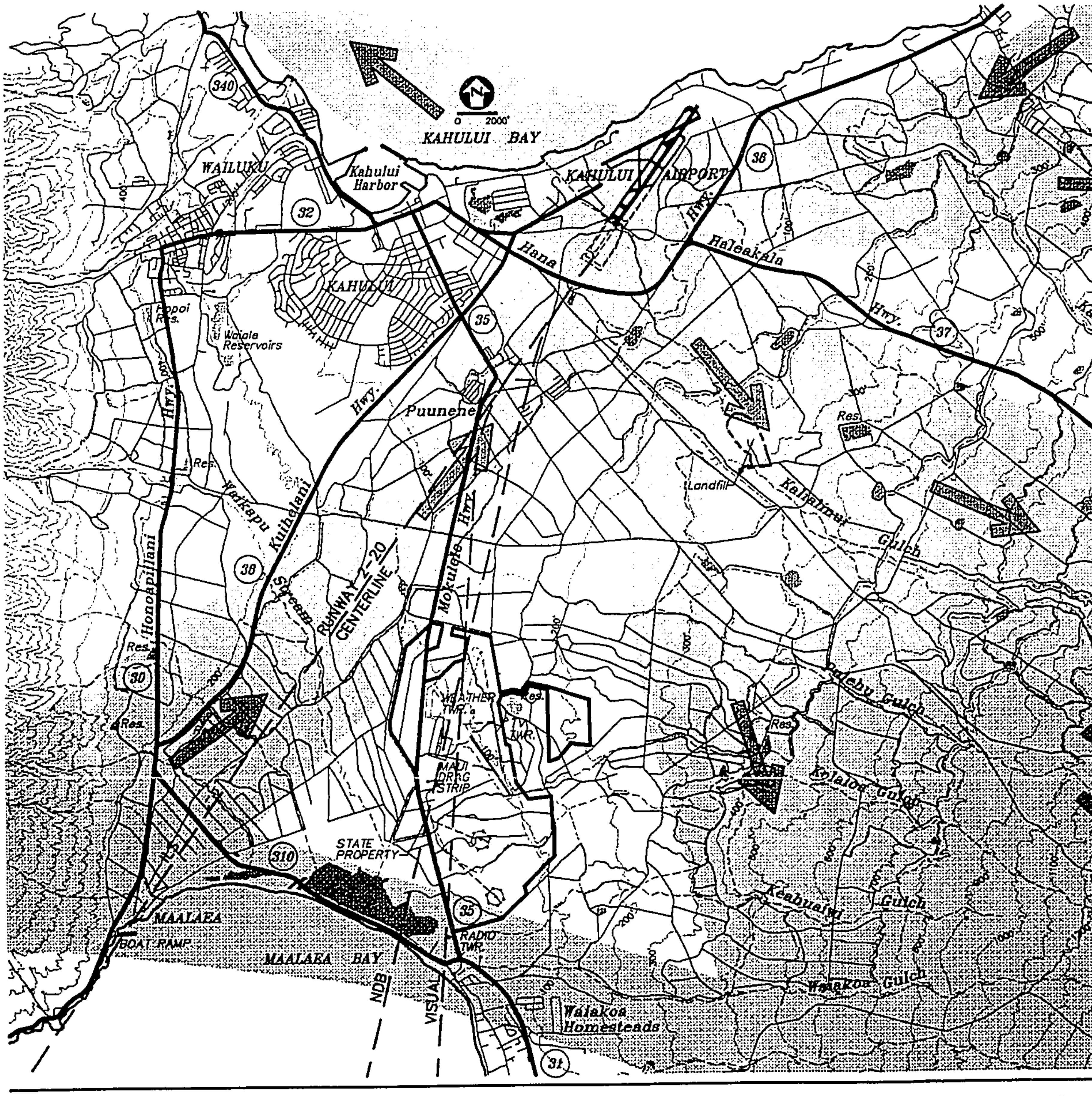
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Waiakoa Gulch
Waiakoa Homesteads
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TWR.
MAUI DRAG STRIP
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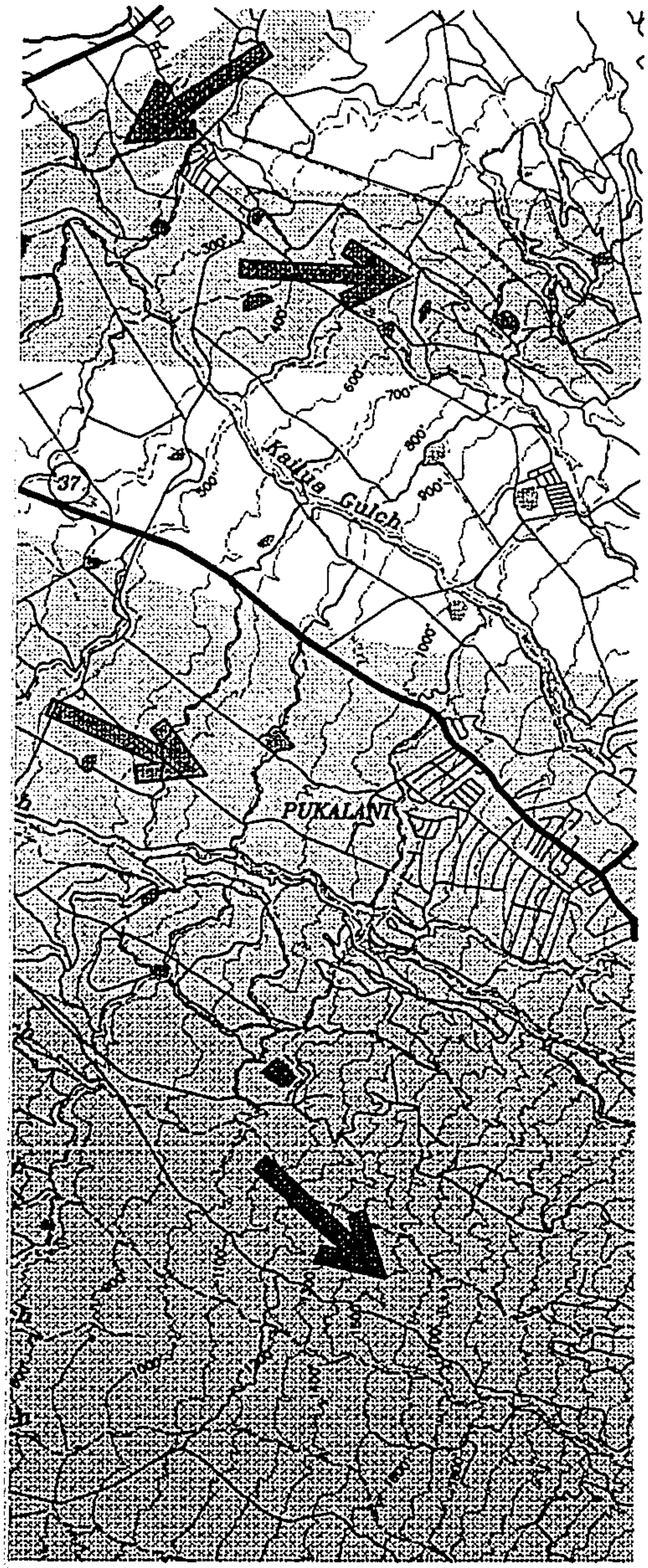


LEGEND

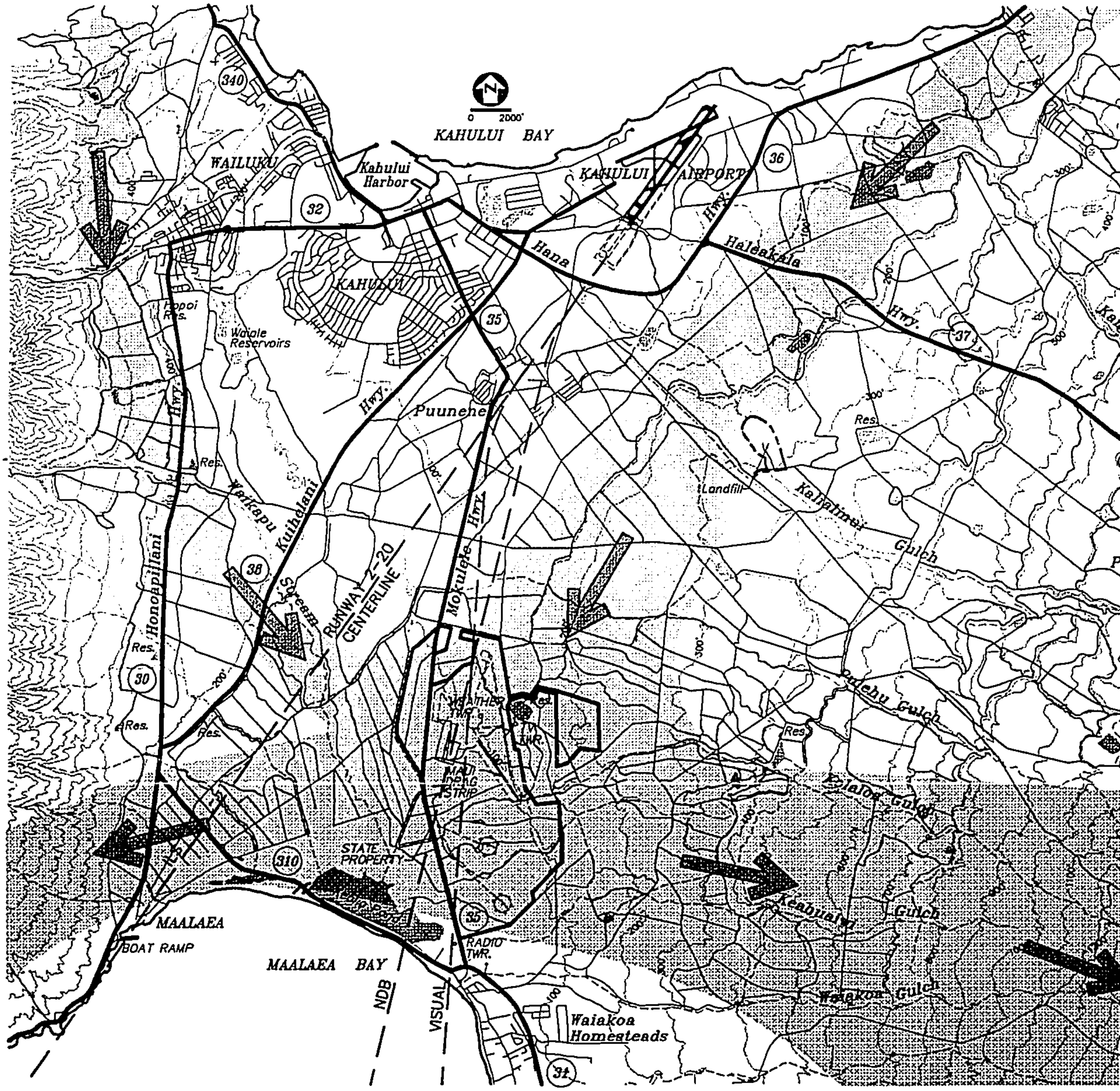
HELICOPTER FLIGHT CORRIDOR

PRIMARY DIRECTION OF FLOW

APPROACH FLIGHT TRACK TO KAHULUI AIRPORT RUNWAY 2

STATE-OWNED PROPERTY (FORMER PUUNENE AIRPORT)

FIGURE 9-5
EXISTING HELICOPTER FLIGHT CORRIDORS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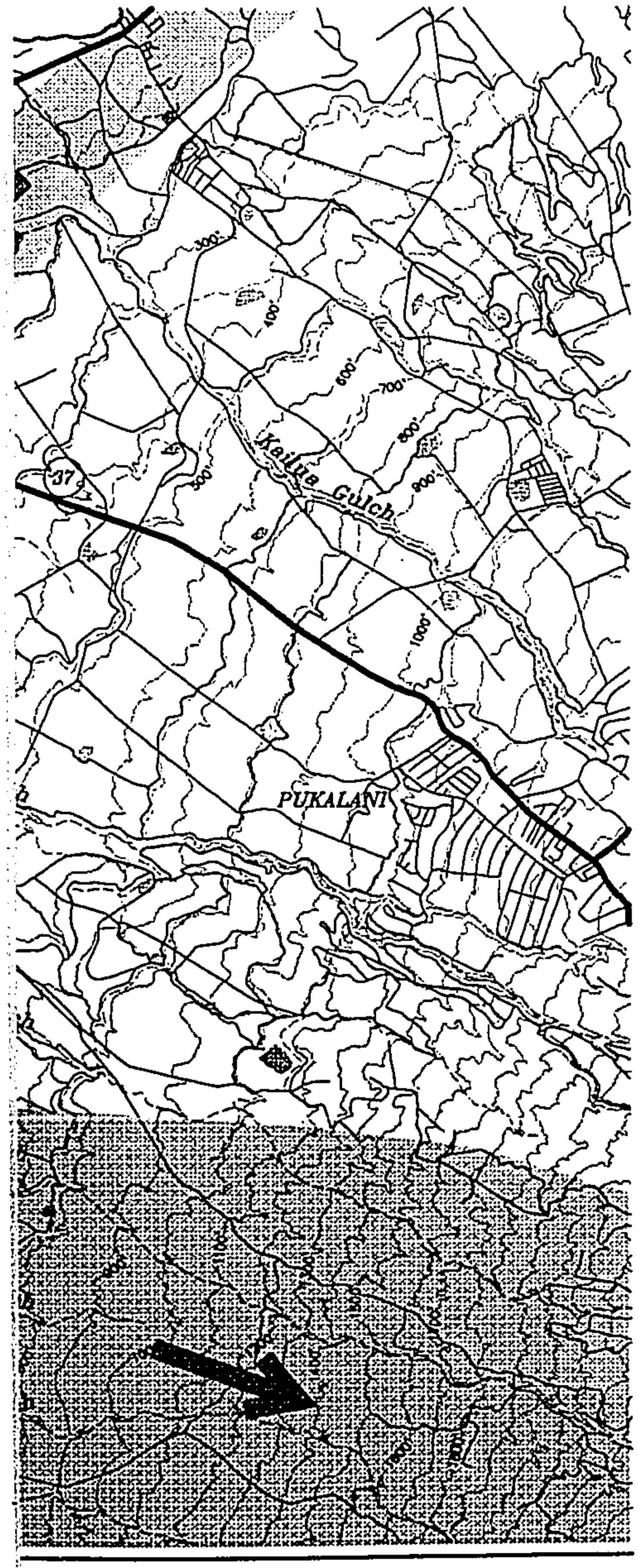

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HELICOPTER FLIGHT CORRIDOR

PRIMARY DIRECTION OF FLOW

APPROACH FLIGHT TRACK TO KAHULUI AIRPORT RUNWAY 2

STATE-OWNED PROPERTY (FORMER PUUNENE AIRPORT)

FIGURE 9-6
HELICOPTER FLIGHT CORRIDORS WITH NEW HELIPORT AT FORMER PUUNENE AIRPORT

The FAA completed its airspace evaluation of these three alternatives on August 25, 1995. The FAA concluded that:

> "reactivation of the [former Puunene] airport for helicopter and general aviation operations would be acceptable from an airspace utilization standpoint under certain conditions which are listed below. It was also determined that transport operations would not be compatible with operations at Kahului Airport due to traffic pattern airspace requirements and operational requirements for instrument operations.
>
> Reactivation of the Puunene Airport for helicopter and general aviation use would be acceptable if the following conditions are met:
>
> 1. Runway would be as closely aligned as possible with the alignment of Runway 2-20 at the Kahului Airport.
> 2. The runway and heliport should be constructed as far as possible to the southeast in order to reduce conflict with operations at Kahului.
> 3. Runway traffic patterns shall be established on the east side of the runway with traffic pattern altitudes established which will not interfere with the traffic flow into Kahului.
> 4. Operations at the airport shall be under positive control provided by an Airport Traffic Control Tower.
> 5. Operations are to be conducted in VFR conditions only."

Previous FAA airspace studies of reactivating the former Puunene Airport were completed on June 24, 1988, August 14, 1989 and March 26, 1991. The conclusions from the earlier studies differ from the recent study, although the specific runway locations and alignments or heliport locations within the former Puunene Airport site were not specified for the earlier studies. The earlier studies concluded as follows:

- 1988 -- Reactivation of one of the former Puunene Airport runways would not be acceptable from an airspace utilization standpoint.
- 1989 -- Reactivation of the former Puunene Airport as a heliport would not be acceptable from an airspace utilization standpoint.
- 1991 -- Reactivation of the former Puunene Airport for helicopter operations would be acceptable provided helicopters fly no higher than 500 feet above ground level and helicopter routes and procedures are established by the FAA and the State.

Meteorological Impacts

Detailed wind coverage data is not available for the various alternative sites. However, due to the proximity of all the alternative sites to the Kahului Airport, it is appropriate to apply wind coverage data for the Kahului Airport to the various alternative sites. In addition, as runway alignments in the alternatives are the same as Runway 2/20 at Kahului, wind coverage will be approximately the same for the various alternatives. It must be acknowledged that there may be variations in both wind speed and direction at the various sites and, when a preferred alternative is selected, a detailed wind study should be done.

Wind data presented in the Kahului Airport Master Plan, prepared in June, 1993, was collected between January 1970 and December,

1979. This data indicates that wind coverage for up to 13 knot crosswinds is 96.1% for a runway alignment of 020/200 degrees.

However, information obtained from pilots familiar with winds in the Puunene area suggests that winds there are often unlike winds at Kahului Airport and would be more hostile to fixed-wing general aviation users. According to such sources, winds at the Puunene site can shift suddenly and can often be blowing from different directions at each end of the site. It has been said that these often strong and unpredictable winds are a primary reason for the relocation of the Naval Air Station from Puunene to Kahului in the 1940s.

A crop dusting operation has been located at the former Puunene Airport for over 30 years. The single fixed-wing plane based there operates from a portion of a former aircraft parking area and taxiway which is aligned approximately parallel to Runway 2-20 at Kahului Airport. There are about 800 to 1,000 operations a years by the crop dusting plane at this site. Flight operations are compatible with Kahului Airport operations because all crop dusting activity stays under 300 feet above ground level and radio contact with the Kahului Air Traffic Control Tower is maintained at all times.

Although the crop dusting airplane is able to use the Puunene site, the operator does not believe the site would be compatible for typical fixed-wing general aviation use, particularly by student pilots, because of the strong, unpredictable winds.

Crosswinds (Wailuku winds) are frequent, particularly in the afternoons. At one time, a portion of the former airfield was used by the crop duster as a cross-wind runway.

An additional concern with all the alternatives is the impact of sugarcane burns. All the alternatives involve the use of lands that are surrounded by agricultural uses with the predominate crop being sugarcane. Burning of the cane results in severe localized impacts to visibility. Burning in the vicinity of any of the alternative sites could present serious short-term operational constraints depending on wind direction and velocity. These effects would tend to impact fixed-wing operations to a greater extent than helicopter operations.

OBSTRUCTIONS

A preliminary evaluation of potential airspace obstructions was undertaken for the various alternative sites. Specifically, each site was reviewed for potential obstructions as defined in FAR Part 77 and TERPS criteria developed by the FAA. It is anticipated that when a preferred alternative is selected, a comprehensive analysis of potential obstructions will be undertaken.

Puunene Site. The Puunene site presents a number of issues with respect to obstructions. The most apparent is the penetration of the Horizontal Surface by terrain located to the east and northeast of the site. With respect to approach slopes it has been determined that a 34:1 approach slope is clear of obstructions for all the Puunene site alternatives. While a clear 50:1 approach slope cannot be achieved due to terrain penetration to the north, it can be achieved to the south of the site.

Several towers are located in the immediate vicinity of the Puunene site and would have to be marked and, if necessary, relocated (Figure 8-2).

Upper Kihei Site. Alternative 5 also will involve terrain penetrations of the Horizontal Surface to the east and northeast of the site. As with the Puunene site, while the 34:1 Approach Surface is clear of penetrations, a clear 50:1 Approach Surface to the north cannot be achieved due to terrain.

Haleakala Highway Site. Alternative 6 is similar to the other alternatives in that terrain will penetrate the Horizontal Surface east of the site. While it appears that a clear 34:1 Approach Surface can be achieved, a clear 50:1 Approach Surface cannot be achieved due to terrain.

Summary. While terrain penetrations of various surfaces do occur at the various sites, they do not present any significant problems to the development of the various sites. All sites do present obstacle free 34:1 Approach Surfaces, thus allowing the establishment of precision instrument procedures with a 3 degree glide slope.

ENVIRONMENTAL AND LAND USE IMPACTS

The environmental effects of new airport/heliport site alternatives, both quantifiable and qualitative, are set forth in the following discussion. Principal effects on the natural and human environment are summarized in Table 9-1.

Alternatives 1, 1A and 1B

Alternative 1. The environmental consequences of the no-action alternative are discussed and evaluated in the Kahului Airport Environmental Impact Statement. Representations in the Kahului EIS are incorporated herein by reference.

Alternative 1A. Under this alternative, the helicopter tour facilities at Kahului Airport would be relocated to the east of the present location on Airport property or property which would be acquired and become part of the airport. Because this alternative would be an expansion of Kahului Airport rather than a new site, the environmental consequences of this alternative were not evaluated in the Maui General Aviation Study to the extent of the other alternatives.

Alternative 1B. Since this alternative involves development of possible heliport sites at unspecified locations, no site-specific evaluations could be undertaken (with the exception of a cursory evaluation of surface traffic effects at a possible West Maui site). The environmental consequences of a new satellite heliport/helipad in Puunene are parallel to those of Alternatives 2, 3, 4, 4A, 7, and 8. Discussion of these and other alternatives are set forth in the subsections which follow.

The subsections which follow discuss the environmental and land use impacts of the remaining alternatives, under the following categories: vegetation and wildlife; noise and land use; air quality; surface transportation; historical and archeological resources; energy supply and natural resources; hydrology, drainage and water quality; and aesthetics.

Vegetation and Wildlife

Each of the principal study alternatives affect a variety of indigenous and exotic vegetation together with various wildlife. The potential effects of development of new airport or heliport sites are illustrated on Figures 9-7 and 9-8. Notations in Table 9-1 reflect possible effects on rare or endangered plant and animal species only.

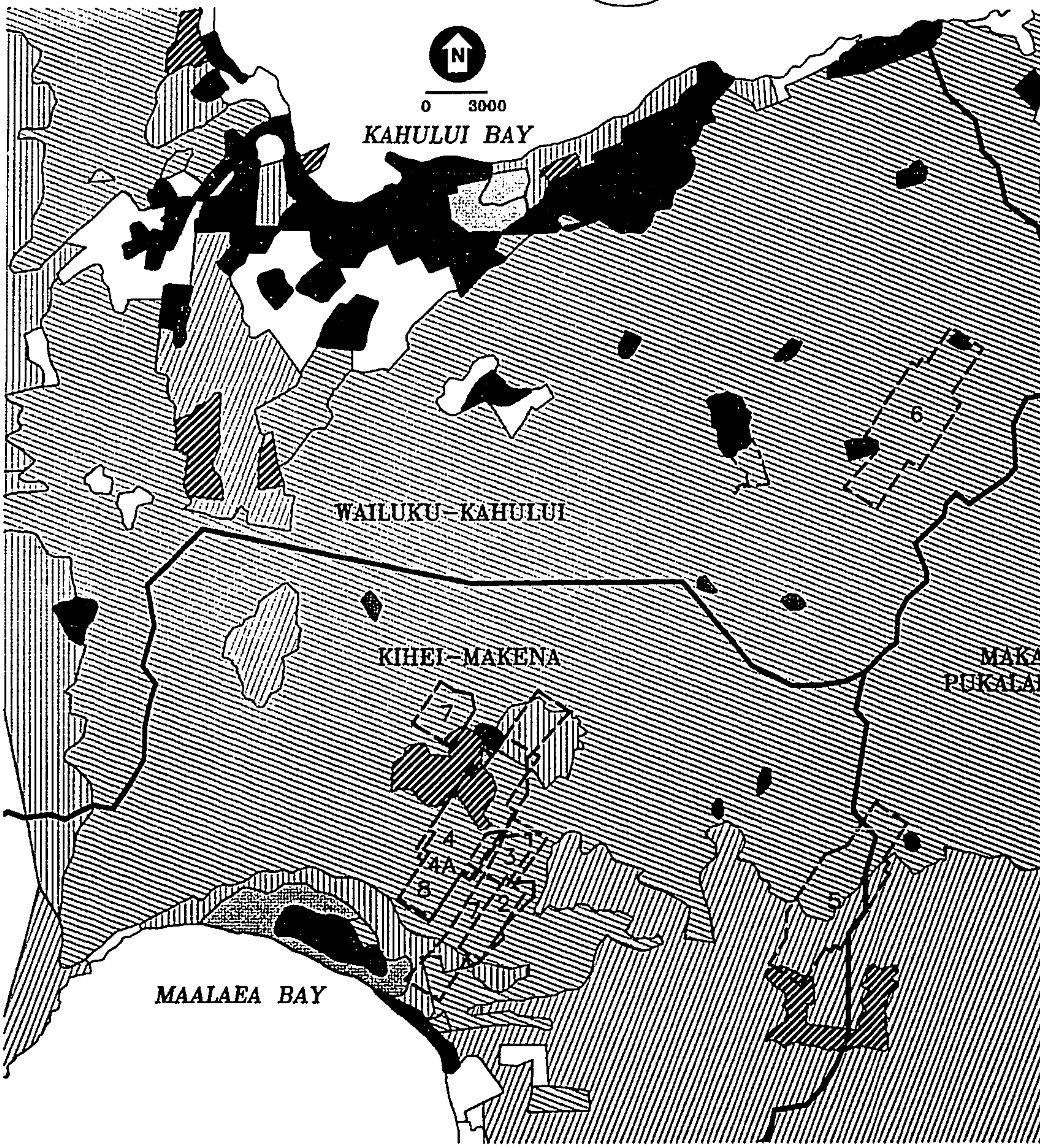
Alternatives 2 and 3. The potential effects of development of a new site east or south of Puunene in the vicinity of the former Puunene Airport, as illustrated on Figures 9-7 and 9-8, are discussed below.

<u>Vegetation</u>. The sites of Alternatives 2 and 3 lie entirely within cultivated lands as shown on Figure 9-7. Development of Alternative 2 or 3 would require approximately 60 acres of land currently devoted to sugarcane production. The airfield and associated aircraft operational and basing areas will necessitate the removal of the greater portion of these cultivated lands from production.

TABLE 9-1
SUMMARY OF PRINCIPAL ENVIRONMENTAL EFFECTS
NEW AIRPORT/HELIPORT SITE ALTERNATIVES

		Natural Environment			Human Environment					
	Alternative	Vegetation Wildlife	Historical	Energy	Land Use/ Noise [a]	Air Qual.	Surface Trans.	Water Quality	Public Services	Aesthetics
1.	Existing Airport System	N/A [b]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1A.	Relocate Kahului Heliport East	N/A	N/A	N/A	520	N/A	N/A	N/A	N/A	N/A
1B.	New Limited Service Heliport(s)	N/A	N/A	N/A	N/A	N/A	Possibly Significant	N/A	N/A	N/A
2.	New Heliport Puunene-South	Possibly Significant	Insignificant	Significant	520	Insignificant	Possibly Significant	Possibly Significant	Significant	Insignificant
3.	New Heliport Puunene-East	Possibly Significant	Insignificant	Significant	520	Insignificant	Possibly Significant	Possibly Significant	Significant	Insignificant
4.	New Utility Airport/Heliport-Puunene	Significant	Possibly Significant	Significant	840	Insignificant	Possibly Significant	Possibly Significant	Significant	Insignificant
4A.	New Utility Airport-Puunene	Significant	Possibly Significant	Significant	420	Insignificant	Possibly Significant	Possibly Significant	Significant	Insignificant
5.	New Utility Airport/Heliport North of Kihei	Possibly Significant	Insignificant	Significant	840	Insignificant	Possibly Significant	Possibly Significant	Significant	Insignificant
6.	New Utility Airport/Heliport-East of Kahului	Possibly Significant	Insignificant	Significant	820	Insignificant	Possibly Significant	Possibly Significant	Significant	Insignificant
7.	New Utility Airport and Heliport-Puunene	Significant	Insignificant	Significant	940	Insignificant	Possibly Significant	Possibly Significant	Significant	Insignificant
8.	New Transport Airport/Heliport-Puunene	Significant	Possibly Significant	Significant	2,230	Insignificant	Possibly Significant	Possibly Significant	Significant	Insignificant

[a] Gross acreage affected by Ldn 55dB and above.
[b] Not analyzed.


N
0 3000
KAHULUI BAY
WAILUKU-KAHULUI
KIHEI-MAKENA
MAALAEA BAY
6
4
4A
B
1
3
2
5

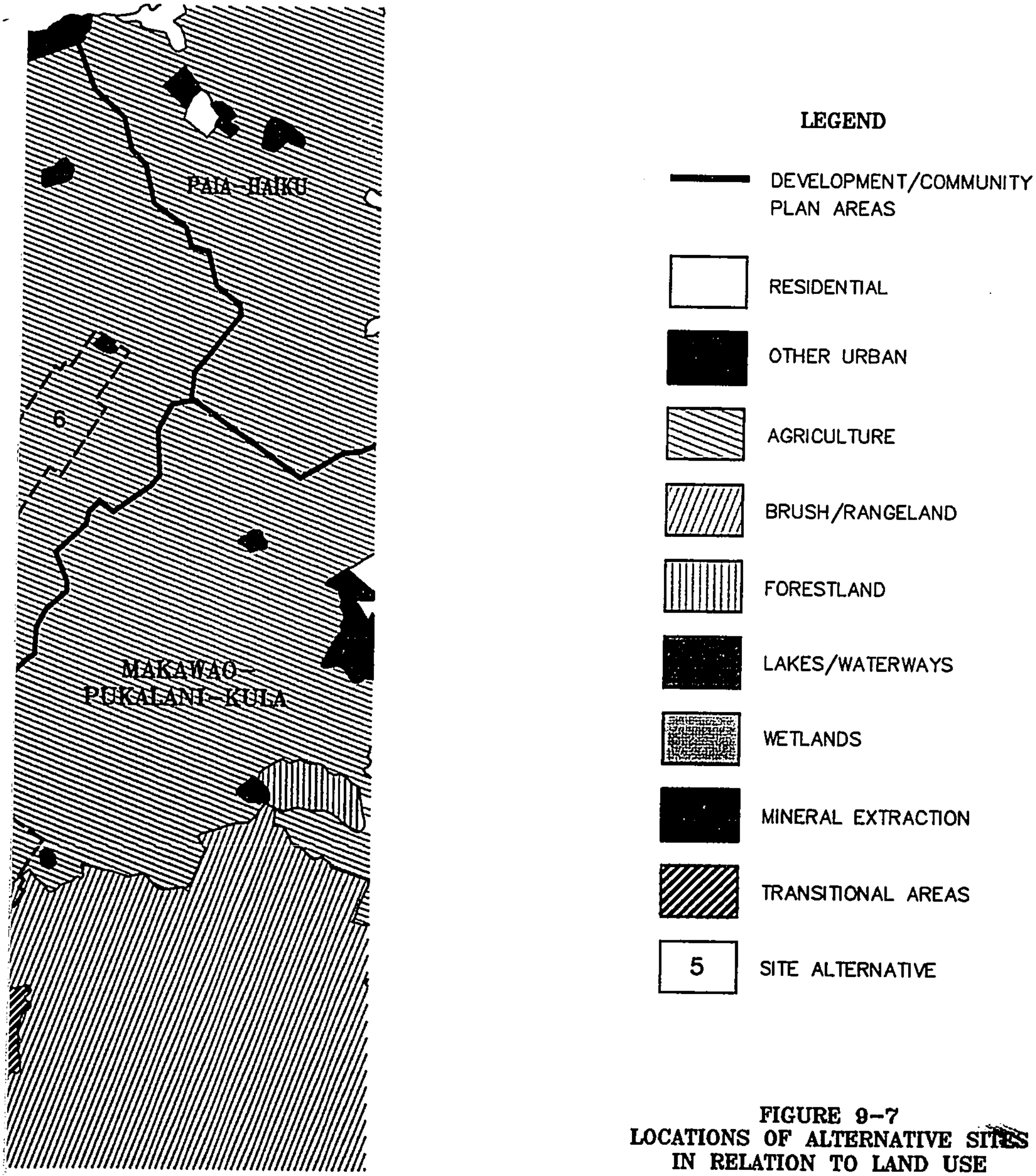
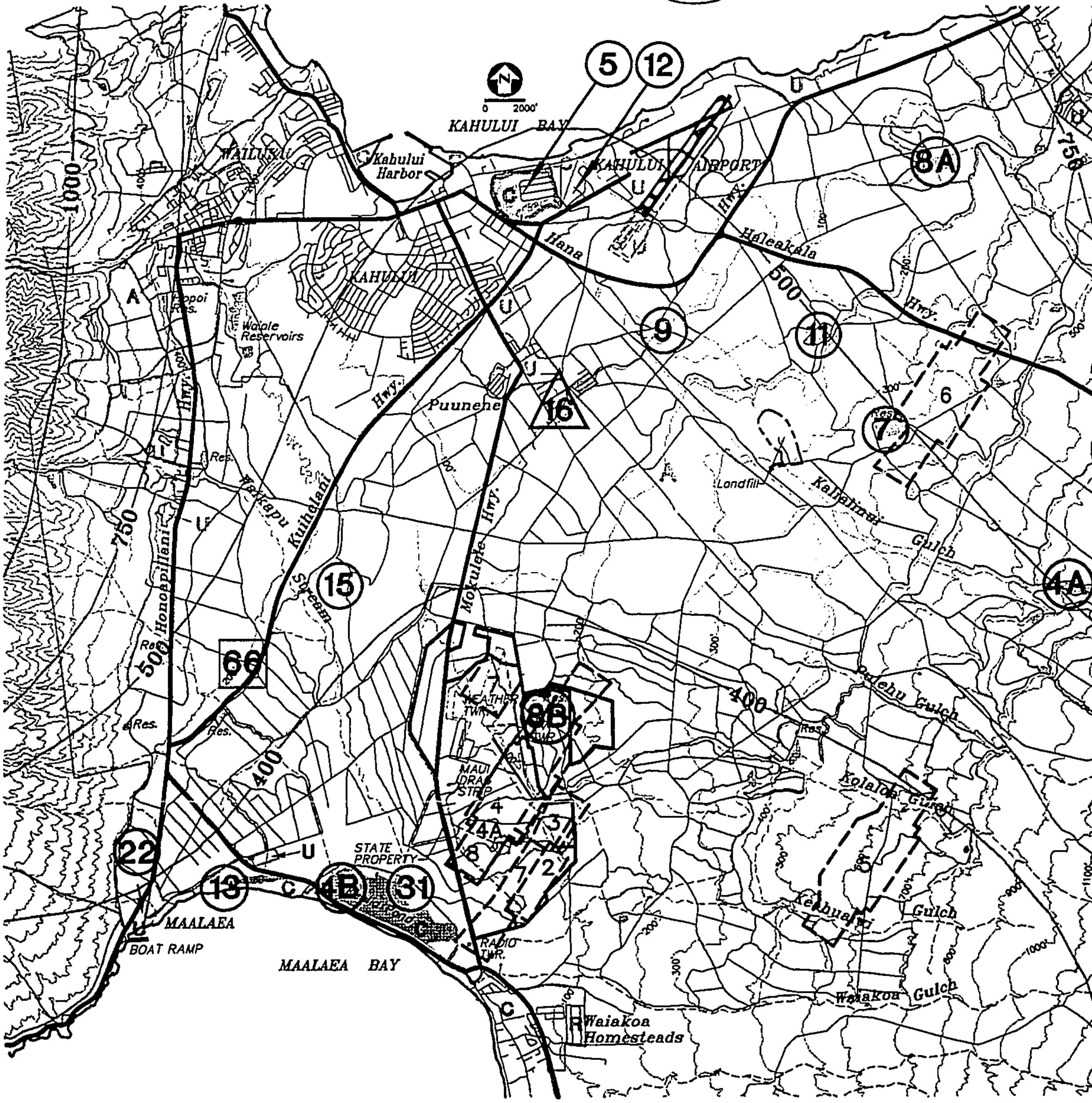
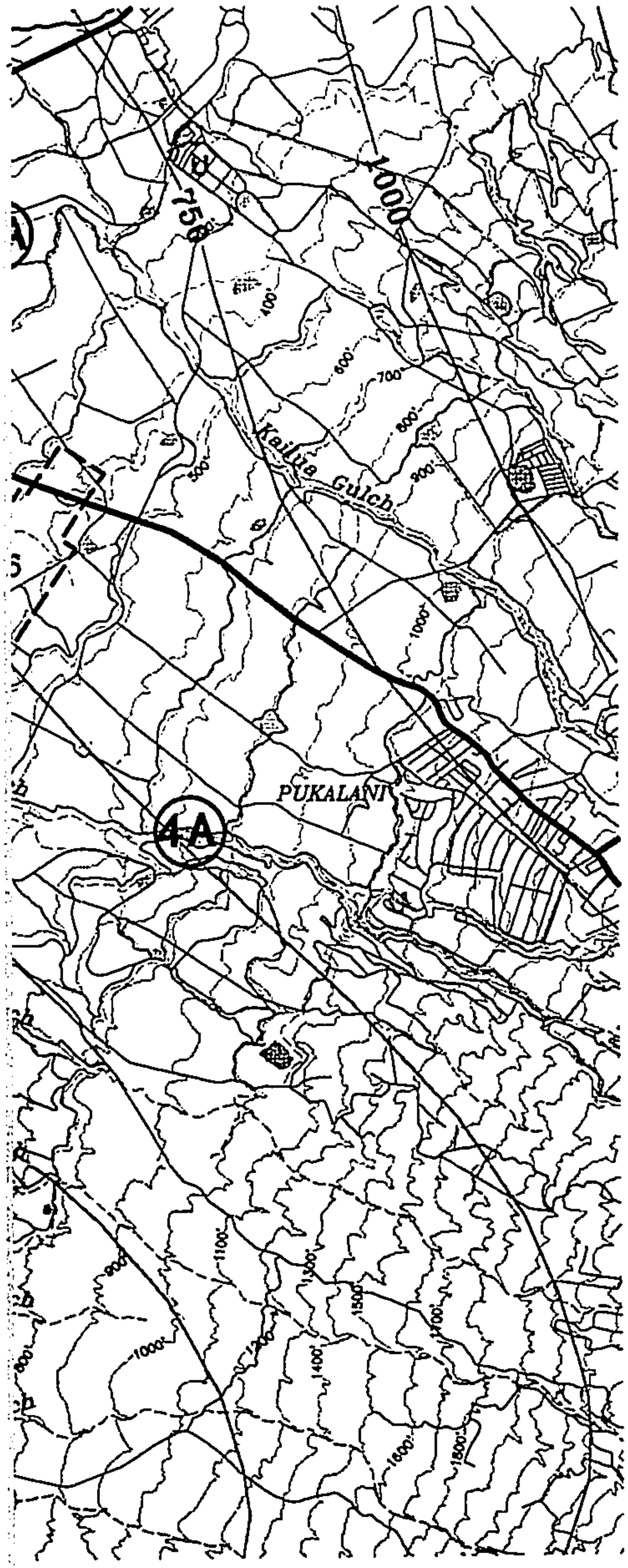


FIGURE 9-7
LOCATIONS OF ALTERNATIVE SITES
IN RELATION TO LAND USE


KAHULUI BAY
0 2000'
WAILUKU
Kahului Harbor
KAHULUI AIRPORT
KAHULUI
Hana
Haleakala
Hwy.
Iao
Waiale Reservoirs
Puunene
Kuihelani
Hwy.
Honoapiilani
Hwy.
Mokulele
Hwy.
Waikapu
Stream
Landfill
Kalialinui
Gulch
Pulehu Gulch
Kolaloa Gulch
Keahuaiwi
Gulch
Waiakoa Gulch
WEATHER TWR.
MAUI DRAG STRIP
STATE PROPERTY
RADIO TWR.
MAALAEA
BOAT RAMP
MAALAEA BAY
Waiakoa Homesteads
5
12
8A
9
11
16
6
7
15
66
8B
4A
22
13
4B
31
1
2
3
4
8
Res.
1000
750
500
400
300
200
100



LEGEND

- Land Use District Boundary
- A Agriculture
- C Conservation
- R Rural
- U Urban
- Annual Rainfall (mm./yr.)
- Stream
- Managed Area – Kanaha Pond Wildlife Sanctuary

Threatened/Endangered Species Hawaii Natural Heritage Program (See Table 3–2 for Identification of species.)

- within 0.3 mile range
- within 1.5 mile range
- within 5 mile range
- STATE–OWNED PROPERTY (FORMER PUUNENE AIRPORT)
- 5 SITE ALTERNATIVE
- ALTERNATIVE AIRPORT/ HELIPORT LOCATION

FIGURE 9–8
LOCATIONS OF ALTERNATIVE SITES IN RELATION TO WILDLIFE AREAS

Wildlife. The sites of Alternatives 2 and 3 lie within a five-mile range of a known habitat for the 'Awiwi. (See Figure 9-8.) This taxa is formally listed as endangered.

Mitigation. Two mitigative actions are recommended in connection with the development of a new airport site under either Alternative 2 or 3:

- Determine whether cultivated lands are candidate "prime or unique farmlands." If so designated, a plan should be implemented to mitigate the lands affected by physical improvements at the site.
- A site survey should be undertaken prior to development to ascertain possible presence of 'Awiwi.

Al[illegible]atives 4, 4A and 8. The potential eff[illegible] of development of a new site at Puunene, as illustrated on Figures 9-7 and 9-8, are discussed below.

Vegetation. The sites of Alternatives 4, 4A and 8 lie primarily within cultivated lands as shown on Figure 9-7. Development of Alternative 4 or 4A would require the acquisition of approximately 510 and 390 acres of land, respectively; approximately 710 acres would be required for Alternative 8. Most of this acreage is currently devoted to sugarcane production. A smaller portion includes lands undergoing transition from agricultural, WW-II (former Puunene Airport) and related uses to quasi-urban uses (e.g., Maui Drag Strip).

The airfield and associated aircraft operational and basing areas will necessitate the removal of the greater portion of the cultivated lands from production. Development of Alternatives 4, 4A or 8 would also necessitate closure or relocation of Maui Drag Strip.

Wildlife. The sites of Alternatives 4, 4A and 8 lie adjacent to a reservoir which is a known habitat for the Hawaiian Coot ('Alae Ke'Oke'O). The Hawaiian Coot is formally listed as an endangered species. The sites also lie within a five-mile range of a known habitat for the 'Awiwi. This taxa is also formally listed as endangered. (See Figure 9-8 and Table 3-2.)

Mitigation. Three mitigative actions are recommended in connection with the development of a new airport site under Alternatives 4, 4A or 8:

- Determine whether cultivated lands are candidate "prime or unique farmlands." If so designated, a plan should be implemented to mitigate the lands affected by physical improvements at the site.
- Develop a relocation plan for the Maui Drag Strip.
- Site surveys should be undertaken to ascertain project effects on the habitat of the Hawaiian Coot. Measures to avoid disturbance of the reservoir habitat should be incorporated into the airport development plan.

Alternative 5. The potential effects of development of a new site north of Kihei, as illustrated on Figures 9-7 and 9-8, are discussed below.

Vegetation. The site of Alternative 5 lies primarily within cultivated lands as shown on Figure 9-7. Development of Alternative 5 would require the acquisition of approximately 510 acres of lands currently devoted to agricultural production. Also involved lands in transitional use which would be required for approach protection at the airfield's southwest end. The airfield and associated aircraft operational and

basing areas will necessitate the removal of the greater portion of these cultivated lands from production. Transitional uses need not be affected providing that strict controls can be implemented to obviate the creation of obstructions to air navigation.

Wildlife. The site of Alternative 5 lies greater than three miles from the nearest known endangered or threatened wildlife habitat. (See Figure 9-8.)

Mitigation. A determination should be made regarding whether cultivated lands are candidate "prime or unique farmlands." If so designated, a plan should be implemented to mitigate the lands affected by physical improvements at the site.

Alternative 6. The potential effects of development of a new site east of Kahului south of Haleakala Highway, as illustrated on Figures 9-7 and 9-8, are discussed below.

Vegetation. The site of Alternative 6 lies entirely within cultivated lands as shown on Figure 9-7 and is bisected by Haleakala Highway. Development of Alternative 6 would require the acquisition of approximately 510 acres lands currently devoted primarily to sugarcane production. The airfield and associated aircraft operational and basing areas will necessitate the removal of the greater portion of these cultivated lands from production.

Wildlife. The site of Alternative 6 lies adjacent to a reservoir which is a known habitat for the Hawaiian Stilt ('Ae'O). The Hawaiian Stilt is formally listed as an endangered species. (See Figure 9-8.)

Mitigation. Two mitigative actions are recommended in connection with the development of a new airport site under Alternative 6:

- Determine whether cultivated lands are candidate "prime or unique farmlands." If so designated, a plan should be implemented to mitigate the lands affected by physical improvements at the site.
- Site surveys should be undertaken to ascertain project effects on the habitat of the Hawaiian Stilt. Measures to avoid disturbance of the reservoir habitat should be incorporated into the airport development plan.

Alternative 7. The potential effects of development of a dual-complex site near Puunene straddling the site of the former Puunene Airport, as illustrated on Figures 9-7 and 9-8, are discussed below.

Vegetation. The dual sites of Alternative 7 are separated by approximately 1.5 miles. The northerly site would accommodate rotorcraft operations; fixed-wing operations would be conducted on the southerly site. The northerly (rotorcraft) site involves some 60 acres devoted primarily to agricultural cultivation. A small portion of this site involves transitional uses (e.g., Maui Drag Strip). The southerly (fixed-wing) site involves some 390 acres devoted primarily to agricultural cultivation. The southwesterly approach area for the fixed-wing site also involves lands designated as forestland.

The airfield and associated aircraft operational and basing areas at the joint sites will necessitate the removal of the greater portion of cultivated lands from production. Continued operation of the Maui Drag Strip may be compatible with new rotorcraft facilities providing that safety and aeronautical requirements are not compromised. Trees which cannot be topped and maintained to clear the required approach slope for the southwesterly fixed-wing approach may conflict with normal aircraft operations and may need to be removed.

Wildlife. The northerly (rotorcraft) site of Alternative 7 lies adjacent to a reservoir which is a known habitat for the Hawaiian Coot ('Alae Ke'Oke'O). The Hawaiian Coot is formally listed as an endangered species. (See Figure 9-8.) The northerly and southerly sites of Alternative 7 lie within a five-mile range of a known habitat for the 'Awiwi. (Also see Figure 9-8.) This taxa is formally listed as endangered.

Mitigation. Several mitigative actions are recommended in connection with the development of a new airport site under Alternatives 7:

- Determine whether cultivated lands are candidate "prime or unique farmlands." If so designated, a plan should be implemented to mitigate the lands affected by physical improvements at the dual sites.
- Determine possible conflicts between the Maui Drag Strip and aeronautical requirements associated with the northerly (rotorcraft) site of Alternative 7.
- Determine potential of forested areas on southerly (fixed-wing) site south-westerly approach to create possible vertical conflicts with aircraft operations.
- Site surveys should be undertaken to ascertain project effects on the habitat of the Hawaiian Coot and 'Awiwi. Measures to avoid disturbance of habitats should be incorporated into the airport development plan.

Noise and Land Use

Under federal land use compatibility criteria, residential and other noise sensitive uses are compatible with cumulative noise levels of Ldn 65 dB or lower. However, federal standards recognize that more restrictive standards may be applicable when local considerations so merit. For example, rural areas and scenic regions often possess a greater level of acoustic sensitivity due to low ambient noise levels. The State of Hawaii has adopted a noise level of Ldn 55 dB as the Fair Disclosure noise level.

Thus a criterion level of Ldn 55 dB was chosen to represent the threshold of compatibility for residential and other noise sensitive uses consistent with State of Hawaii Fair Disclosure policies. Although highly conservative, this criterion is deemed an appropriate level upon which to judge land use compatibility for this study.

Seven of the eight major study alternatives involve the establishment of new bases for rotorcraft operations. Under recently-imposed FAA rules, rotorcraft must maintain an altitude of at least 1,500 feet AGL in transit to and from points of interest. This minimum descent altitude (MDA) restriction also applies to overflight of scenic resources. The net acoustic effect of this restriction is to limit cumulative noise levels to the immediate environs of proposed heliport facilities.

Alternative 1A. One option under Alternative 1A is to relocate the helicopter activity to a site at the intersection of Hana Highway and Haleakala Highway. This site would become part of Kahului Airport, assuming a parallel runway was constructed west of Hana Highway. Because this alternative does not constitute a new site, it has not been evaluated to the extent of the new site alternatives. However, helicopter noise contours were developed for helicopter operations under this alternative. Noise contours (Ldn) for helicopter activity

within the environs of the site are shown on Figure 9-9. These contours do not include noise from fixed-wing aircraft activity. The inclusion of noise from fixed-wing aircraft operations at Kahului Airport, especially with a new parallel runway, could result in an expansion of the noise contours shown in Figure 9-9.

The Ldn 55 dB (outermost) contour encompasses an area of approximately 520 gross acres and lies south of the coastal communities of Spreckelsville and Paia. However, with the possible exception of farm residences, no urban residential uses lie within or are planned within the projected Ldn 55 dB helicopter contour.

> Mitigation. Continued imposition of the 1,500-foot MDA restriction should mitigate helicopter noise under Alternative 1A to a level of insignificance.

Alternative 2. The principal acoustic effects of the operation of a new heliport under Alternative 2 result from the overflight of noise sensitive (primarily residential) land uses by rotorcraft in transit to and from scenic points of interest on-Island.

Noise contours describing cumulative (Ldn) noise exposure within the heliport environs are illustrated on Figure 9-10. The Ldn 55 dB (outermost) contour encompasses an area of approximately 520 gross acres and lies in proximity to a variety of urban uses along the shore of Maalaea Bay including the Waiako Homesteads as shown. However, with the possible exception of farm residences, no urban residential uses lie within the projected Ldn 55 dB contour.

> Mitigation. Continued imposition of the 1,500-foot MDA restriction should mitigate cumulative noise under Alternative 2 to a level of insignificance.

Alternative 3. Noise contours describing cumulative (Ldn) noise exposure within the heliport environs are illustrated on Figure 9-11. The Ldn 55 dB (outermost) contour encompasses an area of approximately 520 gross acres and overlies primarily agricultural land uses. With the likely exception of farm residences, no urban residential uses lie within the projected Ldn 55 dB contour.

> Mitigation. Continued imposition of the 1,500-foot MDA restriction should mitigate cumulative noise under Alternative 3 to a level of insignificance.

Alternative 4. Noise contours describing cumulative (Ldn) noise exposure within the airport/heliport environs are illustrated on Figure 9-12. The Ldn 55 dB (outermost) contour encompasses an area of approximately 840 gross acres and overlies agricultural, transitional and forestland land uses. With the likely exception of farm residences, no urban residential uses lie within the projected Ldn 55 dB contour.

> Mitigation. Continued imposition of the 1,500-foot MDA restriction should mitigate cumulative noise under Alternative 4 to a level of insignificance.

Alternative 4A. Noise contours describing airport environs are illustrated on Figure 9-13. The Ldn 55 dB (outermost) contour encompasses an area of approximately 420 gross acres and overlies agricultural, transitional and forestland cumulative (Ldn) noise exposure within the land uses. With the possible exception of farm residences, no urban residential uses lie within the projected Ldn 55 dB contour.

> Mitigation. Continued imposition of the 1,500-foot MDA restriction should mitigate cumulative noise under Alternative 4A to a level of insignificance.

FIGURE 9-9
ESTIMATED LDN NOISE CONTOURS IN YEAR 2015 FOR
ALTERNATIVE 1A: HELIPORT RELOCATED EAST OF HANA HIGHWAY

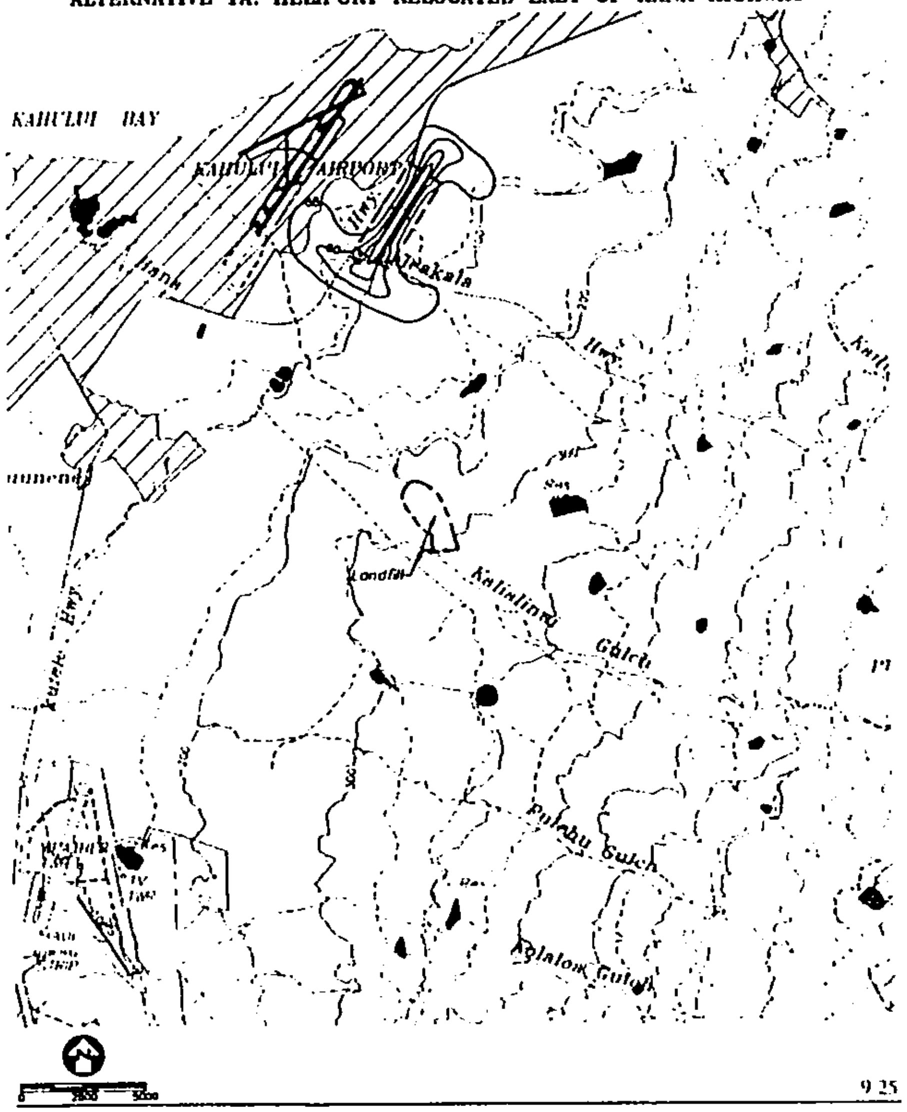


FIGURE 9-10
ESTIMATED LDN NOISE CONTOURS IN YEAR 2015 FOR
ALTERNATIVE 2: NEW HELIPORT-PUUNENE SOUTH

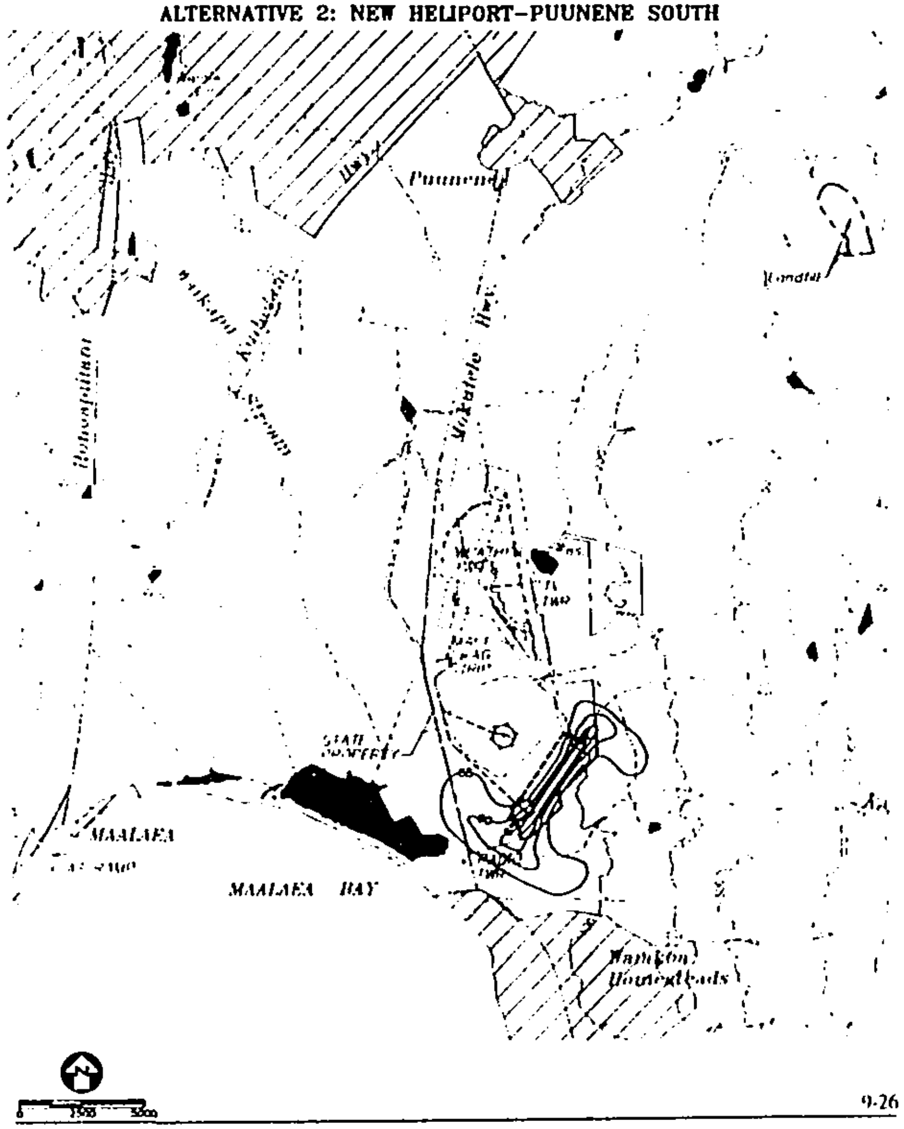


FIGURE 9-11
ESTIMATED LDN NOISE CONTOURS IN YEAR 2015 FOR
ALTERNATIVE 3: NEW HELIPORT-PUUNENE EAST

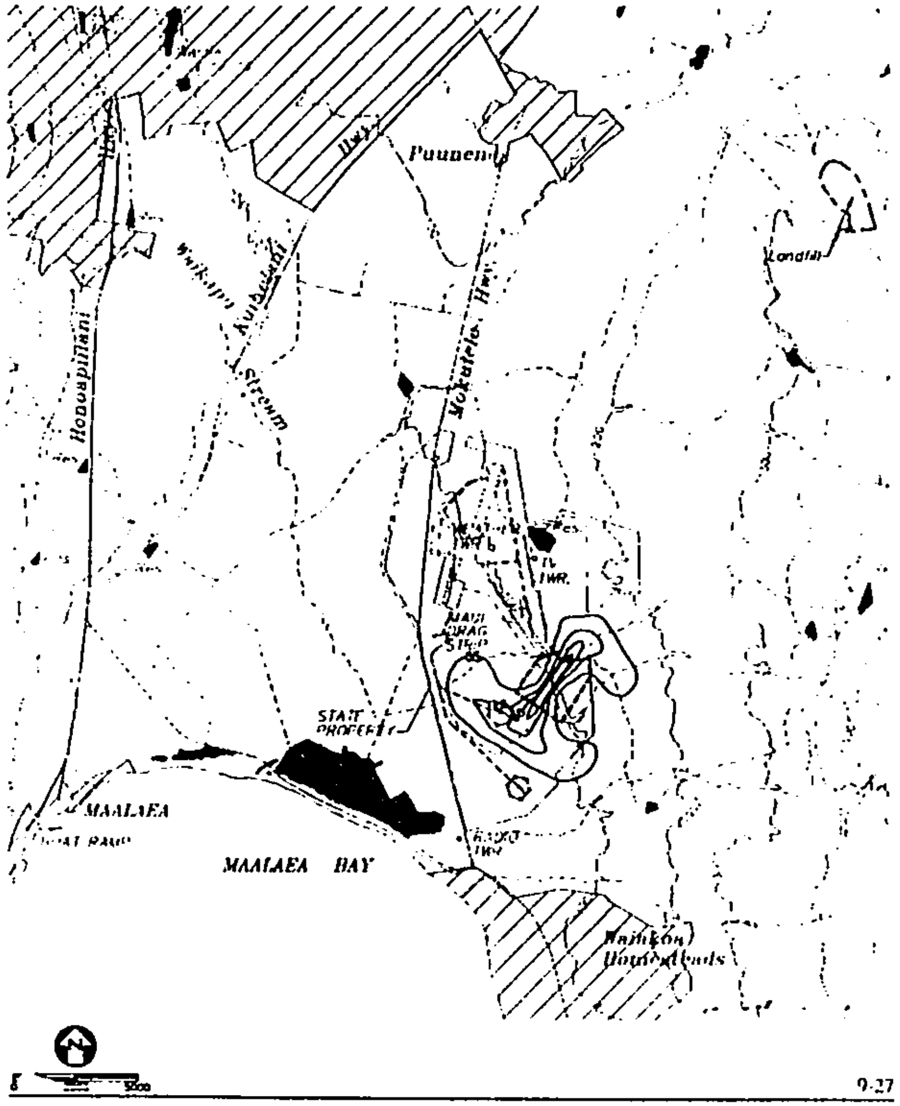


FIGURE 9-12
ESTIMATED LDN NOISE CONTOURS IN YEAR 2015 FOR
ALTERNATIVE 4: NEW UTILITY AIRPORT/ HELIPORT-PUUNENE

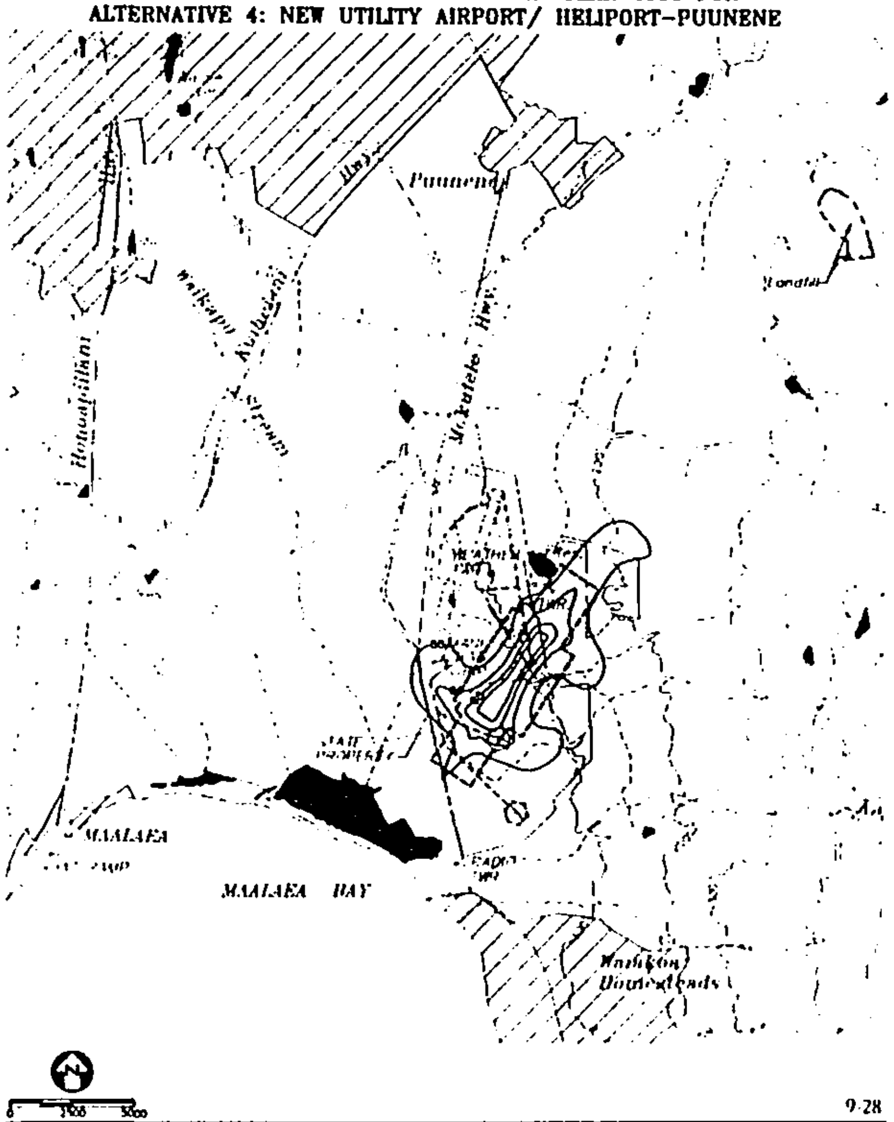
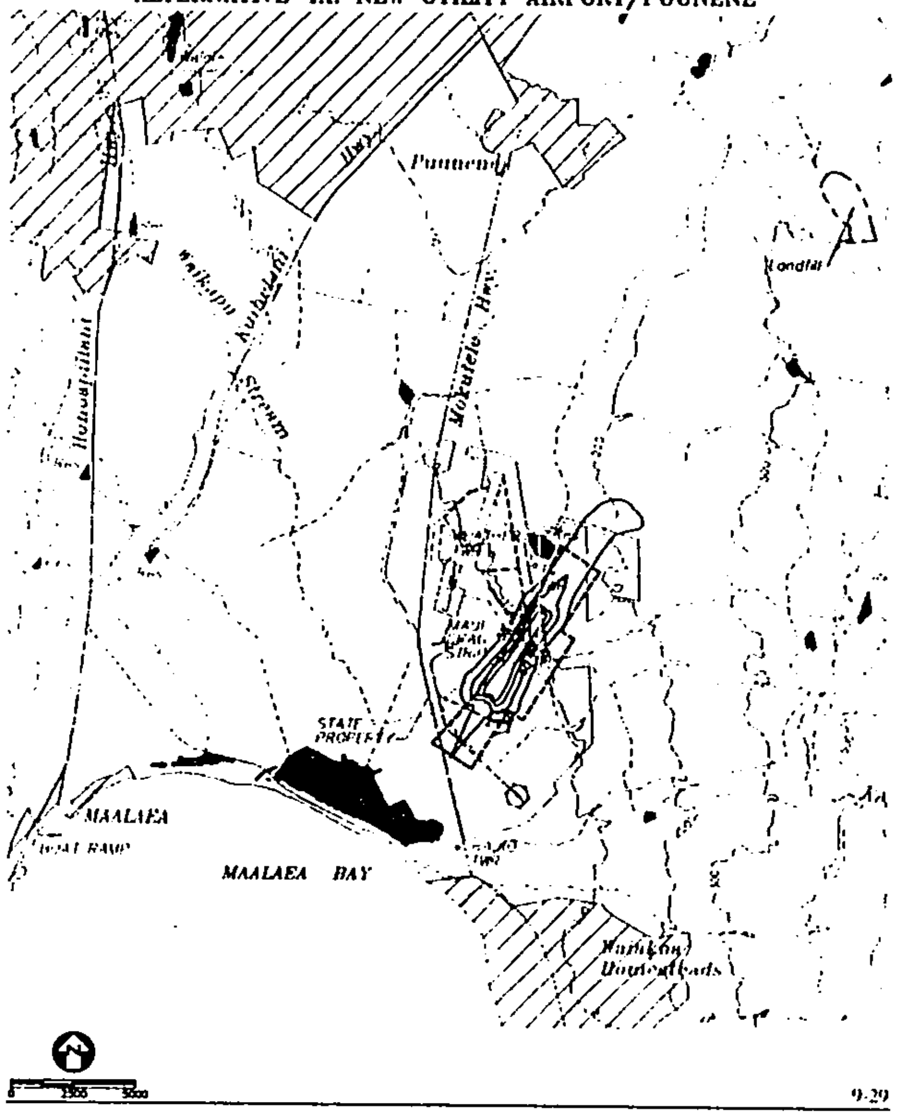


FIGURE 9-13
ESTIMATED LDN NOISE CONTOURS IN YEAR 2015 FOR ALTERNATIVE 4A: NEW UTILITY AIRPORT/PUUNENE



Alternative 5. Noise contours describing cumulative (Ldn) noise exposure within the airport/heliport environs are illustrated on Figure 9-14. The Ldn 55 dB (outermost) contour encompasses an area of approximately 840 gross acres and overlies agricultural, transitional and brush/rangeland land uses. With the possible exception of farm residences, no urban residential uses lie within the projected Ldn 55 dB contour.

Mitigation. Continued imposition of the 1,500-foot MDA restriction should mitigate cumulative noise under Alternative 5 to a level of insignificance.

Alternative 6. Noise contours describing cumulative (Ldn) noise exposure within the airport/heliport environs are illustrated on Figure 9-15. The Ldn 55 dB (outermost) contour encompasses an area of approximately 820 gross acres and overlies primarily agricultural land uses. With the possible exception of farm residences, no urban residential uses lie within the projected Ldn 55 dB contour.

Mitigation. Continued imposition of the 1,500-foot MDA restriction should mitigate cumulative noise under Alternative 6 to a level of insignificance.

Alternative 7. Noise contours describing cumulative (Ldn) noise exposure within the airport and heliport environs are illustrated on Figure 9-16. The Ldn 55 Db (outermost) contours encompasses a combined area of approximately 940 gross acres and overlies agricultural, transitional and forestland land uses. With the possible exception of farm residences, no urban residential uses lie within the projected Ldn 55 Db contour.

Mitigation. Continued imposition of the 1,500-foot MDA restriction should mitigate cumulative noise under Alternative 7 to a level of insignificance.

Alternative 8. Noise contours describing cumulative (Ldn) noise exposure within the airport/heliport environs are illustrated on Figure 9-17. The Ldn 55 Db (outermost) contour encompasses an area of approximately 2,230 gross acres and overlies agricultural, transitional and forestland land uses. In addition, cumulative noise levels of Ldn 55 Db and greater affect a portion of the Kealia Pond.

With the possible exception of farm residences, no urban residential uses lie within the projected Ldn 55 Db contour (in consideration of State Fair Disclosure policies regarding residential uses). Furthermore, federal criteria (as set forth in FAR Part 150) suggest zoos, parks and related uses (including, by implication, wildlife sanctuaries) are compatible at noise levels of up to Ldn 70 Db. Thus no significant acoustic impact on Kealia Pond is anticipated as a consequence of Alternative 8 based on projected cumulative noise levels.

Mitigation. Continued imposition of the 1,500-foot MDA restriction should mitigate cumulative noise under Alternative 8 to a level of insignificance.

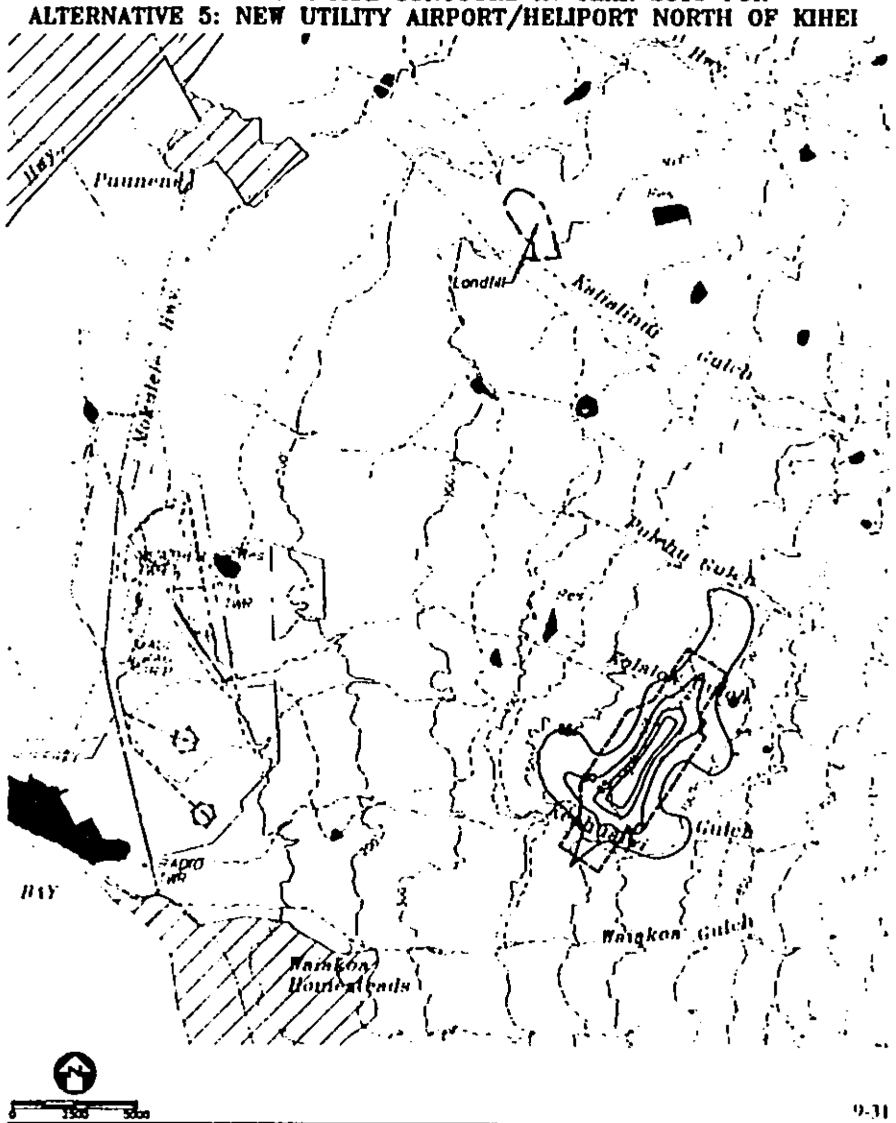
Air Quality

The intent of this study is to identify possible alternatives for the relocation of existing flight operations. It is not anticipated that any of the proposed alternatives will result in any significant changes in the air quality as there will be no increase in the total number of flight operations for Maui, except some additional helicopter flights for Alternative 1B. When preferred alternative is selected, it is anticipated that a comprehensive air quality analysis will be undertaken as part of the preparation of the associated environmental review.

Surface Transportation

Forecasts of Island-wide vehicular traffic suggest that the existing roadway system (see

FIGURE 9-14
ESTIMATED LDN NOISE CONTOURS IN YEAR 2015 FOR
ALTERNATIVE 5: NEW UTILITY AIRPORT/HELIPORT NORTH OF KIHEI



Maui General Aviation Study
Hawaii Department of Transportation
Airports Division

FIGURE 9-15
ESTIMATED LDN NOISE CONTOURS IN YEAR 2015 FOR
ALTERNATIVE 6: NEW UTILITY AIRPORT/HELIPORT-EAST OF KAHULUI

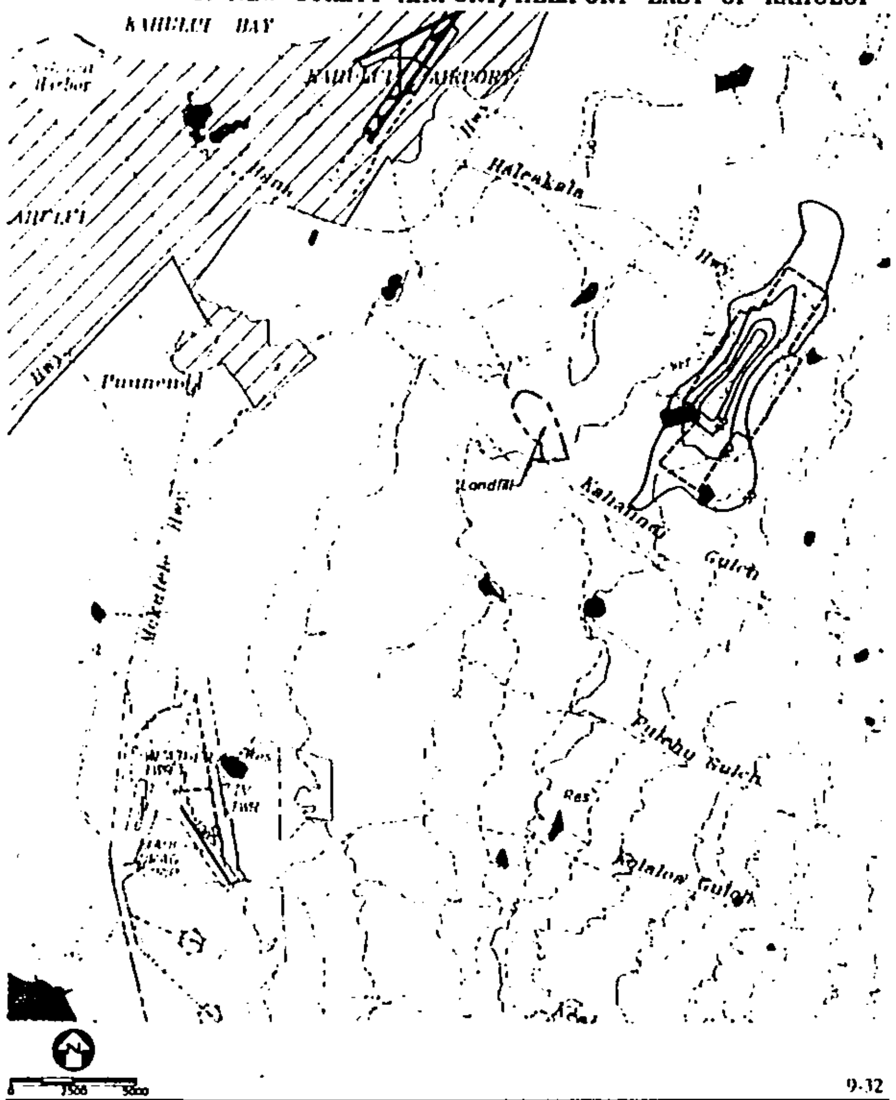


FIGURE 9-16
ESTIMATED LDN NOISE CONTOURS IN YEAR 2015 FOR ALTERNATIVE 7: NEW UTILITY AIRPORT AND NEW HELIPORT–PUUNENE

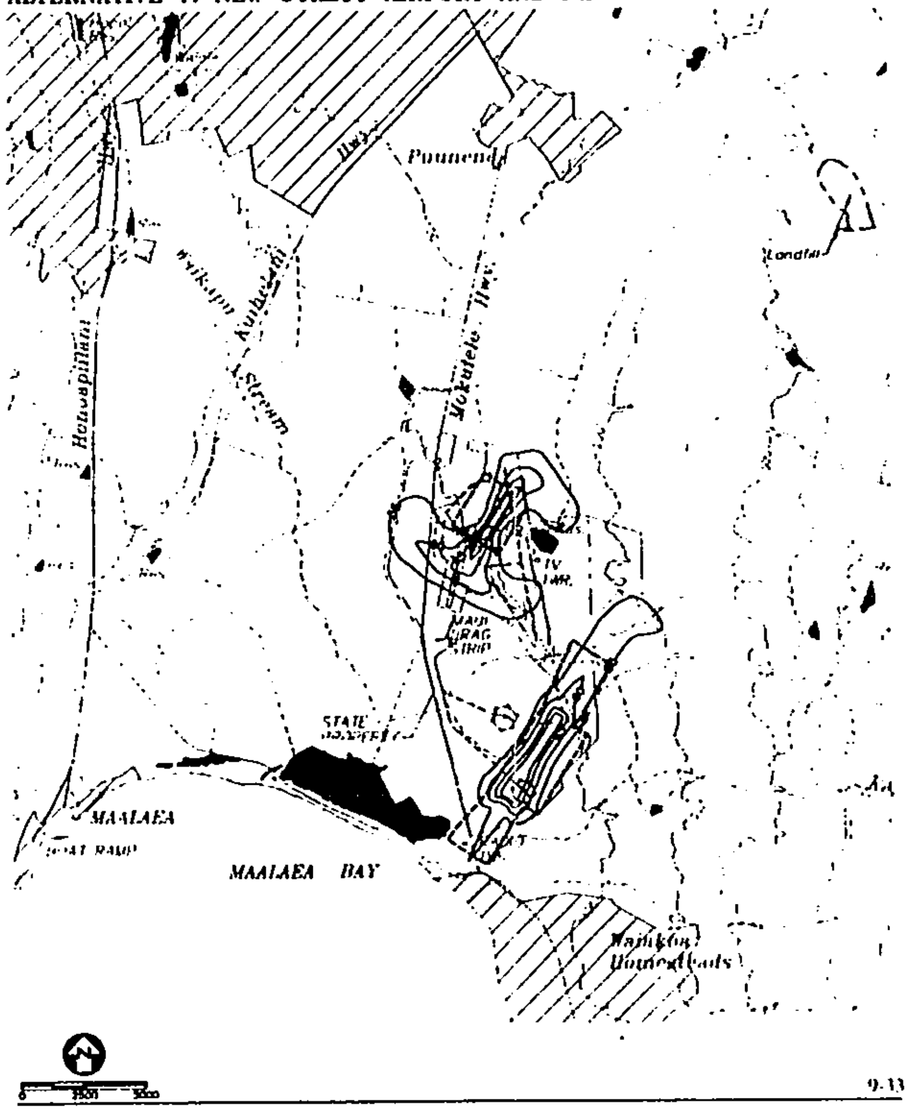


FIGURE 9-17
ESTIMATED LDN NOISE CONTOURS IN YEAR 2015 FOR ALTERNATIVE 8: NEW TRANSPORT AIRPORT/HELIPORT–PUUNENE

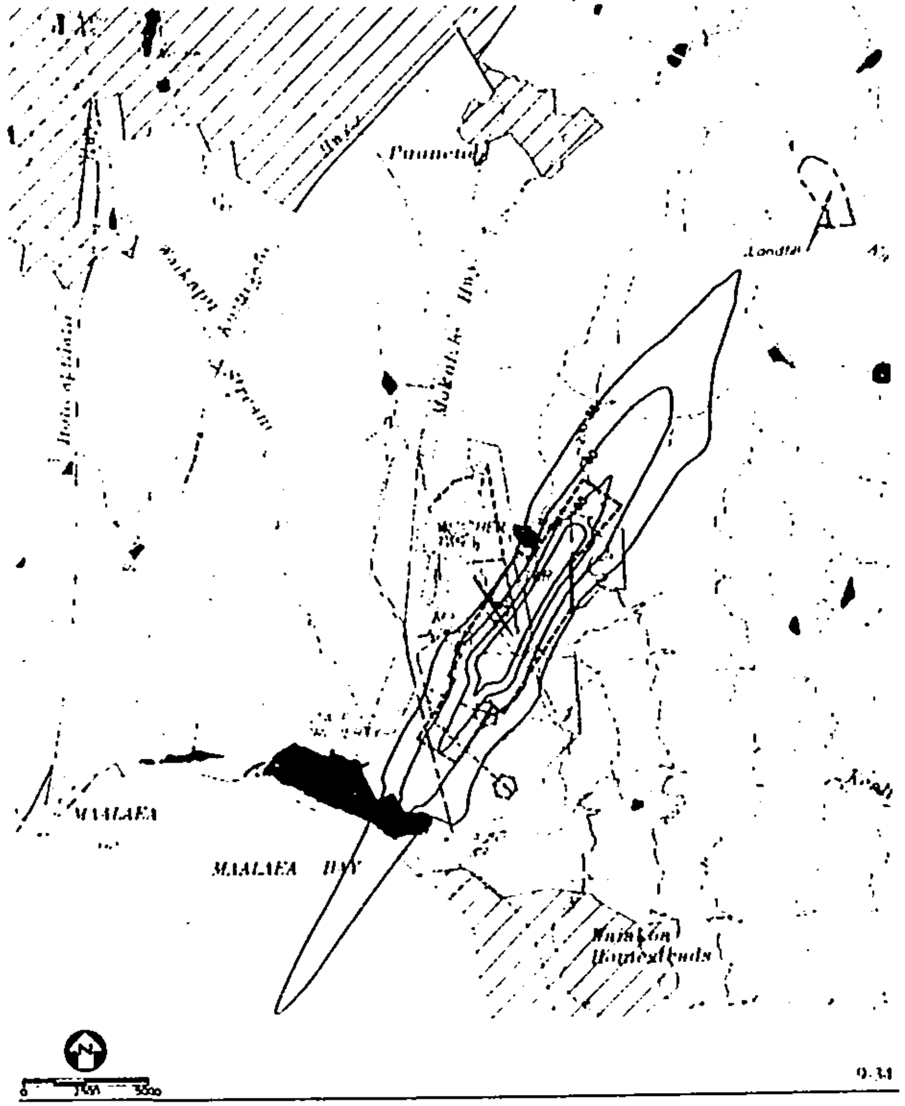


Figure 9-8) may see gradually deteriorating congestion in future years due to forecast growth of population, income and tourism activities. The additive effects of forecast vehicular traffic generated by a new airport/heliport site may further aggravate these conditions along certain busy highway links and at key highway intersections.

A Long Range Highway Plan for Maui, prepared in 1991, identified roadway deficiencies along road segments which could be used to access alternative airport/heliport sites from the Kahului/Wailuku urbanized area. Some of these deficiencies include:

- Hana Highway and Haleakala Highway which operate at LOS F conditions inbound in AM peak and outbound in PM peak.
- Honoapiilani Highway and Kuihelani Highway experience LOS F during both AM and PM peaks. Because of peak period problems in Honoapiilani Highway, North Kihei Road also operates at LOS F during peak.
- Honoapiilani Highway -- three-lane section between Lahaina and Kaanapali operates at LOS F during most of the afternoon, and the two-lane section south of Lahaina operates at LOS E.

Within the context of these deficiencies, the development of a new airport/heliport site may have identifiable effects.

Alternative 1B. The development of a West Maui site to serve commercial rotorcraft operations could have a beneficial effect on peak-hour level of service on Honoapiilani Highway (State Route 30), linking the coastal West Maui communities (including Lahaina and Kaanapali) to the urbanized areas of the Isthmus (incl. Kahului and Wailuku). Up to 620 daily passenger trips could be diverted from Honoapiilani Highway (Route 30), south of Lahaina, lessening peak-hour congestion on that link.

Under the further assumption that 15% of daily demand is accommodated during the peak hour, demand on Honoapiilani Highway could be reduced by approximately 93 peak hour movements. Conversely, the addition of these 93 peak hour movements on the highway link joining Lahaina and the heliport site may aggravate local traffic congestion.

Since Honoapiilani Highway between Lahaina and Kaanapali currently operates at LOS F during most afternoon peaks, the addition of 93 peak hour movements generated by a new heliport could be significant.

An access road and highway connection would also be required to implement this alternative. The new intersection could further adversely affect traffic flow on Honoapiilani Highway between Lahaina and Kaanapali.

Mitigation. To ascertain the quantifiable effects (both favorable and adverse) of a new West Maui heliport site, it is recommended that "planning" analyses be undertaken for key Highway 30 links between the urban/resort centroid near Lahaina and (1) the heliport site (which would be adversely affected), and (2) the route south of Lahaina (which might see peak hour improvement).

The intersection between the new heliport access road and Highway 30 should be designed and signalized so as to minimize effects on through traffic.

Alternatives 2, 3, 4, 7 and 8. Each of these alternatives involves development of a site to serve either fixed-wing aircraft, rotorcraft or a combination of both in Puunene. Available roadway access routes are shared among these alternatives and the general discussion is applicable to each.

Development of any one of the five principal Puunene site alternatives could generate from as few as 1,570 to as many as 2,440 daily vehicle trips. Under an assumption that 15 percent of these trips would be accomplished during the peak hour, a range of from 235 to 365 peak hour vehicular movements could be generated.

The principal highway access route to these sites from the Kahului/Wailuku urbanized area would be Puunene Avenue via Mokulele Highway (State Route 35). Under current conditions, Mokulele Highway is classified as a light duty thoroughfare. Although peak-hour usage is assumed to be less than 1,000 vehicles per hour, estimated bi-directional throughput capacity could be as high as 2,000 vehicles per hour on this two-lane thoroughfare.

In its Long Range Plan for the year 2020, the State of Hawaii has forecast that AM peak hour traffic could increase to as much as 1,124 VPH going toward Kihei and 1,552 VPH going toward Puunene Mill. PM peaks for the same directions of flow could be as high as 1,325 VPH and 1,487 VPH, respectively.

Thus, under current conditions, the addition of as many as 365 peak hour traffic movements generated by a fully functional airport/heliport (including commercial cargo operations under Alternative 8, which would not occur during peak periods) would not be expected to materially affect peak hour level of service on Mokulele Highway.

However, by the year 2020, traffic growth forecast by the State of Hawaii combined with incremental airport-related traffic could materially affect peak period levels of service on Mokulele Highway.

An access road and highway connection would also be required to implement any one of these five alternatives. The new intersection could adversely affect traffic flow on Mokulele Highway.

Mitigation. To verify the quantifiable effects of these alternatives, traffic analyses would need to be undertaken for:

- Puunene Avenue between Kaahumanu Avenue and Mokulele Highway in Puunene, and
- Mokulele Highway from Puunene to Maui Drag Strip.

Forecast peak-hour traffic demand on Mokulele Highway could result in unacceptable levels of delay by the year 2020 planning horizon. Thus, the potential provision of turning lanes and signalization (where appropriate) together with possible widening of Mokulele Highway to 4 lanes from Puunene Avenue to the airport access road should be explored in connection with the recommended traffic analysis.

In addition, the intersection between the new airport/heliport access road and Mokulele Highway should be designed and signalized so as to minimize effects on through traffic. (Note that if the existing Maui Drag Strip access road is salvaged to serve as an airport access road, the intersection at Mokulele Highway should be evaluated and measures to improve efficiency may be appropriate.)

Alternative 4A. The development of a fixed-wing utility airport as envisioned under Alternative 4A is expected to generate as many as 480 average daily vehicular trips when in full operation. Fewer than 75 peak hour trips are expected under the aforementioned demand assumptions. (See discussion of Alternatives 2-8.) As discussed under Alternatives 2-8, the principal highway access route to the Puunene site from the Kahului/Wailuku urbanized area would utilize Puunene Avenue via Mokulele Highway. The addition of 75 peak hour movements is not expected to significantly affect level of service on the principal access route.

Mitigation. A planning analysis is recommended for Puunene Avenue between Kaahumanu Avenue and Mokulele Highway in Puunene to verify that LOS would not be adversely affected.

Alternative 5. Development of Alternative 5 at the site north of Kihei could generate as many as 2,020 daily vehicle trips. Under the assumption that 15 percent of these trips would be accomplished during the peak hour (as discussed previously), as many as 300 peak hour vehicular movements could be generated.

Several possible highway access routes to the site of Alternative 5 from the Kahului/Wailuku urbanized area could be utilized:

- Puunene Avenue via Mokulele Highway (State Route 35). A long access road of up to seven miles length would be required.
- Hana Highway via Pulehu Road, Central Power Plant Road, Spanish Road, Omaopio Road, and Waiakoa Road.
- Access via a proposed new Upcountry Highway.

Each of the light duty roads involved in the optional access routes may require considerable improvements in order to accommodate forecast vehicular traffic (300 peak hour movements) with an adequate level of service.

An access road and highway/roadway connection would also be required.

Mitigation. To verify the quantifiable effects of this alternative on the preferred Puunene Avenue/Mokulele Highway access option, planning traffic analyses would need to be undertaken for:

- Puunene Avenue between Kaahumanu Avenue and Mokulele Highway in Puunene, and
- Mokulele Highway from Puunene to Maui Drag Strip.

The intersection between the new airport/heliport access road and Mokulele Highway should be designed and signalized so as to minimize effects on through traffic.

Costs associated with the lesser access options could also be estimated in order to determine their financial feasibility.

Alternative 6. Development of Alternative 6 at a site east of Kahului south of Haleakala Highway could generate as many as 2,020 daily vehicle trips. Under an assumption that 15 percent of these trips would be accomplished during the peak hour, as many as 300 peak hour vehicular movements could be generated.

The principal highway access route to the site of Alternative 6 from the Kahului/Wailuku urbanized area would utilize Hana Highway (State Route 36) via Haleakala Highway (State Route 37). Under current conditions, the pertinent portion of Hana Highway is a busy, four-lane thoroughfare. In the vicinity of Kahului Airport both Hana Highway and Haleakala Highway operate at LOS F conditions inbound during the AM peak and outbound during the PM peak under present conditions.

Under the assumption that rotorcraft (and limited fixed-wing utility) operations would be diverted from Kahului Airport to the new Alternative 6 site, it is likely that congestion on Hana Highway west of Dairy Road would not be materially affected since this link would be utilized under both alternatives (i.e., Alternatives 1 and 6).

The more significant effects are likely to be incurred on Hana Highway between Dairy Road and Haleakala Highway, Haleakala Highway and at the Hana Highway/Haleakala Highway intersection.

Thus, the addition of as many as 300 peak hour traffic movements generated by a fully functional airport/heliport may adversely affect LOS on both Hana and Haleakala Highways.

An access road and highway connection would also be required to implement this alternative. The new intersection could further adversely affect traffic flow on Haleakala Highway.

Mitigation. To verify the quantifiable effects of this alternative, planning traffic analyses would need to be undertaken for:

- Hana Highway between Dairy Road and Haleakala Highway, and
- Haleakala Highway from Hana Highway to future Alternative 6 access road.

The intersection between the new airport/heliport access road and Haleakala Highway should be designed and signalized so as to minimize effects on through traffic.

Historical and Archaeological Resources

The evaluation of potential effects on known historic or archaeological resources was based on information obtained from a variety of sources including Hawaii Office of State Planning, informal site reconnaissance and local interests. Potential sites of archaeological significance are set forth in the following discussion.

Alternatives 2, 3, 5, 6 and 7. No resources of historic or archaeological significance are know to exist on the site of Alternatives 2, 3, 5, 6 and 7.

Mitigation. None required.

Alternatives 4, 4A and 8. The locale of Alternatives 4, 4A and 8 possesses relic World War II construction which may be a candidate for consideration (and mitigation) as a historical resource.

The site of the former Puunene Airport (also known as former NAS Puunene) contains several structures of possible note, namely, a series of aircraft revetments (protective earthen barriers) and ammunition storage bunkers.

The concrete ammunition storage bunkers (arranged in a circular layout) were constructed by the U.S. Navy between 1942 and 1944. Earthen/concrete revetments were also constructed by the Navy for the purpose of protecting parked aircraft from aerial attack.

Mitigation. A procedure for consideration of potential candidate historic or archaeological sites has been established by the State of Hawaii Office of State Planning. This procedure, overseen by a State archaeologist, applies to any structure greater than 50 years in age. The procedure involves the following basic steps:

- Recognize potential resource.
- Determine date and circumstances of construction.
- Determine who initiated construction.
- Determine purpose of structure or candidate resource.
- Determine current ownership of or responsibility for disposition of resource.
- Determine if the candidate resource is unique in any way.

An assessment should also include a determination of possible social or historic value of the candidate resource and a determination of whether the potential value (or need) may be provided by another similar resource situated elsewhere. More importantly, a mitigation program should be developed which, at a minimum, should include a written record including:

- photography,
- plan drawings, and
- a description of construction material and details.

The pursuit of any of the three former Puunene Airport development alternatives should be conditioned on acquisition of the necessary drawings and information together with a formal determination by the Hawaii Office of State Planning.

Energy Supply and Natural Resources

The day-to-day operation of a new airport or heliport under each alternative would require the consumption of energy and natural resources including electricity and (possibly) natural gas. Ongoing airport development and maintenance would require the use of water and construction materials, including sand and gravel, cement, lumber, and other building materials.

Alternatives 2, 3, 4, 4A, 5, 6, 7 and 8. The principal study alternatives span a range of fixed-wing and rotorcraft operations and would entail differing degrees of consumption of both construction materials and consumable resources. Pending development of a detailed concept plan, specific quantities of construction materials are unknown. Consumable resources for each alternative, while indeterminate, would be expended in approximate proportion to the activity levels associated with each.

Mitigation. Providers of materials used in construction (including asphaltic and Portland cement concretes) should comply with established energy conservation measures as stipulated in State and federal codes. State of Hawaii policies regarding use and conservation of consumable should also be applied to the management and operation of the new airport and/or heliport sites.

Hydrology, Drainage and Water Quality

Alternatives 2, 3, 4, 4A, 7 and 8. The general sites of these five alternatives lie in the vicinity of two streams draining Keahuaiwi Gulch and Kolaloa Gulch as shown on Figure 9-8. These streams drain large tributary areas and flow directly into Maalaea Bay and Kealia Pond. Normal airport activities including maintenance and washing of aircraft may result in the flow of detergents and other substances into nearby streams.

Water quality in the immediate site vicinity of the alternatives is heavily influenced by the existence of agricultural uses including sugarcane production. Potable water may be either collected from rainwater and stored in tanks for subsequent consumption or obtained from wells. No water quality samples for the sites of these alternatives are presently available.

Mitigation. Provisions should be made to collect runoff from maintenance and washing activities in retention ponds for subsequent treatment or disposal. Potential sources of potable water should be tested and certified.

It should be noted that collection of storm runoff into retention ponds may become a bird attractant. The potential adverse effects, if any, due to creation of retention ponds could be readily mitigated and are thus not considered significant.

Alternative 5. The Kihei site of Alternative 5 lies within watershed defined by Kolaloa Gulch and Keahuaiwi Gulch. These gulleys are drained by perennial streams as shown on Figure 9-8. These streams drain large tributary areas and flow directly into Maalaea Bay. (Also see discussion under Alternative 2.) Normal airport activities including maintenance and

washing of aircraft may result in the flow of detergents and other substances into nearby streams.

Water quality in the immediate site vicinity of Alternative 5 is heavily influenced by the existence of agricultural uses. Potable water may be either collected from rainwater and stored in tanks for subsequent consumption or obtained from wells. No water quality samples for the site of Alternative 5 are presently available.

Mitigation. Provisions should be made to collect runoff from maintenance and washing activities in retention ponds for subsequent treatment or disposal. Potential sources of potable water should be tested and certified.

It should be noted that collection of storm runoff into retention ponds may become a bird attractant. The potential adverse effects, if any, due to creation of retention ponds could be readily mitigated and are thus not considered significant.

Alternative 6. The Haleakala Highway site of Alternative 6 is drained via perennial streams flowing into Kailua Gulch as shown on Figure 9-8. Kailua Gulch drains ultimately into Kahului Bay. (Also see discussion under Alternative 2.) Normal airport activities including maintenance and washing of aircraft may result in the flow of detergents and other substances into nearby streams.

As with all other alternatives, water quality in the immediate site vicinity of Alternative 6 is heavily influenced by the existence of agricultural uses. Potable water may be either collected from rainwater and stored in tanks for subsequent consumption or obtained from wells. No water quality samples for the site of Alternative 6 are presently available.

Mitigation. Provisions should be made to collect runoff from maintenance and washing activities in retention ponds for subsequent treatment or disposal. Potential sources of potable water should be tested and certified.

It should be noted that collection of storm runoff into retention ponds may become a bird attractant. The potential adverse effects, if any, due to creation of retention ponds could be readily mitigated and are thus not considered significant.

Aesthetics

The principal aesthetic consideration associated with the development of a new airport or heliport involves light emissions. Illumination of airfield pavements, parking aprons, structures and surface vehicle parking are potential sources of objectionable emissions within the rural airport study site environs.

Alternatives 2, 3, 4, 4A, 5, 6, 7 and 8. Although the population density of the environs of each of the primary airport site alternatives is low, the actual impact or effects of illumination is unknown and is largely dependent of the perceptions and sensitivities of local residents.

Mitigation. Impact indeterminate, none required.

DEVELOPMENT COSTS

Total Site Development Costs

The total cost of site acquisition, airport/heliport construction and mitigation of environmental impacts were estimated in 1994 dollars. Cost estimates include the costs of engineering design, surveys, soils tests and construction services. The cost of relocating facilities at a new airport site are included if it is determined that such relocation is necessary. Environmental mitigation costs include costs of bridging a major gulch and providing lined drainage channels where necessary.

... costs include:

- Land Acquisition
- Airfield
- Buildings
- Roads and Vehicle Parking
- Utilities (water, sewer system, electrical system)
- Drainage System
- Miscellaneous

The costs of navaids and an air traffic control tower (if necessary) are included. These facilities could be provided by the Federal Aviation Administration through the Facilities and Equipment Program if the airport activity level is sufficient and FAA funds are available. It is assumed that the non-precision and precision instrument approach procedures would use satellite global positioning system (GPS) technology.

The site development costs are shown in Tables 9-2 through 9-10 for site Alternatives 1B through 8 respectfully. Cost estimates were based on the following methodologies and assumptions:

- The cost of leasehold improvements made by helicopter and general aviation operators at Kahului Airport is estimated to be in the neighborhood of $5 million. If these operators are moved to a new site prior to the expiration of their leases, the State would be obligated to compensate the tenants for their loss of use of these improvements. The cost to the State would depend upon the timing of a relocation to a new site, and therefore compensation for tenants improvements has not been included in the development costs.
- Land acquisition costs were based on market values for agricultural lands from the Maui County Real Property office, based on tax assessment values. In one instance, an independent appraisal of property in the vicinity of the former Puunene Airport was available. Estimates of property cost per acre prepared for this study include an allowance for legal fees and other acquisition costs.
- Earthwork quantities were determined from the development of profiles of the ground surface parallel with and perpendicular to the runway or helicopter operating direction. An average excavation cost per square foot was used.
- Airfield pavement quantities were developed from the facility requirements tables in Section 6, Facility Requirements. Pertinent dimensions were also obtained from the site drawings contained in Section 8, Airport Site Alternatives.
- Non-precision GPS approach procedures do not require any ground-based equipment and therefore there would be no cost associated with the airport. Although these approach procedures are available now only as a back-up procedure in conjunction with a ground-based procedure, it is assumed that a stand-alone GPS non-precision approach system will be available in five years. It is assumed that the GPS precision approach procedure will require ground-based equipment and an approach light system.
- The highway connection is based on pavement widening for left and right turn lanes. The access road is based on a 24-foot pavement width with 10-foot shoulders on each side.
- The onsite roads and parking quantities were based on the number of parking spaces identified in Section 6 and a 24-foot wide roadway.

TABLE 9-2
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 1B: NEW LIMITED-SERVICE HELIPORT [a]

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Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Land Acquisition			
Private Property	12 AC	50,000/AC	600,000
Subtotal			600,000
Airfield			
Site Preparation	12 AC	8,600/AC	100,000
Excavation/Fill	20,000 CY	12/CY	240,000
Bituminous Surface Course	3,000 TN	86/TN	260,000
Aggregate Base Course	2,800 CY	49/CY	140,000
Subtotal			740,000
Buildings			
Airport Administration/Terminal	3,900 SF	138/SF	540,000
ARFF/Airport Maintenance	2,000 SF	115/SF	230,000
Subtotal			770,000
Roads and Vehicle Parking			
Highway Connection	Allowance	-	120,000
Access Road	Allowance	-	900,000
On-Site Roads and Parking	LS	LS	160,000
Subtotal			1,180,000
Water			
Subtotal	Allowance	-	1,300,000
Sewer System			
Subtotal	Allowance	-	200,000
Electrical System			
Transmission Line	Allowance	-	90,000
Transformer	LS	LS	40,000
Subtotal			130,000

TABLE 9-2
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 1B: NEW LIMITED-SERVICE HELIPORT [a]

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Drainage System			
Subtotal	Allowance	-	100,000
Miscellaneous			
Fencing	3,000 LF	32/LF	100,000
Fuel Storage	30,000 GA	7.5/GA	230,000
Subtotal			330,000
Subtotal Capital Cost			5,350,000
Contingencies (20%)			1,070,000
Total Estimated Capital Cost			6,420,000

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.

[b] Abbreviations of quantities are:

AC Acres
CY Cubic Yards
EA Each
GA Gallons
LF Lineal Feet
LS Lump Sum
SF Square Feet
SY Square Yards
TN Ton

[c] Unit costs include construction costs plus 15 percent for engineering design, surveys, soil tests, and construction phase services.

TABLE 9-3
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 2: NEW HELIPORT-PUUNENE SOUTH [a]

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Land Acquisition			
State-owned Property	60 AC	0/AC	0
Subtotal			0
Airfield			
Site Preparation	30 AC	8,600/AC	260,000
Excavation/Fill	100,000 CY	12/CY	1,200,000
Bituminous Surface Course	8,300 TN	86/TN	710,000
Aggregate Base Course	9,800 CY	49/CY	480,000
Subtotal			2,650,000
Air Traffic Control and Navaids			
Air Traffic Control Facility	1 EA	300,000/EA	300,000
Nonprecision GPS Approach	1 EA	0/EA	0
Subtotal			300,000
Buildings			
Airport Administration/Terminal	2,500 SF	138/SF	350,000
ARFF/Airport Maintenance	2,500 SF	115/SF	290,000
Subtotal			640,000
Roads and Vehicle Parking			
Highway Connection	1 EA	120,000/EA	120,000
Access Road	3,500 LF	173/LF	610,000
On-Site Roads and Parking	LS	LS	210,000
Subtotal			940,000
Water			
Storage Tank(s)	350,000 GA	LS	1,010,000
Transmission Line	7,500 LF	46/LF	350,000
Distribution Line	6,000 LF	81/LF	490,000
Subtotal			1,850,000

TABLE 9-3
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 2:
NEW HELIPORT-PUUNENE SOUTH [a]

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Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Sewer System			
Collection System	1,500 LF	81/LF	120,000
Treatment Facilities	LS	LS	350,000
Subtotal			470,000
Electrical System			
Transmission Line	3,500 LF	18/LF	60,000
Transformer	LS	LS	40,000
Subtotal			100,000
Drainage System			
Onsite Drainage	3,000 LF	98/LF	290,000
Retention Basin	8,400 CY	23/CY	190,000
Subtotal			480,000
Miscellaneous			
Fencing	8,000 LF	32/LF	260,000
Fuel Storage	40,000 GA	7.5/GA	300,000
Subtotal			560,000
Subtotal Capital Cost			7,990,000
Contingencies (20%)			1,600,000
Total Estimated Capital Cost			9,590,000

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.

[b] Abbreviations of quantities are:
AC Acres
CY Cubic Yards
EA Each
GA Gallons
LF Lineal Feet
LS Lump Sum
SF Square Feet
SY Square Yards
TN Ton

[c] Unit costs include construction costs plus 15 percent for engineering design, surveys, soil tests, and construction phase services.

TABLE 9-4
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 3:
NEW HELIPORT - PUUNENE EAST [a]

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Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Land Acquisition			
State-owned Property	60 AC	0/AC	0
Subtotal			0
Airfield			
Site Preparation	30 AC	8,600/AC	260,000
Excavation/Fill	100,000 CY	12/CY	1,200,000
Bituminous Surface Course	8,300 TN	86/TN	710,000
Aggregate Base Course	9,800 CY	49/CY	480,000
Subtotal			2,650,000
Air Traffic Control and Navaids			
Air Traffic Control Facility	1 EA	300,000/EA	300,000
Nonprecision GPS Approach	1 EA	0/EA	0
Subtotal			300,000
Buildings			
Airport Administration/Terminal	2,500 SF	138/SF	350,000
ARFF/Airport Maintenance	2,500 SF	115/SF	290,000
Subtotal			640,000
Roads and Vehicle Parking			
Highway Connection	1 EA	120,000/EA	120,000
Access Road	6,000 LF	173/LF	1,040,000
On-Site Roads and Parking	LS	LS	210,000
Subtotal			1,370,000
Water			
Storage Tank(s)	350,000 GA	LS	1,010,000
Transmission Line	11,000 LF	46/LF	510,000
Distribution Line	6,000 LF	81/LF	490,000
Subtotal			2,010,000
Sewer System			
Collection System	1,000 LF	81/LF	80,000
Treatment Facilities	LS	LS	350,000
Subtotal			430,000

TABLE 9-4
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 3:
NEW HELIPORT - PUUNENE EAST [a]

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Electrical System			
Transmission Line	6,000 LF	18/LF	110,000
Transformer	LS	LS	40,000
Subtotal			150,000
D. . age System			
Onsite Drainage	2,000 LF	98/LF	200,000
Retention Basin	8,400 CY	23/CY	190,000
Subtotal			390,000
Miscellaneous			
Fencing	7,000 LF	32/LF	220,000
Fuel Storage	40,000 GA	7.5/GA	300,000
"elocate Drag Strip	3,500 LF	173/LF	610,000
Subtotal			1,130,000
Subtotal Capital Cost			9,070,000
Contingencies (20%)			1,810,000
Total Estimated Capital Cost			10,880,000

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.

[b] Abbreviations of quantities are:
AC Acres
CY Cubic Yards
EA Each
GA Gallons
LF Lineal Feet
LS Lump Sum
SF Square Feet
SY Square Yards
TN Ton

[c] Unit costs include construction costs plus 15 percent for engineering design, surveys, soil tests, and construction phase services.

TABLE 9-5
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 4:
NEW UTILITY AIRPORT/HELIPORT PUUNENE [a]

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Land Acquisition			
State-owned Property	380 AC	0/AC	0
Private Property	130 AC	17,000/AC	2,210,000
Subtotal			2,210,000
Airfield			
Site Preparation	325 AC	8,600/AC	2,800,000
Excavation/Fill	290,000 CY	12/CY	3,480,000
Bituminous Surface Course	26,000 TN	86/TN	2,240,000
Bituminous Base (ATB)	11,300 TN	75/TN	850,000
Aggregate Base Course	23,700 CY	49/CY	1,160,000
Lighting/Signage	LS	LS	170,000
Subtotal			10,700,000
Air Traffic Control and Navaids			
Air Traffic Control Facility	1 EA	300,000/EA	300,000
Nonprecision GPS Approach	1 EA	0/EA	0
Precision GPS Approach	1 EA	300,000/EA	300,000
Subtotal			600,000
Buildings			
Airport Administration/Terminal	3,600 SF	138/SF	500,000
ARFF/Airport Maintenance	3,600 SF	115/SF	410,000
Hangars	60 EA	23,000/EA	1,380,000
Subtotal			2,290,000
Roads and Vehicle Parking			
Highway Connections	2 EA	120,000/EA	240,000
Access Road	5,000 LF	173/LF	870,000
On-Site Roads and Parking	LS	LS	330,000
Subtotal			1,440,000
Water			
Storage Tank(s)	450,000 GA	LS	1,090,000
Transmission Line	12,500 LF	46/LF	580,000
Distribution Line	17,000 LF	81/LF	1,380,000
Subtotal			3,050,000

TABLE 9-5
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 4:
NEW UTILITY AIRPORT/HELIPORT PUUNENE [a]

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Sewer System			
Collection System	4,000 LF	81/LF	320,000
Treatment Facilities	LS	LS	530,000
Subtotal			850,000
Electrical System			
Transmission Line	3,500 LF	18/LF	60,000
Transformer/Vault	LS	LS	140,000
Subtotal			200,000
Drainage System			
Drainage Channel	6,000 LF	98/LF	590,000
Lined Drainage Channel	6,000 LF	550/LF	3,300,000
Bridge	LS	LS	1,730,000
Retention Basin	87,700 CY	17/CY	1,490,000
Subtotal			7,110,000
Miscellaneous			
Fencing	14,000 LF	32/LF	450,000
Fuel Storage	55,000 GA	7.5/GA	410,000
Relocate Drag Strip	LS	LS	580,000
Subtotal			1,440,000
Subtotal Capital Cost			29,890,000
Contingencies (20%)			5,980,000
Total Estimated Capital Cost			35,870,000

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.

[b] Abbreviations of quantities are:

AC	Acres	LF	Lineal Feet
CY	Cubic Yards	LS	Lump Sum
EA	Each	SF	Square Feet
GA	Gallons	SY	Square Yards
TN	Ton		

[c] Unit costs include construction costs plus 15 percent for engineering design, surveys, soil tests, and construction phase services.

TABLE 9-6
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 4A:
NEW UTILITY AIRPORT - PUUNENE [a]

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Land Acquisition			
State-owned Property	270 AC	0/AC	0
Private Property	120 AC	17,000/AC	2,040,000
Subtotal			2,040,000
Airfield			
Site Preparation	264 AC	8,600/AC	2,270,000
Excavation/Fill	240,000 CY	12/CY	2,880,000
Bituminous Surface Course	16,000 TN	86/TN	1,380,000
Bituminous Base (ATB)	11,300 TN	75/TN	850,000
Aggregate Base Course	9,300 CY	49/CY	460,000
Lighting/Signage	LS	LS	170,000
Subtotal			8,010,000
Air Traffic Control and Navaids			
Air Traffic Control Facility	1 EA	300,000/EA	300,000
Nonprecision GPS Approach	1 EA	0/EA	0
Subtotal			300,000
Buildings			
Airport Administration/Terminal	3,600 SF	138/SF	500,000
ARFF/Airport Maintenance	2,500 SF	115/SF	290,000
Hangars	55 EA	23,000/EA	1,270,000
Subtotal			2,060,000
Roads and Vehicle Parking			
Highway Connection	1 EA	120,000/EA	120,000
Access Road	4,000 LF	173/LF	690,000
On-Site Roads and Parking	LS	LS	170,000
Subtotal			980,000
Water			
Storage Tank(s)	450,000 GA	LS	1,090,000
Transmission Line	12,500 LF	46/LF	580,000
Distribution Line	12,000 LF	81/LF	970,000
Subtotal			2,640,000

TABLE 9-6
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 4A:
NEW UTILITY AIRPORT - PUUNENE [a]

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Sewer System			
Collection System	2,000 LF	81/LF	160,000
Treatment Facilities	LS	LS	230,000
Subtotal			390,000
Electrical System			
Transmission Line	3,000 LF	18/LF	60,000
Transformer/Vault	LS	LS	140,000
Subtotal			200,000
Drainage System			
Onsite Drainage	5,000 LF	98/LF	490,000
Lined Drainage Channel	6,000 LF	550/LF	3,300,000
Bridge	LS	LS	1,730,000
Retention Basin	70,000 CY	17/CY	1,190,000
Subtotal			6,710,000
Miscellaneous			
Fencing	12,000 LF	32/LF	380,000
Fuel Storage	15,000 GA	7.5/GA	110,000
Relocate Drag Strip	LS	LS	580,000
Subtotal			1,070,000
Subtotal Capital Cost			24,400,000
Contingencies (20%)			4,880,000
Total Estimated Capital Cost			29,280,000

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.
[b] Abbreviations of quantities are:

AC	Acres	LS	Lump Sum
CY	Cubic Yards	SF	Square Feet
EA	Each	SY	Square Yards
GA	Gallons	TN	Ton
LF	Lineal Feet		

[c] Unit costs include construction costs plus 15 percent for engineering design, surveys, soil tests, and construction phase services.

TABLE 9-7
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 5:
NEW UTILITY AIRPORT/HELIPORT NORTH OF KIHEI [a]

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Land Acquisition			
Private Property	510 AC	10,000/AC	5,100,000
Subtotal			5,100,000
Airfield			
Site Preparation	325 AC	5,750/AC	1,870,000
Excavation/Fill	580,000 CY	12/CY	6,960,000
Bituminous Surface Course	26,000 TN	86/TN	2,240,000
Bituminous Base (ATB)	11,300 TN	75/TN	850,000
Aggregate Base Course	23,700 CY	49/CY	1,160,000
Lighting/Signage	LS	LS	170,000
Subtotal			13,250,000
Air Traffic Control and Navaids			
Air Traffic Control Facility	1 EA	300,000/EA	300,000
Nonprecision GPS Approach	1 EA	0/EA	0
Precision GPS Approach	1 EA	300,000/EA	300,000
Subtotal			600,000
Buildings			
Airport Administration/Terminal	3,600 SF	138/SF	500,000
ARFF/Airport Maintenance	3,600 SF	115/SF	410,000
Hangars	60 EA	23,000/EA	1,380,000
Subtotal			2,290,000
Roads and Vehicle Parking			
Highway Connections	2 EA	120,000/EA	240,000
Access Road	35,000 LF	173/LF	6,060,000
On-Site Roads and Parking	LS	LS	330,000
Subtotal			6,630,000
Water			
Storage Tank(s)	460,000 GA	LS	1,150,000
Transmission Line	19,500 LF	46/LF	900,000
Distribution Line	11,500 LF	81/LF	930,000
Pump	1 EA	460,000/EA	430,000
Subtotal			3,440,000

TABLE 9-7
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 5:
NEW UTILITY AIRPORT/HELIPORT NORTH OF KIHEI [a]

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Sewer System			
Collection System	6,000 LF	81/LF	490,000
Treatment Facilities	LS	LS	530,000
Subtotal			1,020,000
Electrical System			
Transmission Line	10,500,000	18/LF	190,000
Transformer/Vault	LS	LS	140,000
Subtotal			330,000
Drainage System			
Onsite Drainage	7,000 LF	98/LF	690,000
Retention Basin	87,700 CY	17/CY	1,490,000
Major Culverts	5 EA	260,000/EA	1,300,000
Subtotal			3,480,000
Miscellaneous			
Fencing	14,000 LF	32/LF	450,000
Fuel Storage	55,000 GA	7.5/GA	410,000
Relocate Paved Cane Field Road	7,500 LF	173/LF	1,300,000
Subtotal			2,160,000
Subtotal Capital Cost			38,300,000
Co[illegible]ngencies (20%)			7,660,000
To[illegible] [illegible]stimated Capital Cost			45,960,000

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.

[b] Abbreviations of quantities are:

AC Acres	LS Lump Sum
CY Cubic Yards	SF Square Feet
EA Each	SY Square Yards
GA Gallons	TN TN
LF Lineal Feet	

[c] Unit costs include construction costs plus 15 percent for engineering design, surveys, soil tests, and construction phase services.

TABLE 9-8
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 6:
NEW UTILITY AIRPORT/HELIPORT EAST OF KAHULUI [a]

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Land Acquisition			
Private Property	510 AC	17,000/AC	8,670,000
Subtotal			8,670,000
Airfield			
Site Preparation	325 AC	5,750/AC	1,870,000
Excavation/Fill	600,000 CY	12/CY	7,200,000
Bituminous Surface Course	26,000 TN	86/TN	2,240,000
Bituminous Base (ATB)	11,300 TN	75/TN	850,000
Aggregate Base Course	23,700 CY	49/CY	1,160,000
Lighting/Signage	LS	LS	170,000
Subtotal			13,490,000
Air Traffic Control and Navaids			
Air Traffic Control Facility	1 EA	300,000/EA	300,000
Nonprecision GPS Approach	1 EA	0/EA	0
Precision GPS Approach	1 EA	300,000/EA	300,000
Subtotal			600,000
Buildings			
Airport Administration/Terminal	3,600 SF	138/SF	500,000
ARFF/Airport Maintenance	3,600 SF	115/SF	410,000
Hangars	60 EA	23,000/EA	1,380,000
Subtotal			2,290,000
Roads and Vehicle Parking			
Highway Connection	2 EA	120,000/EA	240,000
Access Road	2,400/LF	173/LF	420,000
On-Site Roads and Parking	LS	LS	330,000
Subtotal			990,000
Water			
Storage Tank(s)	460,000 GA	LS	1,150,000
Transmission Line	19,600 LF	46/LF	900,000
Distribution Line	13,000 LF	81/LF	1,050,000
Pump	1 EA	460,000/EA	460,000
Subtotal			3,560,000

TABLE 9-8
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 6:
NEW UTILITY AIRPORT/HELIPORT EAST OF KAHULUI [a] Page 2 of 2

Development Item	Estimated Quantity [b]	Unit Cost [c] (1994 Dollars)	Estimated Cost (1994 Dollars)
Sewer System			
Collection System	6,000 LF	81/LF	490,000
Treatment Facilities	LS	LS	530,000
Subtotal			1,020,000
Electrical System			
Transmission Line	2,000 LF	18/LF	40,000
Transformer/Vault	LS	LS	140,000
Subtotal			180,000
Drainage System			
Onsite Drainage	6,000 LF	98/LF	590,000
Retention Basin	87,700 CY	17/CY	1,490,000
Diversion Ditch	7,700 LF	35/LF	270,000
Subtotal			2,350,000
Miscellaneous			
Fencing	14,000 LF	32/LF	450,000
Fuel Storage	55,000 GA	7.5/GA	410,000
Relocate Irrigation Ditch	4,800 LF	173/LF	830,000
Relocate Paved Cane Field Road	6,900 LF	178/LF	1,230,000
Subtotal			2,920,000
Subtotal Capital Cost			36,070,000
Contingencies (20%)			7,210,000
Total Estimated Capital Cost			43,280,000

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.

[b] Abbreviations of quantities are:
AC Acres; CY Cubic Yards; EA Each; GA Gallons; LF Lineal Feet; LS Lump Sum; SF Square Feet; SY Square Yards; TN TN

[c] Unit costs include construction costs plus 15 percent for engineering design, surveys, soil tests, and construction phase services.

TABLE 9-9
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 7:
NEW UTILITY AIRPORT AND NEW HELIPORT - PUUNENE [a] Page 1 of 2

Development Item	Estimated Quantity	Unit Cost [b] (1994 Dollars)	Estimated Cost (1994 Dollars)
Land Acquisition			
Heliport: State-owned Property	60 AC	0/AC	0
Airport: State-owned Property	325 AC	0/AC	0
Airport: Private Property	65 AC	17,000/AC	1,110,000
Subtotal			1,110,000
Airfield			
Site Preparation	346 AC	8,630/AC	2,990,000
Excavation/Fill	250,000 CY	12/CY	3,000,000
Bituminous Surface Course	26,000 TN	86/TN	2,240,000
Bituminous Base (ATB)	11,300 TN	75/TN	850,000
Aggregate Base Course	23,700 CY	49/CY	1,160,000
Lighting/Signage	LS	LS	170,000
Subtotal			10,410,000
Air Traffic Control and Navaids			
Air Traffic Control Facility	1 EA	300,000/EA	300,000
Nonprecision GPS Approach	2 EA	0/EA	0
Subtotal			300,000
Buildings			
Airport Administration/Terminal	3,600 SF	138/SF	500,000
ARFF/Airport Maintenance	5,000 SF	115/SF	580,000
Hangars	55 EA	23,000/EA	1,270,000
Subtotal			2,350,000
Roads and Vehicle Parking			
Highway Connections	2 EA	120,000/EA	240,000
Access Road	6,700 LF	173/LF	1,160,000
On-Site Roads and Parking	LS	LS	330,000
Subtotal			1,730,000
Water			
Storage Tank(s)	450,000 GA	LS	1,090,000
Transmission Line	10,700 LF	46/LF	490,000
Distribution Line	19,200 LF	81/LF	1,560,000
Subtotal			3,140,000

TABLE 9-9
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 7:
NEW UTILITY AIRPORT AND NEW HELIPORT - PUUNENE [a]

Development Item	Estimated Quantity	Unit Cost [b] (1994 Dollars)	Estimated Cost (1994 Dollars)
Sewer System			
Collection System	4,000 LF	81/LF	320,000
Treatment Facilities	LS	LS	530,000
Subtotal			850,000
Electrical System			
Transmission Line	6,700	18/LF	120,000
Transformer/Vault	LS	LS	180,000
Subtotal			300,000
Drainage System			
Onsite Drainage	4,500 LF	98/LF	440,000
Drainage Channel	2,000 CY	345/LF	690,000
Subtotal			1,130,000
Miscellaneous			
Fencing	19,500 LF	32/LF	620,000
Fuel Storage	55,000 GA	7.5/GA	410,000
Relocate Irrigation Ditch	2,500 LF	86/LF	220,000
Subtotal			1,250,000
Subtotal Capital Cost			22,570,000
Contingencies (20%)			4,510,000
Total Estimated Capital Cost			27,080,000

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.

[b] Abbreviations of quantities are:
- AC Acres
- CY Cubic Yards
- EA Each
- GA Gallons
- LF Lineal Feet
- LS Lump Sum
- SF Square Feet
- SY Square Yards
- TN TN

[c] Unit costs include construction costs plus 15 percent for engineering design, surveys, soil tests, and construction phase services.

TABLE 9-10
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 8:
NEW TRANSPORT AIRPORT/HELIPORT - PUUNENE [a]

Development Item	Estimated Quantity	Unit Cost [b] (1994 Dollars)	Estimated Cost (1994 Dollars)
Land Acquisition			
State-owned Property	460 AC	0/AC	0
Private Property	250 AC	17,000/AC	4,250,000
Subtotal			4,250,000
Airfield			
Site Preparation	570 AC	8,600/AC	4,900,000
Excavation/Fill	560,000 CY	12/CY	6,720,000
Bituminous Surface Course	46,000 TN	86/TN	3,960,000
Bituminous Base (ATB)	27,000 TN	75/TN	2,030,000
Aggregate Base Course	42,000 CY	49/CY	2,060,000
Lighting/Signage	LS	LS	250,000
Subtotal			19,920,000
Air Traffic Control and Navaids			
Air Traffic Control Facility	1 EA	300,000/EA	300,000
Nonprecision GPS Approach	1 EA	0/EA	0
Precision GPS Approach	1 EA	300,000/EA	300,000
Subtotal			600,000
Buildings			
Airport Administration/Terminal	3,600 SF	138/SF	500,000
ARFF/Airport Maintenance	5,000 SF	115/SF	580,000
Hangars	60 EA	23,000/EA	1,380,000
Subtotal			2,460,000
Roads and Vehicle Parking			
Highway Connections	2 EA	120,000/EA	240,000
Access Road	5,700 LF	173/LF	990,000
On-Site Roads and Parking	LS	LS	380,000
Subtotal			1,610,000
Water			
Storage Tank(s)	500,000 GA	LS	1,150,000
Transmission Line	14,500 LF	46/LF	670,000
Distribution Line	17,000 LF	81/LF	1,380,000
Subtotal			3,200,000

TABLE 9-10
ESTIMATED CAPITAL COSTS FOR ALTERNATIVE 8:
NEW TRANSPORT AIRPORT/HELIPORT6 - PUUNENE [a]

Page 2 of 2

Development Item	Estimated Quantity	Unit Cost [b] (1994 Dollars)	Estimated Cost (1994 Dollars)
Sewer System			
Collection System	9,000 LF	81/LF	730,000
Treatment Facilities	LS	LS	690,000
Subtotal			1,420,000
Electrical System			
Transmission Line	3,500	18/LF	60,000
Transformer/Vault	LS	LS	140,000
Subtotal			200,000
Drainage System			
Onsite Drainage	10,000 LF	98/LF	980,000
Lined Drainage Channel	6,800 CY	550/LF	3,740,000
Bridge	LS	LS	1,730,000
Retention Basin	154,000 CY	17/CY	2,620,000
Kolaloa Crossing	50 LF	6,900/LF	350,000
Subtotal			9,420,000
Miscellaneous			
Fencing	22,000 LF	32/LF	700,000
Fuel Storage	85,000 GA	7.5/GA	640,000
Relocate Drag Strip	LS	LS	580,000
Relocate Quarry Road	3,300 LF	173/LF	570,000
Subtotal			2,490,000
Subtotal Capital Cost			45,570,000
Contingencies (20%)			9,110,000
Total Estimated Capital Cost			54,680,000

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.
[b] Abbreviations of quantities are:
AC Acres; CY Cubic Yards; EA Each; GA Gallons; LF Lineal Feet; LS Lump Sum; SF Square Feet; SY Square Yards; TN TN
[c] Unit costs include construction costs plus 15 percent for engineering design, surveys, soil tests, and construction phase services.

- The water storage tank quantity is based on a two hour/2,000 gallons per minute fireflow plus domestic flow.
- Treatment facilities and leach field quantities are based on the Kahului Airport proposed East Ramp Sewage Improvements (existing and future population).

  The closest Maui County sewerage system is located on Kihei Road which is approximately 8,000 feet from the closest alternative. Construction to the system does not appear to be practical.

  All facilities proposed in the County's Puunene Airport Area Master Plan will be serviced by the proposed Central Maui Wastewater Reclamation Facility.
- The retention basin quantity is based on the site area and a 2 inch rainfall. Development estimates for bridges and lined and unlined drainage channels are based on the Kahului Airport Kalialinui Gulch and Bridge Crossing Project (1989).
- Airfield lighting includes taxiway and runway edge lights, visual approach light system (PAPI) and signage. Heliport lighting is a relatively minor cost and is assumed to be included in the airfield costs.
- An allowance of 20 percent of all other costs is included for contingencies.

Site development costs are summarized in Table 9-11. Estimated costs range from $6.4 million for Alternative 1B, a limited service heliport, to $54.7 million for Alternative 8, a transport/airport heliport. Costs for a full service heliport would be $9.6 million to $10.9 million. Costs for an airport only (Alternative 4A) are estimated to be $29.3 million.

Costs for a utility airport/heliport vary considerably according to location. Alternative 7 would provide the lowest cost facility with general aviation and helicopter service. Although the helicopter and fixed-wing facilities, under Alternative 7, would be located at different sites, the overall cost would be lowest of the four airports/heliport alternatives because of lower earthwork, drainage and land acquisition costs. Development costs for Alternative 5 would be the greatest of the four due to high costs associated with earthwork, roads and utilities.

Costs Ineligible for FAA Funding. Most costs associated with the development of the airport and/or heliport sites are eligible for federal funding through the Federal Aviation Administration's Airport Improvement Program (AIP). The AIP funds 90 percent of eligible costs for land acquisition, airfield, utilities and access roads. Terminal buildings are funded at 50 percent of their cost and only the public-use portion of terminal buildings is eligible. Projects must compete for a limited amount of AIP funds and projects with the highest priority are funded first. Not all projects are funded.

Table 9-12 provides an estimate of the portion of the site development cost that would be eligible for federal funding under the AIP program. Although there is no assurance that this amount of federal funding would be provided, the table provides an indication of the maximum amount of federal funding that could be expected. The remaining funds must be provided by the state or private sources. Of course, the state share could be higher than shown in Table 9-12 if federal funding was not received in the maximum amount. Private sources could fund T-hangar development and terminal construction under the limited-service heliport alternative. The primary items which are ineligible for AIP funding include revenue producing facilities such as aircraft hangars, leasable portions of terminal buildings, firefighting (ARFF) facilities at airports without

TABLE 9-11
SUMMARY OF ESTIMATED DEVELOPMENT COSTS FOR SITE ALTERNATIVES [a]

Development Item	Estimated Capital Cost for Site Alternatives (Millions of 1994 Dollars)								
	1B	2	3	4	4A	5	6	7	8
Land Acquisition	0.60	0	0	2.21	2.04	5.10	8.67	1.11	4.25
Airfield	0.74	2.65	2.65	10.70	8.01	13.25	13.49	10.41	19.92
Air Traffic Control and Navaids	0.00	0.30	0.30	0.60	0.30	0.60	0.60	0.30	0.60
Building	0.77	0.64	0.64	2.29	2.06	2.29	2.29	2.35	2.46
Roads and Vehicle Parking	1.18	0.94	1.37	1.44	0.98	6.63	0.99	1.73	1.61
Water	1.30	1.85	2.01	3.05	2.64	3.44	3.56	3.14	3.20
Sewer system	0.20	0.47	0.43	0.85	0.39	1.02	1.02	0.85	1.42
Electrical System	0.13	0.10	0.15	0.20	0.20	0.33	0.18	0.30	0.20
Drainage System	0.10	0.48	0.39	7.11	6.71	3.48	2.35	1.13	9.42
Miscellaneous	0.33	0.56	1.13	1.44	1.07	2.16	2.92	1.25	2.49
Subtotal	5.35	7.99	9.07	29.89	24.40	38.30	36.07	22.57	45.57
Contingencies (20%)	1.07	1.60	1.81	5.98	4.88	7.66	7.21	4.51	9.11
Total	6.42	9.59	10.88	35.87	29.28	45.96	43.28	27.08	54.68

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.

TABLE 9-12
ESTIMATED DEVELOPMENT COSTS ELIGIBLE FOR FEDERAL FUNDING AND STATE OR PRIVATE SHARE OF COSTS [a]

	New Site Alternative	Estimated Cost (1994 Dollars)		
		Total	Eligible for Federal Funding [b]	State or Private Share
1.	New Limited Service Heliport	6.42	5.18	1.24
2.	New Heliport-Puunene South	9.59	8.12	1.47
3.	New Heliport-Puunene East	10.88	9.28	1.60
4.	New Utility Airport/Heliport-Puunene	35.87	30.10	5.77
4A.	New Utility Airport-Puunene	29.28	24.05	5.23
5.	New Utility Airport/Heliport-North of Kihei	45.96	39.18	6.78
6.	New Utility Airport/Heliport-East of Kahului	43.28	36.76	6.52
7.	New Utility Airport and New Heliport-Puunene	27.08	21.89	5.19
8.	New Transport Airport/Heliport-Puunene	54.68	46.57	8.11

[a] Sources: R.T. Tanaka Engineers, Inc. and P&D Aviation.

[b] Based on the maximum funding of all eligible projects under the FAA Airport Improvement Program.

commercial service, and fuel farms.

The estimated state or private share, assuming all items eligible for federal funding are funded at the maximum percentage, would be $1.2 to $1.6 million for heliports, $5.2 million to $6.8 million for airports/heliport facilities and $8.1 million for a transport airport/heliport.

AFFECT ON CAPACITY AND DELAY AT KAHULUI AIRPORT

Reduction in Kahului Airport Aircraft Operations

Table 9-13 provides estimates of the numbers of annual aircraft operations that would be shifted from Kahului Airport to a new site in the year 2015. Also shown in the table is the amount of annual operations that would remain at Kahului Airport.

Alternatives 1 and 1A. Under Alternatives 1 and 1A, there would be no shifting of operations from the airport.

Alternative 1B. A new limited service heliport would be the only alternative concept in which the total number of aircraft operations at Kahului Airport and the new site would be more than at Kahului Airport without the new site.

This is due to the additional operations needed to ferry aircraft in the morning and evening between Kahului Airport and the new site. Under Alternative 1B, operations at Kahului Airport in the year 2015 would be reduced from 274,800 to 208,400, a 24 percent reduction.

Alternatives 2 and 3. A new full service heliport would result in the relocation of all helicopter activity from Kahului Airport. Kahului Airport operations in the year 2015 would decrease to 169,700, a 38 percent reduction.

Alternatives 4, 5, 6 and 7. Under alternatives with a new heliport and airport, all helicopter activity and fixed-general aviation piston activity would be relocated to the new site. Operations at Kahului Airport in the year 2015 would be reduced to 127,900, a decrease of 53 percent.

Alternative 4A. With a new utility airport, only a fixed-wing general aviation piston aircraft would be served at the new site and annual operations at Kahului Airport in 2015 would be reduced to 233,000, a 15 percent reduction.

Alternative 8. With a new transport airport/heliport, all helicopter activity, most general aviation activity and some cargo service would be transferred to the new site. In the year 2015 only 120,800 operations would remain at Kahului Airport, a reduction of 56 percent.

Although most of the new site alternatives would result in a substantial reduction in operations at Kahului Airport, a proportional relief in airfield congestion cannot be expected. Airfield congestion is affected by runway activity and capacity and is not directly affected by helicopter activity which does not use the runway. The affects on airfield capacity and delay are described in the next subsection.

Airfield Capacity and Delay Analyses

The 1993 Kahului Airport Master Plan estimates the future runway capacity (Annual Service Volume) of Kahului Airport to be 187,000 operations per year (estimated for the year 2010). Current projections of demand at Kahului Airport are 167,700 annual fixed-wing aircraft operations in the year 2015, with no new airport. The ratio of fixed-wing aircraft operations to Annual Service Volume would, therefore, be 0.91 in 2015 (Table 9-14).

As this ratio approaches 1.0 the amount of aircraft operating delay and the cost of this

TABLE 9-13
IMPACT OF NEW AIRPORT/HELIPORT ALTERNATIVES ON OPERATIONS AT KAHULUI AIRPORT, 2015 [a]

Alternative	Annual Operations Shifted From Kahului Airport to New Airport/Heliport, 2015 (Thousands)			Annual Operations at Kahului Airport, 2015 (Thousands)		
	Total	Fixed-Wing	Helicopter	Total	Fixed-Wing	Helicopter
1. No New Airport	0	0	0	274.8	169.7	105.1
1A. Relocation of Kahului Helicopter Facilities East	0	0	0	274.8	169.7	105.1
1B. New Limited Service Heliport	66.4	0	66.4	208.4	169.7	38.7
2. New Heliport-Puunene South	105.1	0	105.1	169.7	169.7	0
3. New Heliport-Puunene East	105.1	0	105.1	169.7	169.7	0
4. New Utility Airport/ Heliport-Puunene	146.9	41.8	105.1	127.9	127.9	0
4A. New Utility Airport-Puunene	41.8	41.8	0	233.0	127.9	105.1
5. New Utility Airport/ Heliport-North of Kihei	146.9	41.8	105.1	127.9	127.9	0
6. New Utility Airport/ Heliport-East of Kahului	146.9	41.8	105.1	127.9	127.9	0
7. New Utility Airport and New Heliport-Puunene	146.9	41.8	105.1	127.9	127.9	0
8. New Transport Airport/ Heliport-Puunene	154.0	48.9	105.1	120.8	120.8	0

[a] Source: P&D Aviation analysis, except as noted.

[b] Aries Consultants, Ltd., Update Hawaii Aviation Demand Forecasts, June 1994, "Low Passenger Forecasts."

TABLE 9-14
IMPACT OF NEW AIRPORT/HELIPORT ALTERNATIVES ON DELAYS AT KAHULUI AIRPORT, 2015 [a]

Alternative	Annual Fixed-Wing Aircraft Operations (Thousands)	Ratio of Fixed-Wing Aircraft Operations to Annual Service Volume	Delays at Kahului Airport: Average Minutes of Delay per Operation [b]	Annual Hours of Delay	Annual Cost of Delay [c] (Millions of 1994 Dollars)
1. No New Airport	169.7	0.91	1.5	4,200	5.9
1A. Relocation of Kahului Helicopter Facilities East	169.7	0.91	1.5	4,200	5.9
1B. New Limited Service Heliport	169.7	0.91	1.5	4,200	5.9
2. New Heliport-Puunene South	169.7	0.91	1.5	4,200	5.9
3. New Heliport-Puunene East	169.7	0.91	1.5	4,200	5.9
4. New Utility Airport/ Heliport-Puunene	127.9	0.68	0.7	1,500	2.7
4A. New Utility Airport-Puunene	127.9	0.68	0.7	1,500	2.7
5. New Utility Airport/ Heliport-North of Kihei	127.9	0.68	0.7	1,500	2.7
6. New Utility Airport/ Heliport-East of Kahului	127.9	0.68	0.7	1,500	2.7
7. New Utility Airport and New Heliport-Puunene	127.9	0.68	0.7	1,500	2.7
8. New Transport Airport/ Heliport-Puunene	120.8	0.65	0.6	1,200	2.2

[a] Source: P&D Aviation analysis. Based on an Annual Service Volume of 187,000 operations, as estimated for 2010 in the Kahului Airport Master Plan, Belt Collins and Associates, June 1993.

[b] Based on methodology contained in FAA Advisory Circular 150/5060-5, Airport Capacity and Delay, September 23, 1983 and subsequent revisions.

[c] Based on the aircraft operating cost per block hour by type of aircraft and the Kahului Airport fleet mix, which have the following averages:

Alternatives	Average Aircraft Operating Cost Per Block Hour
1, 1A, 1B, 2, 3	$1,400
4, 4A, 5, 6, 7	$1,800
8	$1,800

delay become intolerable. At that time, some expansion of airfield capacity is necessary, such as the construction of a new runway.

Alternatives 1A, 1B, 2 and 3. Aircraft operating delays average approximately 1.5 minutes per aircraft operation at Kahului Airport, or a total of 4,200 hours of delay annually (Table 9-14). The annual cost of this delay based on the average aircraft operating cost per block hour and the current fleet-mix operating at the airport is estimated to be $5.9 million.

Alternative 1A and the new heliport alternatives (Alternatives 1B, 2 and 3) would not reduce the ratio of fixed-wing aircraft operations to Annual Service Volume. Similarly, the amount of annual airfield delay and annual delay cost would not be reduced under these alternatives.

Alternatives 4, 4A, 5, 6 and 7. All alternatives with a new utility airport would result in a reduction in the ratio of fixed-wing aircraft operations to capacity at Kahului Airport from 0.91 to 0.68. This magnitude of reduction in demand relative to capacity would be substantial enough to postpone the need for additional runway capacity beyond the year 2015, based on the forecasts shown in Table 9-14.

Under these alternatives the annual hours of delay at Kahului Airport would be reduced from 4,200 to 1,500, a 64 percent reduction. Furthermore, the cost of delays would be reduced from $5.9 million to $2.7 million, a 54 percent reduction.

Alternative 8. Alternative 8 would result in the greatest shifting of fixed-wing aircraft operations from Kahului Airport and hence would have the greatest affect on easing congestion at the airport. The ratio of annual fixed-wing aircraft operations to capacity would be reduced to 0.65 in 2015. In that same year, the annual hours of delay would be reduced to 1,200 and annual delay cost would be reduced to $2.2 million. It should be noted that most all-cargo flights at Kahului Airport are after the peak daytime operations hours and the relocation of these flights would not have a significant impact on the delays at Kahului Airport.

According to current forecasts of fixed-wing aircraft activity at Kahului Airport, an increase in airport capacity (for example a new runway) will be needed by the year 2020 (Figure 9-18). At this point in time, the airport's fixed-wing aircraft operations are expected to exceed the airport's capacity (Annual Service Volume). If fixed-wing aircraft operations were shifted from Kahului Airport to a new site (as in Alternatives 4, 4A, 5, 6, 7 and 8) the fixed-wing aircraft demand at Kahului would not reach capacity until well beyond the year 2020, as shown in Figure 9-18. The need for a third runway at Kahului Airport would be deferred approximately 20 years, if a new fixed-wing airport were built.

Acres at Kahului Airport Made Available for Other Uses

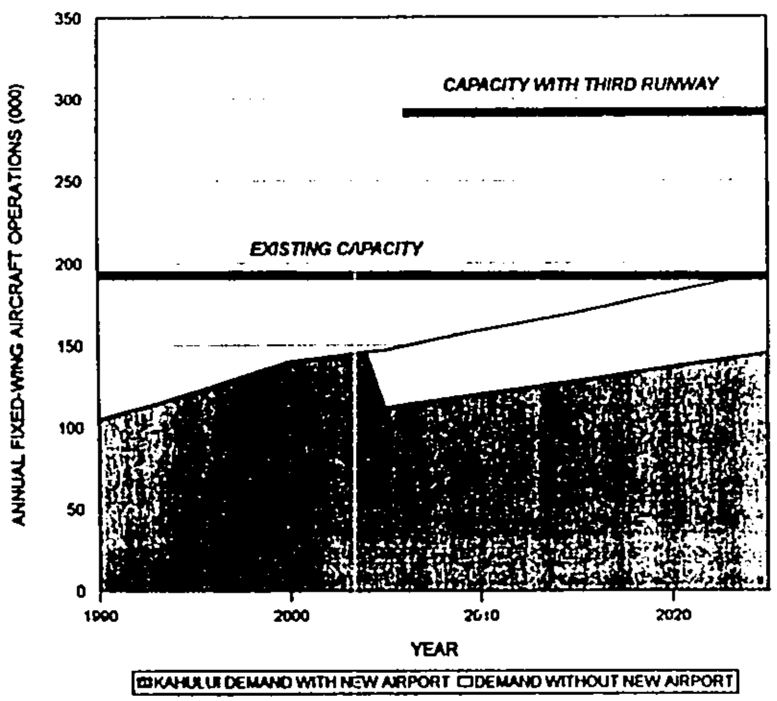
Alternative 2 and 3. Removal of helicopter operations from Kahului Airport would make approximately 15.7 acres available for alternatives uses at the southeasterly corner of the airport, adjacent to the threshold of Runway 02.

Alternatives 3A and 4A. While a remote pickup/dropoff point for passengers might free up several helipads at Kahului Airport, helicopter parking, maintenance and fueling would remain and, in essence, no land would be available for alternative uses.

Alternatives 4, 5, 6, and 7. The removal of both helicopter operations and general aviation activity from the Kahului Airport would make a total of approximately 40.5 acres available for alternative uses along the east side of the airport.

FIGURE 9-18

FIXED-WING OPERATIONS DEMAND-CAPACITY RELATIONSHIPS AT KAHULUI AIRPORT



Source: P & D Aviation.

Alternative 8. The removal of helicopter operations, general aviation activity and dedicated air cargo activity from the Kahului Airport would make approximately 40.5 acres available for alternative development along the east side of the airport. Approximately 1.4 acres in the vicinity of the main passenger terminal is utilized by both air cargo operators and processing belly cargo from passenger carriers. It must be noted that only exclusive air cargo operations would be shifted to the new facility. At this time it is not possible to determine exactly how much of the 1.4 acres would still be needed to accommodate the processing of belly cargo.

SUMMARY OF FINDINGS OF THE SITE ALTERNATIVES ANALYSES

The important findings of the evaluation of alternative sites are summarized in Table 9-15. This matrix highlights significant constraints and major differences among the alternatives. Conclusions from the site alternatives evaluation are as follows:

- Alternatives 4, 4A and 8 have significant airspace conflicts with aircraft approaching Runway 02 at Kahului Airport. The vertical separation of aircraft approaching Runway 02 at Kahului Airport and aircraft in the traffic pattern to land at the new site would be less than 1,000 feet (measured at the lower range of aircraft approaching Kahului Airport). Air traffic control tower coordination between the two airports would be necessary to properly separate the traffic.

  Furthermore, wind conditions at the Puunene site are unfavorable for fixed-wing aircraft, and aircraft using the new airport could be subject to wake turbulence produced by large jet aircraft approaching Runway 02 at Kahului Airport.

- Although Alternative 7 is better located than Alternatives 4, 4A and 8 with respect to Kahului Airport traffic, the traffic pattern for the new site would overfly developed areas of Kihei. Although the Kihei area is outside the projected 55 Ldn noise contour for the new site, aircraft overflights would be a major concern to the community.

- Alternatives 4, 4A, 7 and 8 have physical site constraints that would make development of the site difficult. All four alternatives are in the vicinity of existing privately-owned radio and TV towers which might require relocation, subject to FAA airspace study. Moreover, the Kolaloa Gulch intersects Alternatives 4, 4A and 8. This is a major drainage feature which the runway would have to bridge. The bridging of this waterway could be a sensitive environmental issue. The cost of construction related to the bridging of Kolaloa are included in the development cost estimates.

- The cost of Alternative 1B does not appear to justify its development in light of the limited relief it would provide Kahului Airport and the duplication of existing facilities. Moreover, a new limited service heliport in the west Maui coastal area would not likely be supported by the surrounding communities due to the precedent established in prohibiting helicopter operations from the Kapalua-West Maui Airport. Perhaps the development of a limited service heliport facility would more appropriately be a private development initiative. A limited-service heliport would be a viable option if it were developed as an initial stage of a full-service heliport, for example at the Puunene site.

- Alternatives 4 through 8 would significantly delay the construction of additional airfield capacity (for example a third runway) at Kahului Airport. These alternatives could defer the need for a third runway approxi-

TABLE 9-15
SUMMARY MATRIX OF AIRPORT SITE ALTERNATIVES E

		Air Service at New Site			Environmental	
Site Alternative	Physical Site Constraints	Type [b]	Operations in 2015 (Thousands)	Aeronautical Constraints	Noise Impacts (55 Ldn)	Land Use Impacts
1. No New Airport	-	-	-	-	-	-
1A. Relocation of Kahului Helicopter Facilities East	-	H	[c]	-	[d]	-
1B. New Limited Service Heliport	-	H	77.0	-	[d]	-
2. New Heliport-Puunene South	-	H	105.1	-	None	-
3. New Heliport-Puunene East	-	H	105.1	Heliport in fringe of Kahului inner Class C Airspace	None	-
4. New Utility Airport/ Heliport-Puunene	Radio/TV Towers Kolaloa Gulch	HG	146.9	Flight path conflicts with Kahului Airport. Unfavorable winds for fixed-wing aircraft.	None	-
4A. New Utility Airport-Puunene	Radio/TV Towers Kolaloa Gulch	G	41.8	Flight path conflicts with Kahului Airport. Unfavorable winds for fixed-wing aircraft.	None	-
5. New Utility Airport/ Heliport-North of Kihei	-	HG	146.9	-	None	-
6. New Utility Airport/ Heliport-East of Kahului	-	HG	146.9	In Kahului inner Class C Airspace	None	-
7. New Utility Airport and New Heliport-Puunene	Radio/TV Towers	HG	146.9	Heliport in fringe of Kahului inner Class C Airspace. Flight path conflicts with Kahului Airport. Unfavorable winds for fixed-wing aircraft.	None	Traffic pattern overflies Kihei
8. New Transport Airport/ Heliport-Puunene	Radio/TV Towers Kolaloa Gulch	HGT	154.0	Flight path conflicts with Kahului Airport. Unfavorable winds for fixed-wing aircraft.	None	-

[a] Source: P&D Aviation analysis.
[b] H = Helicopter, G = general aviation (piston), T = turbine-powered general aviation and cargo
[c] Not considered a new site.
[d] Not estimated.

BLE 9-15
SITE ALTERNATIVES EVALUATION [a]

Environmental Impacts			New Site Development Cost (Millions of 1994 Dollars)		Relief of Congestion at Kahului Airport, 2015	
Noise Impacts (55 Ldn)	Land Use Impacts	Vehicle Traffic	Total	Ineligible for FAA Funding	Kahului Fixed-Wing Operations Demand-Capacity Ratio	Annual Delay Savings (Millions of 1994 Dollars)
-	-	-	-	-	0.91	-
[d]	-	-	[d]	[d]	0.91	0
[d]	-	Reduction of 620 daily trips	6.42	1.24	0.91	0
None	-	-	9.59	1.47	0.91	0
None	-	-	10.80	1.60	0.91	0
None	-	-	35.87	5.77	0.68	3.2
None	-	-	29.28	5.23	0.68	3.2
None	-	-	45.96	6.78	0.68	3.2
None	-	-	43.28	6.52	0.68	3.2
None	Traffic pattern overflies Kihei	-	27.08	5.19	0.68	3.2
None	-	-	54.68	8.11	0.65	3.7

mately 25 years. Furthermore, these alternatives would reduce the cost of delay associated with aircraft operations at Kahului Airport by $3.2 million a year by the year 2015.

It is, therefore, concluded that Alternatives 1B, 4, 4A, 7 and 8 should not be pursued further because of the constraints and limitations noted above. A decision on the selection of an airport and/or heliport site alternative is an airport system issue, which depends largely on the timing and extent of future capacity improvements at Kahului Airport. These airport system issues are discussed in Section 10.

Section 10
RECOMMENDED AIRPORT SYSTEM

SECTION 10
RECOMMENDED AIRPORT SYSTEM

INTRODUCTION

The site evaluation described in Section 9 concluded that Alternatives 1B, 4, 4A, 7 and 8 were not recommended for further consideration due to the constraints identified. The remaining a... natives, Alternatives 1A, 2, 3, 5 and 6 were evaluated from an airport systems standpoint. This systems evaluation resulted in recommendations regarding the development of a new heliport site to serve Maui.

AIRPORT SYSTEM CONSIDERATIONS

The discussion of airport system considerations has been divided into general aviation and helicopter considerations because each involves separate airport system issues. General aviation system issues on Maui generally concern: when additional airfield capacity is needed, where to add additional airfield capacity (a new site or existing airport) and how to minimize long term development costs. Helicopter operations do not directly impact airfield capacity and, thus, are not directly related to the decisions affecting fixed-wing aviation demand and capacity.

Airport system issues relating to helicopter operations on Maui include: what is the need for separation of fixed-wing and helicopter activity and where is the best location for helicopter operations to provide the necessary separation and satisfy helicopter demand.

General Aviation Considerations

Capacity of Kahului Airport With No New Runway. The existing airfield capacity (Annual Service Volume) of Kahului Airport was estimated in the 1993 Airport Master Plan to be 193,000 operations a year. For the mix of aircraft forecast in the year 2010 (which includes a higher percentage of large and heavy Class C and D aircraft) and no new runway, the Annual Service Volume is projected to decrease to 187,000 operations a year according to the 1993 Airport Master Plan (see Figure 9-18).

Total Demand for Fixed-Wing Aircraft Operations. According to projections prepared for the State, fixed-wing aircraft demand at Kahuli Airport will increase from approximately 114,000 operations per year in 1993 to 182,000 annual operations in 2020. Therefore, in the year 2020 the number of fixed-wing aircraft operations at Kahului Airport would about equal its operations capacity (Figure 9-18). Sometime between 2010 and 2020 steps must be taken to provide additional capacity for fixed wing aircraft operations on Maui. There are two general options for expanding airfield capacity: building a new general aviation airport or constructing a third runway at Kahului Airport.

New General Aviation Airport Option. A new general aviation airport would shift fixed-wing aircraft demand from Kahului Airport to the new site. The new site would accommodate approximately 42,000 general aviation operations in the year 2015. The forecast of fixed-wing aircraft operations at a new site is illustrated graphically in Figure 9-18.

With a new general aviation airport, the fixed-wing aircraft demand at Kahului Airport would reach airfield capacity well beyond the year 2020. Prior to the time that Kahului Airport fixed-wing demand exceeds capacity, a third runway would be required at Kahului Airport. It should be noted that a new general aviation airport at the Puunene site could potentially reduce the arrival rate for Runway 02 at Kahului Airport, and, consequently, reduce the airfield capacity at Kahului. The effect of a

new airport at Puunene has not been included in the estimate of airfield capacity.

The capital cost of a new general aviation airport at a feasible site, would be approximately $43 million to $46 million.

New General Aviation Runway at Kahului Airport. Another option to relieve the future demand-capacity shortfall is to add a new general aviation runway at Kahului Airport between 2010 and 2020. This would increase the Annual Service Volume of Kahului Airport to approximately 285,000 operations a year, based on the long range planning methodology contained in the Federal Aviation Advisory Circular 150/5060-5, Airfield Capacity and Delay. With the new runway, the airfield capacity would exceed demand well beyond 2020 (Figure 9-18). The new runway would initially serve general aviation and commuter aircraft operations.

Eventually however, the capacity of the main runway (Runway 2L-20R) would be incapable of handling all air carrier demand. Under the broad assumption that Runway 2L-20R would have half the airfield capacity (i.e., about 140,000 operations per year), the runway would be capable of handling air carrier operations well beyond 2020. Then the general aviation runway would need to be upgraded to accommodate, at least, commercial jet service by interisland flights. A runway length of 8,500 feet for a new parallel runway is proposed in the 1993 Kahului Airport Master Plan.

Based on the capital costs shown in the Master Plan, it is estimated that the general aviation runway development at Kahului Airport would cost approximately $25 million including land acquisition on the southeast side of the airport west of Hana Highway. It is estimated that the development cost to widen and extend the runway to 8,500 feet to serve air carrier aircraft would be approximately $100 million based on the 1993 Master Plan cost estimates.

Helicopter Issues

Helipad and Runway Separation Standards. FAA heliport design standards provide for a separation between the center of a helipad and runway centerline of 500 feet for runways used by aircraft under 300,000 pounds maximum takeoff weight and 700 feet for runways used by aircraft over 300,000 pounds maximum takeoff weight. All widebody aircraft, including the DC10 and L1011 operating at Kahului Airport, exceed the 300,000 pound limit. These separations are the minimum recommended and heliports with extensive helicopter activity would preferably be located farther from the runway.

Existing Helipad Separations. At Kahului Airport the two helipads in the tour helicopter operating area are located approximately 450 feet and 700 feet from the Runway 2-20 centerline. Furthermore, helicopters entering and leaving the helicopter area often fly closer than 700 feet to Runway 2-20. The recent concerns of fixed-wing aircraft operators with the proximity of helicopter flights result largely from the close proximity of the helipads and helicopter operating area to the Runway 2-20 centerline, as well as the large number of helicopter operations.

Separations Provided Under Site Alternatives. Under Alternative 1A, helicopter operations would be relocated to an area immediately east of the present area or to a location on the eastside of Hana Highway. The first location would allow a 1,500 foot separation between the helicopter operating area and the Runway 2-20 centerline. The second location would allow a separation of 1,500 feet between the helicopter operating area and the centerline of the future Runway 2R-20L.

Heliport Alternatives 2 and 3 would relocate all helicopter activity to a new site, which would separate helicopter activity from fixed-wing aircraft activity at Kahului Airport.

Affect of Helicopter Activity on Runway Capacity. According to FAA methodology, there is no direct or measurable affect of helicopter activity (to designated helipads) on the runway capacity. Therefore, the relocation of helicopter activity to a new site would not defer the need for runway capacity at Kahului Airport.

AIRPORT SYSTEM/SITE CONCLUSIONS

It is concluded from the airport site and system evaluations described above and in Section 9 that airport system improvements relating to fixed-wing general aviation activity should consist of phased improvements to Kahului Airport and no new fixed-wing airport should be built on Maui. This recommendation is made for the following reasons:

- There is no feasible site alternative for the relocation of air cargo from Kahului Airport; relocating only nighttime air cargo flights to a new site would not be a viable option because cargo operators transport cargo in the holds of passenger aircraft through the day and all cargo (whether carried day or night) is shipped through one central warehouse. Alternative 8, a new transport airport/heliport at the Puunene site, is infeasible due to airspace conflicts with Kahului Airport, the high development cost ($54.7 million), and the need to duplicate facilities available at Kahului Airport. No other site exists on Maui for the development of a new transport airport capable of accommodating commercial air cargo jets.

- Over the 20-year planning period, growth in general aviation activity is projected to be modest, an increase of 11,000 fixed-wing piston general aviation operations and 11 fixed-wing piston based aircraft from 1993 to 2015 (Table 5-2). This relatively slow growth in general aviation activity does not warrant the construction of a new airport. From 1993 to 1994, annual general aviation operations decreased from 37,100 to 33,300.

- The only feasible general aviation new airport alternatives (Alternatives 5 and 6) would have very high development costs ($46 million and $43 million, respectively) and require the duplication of many support facilities and services currently available at Kahului Airport, such as air traffic control, navaids, fire-fighting, airport security and fueling. Furthermore, the level of these services that would be available at a new general aviation airport would be less than provided at Kahului Airport due to its larger size.

- Although retaining general aviation activity at Kahului Airport rather than constructing a new airport could require that a third runway be built at Kahului sooner than would be necessary if a new airport were built, the third runway will ultimately be required at Kahului Airport regardless of whether a new general aviation airport is developed. When a third runway is built at Kahului, it is suggested that it initially be constructed as a smaller, general aviation runway. This would provide the opportunity for better separation between general aviation aircraft, which would primarily use the new runway, and the commercial jets on the existing Runway 2-20.

- Adding the additional runway capacity at Kahului Airport will allow the added capacity to be shared (when the new runway is expanded) by airline as well as general aviation users. This will provide increased flexibility for the airport system.

- Maintaining the fixed-wing operations at Kahului Airport would eliminate potential airspace conflicts between Kahului Airport and a new fixed-wing airport. All fixed-wing flight activity would remain under the

control of a single air traffic control tower.

It is further concluded that there are two long-term options for satisfying the helicopter demand and providing adequate separation with fixed-wing aircraft operations: relocating helicopter activity to the Puunene site (Alternatives 2 or 3) or keeping helicopter operations at Kahului Airport but moving them to a location on the east side of Hana Highway (Alternative 1A). Under both of these options, the relocation of helicopter activity would be conducted in stages to provide maximum flexibility to helicopter tour operators and to allow them to recover their investments at Kahului Airport.

Although both options have merit, it is recommended that helicopter activity be relocated ultimately to a new heliport at the Puunene site (Alternatives 2 or 3). This recommendation is based on the following:

- Helicopter activity is projected to grow rapidly over the planning period. Tour helicopter operations are forecast to increase from 69,000 in 1993 to 99,400 in 2015. This amount of helicopter activity is large enough to justify the facilities necessary to establish a new site.

- Over the next 20 years, air carrier operations are expected to grow from 54,300 to 86,700. Therefore, airspace conflicts between rotary-wing aircraft and commercial jets at Kahului are bound to increase. The ultimate relocation of helicopter activity to the Puunene site will enhance aviation safety by providing maximum separation between aircraft activity with dissimilar flight characteristics.

- The relocation of helicopter activity to the Puunene area can be done in stages to minimize the disruption to existing helicopter operators. After the initial heliport facilities are established, existing operators would have the option of locating at the new site. New operators would locate at the new site. Helicopter operators would be required to relocate from Kahului Airport when a new parallel runway is constructed there.

- In light of recent legislation requiring all tour helicopters to operate over 1,500 feet above ground level, some believe that the tour helicopter activity will not grow as rapidly as projected here and might instead decline. Staging of the new heliport development will allow for the reassessment of heliport needs before the year 2000. The recommended staging plan is to set aside the land in the first phase (1995 to 2000). Construction at the Puunene site would not begin until after 2000, which will allow heliport needs to be reevaluated first.

- When a new parallel runway is built at Kahului, the present helicopter area must be relocated because a busy helicopter arrival and departure area between two parallel runways would seriously reduce the operational capacity of the runways and create air safety concerns. The Puunene site is on property already owned by the State and is closer to most tour helicopter customers.

- Development of a new heliport at the Puunene site is consistent with current County of Maui planning for the Puunene area. A heliport at the Puunene site, furthermore, is compatible with existing land uses and community plans for the area. Although the 55 dB Ldn noise contour would not impact residential or other noise-sensitive land uses at the Puunene or Hana Highway sites, the noise contours at the Puunene site would be farther from residential areas (Kihei) than for development at the Hana Highway site (Spreckelsville and Paia).

RECOMMENDED PHASING PLAN

The following phasing plan is recommended in the Maui General Aviation Study:

- ***Phase 1 (1995 to 2000).*** General aviation activity would continue in its present location at Kahului Airport. Expansion in this area could include additional tie-downs, new aircraft T-hangars and expansion of tenant lease areas.

  In the beginning of Phase 1, the existing helicopter operating area would be relocated immediately east of the current location (Figure 10-1). Some private property may need to be acquired for the new helicopter operating area. Helicopter operators would continue to use their existing buildings. Helicopters would be air taxied to the new operating area, where passengers would be boarded for flights during the day. Helicopters would air taxi back to the existing helicopter area for overnight parking or maintenance activity if necessary. At this new location, helicopter arrivals and departures would be separated from the Runway 2-20 centerline by approximately 1,500 feet.

  Also in Phase 1, land would be set aside at the Puunene site for the ultimate relocation of all tour helicopter activity from Kahului Airport. Sixty acres should be reserved as described in Section 6. Surrounding land uses should be planned and zoned to prevent incompatible land uses to be located in the heliport vicinity.

- ***Phase 2 (2000 to 2010).*** During Phase 2, the timeframe for the development of a new heliport at Puunene would be reevaluated. This evaluation would consider trends in tour helicopter demand and improvements in airfield safety conditions resulting from the helicopter operating area relocation in Phase 1. Construction of the initial phase of the heliport at the Puunene site could occur during Phase 2 or Phase 3 but should be completed before construction begins on the parallel runway at Kahului Airport.

  Once the first phase of the new heliport facility was constructed, existing operators would have the choice of remaining at Kahului, relocating some activity to the new site or relocating all activity to the new site. New operators would locate at the Puunene site.

  The initial heliport facilities at Puunene could include two final approach and take-off areas (FATOs), helicopter parking apron, airport administration/terminal building and tour operator improvements (see Table 6-6).

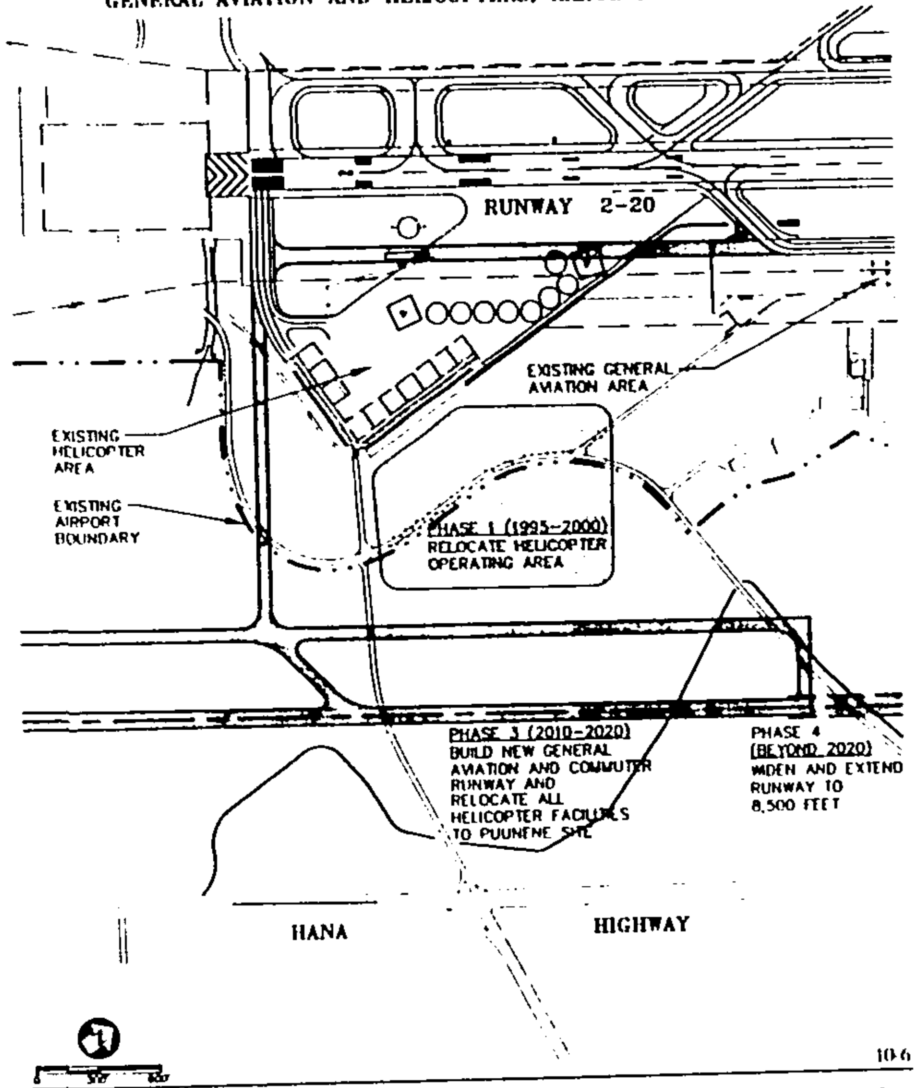
- ***Phase 3 (2010 to 2020).*** During Phase 3, a new parallel runway would be constructed at Kahului Airport for use by general aviation and commuter operators. A runway length of approximately 4,000 feet would be required. The centerline of the new runway would be 2,500 feet from the centerline of Runway 2-20 (Figure 10-1). The new runway would provide separation of the smaller general aviation and commuter aircraft from the larger air carrier jets.

  At the time the new runway is built, all remaining helicopter tour activity would be relocated to the Puunene site.

  After the relocation of the helicopter activity, the former helicopter area could be used for air cargo and/or general aviation purposes. General aviation would continue to expand in the area between the two parallel runways.

- ***Phase 4 (After 2020).*** During Phase 4, the third runway at Kahului Airport would

FIGURE 10-1
AIRPORT SYSTEM IMPROVEMENTS RECOMMENDED IN THE MAUI GENERAL AVIATION STUDY RELATED TO GENERAL AVIATION AND HELICOPTERS, KAHULUI AIRPORT



be converted to air carrier use. It would be widened and lengthened to 8,500 feet to accommodate primarily general aviation use, commuter activity and interisland flights by smaller jet aircraft.

The development strategy described above would provide for the orderly growth of aviation capacity while making the best use of existing facilities. Aviation demand in all sectors of aviation on the island of Maui would be satisfied. Furthermore, safety concerns would be addressed by the greater separation of helicopter, general aviation and large jet aircraft activity.

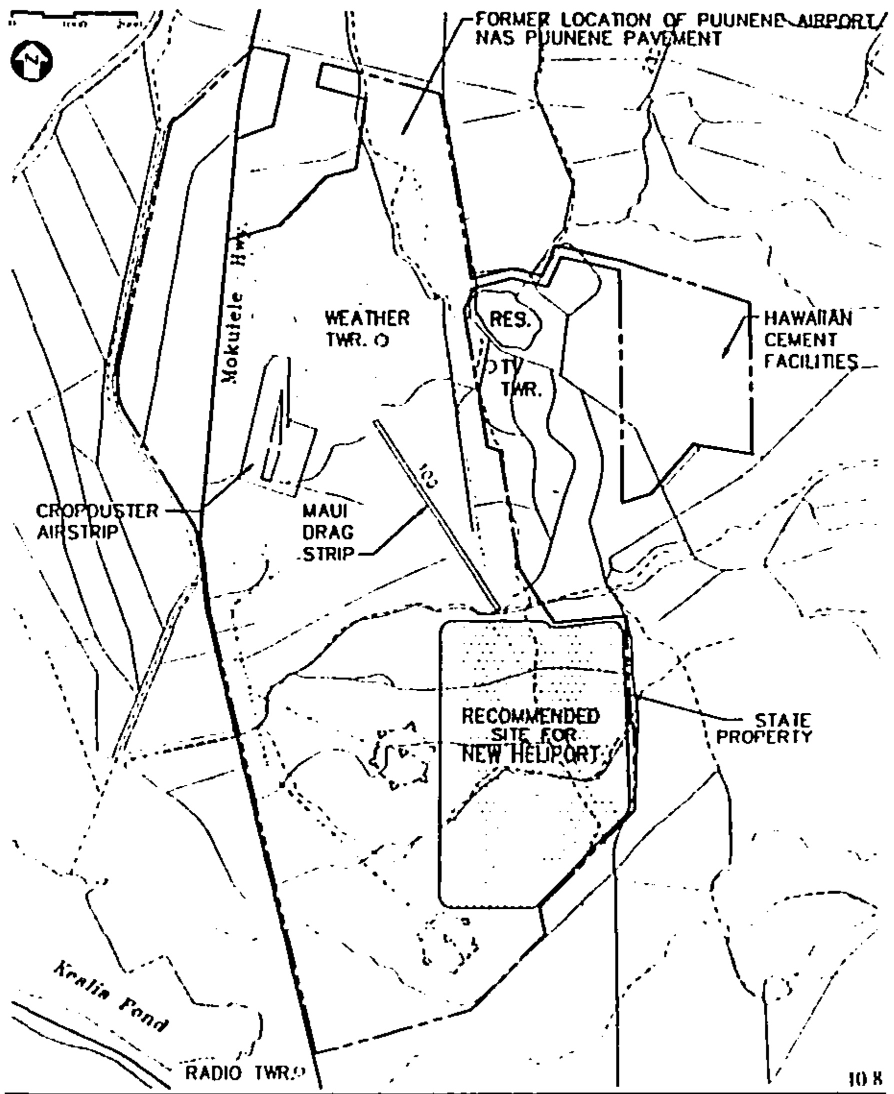
RECOMMENDED AIRPORT SYSTEM FOR MAUI

With the airport recommendations described abo · the future airport system for Maui Island wil: .

- Kahului Airport--The primary commercial-service airport on Maui, serving air carrier and commuter passengers, air cargo, fixed-wing general aviation users.
- Kapalua-West Maui Airport--A commuter service airport serving the West Maui coastal area with propeller-driven commuter aircraft only (no helicopter, jet or general aviation service).
- Hana Airport--An airport serving the north coastal area of East Maui with commuter service, and general aviation.
- New Heliport at Puunene Site--A new heliport at the Puunene site (Figure 10-2). The new heliport will serve helicopter tour operators as well as other helicopter users. When a new parallel runway is constructed at Kahului Airport all helicopter activity remaining at Kahului will be relocated to the new site.

The new heliport will be in the general area of Alternatives 2 and 3. The precise location of new heliport facilities will be identified in Volume 2, documenting the Heliport Master Plan. In the heliport master planning study, a layout plan will be prepared and a financial analysis of the proposed development will be conducted.

FIGURE 10-2
RECOMMENDED NEW HELIPORT SITE



APPENDIX A
GLOSSARY OF TERMS

GLOSSARY OF TERMS

"A"

A-WEIGHTED SOUND LEVEL - The sound pressure level which has been filtered or weighted to reduce the influence of low and high frequency (dBA).

AC - Advisory Circular published by the Federal Aviation Administration.

ADPM - Average Day of the Peak Month

AIR CARRIER AIRCRAFT - Aircraft with more than 60 seats operated by an air carrier airline.

AIR CARRIER AIRLINE - An airline certificated in accordance with FAR Part 121 or 127 to conduct scheduled services on specified routes operating aircraft with more than 60 seats. These air carriers may also provide nonscheduled or charter services as a secondary operation. Four carrier groupings have been designated for statistical and financial data aggregation and analysis.

1. MAJORS; Air carriers with annual operating revenues greater than $1 billion.
2. NATIONALS: Air Carriers with annual operating revenues between $100 million and $1 billion.
3. LARGE REGIONAL: Air carriers with annual operating revenues between $20 million and $99,999,999.
4. MEDIUM REGIONALS: All carriers with annual operating revenues less than $20 million.

AIRCRAFT MIX - The relative percentage of operations conducted at an airport by each of four classes of aircraft differentiated by gross takeoff weight and number of engines.

AIR[illegible]FT TYPES - An arbitrary classification system which identifies and groups aircraft having similar operational characteristics for the purpose of computing runway capacity.

AIR NAVIGATIONAL FACILITY (NAVAID) - Any facility used for guiding or controlling flight in the air or during the landing or takeoff of aircraft.

AIR ROUTE SURVEILLANCE RADAR (ARSR) - Long-range radar which increases the capability of air traffic control for handling heavy enroute traffic. An ARSR site is usually located at some distance from the ARTCC it serves. Its range is approximately 200 nautical miles. Also called ATC Cen[illegible] Radar.

AIR TAXI/COMMUTER AIRCRAFT - Aircraft with 60 seats or less operated by a commuter carrier, air taxi operator, or air carrier.

AIR TAXI OPERATOR - An operator certificated in accordance with FAR Part 135 and authorized to provide, on demand, public transportation of persons and property by aircraft. Generally operates small aircraft "for hire" for specific trips.

AIRPORT ENVIRONS - The area surrounding an airport that is affected by airport operations.

AIRPORT LAYOUT PLAN (ALP) - The current and planned airport development portrayal, which may be part of an airport master plan.

AIRPORT MASTER PLAN (AMP) - A long term development plan for an airport, adopted by the airport proprietor.

AIRPORT NOISE COMPATIBILITY PROGRAM - A program developed in accordance with FAR Part 150, including measures proposed or taken by the airport operator to reduce existing incompatible land use and to prevent the introduction of additional incompatible land uses within the area.

AIRPORT SURVEILLANCE RADAR (ASR) - Radar providing position of aircraft by azimuth and range of data without elevation data. It is designed for a range of 50 miles. Also called ATC Terminal Radar.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC) - A facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled airspace and principally during the enroute phase of flight.

AIRSPACE - The space lying above land or water which is necessary to conduct aeronautical operations.

ALERT AREA - Airspace which may contain a high volume of pilot training activities or unusual type of aerial activity.

ALP - Airport Layout Plan

ALSF-1 - Approach Light System with Sequence Flasher Lights.

AGL - Above Ground Level

ALS - Approach Light System

AMBIENT SOUND LEVELS - Ambient noise is the total noise associated with a given environment and usually comprises sounds from many different sources both near and far. Ambient noise is often defined in terms of the following statistical indicators:

L10 - the sound pressure level exceeded 10 percent of the time
L50 - the sound pressure level exceeded 50 percent of the time
L90 - the sound pressure level exceeded 90 percent of the time

APPROACH CONTROL SERVICE - Air traffic control service provided by a terminal area traffic control facility for arriving and departing IFR aircraft and, on occasion, VFR aircraft.

APPROACH FIX - The point from or over which final approach (IFR) to an airport is executed.

APPROACH LIGHTING SYSTEM - Approach lighting systems (ALS) are configurations of lights positioned symmetrically along the extended runway threshold and extend towards the approach. An ALS augments the electronic navigational aids.

APPROACH SLOPE - Imaginary areas extending out and away from the approach ends of runways which are to be kept clear of obstructions.

APPROACH SURFACE - An element of the airport imaginary surfaces, longitudinally centered on the extended runway centerline, extending upward and outward from the end of the primary surface at a designated slope.

AREA NAVIGATION(RNAV) - A method of navigation that permits aircraft operations on any desired course within the coverage or stationed-reference navigation systems or within the limits of self-contained system capability.

ARFF - Airport Rescue and Fire Fighting.

ARTS-III - Automated Radar Terminal Service - Phase III. A terminal facility in the air traffic control system using air ground communications and radar intelligence to detect and display pertinent data such as flight identification, altitude and position of aircraft operating in the terminal area.

ASDE - Airport Surface Detection Equipment

ASV - Annual Service Volume - a reasonable estimate of the airfield's annual capacity.

ATCT - Airport Traffic Control Tower

ATC - Air Traffic Control

ATIS - Automatic Terminal Information Service

AVERAGE DAY PEAK MONTH (ADPM) ACTIVITY - Activity (passengers or aircraft operations) in the average day of the peak month of the activity. Average day activity is obtained by dividing the pe[illegible] onth activity by the number of days in the month. ADPM activity is used for planning airport requirements.

AVIGATION AND HAZARD EASEMENT - An easement which provides right of flight at any altitude above the approach surface, prevents any obstruction above the approach surface, provides a right to cause noise vibrations, prohibits the creation of electrical interferences, and grants right-of-way entry to remove trees or structures above the approach surface.

"B"

BASED AIRCRAFT - An aircraft permanently stationed at the airport, usually by some form of agreement between the aircraft owner and airport management.

BUSINESS JET - Any of a type of turbine powered aircraft carrying six or more passengers and weighing less than approximately 70,000 pounds gross takeoff weight.

"C"

CAT I - Category I Instrument Landing System. (Minimums: decision height of 200 feet; Runway visual range 1,800 feet).

CAT II - Category II Instrument Landing System. (Minimums: decision height of 100 feet; Runway visual range 1,200 feet).

CAT III - Category III Instrument Landing System. (Minimums: no decision height; Runway visual range of from 0 to 700 feet depending on type of CAT III facility).

CALIBRATION - The procedure used to adjust an urban area traffic model so that it matches base year of present day conditions.

CENTER'S AREA - The specified airspace within which an air route traffic control center provides air traffic control and advisory service.

CFR - Crash, Fire and Rescue (now called Airport Rescue and Fire Fighting (ARFF)

CIRCLING APPROACH - A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in instrument approach is not possible. This maneuver requires ATC clearance and that the pilot establish visual reference to the airport.

CL - Centerline

CLEARWAY - A defined rectangular area beyond the end of a runway cleared or suitable for use in lieu of runway to satisfy takeoff distance requirements.

COMMERCIAL SERVICE AIRPORT - A public airport which received scheduled passenger service and enplanes annually 2,500 or more passengers.

COMMUTER CARRIER - An airline certificated in accordance with FAR Part 135 or 121 that operates aircraft with a maximum of 60 seats, and that provides at least five scheduled round trips per week between two or more points, or that carries mail.

CONICAL SURFACE - An imaginary surface extending upward and outward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

CONNECTING PASSENGERS - A passenger who boards an aircraft directly after deplaning from another flight. On-line single carrier connections involve flights of the same carrier, while interline or off-line connections involve flights of two different carriers. The term connection can also be applied to freight shipments.

CONTROLLED AREA - Airspace within which some or all aircraft may be subject to air traffic control.

CONTROL TOWER - A central operations facility in the terminal air traffic control system consisting of a tower cab structure (including an associated IFR room if radar equipped) using air/ground communications and/or radar, visual signaling and other devices to provide safe and expeditious movement of terminal air traffic.

CONTROL ZONES - These are areas of controlled airspace which extend upward from the surface and terminate at the base of the continental control area. Control zones that do not underlie the continental control area have no upper limit. A control zone may include one or more airports and is normally a circular area with a radius of 5 statute miles of any extensions necessary to include instrument departure and arrival paths and are regulatory in nature.

CONTROLLED AIRSPACE - Airspace designated as continental control area, control area, control zone or transition area within which some or all aircraft may be subject to air traffic control.

CROSSWIND RUNWAY - A runway aligned at an angle to the prevailing wind which allows use of an airport when crosswind conditions on the primary runway would otherwise restrict use.

CURFEW - A restriction placed upon all or certain classes of aircraft by time of day, for purposes of reducing or controlling airport noise.

"D"

DECISION HEIGHT (DH) - With respect to the operation of aircraft, this means the height at which a decision must be made, using an ILS or PAR instrument approach, to either continue the approach or to execute a missed approach.

DECLARED DISTANCES - The distances the airport owner declares available and suitable for satisfying the airplane's takeoff um, takeoff distance, accelerate-stop distance, and landing distance requirements. The distances are:

- *Takeoff run available (TORA)* - the runway length declared available and suitable for the ground run of an airplane taking off.

- *Takeoff distance available (TODA)* - the TORA plus the length of any remaining runway and/or clearway beyond the far end of the TORA.
- *Accelerate-stop distance available (ASDA)* - the runway plus stopway length declared available and suitable for the acceleration and deceleration of an airplane aborting a takeoff; and
- *Landing distance available (LDA)* - the runway length declared available and suitable for a landing airplane.

DEMAND - The actual number of persons, aircraft or vehicles currently using a facility if that facility is operating at or below capacity or the number of persons, aircraft or vehicles who want to use the facility when the facility is operating above capacity.

DEPLANEMENT - Any passenger getting off an arriving aircraft at an airport. Can be both a terminating and connecting passenger. Also applies to freight shipments.

DISPLACED THRESHOLD - A threshold that is located at a point on the runway other than the designated beginning of the runway.

DISTANCE MEASURING EQUIPMENT (DME) - An electronic installation established with either a VOR or ILS to provide distance information from the facility to pilots by reception of electronic signals. It measures, in nautical miles, the distance of an aircraft from a NAVAID.

"E"

EA (Environmental Assessment) - A document prepared under the National Environmental Policy Act of 1969 to determine whether potential impacts appear to be significant. The completion of an EA often precedes the decision to prepare and EIS.

ENPLANEMENT - Any passenger boarding a departing aircraft at an airport. Can be both a local origin and a connecting passenger. Applies also to freight shipments.

ENROUTE - The route of flight from point of departure to point of destination, including intermediate stops (excludes local operations).

ENROUTE AIRSPACE - Controlled airspace above and/or adjacent to terminal airspace.

ENVIRONMENTAL IMPACT STATEMENT (EIS) - A document prepared under the National Environmental Policy Act of 1969 to describe the social, economic, and physical impacts of proposed federal projects or projects requiring federal money or approval.

EQUIVALENT SOUND LEVEL (LEQ) - The steady A-weighted sound level over a specified period that has the same acoustic energy as the fluctuating noise during that period.

ERG - Effective Runway Gradient

"F"

F&E - Facilities and Equipment Programming - FAA

FAR Part 36 - A regulation establishing noise certification standards for aircraft.

FAR Part 77 - Establishes standards for determining obstructions in navigable airspace, sets forth requirements for notice of proposed construction or alteration and provides for aeronautical studies of obstructions to air navigation.

FAR Part 150 (Federal Aviation Regulation Part 150, 14 CFR 150) - The regulation describing the requirements and procedures for conducting a voluntary aircraft noise and land use compatibility study.

FEDERAL AIRWAYS - See Low Altitude Airways.

FEDERAL AVIATION ADMINISTRATION (FAA) - The federal agency charged with regulating air commerce to promote its safety and development, encouraging and developing civil aviation, air traffic control, and air navigation and promoting the development of a national system of airports.

FEDERAL AVIATION REGULATIONS (FAR) - Regulations issued by the FAA to regulate air commerce; issued as separate "Parts," e.g., Part 77

FINAL APPROACH IFR - The flight plan of landing aircraft in the direction of landing along the extended runway centerline from the base leg to the runway.

FIXED BASE OPERATOR (FBO) - An airport service operation, normally consisting of fuel sales, aircraft rentals, charter aircraft sales and maintenance with a fixed base of operation at the airport.

FLEET MIX - The proportion of aircraft types or models expected to operate at an airport.

FLIGHT SERVICE STATION (FSS) - A facility operated by the FAA to provide flight assistance service.

"G"

GENERAL AVIATION (GA) - All segments of aviation except air carrier and military. Included are corporate, industrial, agricultural, public and emergency services, business, charter, personal and sport flying.

GLIDE SCOPE (GS) - The vertical guidance component of an Instrument Landing System (ILS).

"H"

HIGH ALTITUDE AIRWAYS - See Jet Routes.

HIRL - High Intensity Runway Lighting

HOLDING PROCEDURE - A predetermined maneuver which keeps an aircraft within a specified airspace while awaiting further clearance from air traffic control.

HORIZONTAL SURFACE - An imaginary surface constituting a horizontal plane 150 feet above the airport elevation.

"I"

IMAGINARY SURFACE - An area established in relation to the airport and to each runway consistent with FAR Part 77 in which any object extending above these imaginary surfaces is, by definition, an obstruction.

INSTRUMENT APPROACH - A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES (IFR) - FAR rules that govern the procedures for conducting instrument flight (FAR Part 91).

INSTRUMENT LANDING SYSTEM (ILS) - A precision landing aid consisting of localizer (azimuth guidance), glide slope (vertical guidance), outer marker (final approach fix) and approach light system.

INSTRUMENT OPERATION - A landing or takeoff conducted while operating on an instrument flight plan.

INSTRUMENT RUNWAY - A runway equipped with electronic and visual navigation aids for which a precision or non-precision approach procedure having straight-in landing minimums has been established.

INTEGRATED NOISE MODEL (INM) - A computer-based airport noise exposure modelling program developed for the FAA.

ITINERANT OPERATIONS - All aircraft arrivals and departures other than local operations.

INTERNATIONAL OPERATIONS - Aircraft operations performed by air carriers engaged in scheduled international service.

"J"

JET ROUTES - A route designed to serve aircraft operating from 18,000 feet MSL up to and including flight level 450.

"L"

LAT - Latitude

LDA - Localizer Type Directional Aid

LDN - Day-Night Average Sound Level. The 24-hour average sound level, in decibels, from midnight to midnight, obtained after the addition of ten decibels to sound levels for periods between 10 p.m. and 7 a.m.

LENGTH OF HAUL - The non-stop airline route distance from a particular airport.

LEQ - Leq is the equivalent continuous sound level defined as the steady state sound pressure level Db(A) which, over a given period of time, has the same total energy as the actual fluctuating noise.

LEVEL OF SERVICE (LOS) - A standardized index of the relative service provided by street or intersection, ranging from A (extremely farmable) to E (oversaturation).

LIRL - Low Intensity Runway Lighting

LOAD FACTOR - Ratio of the number of passenger miles to the available seat miles flown by an airline representing the proportion of aircraft seating capacity that is actually sold and utilized. Load factors are also referred to in air cargo and can be determined by weight or volume.

LOC - Localizer (part of a ILS)

LOCAL OPERATION - Operations performed by aircraft which: (a) operate in the local traffic pattern or within the sight of the tower; (b) are known to be departing for, or arriving from, flight in local practice areas located within a 20-mile radius of the control tower, or (c) execute simulated instrument approaches or low passes at the airport.

LOM - Compass locator at an outer marker (part of an ILS). Also call COMLO.

LONG - Longitude

LOW ALTITUDE AIRWAYS - Air routes below 18,000 feet MSL. They are referred to as Federal Airways.

LRR - Long-Range Radar

"M"

MALS - Medium Intensity Approach Light System

MALSF - Medium Intensity Approach Light System with sequence flashing lights.

MALSR - MALS with Runway Alignment Indicator Lights (RAIL)

MARKER BEACON - An electronic navigation facility which transmits a fan or boneshaped radiation pattern. When received by compatible airborne equipment they indicate to the pilot that he is passing over the facility. Beacons are used to advise pilots of their position during an ILS approach. Marker beacons are of three types: Outer Marker, Middle Marker, and Inner Marker.

MASTER PLAN - Long-range plan of airport development requirements.

MILITARY OPERATION - An operation by military aircraft.

MINIMUM DESCENT ALTITUDE (MDA) - The lowest altitude, expressed in feet above mean sea level, to which descent is authorized on final approach or during circling-to-land maneuvering in execution of a standard instrument approach procedure where no electronic glide slope is provided.

MIRL - Medium Intensity Runway Lighting

MISSED APPROACH - A prescribed procedure to be followed by aircraft that cannot complete an attempted landing at an airport.

MITL - Medium Intensity Taxiway Lighting

MLS - Microwave Landing System

MM - Middle Marker (part of an ILS)

MOA - Military Operations Area

MOVEMENT - Synonymous with the term operation, i.e., a takeoff or a landing.

MSL - Mean Sea Level

"N"

NARROWBODY AIRCRAFT - A commercial passenger jet having a single aisle and a maximum of three seats on each side of the aisle. Narrowbody aircraft include the B727, B737, B757, DC9, MD80, MD90 and A320.

NAS - NATIONAL AIRSPACE SYSTEM - The common system or air navigation and air traffic encompassing communications facilities, air navigation facilities, airways, controlled airspace, special use airspace and flight procedures authorized by Federal Aviation Regulations for domestic and international aviation.

NAVAID - Any facility used for guiding or controlling flight in the air or during the landing or takeoff of aircraft.

NDB - NON-DIRECTIONAL BEACON - An electronic ground station transmitting in all directions in the L/MF frequency spectrum; provides azimuth guidance to aircraft equipped with direction finder receivers. These facilities are often established with ILS outer markers to provide transition guidance to the ILS system.

NEPA - National Environmental Policy Act

NM - Nautical Mile

NOISE ABATEMENT - A procedure for the operation of aircraft at an airport which minimizes the impact of noise on the environs of the airport.

NOISE CONTOUR - A noise impact boundary line connecting points on a map where the level of sound is the same.

NOISE EXPOSURE MAP (NEM) - A scaled, geographic depiction of an airport, its noise contours and surrounding area, as described in FAR Part 150.

NOISE LEVEL REDUCTION (NLR) - The amount of noise level reduction achieved through incorporation of noise attenuation (between outdoor and indoor levels) in the design and construction of a structure.

NON-PRECISION APPROACH - A standard instrument approach procedure in which no electronic glide slope is provided.

"O"

OAG - Official Airline Guide

OBSTRUCTION - Any structure, growth, or other object, including a mobile object, that exceeds a limiting height established by federal regulations or by a hazard zoning regulation.

OM - Outer Marker (part of an ILS)

OPERATION - An aircraft arrival at or departure from an airport.

ORIGIN AND DESTINATION PASSENGERS (O&D) - Those passengers--whether visitors or residents-- whose trips begin or end in the region.

OUTER FIX - A point in the destination terminal area from which aircraft are cleared to the approach fix or final approach course.

"P"

PAPI - Precision Approach Path Indicator

PAR - Precision Approach Radar

PEAK HOUR ACTIVITY - Activity (passengers or aircraft operations) in the busiest hour of the average day peak month (ADPM).

POSITIVE CONTROL AREA - Airspace wherein aircraft are required to be operated under Instrument Flight Rules.

PRECISION APPROACH - A standard instrument approach procedure in which an electronic glideslope/glidepath is provided; eg., ILS/MLS and PAR.

PRIMARY COMMERCIAL SERVICE AIRPORT - A commercial service airport which enplanes .01 percent or more of the total annual U.S. enplanements.

PRIMARY RUNWAY - The runway on which the majority of operations take place. On large, busy airports, there may be two or more parallel primary runways.

PRIMARY SURFACE - An area longitudinally centered on a runway with a width ranging from 250 to 1,000 feet and extending 200 feet beyond the end of a paved runway.

PROHIBITED AREA - Airspace of defined dimensions identified by an area on the surface of the earth within flight is prohibited.

"Q"

QUEUE - A line of pedestrians or vehicles waiting to be served.

"R"

RADAR SEPARATION - Radar spacing of aircraft in accordance with established minima.

RAIL - Runway Alignment Indicator Lights

RCAG - Remote Center Air/Ground Communications

REIL - Runway End Identification Lights

RELIEVER AIRPORT - An airport which, when certain criteria are met, relieves the aeronautical demand on a high density air carrier airport.

RESTRICTED AREAS - Airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions.

RNAV - See Area Navigation.

ROTATING BEACON - A visual NAVAID displaying flashes of white and/or colored light used to indicate location of an airport.

RPZ - Runway Protection Zone (inner portion of runway approach zone; formerly called Clear Zone)

RUNWAY SAFETY AREA - An area symmetrical about the runway centerline and extending beyond the ends of the runway which shall be free of obstacles as specified.

RVR - Runway Visual Range

RVV - Runway Visibility Value

"S"

SALS - Short Approach Light System

SDF - Simplified Directional Facility landing aid providing final approach course.

SEGMENTED CIRCLE - An airport aid identifying the traffic pattern direction.

SEPARATION MINIMA - The minimum longitudinal, lateral, or vertical distances by which aircraft are spaced through the application of air traffic control procedures.

SMSA - Standard Metropolitan Statistical Area.

SOCIOECONOMIC - Data pertaining to the population and economic characteristics of a region.

SOUND EXPOSURE LEVEL - That constant sound level which has the same amount of energy in one second as the original noise event.

SSALF - Simplified Short Approach Light System with Sequence Flashing lights.

SSALS - Simplified Short Approach Light System.

SSALR - Simplified Short Approach Light System with Runway Alignment Indicator Lights (RAIL)

STOPWAY - A defined rectangular surface beyond the end of a runway prepared or suitable for use in lieu of runway to support an airplane, without causing structural damage to the airplane, during an aborted takeoff.

STRAIGHT-IN APPROACH - A descent in an approved procedure in which the final approach course alignment and descent gradient permits authorization of straight-in landing minimums.

STOL - Short Takeoff and Landing

STOVL - Short Takeoff Vertical Landing

SYSTEM PLAN - A representative of the aviation facilities required to meet the immediate and future air transportation needs and to achieve the overall goals.

"T"

TACAN - Tactical Air Navigation

TDZ - Touchdown Zone

TERMINAL AIRSPACE - The controlled airspace normally associated with aircraft departure and arrival patterns to/from airports within a terminal system and between adjacent terminal systems in which tower enroute air traffic control service is provided.

TERMINAL CONTROL AREA (TCA) - This consists of controlled airspace extending upward from the surface or higher to specified altitudes within which all aircraft are subject to positive air traffic control procedures.

TERPS - Terminal Instrument Procedures

T-HANGAR - A T-shaped aircraft hangar which provides shelter for a single airplane.

THRESHOLD - The beginning of that portion of the runway usable for landing.

TIME ABOVE - Time above indicates the time in minutes that a given Db(A) levels is exceeded during a 24-hour period.

TOUCH-AND-GO OPERATION - An operation in which the aircraft lands and begins takeoff roll without stopping.

TRAFFIC PATTERN - The traffic flow that is prescribed for aircraft landing at, taxiing on, and taking off from an airport. The usual components of a traffic pattern are upwind leg, crosswind leg, downwind leg and final approach.

TRANSIENT OPERATIONS - See Itinerant Operations.

TRANSITIONAL SURFACE - An element of the imaginary surfaces extending outward at right angles to the runway centerline and from the sides of the primary and approach surfaces to where they intersect the horizontal and conical surfaces.

TRANSITIONAL AIRSPACE (TRANSITION AREA) - Areas designated to contain IFR operations in controlled airspace during portions of the terminal operations and while transitioning between the terminal and enroute environment.

TRIP - The one-way unit of travel between an origin and a destination.

TRIP GENERATION - That portion of the transportation planning process concerned with developing an estimate of the total number of trips attracted or produced by each traffic analysis zone in a study area.

TVOR - Terminal Very High Frequency Omnirange Station

"U"

UHF - Ultra High Frequency

UNCONTROLLED AIRSPACE - That portion of the airspace that has not been designated as continental control area, control area, control zone, terminal control area or transition area and within which ATC has neither the authority nor the responsibility for exercising control over air traffic.

UNICOM - Radio communications station which provides pilots with pertinent airport information (winds, weather, etc.) at specific airports.

UTILITY RUNWAY - A runway intended to be used by propeller driven aircraft of 12,500 pounds maximum gross weight or less.

"V"

VASI - Visual Approach Slope Indicator providing visual glide path.

VASI-2 - Two Box Visual Approach Slope Indicator

VASI-4 - Four Box Visual Approach Slope Indicator

VECTOR - A heading issued to an aircraft to provide navigational guidance by radar.

VFR - Visual Flight Rules that govern flight procedures in good weather.

VFR AIRCRAFT - An aircraft conducting flight in accordance with Visual Flight Rules.

VHF - Very High Frequency

VISUAL APPROACH RUNWAY - A runway intended for visual approaches only.

VOR - Very High Frequency Omnirange Station. A ground-based radio (electronic) navigation aid transmitting radials in all directions in the VHF frequency spectrum; provides azimuth guidance to pilots by reception of electronic signals.

VORTAC - Co-located VOR and TACAN.

V/STOL - Vertical/Short Takeoff and Landing

VTOL - Vertical Takeoff and Landing (includes, but is not limited to, helicopters).

"W"

WARNING AREA - Airspace which may contain hazards to non-participating aircraft in international airspace.

WIND CONE (WIND SOCK) - Conical wind directional indicator.

WIND TEE - A visual device used to advise pilots about wind direction at an airport.

APPENDIX B
GROUND PROFILES OF ALTERNATIVE SITES

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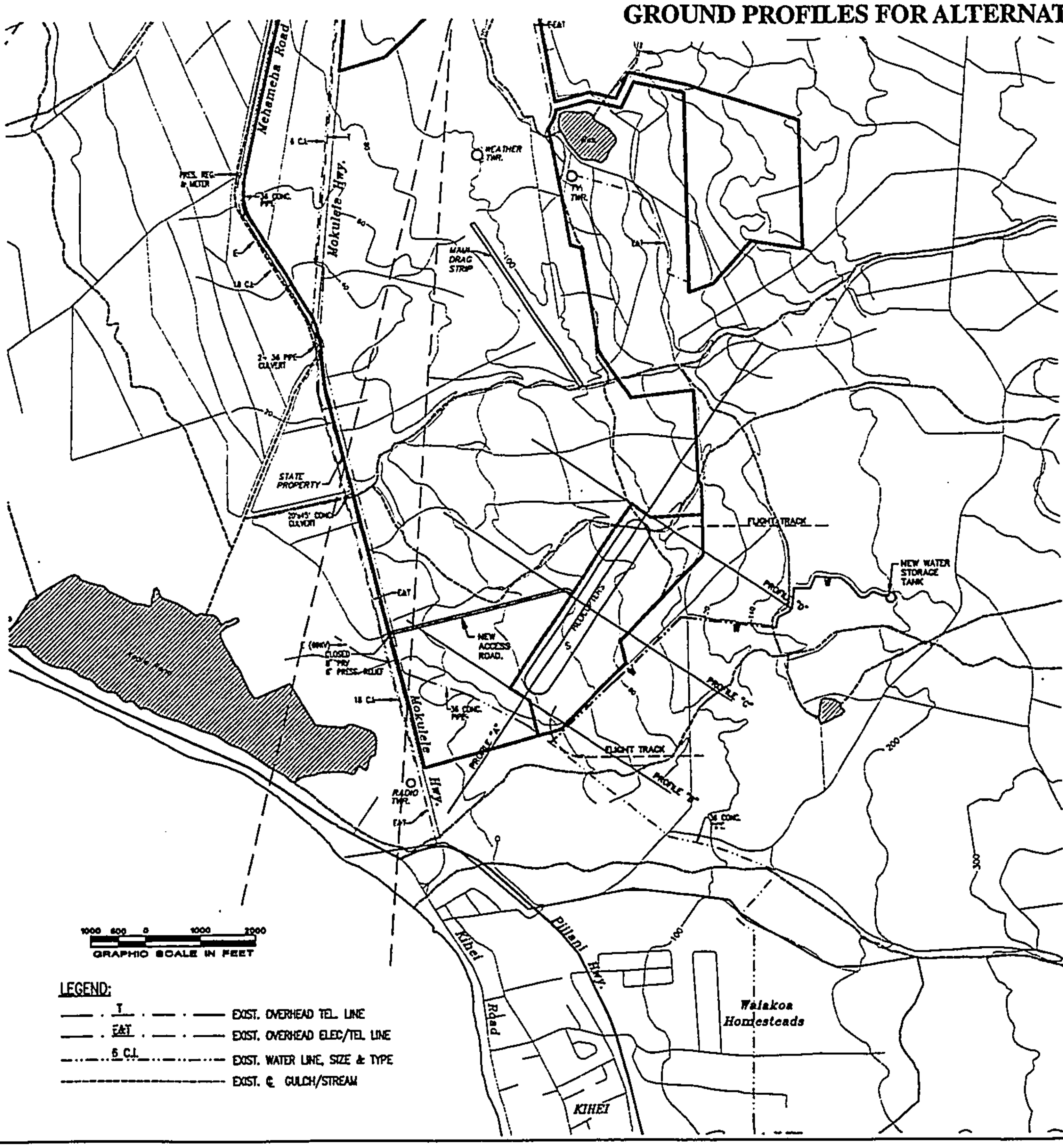
FIGURE B- 1
GROUND PROFILES FOR ALTERNATIV[E]



E B- 1
OR ALTERNATIVE 2

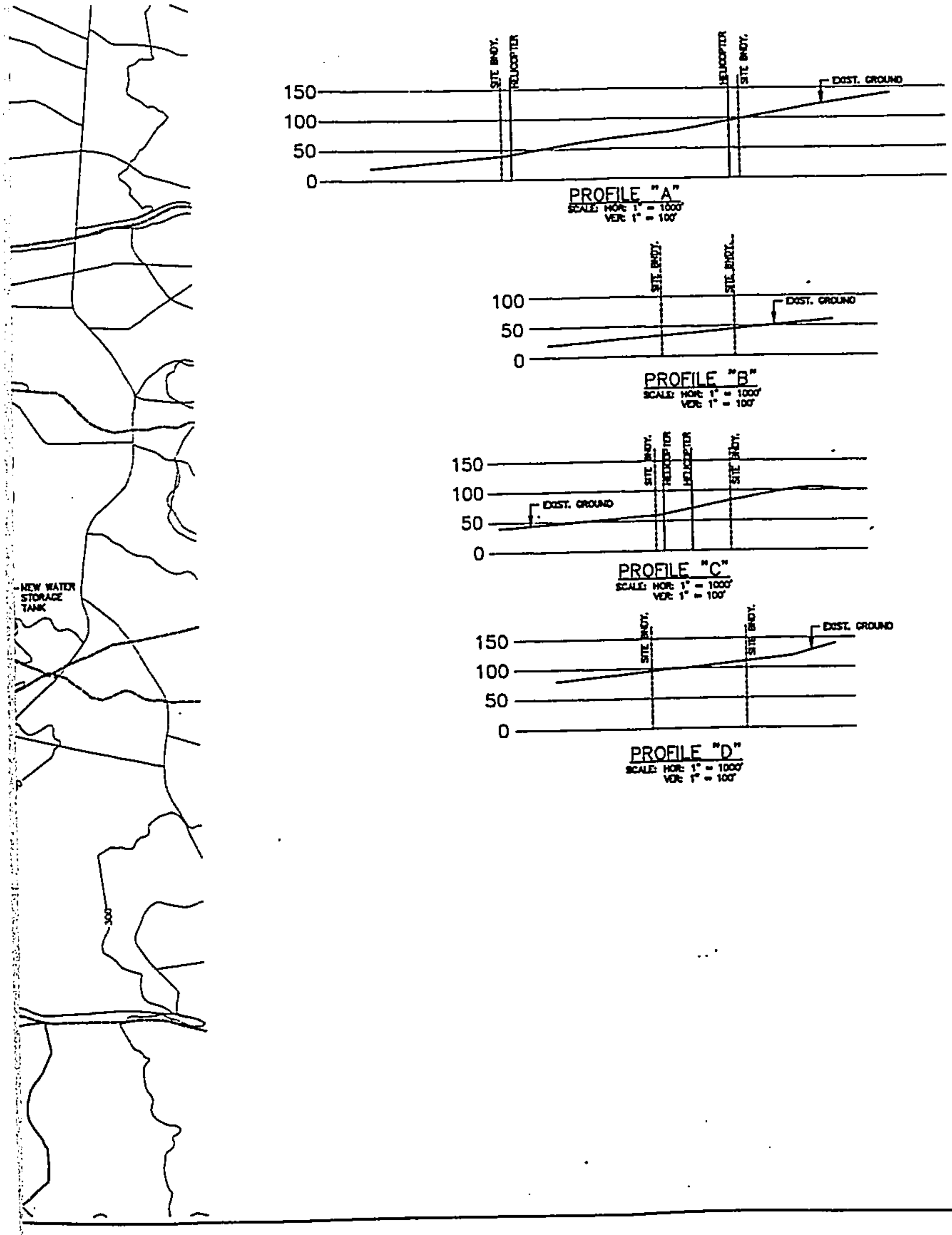
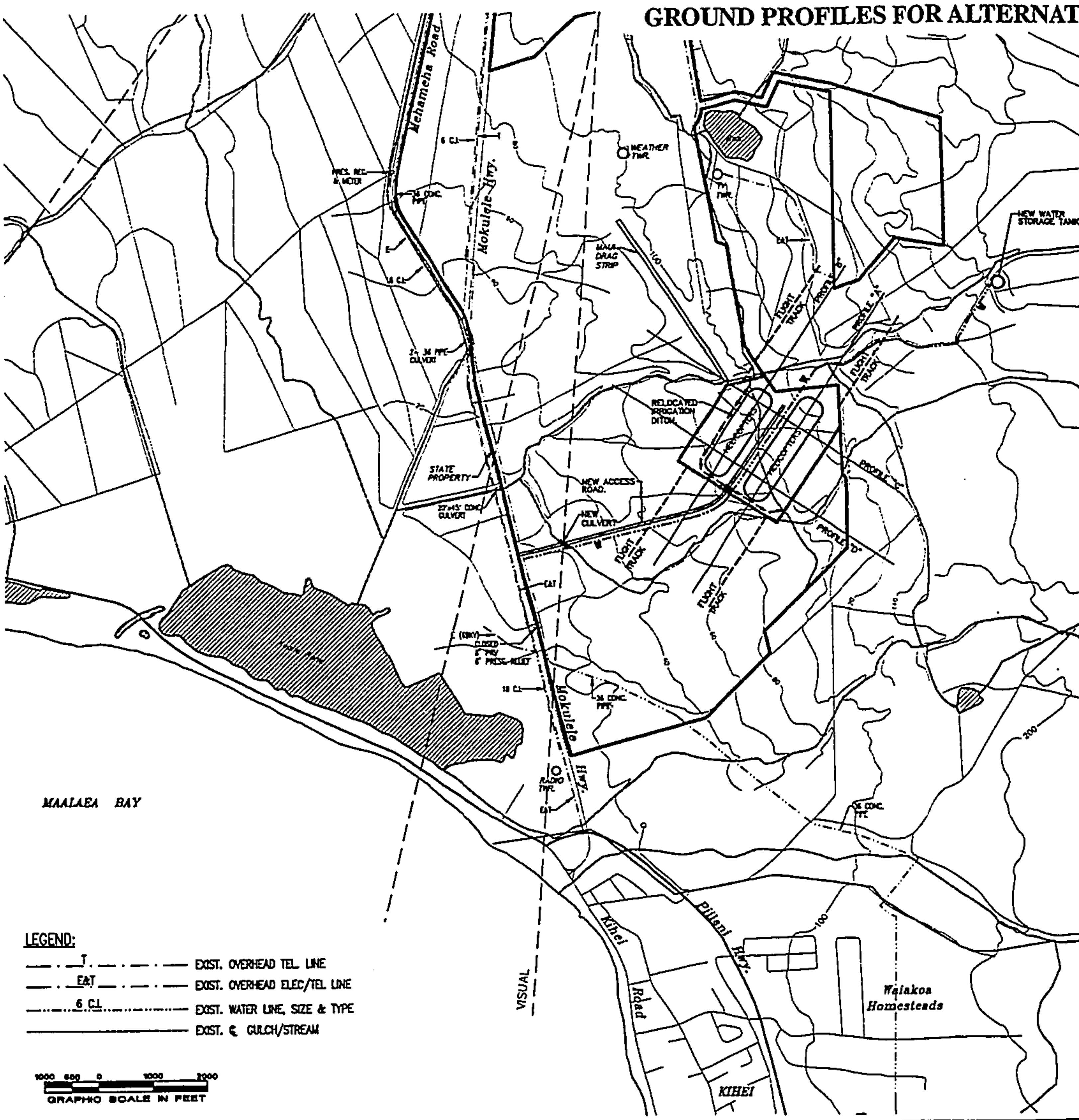
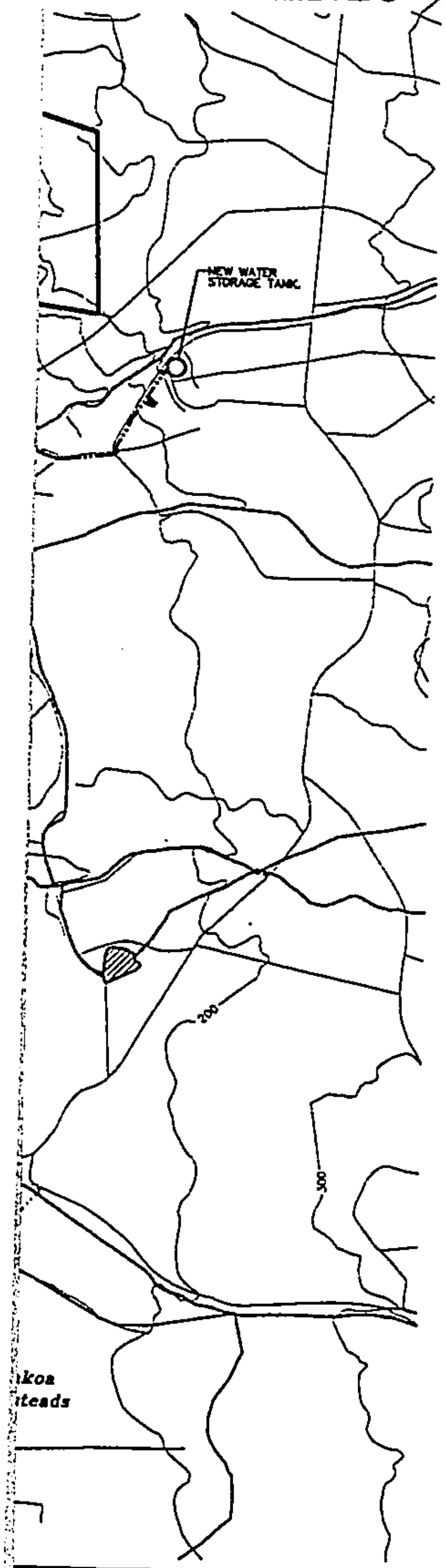


FIGURE B- 2
GROUND PROFILES FOR ALTERNAT



:E B- 2

:OR ALTERNATIVE 3



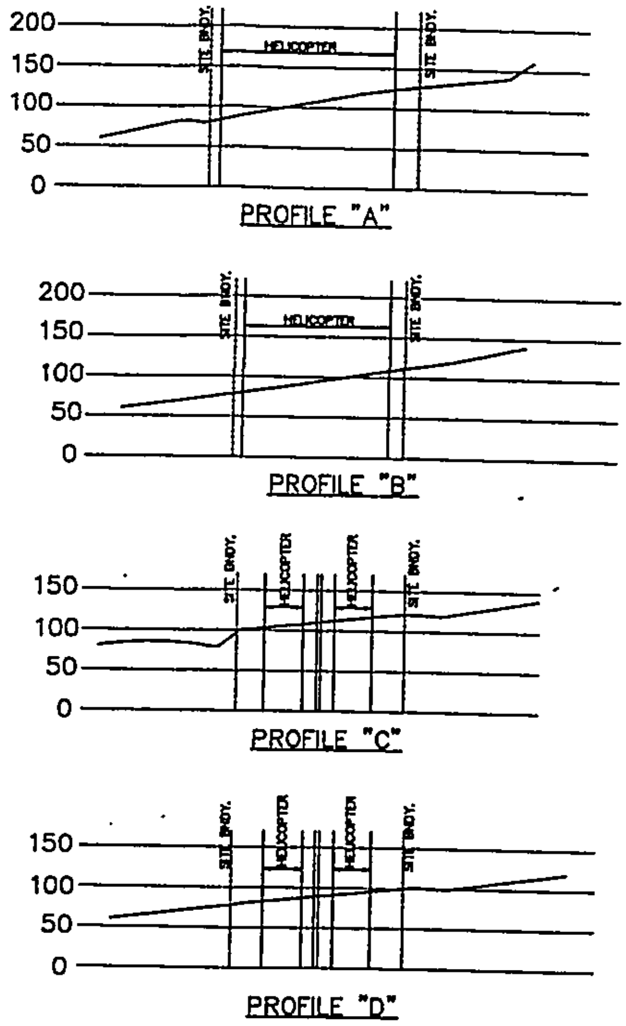
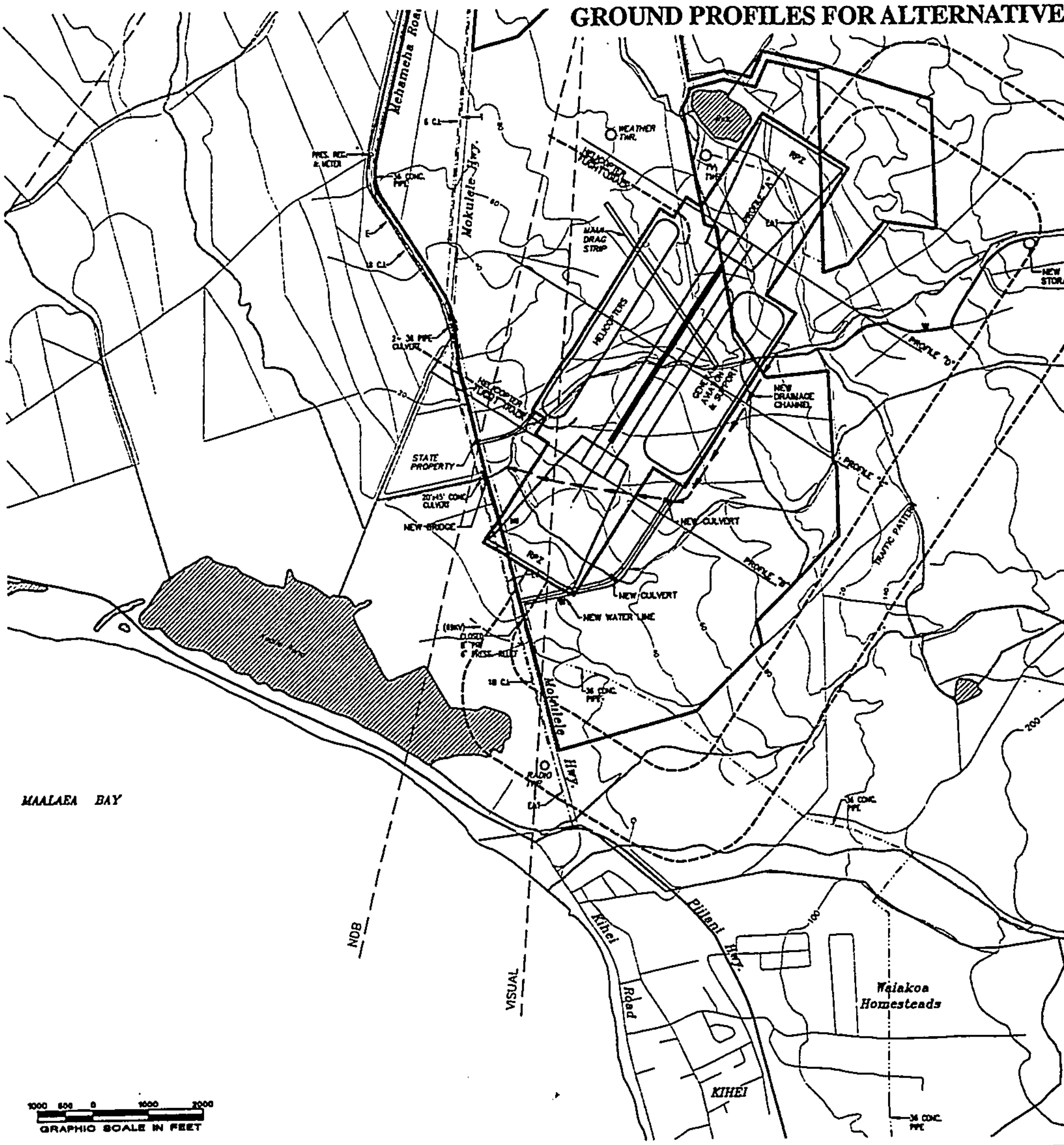
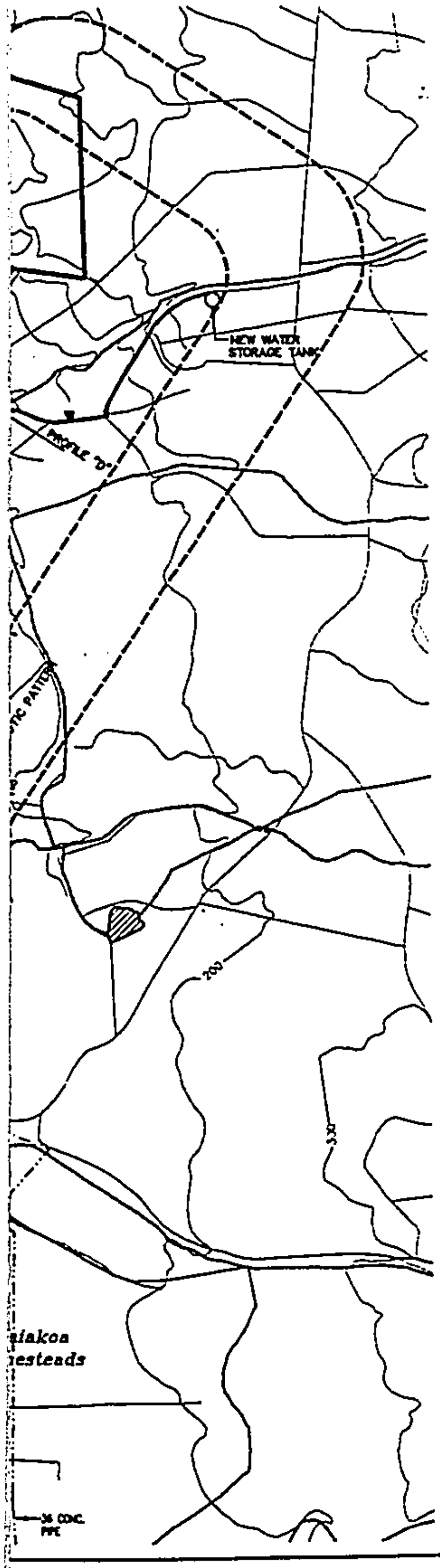


FIGURE B- 3
GROUND PROFILES FOR ALTERNATIVE



E B- 3
ALTERNATIVES 4 AND 4A



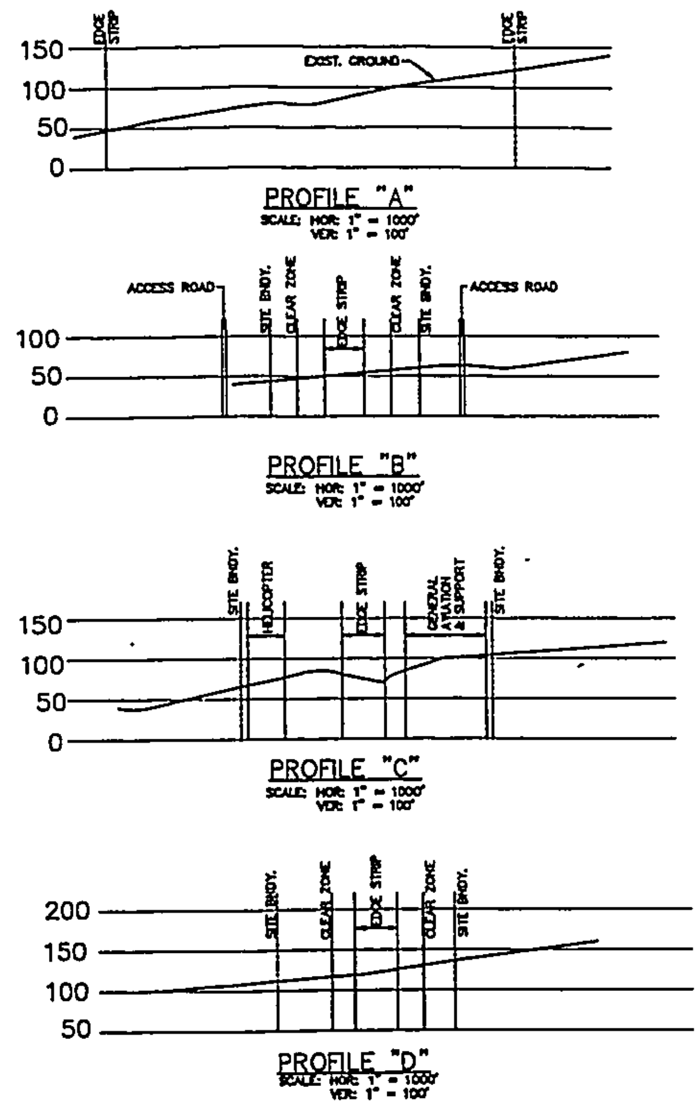
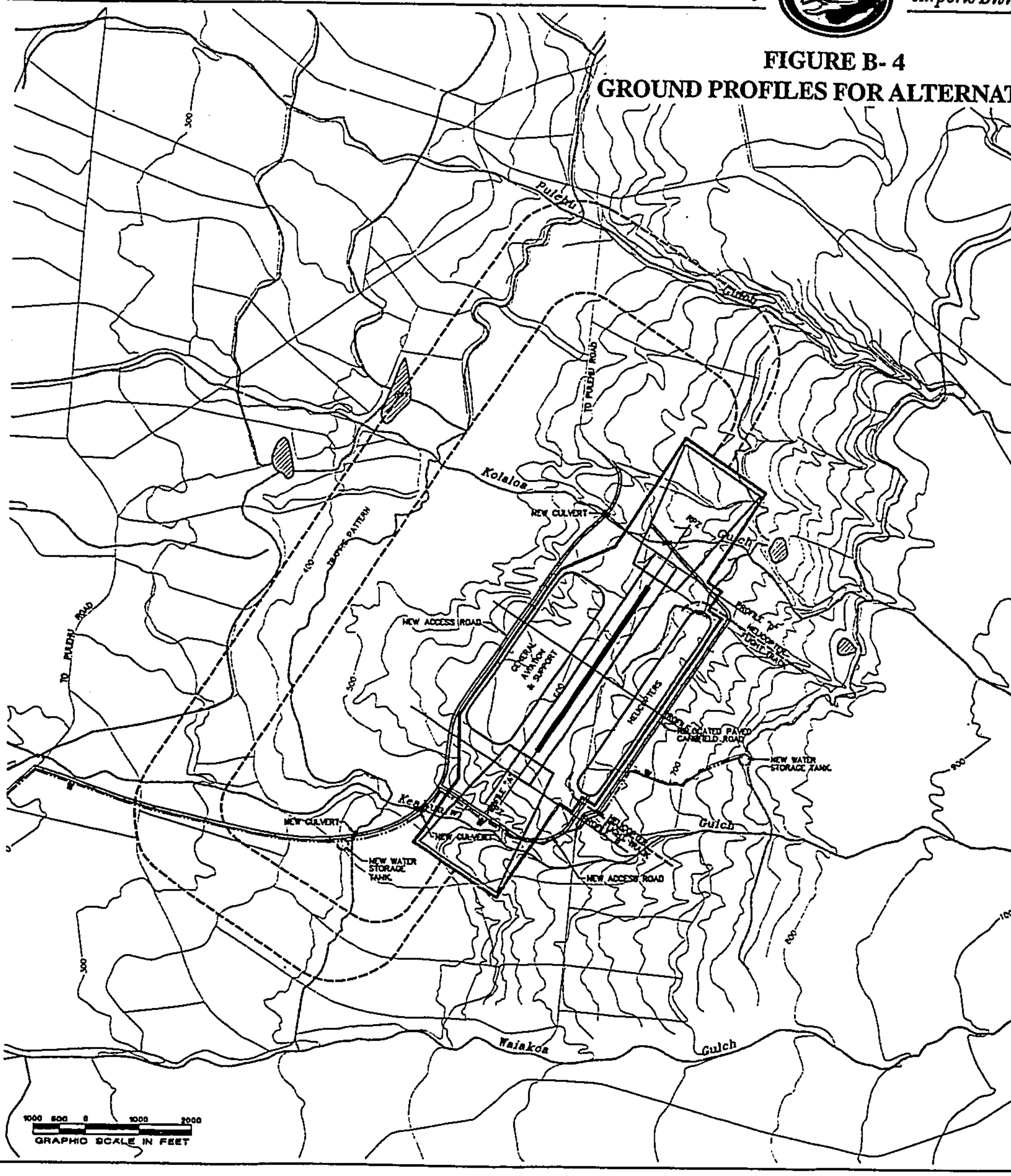
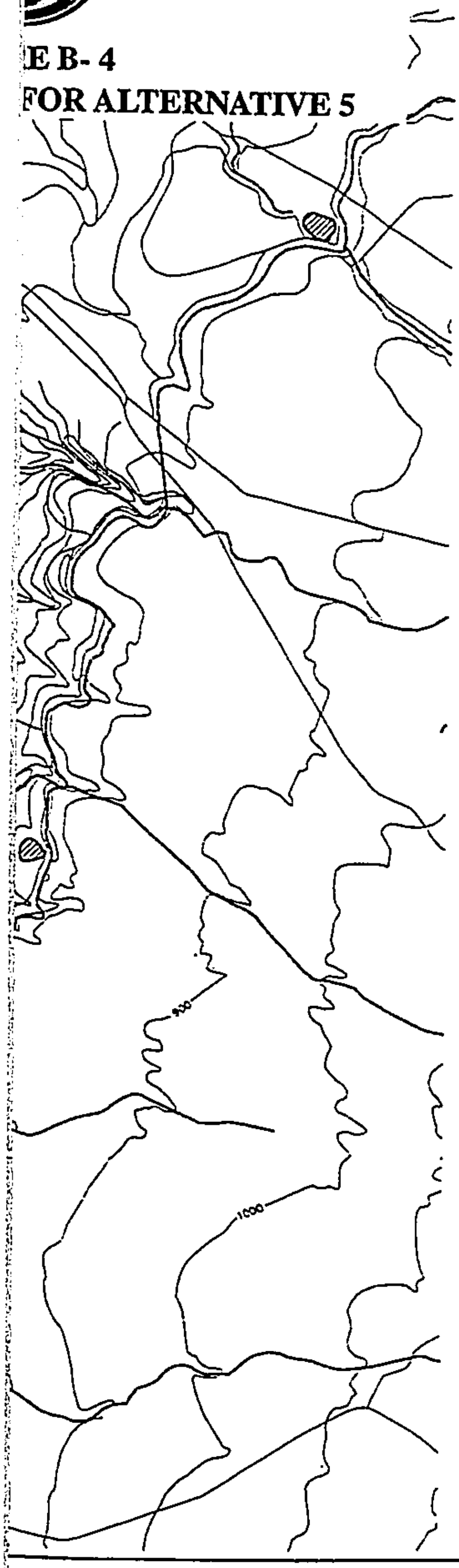
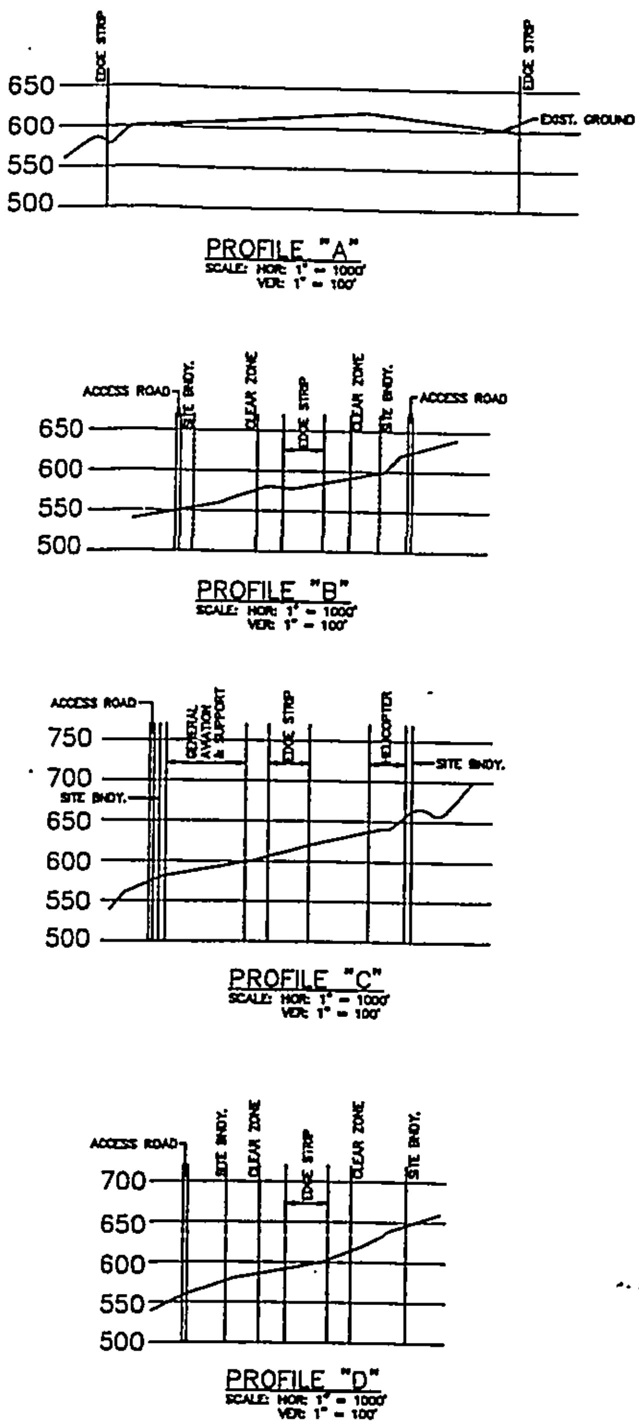


FIGURE B- 4
GROUND PROFILES FOR ALTERNAT



E B- 4
FOR ALTERNATIVE 5

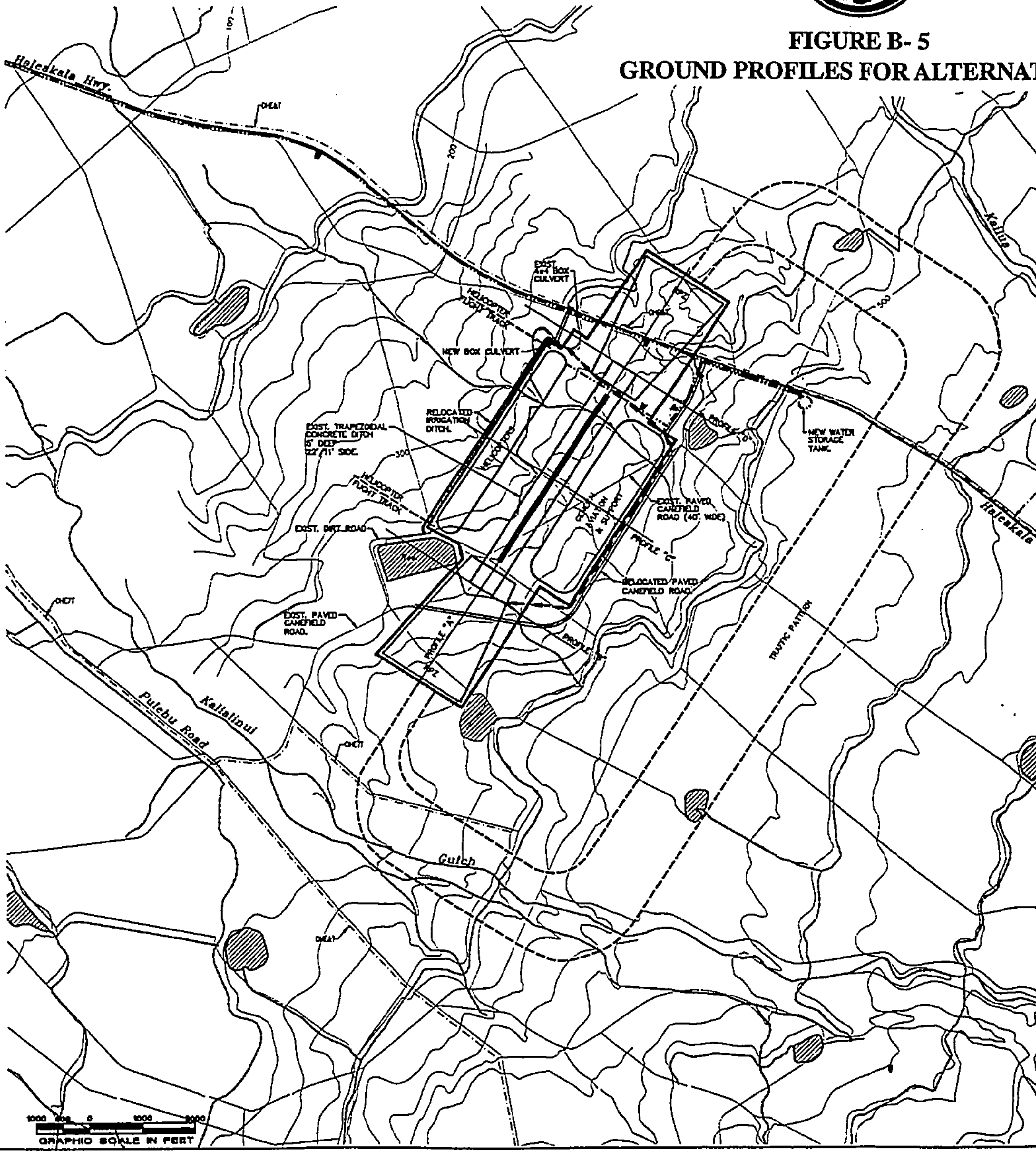




LEGEND:

T	EXIST. OVERHEAD TEL. LINE
E&T	EXIST. OVERHEAD ELEC/TEL LINE
6 C.I.	EXIST. WATER LINE, SIZE & TYPE
	EXIST. ℄ GULCH/STREAM

FIGURE B- 5
GROUND PROFILES FOR ALTERNAT



E B-5
'OR ALTERNATIVE 6

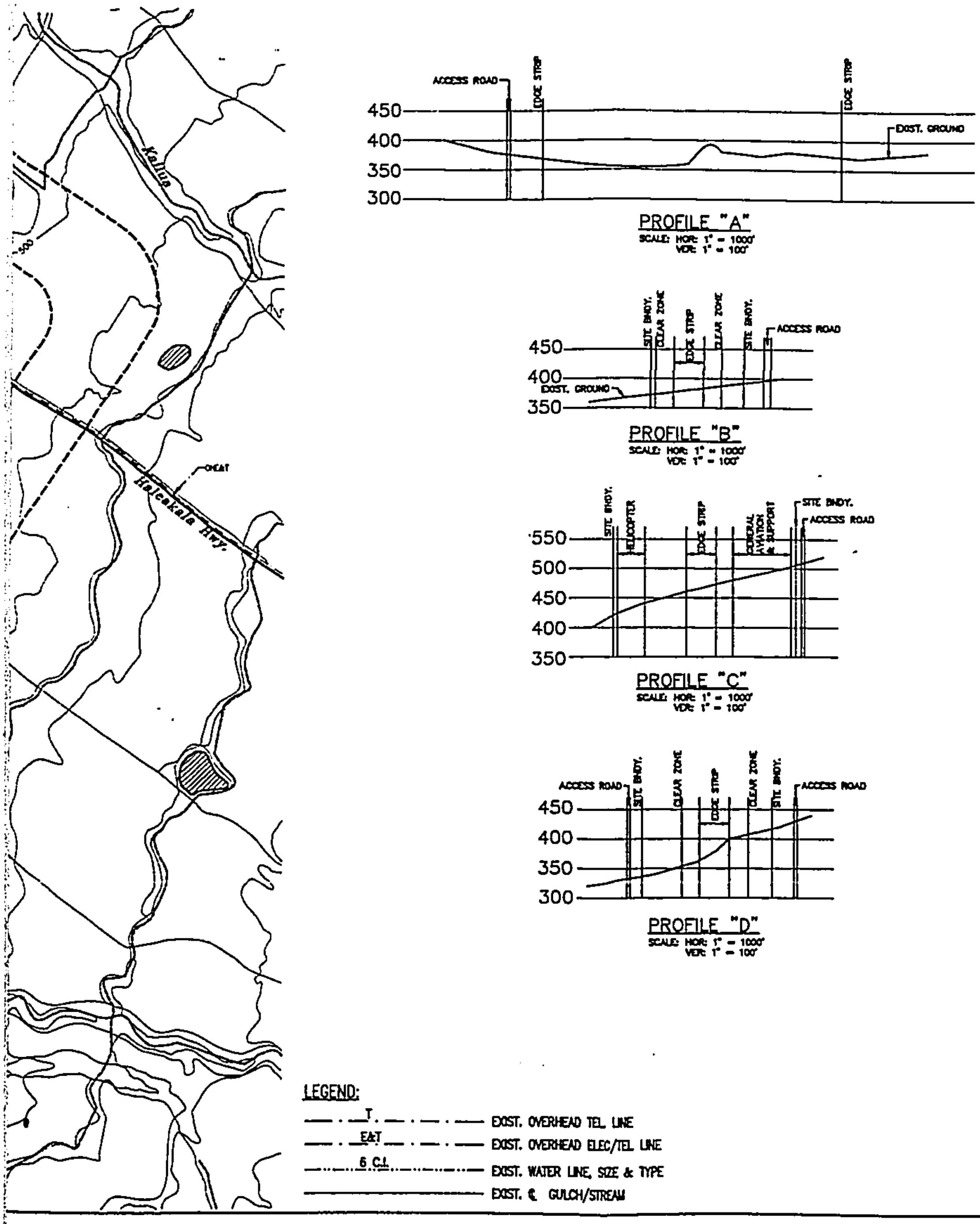
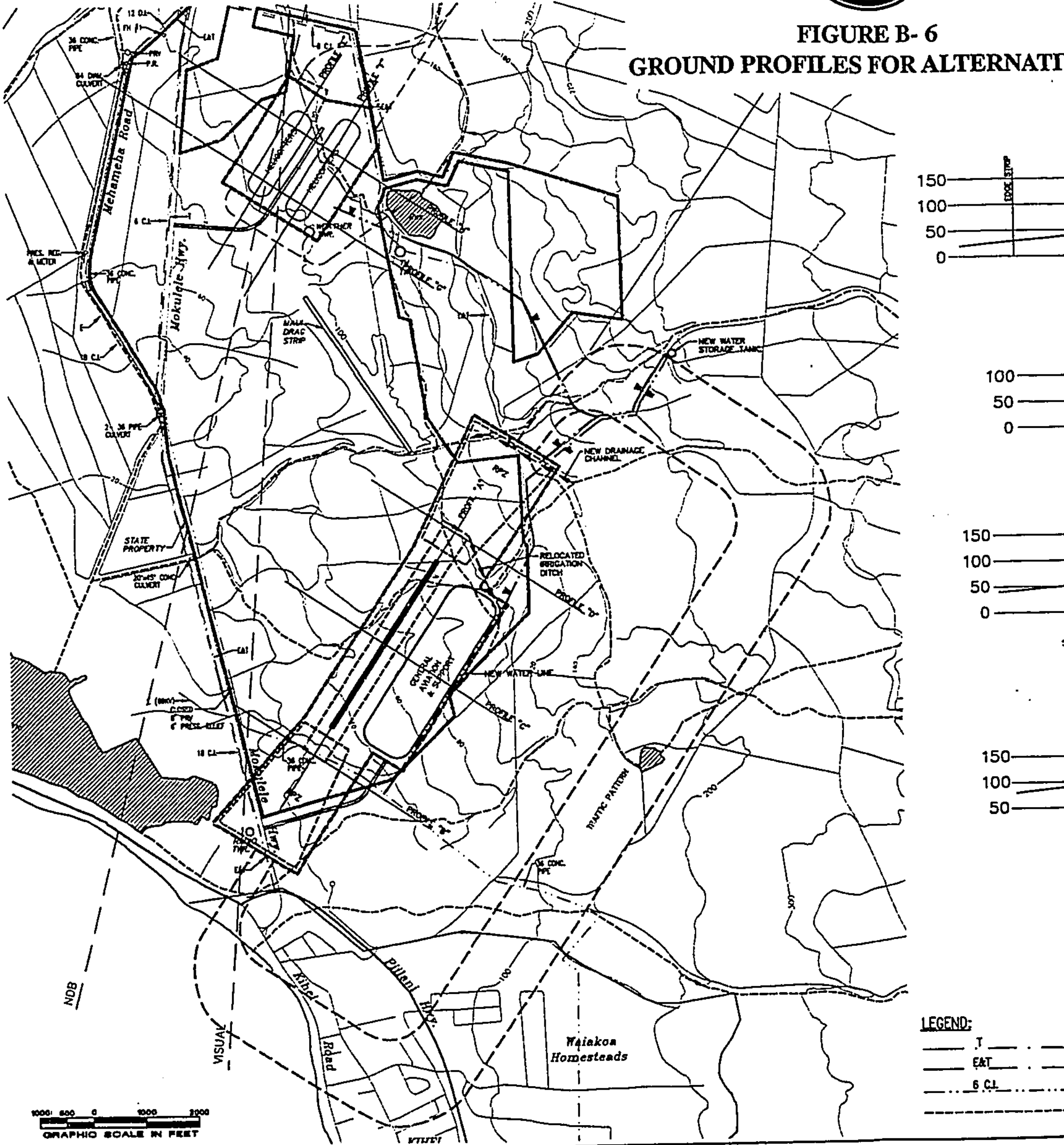
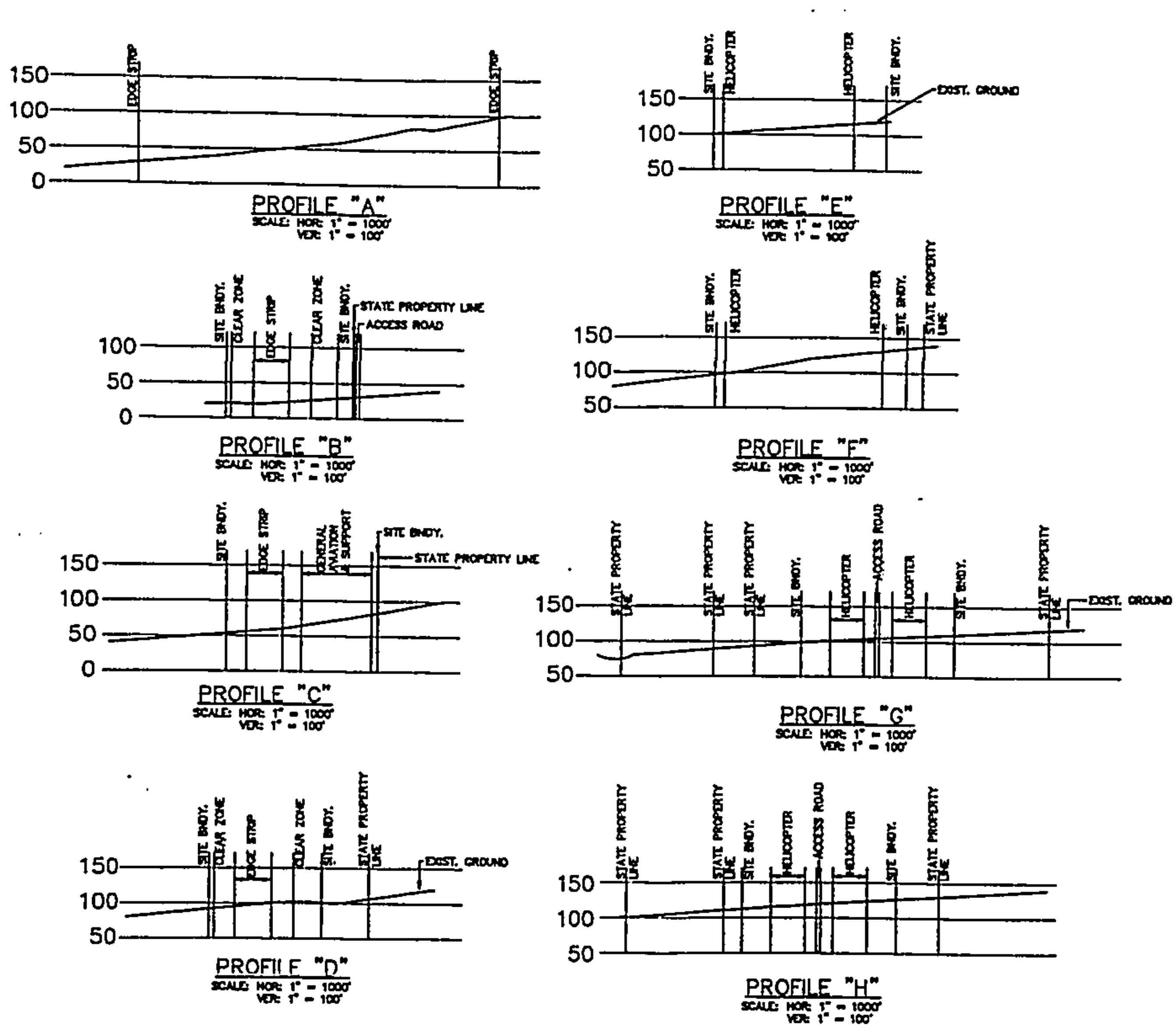


FIGURE B- 6
GROUND PROFILES FOR ALTERNATI[VE]



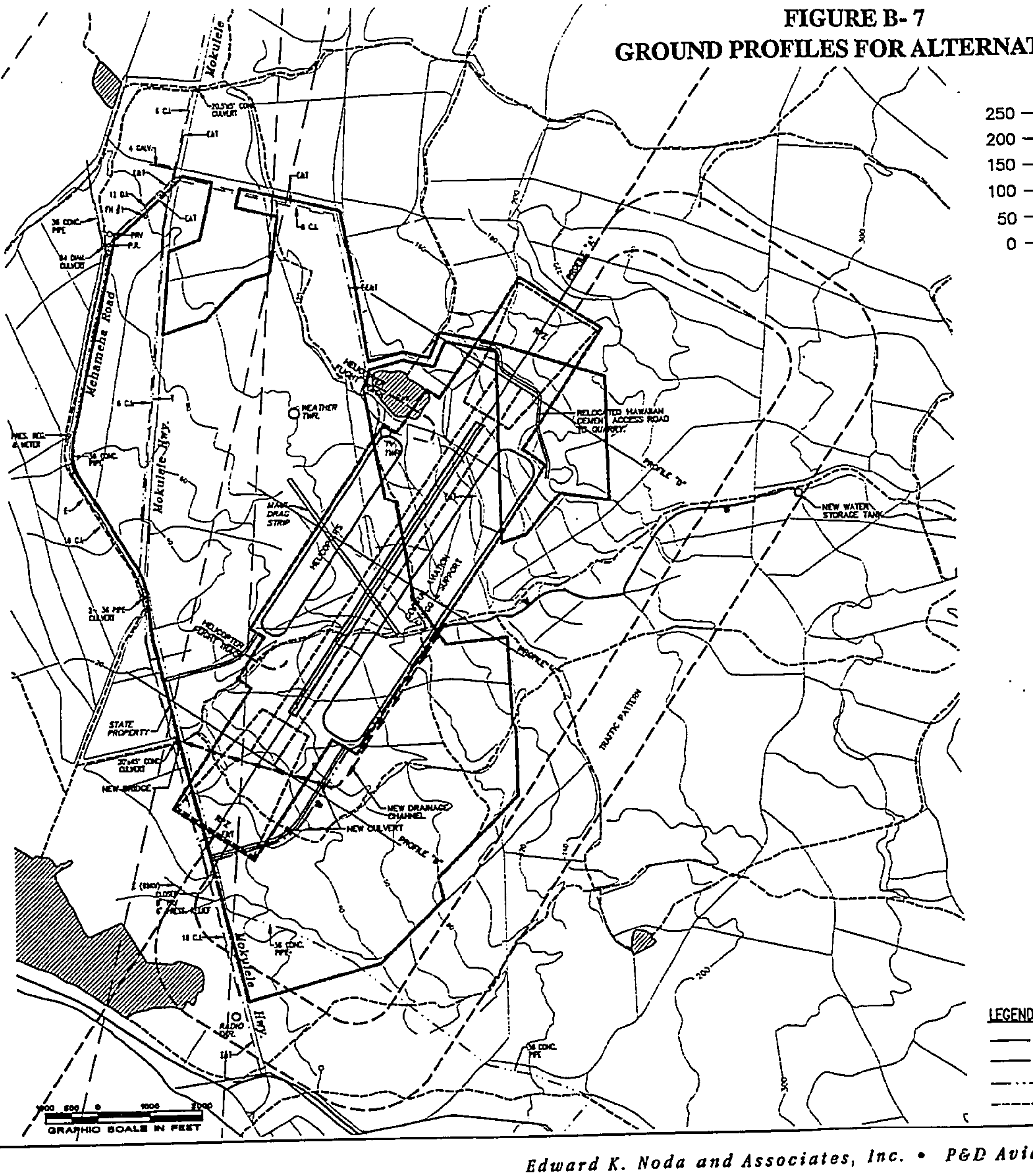
E B- 6
FOR ALTERNATIVE 7



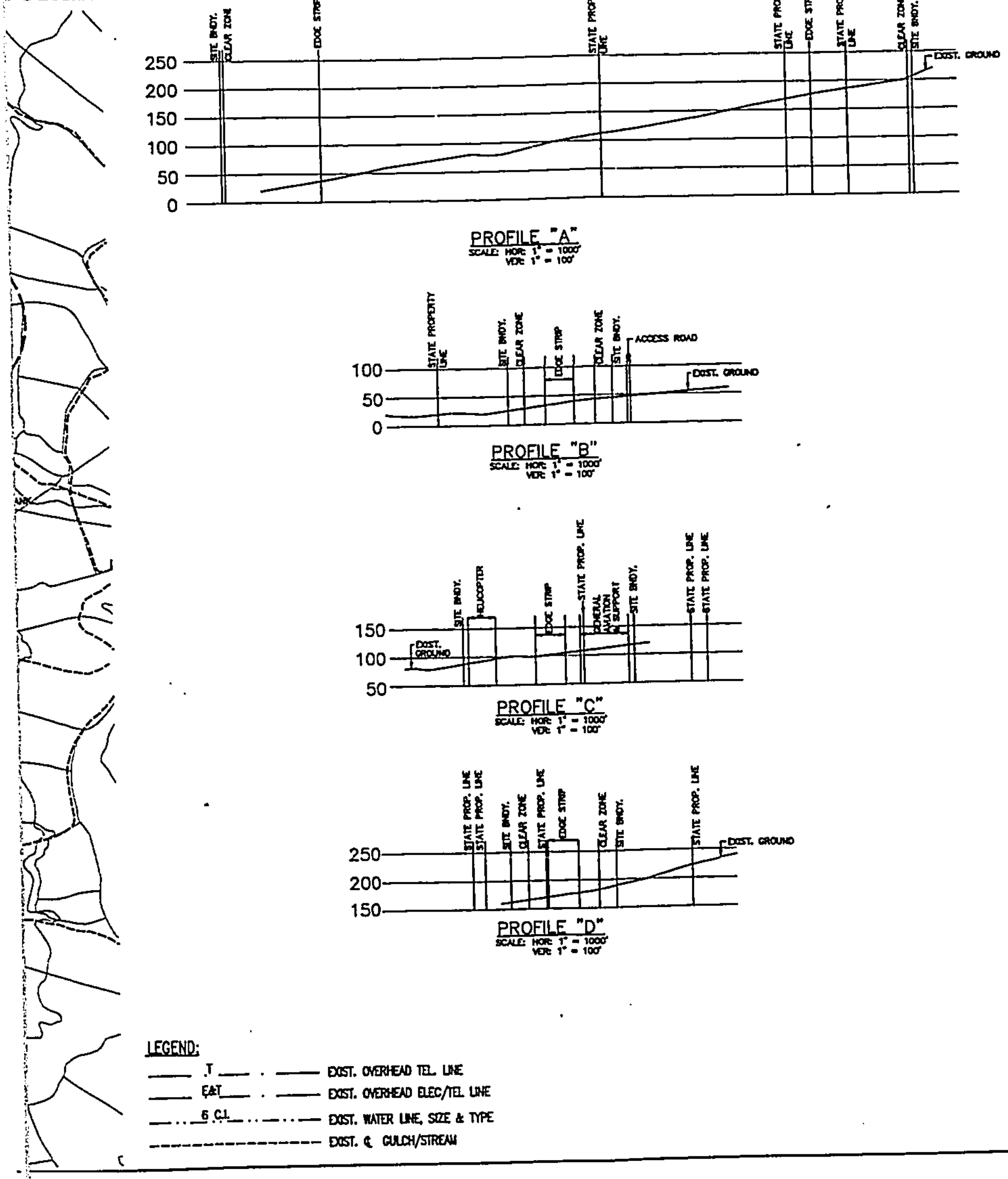
LEGEND:

T — EXIST. OVERHEAD TEL. LINE
E&T — EXIST. OVERHEAD ELEC/TEL LINE
6 C.I. — EXIST. WATER LINE, SIZE & TYPE
— EXIST. ℄ GULCH/STREAM

FIGURE B- 7
GROUND PROFILES FOR ALTERNAT



E B- 7
FOR ALTERNATIVE 8



APPENDIX C
TECHNICAL ADVISORY COMMITTEE MEMBERS

APPENDIX C
TECHNICAL ADVISORY COMMITTEE MEMBERS
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Edward K. Noda and Associates, Inc. • P&D Aviation • R.T. Tanaka Engineers, Inc.

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END

CERTIFICATION

I HEREBY CERTIFY THAT THE MICROPHOTOGRAPH APPEARING IN THIS REEL OF FILM ARE TRUE COPIES OF THE ORIGINAL DOCUMENTS.

2007

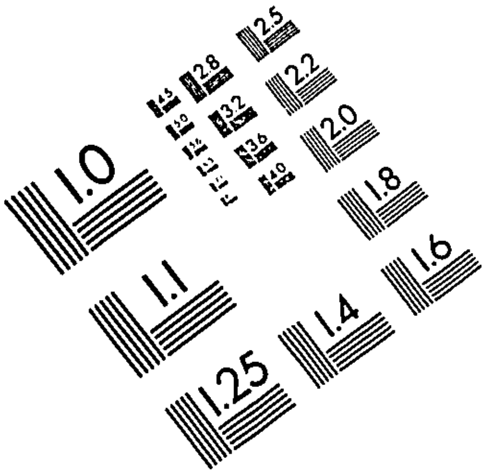
DATE

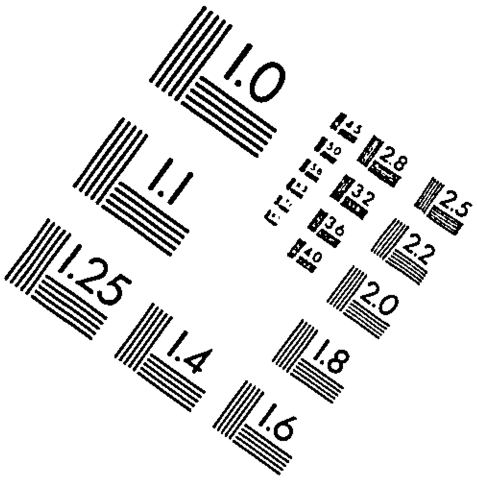
J. Kaai

SIGNATURE OF OPERATOR

TOP

Film Identification





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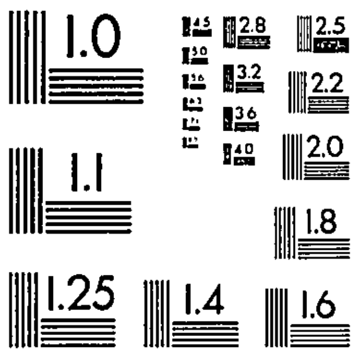
PRECISION℠ RESOLUTION TARGETS

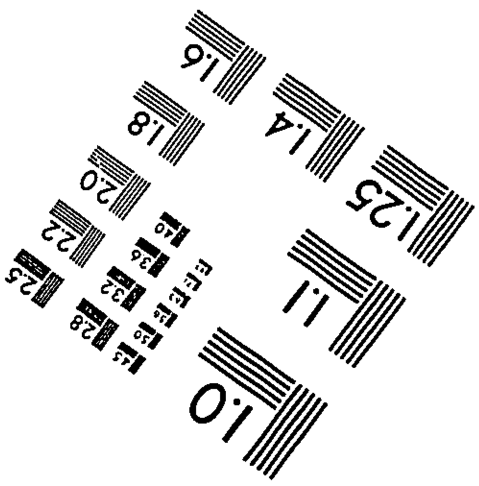
LEFT

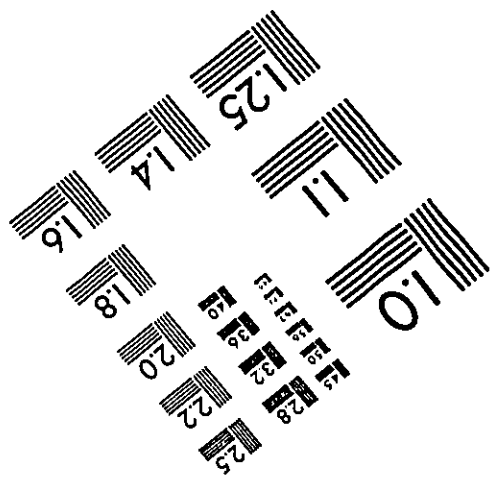


RIGHT

150 MM

6"





PA-3 8½"x11" PAPER PRINTED GENERAL TARGET

DENSITY TARGET

START OF

RETAKE

THE IMAGES APPEARING BETWEEN THIS POINT AND THE "END OF RETAKE" ARE TRUE COPIES OF THE RECORDS, MICRO-PHOTOGRAPHED OF WHICH WERE MISSING OR PROVED UNSATISFACTORY ON INSPECTION OF THE ORIGINAL MICROFILM REEL.

FOR DESCRIPTION OF RE-PHOTOGRAPHED MATERIAL SEE OPERATOR'S "RETAKE CERTIFICATE" AT END OF THIS RETAKE SECTION.