BENJAMIN J. CAYETANO
GOVERNOR

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
GLENN M. OKIMOTO

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

RECEIVED
'97 JUL 10 P3:21
OFC. OF ENVIRONMENTAL QUALITY CONTROL

HWY-M
2.173-97

July 7, 1997

TO: GARY GILL, DIRECTOR
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

FROM: KAZU HAYASHIDA KH.
DIRECTOR OF TRANSPORTATION

SUBJECT: FINDING OF NO SIGNIFICANT IMPACT (FONSI) - FINAL ENVIRONMENTAL ASSESSMENT - MOKULELE HIGHWAY/PUUNENE BYPASS, PROJECT NO. 311A-02-92

The State Department of Transportation has reviewed the comments received during the 30-day public comment period which began on March 23, 1997. The agency has determined that this project will not have significant environmental effects and has issued a Finding of No Significant Impact (FONSI). Please publish this notice in the July 23, 1997 OEQC Bulletin.

We have enclosed a completed OEQC Bulletin Publication Form and four (4) copies of the Final Environmental Assessment.

Please contact Mr. Robert Siarot, Maui District Engineer, at (808) 877-5061 if you have any questions.

Enclosure

74

1997- ~~MA~~ 07-23-MA-FEA- **FILE COPY** JUL 23 1997

Mokulele Highway / Puunene Bypass

FINAL
ENVIRONMENTAL ASSESSMENT

MOKULELE HIGHWAY / PUUNENE BYPASS

Project No. 311A - 02 - 92

Prepared by:

Warren S. Unemori Engineering, Inc.
2145 Wells Street, Suite 403
Wailuku, Maui, Hawaii 96793

PBR HAWAII
1001 Bishop Street,
Pacific Tower, Suite 650
Honolulu, Hawaii 96813

July 1997

MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A - 02 - 92
ENVIRONMENTAL ASSESSMENT

Submitted Pursuant to
Chapter 343, Hawaii Revised Statutes (HRS)

Prepared for:
State of Hawaii Department of Transportation (SDOT)
Highways Division

The following person may be contacted for additional information concerning this document:

Mr. Kazu Hayashida, Director
State of HAWAII, Department of Transportation
869 Punchbowl street
Honolulu, Hawaii 96813
(808) 587-2150

Prepared by:

Warren S. Unemori Engineering, Inc.
2145 Wells Street, Suite 403
Wailuku, Maui, Hawaii 96793

PBR HAWAII
1001 Bishop Street,
Pacific Tower, Suite 650
Honolulu, Hawaii 96813

July 1997

TABLE OF CONTENTS

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

SUMMARY

Proposing Agency: State of Hawaii, Department of Transportation (DOT)

Kazu Hayashida, Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097
Telephone: (808) 548-3205

Federal Highway Administration
U.S. Department of Transportation
Box 50206
300 Ala Moana Boulevard
Honolulu, Hawaii 96850
Tel.: (808) 541-2700

Accepting Authority: Governor, State of Hawaii

Proposed Action: The State Department of Transportation (DOT) proposes the improvement of Mokulele Highway between Puunene Avenue and Piilani Highway to a high quality four-lane highway. The eventual construction of the "Puunene Bypass" would connect Mokulele Highway to Kuihelani Highway, is also planned. However, the County of Maui is not planning to pay for the construction of the proposed Puunene Bypass and that future funding for the project is not determined at this time.

The Mokulele Highway widening project consists of the addition of two lanes to establish a four-lane divided arterial between Piilani Highway and the existing Puunene Avenue. The Puunene Bypass would bypass Puunene Town and intersect Kuiheleani Highway at the proposed Maui Lani Parkway.

Determination: Because the proposed project consists primarily of widening improvements to an existing highway and associated intersection improvements, the proposed project has been determined to have a Finding of No Significant Impact (FONSI) pursuant to Subchapter 10 of Chapter 200 of Title 11, Administrative Rules, entitled "Environmental Impact Statement Rules" and the Federal National Environmental Policy Act (NEPA).

PURPOSE AND NEED FOR ACTION

SECTION 1.0

1.0 PURPOSE AND NEED FOR ACTION

1.1 BACKGROUND AND EXISTING CONDITIONS

In 1988, the State Department of Transportation, in cooperation with the County of Maui, Departments of Planning and Public Works, initiated the *Maui Long-Range Highway Planning Study, Island-wide Plan ("Highway Planning Study")*. Completed in May 1991, this study evaluated the existing major roadway conditions and base year parameters (population, employment and visitor census estimates) to develop a prioritized list of needed transportation improvements for the County of Maui.

Recently, an up-date to the 1988 Highway Planning Study, entitled *Draft Final Report Maui Long Range Land Transportation Plan, February 1996 (MLRLTP)*, was released which evaluated similar indicators of future traffic patterns and trip generation characteristics. This 1996 study, prepared by Kaku and Associates, also utilized land use forecasting to determine Maui's population and employment growth centers in order to project travel demand relative to the existing transportation system. These forecasts form the basis for determining the need for the proposed improvements used in this Environmental Assessment.

According to the MLRLTP, population forecasts indicate that by the year 2020, the population of Maui is expected to increase from 91,254 in 1990 to 147,500 in 2020. During this same period, island-wide employment will increase from 51,768 to 83,400, an increase of over 31,632 jobs by the Year 2020. Clearly, this projected growth will also stimulate increased levels of traffic on an island wide basis.

Specifically, the study notes that the Kihei-Makena area is expected to become a major employment center while Wailuku-Kahului will continue to be Maui's most populous community. The growth in population of approximately 11,705 persons in Kihei-Makena will not be comparable to the growth in employment of only 5,608 new jobs or approximately 0.48 new jobs per person. In Wailuku-Kahului, the projected job/person ratio is approximately 0.80 reflecting almost twice as many jobs/person as expected in Kihei-Makena. This relationship indicates that there would be an increase in commuter traffic between the residential areas of Kihei-Makena and employment opportunities in Wailuku-Kahului.

This correlation will become more pronounced as the projected annual visitor arrivals increase from 2,987,500 in 1995 to 4,000,000 in the year 2020. Consequently, in order to accommodate this increase in the visitor population, an increase of approximately 8,700 hotel rooms are needed on Maui. Therefore, much of the economic growth, in terms of employment, is attributed to the visitor industry which will steadily occur within Maui's major resort areas throughout the planning period.

This information on population, employment, and land use, along with information on the transportation network was incorporated into a "Travel Demand Forecasting Model", in which the MLRLTP projects that total island-wide daily traffic will increase from 233,650 in 1990 to 386,280 by the year 2020 representing a 65.3 percent increase in traffic, or 2.17 percent average annual increase in traffic levels. For the Mokulele Highway, the study indicates that by the year 2020 traffic conditions for morning and evening peak hours for vehicles traveling northbound and southbound on Mokulele Highway (s/o Puunene Avenue) will deteriorate to a level of service of F (which represents forced or breakdown flow) without the proposed improvements. Therefore, the MLRLTP identifies the Mokulele Highway from Puunene Highway to Piilani Highway as a deficient roadway which will require improvement to meet the future transportation traffic volume.

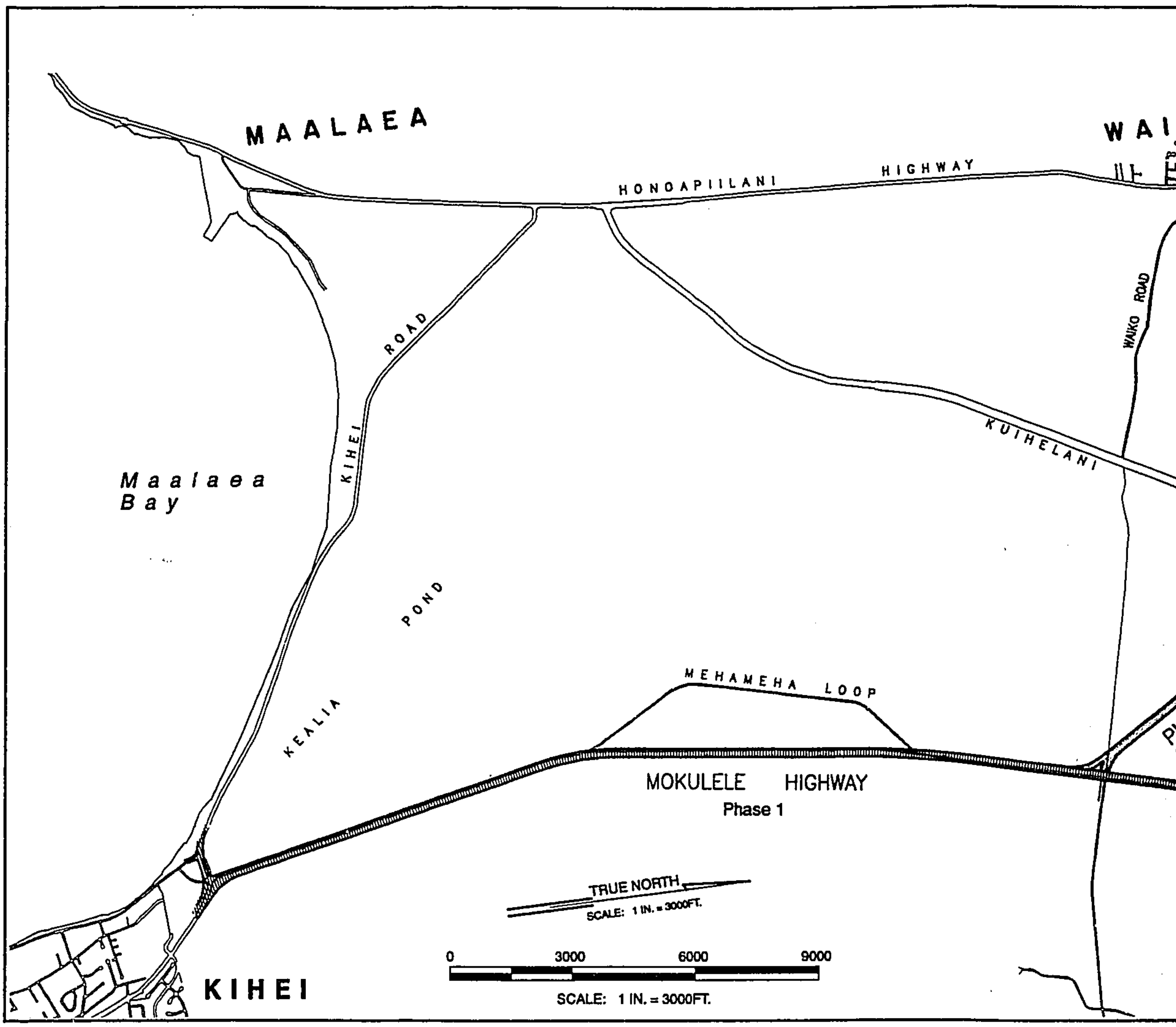
The MLRLTP also identified a range of alternatives in response to the deficiencies identified in forecasts for the island-wide traffic increase by the year 2020. Consistent with the standards established for the County of Maui as part of the long range land transportation planning process, the alternatives were directed at the goal of achieving a Level of Service C throughout the island. These alternatives were evaluated based on performance criteria--which measured the relative effectiveness of the alternatives in providing an efficient and safe transportation system and improving mobility, and on impact evaluation criteria--which considered environmental impacts.

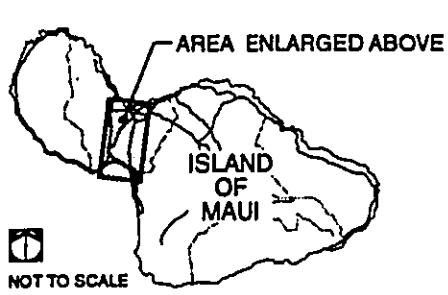
The results of this evaluation identified a series of transportation improvements for the island of Maui. Of these, the proposed widening of Mokulele Highway and the future development of the Puunene Bypass were identified as necessary improvements as stated in the highway element of the Recommended Improvement Plan for the MLRTP. Specific transportation related impacts are described in Section 5.0 of this Environmental Assessment and in Appendix A.

For implementation purposes, the Mokulele Highway project will be improved with one portion from Puunene Avenue southerly for 1.2 miles (point where Puunene Bypass will intersect) and a second portion from the future Puunene Bypass intersection to North Kihei Road. All improvements to the Mokulele Highway would likely be completed during one construction phase and be completed by the year 2005. The Puunene Bypass is scheduled for a second phase, and this new roadway would be completed by the year 2020 (Figure 1).

1.2 REGIONAL CONTEXT AND LOCATION

The project is located in Central Maui between the West Maui Mountains and the slopes of Haleakala (Figure 1). The project area extends from the intersection of Piilani Highway and Mokulele Highway in Kihei to Puunene Avenue. The proposed Puunene Bypass would also be built in the future and connect the intersection of Kuihelani Highway and the Maui Lani Parkway (as yet unbuilt) to Mokulele Highway. However, the County of Maui is not planning to pay for the construction of the proposed Puunene Bypass and that future funding for the project is not determined at this time. The distance along the existing Mokulele Highway to Puunene Avenue is approximately 6 miles. The Puunene Bypass would be approximately 1.5 miles long.





LEGEND
Phase 1
Phase 2 (Future Project by County)

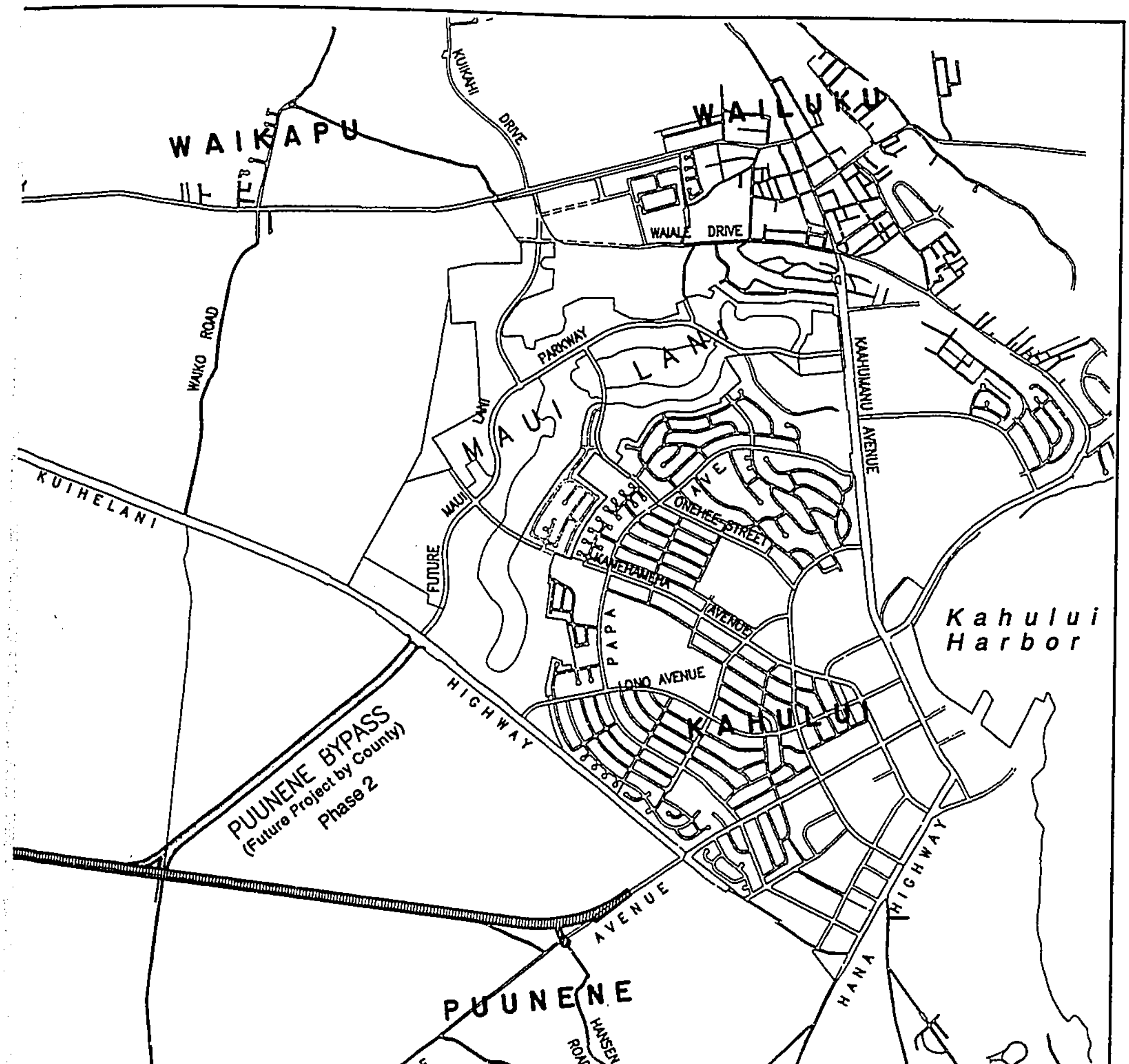


FIGURE 1
PROJECT LOCATION MAP
MOKULELE HIGHWAY/PUUNENE BYPASS

0 1000 3000
FEET

February, 1997

PBR

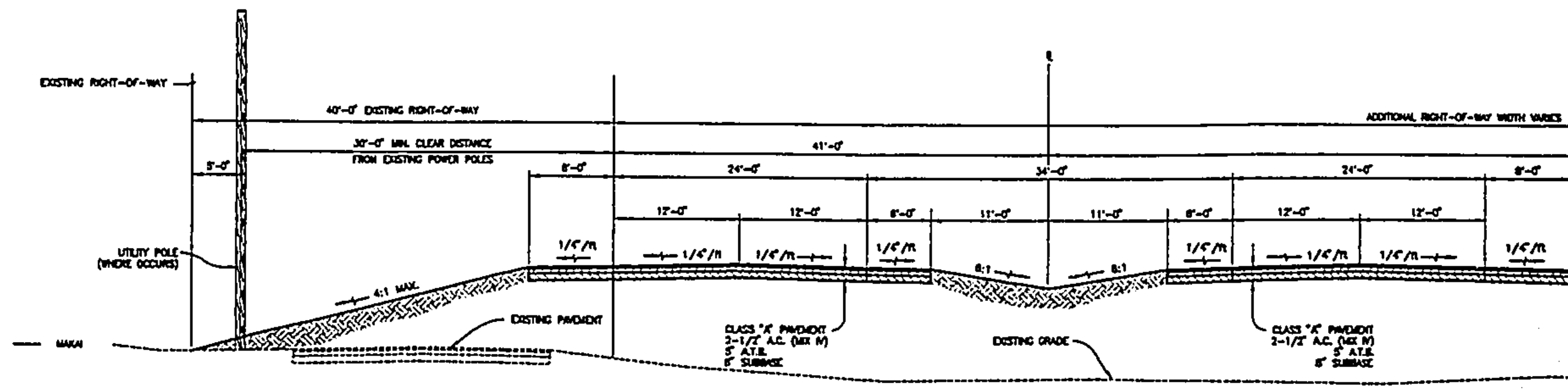
1.3 OBJECTIVES

Central Maui lies at the crossroads between West Maui, Wailuku-Kahului, Up Country Maui, and the Kihei-Makena regions of the island. Air and water transportation terminals for Maui also surround the region at Kahului Airport and harbors at Kahului and Maalaea. The existing highway network connects these major residential, employment, and transportation centers. Major highway corridors radiating from Wailuku-Kahului consist of the Hana Highway to east Maui; Haleakala Highway extending to Up Country Maui; Honoapiilani Highway and Kuihelani Highway south to Lahaina; and Mokulele Highway south to Kihei.

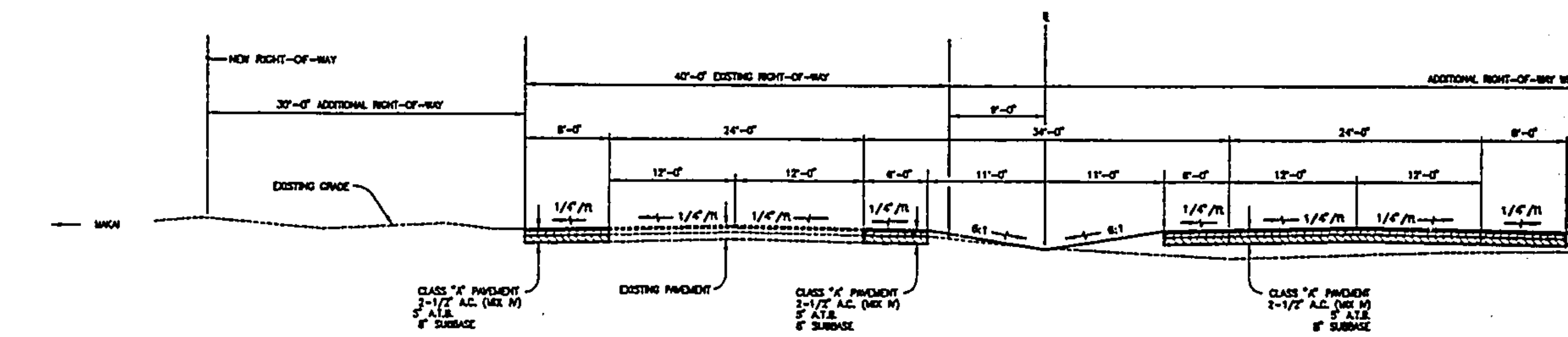
The MLRLTP indicates that traffic problems can be expected to occur at the junctions between any two or more of these major corridors. For example, the 24 hour traffic volume at Puunene Avenue/Mokulele Highway has increased from 12,000 in 1983 to 23,400 in 1991. In addition, the County of Maui is planning on the eventual development of the old Puunene Airport property located adjacent and mauka of the Mokulele Highway.

Mokulele Highway is the only major highway providing a relatively convenient connection between Kahului and Kihei. Presently, traffic on Mokulele Highway must turn left on Puunene Avenue to enter Kahului. Except for Puunene Avenue, no connection presently exists between Mokulele Highway, Kuihelani Highway, and Honoapiilani Highway except for Kuihelani Highway/Piilani Highway via North Kihei Road.

Because of the direct connections between Central Maui and Kihei-Makena afforded by the Mokulele Highway, the existing transportation system is experiencing increasingly high congestion resulting in often significant delays. Without improvements, the *Maui Long Range Land Transportation Plan* has projected that this congestion will increase dramatically as the future traffic continues to grow during in the future. As such, as described in Appendix A, the widening of Mokulele Highway and Puunene Avenue will provide Maui residents and visitors with an improved transportation connection between Kihei and Kahului, reducing travel times and existing traffic congestion at Puunene. The future Puunene Bypass will also significantly improve the connection between Maui Lani and Kihei-Makena.

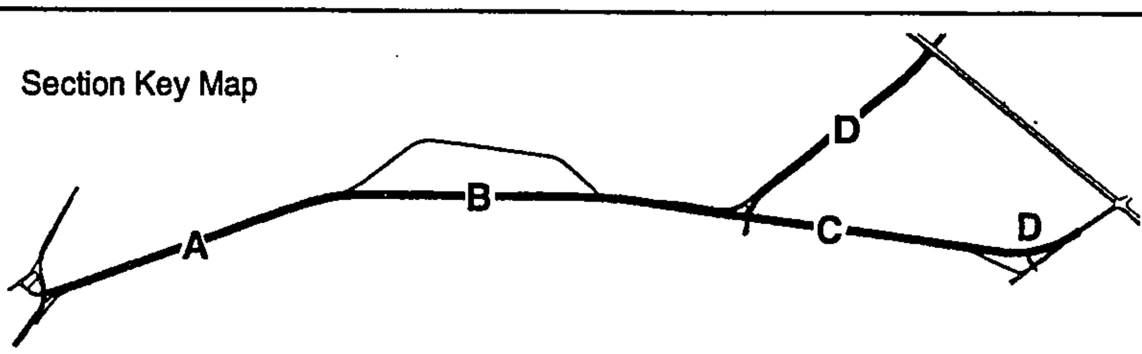


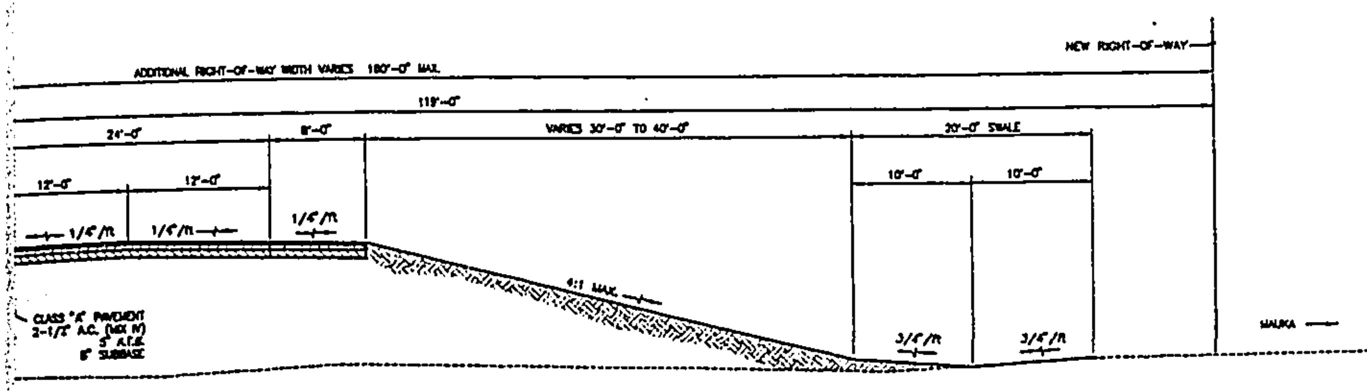
A TYPICAL SECTION – PIILANI HWY
MOKULELE HWY / SOUTH MEHAMEHA INT



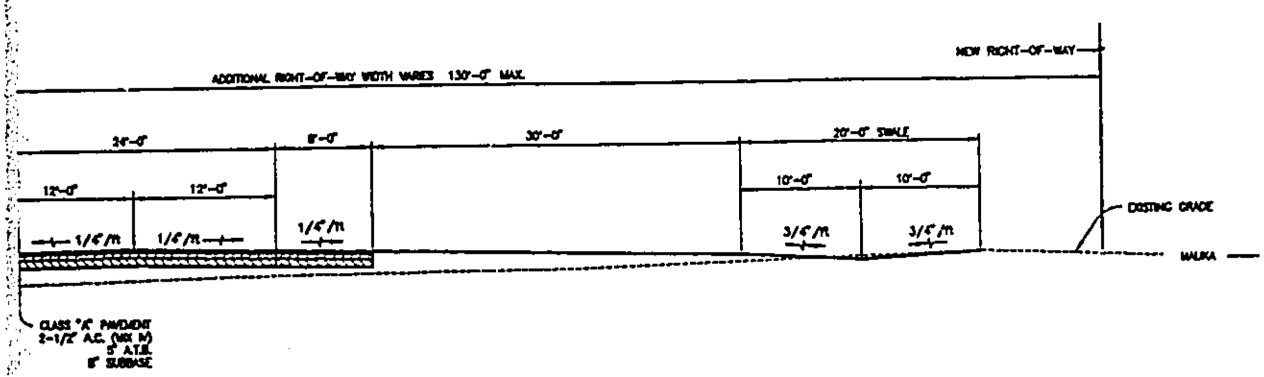
B TYPICAL SECTION – MOKULELE HWY / SOUTH
INTERSECTION TO ANIMAL SHELTER

Section Key Map





ON – PIILANI HWY TO
UTH MEHAMEHA INTERSECTION



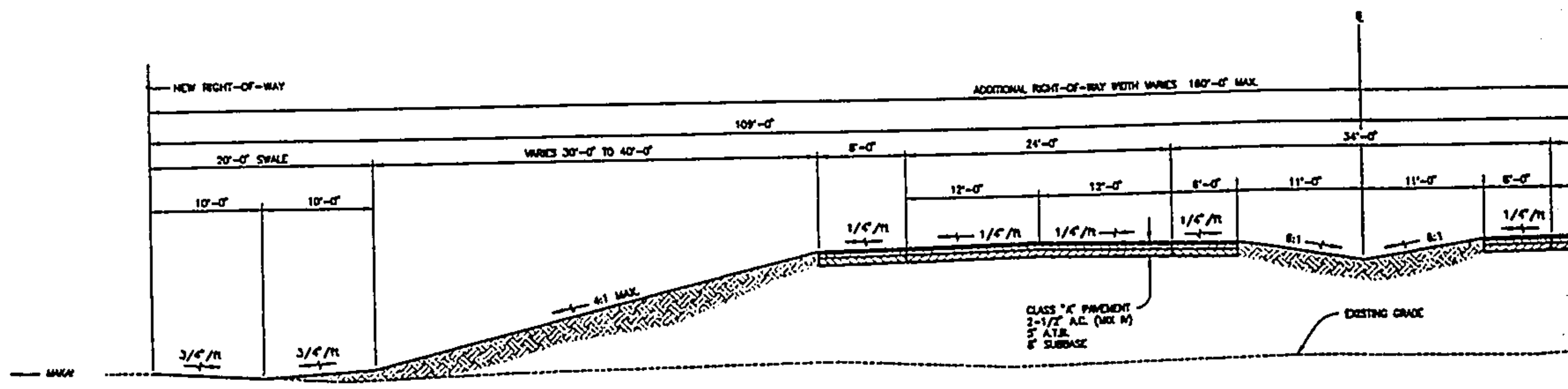
ELE HWY / SOUTH MEHAMEHA
O ANIMAL SHELTER

FIGURE 2A
TYPICAL SECTIONS (A & B)
MOKULELE HIGHWAY/PUUNENE BYPASS

0 8 16
FEET

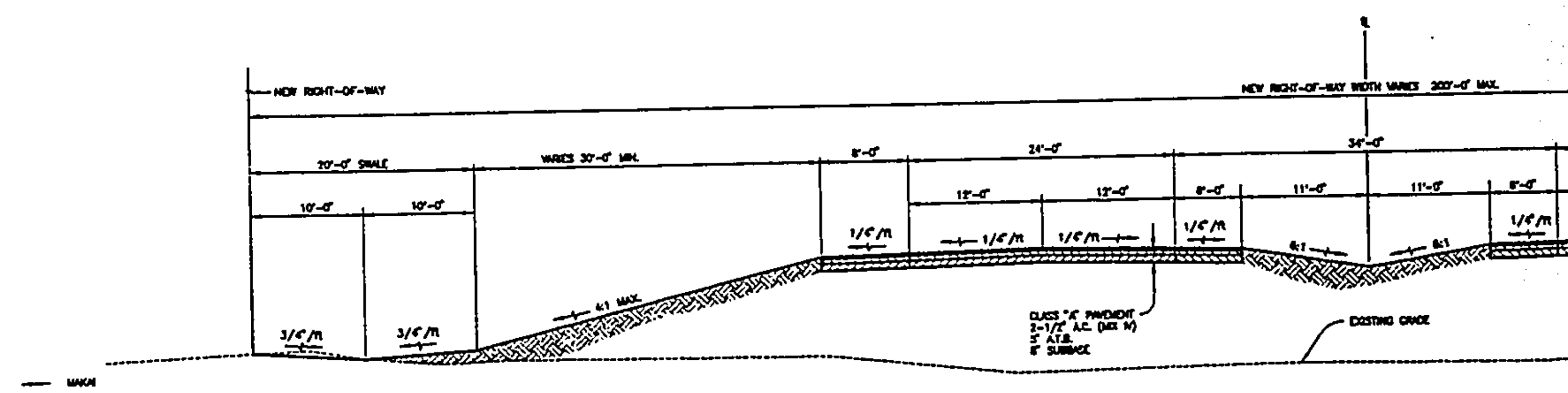
November, 1996

PBR HAWAII



TYPICAL SECTION

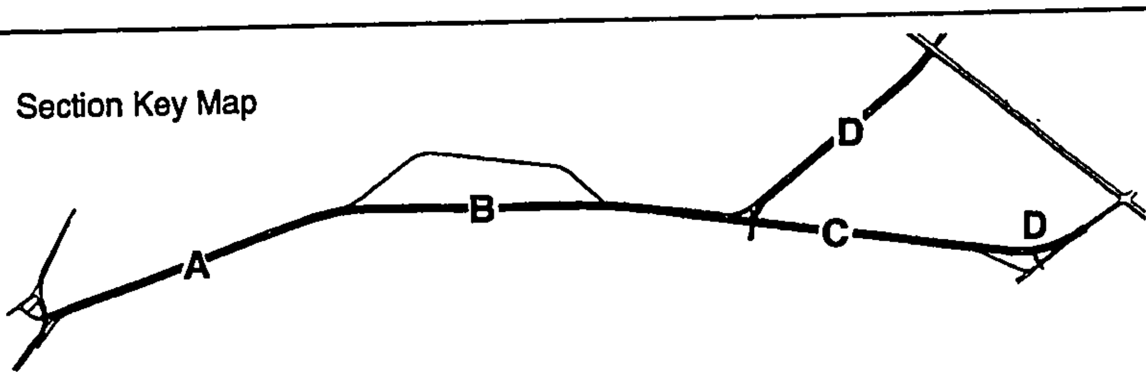
C NORTH OF ANIMAL SHELTER

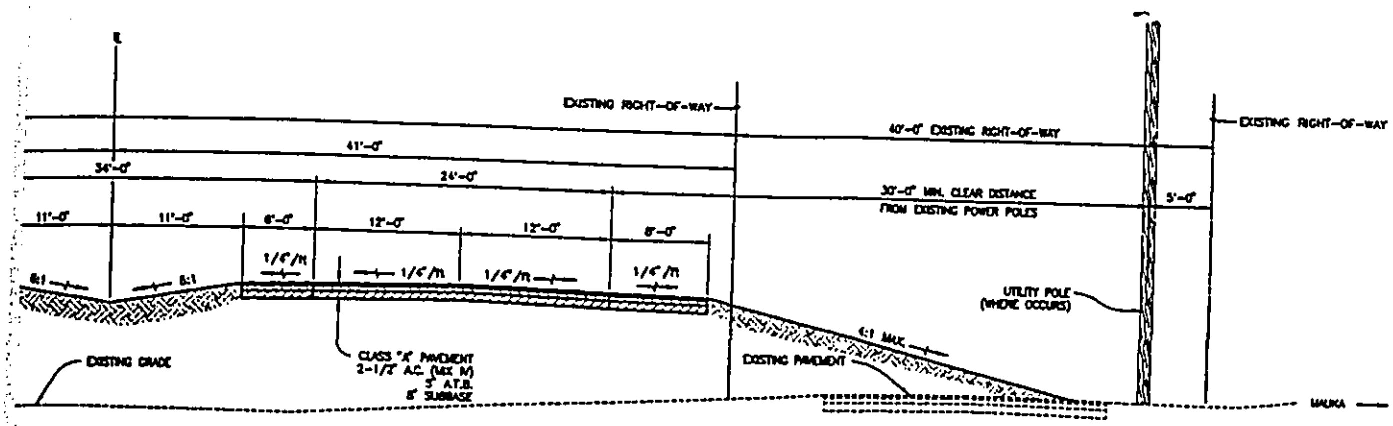


TYPICAL SECTION

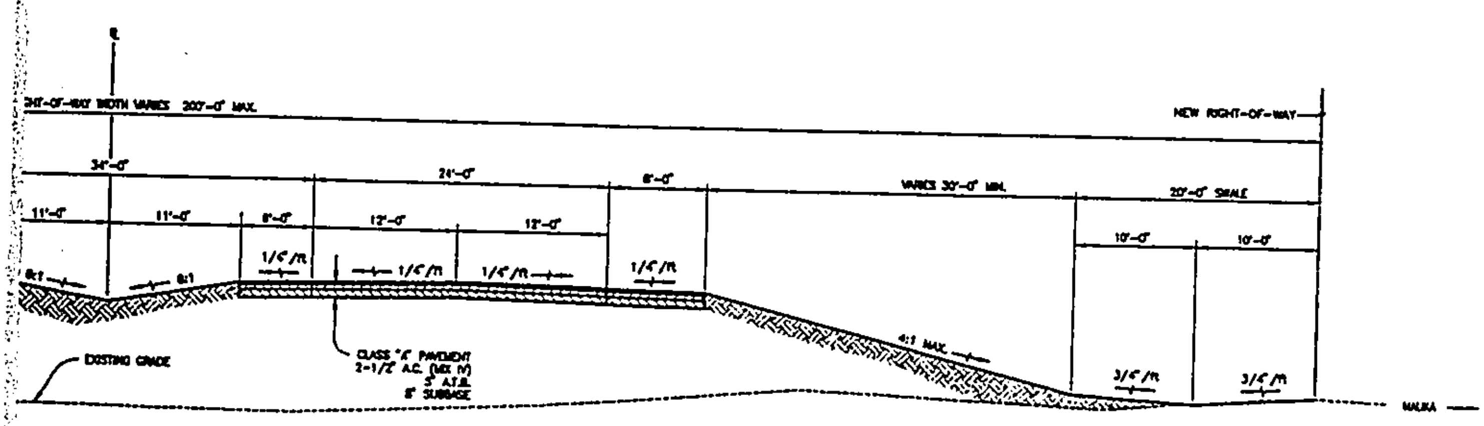
D PUUNENE BYPASS AND PUUNENE AVENUE N

Section Key Map





:AL SECTION
: ANIMAL SHELTER



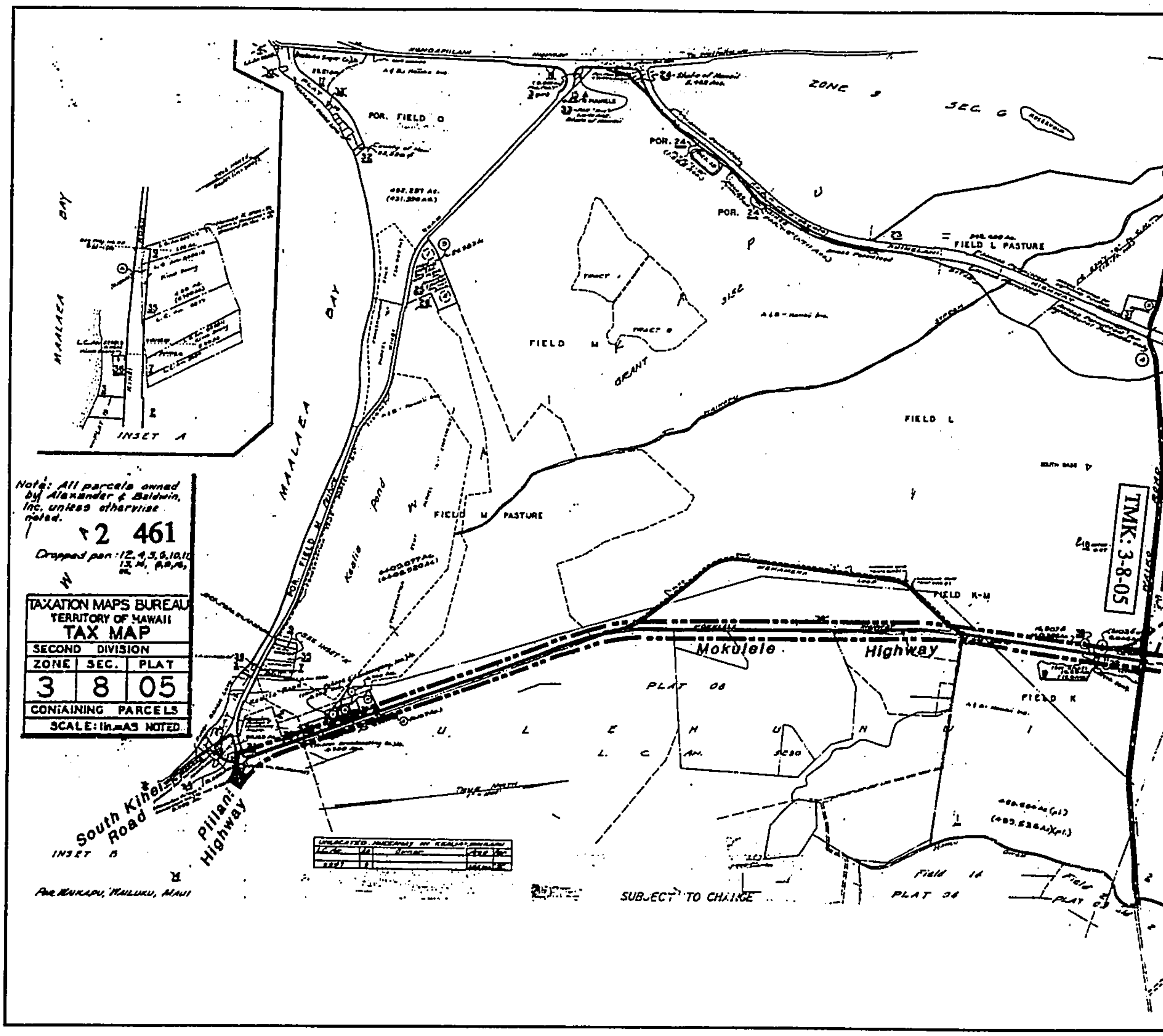
:AL SECTION
NENE AVENUE NORTH OF MOKULELE

FIGURE 2B
TYPICAL SECTIONS (C & D)
MOKULELE HIGHWAY/PUUNENE BYPASS

0 8 16
FEET

February, 1997

PBR HAWAII



LEGEND

Approximate Project Area Boundary (See Figure 1)

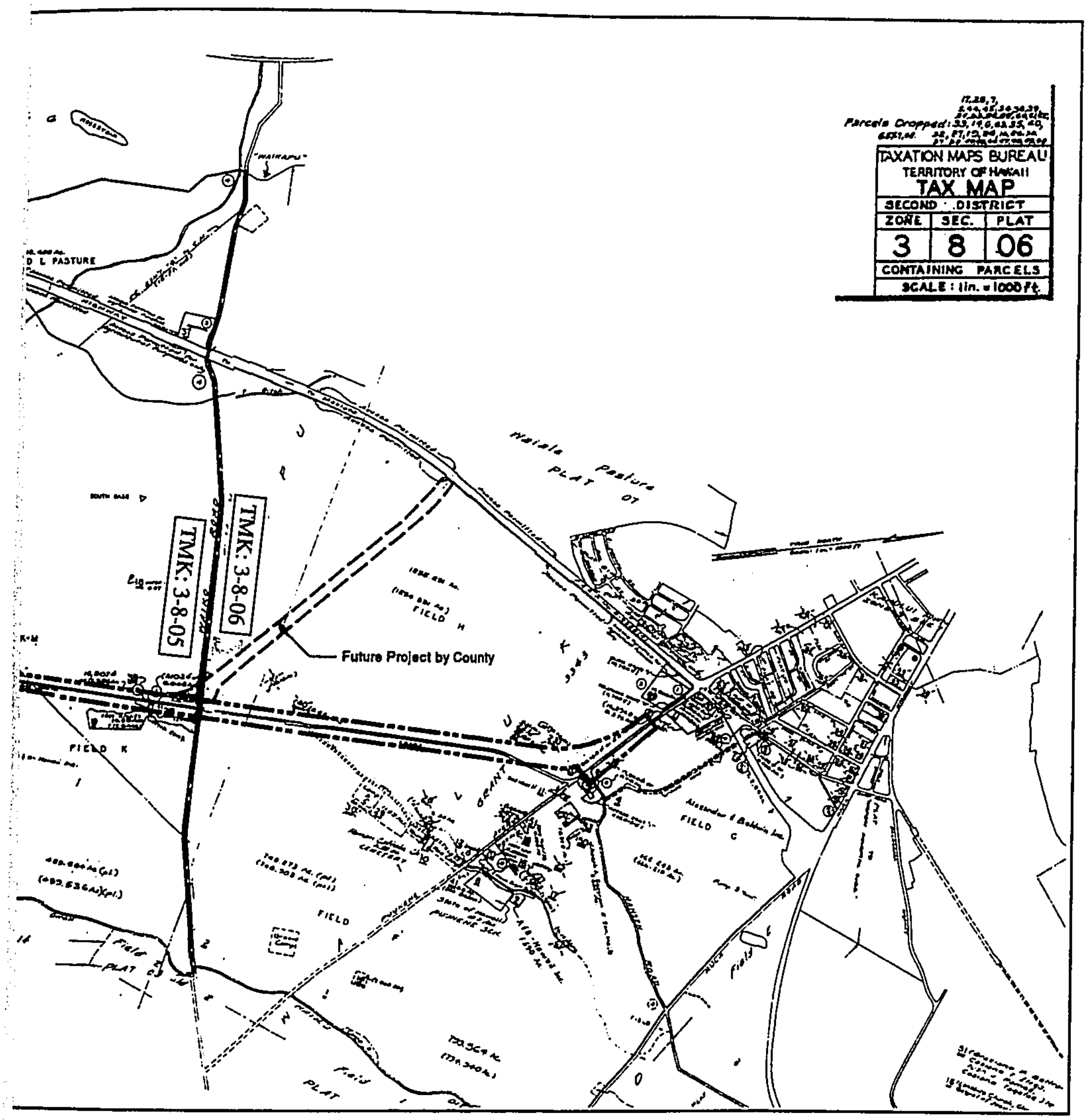


FIGURE 3
TAX MAP KEY
MOKULELE HIGHWAY/PUUNENE BYPASS

0 1000 3000
FEET

February, 1997

PBR HAWAII

PROJECT OVERVIEW

SECTION 2.0

2.0 PROJECT OVERVIEW

2.1 PROJECT SCOPE

The proposed project consists of two primary phases of roadway improvements: 1) The widening of Mokulele Highway and Puunene Avenue from a two lane to a four lane highway (Figure 1); and, 2) the future construction of the "Puunene Bypass". Because the Puunene Bypass will not be constructed for many years, the Mokulele Highway widening is the primary focus of this Environmental Assessment. The County of Maui is not planning to pay for the construction of the proposed Puunene Bypass and future funding for the project is not determined at this time.

The purpose of the proposed widening improvements on Mokulele Highway and Puunene Avenue, is to provide additional highway capacity between Wailuku-Kahului, Maui's primary urban center, and the rapidly growing areas of Kihei, Wailea and Makena along Maui's leeward shore. Intersection improvements are also planned to provide improved efficiency along the entire length of the Mokulele Highway corridor.

By widening the existing Mokulele Highway and ultimately bypassing Puunene Town via the Puunene Bypass, traffic will eventually bypass Kahului through the proposed Maui Lani community, and intersect Honoapiilani Highway between Wailuku and Waikapu. With the future development of Maui Lani, this circulation pattern would allow vehicles to travel from Kihei to Wailuku without entering Waikapu or Kahului. The general description of the project as shown on Figure 1 is as follows:

Mokulele Highway. The Mokulele Highway widening, identified as Phase 1 for planning purposes (see Phase 1, Figure 1), would add two new lanes to create a four-lane divided arterial between Piilani Highway in Kihei and Puunene Avenue. The length of the Mokulele Highway widening is approximately 6 miles. Preliminary design alternatives indicate that the Mokulele Highway widening will be taken on the mauka (easterly and southeasterly) side of the existing highway. Once it leaves the north boundary of the old Puunene Airport near the existing animal shelter, widening would shift to the northwesterly (Wailuku) side of Mokulele Highway. Intersection improvements with Hansen Road in Puunene, reconfiguration of the Mokulele/Piilani Highway intersection, and the widening of Puunene Avenue are also elements of Phase 1. As shown on the typical sections (Figures 2A and 2B), the improved Mokulele Highway will have significantly more capacity than the existing conditions.

The estimated construction costs of the proposed widening to four lanes, widening of Puunene Avenue, and associated intersection improvements is estimated at $37.7 million and land acquisition for right of way at $3.3 million. Total cost is then estimated at approximately $41 million.

Puunene Bypass. The Puunene Bypass, identified as Phase 2 for planning purposes (see Figure 1, Phase 2), consists of a new four-lane, high-quality roadway between Mokulele Highway and Kuihelani Highway. This proposed new highway would bypass Puunene Town and intersect Kuihelani Highway at the proposed Maui Lani Parkway. A typical section of the new highway is shown on Figure 2B. The estimated construction cost is $12.9 million and right of way acquisition at $586,000. Total cost for the Puunene Bypass is then estimated at approximately $13.486 million. Construction of the proposed Puunene Bypass and future funding for the project is not determined at this time.

Design Criteria

Preliminary Design Criteria, utilized for the design of the project by Warren S. Unemori Engineering, was prepared in accordance with the *Hawaii Statewide Uniform Design Manual for Streets and Highways* (1980) (*"Design Manual"*) and is classified as Rural Principal Arterial with Partial Control of Access. The highway design speed for roadways in this classification is 60 miles per hour ("MPH") and is applicable to highways in rolling or level terrain in open areas. Generally, the maximum grades characteristic of the project area are approximately three percent. A typical section within the right-of-way will be a minimum of 160 feet as shown on Figures 2A and 2B.

<u>Primary Controls</u> (Highway Systems/Classification, Topography/Physical Features, Traffic)

As noted in the *Design Manual*, highway systems within the State of Hawaii are classified in four categories: 1) Freeway (or expressway), 2) Arterial highway or arterial road, 3) Collector street or collector road, and 4) Local street or local road. The proposed project falls within the Arterial Highway category and its design will be designed according to those standards.

The location and geometric features of a highway are influenced to a large degree by the topography, physical features, and land use of the area traversed. For example, the character of the terrain has a pronounced effect on longitudinal features; geological conditions may affect the location and geometrics of the highway; and climatic, soil and drainage conditions may affect the profile of the road relative to the existing ground.

Man-made features and surrounding land use may also have an effect on the alignment location and design of the highway. Industrial, commercial, and residential areas will each dictate different geometric requirements. The traffic characteristics (i.e. volume, composition and speed), indicate the service for which the highway improvement is being made, and will also directly affect the geometric features of design, such as the number of traffic lanes, alignment, grades, etc. Traffic volume affects the capacity, and thus the number of lanes required.

For planning and design purposes, the demand of traffic is generally expressed in terms of the design-hourly volume (DHV), predicated on the design year. The design year for the project is 2022.

Secondary Controls (Design Speed)

"Design speed" is the speed determined suitable relative to the design and correlation of the physical features of the highway that influence vehicle operation. It is a maximum safe speed that can be maintained over a specific section of highway when conditions are favorable that the design features of the highway govern.

The assumed design speed will be in accordance with the relatively flat terrain and expected high speeds designed for the highway. To attain a desired degree of safety, mobility and efficiency a design speed of 60 MPH has been determined for this relatively level highway alignment with maximum slopes of 3 percent. Design features of the highway such as curvature, super-elevation and sight distance will be considered in determining the final design speed.

Other features such as widths of pavements and shoulders, and clearances to walls and rails, which do not directly affect design speed, but affect vehicle speed, will be accorded to these standards to account for the higher design speed. Determination of design speed assumes favorable conditions of climate, little or no traffic on the highway, and is influenced principally by the terrain, and the extent of man-made features and economic considerations (construction and rights-of-way costs).

A typical section for the proposed highway improvements within the right-of-way, width will average a minimum of approximately 160 feet and include four lanes, divided. Pavement will be provided for two 12-foot lanes in each direction. Planned median width will be approximately 30 feet minimum with paved shoulders varying from 6 to 8 feet (Figures 2A and 2B).

Safety

Presently, overall safety is impacted by the relatively high volume of traffic and occasional low speeds experienced along the existing highway system due to the high congestion. Consequently, safety is a concern relative to the present width of the Mokulele Highway and high level of average daily travel when drivers try to pass slower vehicles during heavy traffic periods.

Circulation

The existing highway network is experiencing a relatively low Level of Service (LOS) (LOS "E") due to the increasing growth in traffic levels resulting from overall population growth and the subsequent need for improvements primarily at roadway intersections.

According to the Traffic Alternatives Study (Appendix A), Mokulele Highway currently operates at or near capacity during the peak hours at LOS "E". The Mokulele Highway intersections at Piilani Highway operates generally at LOS "E" or "F", Kihei Road intersections at LOS "C", Puunene Avenue at "D" and "F", and Puunene Avenue and Kuihelani Highway/Dairy Road Intersection at LOS "D" and "E". During some periods, movements operate at LOS "C" at some intersections, however, the Traffic Alternatives Study concludes that the existing Mokulele Highway and associated intersections are currently operating at congested levels. Future LOS without the proposed improvements are all projected at LOS "F" except for the Puunene Avenue and Kuihelani Highway/Dairy Road intersection which will operate at LOS "D".

2.2 LANDOWNERSHIP

Landownership of the affected parcels and the TMK's are provided by Figure 3 and Appendix I respectively. As indicated, the existing two lane Mokulele Highway right-of-way is owned by the State Department of Transportation Highways Division, with adjacent land on both sides owned by private interests, the State of Hawaii and the County of Maui (Old Puunene Airport property). Since additional right-of-way will need to be taken to increase the width of the highway to four lanes, three major landowners will be affected by the proposed widening. These include Hawaiian Commercial & Sugar Co. (HC&S), the State of Hawaii and its lessees which include Pfizer Genetics, Inc./Trojan Farms and Alexander & Baldwin, Inc.

The construction of the Puunene Bypass will primarily affect HC&S lands which have been historically used for sugar cane production removing approximately 40 acres from operation. The existing Humane Society located on land leased from the State of Hawaii would not be affected.

In the vicinity of the project right-of-way, a portion of the proposed Mokulele Highway widening is located approximately 600-ft makai of the Kealia Pond National Wildlife Refuge, well outside of the refuge boundaries. In addition, the construction of the highway improvements will occur primarily on the mauka side of the existing Mokulele Highway away from Kealia Pond. As such, the construction of proposed improvements and the long-term operation of the widened Mokulele Highway are not expected to impact the refuge. The only impact to the refuge that may occur, involves improvement to the existing drainage structures which can presently restrict flows moving under Mokulele Highway toward Kealia Pond during intense storm events. The proposed improvements will reestablish these drainage patterns to a more "natural" condition.

For example, the existing drainage structures under Mokulele Highway are seriously inadequate to accommodate the 100-year flood. Preliminary estimates are that approximately 8,000 to 12,000 cfs would flow from the upper slopes of Central Maui toward Kealia Pond during an intense storm event. However, by improving the capacity of drainage structures within the Mokulele Highway corridor to accommodate these occasional natural flows, drainage patterns potentially impacting Kealia Pond would be restored to more closely resemble their original natural configuration.

ALTERNATIVES

SECTION 3.0

ALTERNATIVES

SECTION 3.0

3.0 ALTERNATIVES

According to the *Highway Planning Study*, May 1991, highways which carry traffic between West and South Maui and the rest of the island, are expected to approach capacity conditions by the Year 2000. To mitigate the projected capacity condition, the Highway Planning Study recommended an overall integrated improvement plan which anticipates the implementation of all proposed components. For example, the Highway Planning Study states "the deletion of one component may affect other facilities, particularly in the Central Maui area." Therefore, the impact of proposed alternative improvements must be evaluated in a comprehensive manner.

The *Highway Planning Study* utilized a regional perspective in its analysis to identify alternate routes between various parts of Maui which would divert traffic from existing corridors and ultimately influence travel patterns. Therefore, the alternatives considered are all needed based on projected traffic volume and essentially consists of recommended improvements to major arterials.

The need for the proposed Mokulele Highway/Puunene Avenue widening and Puunene Bypass, was confirmed in the more recently completed *Maui Long Range Land Transportation Plan (MLRLTP)*. According to the MLRLTP, growth factors reflecting the islandwide growth and development were prepared for the 11-year period from 1994 to 2005 using the long-range travel forecasting model. These factors were applied to the existing traffic volumes to estimate the effects of islandwide growth on traffic volumes. Development projects expected to be completed within Kihei by 2005 were identified and used to estimate the effect of future growth in local traffic on the traffic volumes. The combination of these two effects were used to identify short-range needs and deficiencies.

The most significant projects proposed for completion between 1996 and 2000 include the following:

- Widening of Honoapiilani Highway.
- Construction of the new four-lane airport access road using the Kuihelani Highway alignment to bypass Diary Road.
- The widening of portion of Puunene Avenue, Kuihelani Highway and Mokulele Highway from two to four lanes.

The most significant projects proposed for completion by 2005 in Kihei include the following in relative order of importance to the plan:

- Reconfiguration of the Mokulele Highway/Piilani Highway intersection in Kihei
- Completion of the North/South Collector Road through Kihei
- Signalization of 14 intersections on South Kihei Road and Piilani Highway

Projects recommended for the 2001 to 2005 time-frame are:

- Construction of the North/South Collector Road through Kihei
- Construction of a portion of the Lahaina Bypass
- Extension of the widening of Mokulele Highway
- Construction of the Alternate Highway in Paia

Highway improvements projects for the 2006 to 2020 period are:

- Widening of existing segment of the Lahaina Bypass.
- Maui Lani Parkway.
- Puunene Bypass.
- Widening of portions of the Honoapiilani Highway.
- Extension of the widening of Kuihelani Highway.

In identifying the Mokulele Highway widening and Puunene Avenue improvements as the preferred alternative, the construction of the Puunene Bypass was also evaluated as a potential second alternative. The alternatives evaluated designed to relieve some of the projected future congestion between Kihei and Wailuku-Kahului are as follows.

3.1 WIDENING MOKULELE HIGHWAY AND PUUNENE AVENUE

This improvement (the preferred alternative) would essentially extend the widening of Mokulele Highway to Puunene Avenue, bypassing the Puunene Mill area, and continuing with the widening of Puunene Avenue to that portion of Puunene Avenue already widened. This alternative would provide more timely improvements to traffic congestion within Kahului, because the Puunene Bypass could be delayed until warranted by the phased development of Maui Lani. The only potentially adverse impact may result from increased traffic noise along properties abutting Puunene Avenue and also jeopardize the preservation of the tree line along Puunene Avenue.

3.2 MOKULELE HIGHWAY/PUUNENE BYPASS

This alternative also consists of the widening of Mokulele Highway into a new four-lane, high quality roadway, but would turn toward Kahului and intersect with Kuihelani Highway via a new highway, the Puunene Bypass. The Puunene Bypass component of the project is intended to bypass Puunene Town and intersect with Kuihelani Highway at the proposed Maui Lani Parkway. Widening of Mokulele Highway would add two lanes creating a divided arterial highway between Piilani Highway and the Puunene Bypass. This Puunene Bypass component of this alternative could be implemented in the future as funding becomes available and traffic volumes warrant.

3.3 NO ACTION ALTERNATIVE

According to the Kihei-Makena Community Plan and County of Maui projections, Kihei-Makena is expected to become a major employment center by the year 2010. Growth in population, however, is not comparable to the projected growth in employment. As such, an increase in commuter traffic between the residential areas of Maui, such as Wailuku-Kahului and Up Country, and the employment centers in Kihei-Makena is projected.

Similarly, the *Maui Long Range Land Transportation Plan* indicates that the annual visitor census is expected to increase by 1,012,500 persons (34%) over the 1995 base year conditions. To accommodate this visitor growth by the year 2020, all the resorts and hotels identified in the Community Plan would be built out. Consequently, socio-economic growth on Maui will translate into an increase in travel demands.

Based on the projected increases in both the resident and visitor populations, the corresponding growth in Maui's economy, and the existing levels of service on Mokulele Highway and Puunene Avenue, the "no-action" alternative was rejected. Congestion and air quality would continue to worsen, making the future employment and residential development of Kahului and Kihei more difficult, and improvements to overall air quality more difficult to achieve.

Therefore, the no-action alternative does not meet the overall transportation objectives for County of Maui. Considering the relatively small amount of agricultural land required for completion of the proposed improvements and the availability of suitable replacement agricultural lands, the preferred alternative which improves the efficiency of existing transportation corridors will meet the overall transportation objectives for Maui and not significantly impact the viability of agriculture in the region.

3.4 TRANSPORTATION SYSTEMS MANAGEMENT ("TSM")

Transportation System Management refers to service-oriented systems that increase the efficiency and effectiveness of existing highway and transportation systems. Some familiar examples are bus systems, carpooling programs, signalization, and development of alternative travel modes. TSM is most viable in areas where development of new roadways is not feasible and funding for new major roadways is not available. In some cases, ride-sharing promotion and signalization will have a high cost per unit of effectiveness gained.

To achieve the potential efficiencies afforded by TSM systems, joint review of these actions by both the State and County should be undertaken as warranted in the future. Development of TSM implementation programs should be considered to facilitate the subsequent monitoring and adjustment of future transportation improvements to achieve the final increments of system efficiency.

3.5 PROJECT SCHEDULE AND ORDER OF MAGNITUDE COST PROJECTION

The schedule and phasing of all alternatives will be contingent on the availability of Federal and State funds, however, the tentative schedule is as follows:

Design Phase

- Provide a Public Information Meeting the describe the proposed project to interested individuals and representatives of public agencies. This meeting was held May 7, 1997 (See Appendix J).

- A public hearing may be held in the summer or fall of 1997 if warranted by comments received from the Environmental Assessment, or if recommended by the Federal Highways Administration.

- The design phase is scheduled to begin in mid- 1997 upon acceptance and processing of the Environmental Assessment.

Construction Phase

- Construction is scheduled to begin as funding becomes available from State and Federal sources in 1999 or 2000. The order of magnitude cost estimate for the preferred alternative in 1996 dollars is approximately $37.7 million for the Mokulele Highway/Puunene Avenue widening and $12.9 million for the Puunene Bypass. Land acquisition cost for right of way along Mokulele Highway is estimated at $3.3 million and $586,000 for acquisition of Puunene Bypass right of way. Total construction and acquisition cost is then estimated at approximately $41 million for Mokulele Highway and $13.486 million for the Puunene Bypass.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

SECTION 4.0

4.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The project corridor is located on the central isthmus of the island of Maui which joins the West and East Maui mountains. Along the shore southwestward from Maalaea, are the sea cliffs of West Maui. Eastward from Maalaea is the long, low, sandy shore of the isthmus which includes Kealia Pond where Waikapu Stream ends its course.

Due to the length of the project corridor of approximately 6 miles, the planning area traverses two Community Plan jurisdictions. For example, that portion of the project area north of the existing cane haul road near the proposed Puunene Bypass and Puunene Town, is located within the Wailuku-Kahului Community Plan area. Similarly, the southern portion of the project area (generally consisting of the Mokulele widening), lies within the Kihei-Makena Community Plan area.

Generally, the project corridor will impact only sugar cane cultivation areas, but by differing degrees. For example, the existing Mokulele Highway right-of-way and additional land area required for the expansion of the highway to four lanes will expand into sugar cane fields without significantly altering existing agricultural infrastructure. However, some sugar cane lands will be irretrievably lost to construction of the widened Mokulele Highway. In addition, the future construction of the Puunene Bypass would also result in the irretrievable loss of agricultural land and may alter agricultural infrastructure patterns. This impact will require appropriate mitigation to ensure that viable agricultural production can continue on surrounding properties.

4.1 PHYSICAL SETTING AND CHARACTERISTICS

4.1.1 Existing Land Use

Mokulele Highway Widening

Existing land uses that could be affected by the project are primarily sugar cane fields, a seed corn production area, a portion of the County of Maui Humane Society parking lot and portions of an old dismantled plantation camp in Puunene. No residential or commercial land uses will be impacted by the project except for alterations to existing traffic circulation patterns and a potential increase in traffic noise along Puunene Avenue. Approximately 123 acres of land will be required to widen Mokulele Highway and Puunene Avenue from two to four lanes.

Future land uses along the corridor include a master plan prepared for the future development of the old Puunene Airport by the County of Maui. This area of approximately 1,875 acres is located on each side of the proposed Mokulele Highway widening corridor. According to the Draft Master Plan Report for the old Puunene Airport, the planning area appears suitable for a potential mix of public/private non-profit land uses. Alternative plans have considered uses such as a county baseyard complex, light industrial, raceway park, recreation facilities, heliport, and General Aviation Airport. The ultimate land uses that will be developed for this area have not been determined.

Although the Mokulele Highway widening will require land within the proposed Puunene Airport Area Master Plan boundaries, the use of these lands will not significantly impact future development of this project. Rather, added roadway capacity afforded by the proposed improvements will assist in mitigation of related transportation impacts as the Puunene Airport project achieves build-out in the future.

Puunene Avenue Widening

Puunene Avenue is bounded primarily by residential and agricultural land uses. Within Puunene Town, Puunene Avenue is also adjacent to industrial land uses associated with the Puunene sugar mill. However, with development of the proposed widening and intersection improvements of Mokulele Highway, the intersection of Mokulele Highway/Hansen Road will be moved mostly away from Puunene Town into the edge of existing sugar cane fields. Historically, a portion of the Mokulele Highway/Hansen Road intersection improvements were utilized as plantation housing. However, these structures no longer exist and the proposed project will not impact any historically significant sites.

Puunene Bypass

According to the preliminary engineering studies, approximately 40 acres of additional land area would be required for development of the Puunene Bypass. Essentially all of the additional land area required is presently used for agricultural cultivation, cane haul roadways, and agricultural irrigation improvements. It is anticipated that the land uses surrounding the Puunene Bypass corridor will remain in agriculture.

4.1.2 Climate

Climate is hot and dry with approximately 15 to 20 inches of rainfall per year. Monthly temperature averages vary only by a few degrees from the warmest months (July and August) to the coolest months (January and February).

Areas within the "wind shadows" of the highest elevations of the West Maui Mountains or Haleakala are shielded from all but the strongest tradewinds and experience a very strong land-sea breeze effect. The northwesterly tradewinds are accelerated due to a venturi affect as they pass between the two major mountain masses. Along the Kihei-Makena coast, the daytime tradewinds appear to have a more northerly component as they pass around the flank of Haleakala. At night, winds coming down the mountains frequently prevail. Afternoon winds demonstrate a strong westerly component and predominance of northwesterly winds.

4.1.3 Topography/Geology

Mokulele Highway Right-of-Way

The project area is located on the southeast shore of the West Maui volcano. The slopes are nearly level to moderately sloping. The Wailuku Series basaltic lavas and associated rocks are approximately 1.3 million years old. According to MacDonald and Abbott, the end of the Honolua Volcanic Series on West Maui was followed by a long period of erosion during which the deep valleys were formed and most of the alluvium along the eastern edge of West Maui Mountain was deposited. This long period of volcanic inactivity was briefly interrupted in recent geologic time- 10,000 to 15,000 years ago- by the post-erosional eruptions of the Lahaina Volcanic Series.

Slopes along the Mokulele Highway corridor generally range from 0.30 to 1.70 percent. No significant alterations to existing topography are anticipated to result from development of the proposed improvements.

Puunene Avenue Widening

Puunene Avenue also has slopes of approximately 0.30 to 0.70 percent. No significant alterations to existing topography are anticipated to result from development of the proposed improvements, however, some grading will be required in the vicinity of the proposed intersection with Hansen Road to accommodate the curve and design speed required for Mokulele Highway and the improvements required for the Hansen Road intersection.

Puunene Bypass

Similar to the Mokulele Highway portion of the proposed project, slopes in the vicinity of the Puunene Bypass are generally within a range of 0 to 5 percent. Some alterations to existing topography will be necessary to accommodate the design speeds associated with roadway curves, drainage, etc. However, these modifications will not be significant or unusual relative to other roadways of similar capacity.

4.1.4 Soils

4.1.4.1 SCS Soil Survey

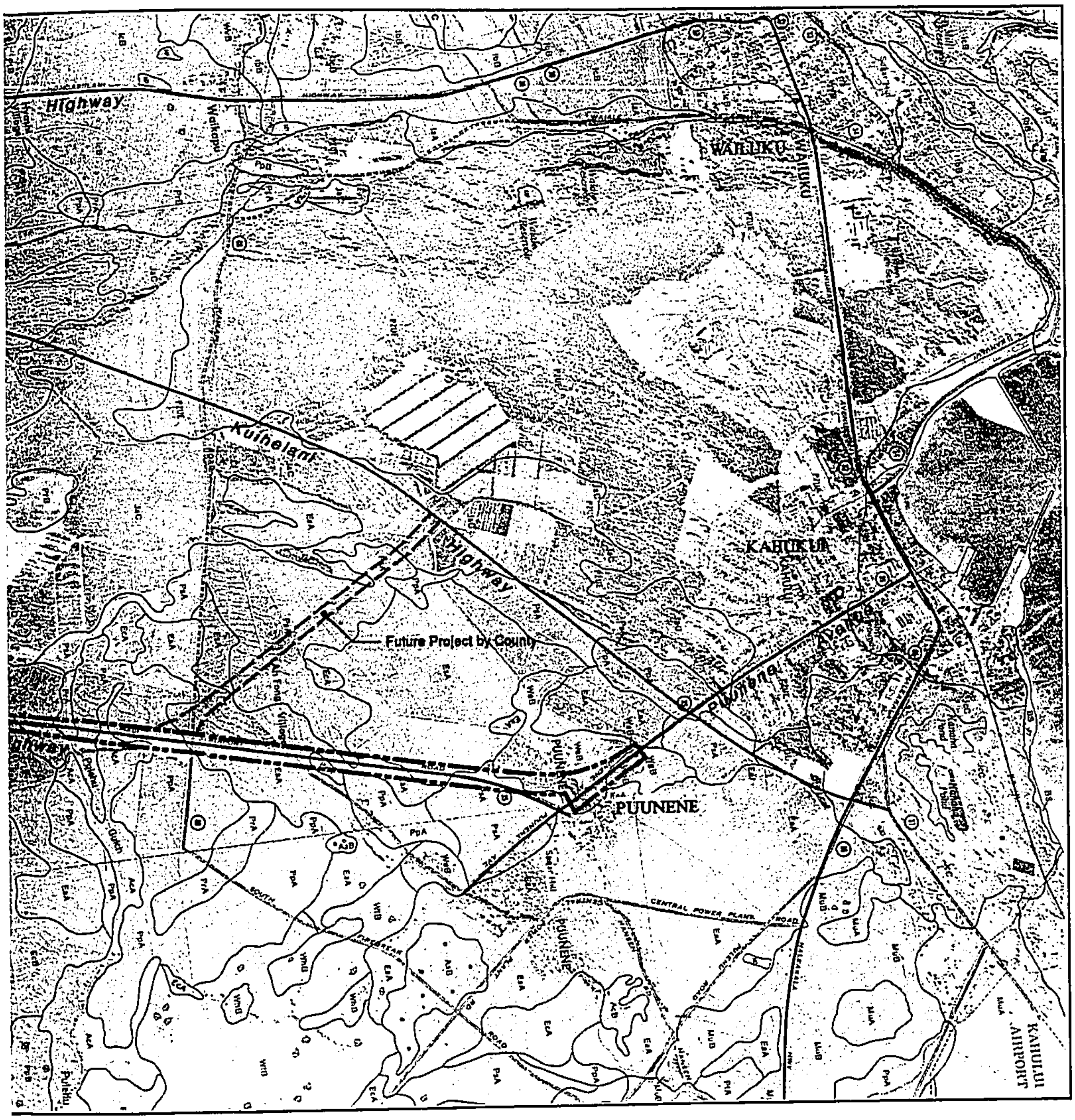
According to the 1972 Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, United States Department of Agriculture Soil Conservation Service, soils in the area are predominately of the Pulehu-Ewa-Jaucas soil association. As shown on Figure 4, these soils include Ewa cobbly silty clay and silty clay, and Pulehu cobbly sit loam, silt loam and cobbly clay loam, and clay loam. Near Kealia Pond, soils are classified as Kealia silt loam; a poorly drained soil with high salt content on the coastal flat land. Soils are deep, nearly level to moderately sloping, well-drained

LEGEND

─··─	Approximate Project Area Boundary (See Figure 1)	PpA	Pulehu silt loam, 0-3% slopes
EaA	Ewa silty clay loam, 0-3% slopes	PrA	Pulehu cobbly silt loam, 0-3% slopes
EcA	Ewa cobbly silty clay loam, 0-3% slopes	AcA	Alae cobbly sandy loam, 0-3% slopes
JaC	Jaucas sand, 0-15% slopes	PsA	Pulehu clay loam, 0-3% slopes

WeB	Waiakoa silty clay lo
WgB	Waiakoa very stony s
WhB	Waiakoa extremely s
EsA	Ewa silty clay, 0-3% s
AaB	Alae sandy loam, 3-7

Source: U.S. Department of Agriculture, Soil Conservation Service and University of Hawaii, August 1972



WeB	Waiakoa silty clay loam, 3-7% slopes
WgB	Waiakoa very stony silty clay loam, 3-7% slopes
WhB	Waiakoa extremely stony clay loam, 7-15% slopes
EsA	Ewa silty clay, 0-3% slopes
AaB	Alae sandy loam, 3-7% slopess

FIGURE 4
SCS SOIL SURVEY
MOKULELE HIGHWAY/ PUUNENE BYPASS

0 1000 3000
FEET

February, 1997

PBR HAWAII

and excessively drained soils that have a moderately fine texture to coarse-textured subsoil or underlying material on alluvial fans and in basins.

Pulehu silt loam (PpA) (0 to 3 percent slopes) - This soil is generally used for sugar cane cultivation and found mostly in alluvial fans and stream terraces and in basins. Surface layer is dark brown. Permeability is moderate, runoff is slow, and the erosion hazard no more than slight.

Pulehu cobbly silt loam (PrA) (0 to 3 percent slopes) - Similar to PpA, except there are many cobblestones on the surface and occasionally throughout the profile. Coral sand may occur at a depth of 20 to 36 inches.

Ewa silty clay loam (EaA) (0 to 3 percent slopes) - Runoff is slow and the erosion hazard is no more than slight. This soil is apparent in areas used for sugarcane and home sites.

Ewa silty clay (EsA) (0 to 3 percent) - This soil is used primarily for sugar cane and has generally very slow runoff and no more than slight erosion hazard.

Alae cobbly sandy loam (AcA) - This soil occurs on smooth alluvial fans. Permeability is rapid and runoff is slow with the erosion hazard no more than slight.

Waiakoa extremely stony silty clay loam (WhB) (3 to 7 percent slopes) - Stones cover approximately 3 to 15 percent of the service of this soil, but is still suitable for sugar cane cultivation, pasture, and wildlife habitat.

Puu Pa very stony silt loam (PZVE) (7 to 40 percent slopes) - This soil is generally associated with small gulches with steep slope. The representative profile is approximately 10 inches thick, dark brown, and blocky structure. The soil is medium acid to slightly acid in the surface layer. permeability is moderately rapid, runoff slow, and erosion hazard slight.

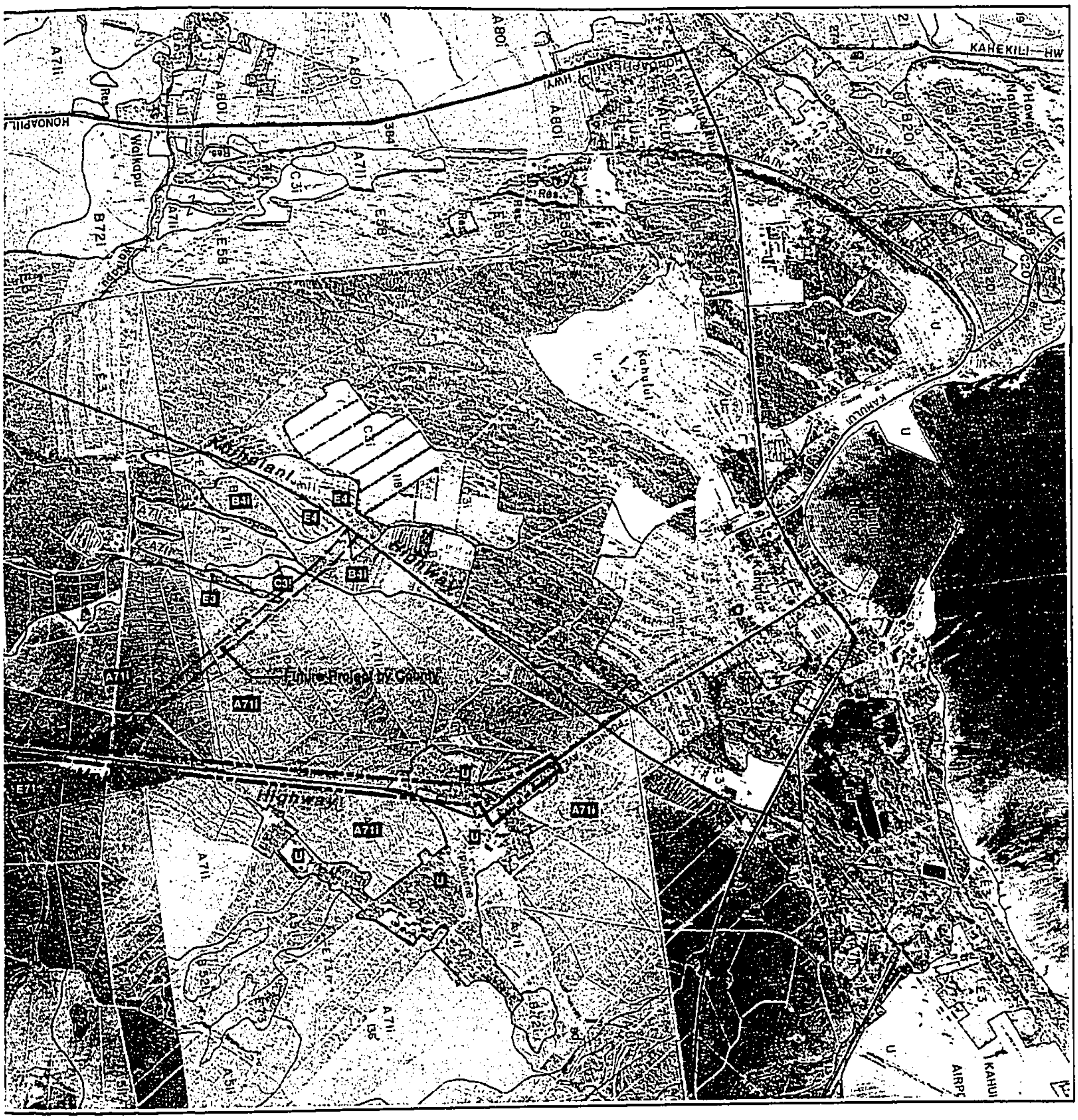
Jaucas sand (JaC) (0 to 5 percent slopes) - This soil is generally single grain, sandy, and more than 60 inches deep. Where organic mater accumulates at the surface, the soil may be dark brown. The soil is neutral to moderately alkaline through the profile. Permeability is rapid, runoff is very slow, and erosion hazard slight. Wind erosion is a severe hazard if vegetation is removed. Roots may penetrate to a depth of 5 feet or more. Workability is slightly difficult because the soil is loose and lacks stability for use of equipment.

Iao clay (LcB) (0 to 8 percent slopes) - This soil is found on colluvial slopes, alluvial fans, and stream bottoms. The subsoil is more that 48 inches thick and has an angular blocky structure. The subsoils is medium acid, however, the surface layer is medium acid to strongly acid. Permeability is moderate, runoff slow, and erosion hazard no more than slight.

LEGEND

(boundary line symbol)	Approximate Project Area Boundary (See Figure 1)
A7L1i	Non-stony; over 30" deep; 0-10% slope; well drained with a moderately fine texture
E71	Non-stony; over 30" deep; 0-10% slope; well drained with a moderately fine texture
E72	Stony; over 30" deep; 0-10% slope; well drained with a moderately fine texture
B72i	Stony; over 30" deep; 0-10% slope; well drained with a moderately fine texture
E73	Rocky; variable depth; 0-35% slope; well drained with a moderately fine texture
E3	Non-stony; over 30" deep; 0-10% slope; excessively drained with a coarse texture
B4i	Non-stony; over 30" deep; 0-10% slope; very well drained with a coarse texture
C3i	Non-stony; over 30" de excessively drained wit
E4	Non-stony; over 30" de very well drained with a

Source: Land Study Bureau, Universi



C3i	Non-stony; over 30" deep; 0-10% slope; excessively drained with a coarse texture
E4	Non-stony; over 30" deep; 0-10% slope; very well drained with a coarse texture

Source: Land Study Bureau, University of Hawaii - State of Hawaii, May 1967

FIGURE 5
DETAILED LAND CLASSIFICATION
MOKULELE HIGHWAY/PUUNENE BYPASS

0 1000 3000
FEET

February, 1997

PBR HAWAII

LEGEND

Approximate Project Area Boundary (See Figure 1)

Prime Agricultural Land

Other Important Agricultural Land

Source: Department of Agriculture - State of Hawaii, January 1977

FIGURE 6
AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII (ALISH)
MOKULELE HIGHWAY/ PUUNENE BYPASS

0 1000 3000
FEET

February, 1997

PBR HAWAII

4.1.4.2 Land Study Bureau Soil Productivity Ratings

As shown on Figure 5, the University of Hawaii Land Study Bureau identified a number of land types and their productivity ratings and corresponding soil profiles ranging from "A" (highest productivity) to "E" (lowest productivity) for the project area. The majority of land to be affected by the Mokulele and Puunene AvenueWidening segments include soils with "A", "B", and "E" ratings. The Puunene Bypass which is currently under sugar cane cultivation is given an "A" rating.

4.1.4.3 Agricultural Lands of Importance to the State of Hawaii (ALISH)

As indicated on the Department of Agriculture's ALISH (1977) maps, the entire project area is classified as "Other Important Agricultural Land" with the exception of a small amount of land area designated as "Prime Agricultural Land" and "Urban" (Figure 6).

4.1.5 Flood and Tsunami Hazard

According to the Federal Emergency Management Agency Flood Insurance Rate Maps, approximately 85 percent of the proposed highway corridor lies outside of the 100-year flood. These maps were updated in April, 1992, and are included in Appendix G. However, new maps have not been published due to funding constraints. The balance of the project area consisting of the Mokulele Highway near Kihei, is located within Flood Hazard Zone A, A3, A4, and AO.

Zone A is an area of 100-year flooding where the base flood elevation and flood hazard factors have not been determined. Zone A3 has a flood elevation of 3 feet and Zone A4 has a flood elevation of 4 feet. The AO hazard area was previously designated as "Zone V18" which has a 100-year coastal flood with velocity (wave action) with a base flood elevation and flood hazard factors determined. However, when the FIRM for the coastline in the area of Kihei was re-evaluated, this designation was revised by the Federal Emergency Management Agency to reduce the Special Flood Hazard Area (SFHA) from approximately 800 feet to approximately 400 feet in width between Mokulele Highway and Uwapo Road. This revision was prepared at the request of the County of Maui to more accurately reflect current topographic information. Consequently, the reduced area is now designated as Zone AO (Depth 1 foot). At the intersection of Kihei Road and Mokulele Highway, the base flood elevation was revised from 12 feet to 8 feet.

According to the Federal Emergency Management Agency (FEMA), a revised FIRM will not be published, however, the map will be incorporated into future Flood Insurance Rate Maps (FIRM) if they are republished. As such, all structures within the flood hazard area designated will be built in accordance with the revised flood hazard designations and the County of Maui Flood Hazard District Regulations (Chapter 19.62) as applicable.

4.1.6 Hydrology

Beginning at an elevation of 1 foot above mean sea level near the coast, the basal water table raises an average of 1.5 to 2.5 feet per mile for the first 2 to 3 miles inland. The basal water table ends 4 to 5 miles inland at an elevation of about 30 feet above sea level. The most dense portion of the basal lens, as well as the most important source of fresh water development, is the Iao aquifer which lies between Waikapu and Waihee Valleys. Water in the main basal lens is impeded by a thick wedge of older alluvium extending from Waihee Valley to Maalaea.

Recharge of the Iao aquifer occurs primarily by underflow of high level dike, or perched water. Recharge also results from rainfall and stream seepage and to some degree percolation of irrigation water. To facilitate the recharge of the groundwater after project development, runoff from the impermeable surfaces will be directed into roadside ditches. As such, no public agencies furnishing water or distribution facilities would be unreasonably burdened by the proposed development.

4.1.7 Scenic and Open Space Resources

From the Mokulele Highway improvement corridor, the primary scenic and open space resources are the expansive views of Haleakala, the West Maui Mountains, and Kealia Pond. Although the proposed project will alter existing views, new vistas along the Puunene Highway corridor will become available to the traveling public. As such, existing visual resources will not be negatively impacted and new views will become accessible to the general public. Widening of the Mokulele Highway and Puunene Avenue will not alter any significant views.

The Visual Analysis preformed for the project area is presented in Appendix H. Note that the vegetation planted intermittently on both sides of Mokuleie Highway often screens the highway from adjoining properties, but external views for passengers traveling on the roadway are also obstructed.

The appearance of the project will be mitigated by design techniques which will create a visually pleasing highway structure integrated into existing topography and landforms by landscaping within portions of the right-of-way along the highway corridor.

4.2 AFFECTED ENVIRONMENT

4.2.1 Flora

According to the Flora Survey Report prepared for the project (Appendix C), the improvement corridor has long been graded and altered to allow for irrigated sugar cane cultivation. As such, no endangered plant species are known to exist in the project area. In addition, no wetlands, streams, estuaries or other habitats that could accommodate endangered plant species within the improvement corridor will be impacted. The flora consists primarily of exotic species due to previous disturbance of the land. Therefore, the project is not expected to result in significant negative impacts on botanical resources and no mitigation measures are recommended.

4.2.2 Fauna

Due to the historical agricultural practices of the region, no suitable habitat for endemic species exists along the highway corridor. According to the Avifaunal and Feral Mammal Survey (Appendix C) prepared for the project, the project area is primarily sugar cane, grass and weed lined ditches, irrigation facilities, dry grass and scattered trees, and some small diversified agricultural development near Kihei. As such, no unique habitat exists.

During the survey, no native land birds were recorded. Only the Short-eared Owl may be occasionally sited in the area, but are fairly common on Maui, particularly on the slopes of Haleakala. The only indigenous species sited was the Black-crowned Night Heron located near the irrigation pond northwest of the animal shelter. This is the only indigenous species not presently listed as endangered. Kealia Pond supports three endangered species, the Black-necked Stilt; Hawaiian Coot, and Hawaiian Duck or Koloa, but these were not observed during the survey.

The only migratory indigenous birds tallied on the survey were the Pacific Golden Plover and the Ruddy Turnstone. Wandering Tattler could also occur in this area although none was recorded during the survey. The Plover is extremely site-faithful and many establish foraging territories which they defend vigorously. None of these shorebirds are listed as endangered or threatened. The only feral mammals observed during the survey were the Indian Mongoose and feral cats.

The Survey concluded that no particularly unusual or exceptional wildlife habitat were found during the survey. No obvious differences in the variety of species or their relative abundance within the future Puunene Bypass corridor were observed.

None of the proposed project development will impact wetland habitat areas, although drainage within three gulches will be improved by enlarging three undersized culverts presently located under Molulele Highway.

4.2.3 Archaeological Resources

Findings of the archaeological survey prepared for the project (Appendix B), indicate that no known cultural or archaeologically significant surface sites or cultural deposits exist within the proposed Puunene Bypass right-of-way or the expanded right-of-way of the Mokulele Highway/Puunene Avenue. Years of agricultural activity and construction of the Mokulele Highway have disturbed any archaeological remains that may have existed.

The area surveyed consisted of an area approximately 9.59 miles long by 200 to 1,570 feet wide. Mokulele Improvements corridor, at the south end, includes 3.45 miles of the existing highway. In addition, the future Puunene Bypass corridor and connections to Mokulele Highway which cover the remaining 6.15 miles were also surveyed.

Research of previous archaeology surveys was also conducted. After reviewing tax maps, historical accounts, and the extent of recent and past land modifications, both within and bordering the highway corridor, it was considered likely that little, if any evidence of archaeological features would be identified during the survey.

As anticipated, no evidence of archaeological sites was identified during the field survey. One off-site area of potential historical significance was identified within the old Maui Airport property. This area (see Appendix B) was apparently utilized during and after World War II as a dumping site of military equipment. However, based on an aerial photograph taken while the ground disturbance area was visible, none of the proposed Mokulele Highway widening improvements impact the old dump site. However, should any sub-surface archaeological or cultural materials be found during grubbing or other construction activities, the Department of Land and Natural Resources Historic Preservation Division will be notified.

4.2.4 Air Quality

Federal and State standards establish six parameters regulating particulate matter, sulphur dioxide, nitrogen dioxide, carbon monoxide, ozone, and lead. In addition, Hawaii has a state-wide standard for hydrogen sulfide. Hawaii air quality standards are more stringent than comparable nation standards, except for sulphur dioxide, particulate matter and lead which are set at the same levels.

Due to the predominant northeast tradewinds, Hawaii generally enjoys high air quality. According to the Air Quality Study prepared for the project (Appendix E), air quality within the project area is impacted primarily by agricultural activities, emissions from the Maui Electric Company generation plant, and vehicular emissions. The current agricultural burning of sugar cane and exposure of disturbed soils within the project corridor will be eliminated with development of the proposed widening, although off-site agricultural activities.

The primary air quality impacts will likely occur during project construction. According to the Air Quality Study prepared for the project, the proposed highway improvements will generate air quality impacts during construction primarily from fugitive dust emissions and vehicular emissions from construction equipment. Following construction, emissions from vehicular traffic, particularly at major intersections along the highway corridor, may have some impact due to the increased levels of traffic, however, it is expected that the resulting mesoscale air quality impacts after project development will remain well within established State and Federal standards and result in emissions significantly below the "no-build" alternative. As such, development of the proposed improvements will improve air quality compared to the scenario if the project were not built.

To ensure that air quality standards are met during construction, conformance with local grading and erosion control measures will be employed. For example, State air pollution control regulations require that no visible fugitive dust emissions occur at the project boundary. Therefore, mitigation measures such as frequent sprinkling, wind screens, keeping adjacent paved roads clean, and covering open-bodied trucks, and landscaping as soon as feasible after grading will largely mitigate air quality impacts. Following construction, it is expected that the resulting air quality after project development will remain generally within established Federal standards. State standards may be rarely exceeded under the extreme worse-case, but still result in air quality significantly improved relative to the no-build alternative. For example, according to the Air Quality Study;

"Compared to the 2020 without-project case, the with project alternative would reduce carbon monoxide emissions by about 82 percent and hydrocarbon emissions by about 73 percent, reducing these emissions to levels comparable to the estimated 1996 levels. Nitrogen oxides emissions would increase by about 10 percent compared to the no-build alternative. These changes in emissions would be due to the higher travel speeds possible with the highway improvements."

Presently, the 1-hour and 8-hour state ambient air quality standards at three of the five locations studies were exceeded. By the year 2020, state air quality standards at all five locations would be exceeded if the project is not built.

The results of the air quality study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. For example, the assumed worse case wind speeds of 1 meter per second used for computation may occur only once a year or less. Wind speeds of 2 meters would reduce carbon monoxide concentrations by about half. Similarly, the 8-hour estimates assume that a person would remain within three meters of the roadway and be exposed to emissions for a period of 8-hours which is very unlikely.

After project development, the increased efficiency of the improved highway will reduce the quantity of emissions that would otherwise occur without the project. Therefore, according to the Air Quality Study, the proposed highway widening project would provide substantial mitigation of long-term air quality impacts compared to the without-project case by improving traffic flow within the project area. Additionally, the realignment of the highway will eliminate or improve two problem intersections within the project corridor. Therefore, the Air Quality Study concludes that any further mitigation to alleviate air quality impacts is probably unwarranted.

4.2.5 Noise Impacts

Existing background noise levels range from the natural sounds of wind, foliage (sugar cane), and birds at the Puunene Bypass corridor to the higher noise level associated with existing traffic on the Mokulele Highway. Natural ambient noise levels are usually estimated at less than 45 dBA. Traffic noise from the Mokulele Highway is estimated at 70 dBA or greater. For example, the Noise Assessment Study (Appendix F), indicates that the noise level within adjoining sugar cane fields was measured at 44.4 dBA, while the Mokulele Highway ranges from 68.4 dBA to 71 dBA. However, with development of the proposed improvements, the noise level will only increase a maximum of 0.2 dB compared to the no-build alternative.

According to the noise impact study, noise sensitive locations (i.e. Kealia Pond Nations Wildlife Refuge) the future build traffic noise levels are expected to be slightly less, about 0.9 dB, than the future no-build traffic noise levels. This decrease is due to the realignment of Mokulele Highway to the east of the existing alignment. At the animal shelter, the project will increase noise levels no more than 0.1 dB. The minimal change in noise levels perceptible to the average listener is generally taken to be 3 dB, therefore, the increase will not be significant.

In the short term, construction will also contribute to temporary increases in noise levels in the project corridor. Standards and guidelines established by the State Department of Health will have to be followed to mitigate the impact on ambient noise levels.

Although some new noise will be generated by the increased capacity of the Mokulele Highway, the greatest noise impacts will occur along the proposed Puunene Highway relative to existing noise levels typical of sugar cane fields. Consequently, land use patterns adjacent to the highway corridor and the level of traffic will ultimately determine whether noise mitigation measures are appropriate. According to the Noise Assessment Study, "If future residences are located no closer than about 180 feet from the Mokulele Highway centerline and about 97 feet from the Puunene Avenue centerline, no additional attenuation other than that provided by normal local construction will be needed to attenuate traffic noise."

4.2.6 Drainage

Soils in the planning area have generally slight slopes which limits the amount of surface runoff while maximizing the potential for rainfall recharge. However, rainfall is generally not adequate in the area to saturate the soils to the point where recharge from rainfall is significant. Consequently, most water recharge occurs from irrigation water and from rainfall on Haleakala slopes which can average as high as 60 inches per year.

Major natural drainage features consist of a number of gulches traversing the project area. Some of the major features include Pulehu Gulch, Kolaloa Gulch, and Keahuaiwi Gulch. Pulehu Gulch intersects Mokulele Highway where it turns and flows downstream along the highway towards Waikapu Stream and Kealia Pond. The Kolaloa Gulch also drains through a culvert under Mokulele Highway. Across the highway from Hawaiian Foliage and Landscaping, a gulch spreads making this a flood prone area. The entire southern portion of highway improvement corridor drains into Kealia Pond and the adjacent coastline in Maalaea Bay. The northern portion of the corridor drains toward Kahului.

As a wetland area, Kealia Pond is the natural collection area of surface runoff prior to discharge into the ocean. As such, wetlands such as Kealia Pond also serve as natural sedimentation basins. Drainage structures required for the proposed improvements will be accomplished by a series of culverts, ditches, and establishment of topographic features used to direct surface flows.

The primary consideration in the design and engineering of the highway improvements, will be to maintain existing drainage patterns (especially in the area proximate to Kealia Pond), design improvements to accommodate intense storms, and to establish drainage improvements designed to control surface flows generated from impermeable surfaces. Detention areas may also be established as applicable to induce sedimentation of water-borne particles, thereby reducing the potential of off-site sedimentation.

4.3 LAND USE CONTROLS AND POLICIES

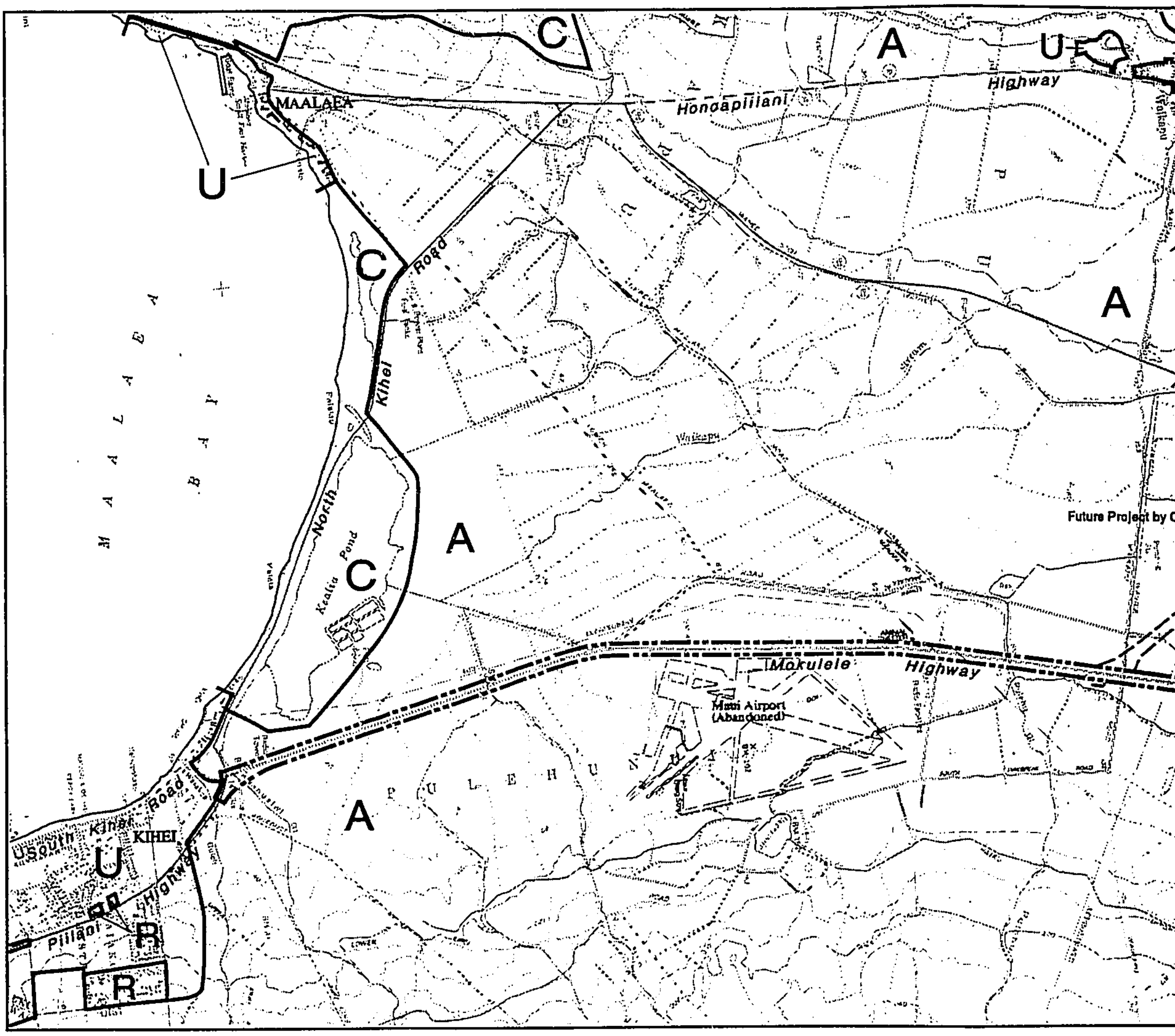
4.3.1 State Land Use Districts

Chapter 205, HRS, establishes the State Land Use Commission (LUC) and gives this body the authority to designate all lands in the State as Urban, Rural, Agricultural, or Conservation District lands. As shown in Figure 7, the Wailuku - Kahului Urban District areas are north of the project area and the Kihei Urban District area lies directly to the south of the area. The widening project will also enter a small urban area located at Puunene. Kealia Pond National Wildlife Refuge located to the south southwest is classified as by the LUC as Conservation District land. The project area and most of central Maui are located within the State Land Use Commission's (LUC) Agricultural District which is consistent with the predominant plantation agricultural land uses in the area.

According to Chapter 205, HRS, and the Land Use Commission Rules, "Public, private, and quasi-public utility lines and roadways..." are permitted within the State Agricultural District and State Urban District. As such, the proposed improvements are consistent with Chapter 205, HRS, and no reclassification of the State's land use designations are required to implement the proposed project.

4.3.2 County of Maui Community Plans

The project area includes two political jurisdictions as delineated in the Kihei-Makena and Wailuku-Kahului Community Planning District maps as shown in Figure 8. All Community Plans are presently comprised of three major components; 1) a narrative describing the intent of the plan and overall recommendations, 2) a land use map depicting the existing and proposed land uses established for the planning period, and 3) a map illustrating proposed transportation/public facility improvements.



LEGEND

━ - ━	Approximate Project Area Boundary (See Figure 1)
U	Urban
R	Rural
A	Agricultural
C	Conservation

Source: State Land use Commission; Maui County office of Economic Development

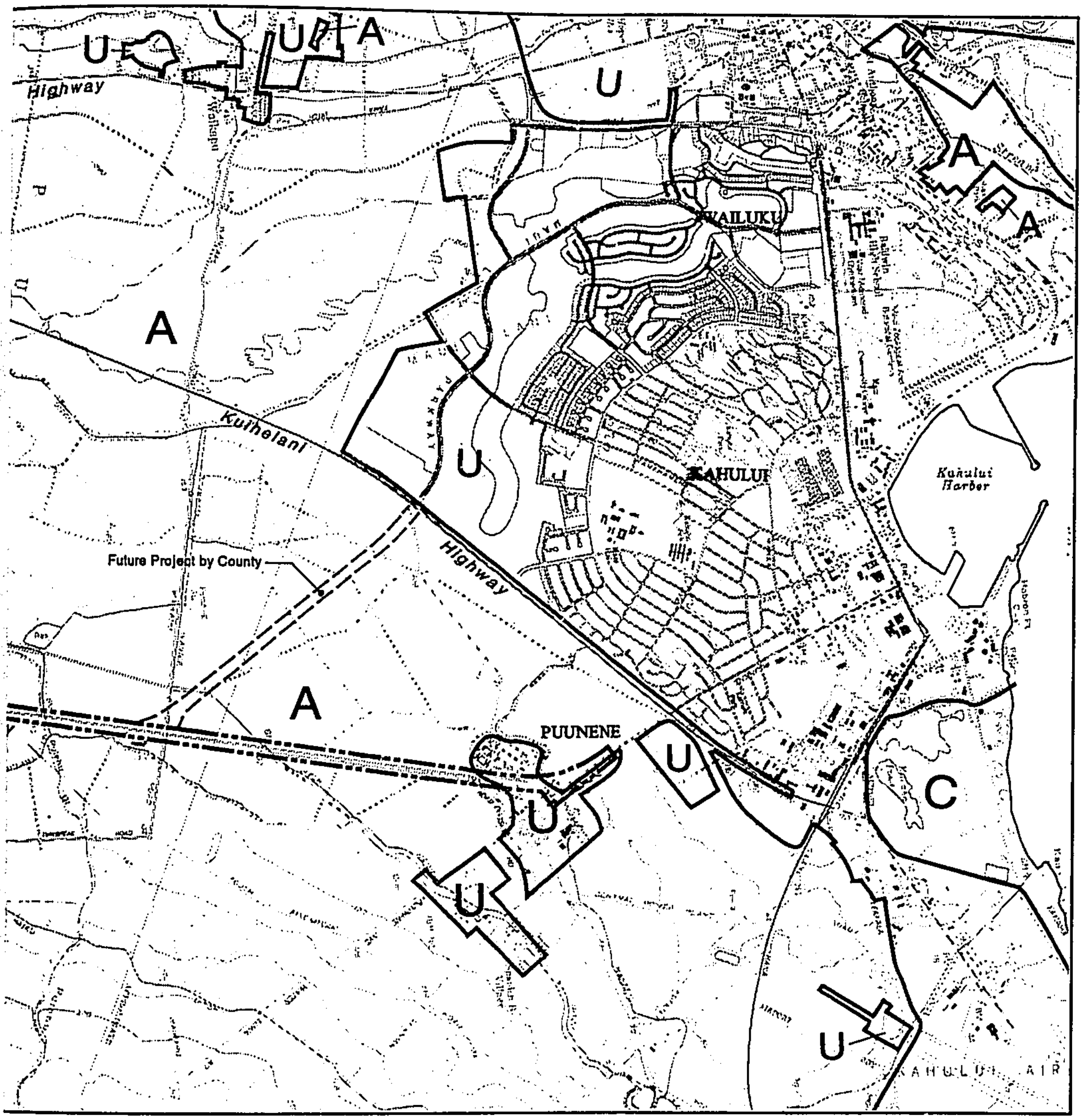


FIGURE 7
STATE LAND USE BOUNDARIES
MOKULELE HIGHWAY/PUUNENE BYPASS

0 1000 3000
FEET

February, 1997

PBR HAWAII

4.3.2.1 Wailuku-Kahului Community Plan

The Wailuku-Kahului Community Plan primarily encompasses only the Puunene Bypass portion of the proposed project. However, as depicted on Figure 8, the Puunene Bypass Highway is not shown as a planned public facility on either the Land Use Map or the Transportation and Public Facilities Map. As such, the proposed project is inconsistent with the existing Wailuku-Kahului Community Plan. Widening of the existing Mokulele Highway and Puunene Avenue is located primarily within an existing right-of-way and may be considered as a maintenance project. Therefore, Mokulele Highway and Puunene Avenue project should not be subject to any restrictions imposed by the Wailuku-Kahului Community Plan.

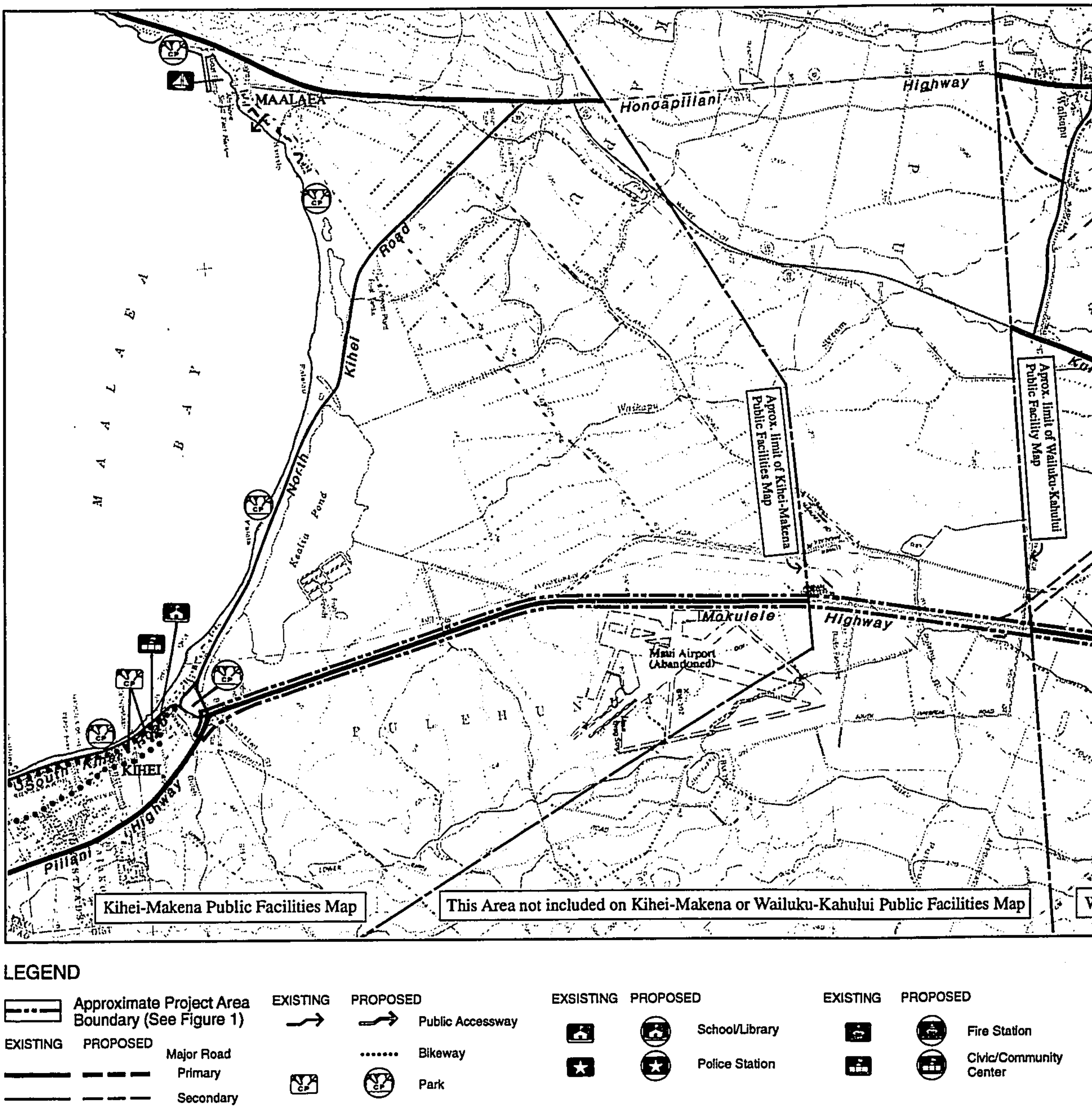
To address changing conditions, the Community Plans are periodically updated (approximately every 5 years) to reflect existing and projected demographics, economic conditions, and overall community needs. For the Wailuku-Kahului Community Plan area, this process began in 1993 with the establishment of the "Wailuku-Kahului *Citizen* Advisory Committee" (CAC) by the County of Maui.

According to the CAC's final "Implementing Actions" for transportation (December, 1993), the County of Maui Wailuku-Kahului Community Plan should "Plan and construct a Puunene Bypass that would connect the Mokulele Highway and Kuihelani Highway and continue to Kaahumanu Avenue, via the future Maui Lani Parkway." Based on the CAC's input, the Planning Department concurred with the CAC Implementing Action and issued their report in September 1994. After due deliberations, the Planning Commission also recommended development of the Puunene Highway in their Planning Report of October 1994.

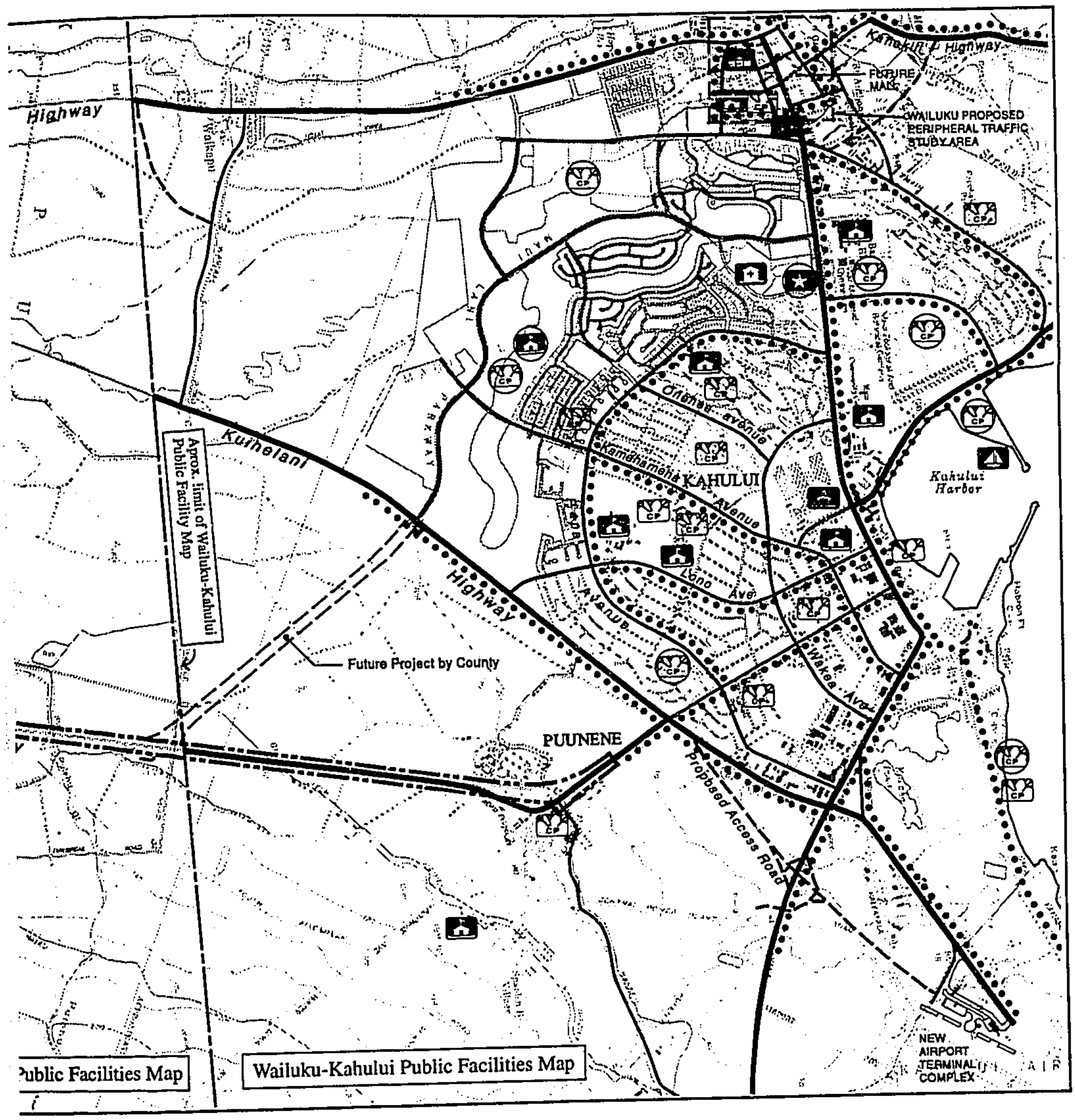
The schedule for final action on the Wailuku-Kahului Community Plan has not been finalized, however, tentative indications are that the plan may be adopted in late 1997. Given the lead time required, the preparation of engineering and construction plans, and determination of final funding sources, the construction of the Puunene Bypass will not occur until the Wailuku-Kahului Community Plan is officially adopted. It is therefore anticipated that the Puunene Bypass will likely be adopted as a primary component of the updated Wailuku-Kahului Community Plan well before commencement of construction.

4.3.2.2 Kihei-Makena Community Plan

A large portion of the Mokulele Highway Widening portion of the project area lies within the Kihei-Makena Community Plan district. Inasmuch as this portion of the project calls for improvement of an existing roadway, the proposed widening and intersection improvements are consistent with the intent of the Kihei-Makena Community Plan and will not require any adjustments or amendments to permit the widening project to proceed.



Source: Maui Community Plan, Wailuku-Kahului, Kihei-Makena Transportation and Public Facilities Map



PROPOSED		EXISTING	PROPOSED	
	Fire Station			Health Facility
	Civic/Community Center			Boating Facility

FIGURE 8
COMMUNITY PLAN/ PUBLIC FACILITIES MAPS
MOKULELE HIGHWAY / PUUNENE BYPASS

0 1000 3000
FEET

PBR HAWAII

4.3.3 County Zoning

According to the County of Maui's official zoning maps, the entire project area is zoned as Agricultural. According to Section 19.30.010 of the County of Maui Zoning Ordinance, "The purpose of this chapter is to provide areas for agricultural development which would be in keeping with the economic base of the county and which will be in keeping with the regulations of the Land Use Commission. As such, the Mokulele Widening, Puunene Avenue Widening, and the Puunene Bypass are consistent with State Land Use Commission and the County of Maui Zoning Ordinance.

4.3.4 Special Management Area

The County of Maui Special Management Area (SMA) boundary pa rallels the western (makai) edge of that portion of Mokulele Highway proximate to Kealia Pond. Inasmuch as the widening will occur primarily along the mauka side of Mokulele Highway outside of the SMA boundary, the project area does not lie within the County of Maui Special Management Area except for a small portion of the proposed intersection improvements with South Kihei Road. As such, the proposed Mokulele Highway Widening/Puunene Bypass project may not be subject to the SMA permitting requirements unless the scope and cost of the South Kihei Road intersection improvements trigger the SMA review process.

4.4 SOCIAL-ECONOMIC CHARACTERISTICS

To identify future travel demand, projections of regional population, employment, and land use development are essential in determining future traffic volume. These growth factors were projected for use in the MLRLTP by the State Department of Transportation and the County of Maui Planning Department for population and land use island-wide and by Community Plan area. Population forecasts provided by the State indicate that by the year 2020, the population of Maui is expected to increase from 91,254 in 1990 to 147,500 in 2020. During this same period, island-wide employment will increase from 51,768 to 83,400, an increase of over 31,632 jobs by the Year 2020.

Similarly, Kihei-Makena is expected to become a major employment center while Wailuku-Kahului will continue to be Maui's most populous community. This relationship between the two regions will significantly contribute to the overall growth in traffic as persons commute between home and work. This correlation will become more pronounced as the projected annual visitor arrivals increase from 2,987,500 in 1995 to 4,000,000 in the year 2020. Consequently, in order to accommodate this increase in the visitor population, an increase of approximately 8,700 hotel rooms are needed. Therefore, much of the economic growth, in terms of employment, is attributed to the visitor industry which will occur within Maui's major resort areas.

For example, the population of Wailuku-Kahului is projected to increase by 19,759 residents between 1990 and 2020 and Kihei-Makena will grow by 11,705 residents during the same period.

At the same time, employment will grow by 15,745 jobs in Wailuku-Kahului and 5,608 jobs in Kihei-Makena. The growth in population of approximately 11,705 persons in Kihei-Makena is not comparable to the growth in employment of only 5,608 new jobs or approximately 0.48 new jobs per person. In Wailuku-Kahului, the job/person ratio is approximately 0.80 reflecting almost twice as many jobs/person as expected in Kihei-Makena. This relationship means there would be an increase in commuter traffic between the residential areas of Kihei-Makena and employment opportunities in Wailuku-Kahului.

By incorporating the land use, population, employment, and transportation network into a "Travel Demand Forecasting Model", the MLRLTP projects that total island-wide daily traffic will increase from 233,650 in 1990 to 386,280 by the year 2020 representing a 65.3 percent increase in traffic, or 2.17 percent average annual increase in traffic levels.

4.4.1 Economy

The County of Maui, like the rest of the State, has recently begun to emerge out of recession brought on by the drop in visitor arrivals and reductions in overall construction activity. Although shifts in bookings from Kauai to other neighbor islands (including Maui) occurred after hurricane Iniki in 1992, this was offset by weak economic conditions on the U.S. mainland and Japan which have had an impact on visitor expenditures.

Through May 1994, total visitors to the state were 5.4 percent below the first five months of 1992. During 1994 and early 1995, visitor arrivals have essentially recovered from these levels resulting in a generally improved economy. By April 1996, Hawaii Visitor Bureau (HVB) figures indicate that visitor arrivals were at record highs state-wide with the best first quarter (1,750,000 visitors for January - March 1996) in history. This reflects an increase of approximately 6 percent over the 1995 visitor arrival levels. Maui visitor arrivals were up 1.2 percent for the first quarter of 1996 due mainly to a 4.7 percent increase in eastbound traffic.

Clearly, the proposed highway construction would create some temporary construction related employment growth and secondary amounts of indirect employment as income from construction workers stimulates commercial, industrial and government support jobs.

4.4.2 Public Facilities/Infrastructure

4.4.2.1 Water

Water transmission lines that may cross the proposed right-of-way will require easements in favor private interests to permit installation of existing and future water transmission lines. No other impact to existing water source or storage facilities is anticipated from development of the proposed transportation improvements. Water transmission facilities may have to be relocated or adjusted at gulch crossings.

Water consumption required for the project, would only occur on a short-term basis during the project construction phase for erosion control and mixing of surface materials. Non-potable water from agricultural irrigation systems may also be available for use during construction if potable water is not available or is not economically feasible.

4.4.2.2 Wastewater

There are currently no County sewage collection or treatment facilities in the area of the proposed improvements that would be impacted by the project. According to the County of Maui's wastewater master plan, sewage transmission lines in the area will be accommodated by easements permitting connection to the North Kihei Treatment Facility. Easement locations will be determined during the preparation of construction plans.

4.4.2.3 Solid Waste Disposal

Presently, solid waste that would be generated from project construction would be serviced by the 55-acre Central Maui Landfill operated by the County of Maui's Department of Public Works. Capacity remaining at the landfill is expected to remain until the year 2000. Presently, no significant solid wastes are generated from the agricultural uses present on the subject property.

Solid wastes that are generated by the project will occur during the construction phase. Wastes will consist primarily of organic matter as a result of grubbing activities. To minimize impacts to the county landfill, the organic material will be deposited to the extent possible on site to allow for natural decomposition. If necessary, this material could be converted to chips for more even distribution and faster decomposition, or for recycling.

To coordinate disposal of solid waste, the County of Maui Department of Public Works and Waste Management will be contacted to make sure that disposal methods conform with County of Maui policies and regulations. To coordinate the disposal or recycling of solid waste, a Solid Waste Management Plan for the entire project area will be prepared as applicable in accordance with adopted County of Maui policies regarding waste management practices.

4.4.2.4 Electrical and Telephone

At present, major electrical overhead power lines and communication lines are located within the project right-of-way along the Mokulele Highway. Portions of the overhead lines are located on both sides of the roadway. With the proposed widening, the overhead lines owned by the Maui Electric Company and communication lines owned by Hawaiian Telephone will be relocated in accordance with applicable design standards and remain as overhead lines.

4.4.3 Public Services

4.4.3.1 Police/Fire Facilities

Police services are presently provided by the Wailuku Police station with two to three beat officers assigned to the Kihei-Makena area. Fire stations are located in Kihei near Kalama Park and in Wailuku at the corner of Main and Kinipopo. Response time to the areas ranges from five to ten minutes depending on traffic. With adequate staffing, existing facilities and police and fire services presently provided by the County of Maui are adequate to service the highway corridor.

Most emergency calls to the project area will likely result from traffic accidents. Regular patrols to enforce posted speed limits and travel to and from Kihei and Wailuku will not significantly impact either the fire or police department's ability to provide the levels of service required.

By establishment of the proposed improvements and greater capacity afforded by four travel lanes, and associated intersection improvements, the travel times between Kahului, the future Maui Lani development, and Kihei-Makena will improve due to the reduced congestion and more direct route to emergency calls. Periodic flooding can also restrict emergency access to Kihei. This will likely provide a greater level of service than presently exists to more efficiently respond to emergency calls as compared to the current congested condition.

Based on the expected lack of significant impacts resulting from the proposed project and the projected improvement afforded to police and fire services, mitigation measures do not appear warranted at this time.

4.4.3.2 Health/Emergency Services

Maui Memorial Hospital, located between Wailuku and Kahului, is the nearest major medical facility to the project area. The proposed project is not expected to add to the requirements for emergency or daily medical care facilities, but improve the capability to provide service through reduced response times provided by the increased capacity of the regional roadway system. Based on the lack of anticipated impacts, no mitigation measures appear warranted at this time.

4.4.3.3 Recreational Facilities

No recreational facilities will be impacted by the proposed project. All existing land uses within the highway corridor are essentially used or associated with agricultural purposes.

POTENTIAL IMPACTS AND MITIGATIVE MEASURES

SECTION 5.0

5.0 POTENTIAL IMPACTS AND MITIGATIVE MEASURES

5.1 IMPACTS TO THE PHYSICAL ENVIRONMENT

5.1.1 Topography/Landforms

The proposed project will involve the clearing, grubbing and grading of lands presently being used for sugar cane cultivation. In general, however, finished contours will follow existing grades to minimize earthwork costs and maintain existing drainage patterns.

While terrain within the corridor will be locally modified to meet design requirements for roadway grades and drainage crossings, the proposed widening of Mokulele Highway and future construction of the Puunene Bypass will not significantly impact adjacent topography or landforms.

5.1.2 Drainage

Surface runoff within a majority of the project's drainage basin eventually flows into Kealia Pond. During and after project construction, surface runoff will continue to flow toward Kealia Pond, but not in significantly greater quantities compared to the current condition. Surface flows resulting from the Mokulele widening are relatively insignificant and the discharges will be managed by construction of drainage control structures. The surface flows which do eventually enter the Kealia Pond drainage system must first cross open fields or travel within existing drainage gulches. As such, the water quality of surface runoff will be impacted by these factors rather than the surface contaminates from the roadway surface. Drainage areas and catch basins established during construction of the improvements will further ensure that water quality is maintained. Road runoff from Puunene Avenue widening and Puunene Bypass will be directed into retention basins since there are no defined drainageways within close proximity to these project limits.

Alterations to the existing topography will be required in conjunction with the clearing, grubbing and grading of lands presently used for sugar cane cultivation. Finished grades will raise the existing highway profile to facilitate drainage requirements. This will also maintain drainage patterns and other facilities necessary for uninterrupted irrigation of surrounding sugar cane lands. Where natural drainageways are crossed, culverts will be sized to minimize impacts during intense storms.

5.1.3 Flora/Fauna

Both the Mokulele and Puunene Avenue Widening, and the Puunene Bypass will impact the existing flora and fauna primarily during the project construction. However, essentially all of the new development area is currently utilized for sugar cane cultivation which is not an important habitat for endangered flora or fauna. No known rare, endangered or threatened species of flora or fauna exist within the proposed improvement area. Consequently, the removal of existing sugar cane will not adversely impact botanical resources or unique habitat.

The only habitats that could potentially be impacted by the proposed project are wetland areas associated with Kealia Pond. Although there are no wetlands located within the project corridor, some animal species may fly over the highway and be subjected to the noise and potential hazards associated with vehicular traffic. Inasmuch as the Mokulele Highway is already a heavily traveled highway, new impacts associated with the proposed widening should not pose a significantly greater hazard than presently experienced.

5.1.4 Noise and Air Quality

Noise and air quality will both be impacted by short term construction activity and long term operation of the proposed highway improvements. Fugitive dust will be generated during grading and as soil is exposed to relatively high winds. Also during construction, noise will be generated by construction heavy equipment. It should be noted, however, that these construction related impacts are also characteristic of agricultural land uses during harvesting operations.

Consequently, the construction related noise and air quality impacts will not be significantly greater than similar impacts associated with the property during agricultural harvesting operations. In addition, the overall air quality along the highway corridor will improve with development of a more efficient transportation system. Technical studies of air quality (Appendix E) and noise impacts (Appendix F) have evaluated these impacts of the project.

5.1.5 Scenic and Open Space Resources

Initially, the proposed project will displace approximately 148 acres of land currently in sugar cultivation (40 acres for Puunene Bypass and 108 acres for Mokulele Highway/Puunene Avenue widening). Where the roadway is constructed above grade for drainage purposes, the highway will be more visually evident, however, the scenic and visual character of the surrounding open agricultural lands will be maintained. In addition, some of the existing trees parallel to the highway will be removed, thereby opening up new vistas of Central Maui not presently available to the traveling public.

The primary visual impacts will become most evident from higher elevations looking down toward the proposed project. By providing new vistas from the highway, the potentially negative visual impacts associated with construction of a new highway will likely be off-set by the general public's improved accessibility to new visual resources.

5.1.6 Archaeological Resources

As previously described, essentially the entire project area is either existing highway right-of-way or has been historically used for sugar cane cultivation. Only relatively small portions of the project area located within the larger drainageways contain lands that are relatively undisturbed by agricultural activities, although no archaeological features were identified within these areas.

Appropriate mitigation measures will be recommended if warranted should subsurface remains, such as artifacts, deposits of charcoal or bones be found during construction activities. Work in the area will be stopped and the Department of Land and Natural Resources contacted to determine the significance of the site and to identify appropriate mitigation measures in accordance with applicable regulations regarding treatment of archaeological resources. The complete archaeological survey report is provided in Appendix B..

5.1.7 Agricultural Resources

The agricultural lands surrounding the proposed highway corridor, are highly productive and close to the Puunene Sugar Mill. As such, the savings which could result from reduced hauling costs could benefit the sugar operation. Indirect impacts to agricultural operations will also result from the relocation required for cane haul roads and agricultural irrigation systems. However, these impacts will be mitigated by close coordination with the property owners during and after the land acquisition phases of development. To the extent required, all necessary agricultural infrastructure will be replaced or relocated to ensure continued high levels of agricultural production in the area. Cane haul crossings will be signalized and consolidated into one crossing location.

Other agricultural resources may be impacted by the irretrievable loss of productive agricultural land now used at the seed corn production facility near the intersection of Kihei Road and Mokulele Highway. However, the seed corn facility can be relocated to other lands in the area with similar capability for this kind of agricultural production.

5.2 IMPACTS TO INFRASTRUCTURE SYSTEMS

The proposed project will improve regional traffic circulation and the subsequent response times for police, fire and emergency medical operations. Easements for electrical/communication lines will be established, and water and wastewater lines will not be impacted over the long term. Other impacts to recreational facilities and public infrastructure will not be significant.

5.2.1 Transportation

The primary objective of the proposed project is to improve the overall regional transportation circulation pattern and roadway system capacity in central Maui. These improvements are necessary in response to the growing population on Maui and the projected corresponding increase in overall traffic between Kihei and Wailuku-Kahului. As described in the Traffic Alternatives Study, Mokulele Highway Widening (Appendix A), the proposed widening and intersection reconfigurations are consistent with the recommendations contained in the MLRLTP, dated February, 1996.

In addition to the increased capacity of the highway linkages between Wailuku-Kahului and Kihei, the internal vehicular circulation patterns within these communities will be altered as traffic levels increase in the future. This is true along Puunene Avenue, within Puunene Town, and as Maui Lani is developed and becomes occupied. Although development of the proposed transportation improvements will impact existing traffic patterns, continuing in this manner without the proposed project will also result in major impacts to these residential areas along the improvement corridor. including increased commuting times, air quality impacts, and inefficient use of existing roadway infrastructure. This uncoordinated allocation of transportation infrastructure and financial resources does not address the future transportation needs generated by population growth and new development of relatively large residential areas planned for Wailuku-Kahului and Kihei.

Mitigative Measures

To address the projected increase in regional traffic, the MLRLTP recommended a series of island-wide transportation improvements that should be implemented on a phased schedule as warranted by future transportation growth. The proposed Mokulele Highway widening project is an important element of this "Maui Long Range Land Transportation Plan". As such, proposed improvements to Puunene Avenue, Maui Lani Parkway, and Kihei Road will also be necessary to contribute toward mitigation of anticipated impacts to regional transportation patterns associated with the project. In addition to the widening improvements previously described, the intersection of the realigned Mokulele Highway with the extended Hansen Road should be monitored, and a traffic signal should be installed when warranted. Due to its proximity to the Kuihelani Highway/Puunene Avenue intersection, the two signals should be interconnected and coordinated.

On balance, however, development of the proposed project will impact existing transportation systems in a positive manner.

According to the Traffic Study provided in Appendix A:

"The widening of Mokulele Highway and the reconfigurations of its intersections at Puunene Avenue and Piilani Highway are needed to accommodate the projected Year 2020 peak hour demand. The improvements proposed are consistent with the most current long-range planning documents and should be implemented."

5.2.2 Drainage

During the project's construction phases, potential water quality impacts may occur which could increase sedimentation and turbidity of off-site runoff. After construction, the quantity of runoff from impermeable surfaces will increase, however, control of runoff will be facilitated by construction of drainage structures designed to direct the flow of runoff and promote the recharge of underground waste. Drainage patterns and capacity of existing drainage structures will be improved to more accurately reflect the natural mauka/makai drainage patterns.

Mitigative Measures

The use of Best Management Practices and implementation of the State Department of Health's Non-point Source Management Plan's soil erosion control measures, will mitigate the potential water quality impacts.

5.3 MITIGATION MEASURES

The proposed widening of the Mokulele Highway and a portion of Puunene Avenue, will impact the surrounding environment primarily in terms of positive impacts on noise, air, and traffic. In addition, the project would also generate increased employment for residents of the State and County during the construction period, but more importantly, provide improved transportation efficiency for area residents. These positive aspects of the project should be weighed against the commitment of resources required to implement the project such as irretrievable resource commitment of water, land, energy, capital and construction materials which are typical of all new construction.

5.3.1 Flora

Field surveys have indicated that no endangered or threatened plant species are located within the proposed improvement area or would otherwise be impacted by the proposed project (Appendix C). The report describes the survey methodology and findings for the land area impacted by the Mokulele widening and the improvement corridor which encompasses the location of the Puunene Bypass.

As summarized in the Flora Report, no mitigation measures are required since no endangered or threatened species were identified within the project area. However, with the establishment of new landscaping within the highway corridor, the diversity of plant species will increase compared to the existing agricultural (sugar cane) and scrub species.

5.3.2 Fauna

Impacts to fauna may be of concern only along the Mokulele Highway near the Kealia National Wildlife Refuge ("NWR"). However, the land area buffer between the highway and the Kealia

NWR is substantial. In addition, the existing Mokulele Highway has been present for many years with little or no identifiable impact on wildlife. Therefore, the likely impact to endangered fauna will not be significant (Appendix D) and no mitigation measures are required. All roadway improvements in this vicinity will occur on the side of the highway opposite the NWR.

5.3.3 Archaeological Resources

An archaeological reconnaissance survey has found no significant or important archaeological or cultural sites within the project corridor. One potential site (No. 50-50-09-4164) consisting of a World War II military dump site, is located adjacent to the Mokulele Highway right-of-way near the Old Puunene Airport. However, the proposed widening improvements have been designed to avoid this site during and after construction. As such, mitigation measures do not appear warranted at this time. During grubbing and grading, however, the Department of Land and Natural Resources will be contacted should subsurface remains, such as artifacts, deposits of charcoal or bones be found during construction activities. Work in the area will be stopped until the significance of the site and appropriate mitigation measures (if any) can be determined.

5.3.4 Air Quality

Air quality impacts may occur during construction from fugitive dust and vehicular emissions from construction equipment. After project completion, potentially higher levels of vehicular emissions may also result as regional traffic levels increase. During construction, Best Management Practices, such as watering exposed soils, establishment of vegetation and wind screens, will be employed as appropriate to reduce fugitive dust emissions.

According to the Air Quality Study, uncontrolled construction dust is projected to amount to approximately 1.2 tons per acre per month or more, depending on rainfall. Therefore, active work areas should be watered at least twice daily on days without rainfall. Wind screens, limitations on size of disturbed areas, use of mulching, establishment of landscaping, and covering trucks to reduce dust are all appropriate mitigation measures available to control fugitive dust.

After construction, capacity of the roadway will greatly improve with more efficient traffic flow and less idling time will result in more efficient combustion of hydrocarbon fuels. As such, overall air quality associated with vehicular emissions will generally improve with development of the proposed highway improvements. Permanent landscaping may provide additional mitigation through filtering of both dust and vehicular emissions as warranted in the future. Air quality impacts are described in Appendix E.

5.3.5 Noise

Temporary noise quality impacts may occur during construction from the use of heavy construction equipment and after project completion along the highway corridor due to higher projected levels of traffic. Permanent noise increases that do occur will generally not be perceptible. However, if the project were not built, increased traffic levels would likely be shifted to other locations on the roadway system and subsequently increase noise along other roadways since traffic levels will increase as a result of population growth with and without the project.

During construction, heavy equipment will utilize mufflers in accordance with applicable Department of Health noise regulations. Construction activity will also be undertaken primarily during day light hours provided no significant disruption to traffic flows can be achieved. Relative to the noise of similar equipment used for agricultural harvesting, noise levels during construction should not be significantly greater. Due to the relatively small increases in projected noise, the Noise Assessment Study (Appendix E) indicates that no additional mitigation measures are required.

5.3.7 Topography/Drainage

Because the roadway corridor does not contain significant variation in topography, drainage improvements will focus primarily on establishment of new drainage patterns and management of storm water runoff flows. In addition to the design of drainage systems, Best Management Practices will be utilized in accordance with an approved Drainage Management Plan and National Pollutant Discharge Elimination System (NPDES) permit requirements to mitigate potential off-site impacts from erosion.

5.3.8 Transportation

Implementation of the proposed project will not stimulate new demand for transportation infrastructure, but respond to the regional and island-wide transportation needs of the existing and future population. The project will not increase the level of traffic, but provide for additional traffic in the future. As such, no mitigation measures are required to address any project related impacts that may affect the regional transportation system. Implementation of the MLRLTP will adequately mitigate future impacts on other transportation infrastructure.

5.3.9 Agricultural Resources

Although the land area required for the proposed project will irretrievably utilize agricultural lands, the primary concerns are maintenance of existing agricultural infrastructure. It is critical that all agricultural infrastructure and existing operations be maintained or modified to allow them to continue without interruption.

Should some use of land at the seed corn production area be necessary, this production will likely be accommodated on lands adjoining the existing corn fields. The State Department of Transportation will coordinate construction activities with the seed corn facility management to provide ample lead time for relocation as applicable.

5.3.10 Sensitive Habitats

No sensitive habitats are associated with the project and no mitigation measures are required.

5.3.11 Visual Impacts

The visual impact of the project will be buffered by landscaping in selected areas and designed to integrate topographic modifications into the existing landforms surrounding the roadway corridor. Relocation of overhead power lines will also improve the overall appearance of the existing power poles.

By implementing these design measures and opening up new visual perspectives to the traveling public, negative visual impacts that may be associated with the project should be balanced against the positive.

5.3.12 Public Services

The project will not negatively impact the State or County capability to deliver public services to the community. Rather, the increase in capacity and improved travel times afforded by the project will expand the County's ability to provide emergency services, and support the movement of goods and services in a more efficient and timely manner.

5.3.13 Summary of Mitigation Measures

To mitigate any negative impacts that may occur, the following summary of mitigative measures previously described are recommended to minimize the potential adverse environmental impacts of the proposed project.

Short term:

- Minimize the quantity of exposed soils by designing the proposed improvements to limit the area of cut and fill.
- Implement phased construction of improvements as applicable.
- Installing dust screen(s) in areas where fugitive dust could impact residential land areas.
- Frequent watering during grading should be used to maintain dust control.
- Use of mulching and establishment of ground covers as soon as practicable once grading has been completed.

- Establish on-site retention areas as soon as practical during construction to permit for siltation of particulates in storm water.
- Comply with all applicable noise control regulations of the State Department of Health.
- Locate all major construction activities and staging areas away from Kealia Pond on the mauka side of Mokulele Highway.

Long term:

- Use of appropriate engineering, design and construction measures to ensure adequate drainage of the highway corridor.
- Establish wind screens using plant materials, wood, or masonry materials as appropriate to limit fugitive dust, visual impacts, and noise.
- Use appropriate landscaping to improve the visual attractiveness of the area and to screen potential sources of noise and light from residential areas.
- Design proposed improvements to be integrated into surrounding landforms and topography.
- Maintain improvements to permit adequate drainage of surface runoff and endurance of landscape buffers.

SECTION 4(f) EVALUATION

SECTION 6.0

6.0 SECTION 4(f) EVALUATION

According to Section 771.135 Section 4(f) (49 U.S.C. 303), the Federal Highway Administration may not approve the use of land from a significant publicly owned public park, recreation area, or wildlife and waterfowl refuge, or any significant historic site unless a determination is made that there is no feasible alternative and the action minimizes harm to the property.

Consideration under Section 4(f) is not required when the Federal, State, or local officials having jurisdiction over Section 4(f) lands determine that the entire site is not significant. Should Section 4(f) lands be determined significant, alternative actions must be considered to mitigate potential negative impacts. To determine the project's applicability to Section 4(f) requirements, the ownership and use of all lands within the proposed highway improvement corridor have been evaluated.

The widening of Mokulele Highwaywill not affect any publicly owned public park, recreation area, or wildlife and waterfowl refuge, or any significant site. There are no publicly owned parks or recreation areas within the project area. The nearest wildlife and waterfowl refuge, Kealia National Wildlife Refuge, is located approximately 600 feet from the nearest point along the southern end of the project area.

To identify the potential impact of the project on archaeological resources in the area, the entire corridor and bypass alignment have been surveyed. The findings of the survey are provided in Appendix B. According to the survey, no surface archaeological features were identified. In addition, since the lands located within the highway improvement corridor have been used for sugar cane cultivation for many years, the presence of any significant subsurface archaeological resources is also not expected.

Based on the land use and ownership assessment conducted for this project, it has been determined that Section 4(f) lands will not be required for development of the highway improvements and that the requirements of this section are not applicable to the project.

ENVIRONMENTAL CONSEQUENCES AND EFFECTS

SECTION 7.0

7.0 ENVIRONMENTAL CONSEQUENCES AND EFFECTS

7.1 CHAPTER 343, HAWAII REVISED STATUES

In general, the proposed project would have beneficial and/or minimal impacts on the physical, natural and socioeconomic environments of the project area. The summary of impacts listed below is based on published information concerning the study area and projections of the types of activities that would be associated with the proposed project.

According to Department of Health Rules (Section 11-200-6) and Chapter 343, HRS, preparation of an Environmental Assessment and/or an Environmental Impact Statement, is required under the following circumstances.

- Use of state or county lands
- Use of lands within the State Conservation District
- Use within the shoreline area
- Any use within any historic site
- Any use within the Waikiki-Diamond Head area of Oahu
- Any amendment to existing county general plans
- Use of State or County funds
- Construction or modification of helicopter facilities

Because the proposed highway improvements will require the use of State funds for construction purposes, Chapter 343, HRS is triggered and preparation of an Environmental Assessment and/or Environmental Impact Statement is required. In addition, Federal regulations require preparation of an Environmental Impact Statement in accordance with the National Environmental Policy Act (NEPA).

7.2 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

In addition to the Hawaii Revised Statutes (HRS) regarding the preparation of Environmental Impact Statements, the Federal government also requires that an EIS is prepared in accordance with the policies and procedures of the Federal Highway Administration (FHWA), Urban Mass Transportation Administration (UMTA), and National Environmental Policy Act (NEPA).

Under Part 771-Environmental Impact and Related Procedures, Section 23 CFR part 771.115 (a) (2) "A highway project of four or more lanes on a new location" qualifies as an action triggering a Class I (EISs). The Class I category of EIS actions, are considered those that significantly affect the environment and normally require preparation of an EIS in accordance with NEPA requirements.

Inasmuch as the proposed Mokulele Highway will be widened to four lanes in essentially the same location, preparation of an EIS in accordance Part 771 and NEPA is not required if no significant environmental impacts are identified in the Environmental Assessment.

7.3 DIRECT AND INDIRECT CUMULATIVE EFFECTS

According to the MLRLTP, a series of island-wide transportation improvements will be required before the year 2020 in order to accommodate the projected island-wide increases in traffic. Overall, the increase in island-wide traffic is due to the projected growth in population, expansion of the visitor industry, growth in employment opportunities, and not development of the proposed highway improvements. Consequently, cumulative and secondary environmental impacts typical of highway improvement projects will occur during and after project development. Existing traffic patterns will be altered, LOS at regional intersections will be impacted, and the physical environment will be altered within the construction area. However, these existing cumulative impacts will improve the overall level of service of the Mokulele Highway and overall transportation system if improvements are implemented as called for the MLRLTP.

If the project were not built, however, traffic will continue to grow at projected rates, growth in Kihei-Makena will increase with visitor growth, and residential development in Wailuku-Kahului will ultimately be realized. Therefore, the project represents a pro-active approach to transportation improvement requirements rather than re-active after traffic levels have exceed capacity.

Consequently, cumulative and secondary environmental impacts would continue to occur in response to population growth on an island-wide basis. Addressing infrastructure needs through planning and construction before they reach critical levels will ensure that those impacts which do occur can be effectively mitigated.

Weighing the effects of the unplanned or "no action" alternative should receive commensurate consideration during the planning phases of project development and review of cumulative effects. Clearly, cumulative growth in traffic will occur even without development of the project. Therefore, project development if approved would mitigate the potential negative cumulative traffic, air, and noise impacts that could occur in the future if the project were not built.

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

As previously discussed, the project area is largely vacant except for the existing agricultural uses associated with sugar cane production. No relocation of residences or other structures will be required. Long-term environmental impacts from the current use, primarily air quality impacts resulting from exposed areas, harvesting activities, potential erosion of soils, and air pollution from agricultural burning are generally considered as undesirable consequences of sugar cane production.

Consequently, these existing impacts to the environment will no longer occur on the subject lands within the highway improvement corridor. In addition, the impact of vehicular emissions will be mitigated by the more efficient use of transportation infrastructure.

Retaining the property in its present use (the "No Action" alternative), would present a less than optimum use of the land especially considering the need to link existing and future residential land uses with future employment centers. Traffic growth would still occur with no action and likely move traffic onto other regional transportation corridors that provide alternative routes making them more congested.

Consequently, the proposed project would result in potential social and economic benefits to the community in the form of increased job opportunities, income growth, and increases in tax revenues. Direct full and part-time employment opportunities and temporary construction employment will also be generated by the project, and these in turn will impart economic benefits to the regional economy.

Long-term impacts to the environment are generally acceptable provided appropriate mitigation measures are implemented. Physical attributes, including the project's relationship to the existing transportation system, other infrastructure, and land use characteristics along the highway corridor, are appropriate for the highway improvements proposed. The consultant studies performed for this EA have also indicated that the proposed project is generally compatible with the existing natural environment.

Through careful site planning, the improvement corridor will be used in a manner that would essentially maintain the open space character of the region for the long term benefit of existing and future residents. Enhanced economic opportunities for the community would also be directly and indirectly created.

7.5 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES THAT WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

The development of the proposed highway improvements would result in the irreversible and irretrievable commitment of certain natural and fiscal resources. Major resource commitments include the land on which the proposed project is located and the financial commitment of construction materials, manpower and energy required for the project's completion. However, the impacts reflected by the commitment of these resources, should be weighed against the positive socio-economic benefits that could be derived from the project versus the consequences of either taking no action or pursuing another less beneficial use of the property.

7.6 PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

The probable adverse environmental effects are air and noise pollution, erosion, alteration of regional traffic patterns and capacity of existing intersections, roadways, etc., and visual impacts. Although these environmental effects cannot be avoided and similar impacts generally result from essentially all new development related to population growth, the relative impact of the highway improvements on the surrounding environment will be mitigated.

Short-term impacts will result during the initial construction phase which will require on-site grading, trenching, and movement of vehicles within the project site. These activities will generate localized noise and dust during construction periods. Mitigation measures to minimize adverse air quality would include frequent watering of unpaved roads and construction areas, dust screens, and mulching and planting of ground cover, and establishment of other vegetation as soon as possible after construction. Construction activities would be limited to daytime hours and comply with all applicable noise control regulations of the State Department of Health. However, even with these mitigation measures, some changes to the environment will occur.

After construction, fugitive dust from agricultural operations may be reduced due to permanent landscaping/ground cover, and paved area. The proposed project is not expected to have any impact on the micro climate of the project area or region. Planned improvements would not effect existing wind patterns; and new landscaping will not significantly effect temperature, although some localized cooling can be expected to result from the establishment of landscaping. Additional paved area may induce localized heating. No specific or predominate natural feature is visually associated with the project site.

The proposed widening of Mokulele Highway will alter the pattern of transportation circulation within central Maui as described in the Maui Long-Range Land Transportation Plan. The overall regional transportation system efficiency will be enhanced, but localized impacts will occur at certain intersections and along the highway corridor. These impacts may be applicable in terms of the visual, noise, air, and traffic impacts associated with traffic growth. However, when weighed against the positive impacts associated with the project, the overall positive impacts associated with the project outweigh the unavoidable negative that may occur.

The following impacts reflect those that are unavoidable, but none are considered significant when appropriate mitigation measures are applied.

1. Temporary increases in soil erosion may occur during construction from fugitive dust emissions and water erosion during intense storm events. However, current levels of soil erosion associated with agricultural activities could be reduced by the establishment of landscaping and drainage improvements.

2. Existing vegetation will be removed, however, no "natural" vegetation consisting of native species remains.

3. Existing faunal habitats will be altered, however, new landscaping will increase plant diversity and the availability of habitat for some species. Construction activity will also affect the feeding patterns of wildlife, however, no important faunal habitats exist within the highway corridor project area.

4. The visual impacts associated with a widened highway will occur, but no significant negative visual impacts are anticipated.

5. Localized noise levels within the highway corridor will increase during construction and minor increases in cumulative noise will also increase as the population of Maui grows in the future. However, the widening of Mokulele Highway will not create new significant increases in traffic noise.

6. Long-term topographical modifications to existing agricultural fields will be required. Drainage improvements will control the quantity of surface runoff and the quality of surface runoff should not be significantly impacted.

7. Treatment of any unknown archaeological sites which could be uncovered during construction will be undertaken in accordance with State laws and regulations.

8. Regional traffic levels will increase on the entire transportation system and at specific intersections. However, this increase in traffic levels will occur with or without the proposed project.

9. Air quality at localized intersections will be slightly impacted by increased vehicular emissions, although the cumulative quantities of air pollutants discharged into the atmosphere will be reduced relative to the "no action" alternative.

7.7 SUMMARY OF UNRESOLVED ISSUES

According to the Content Requirements, Section 11-200-17(n) of the Department of Health Environmental Impact Statement Administrative Rules, a summary of "unresolved issues" should describe how such issues will be resolved and what overriding reasons there are for proceeding without resolving the issues. As herein described, the unresolved issues applicable to the project deal primarily with future actions and decisions of governmental bodies that cannot be determined at this time.

The County's Wailuku-Kahului Community Plan must be updated to allow construction to begin, however, detailed site planning, preparation of construction plans, and securing the required funding will be required before construction can occur. As such, the pending adoption of the applicable Wailuku-Kahului Community Plan remains as an unresolved issue. Funding of the project construction remains unresolved, although likely funding will be derived from the State and Federal governments.

Other unresolved issues associated with the proposed project are characteristic of similar infrastructure development projects in Hawaii. Agricultural land will be utilized; visual alteration of the existing open space/agricultural land will occur; noise and traffic patterns will be altered; and air pollution will occur but generally within the Federal and State allowable levels except under extremely rare atmospheric conditions. Indirect impacts will also occur that could affect lifestyles and economic conditions for many residents. These environmental issues, as they arise, will be resolved through adoption of appropriate mitigative measures and coordination with the applicable Federal, State, and Local governmental agencies.

As herein described, the unresolved issues applicable to the project deal primarily with future actions and decisions that cannot be determined at this time.

Overview

The unresolved issues are described below and include: 1) timing and completion of proposed improvements, 2) development of construction plans, and 3) traffic monitoring and mitigation.

Timing of the Completion of the Proposed Improvements

The construction timing for the proposed improvements will be determined as funds become available. Therefore, this issue will remain unresolved until funding is secured.

Development of Construction Plans

The physical design of improvements cannot be known until construction plans are prepared and approved. Therefore, this issue will remain unresolved until more detailed planning and engineering design can be undertaken.

Traffic Monitoring and Mitigation

Although the proposed improvements will alter area-wide transportation patterns, traffic congestion will remain high with or without development of the proposed project. As future regional transportation patterns are permanently established, Maui will evolve into an important residential, employment, and commercial center. As such, continued transportation planning and periodic monitoring of traffic levels should be implemented to identify when traffic mitigation measures and system improvements are warranted.

Because the relatively high levels of traffic congestion are likely to continue even after improvements to the system are in place, this will remain as an unresolved issue into the foreseeable future. However, with proper attention to traffic monitoring and planning of future transportation improvements, the existing level of service on major roadways should not be significantly impacted.

Alteration of Visual Resource

Alteration of existing visual resources will occur. To some viewers, this alteration of the visual resource will represent a significant loss. To other viewers, the visual impact of the proposed improvements will be negligible. Therefore, determining the significance of altered visual resources will remain unresolved, depending on the priorities and perception of the viewer.

Conclusion

None of the unresolved issues significantly impact the environmental quality of the area. Over the development period, Central Maui will evolve in accordance with the needs of the community and future growth of population. The significant range of community and socio-economic benefits provided by the project warrants implementation and the coordination with government agencies regarding the unresolved issues should continue.

FINDINGS AND REASONS FOR SUPPORTING DETERMINATION

SECTION 8.0

8.0 DETERMINATION, FINDINGS AND REASONS FOR SUPPORTING DETERMINATION

8.1 SIGNIFICANCE CRITERIA

According to the Department of Health Rules (11-200-12), an applicant or agency must determine whether an action may have a significant impact on the environment, including all phases of the project, its expected consequences both primary and secondary, its cumulative impact with other projects, and its short and long-term effects. In making the determination, the Rules establish "Significance Criteria" to be used as a basis for identifying whether significant environmental impact will occur. According to the Rules, an action shall be determined to have a significant impact on the environment if it meets any one of the following criteria:

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resources;

The proposed project will not impact scenic views of the ocean or any ridge lines in the area. The visual character of the area will change from the current agricultural land to an improved 4-lane highway which is compatible with the surrounding land use plans and programs being implemented for the region. The highway corridor is comprised of "Prime" agricultural land which is an important resource. Development of drainage systems will follow established design standards to ensure the safe conveyance and discharge of storm runoff. In addition, the subject property is located outside of the Count's Special Management Area (SMA).

As previously noted, no significant archaeological or historical sites are known to exist within the corridor. Should any archaeologically significant artifacts, bones, or other indicators of previous on-site activity be uncovered during the construction phases of development, their treatment will be conducted in strict compliance with the requirements of the Department of Land and Natural Resources.

(2) Curtails the range of beneficial uses of the environment;

Although the subject property is suitable for agricultural uses, the land area adjoining the Mokulele Highway is naturally suited for transportation purposes due to its location proximate to an existing highway system. To return the site to a natural environmental condition is not practical from both an environmental and economic perspective.

(3) Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS; and any revisions thereof and amendments thereto, court decisions, or executive orders;

The proposed development is consistent with the Environmental Policies established in Chapter 344, HRS, and the National Environmental Policy Act.

(4) Substantially affects the economic or social welfare of the community or state;

The proposed project will provide a significant contribution to Maui's future population by providing residents with the opportunity to "live and work in harmony" in a high quality living environment. The proposed project is designed to support surrounding land use patterns, will not negatively or significantly alter existing residential areas, nor will unplanned population growth or its distribution be stimulated. The project's development is responding to projected population growth rather than contributing to new population growth by stimulating in-migration.

(5) Substantially affects public health

Impacts to public health may be affected by air, noise, and water quality impacts, however, these will be insignificant or not detectable, especially when weighed against the positive economic, social, and quality of life implications associated with the project. Overall, air, noise, and traffic impacts will be significantly positive in terms of public health as compared to the "no action" alternative.

(6) Involves substantial secondary impacts, such as population changes or effects on public facilities

Existing and planned large-scale housing development projects within Wailuku-Kahului and Kihei will contribute to a future population growth rate that will require expansion of public and private facilities and services. These improvements will become necessary as the overall population of Maui grows and settlement patterns shift. However, the proposed project will not in itself generate new population growth, but provide needed infrastructure the area's present and future population.

In addition, new employment opportunities will generate new sources of direct and indirect revenue for individuals and the County of Maui by providing both temporary and long-term employment opportunities during the construction period. Indirect employment in a wide range of service related industries will also be created from construction during project development.

(7) Involves a substantial degradation of environmental quality;

The proposed development will utilize existing vacant agricultural land. With development of the proposed project, the addition of urban landscaping will significantly mitigate the visual impact of the development as viewed from outside the site while the overall design will complement background vistas.

Makai views from the subject property are available, however, they are not significant nor generally available to the public in the property's present restricted condition.

(8) Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions;

By planning now to address the future needs of the community and the State, improvement of the transportation system is consistent with the long term plans for Maui. No views will be obstructed or be visually incompatible with the surrounding area.

(9) Substantially affects a rare, threatened or endangered species or its habitat;

No endangered plant or animal species are located within the highway corridor.

(10) Detrimentally affects air or water quality or ambient noise levels;

Any possible impact to near-shore ecosystems resulting from surface runoff, will be mitigated by the establishment of on-site retention basins during the construction phases of development. After development, retention areas within the highway right-of-way will serve the same function to encourage recharge of the groundwater.

(11) Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, freshwater, or coastal waters.

Development of the property is compatible with the above criteria since there are not environmentally sensitive areas associated with the project and the physical character of the corridor has been previously disturbed by agricultural uses. As such, the property no longer reflects a "natural environment". Shoreline, valleys, or ridges will not be impacted by the development.

(12) Substantially affects scenic vistas and view planes identified in county or state plans or studies;

Due to topographical characteristics of the property, views of the area to be developed are generally not significant although they are visible. The majority of the proposed project will not be visible, except from higher elevations by the general public or from persons traveling along the highway.

(13) Requires substantial energy consumption.

The location of the proposed project is between Maui's major growth areas. This relationship will reduce travel times and energy consumption after project build out through efficiencies gained by the increased capacity of the highway. Construction of the proposed project will not require substantial energy consumption relative to other similar projects.

DETERMINATION

SECTION 9.0

9.0 DETERMINATION

Pursuant to Section 23 CFR part 771.115 (a) (4) "New construction or extension of a separate roadway for buses or high occupancy vehicles not located within an existing highway facility" qualify as Class I (EISs) actions that significantly affect the environment and normally require an EIS. However, the proposed widening of Mokulele Highway and associated intersection improvements does not constitute "new construction or extension of a separate roadway." Existing and projected traffic congestion on the Mokulele Highway is expected to be alleviated through the construction of the proposed improvements and may indirectly improve levels of service within Kihei, Wailuku-Kahului, and proposed Maui Lani development.

The proposed widening of the Mokulele Highway and Puunene Avenue may impact the surrounding environment in terms of visual, noise, air, and traffic impacts. However, these environmental impacts will not be significant considering the existing use and location of the Mokulele Highway corridor and the potentially negative environmental impacts (i.e., air quality and traffic impacts) that may occur if the project is not built. Therefore, a "Finding of no Significant Impact" (FONSI) is determined for the project.

AGENCIES WHICH HAVE BEEN CONSULTED IN THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

SECTION 10.0

10.0 AGENCIES WHICH HAVE BEEN CONSULTED IN THE PREPARATION OF THE FINAL ENVIRONMENTAL ASSESSMENT

10.1 STATE AGENCIES

Department of Agriculture
Department of Land and Natural Resources
State Historic Preservation Division
Department of Transportation
Office of Planning

10.2 COUNTY AGENCIES

County of Maui Planning Department
County of Maui Department of Public Works
County of Maui Department of Parks and Recreation

10.3 FEDERAL AGENCIES

US Environmental P rotection Agency
US Department of Agriculture
US Fish and Wildlife Service

10.4 ORGANIZATIONS

Hawaiian Electric Company

(ALSO SEE APPENDIX J)

REFERENCES

SECTION 11.0

11.0 REFERENCES

Austin, Tsutsumi & Associates, *Maui Long-Range Highway Planning Study, Islandwide Plan*, prepared for State Of Hawaii, Department of Transportation and County of Maui, Departments of Planning and Public Works, May 1991

Brier, James A., *Reference Maps of the Islands of Hawaii, Map of Maui, The Valley Isle*, Fourth Edition, Published by the University of Hawaii Press.

County of Maui, Departments of Planning and Water Supply, *Technical Report and Water Use Development Plan*, March 1990.

Decision Analysts Hawaii, Inc., *Hawaii's Sugar Industry and Sugarcane Lands: Outlook, Issues and Options*, Prepared for State of Hawaii, department of Business and Economic Development, April 1989.

Helber Hastert & Fee, Planners, Inc., *Draft Report, Puunene Airport Area Master Plan/MEO Transportation Facility Concept Plan, Pulehunui, Maui, Hawaii*, Prepared for Planning Department, County of Maui, November 23, 1994.

Kaku Associates, *Draft Final Maui Long Range Land Transportation Plan*, prepared for State Of Hawaii, Department of Transportation and County of Maui, Departments of Planning and Public Works, February 1996

State of Hawaii, Department of Business, Economic Development, and Tourism, *Data Book*, 1994.

State of Hawaii, Department of Transportation, *Hawaii Statewide Uniform Design Manual for Streets and Highways*, October 1980.

Streams, Harold T. and G.A. McDonald, *Geology and Groundwater Resources on the Island of Maui, Hawaii*, Hawaii Division of Hydrography, Bulletin 7, 1989.

U.S. Department of Agriculture, August 1972. *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii.* Soil Conservation Service in cooperation with the University of Hawaii Agricultural Experiment Station.

University of Hawaii, Department of Geography, *Atlas of Hawaii*, Second Edition, 1983.

APPENDICES

TRAFFIC ALTERNATIVES STUDY
MOKULELE HIGHWAY WIDENING

APPENDIX A

TRAFFIC ALTERNATIVES STUDY

MOKULELE HIGHWAY WIDENING

CENTRAL MAUI, HAWAII

January 1997

PARSONS BRINCKERHOFF

Over a Century of Engineering Excellence

TRAFFIC ALTERNATIVES STUDY

MOKULELE HIGHWAY WIDENING

Central Maui, Hawaii

Prepared for:
Warren S. Unemori Engineering, Inc.
2145 Wells Street, Suite 403
Wailuku, Hawaii 96793
Ph: (808) 242-4403

Prepared by:
Parsons Brinckerhoff
Quade & Douglas, Inc.
Pacific Tower Suite 3000
1001 Bishop Street
Honolulu, Hawaii 96813
Ph. 808-531-7094

January 1997

PBQD Ref.: 16221A02

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. INTRODUCTION

The State of Hawaii Department of Transportation (SDOT) proposes to widen Mokulele Highway from a two-lane undivided highway to a four-lane divided highway between Puunene Avenue and Piilani Highway. The project location is shown in Figure 1.

As part of this improvement, the Mokulele Highway/Puunene Avenue intersection will be realigned to provide a smoother Mokulele Highway-Puunene Avenue connection. Similarly, the Mokulele Highway/Piilani Highway intersection will be realigned to provide a smoother connection between Mokulele Highway and Piilani Highway in Kihei.

This project has been identified as a highway improvement in the Draft Final Maui Long Range Land Transportation Plan[1], dated February 1996 and is, therefore, consistent with the most current regional transportation plan for Maui.

This study documents traffic analyses that were conducted to evaluate a No Build alternative, that assumes no improvements to Mokulele Highway or to its connections with Puunene Avenue and Piilani Highway, and the proposed action as previously described.

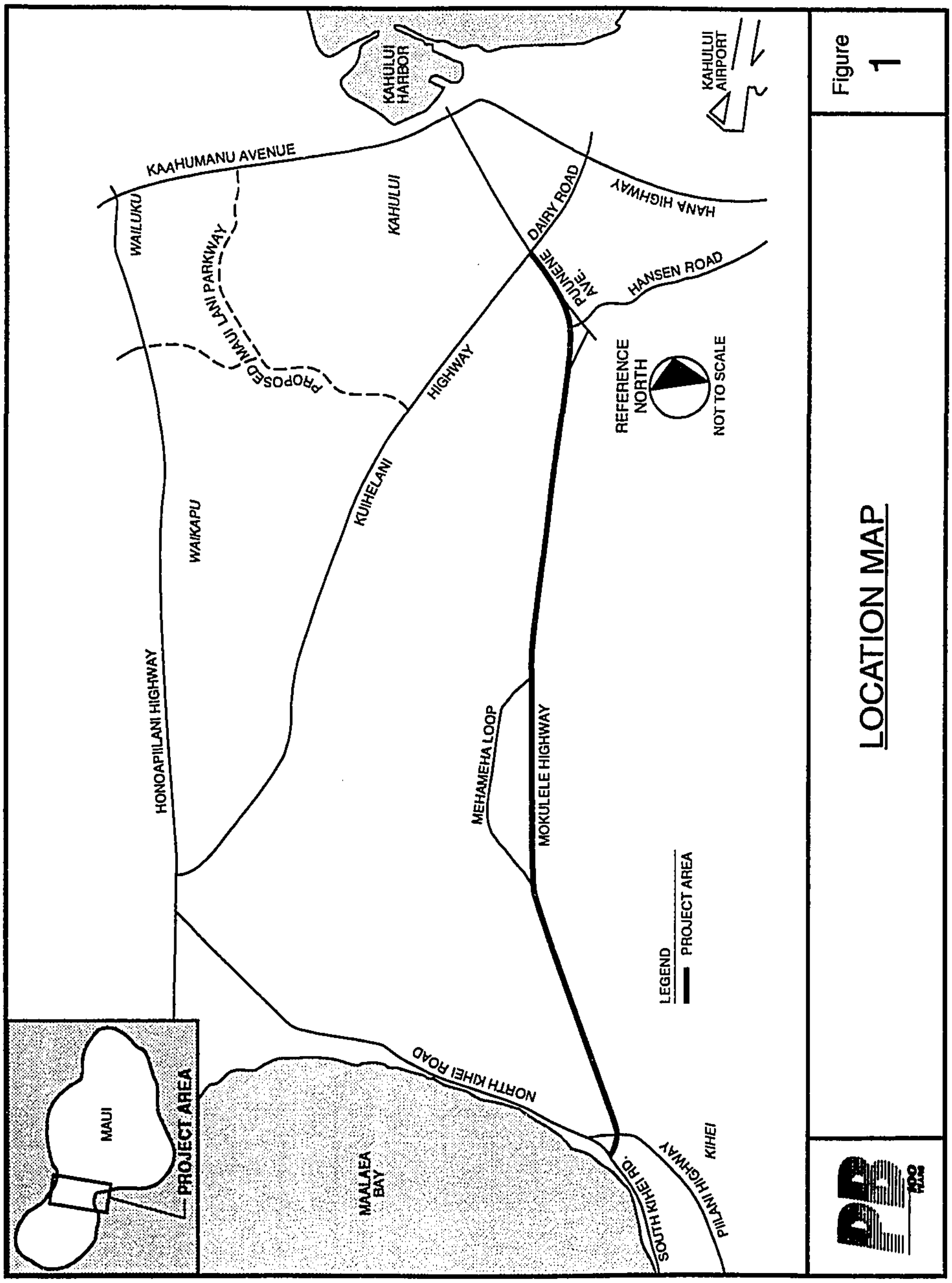


Figure 1

LOCATION MAP

II. EXISTING CONDITIONS

Existing Roadway System

Mokulele Highway

Mokulele Highway is a two-lane arterial that extends from Puunene Avenue near the sugar mill to Piilani Highway in Kihei. Mokulele Highway is a major segment in the highway system connecting the Wailuku/Kahului and Kihei/Makena areas. The posted speed limit is 45 miles per hour except through Puunene town where the posted speed limit is 30 miles per hour.

Puunene Avenue

Puunene Avenue extends from the sugar mill, crosses Kuihelani Highway/Dairy Road at a signalized intersection, continues through Kahului town and intersects Kaahumanu Avenue at a signalized intersection. Through Kahului town, Puunene Avenue is mostly a four-lane major collector roadway with median left-turn lanes. South of the Kuihelani Highway/Dairy Road intersection, Puunene Avenue is currently a two-lane roadway. Based on recommendations contained in the Draft Final Maui Long Range Land Transportation Plan[2], dated February 1996, it is expected to be widened to 4 lanes in the near future.

Piilani Highway

Piilani Highway is a two-lane arterial roadway with left-turn lanes provided at major intersections. It begins at Mokulele Highway and extends south to Makena, functioning as the primary roadway facility in the Kihei area. The posted speed limit on Piilani Highway is 45 mph. Long-range plans anticipate that Piilani Highway will be widened to 4 lanes.

Existing Traffic Conditions

Data Collection

Manual traffic counts were conducted at the intersections of Mokulele Highway with Piilani Highway and with Kihei Road during the morning peak period of 6:30 AM to

8:30 AM and during the afternoon peak period of 3:30 PM to 6:30 PM on June 5, and June 6, 1996. Manual traffic counts were also conducted at the intersections of Puunene Avenue with Kuihelani Highway/Dairy Road, with Mokulele Highway and with Hansen Road during the morning peak period of 6:30 AM to 9:30 AM and during the afternoon peak period of 3:30 PM to 6:30 PM on July 31, and August 1, 1996. The count data is included in Appendix A. The counts indicate that the morning peak hour occurs between 7:00 and 8:00 AM and the afternoon peak hour occurs between 4:30 and 5:30 PM. The existing peak hour turning movements are shown in Figure 2.

Traffic Operational Analysis

Methodology

The intersections studied within this report were evaluated using methodologies for unsignalized and signalized intersections documented in the 1994 Highway Capacity Manual[3] (HCM). Operating conditions along a highway and at an intersection are expressed as a qualitative index known as Level of Service (LOS) with letter designations ranging from A through F, with LOS A representing free-flow operating conditions and LOS F representing over-capacity conditions. Levels of Service for unsignalized intersections are evaluated for specific movements at the intersection (all movements of the minor street approaches and the left turns of the major street approaches), while Levels of Service for signalized intersections are evaluated for overall intersection operations.

Levels of Service for Mokulele Highway were evaluated using methodologies for two-laned roadways documented in the 1994 Highway Capacity Manual[4] (HCM). Two-lane roadways are evaluated for the two directions of traffic flow combined,. Level of Service criteria are described in Appendix B. The analysis worksheets are included as Appendix C.

Analysis Results

Mokulele Highway

Analysis results indicate that the highway presently operates at or near capacity during the peak hours (LOS E).

Mokulele Highway and Piilani Highway Intersection

Analysis results indicate that the intersection operates poorly (LOS E) during the morning and afternoon peak hours. This is primarily due to the southbound left turn from Mokulele Highway to eastbound Piilani Highway movement (LOS F), the westbound through movement, and the eastbound shared through/right turn movement (LOS E). Other movements operate well (LOS C or better).

Mokulele Highway and Kihei Road Intersection

The intersection operates well, with movements operating at LOS C or better during the morning and afternoon peak hours.

Mokulele Highway and Puunene Avenue Intersection

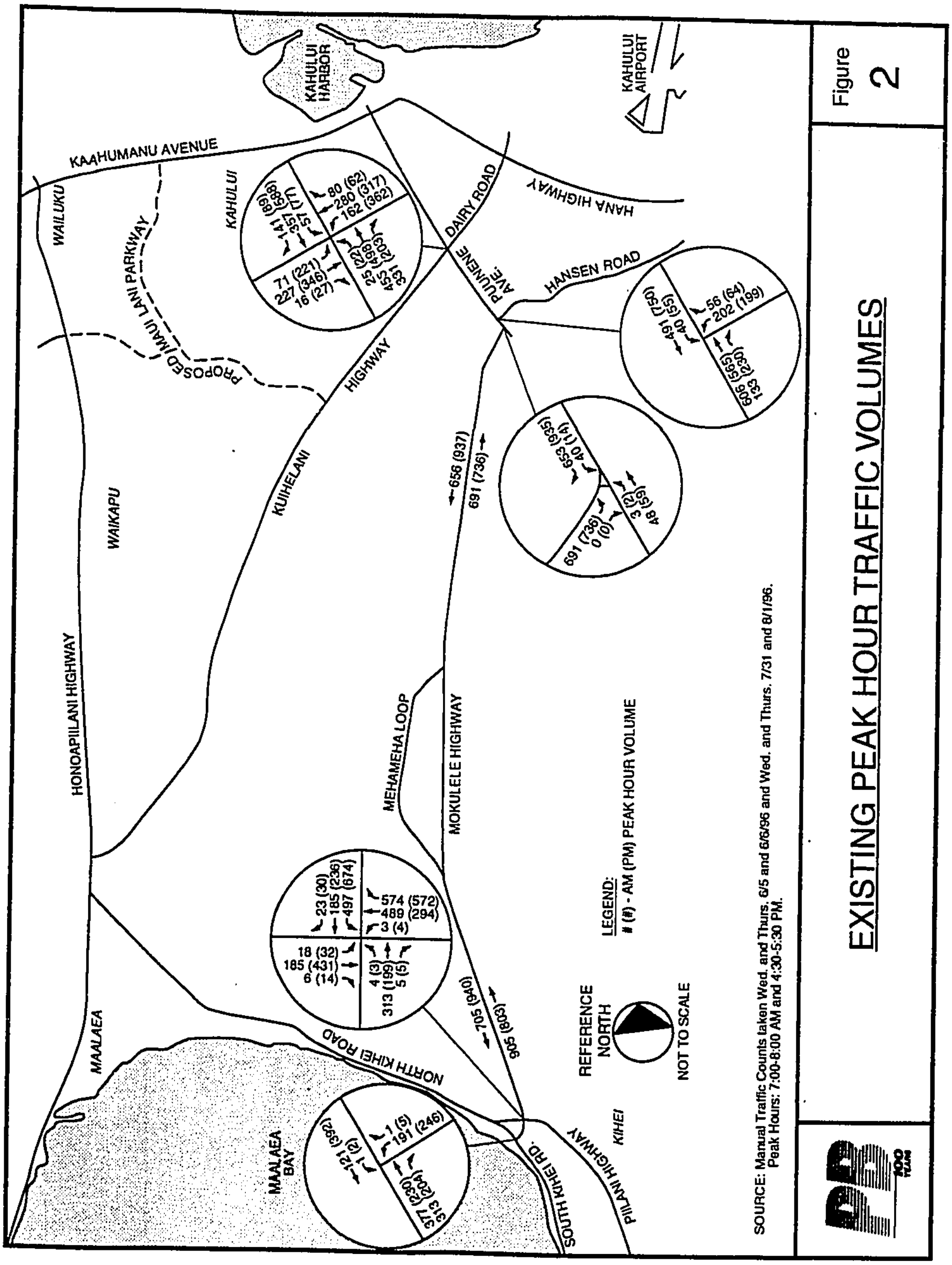
The intersection operates well overall with most movements operating at LOS C or better. The left turns from Puunene Avenue, exiting the sugar mill, onto Mokulele Highway experience significant delays, LOS D in the morning and LOS F in the afternoon. However, the magnitude of traffic is very low, 3 vehicles during the morning peak hour and 2 vehicles during the afternoon peak hour. Therefore the resulting overall delay for the intersection is low.

Puunene Avenue and Kuihelani Highway/Dairy Road Intersection

Analysis results indicate that the intersection operates adequately, at LOS D during the morning and poorly, LOS E in the afternoon. The primary reason appears to be the excessive cycle length (approximately 3 minutes) and the preference given to Kuihelani Highway/Dairy Road traffic which results in excessive delays for Puunene Avenue traffic. It should be noted that this intersection is in transition, as improvements are currently being constructed.

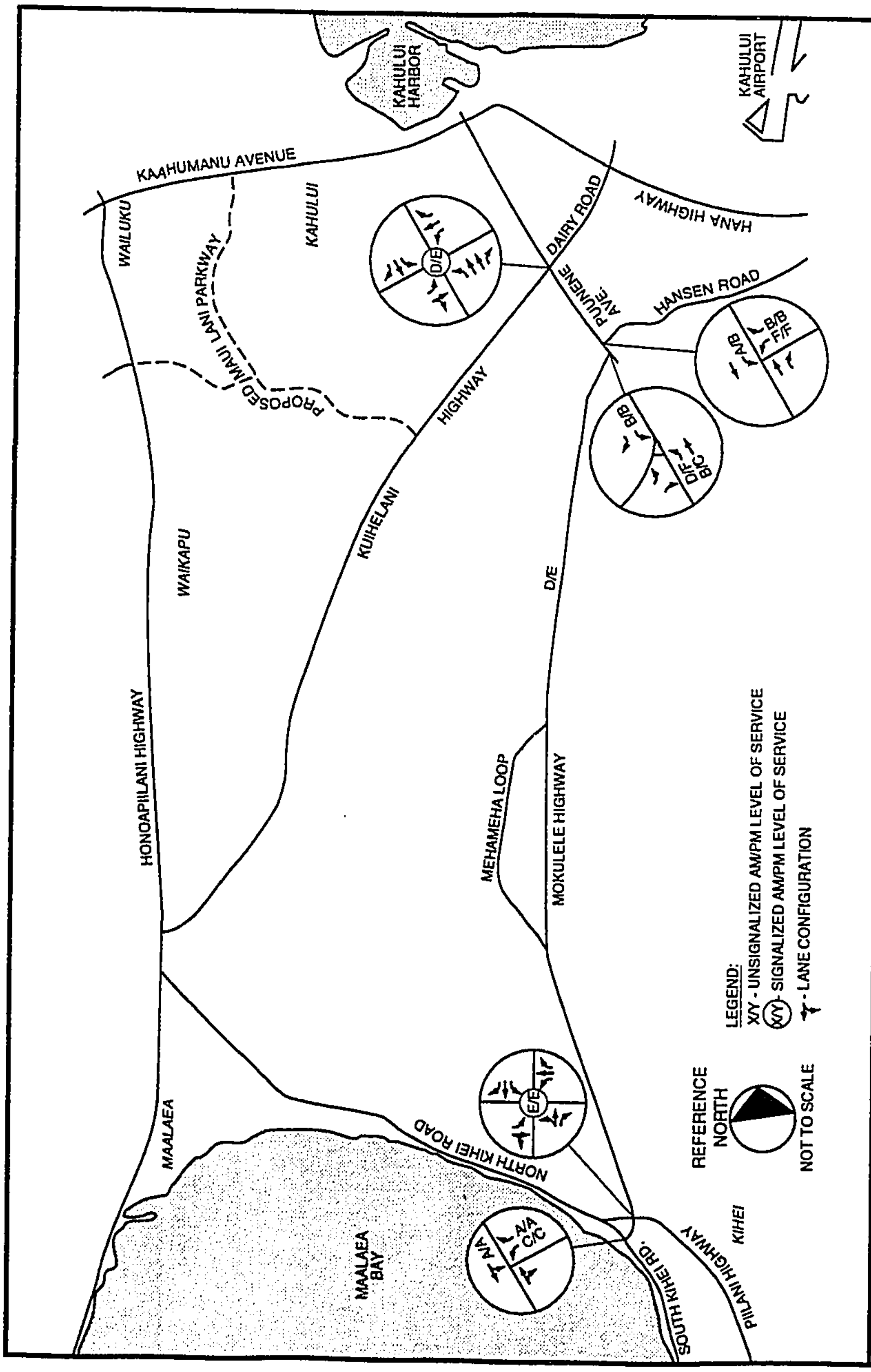
Summary of Results

The analysis results indicate that there currently are congested conditions along the Mokulele Highway and Puunene Avenue corridor from Kihei Road to Kuihelani Highway. Levels of service for existing conditions are displayed in Figure 3.



EXISTING PEAK HOUR TRAFFIC VOLUMES

Figure 2



EXISTING INTERSECTION LANE CONFIGURATION AND LEVEL OF SERVICE

Figure 3

III. YEAR 2020 NO BUILD

Traffic Volume Forecasts

Year 2020 traffic volume forecasts were obtained from the travel demand model used in developing the Draft Final Maui Long Range Land Transportation Plan[5], dated February 1996, Forecasts using the baseline transportation network, which included existing roadways and committed improvements, were used.

Turning movement volumes were developed from link volumes for the Year 2020 forecasts. The turning movement volumes were developed using the NCHRP 255 technique that made use of existing turning movements patterns to derive turning movements from projected approach and departure volumes at the study intersections.

The resulting Year 2020 AM and PM peak hour turning movements are shown in Figure 4.

Traffic Operational Analysis

Mokulele Highway

An assessment of Mokulele Highway indicated that the Year 2020 forecasts will exceed the capacity of the current two-lane highway (LOS F).

Mokulele Highway and Piilani Highway Intersection

Traffic forecasts are expected to exceed the capacity of the intersection. Analysis results indicate that the intersection will operate poorly (LOS F) during the morning and afternoon peak hours.

Mokulele Highway and Kihei Road Intersection

Analysis results indicate that the intersection will operate poorly (LOS F). Traffic turning left from Mokulele Highway onto Kihei Road will experience extreme delays and may result in queues extending through the Mokulele Highway/Piilani Highway intersection.

Mokulele Highway and Puunene Avenue Intersection

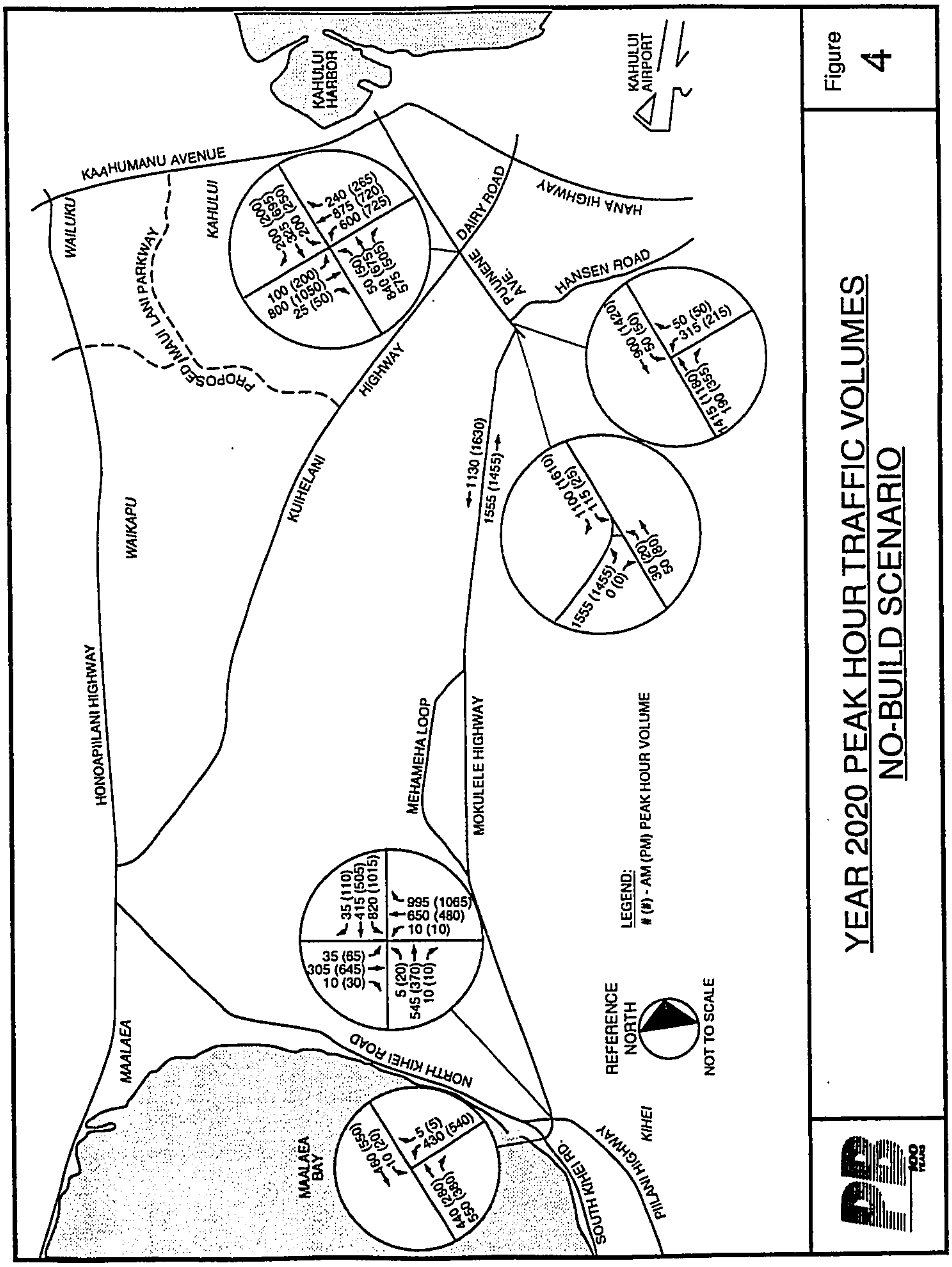
The intersection will operate poorly (LOS F). Drivers exiting the mill attempting to turn left onto Mokulele Highway will experience extreme delays.

Puunene Avenue and Kuihelani Highway/Dairy Road Intersection

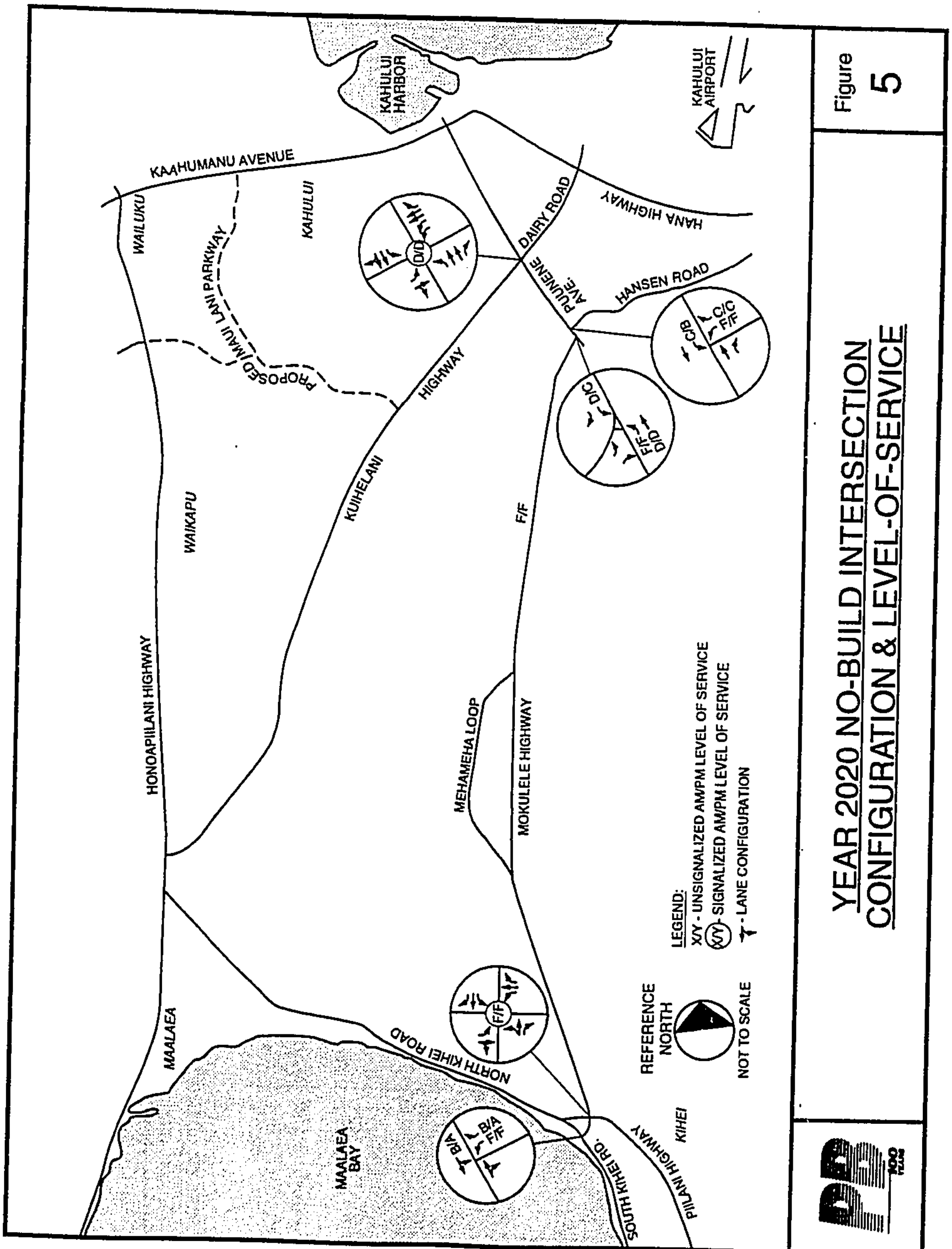
Analysis results indicate that the intersection will operate adequately overall (LOS D) with the improvements currently being constructed. However, congestion is expected for drivers turning into the south leg of Puunene Avenue, which becomes Mokulele Highway.

Summary of Results

Traffic volumes are expected to exceed the capacity of a two-lane Mokulele Highway in Year 2020. Subsequently, intersections along the corridor will operate poorly. The analysis results indicate that the current two-lane Mokulele Highway as well as intersections along the highway will not be able to accommodate the projected Year 2020 traffic volumes without improvements. Levels of service for Year 2020 No Build alternative are displayed in Figure 5.



YEAR 2020 PEAK HOUR TRAFFIC VOLUMES
NO-BUILD SCENARIO
Figure
4
KAAHUMANU AVENUE
KAHULUI HARBOR
KAHULUI AIRPORT
HANA HIGHWAY
DAIRY ROAD
PUUNENE AVE
HANSEN ROAD
WAILUKU
KAHULUI
PROPOSED MAUI LANI PARKWAY
KUIHELANI HIGHWAY
WAIKAPU
HONOAPIILANI HIGHWAY
MEHAMEHA LOOP
MOKULELE HIGHWAY
1130 (1630)
1555 (1455)
MAALAEA
MAALAEA BAY
NORTH KIHEI ROAD
SOUTH KIHEI RD.
PIILANI HIGHWAY
KIHEI
LEGEND:
(#) - AM (PM) PEAK HOUR VOLUME
REFERENCE NORTH
NOT TO SCALE



YEAR 2020 NO-BUILD INTERSECTION CONFIGURATION & LEVEL-OF-SERVICE

Figure 5

IV. YEAR 2020 BUILD

Project Description

The build alternative includes the widening of Mokulele Highway from a two-lane, undivided roadway to a four-lane, divided roadway. The alternative also strives to

The alternative also includes the realignment of the Mokulele Highway/Puunene Avenue intersection to provide a more direct alignment between Mokulele Highway and Puunene Avenue. The realignment would require the extension of Hansen Road and would consolidate the Puunene Avenue/Hansen Road and the Mokulele Highway/Puunene Avenue/Mill access road intersections into one intersection.

Also as part of the project, the intersection of Mokulele Highway and Piilani Highway will be reconfigured to make the Mokulele Highway to Piilani Highway the through movement, as documented in the Maui Long Range Land Transportation Plan.

Traffic Volume Forecasts

Year 2020 traffic volume forecasts utilized in the No Build alternative were also used for the Build alternative. Some reassignment of traffic was needed due to the reconfiguration of the Mokulele Highway/Puunene Avenue intersection, as well as the reconfiguration of the Mokulele Highway/Piilani Highway intersection. Year 2020 traffic volumes for the Build alternative are shown in Figure 6.

Traffic Operational Analysis

Mokulele Highway

An assessment of the improved Mokulele Highway indicated that traffic operations will be very good (LOS B and A) in Year 2020.

Mokulele Highway and Piilani Highway Intersection

Analysis results indicate that the intersection will operate well (LOS C) during the morning and afternoon peak hours as a reconfigured T-intersection.

Mokulele Highway/Puunene Avenue and Hansen Road Intersection

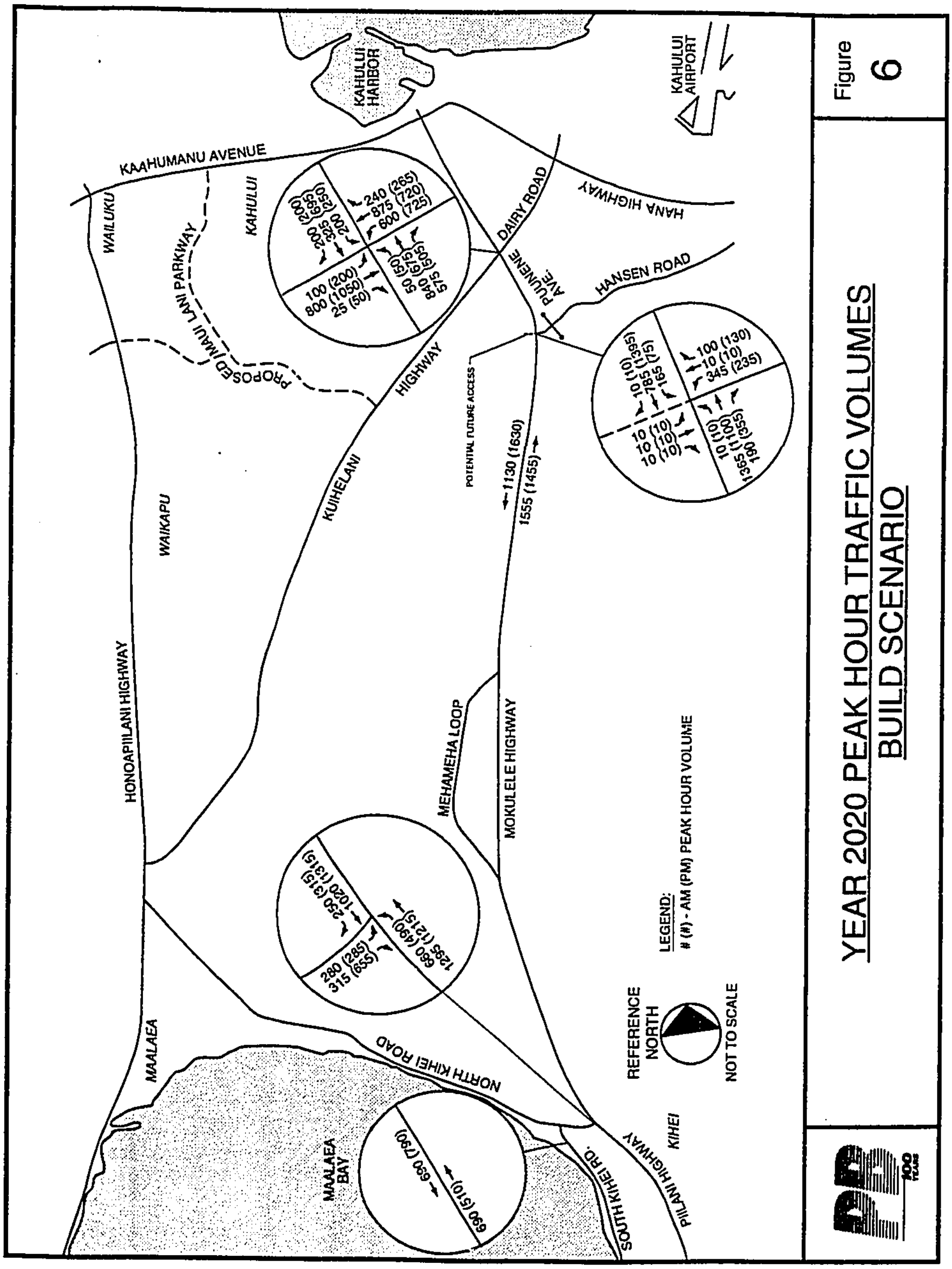
An evaluation of the Year 2020 traffic volumes at the intersection indicate that the Peak Hour Traffic Signal Warrant will be met. As a signalized intersection, the intersection will operate acceptably (LOS D) during the morning and afternoon peak hours.

Puunene Avenue and Kuihelani Highway/Dairy Road Intersection

Analysis results indicate that the intersection will operate acceptably (LOS D) during the morning and afternoon peak hours.

Summary of Results

The analysis results indicate that the widening of Mokulele Highway and the reconfiguration of the Puunene Avenue/Mokulele Highway and Piilani Highway/ Mokulele Highway intersections is needed to accommodate the projected Year 2020 AM and PM peak hour traffic volumes. Lane configuration and level of service for the Year 2020 Build alternative are summarized in Figure 7, while projected traffic operations for the No Build and Build alternatives are compared in Table 1.


YEAR 2020 PEAK HOUR TRAFFIC VOLUMES
BUILD SCENARIO
Figure
6
KAAHUMANU AVENUE
WAILUKU
KAHULUI
KAHULUI HARBOR
KAHULUI AIRPORT
HANA HIGHWAY
DAIRY ROAD
PUUNENE AVE
HANSEN ROAD
PROPOSED MAUI LANI PARKWAY
KUIHELANI HIGHWAY
WAIKAPU
HONOAPIILANI HIGHWAY
POTENTIAL FUTURE ACCESS
MEHAMEHA LOOP
MOKULELE HIGHWAY
1130 (1630)
1555 (1455)
MAALAEA
MAALAEA BAY
NORTH KIHEI ROAD
SOUTH KIHEI RD.
PIILANI HIGHWAY
KIHEI
REFERENCE NORTH
NOT TO SCALE
LEGEND:
(#) - AM (PM) PEAK HOUR VOLUME
200 (200)
325 (650)
200
240 (265)
875 (720)
600 (725)
100 (200)
800 (1050)
25 (50)
50 (50)
840 (615)
575 (505)
10 (10)
785 (1395)
165 (75)
100 (130)
10 (10)
345 (235)
10 (10)
10 (10)
10 (10)
10 (10)
1365 (1100)
190 (355)
250 (315)
1020 (1315)
280 (285)
315 (655)
660 (490)
1295 (1215)
690 (790)
690 (510)

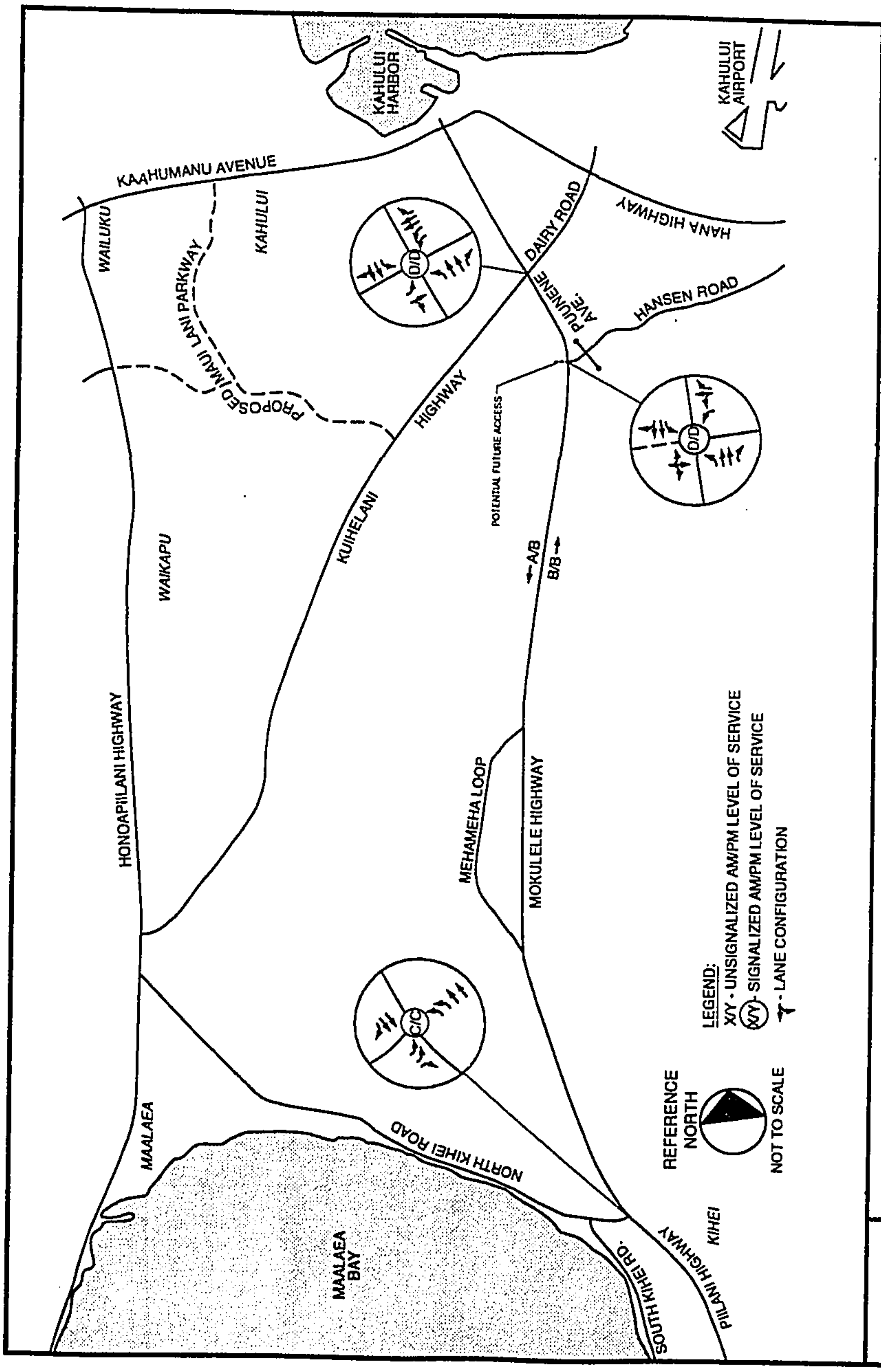


Figure 7

YEAR 2020 BUILD INTERSECTION CONFIGURATION & LEVEL-OF-SERVICE

Table 1. Level-of-Service Summary

Intersection	Existing AM	Existing PM	Future Year 2020 No Build AM	Future Year 2020 No Build PM	Future Year 2020 Build AM	Future Year 2020 Build PM
Mokulele Highway	E	E	F	F	A/B	B/B
Mokulele Hwy. and Piilani Hwy.	E	E	F	F	C	C
Mokulele Hwy. and Kihei Rd.						
Kihei Rd. EB L	A	A	B	B	N/A	N/A
Mokulele Hwy. SB L	C	A	F	F	N/A	N/A
Mokulele Hwy. SB R	C	A	B	B	N/A	N/A
Mokulele Hwy. and Puunene Ave.						
Puunene Ave. SB L	B	B	D	C	N/A	N/A
Mill Access WB L	D	F	F	F	N/A	N/A
Mill Access WB R	B	C	D	D	N/A	N/A
Puunene Ave. and Hansen Rd.					D	D
Puunene Ave. SB L	A	B	C	B	overall signalized	
Hansen Rd. WB L	F	F	F	F		
Hansen Rd. WB R	B	B	C	C		
Kuihelani Hwy. and Puunene Ave.	E	F	D	D	D	D

NB - northbound	L - left turn
SB - southbound	T - through
WB - westbound	R - right turn
EB - eastbound	N/A - not applicable

Conceptual Intersection Layout

The following recommendations are provided as design guidelines for intersection improvements proposed as part of the Build alternative.

<u>Mokulele Highway/Piilani Highway and Kihei Road Intersection Improvements</u>

- Reconfigure the four-legged intersection to a T-intersection with the Mokulele Highway-Piilani Highway interaction as the through movement.
- Southbound approach - *Provide two through lanes and a separate right-turn* lane.
- Northbound approach - Provide a double left-turn storage lane and two through lanes.
- Eastbound approach - Provide double left-turn lanes and an exclusive right-turn lane.
- Provide a three phase signal with a protected lead-left phase for the northbound approach. Analysis results indicate the intersection will operate well (LOS C) with this phasing.

<u>Intersection of Mokulele Highway/Puunene Avenue and Hansen Road</u>

As part of the Mokulele Highway widening project, it is planned to reconfigure the Mokulele Highway/Puunene Avenue intersection to create a smoother transition between Puunene Avenue and Mokulele Highway. As a result, Hansen Road will need to be extended to intersect the realigned highway.

- Southbound approach - Along with the two through lanes, provide an exclusive left-turn lane in the median.
- Northbound approach - Along with the two through lanes, provide a separate left-turn lane, and a separate right-turn lane.
- Hansen Road approach - provide a separate left-turn lane, a shared left-turn/through lane and an exclusive right turn lane.

- The intersection should be signalized. A three phase signal with a protected lead-left phase for the southbound approach should be provided. Analysis results indicate the intersection will operate acceptably (LOS D) with this phasing.
- The intersection of old Puunene Avenue with Hansen Road should remain unsignalized with the old Puunene Avenue approaches being STOP-sign controlled.

V. SUMMARY AND RECOMMENDATIONS

Summary

The Mokulele Highway widening project proposes to widen Mokulele Highway from a two-lane undivided roadway to a four-lane, divided roadway. The purpose of the project is to alleviate existing traffic congestion and to accommodate future traffic demand along the Puunene Avenue/ Mokulele Highway/Piilani Highway corridor.

Also proposed, are the reconfigurations of the Mokulele Highway/Puunene Avenue and the Mokulele/Piilani Highway intersections. These reconfigurations will make the Puunene Avenue/ Mokulele Highway/Piilani Highway path more continuous and provide a more direct path between the Wailuku/Kahului and Kihei/Makena areas.

In Puunene, the intersection reconfiguration would require the extension of Hansen Road and would consolidate the Puunene Avenue/Hansen Road and the Mokulele Highway/Puunene Avenue/Mill access road intersections into one intersection. This will improve traffic operations in this intersection area.

In Kihei, the reconfiguration of the Mokulele Highway/Piilani Highway intersection will simplify the awkward existing intersection complex formed by Piilani Highway, Mokulele Highway, North Kihei Road, and South Kihei Road. In doing so, it will improve intersection operations at this location.

The widening and the intersection reconfigurations are consistent with recommendations contained in the Draft Final Maui Long Range Land Transportation Plan[6], dated February 1996. This document is expected to be adopted as the long-range transportation plan for the County of Maui.

In addition to the improvements listed above, the intersection of the realigned Mokulele Highway with the extended Hansen Road should be monitored, and a traffic signal should be installed when warranted. Due to its proximity to the Kuihelani Highway/Puunene Avenue intersection, the two signals should be interconnected and coordinated.

Conclusion

The widening of Mokulele Highway and the reconfigurations of its intersections at Puunene Avenue and Piilani Highway are needed to accommodate the projected Year 2020 peak hour demand. The improvements proposed are consistent with the most current long-range planning documents and should be implemented.

REFERENCES

1 Kaku Associates, Draft Final Report - Maui Long Range Land Transportation Plan, February 1996.

2 Kaku Associates, Draft Final Report - Maui Long Range Land Transportation Plan, February 1996.

3 Transportation Research Board, National Research Council, Special Report Highway Capacity Manual, Washington D.C., 1994.

4 Transportation Research Board, National Research Council, Special Report Highway Capacity Manual, Washington D.C., 1994.

5 Kaku Associates, Draft Final Report - Maui Long Range Land Transportation Plan, February 1996.

6 Kaku Associates, Draft Final Report - Maui Long Range Land Transportation Plan, February 1996.

APPENDIX A

SUMMARY OF MANUAL TRAFFIC COUNTS

NAME: Upcountry Maui
LOCATION: N/S Mokulele Hwy E/W Piilani Hwy
DATE OF COUNTS : 8/1 6/6/96
COUNTED BY : K. Okamoto
INPUTED BY : K. Okamoto

File Name:i:\users\traffic\common\kihei\counts\hanshana.xls

Mokulele Hwy (North)

D E F
0 0 0

Piilani Hwy

C · 0
B 0
A 0

0 G
0 H
0 I

0 0 0
L K J

COUNT READINGS

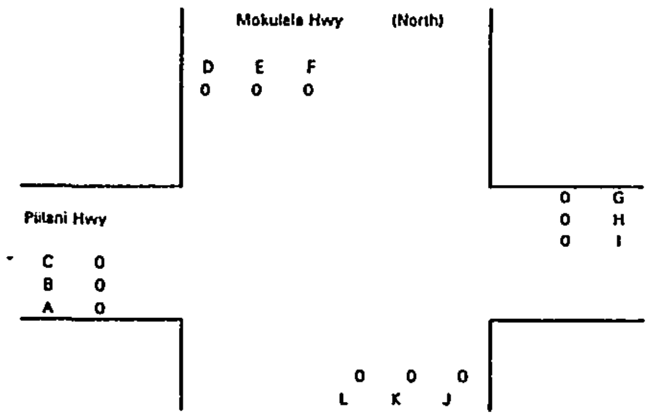
TIME	A	B	C	D	E	F	I	H	G	L	K	J
6:30 - 6:45	0	0	0	0	0	0	0	0	0	0	0	0
- 7:00	0	0	0	0	0	0	0	0	0	0	0	0
- 7:15	0	0	0	0	0	0	0	0	0	0	0	0
- 7:30	0	0	0	0	0	0	0	0	0	0	0	0
- 7:45	0	0	0	0	0	0	0	0	0	0	0	0
- 8:00	0	0	0	0	0	0	0	0	0	0	0	0
- 8:15	0	0	0	0	0	0	0	0	0	0	0	0
- 8:30	0	0	0	0	0	0	0	0	0	0	0	0
- 8:45	0	0	0	0	0	0	0	0	0	0	0	0
- 9:00	0	0	0	0	0	0	0	0	0	0	0	0
- 9:15	0	0	0	0	0	0	0	0	0	0	0	0
- 9:30	0	0	0	0	0	0	0	0	0	0	0	0

COUNT VOLUMES

TIME	A	B	C	D	E	F	I	H	G	L	K	J	TOTAL	TOT4
6:30 - 6:45	0	31	3	4	29	96	1	101	114	0	63	1	443	
- 7:00	0	32	5	6	27	102	1	126	120	1	56	0	476	
- 7:15	1	40	7	5	50	104	0	143	142	0	83	0	575	
- 7:30	1	57	1	3	51	146	1	115	139	3	71	1	589	2083
- 7:45	3	48	7	8	33	116	1	128	142	0	89	2	576	2216
- 8:00	1	40	3	7	51	132	1	103	151	1	70	2	562	2302
- 8:15	1	64	10	11	33	83	0	83	120	0	64	4	463	2190
- 8:30	1	41	5	6	30	100	0	79	130	2	64	1	459	2060
- 8:45	0	0	0	0	0	0	0	0	0	0	0	0	0	1484
- 9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	922
- 9:15	0	0	0	0	0	0	0	0	0	0	0	0	0	459
- 9:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 - 9:30 TOTAL	8	343	41	50	304	878	5	878	1058	7	560	11	4143	
PEAK HOUR 7:00 - 8:00 TOTAL	6	185	18	23	185	497	3	489	574	4	313	5	2302	
15 min PEAK	3	67	7	8	51	146	1	143	151	3	89	2		
PHF (per movement)	0.5	0.811	0.643	0.719	0.907	0.851	0.75	0.855	0.95	0.333	0.879	0.625		
Approach Pk Hr Vol		209			705			1066			322			
1st 15 min		48			159			285			83			
2nd 15 min		59			200			255			75			
3rd 15 min		58			156			271			91			
4th 15 min		44			190			256			73			
15 min Peak		59			200			285			91			
PHF (per approach)		0.886			0.881			0.935			0.885			

NAME: Upcountry Maui
LOCATION: N/S Mokulele Hwy E/W Piilani Hwy
DATE OF COUNTS : 7/ 6/5/96
COUNTED BY : K. Okamoto
INPUTED BY : K. Okamoto

File Name:I:\users\traffic\common\kihei\counts\hanshana.xls



COUNT READINGS

TIME	A	B	C	D	E	F	I	H	G	L	K	J
3:30 - 3:45	0	0	0	0	0	0	0	0	0	0	0	0
- 4:00	0	0	0	0	0	0	0	0	0	0	0	0
- 4:15	0	0	0	0	0	0	0	0	0	0	0	0
- 4:30	0	0	0	0	0	0	0	0	0	0	0	0
- 4:45	0	0	0	0	0	0	0	0	0	0	0	0
- 5:00	0	0	0	0	0	0	0	0	0	0	0	0
- 5:15	0	0	0	0	0	0	0	0	0	0	0	0
- 5:30	0	0	0	0	0	0	0	0	0	0	0	0
- 5:45	0	0	0	0	0	0	0	0	0	0	0	0
- 6:00	0	0	0	0	0	0	0	0	0	0	0	0
- 6:15	0	0	0	0	0	0	0	0	0	0	0	0
- 6:30	0	0	0	0	0	0	0	0	0	0	0	0

COUNT VOLUMES

TIME	A	B	C	D	E	F	I	H	G	L	K	J	TOTAL	TOT4
3:30 - 3:45	3	100	10	9	68	155	2	77	137	0	32	1	594	
- 4:00	2	99	7	2	57	158	1	80	139	0	46	0	591	
- 4:15	4	91	11	6	71	164	3	74	105	0	35	1	565	
- 4:30	6	93	8	8	59	149	1	71	154	0	47	1	597	2347
- 4:45	3	107	6	5	53	167	2	72	175	0	65	0	655	2408
- 5:00	2	93	7	9	69	159	0	64	141	0	53	1	598	2415
- 5:15	5	125	9	8	35	171	1	84	133	3	44	1	619	2469
- 5:30	4	106	10	8	79	177	1	74	123	0	37	3	622	2494
- 5:45	7	108	9	6	58	150	1	54	107	0	34	1	533	2372
- 6:00	1	84	6	11	59	148	2	48	102	0	37	1	499	2273
- 6:15	6	66	6	4	67	153	2	32	80	0	41	1	458	2112
- 6:30	2	71	11	5	59	128	2	42	109	1	53	1	484	1974
3:30 - 6:30 TOTAL	45	1141	100	81	734	1879	18	772	1505	4	524	12	6815	
PEAK HOUR 4:30 - 5:30 TOTAL	14	431	32	30	236	674	4	294	572	3	199	5	2494	
15 min PEAK	5	125	10	9	79	177	2	84	175	3	65	3		
PHF (per movement)	0.7	0.862	0.8	0.833	0.747	0.952	0.5	0.875	0.817	0.25	0.765	0.417		
Approach Pk Hr Vol		477			940			870			207			
1st 15 min		116			225			249			65			
2nd 15 min		102			237			205			54			
3rd 15 min		139			214			218			48			
4th 15 min		120			264			198			40			
15 min Peak		139			264			249			65			
PHF (per approach)		0.858			0.89			0.873			0.796			

NAME: Upcountry Maui
LOCATION: N/S S. Kihei Rd E/W Mokulele Hwy
DATE OF COUNTS : 6/6/96
COUNTED BY : Dolores Kirby
INPUTED BY : J. Imai

File Name:l:\users\traffic\common\kihei\kihelele.xls

S. Kihei Rd (North)

D E F
0 121 1

1 G
0 H
191 I

Mokulele Hwy

0 377 313
L K J

COUNT READINGS

TIME	A	B	C	D	E	F	I	H	G	L	K	J
5:45 - 6:00	0	0	0	0	0	0	0	0	0	0	0	0
- 6:15	0	0	0	0	0	0	0	0	0	0	0	0
- 6:30	0	0	0	0	0	0	0	0	0	0	0	0
- 6:45	0	0	0	0	17	0	25	0	0	0	79	62
- 7:00	0	0	0	0	42	1	44	0	0	0	167	119
- 7:15	0	0	0	0	67	1	95	0	0	0	266	208
- 7:30	0	0	0	0	96	2	143	0	0	0	386	290
- 7:45	0	0	0	0	131	2	176	0	0	0	461	359
- 8:00	0	0	0	0	163	2	221	0	1	0	542	426
- 8:15	0	0	0	0	195	4	255	0	1	0	621	494
- 8:30	0	0	0	0	229	4	283	0	4	0	672	557
- 8:45	0	0	0	0	0	0	0	0	0	0	0	0

COUNT VOLUMES

TIME	A	B	C	D	E	F	I	H	G	L	K	J	TOTAL	TOT4
5:45 - 6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	
- 6:15	0	0	0	0	0	0	0	0	0	0	0	0	0	
- 6:30	0	0	0	0	0	0	0	0	0	0	0	0	0	
- 6:45	0	0	0	0	17	0	27	0	0	0	80	64	188	188
- 7:00	0	0	0	0	25	1	24	0	0	0	89	59	198	386
- 7:15	0	0	0	0	25	0	52	0	0	0	100	91	268	654
- 7:30	0	0	0	0	29	1	54	0	0	0	121	82	287	941
- 7:45	0	0	0	0	35	0	35	0	0	0	75	70	215	868
- 8:00	0	0	0	0	32	0	50	0	1	0	81	70	234	1004
- 8:15	0	0	0	0	32	2	37	0	0	0	81	70	222	958
- 8:30	0	0	0	0	34	0	30	0	3	0	51	69	187	858
6:30 - 8:30 TOTAL	0	0	0	0	229	4	309	0	4	0	678	575	1799	
7:00 - 8:00 TOTAL	0	0	0	0	121	1	191	0	1	0	377	313	1004	

NAME: Upcountry Maui
LOCATION: N/S S. Kihei Rd E/W Mokulele Hwy
DATE OF COUNTS : 6/5/96
COUNTED BY : Dolores Kirby
INPUTED BY : J. Imai

File Name:I:\users\traffic\common\kihelele.xls

S. Kihei Rd (North)

D E F
0 372 0

4 G
0 H
283 I

Mokulele Hwy

0 222 218
L K J

COUNT READINGS

TIME	A	B	C	D	E	F	I	H	G	L	K	J
3:30 - 3:45	0	0	0	0	71	1	56	0	1	0	48	30
- 4:00	0	0	0	0	150	2	112	0	2	0	101	73
- 4:15	0	0	0	0	279	2	215	0	2	0	166	141
- 4:30	0	0	0	0	318	2	257	0	2	0	201	168
- 4:45	0	0	0	0	405	2	320	0	3	0	253	239
- 5:00	0	0	0	0	520	2	392	0	6	0	322	291
- 5:15	0	0	0	0	614	4	427	0	6	0	377	335
- 5:30	0	0	0	0	649	4	446	0	6	0	386	350
- 5:45	0	0	0	0	801	5	572	0	8	0	482	409
- 6:00	0	0	0	0	886	6	633	0	8	0	537	447
- 6:15	0	0	0	0	950	7	699	0	8	0	571	485
- 6:30	0	0	0	0	1013	7	764	0	9	0	630	538

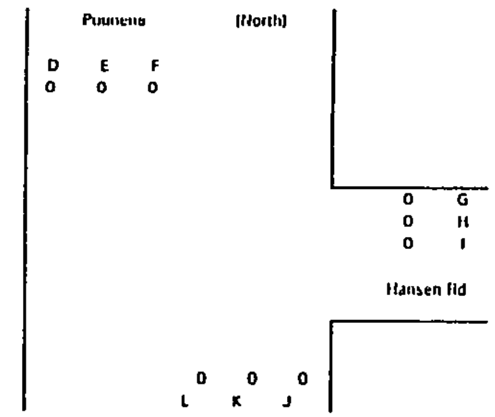
COUNT VOLUMES

TIME	A	B	C	D	E	F	I	H	G	L	K	J	TOTAL	TOT4
3:30 - 3:45	0	0	0	0	71	2	63	0	1	0	49	33	219	
- 4:00	0	0	0	0	79	1	56	0	1	0	53	45	235	
- 4:15	0	0	0	0	129	0	104	0	0	0	65	68	366	
- 4:30	0	0	0	0	40	0	42	0	0	0	35	27	144	964
- 4:45	0	0	0	0	67	0	64	0	1	0	53	71	276	1021
- 5:00	0	0	0	0	116	0	73	0	3	0	69	52	313	1099
- 5:15	0	0	0	0	95	2	35	0	0	0	55	44	231	964
- 5:30	0	0	0	0	35	0	20	0	0	0	8	15	79	899 1071
- 5:45	0	0	0	0	152	1	127	0	2	0	86	59	437	1060
- 6:00	0	0	0	0	88	1	61	0	0	0	56	39	243	990
- 6:15	0	0	0	0	64	1	68	0	0	0	34	38	203	962
- 6:30	0	0	0	0	63	0	65	0	1	0	59	54	242	1125
3:30 - 6:30 TOTAL	0	0	0	0	1017	8	776	0	9	0	633	545	2988	
					0.721			0.616				0.871		
4:00 - 5:00 TOTAL	0	0	0	0	372	0	283	0	4	0	222	218	1099	

4:00-5:30

NAME: Upcountry Maui
LOCATION: N/S Puunene E/W Hansen Rd
DATE OF COUNTS : 8/1/96
COUNTED BY : Erol Baybura
INPUTED BY : J. Imai

File Name:i:\users\traffic\common\kihei\counts\puuhans.xls



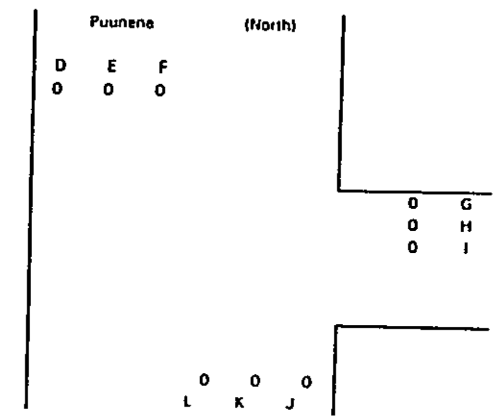
COUNT READINGS

TIME	A	B	C	D	E	F	I	H	G	L	K	J
6:30 - 6:45	0	0	0	0	173	15	65	0	7	0	135	39
- 7:00	0	0	0	0	347	39	114	0	19	0	262	69
- 7:15	0	0	0	0	527	48	167	0	28	0	388	95
- 7:30	0	0	0	0	711	58	210	0	47	0	546	136
- 7:45	0	0	0	0	898	68	264	0	57	0	717	167
- 8:00	0	0	0	0	1040	79	316	0	75	0	868	202
- 8:15	0	0	0	0	1201	89	352	0	85	0	1010	220
- 8:30	0	0	0	0	1345	100	407	0	98	0	1129	249
- 8:45	0	0	0	0	1510	118	442	0	112	0	1264	276
- 9:00	0	0	0	0	1642	126	479	0	123	0	1372	299
- 9:15	0	0	0	0	1763	133	500	0	131	0	1477	326
- 9:30	0	0	0	0	1917	145	533	0	137	0	1560	349

COUNT VOLUMES

TIME	A	B	C	D	E	F	I	H	G	L	K	J	TOTAL	TOT4
6:30 - 6:45	0	0	0	0	108	15	65	0	7	0	135	39	369	
- 7:00	0	0	0	0	125	24	49	0	12	0	127	30	367	
- 7:15	0	0	0	0	127	9	53	0	9	0	126	26	350	
- 7:30	0	0	0	0	141	10	43	0	19	0	158	41	412	1498
- 7:45	0	0	0	0	133	10	54	0	10	0	171	31	409	1538
- 8:00	0	0	0	0	90	11	52	0	18	0	151	35	357	1528
- 8:15	0	0	0	0	125	10	36	0	10	0	142	18	341	1519
- 8:30	0	0	0	0	89	11	55	0	13	0	119	29	316	1423
- 8:45	0	0	0	0	130	18	35	0	14	0	135	27	359	1373
- 9:00	0	0	0	0	95	8	37	0	11	0	108	23	282	1298
- 9:15	0	0	0	0	100	7	21	0	8	0	105	27	268	1225
- 9:30	0	0	0	0	121	12	33	0	6	0	83	23	278	1187
6:30 - 9:30 TOTAL	0	0	0	0	1384	145	533	0	137	0	1560	349	4108	
PEAK HOUR 7.00 - 8:00 TOTAL	0	0	0	0	491	40	202	0	56	0	606	133	1528	
15 min PEAK	0	0	0	0	141	11	54	0	19	0	171	41		
PHF (per movement)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.871	0.909	0.935	#DIV/0!	0.737	#DIV/0!	0.886	0.811		
Approach Pk Hr Vol		0			531			258			739			
1st 15 min		0			136			62			152			
2nd 15 min		0			151			62			199			
3rd 15 min		0			143			64			202			
4th 15 min		0			101			70			186			
15 min Peak		0			151			70			202			
PHF (per approach)		#DIV/0!			0.879			0.921			0.915			

NAME: Upcountry Maui
LOCATION: N/S Puunene E/W Hansen Rd
DATE OF COUNTS : 7/31/96
COUNTED BY : Erol Baybura
INPUTED BY : J. Ikna
File Name:l:\users\traffic\common\kihei\counts\puuhans.xls



COUNT READINGS

TIME	A	B	C	D	E	F	I	H	G	L	K	J
3:30 - 3:45	0	0	0	0	0	18	37	0	32	0	183	59
- 4:00	0	0	0	0	198	36	102	0	60	0	346	114
- 4:15	0	0	0	0	495	49	170	0	80	0	497	163
- 4:30	0	0	0	0	765	61	229	0	112	0	650	200
- 4:45	0	0	0	0	946	72	272	0	132	0	854	255
- 5:00	0	0	0	0	1199	92	332	0	157	0	1025	320
- 5:15	0	0	0	0	1520	104	388	0	168	0	1117	379
- 5:30	0	0	0	0	1714	116	428	0	176	0	1215	430
- 5:45	0	0	0	0	1975	122	469	0	193	0	1326	458
- 6.00	0	0	0	0	2202	134	511	0	213	0	1434	521
- 6:15	0	0	0	0	2364	142	548	0	223	0	1539	558
- 6:30	0	0	0	0	2543	153	573	0	230	0	1653	599

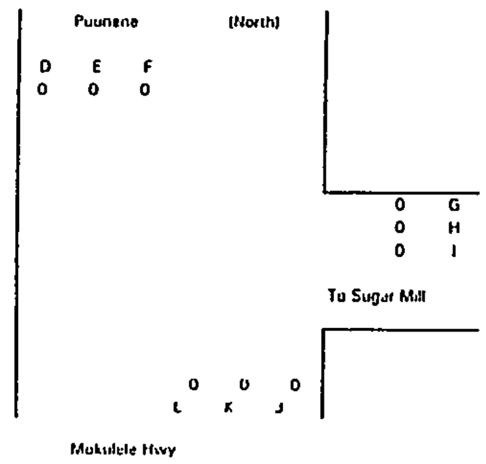
COUNT VOLUMES

TIME	A	B	C	D	E	F	I	H	G	L	K	J	TOTAL	TOT4
3:30 - 3:45	0	0	0	0	0	18	37	0	32	0	183	59	329	
- 4:00	0	0	0	0	133	18	65	0	28	0	163	55	462	
- 4:15	0	0	0	0	229	13	68	0	20	0	151	49	530	
- 4:30	0	0	0	0	211	12	59	0	32	0	153	37	504	1825
- 4:45	0	0	0	0	138	11	43	0	20	0	204	55	471	1967
- 5:00	0	0	0	0	193	20	60	0	25	0	171	65	534	2039
- 5:15	0	0	0	0	265	12	56	0	11	0	92	59	495	2004
- 5:30	0	0	0	0	154	12	40	0	8	0	98	51	363	1863
- 5:45	0	0	0	0	220	6	41	0	17	0	111	28	423	1815
- 6.00	0	0	0	0	185	12	42	0	20	0	108	63	430	1711
- 6:15	0	0	0	0	125	8	37	0	10	0	105	37	322	1538
- 6:30	0	0	0	0	154	11	25	0	7	0	114	41	352	1527
3:30 - 6:30 TOTAL	0	0	0	0	2007	153	573	0	230	0	1653	599	5215	
PEAK HOUR 4:30 - 5:30 TOTAL	0	0	0	0	750	55	199	0	64	0	565	230	1863	
15 min PEAK	0	0	0	0	265	20	60	0	25	0	204	65		
PHF (per movement)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.708	0.688	0.829	#DIV/0!	0.64	#DIV/0!	0.692	0.885		

Approach Pk Hr Vol	0	805	263	795
1st 15 min	0	149	63	259
2nd 15 min	0	213	85	236
3rd 15 min	0	277	67	151
4th 15 min	0	166	48	149
15 min Peak	0	277	85	259
PHF (per approach)	#DIV/0!	0.727	0.774	0.767

NAME: Upcountry Maui
LOCATION: N/S Mokulele Hwy E/W To Sugar Mill
DATE OF COUNTS : 8/1/96
COUNTED BY : Dolores K.
INPUTED BY : J. Imai

File Name:I:\users\traffic\common\ulie\counts\mokumill.xls



COUNT READINGS

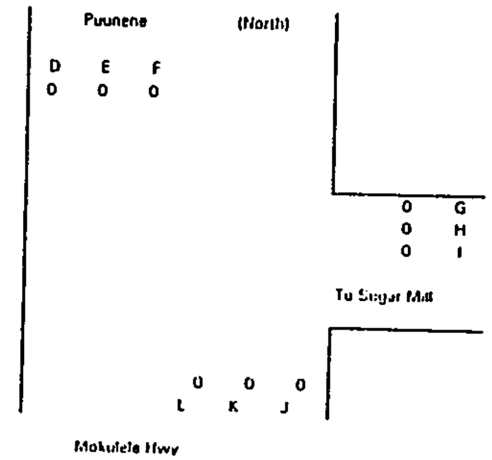
TIME	A	B	C	D	E	F	I	H	G	L	K	J
6:30 - 6:45	0	0	0	0	161	12	0	0	6	0	174	0
- 7:00	0	0	0	0	325	22	2	0	12	0	331	1
- 7:15	0	0	0	0	498	29	3	0	23	0	483	1
7:30	0	0	0	0	667	44	4	0	38	0	682	1
- 7:45	0	0	0	0	843	55	5	0	50	0	884	1
- 8:00	0	0	0	0	978	62	5	0	60	0	1070	1
- 8:15	0	0	0	0	1135	66	5	0	74	0	1230	2
8:30	0	0	0	0	1269	76	6	0	84	0	1378	3
8:45	0	0	0	0	1421	89	6	0	97	0	1540	3
9:00	0	0	0	0	1546	96	6	0	109	0	1671	4
- 9:15	0	0	0	0	1663	100	6	0	118	0	1803	4
- 9:30	0	0	0	0	1807	110	9	0	122	0	1909	6

COUNT VOLUMES

TIME	A	B	C	D	E	F	I	H	G	L	K	J	TOTAL	TOT4
6:30 - 6:45	0	0	0	0	161	12	0	0	6	0	174	0	353	
- 7:00	0	0	0	0	164	10	2	0	6	0	151	1	334	
- 7:15	0	0	0	0	173	7	1	0	11	0	141	0	333	
- 7:30	0	0	0	0	169	15	1	0	15	0	184	0	384	1404
- 7:45	0	0	0	0	176	11	1	0	12	0	190	0	390	1441
- 8:00	0	0	0	0	135	7	0	0	10	0	176	0	328	1435
- 8:15	0	0	0	0	157	4	0	0	14	0	146	1	322	1424
8:30	0	0	0	0	134	10	1	0	10	0	138	1	294	1334
- 8:45	0	0	0	0	152	13	0	0	13	0	149	0	327	1271
- 9:00	0	0	0	0	125	7	0	0	12	0	119	1	264	1207
- 9:15	0	0	0	0	117	4	0	0	9	0	123	0	253	1138
- 9:30	0	0	0	0	144	10	3	0	4	0	102	2	265	1109
6:30 - 9:30 TOTAL	0	0	0	0	1807	110	9	0	122	0	1793	6	3847	
PEAK HOUR 7:00 - 8:00 TOTAL	0	0	0	0	653	40	3	0	48	0	691	0	1435	
15 min PEAK	0	0	0	0	176	15	1	0	15	0	190	0		
PHF (per movement)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.928	0.667	0.75	#DIV/0!	0.8	#DIV/0!	0.909	#DIV/0!		
Approach Pk Hr Vol		0			693			51			691			
1st 15 min		0			180			12			141			
2nd 15 min		0			184			16			184			
3rd 15 min		0			187			13			190			
4th 15 min		0			142			10			176			
15 min Peak		0			187			16			190			
PHF (per approach)		#DIV/0!			0.926			0.797			0.909			

NAME: Upcountry Maui
LOCATION: N/S Mokulele Hwy E/W To Sugar Mill
DATE OF COUNTS : 7/31/96
COUNTED BY : Dolores K.
INPUTED BY : J. Imai

File Name:I:\users\traffic\common\kihei\counts\mokumil.xls



COUNT READINGS

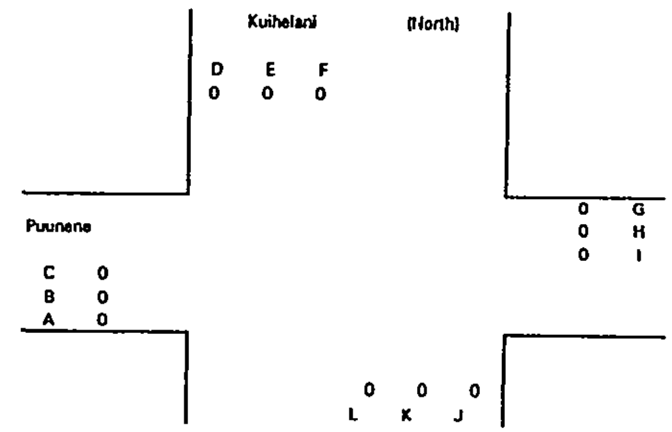
TIME	A	B	C	D	E	F	I	H	G	L	K	J
3:30 - 3:45	0	0	0	0	0	0	0	0	0	0	242	0
- 4:00	0	0	0	0	193	5	3	0	22	0	460	2
- 4:15	0	0	0	0	484	11	4	0	41	0	660	2
- 4:30	0	0	0	0	749	16	5	0	63	0	850	4
- 4:45	0	0	0	0	926	20	5	0	88	0	1109	9
- 5:00	0	0	0	0	1175	24	6	0	105	0	1345	11
- 5:15	0	0	0	0	1492	28	7	0	116	0	1496	11
- 5:30	0	0	0	0	1684	30	7	0	122	0	1645	11
- 5:45	0	0	0	0	1937	38	7	0	133	0	1784	14
6:00	0	0	0	0	2161	41	7	0	140	0	1955	14
- 6:15	0	0	0	0	2317	47	7	0	146	0	2097	14
- 6:30	0	0	0	0	2496	47	7	0	148	0	2252	14

COUNT VOLUMES

TIME	A	B	C	D	E	F	I	H	G	L	K	J	TOTAL	TOT4
3:30 - 3:45	0	0	0	0	0	0	0	0	0	0	242	0	242	
- 4:00	0	0	0	0	193	5	3	0	22	0	196	2	421	
- 4:15	0	0	0	0	291	6	1	0	19	0	181	0	498	
- 4:30	0	0	0	0	265	5	1	0	22	0	168	2	463	1624
- 4:45	0	0	0	0	177	4	0	0	25	0	234	5	445	1827
- 5:00	0	0	0	0	249	4	1	0	17	0	219	2	492	1898
- 5:15	0	0	0	0	317	4	1	0	11	0	140	0	473	1873
- 5:30	0	0	0	0	192	2	0	0	6	0	143	0	343	1753
- 5:45	0	0	0	0	253	8	0	0	11	0	128	3	403	1711
- 6:00	0	0	0	0	224	3	0	0	7	0	164	0	398	1617
- 6:15	0	0	0	0	156	6	0	0	6	0	136	0	304	1448
- 6:30	0	0	0	0	179	0	0	0	2	0	153	0	334	1439
3:30 - 6:30 TOTAL	0	0	0	0	2496	47	7	0	148	0	2104	14	4816	
PEAK HOUR 4:30 - 5:30 TOTAL	0	0	0	0	935	14	2	0	59	0	736	7	1753	
15 min PEAK	0	0	0	0	317	4	1	0	25	0	234	5		
PHF (per movement)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.737	0.875	0.5	#DIV/0!	0.59	#DIV/0!	0.786	0.35		
Approach Pk Hr Vol		0			949			61			743			
1st 15 min		0			181			25			239			
2nd 15 min		0			253			18			221			
3rd 15 min		0			321			12			140			
4th 15 min		0			194			6			143			
15 min Peak		0			321			25			239			
PHF (per approach)		#DIV/0!			0.739			0.61			0.777			

NAME: Puunene Bypass
LOCATION: N/S Kuihelani E/W Puunene
DATE OF COUNTS : 7/3 8/1/96
COUNTED BY : K. Okamoto
INPUTED BY : L. Aburamen

File Name:I:\users\traffic\common\kihei\counts\hanshana.xls



COUNT READINGS

TIME	A	B	C	D	E	F	I	H	G	L	K	J
6:30 - 6:45	0	0	0	0	0	0	0	0	0	0	0	0
- 7:00	0	0	0	0	0	0	0	0	0	0	0	0
- 7:15	0	0	0	0	0	0	0	0	0	0	0	0
- 7:30	0	0	0	0	0	0	0	0	0	0	0	0
- 7:45	0	0	0	0	0	0	0	0	0	0	0	0
- 8:00	0	0	0	0	0	0	0	0	0	0	0	0
- 8:15	0	0	0	0	0	0	0	0	0	0	0	0
- 8:30	0	0	0	0	0	0	0	0	0	0	0	0
- 8:45	0	0	0	0	0	0	0	0	0	0	0	0
- 9:00	0	0	0	0	0	0	0	0	0	0	0	0
- 9:15	0	0	0	0	0	0	0	0	0	0	0	0
- 9:30	0	0	0	0	0	0	0	0	0	0	0	0

COUNT VOLUMES

TIME	A	B	C	D	E	F	I	H	G	L	K	J	TOTAL	TOT4
6:30 - 6:45	34	84	15	20	84	31	6	53	81	20	45	4	477	
- 7:00	52	99	16	23	79	31	9	76	68	23	46	6	528	
- 7:15	46	95	9	20	73	25	7	80	64	15	39	3	476	
- 7:30	35	101	13	9	80	51	7	125	78	9	63	3	574	2055
- 7:45	28	96	19	25	60	47	4	117	83	27	56	6	568	2146
- 8:00	32	65	16	20	67	39	7	133	106	20	69	4	584	2202
- 8:15	35	70	8	12	54	38	8	103	87	22	90	1	528	2254
- 8:30	28	58	15	17	54	47	3	103	77	20	66	6	494	2174
- 8:45	34	82	12	20	46	46	9	112	98	17	120	4	600	2206
- 9:00	26	55	10	21	46	39	3	83	88	23	90	2	486	2108
6:30-9:00	350	805	133	193	643	394	63	985	830	196	684	39	5315	
PEAK HOUR 7:00-8:00 TOTAL	141	357	57	80	280	162	25	455	331	71	227	16	2202	6403
15 min PEAK	46	101	19	26	80	51	7	133	106	27	69	6		
PHF (per movement)	0.766	0.884	0.75	0.769	0.875	0.794	0.893	0.855	0.781	0.657	0.822	0.667		
Approach Pk Hr Vol		555			522			811			314			
1st 15 min		150			118			151			57			
2nd 15 min		149			140			210			75			
3rd 15 min		143			132			204			89			
4th 15 min		113			132			246			93			
15 min Peak		150			140			210			93			
PHF (per approach)		0.925			0.932			0.965			0.844			

Parsons Brinckerhoff

Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813

Site Code : 00000000
Start Date: 07/31/96
File I.D. : DAIRYPM
Page : 3

Peak Hour Analysis By Entire Intersection for the Period: 04:00pm to 05:45pm on 07/31/96

Direction	Street Name	Start Peak Hour	Peak Hr Factor	Volumes Rght	Volumes Thru	Volumes Left	Volumes Total	Percentages Rght	Percentages Thru	Percentages Left
From North	DAIRY KUIHELANI	04:30pm	.936	62	317	362	741	8.3	42.7	48.8
From East	PUUNENE		.726	203	498	22	723	28.0	68.8	3.0
From South	DAIRY KUIHELANI		.869	27	346	211	584	4.6	59.2	36.1
From West	PUUNENE		.869	89	588	77	754	11.8	77.9	10.2

Parsons Brinckerhoff
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813

Site Code : 00000000
Start Date: 07/31/96
File I.D. : DAIRYPM
Page : 1

Movement 1

Start Time	DAIRY KUIHELANI From North Rght	Thru	Left	PUUNENE From East Rght	Thru	Left	DAIRY KUIHELANI From South Rght	Thru	Left	PUUNENE From West Rght	Thru	Left	Total
4:00pm	11	82	105	74	81	4	2	81	43	24	132	14	653
4:15	7	76	87	53	131	7	5	75	39	26	148	11	665
4:30	14	86	95	75	163	11	5	63	39	26	114	13	704
4:45	15	70	90	53	125	2	6	70	66	21	171	25	714
Hour Total	47	314	377	255	500	24	18	289	187	97	565	63	2736
5:00pm	17	91	90	45	102	5	10	113	45	22	143	19	702
5:15	16	70	87	30	108	4	6	100	61	20	160	20	682
5:30	23	74	98	48	105	6	7	77	38	23	129	28	656
5:45	24	61	83	44	85	1	5	76	37	29	93	14	552
Hour Total	80	296	358	167	400	16	28	366	181	94	525	81	2592
Grand	127	610	735	422	900	40	46	655	368	191	1090	144	5328
% of Total	2.4%	11.4%	13.8%	7.9%	16.9%	.8%	.9%	12.3%	6.9%	3.6%	20.5%	2.7%	
Apprch %	27.6%			25.6%			20.1%			26.7%			
% of Apprch	8.6%	41.4%	49.9%	31.0%	66.1%	2.9%	4.3%	61.3%	34.4%	13.4%	76.5%	10.1%	

APPENDIX B

LEVEL OF SERVICE DEFINITIONS

The Highway Capacity Manual defines six Levels of Service, labeled A through F, from free-flow to congested conditions. Levels of Service for signalized and unsignalized intersections are defined in terms of average user delays. Increased delay is indicative of driver discomfort, added fuel consumption, and lost travel time.

Unsignalized Intersections

For unsignalized intersections, the Highway Capacity Manual method evaluates gaps in the major street traffic flow and calculates available gaps for left turns across oncoming traffic and for the left and right turns onto the major roadway from the minor street.

LEVEL OF SERVICE A: Little or no delay.
LEVEL OF SERVICE B: Short traffic delays.
LEVEL OF SERVICE C: Average traffic delays.
LEVEL OF SERVICE D: Long traffic delays.
LEVEL OF SERVICE E: Very long traffic delays.
LEVEL OF SERVICE F: Demand volume exceeds capacity, resulting in extreme delays with queuing that may cause severe congestion and affect other movements at the intersection.

Signalized Intersections

For signalized intersections, the Operational Analysis method evaluates intersection operations based on signal timing, lane geometry, and traffic demand. Volume-to-capacity ratios (v/c) are calculated and used to estimate delay by each intersection approach. The delay, in turn, is translated into the qualitative index known as Level of Service, that ranges from LOS A to LOS F.

LEVEL OF SERVICE A: This level describes operation with very low delay, i.e., less than 5.0 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

LEVEL OF SERVICE B: This level describes operation with delays in the range of 5.1 to 15.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than at Level of Service A, causing higher delays.

LEVEL OF SERVICE C: This level describes operations with delays in the range of 15.1 to .25.0 seconds per vehicle. These higher delays may result from fair progression and/or cycle lengths. Individual cycle failures (queued vehicles do not clear in one cycle) may begin to appear as the number of vehicles stopping is significant; many vehicles, however, still pass through the intersection without stopping.

LEVEL OF SERVICE D: This level describes operations with delays in the range of 25.1 to 40.0 seconds per vehicle. At Level of Service D, the influence of congestion becomes more noticeable. Longer delays may result from a combination of unfavorable congestion, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LEVEL OF SERVICE E: This level describes operation with delays in the range of 40.1 to 60.0 seconds per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.

LEVEL OF SERVICE F: This level describes operation with delay in excess of 60.0 seconds per vehicle. A symptom is a long vehicle queue on the approach with LOS F operations. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle length may also be major contributing causes to such delay levels.

APPENDIX C

ANALYSIS WORKSHEETS

1985 HCM:TWO-LANE HIGHWAYS

****

FACILITY LOCATION.... Mokulele Highway
ANALYST.............. K. Okamoto
TIME OF ANALYSIS..... Exist AM Pk
DATE OF ANALYSIS..... 08-09-1996
OTHER INFORMATION.... Near Kihei

A) ADJUSTMENT FACTORS

PERCENTAGE OF TRUCKS........................ 2
PERCENTAGE OF BUSES......................... 0
PERCENTAGE OF RECREATIONAL VEHICLES......... 0
DESIGN SPEED (MPH).......................... 60
PEAK HOUR FACTOR............................ .89
DIRECTIONAL DISTRIBUTION (UP/DOWN).......... 44 / 56
LANE WIDTH (FT)............................. 12
USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
PERCENT NO PASSING ZONES.................... 50

B) CORRECTION FACTORS

LEVEL TERRAIN

LOS	E_T	E_B	E_R	f_w	f_d	f_{HV}
A	2	1.8	2.2	1	.96	.98
B	2.2	2	2.5	1	.96	.98
C	2.2	2	2.5	1	.96	.98
D	2	1.6	1.6	1	.96	.98
E	2	1.6	1.6	1	.96	.98

C) LEVEL OF SERVICE RESULTS

INPUT VOLUME(vph): 1610
ACTUAL FLOW RATE: 1809

LOS	SERVICE FLOW RATE	V/C
A	238	.09
B	554	.21
C	949	.36
D	1588	.6
E	2646	1

LOS FOR GIVEN CONDITIONS: E

1985 HCM:TWO-LANE HIGHWAYS

****

FACILITY LOCATION.... Mokulele Highway
ANALYST.............. K. Okamoto
TIME OF ANALYSIS..... Exist PM Pk
DATE OF ANALYSIS..... 08-09-1996
OTHER INFORMATION.... Near Kihei

A) ADJUSTMENT FACTORS

PERCENTAGE OF TRUCKS.........................	2
PERCENTAGE OF BUSES..........................	0
PERCENTAGE OF RECREATIONAL VEHICLES.........	0
DESIGN SPEED (MPH)..........................	60
PEAK HOUR FACTOR............................	.89
DIRECTIONAL DISTRIBUTION (UP/DOWN)..........	54 / 46
LANE WIDTH (FT).............................	12
USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)...	6
PERCENT NO PASSING ZONES....................	50

B) CORRECTION FACTORS

LEVEL TERRAIN

LOS	E_T	E_B	E_R	f_w	f_d	f_{HV}
A	2	1.8	2.2	1	.96	.98
B	2.2	2	2.5	1	.96	.98
C	2.2	2	2.5	1	.96	.98
D	2	1.6	1.6	1	.96	.98
E	2	1.6	1.6	1	.96	.98

C) LEVEL OF SERVICE RESULTS

INPUT VOLUME(vph): 1743
ACTUAL FLOW RATE: 1958

LOS	SERVICE FLOW RATE	V/C
A	237	.09
B	551	.21
C	945	.36
D	1581	.6
E	2635	1

LOS FOR GIVEN CONDITIONS: E

1985 HCM:TWO-LANE HIGHWAYS

****

FACILITY LOCATION.... Mokulele Highway
ANALYST.............. K. Okamoto
TIME OF ANALYSIS..... Exist AM Pk
DATE OF ANALYSIS..... 08-09-1996
OTHER INFORMATION.... Near Puunene

A) ADJUSTMENT FACTORS

PERCENTAGE OF TRUCKS........................	2
PERCENTAGE OF BUSES.........................	0
PERCENTAGE OF RECREATIONAL VEHICLES.........	0
DESIGN SPEED (MPH)..........................	60
PEAK HOUR FACTOR............................	.92
DIRECTIONAL DISTRIBUTION (UP/DOWN)..........	49 / 51
LANE WIDTH (FT).............................	12
USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)...	6
PERCENT NO PASSING ZONES....................	50

B) CORRECTION FACTORS

LEVEL TERRAIN

LOS	E_T	E_B	E_R	f_w	f_d	f_{HV}
A	2	1.8	2.2	1	.96	.98
B	2.2	2	2.5	1	.96	.98
C	2.2	2	2.5	1	.96	.98
D	2	1.6	1.6	1	.96	.98
E	2	1.6	1.6	1	.96	.98

C) LEVEL OF SERVICE RESULTS

INPUT VOLUME(vph): 1347
ACTUAL FLOW RATE: 1464

LOS	SERVICE FLOW RATE	V/C
A	237	.09
B	551	.21
C	945	.36
D	1581	.6
E	2635	1

LOS FOR GIVEN CONDITIONS: D

1985 HCM:TWO-LANE HIGHWAYS

****

FACILITY LOCATION.... Mokulele Highway
ANALYST.............. K. Okamoto
TIME OF ANALYSIS..... Exist PM Pk
DATE OF ANALYSIS..... 08-09-1996
OTHER INFORMATION.... Near Puunene

A) ADJUSTMENT FACTORS

PERCENTAGE OF TRUCKS........................ 2
PERCENTAGE OF BUSES......................... 0
PERCENTAGE OF RECREATIONAL VEHICLES......... 0
DESIGN SPEED (MPH).......................... 60
PEAK HOUR FACTOR............................ .76
DIRECTIONAL DISTRIBUTION (UP/DOWN).......... 56 / 44
LANE WIDTH (FT)............................. 12
USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 6
PERCENT NO PASSING ZONES.................... 50

B) CORRECTION FACTORS

LEVEL TERRAIN

LOS	E_T	E_B	E_R	f_w	f_d	f_{HV}
A	2	1.8	2.2	1	.96	.98
B	2.2	2	2.5	1	.96	.98
C	2.2	2	2.5	1	.96	.98
D	2	1.6	1.6	1	.96	.98
E	2	1.6	1.6	1	.96	.98

C) LEVEL OF SERVICE RESULTS

INPUT VOLUME(vph): 1673
ACTUAL FLOW RATE: 2201

LOS	SERVICE FLOW RATE	V/C
A	237	.09
B	551	.21
C	945	.36
D	1581	.6
E	2635	1

LOS FOR GIVEN CONDITIONS: E

```
HCM: SIGNALIZED INTERSECTION SUMMARY   Version 2.4c       08-22-1996
                  Parsons Brinckerhoff Quade & Douglas
=====================================================================
Streets: (E-W) Kuihelani/Dairy Rd        (N-S) Puunene
Analyst: J. Imai                         File Name: PUUKUIAM.HC9
Area Type: Other                         8-8-96
Comment: AM Peak Existing
=====================================================================
              |    Eastbound   |   Westbound    |   Northbound   |   Southbound
              |  L    T    R   |  L    T    R   |  L    T    R   |  L    T    R
              | ---- ---- ---- | ---- ---- ---- | ---- ---- ---- | ---- ---- ----
No. Lanes     |  1    1  <     |  1    1    1   |  1    2    1   |  1    1    1
Volumes       |   71  227   16 |  162  280   80 |   25  455  331 |   57  357  141
PHF or PK15   | 0.84 0.84 0.84 | 0.93 0.93 0.93 | 0.82 0.82 0.82 | 0.93 0.93 0.93
Lane W (ft)   | 12.0 12.0      | 12.0 12.0 12.0 | 12.0 12.0 12.0 | 12.0 12.0 12.0
Grade         |        0       |        0       |        0       |        0
% Heavy Veh   |    2    2    2 |    2    2    2 |    2    2    2 |    2    2    2
Parking       | (Y/N) N        | (Y/N) N        | (Y/N) N        | (Y/N) N
Bus Stops     |              0 |              0 |              0 |              0
Con. Peds     |              0 |              0 |              0 |              0
Ped Button    | (Y/N) Y 17.5 s | (Y/N) Y 17.5 s | (Y/N) Y 14.5 s | (Y/N) Y 11.5
Arr Type      |    3    3      |    3    3    3 |    3    3    3 |    3    3    3
RTOR Vols     |              0 |              0 |              0 |              0
Lost Time     | 3.00 3.00 3.00 | 3.00 3.00 3.00 | 3.00 3.00 3.00 | 3.00 3.00 3.00
Prop. Share   |                |                |                |
Prop. Prot.   |                |             18 |             53 |
---------------------------------------------------------------------
                          Signal Operations
Phase Combination 1    2    3    4 |               5    6    7    8
EB  Left          *    *           | NB  Left      *    *
    Thru               *           |     Thru           *
    Right              *           |     Right          *
    Peds                           |     Peds           *
WB  Left          *    *           | SB  Left      *    *
    Thru               *           |     Thru           *
    Right              *           |     Right          *
    Peds               *           |     Peds
NB  Right         *                | EB  Right
SB  Right         *                | WB  Right     *
Green          35.0P 55.0P         | Green     10.0P 40.0P
Yellow/AR        5.0   5.0         | Yellow/AR 5.0   5.0
Cycle Length: 160 secs  Phase combination order: #1 #2 #5 #6
---------------------------------------------------------------------
                   Intersection Performance Summary
     Lane   Group:   Adj Sat    v/c     g/C                  Approach:
     Mvmts   Cap      Flow     Ratio   Ratio   Delay  LOS    Delay  LOS
     -----  ----    -------    -----   -----   -----  ---    -----  ---
EB   L       588      1770     0.145   0.481   11.1    B     25.8    D
     TR      657      1844     0.440   0.356   30.2    D
WB   L       599      1770     0.290   0.481   11.7    B     22.9    C
     T       664      1863     0.454   0.356   30.4    D
     R       712      1583     0.121   0.450   19.5    C
NB   L       180      1770     0.167   0.169   28.2    D     31.6    D
     T       978      3725     0.596   0.262   39.9    D
     R       811      1583     0.498   0.512   19.8    C
SB   L       207      1770     0.295   0.169   27.7    D     37.4    D
     T       489      1863     0.785   0.262   47.3    E
     R       811      1583     0.187   0.512   16.0    C
               Intersection Delay =  30.2 sec/veh Intersection LOS = D
Lost Time/Cycle, L =  12.0 sec   Critical v/c(x)     = 0.541
```

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4c 08-22-1996
Parsons Brinckerhoff Quade & Douglas

Streets: (E-W) Kuihelani/Dairy Rd (N-S) Puunene
Analyst: J. Imai File Name: PUUKUIPM.HC9
Area Type: Other 8-8-96
Comment: PM Peak Existing

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	<	1	1	1	1	2	1	1	1	1
Volumes	221	346	27	362	317	62	22	498	203	77	588	89
PHF or PK15	0.87	0.87	0.87	0.94	0.94	0.94	0.73	0.73	0.73	0.87	0.87	0.87
Lane W (ft)	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Grade		0			0			0			0	
% Heavy Veh	2	2	2	2	2	2	2	2	2	2	2	2
Parking	(Y/N)	N		(Y/N)	N		(Y/N)	N		(Y/N)	N	
Bus Stops			0			0			0			0
Con. Peds			0			0			0			0
Ped Button	(Y/N)	Y	17.5 s	(Y/N)	Y	17.5 s	(Y/N)	Y	14.5 s	(Y/N)	Y	11.5
Arr Type	3	3		3	3	3	3	3	3	3	3	3
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Prop. Share												
Prop. Prot.						18			53			

Signal Operations

Phase Combination		1	2	3	4
EB	Left	*	*		
	Thru		*		
	Right		*		
	Peds				
WB	Left	*	*		
	Thru		*		
	Right		*		
	Peds		*		
NB	Right	*			
SB	Right	*			
Green		30.0P	45.0P		
Yellow/AR		5.0	5.0		

		5	6	7	8
NB	Left	*	*		
	Thru		*		
	Right		*		
	Peds		*		
SB	Left	*	*		
	Thru		*		
	Right		*		
	Peds				
EB	Right				
WB	Right	*			
Green		10.0P	55.0P		
Yellow/AR		5.0	5.0		

Cycle Length: 160 secs Phase combination order: #1 #2 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	452	1770	0.562	0.419	20.7	C	36.0	D
	TR	541	1843	0.792	0.294	45.0	E		
WB	L	401	1770	0.965	0.419	65.5	F	50.5	E
	T	547	1863	0.619	0.294	38.6	D		
	R	613	1583	0.108	0.387	23.8	C		
NB	L	179	1770	0.168	0.169	26.3	D	26.5	D
	T	1327	3725	0.543	0.356	31.6	D		
	R	910	1583	0.308	0.575	13.4	B		
SB	L	213	1770	0.418	0.169	22.2	C	59.2	E
	T	664	1863	1.020	0.356	71.2	F		
	R	910	1583	0.112	0.575	11.7	B		

Intersection Delay = 42.5 sec/veh Intersection LOS = E
Lost Time/Cycle, L = 12.0 sec Critical v/c(x) = 0.915

HCS: Unsignalized Intersections   Release 2.1c   PUUHANAM.HC0   Page 1

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI   96813-
Ph: (808) 531-7094

Streets: (N-S) Puunene Ave   (E-W) Hansen Rd
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... J. Imai
Date of Analysis.......... 8/8/96
Other Information.........AM Peak Existing
Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	0	0	0	0	1	0	1
Stop/Yield			Y			Y						
Volumes		606	133	40	491					202		56
PHF		.915	.915	.879	.879					.921		.921
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	662	
Potential Capacity: (pcph)	640	
Movement Capacity: (pcph)	640	
Prob. of Queue-Free State:	0.90	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	662	
Potential Capacity: (pcph)	829	
Movement Capacity: (pcph)	829	
Prob. of Queue-Free State:	0.94	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	1268	
Potential Capacity: (pcph)	195	
Major LT, Minor TH Impedance Factor:	0.94	
Adjusted Impedance Factor:	0.94	
Capacity Adjustment Factor due to Impeding Movements	0.94	
Movement Capacity: (pcph)	183	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	241	183		220.4	12.0	F	173.9
WB R	67	640		6.3	0.3	B	
SB L	51	829		4.6	0.1	A	0.3

Intersection Delay = 29.5 sec/veh

HCS: Unsignalized Intersections Release 2.1c PUUHANPM.HC0 Page 1

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813-
Ph: (808) 531-7094

Streets: (N-S) Puunene Ave (E-W) Hansen Rd
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... J. Imai
Date of Analysis.......... 8/8/96
Other Information.........PM Peak Existing
Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	0	0	0	0	1	0	1
Stop/Yield			Y			Y						
Volumes		565	230	55	750					199		64
PHF		.767	.767	.727	.727					.774		.774
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	737	
Potential Capacity: (pcph)	586	
Movement Capacity: (pcph)	586	
Prob. of Queue-Free State:	0.84	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	737	
Potential Capacity: (pcph)	764	
Movement Capacity: (pcph)	764	
Prob. of Queue-Free State:	0.89	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	1845	
Potential Capacity: (pcph)	90	
Major LT, Minor TH Impedance Factor:	0.89	
Adjusted Impedance Factor:	0.89	
Capacity Adjustment Factor due to Impeding Movements	0.89	
Movement Capacity: (pcph)	80	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	283	80		*	26.4	F	944.9
WB R	91	586		7.3	0.6	B	
SB L	84	764		5.3	0.3	B	0.4

Intersection Delay = 133.6 sec/veh

* The calculated value was greater than 999.9.

===

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813-
Ph: (808) 531-7094

===

Streets: (N-S) Puunene/Mokulele (E-W) Road to Sugar Mill
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... J. Imai
Date of Analysis.......... 8/8/96
Other Information.........AM Peak Existing
Two-way Stop-controlled Intersection

===

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	1	1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		691		40	653					3		48
PHF		.909		.926	.926					.797		.797
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	760	
Potential Capacity: (pcph)	570	
Movement Capacity: (pcph)	570	
Prob. of Queue-Free State:	0.88	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	760	
Potential Capacity: (pcph)	745	
Movement Capacity: (pcph)	745	
Prob. of Queue-Free State:	0.94	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	1508	
Potential Capacity: (pcph)	142	
Major LT, Minor TH Impedance Factor:	0.94	
Adjusted Impedance Factor:	0.94	
Capacity Adjustment Factor due to Impeding Movements	0.94	
Movement Capacity: (pcph)	133	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	4	133		27.9	0.0	D	8.4
WB R	66	570		7.1	0.4	B	
SB L	47	745		5.2	0.1	B	0.3

Intersection Delay = 0.4 sec/veh

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813-
Ph: (808) 531-7094

Streets: (N-S) Puunene/Mokulele (E-W) Road to Sugar Mill
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... J. Imai
Date of Analysis.......... 8/8/96
Other Information.........PM Peak Existing
Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	1	1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		736		14	935					2		59
PHF		.777		.739	.739					.61		.61
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	947	
Potential Capacity: (pcph)	459	
Movement Capacity: (pcph)	459	
Prob. of Queue-Free State:	0.77	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	947	
Potential Capacity: (pcph)	606	
Movement Capacity: (pcph)	606	
Prob. of Queue-Free State:	0.97	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	2231	
Potential Capacity: (pcph)	54	
Major LT, Minor TH Impedance Factor:	0.97	
Adjusted Impedance Factor:	0.97	
Capacity Adjustment Factor due to Impeding Movements	0.97	
Movement Capacity: (pcph)	52	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	3	52		73.4	0.0	F	12.3
WB R	107	459		10.2	1.0	C	
SB L	21	606		6.2	0.0	B	0.1

Intersection Delay = 0.5 sec/veh

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4c 08-09-1996
Parsons Brinckerhoff Quade & Douglas

==

Streets: (E-W) Piilani Hwy (N-S) Mokulele Hwy
Analyst: J. Imai File Name: PIIMOK1A.HC9
Area Type: Other 6-10-96
Comment: AM Peak Existing

==

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	<	1	1	1		> 1	1	1	1	1
Volumes	18	185	6	3	489	574	4	313	5	497	185	23
PHF or PK15	0.89	0.89	0.89	0.94	0.94	0.94	0.89	0.89	0.89	0.88	0.88	0.88
Lane W (ft)	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0
Grade		0			0			0			0	
% Heavy Veh	2	2	2	2	2	2	2	2	2	2	2	2
Parking	(Y/N)	N		(Y/N)	N		(Y/N)	N		(Y/N)	N	
Bus Stops			0			0			0			0
Con. Peds			0			0			0			0
Ped Button	(Y/N)	Y 11.5	s	(Y/N)	Y 14.5	s	(Y/N)	Y 14.5	s	(Y/N)	Y 11.5	
Arr Type	3	3		3	3	3		3	3	3	3	3
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Prop. Share												
Prop. Prot.												

Signal Operations

Phase Combination		1	2	3	4
EB	Left	*			
	Thru	*			
	Right	*			
	Peds				
WB	Left	*			
	Thru	*			
	Right	*			
	Peds				
NB	Right				
SB	Right				
Green		27.0A			
Yellow/AR		5.0			

		5	6	7	8
NB	Left	*			
	Thru	*			
	Right	*			
	Peds				
SB	Left	*			
	Thru	*			
	Right	*			
	Peds				
EB	Right				
WB	Right	*			
Green		68.0A			
Yellow/AR		5.0			

Cycle Length: 105 secs Phase combination order: #1 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	L	71	257	0.282	0.276	19.9	C	20.4	C
	TR	512	1854	0.420	0.276	20.4	C		
WB	L	218	788	0.014	0.276	17.8	C	26.6	D
	T	515	1863	1.011	0.276	57.8	E		
	R	1583	1583	0.386	1.000	0.1	A		
NB	LT	1238	1857	0.288	0.667	4.7	A	4.7	A
	R	1055	1583	0.006	0.667	3.8	A		
SB	L	475	713	1.189	0.667	*	*	*	*
	T	1242	1863	0.169	0.667	4.3	A		
	R	1055	1583	0.025	0.667	3.8	A		

Intersection Delay = * (sec/veh) Intersection LOS = *

(g/C)*(V/c) is greater than one. Calculation of D1 is infeasable.

NS Mokulele Highway
Date of Analysis: 11/19/96
Analyst: KO
Comments: EXISTING AM PEAK HOUR

		Vmeas	PHF	Va	Vgp	C	g/C	c	X = Vgp/c	d1	d2	PF	TD	LOS
EB	LT	18	0.89	20	20	105	0.28	71	0.282	22.7	0.6	1	23.3	C
	TH	185	0.89	208	215	105	0.28	512	0.42	23.7	0.3	1	24.0	C
	RT	6	0.89	7										A
WB	LT	3	0.94	3	3	105	0.28	218	0.014	21.0	0.0	1	21.0	C
	TH	489	0.94	520	520	105	0.28	515	1.011	29.0	33.3	1	62.4	F
	RT	574	0.94	611	611	105	1	1583	0.386	0.0	0.1	1	0.1	A
NB	LT	4	0.89	4										A
	TH	313	0.89	352	356	105	0.67	1238	0.288	5.5	0.0	1	5.5	B
	RT	5	0.89	6	6	105	0.67	1055	0.006	4.4	0.0	1	4.4	A
SB	LT	497	0.88	565	565	105	0.67	475	1.189	21.4	113.5	1	134.9	F
	TH	185	0.88	210	210	105	0.67	1242	0.169	5.0	0.0	1	5.0	A
	RT	23	0.88	26	26	105	0.67	1055	0.025	4.5	0.0	1	4.5	A

SUM Vgp = 2532

INTERSECTION DELAY = 46.42 E

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4c 08-09-1996

Parsons Brinckerhoff Quade & Douglas

===

Streets: (E-W) Piilani Hwy (N-S) Mokulele Hwy

Analyst: J. Imai File Name: PIIMOK1P.HC9

Area Type: Other 6-10-96

Comment: PM Peak Existing

===

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	<	1	1	1		> 1	1	1	1	1
Volumes	32	431	14	4	294	572	3	199	5	674	236	30
PHF or PK15	0.86	0.86	0.86	0.87	0.87	0.87	0.80	0.80	0.80	0.89	0.89	0.89
Lane W (ft)	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0
Grade		0			0			0			0	
% Heavy Veh	2	2	2	2	2	2	2	2	2	2	2	2
Parking	(Y/N)	N		(Y/N)	N		(Y/N)	N		(Y/N)	N	
Bus Stops			0			0			0			0
Con. Peds			0			0			0			0
Ped Button	(Y/N)	Y	11.5 s	(Y/N)	Y	14.5 s	(Y/N)	Y	14.5 s	(Y/N)	Y	11.5
Arr Type	3	3		3	3	3		3	3	3	3	3
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Prop. Share												
Prop. Prot.												

Signal Operations

Phase Combination		1	2	3	4
EB	Left	*			
	Thru	*			
	Right	*			
	Peds				
WB	Left	*			
	Thru	*			
	Right	*			
	Peds				
NB	Right				
SB	Right				
Green		27.0A			
Yellow/AR		5.0			

		5	6	7	8
NB	Left	*			
	Thru	*			
	Right	*			
	Peds				
SB	Left	*			
	Thru	*			
	Right	*			
	Peds				
EB	Right				
WB	Right	*			
Green		68.0A			
Yellow/AR		5.0			

Cycle Length: 105 secs Phase combination order: #1 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	Approach: LOS
EB	L	110	399	0.336	0.276	20.3	C	55.1	E
	TR	512	1854	1.010	0.276	57.6	E		
WB	L	71	257	0.070	0.276	18.1	C	8.2	B
	T	515	1863	0.657	0.276	23.8	C		
	R	1583	1583	0.415	1.000	0.1	A		
NB	LT	1235	1853	0.205	0.667	4.4	A	4.4	A
	R	1055	1583	0.006	0.667	3.8	A		
SB	L	616	924	1.229	0.667	*	*	*	*
	T	1242	1863	0.213	0.667	4.4	A		
	R	1055	1583	0.032	0.667	3.9	A		

Intersection Delay = * (sec/veh) Intersection LOS = *

(g/C)*(V/c) is greater than one. Calculation of D1 is infeasable.

NS Mokulele Highway
Date of Analysis: 11/19/96
Analyst: KO
Comments: EXISTING PM PEAK HOUR

		Vmeas	PHF	Va	Vgp	C	g/C	c	X = Vgp/c	d1	d2	PF	TD	LOS
	LT	32	0.86	37	37	105	0.28	110	0.336	23.1	0.7	1	23.8	C
EB	TH	431	0.86	501	517	105	0.28	512	1.01	29.0	33.2	1	62.2	F
	RT	14	0.86	16										A
	LT	4	0.87	5	5	105	0.28	71	0.07	21.3	0.0	1	21.3	C
WB	TH	294	0.87	338	338	105	0.28	515	0.657	25.5	2.1	1	27.7	D
	RT	572	0.87	657	657	105	1	1583	0.415	0.0	0.1	1	0.1	A
	LT	3	0.80	4										A
NB	TH	199	0.80	249	253	105	0.67	1235	0.205	5.1	0.0	1	5.1	B
	RT	5	0.80	6	6	105	0.67	1055	0.006	4.4	0.0	1	4.4	A
	LT	674	0.89	757	757	105	0.67	616	1.229	24.5	135.7	1	160.3	F
SB	TH	236	0.89	265	265	105	0.67	1242	0.213	5.2	0.0	1	5.2	B
	RT	30	0.89	34	34	105	0.67	1055	0.032	4.5	0.0	1	4.5	A

SUM Vgp = 2870 INTERSECTION DELAY = 58.13 E

WORKSHEET FOR ANALYSIS OF TWSC T-INTERSECTIONS

Location: MOKULELE / S. KIHEI

Name: K. OKAMOTO

HOURLY VOLUMES

Major Street Name: S. KIHEI

N= 1   N= 1   Exclusive LT Lane? N (Y/N)

Grade %   Grade %

N= 2

Date of Counts: 6/6/96

Time Period: AM PEAK

Average Running Speed: ____

PHF: ____

Minor Street Name: MOKULELE

VOLUMES IN PCPH

V_2 NA V_3 NA V_5 NA V_4 V_7 V_9

VOLUME ADJUSTMENTS

Movement No.	2	3	4	5	7	9
Volume, V (vph)	377	313	1	121	191	1
Volume, v (pcph), see Table 10-1			1		210	1

STEP 1: RT from Minor Street (V_9)

Conflicting Flows: V_c (Figure 10-3) — $V_{c,9}=1/2V_3^{①}+V_2$ 157 + 377 = 534 vph

Potential Capacity: $c_{p,i}$ (Fig. 10-4, 5) — $c_{p,9}=$ 743 pcph

Movement Capacity: $c_{m,i}$ — $c_{m,9}=c_{p,9}=$ 743 pcph

STEP2: LT From Major Street (V_4)

Conflicting Flows: V_c (Figure 10-3) — $V_{c,4}=\cancel{V_3^{②}}+V_2$ ____ + 377 = 377 vph   AND $V_{c,4} = V_3 + V_7 = 313 + 191 = 504$

Potential Capacity: $c_{p,i}$ (Fig. 10-4, 5) — $c_{p,4}=$ 1134 pcph $c_{p,4} = 986$

Movement Capacity: $c_{m,i}$ — $c_{m,4}=c_{p,4}=$ 1134 pcph $c_{m,4} = c_{p,4} = 986$

Prob. of Queue-free State: $p_{0,i}$ (Equation 10-3) — $p_{0,4}=1-v_4/c_{m,4}=$ 0.999 $p_{0,4} = 0.999$

Major Left Shared Lane Prob. of Queue-free State: $p^*_{0,i}$ (Equation 10-10) — $p^*_{0,4}= 1-\dfrac{1-p_{0,4}}{1-\left(\frac{V_5}{s_5}\right)} =$ 0.999 $p^*_{0,4} = 0.999$

STEP 3: LT From Minor Street (V_7)

Conflicting Flows: V_c (Figure 10-3) — $V_{c,7}=1/2V_3^{①}+V_2+V_5+\cancel{V_4}$ 157 + 377 + 121 + ____ = 655 vph

Potential Capacity: $c_{p,i}$ (Fig. 10-4, 5) — $c_{p,7}=$ 442 pcph

Capacity Adjustment Factor due to Impeding Movements: f_i — $f_7=p_{0,4}=$ 0.999 (shared lane use p^*)

Movement Capacity: $c_{m,i}$ — $c_{m,7}=f_7 \times c_{p,7}=$ 442 pcph

SHARED-LANE CAPACITY

$$c_{SH}=\frac{v_7+v_9}{(v_7/c_{m,7})+(v_9/c_{m,9})} \text{ if lane is shared}$$

Movement No.	v(pcph)	c_m(pcph)	c_{SH} (pcph)	Avg. Total Delay (Fig. 10-7)	LOS	D_A
7	210	442		15.3	C	
9	1	743		4.9	A	
4	1	1134		3.2	A	

Average total delay for the intersection (Eq. 10-14) $\dfrac{D_7V_7 + D_9V_9 + D_4V_4}{V_2 + V_3 + V_4 + V_5 + V_7 + V_9}$ ____

① - if a right turn lane exists on major road V_3 is excluded
② - if right turn from major street is channelized and yields to major street left turning traffic, V_3 is excluded.

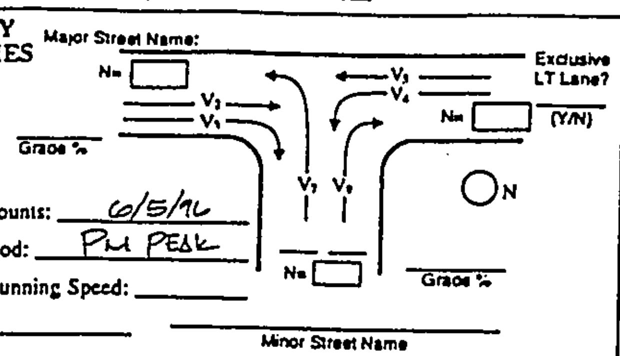
Figure 10-10. Worksheet for analysis of TWSC T-intersections.

Updated October 1994

WORKSHEET FOR ANALYSIS OF TWSC T-INTERSECTIONS

Location: Makulele/S. Kihei Rd. Name: B. Okamoto

HOURLY VOLUMES



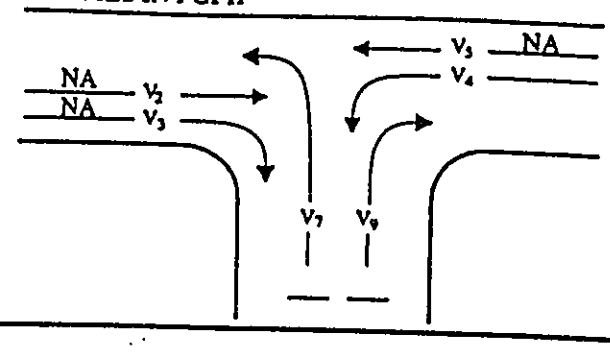
Date of Counts: 6/5/96

Time Period: PM PEAK

Average Running Speed: ______

PHF: ______

VOLUMES IN PCPH



VOLUME ADJUSTMENTS

Movement No.	2	3	4	5	7	9
Volume, V (vph)	230	204	2	392	246	5
Volume, v (pcph), see Table 10-1			2		271	6

STEP 1: RT from Minor Street — V_9

Conflicting Flows: V_c (Figure 10-3): $V_{c,9}=1/2V_3^{①}+V_2$ — 102 + 230 = 332 vph

Potential Capacity: $c_{p,i}$ (Fig. 10-4, 5): $c_{p,9}=$ 940 pcph

Movement Capacity: $c_{m,i}$: $c_{m,9}=c_{p,9}=$ 940 pcph

STEP2: LT From Major Street — V_4

Conflicting Flows: V_c (Figure 10-3): $V_{c,4}=\cancel{V_3}^{②}+V_2$ — ____ + 230 = 230 vph AND $V_{c,4} = V_3 + V_7$ = 204 + 246 = 450

Potential Capacity: $c_{p,i}$ (Fig. 10-4, 5): $c_{p,4}=$ 1332 pcph $c_{p,4}$ = 1046

Movement Capacity: $c_{m,i}$: $c_{m,4}=c_{p,4}=$ 1332 pcph $c_{m,4} = c_{p,4}$ = 1046

Prob. of Queue-free State: $p_{0,i}$ (Equation 10-3): $p_{0,4}=1-v_4/c_{m,4}=$ 0.9985 $p_{0,4}$ = 0.9981

Major Left Shared Lane Prob. of Queue-free State: $p^*_{0,i}$ (Equation 10-10): $p^*_{0,4}= 1-\frac{1-p_{0,4}}{1-\left(\frac{V_5}{S_5}\right)}$ = 0.9981 $p^*_{0,4}$ = 0.9976

STEP 3: LT From Minor Street — V_7

Conflicting Flows: V_c (Figure 10-3): $V_{c,7}=1/2V_3^{①}+V_2+V_5+\cancel{V_4}$ — 102 + 230 + 392 + ____ = 724 vph

Potential Capacity: $c_{p,i}$ (Fig. 10-4, 5): $c_{p,7}=$ 403 pcph

Capacity Adjustment Factor due to Impeding Movements: f_i: $f_7=p_{0,4}=$ 0.998 (shared lane use p*)

Movement Capacity: $c_{m,i}$: $c_{m,7}=f_7\times c_{p,7}=$ 402 pcph

SHARED-LANE CAPACITY

$$c_{SH}=\frac{v_7+v_9}{(v_7/c_{m,7})+(v_9/c_{m,9})}$$ – if lane is shared

Movement No.	v(pcph)	c_m(pcph)	c_{SH} (pcph)	Avg. Total Delay (Fig. 10-7)	LOS	D_A
7	271	402		18.6	C	
9	6	940		3.8	A	
4	2	1046		3.4	A	

Average total delay for the intersection (Eq. 10-14) $\frac{D_7V_7+D_9V_9+D_4V_4}{V_2+V_3+V_4+V_5+V_7+V_9}$ ______

① - if a right turn lane exists on major road V_3 is excluded
② - if right turn from major street is channelized and yields to major street left turning traffic, V_3 is excluded.

Figure 10-10. Worksheet for analysis of TWSC T-intersections.

Updated October 1994

1985 HCM:TWO-LANE HIGHWAYS

```
*********************************************************
```

FACILITY LOCATION.... Mokulele Highway
ANALYST.............. K. Okamoto
TIME OF ANALYSIS..... AM Peak
DATE OF ANALYSIS..... 11/21/96
OTHER INFORMATION.... Year 2020 No Build Near Puunene

A) ADJUSTMENT FACTORS

PERCENTAGE OF TRUCKS........................	2
PERCENTAGE OF BUSES.........................	0
PERCENTAGE OF RECREATIONAL VEHICLES.........	0
DESIGN SPEED (MPH)..........................	60
PEAK HOUR FACTOR............................	.95
DIRECTIONAL DISTRIBUTION (UP/DOWN)..........	49 / 51
LANE WIDTH (FT).............................	12
USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)...	6
PERCENT NO PASSING ZONES....................	40

B) CORRECTION FACTORS

LEVEL TERRAIN

LOS	E_T	E_B	E_R	f_w	f_d	f_{HV}
A	2	1.3	2.2	1	.99	.98
B	2.2	2	2.5	1	.99	.98
C	2.2	2	2.5	1	.99	.98
D	2	1.6	1.6	1	.99	.98
E	2	1.6	1.6	1	.99	.98

C) LEVEL OF SERVICE RESULTS

INPUT VOLUME(vph): 2680
ACTUAL FLOW RATE: 2821

LOS	SERVICE FLOW RATE	V/C
A	246	.09
B	571	.21
C	978	.36
D	1637	.6
E	2729	1

LOS FOR GIVEN CONDITIONS: F

1985 HCM:TWO-LANE HIGHWAYS

****

FACILITY LOCATION.... Mokulele Highway
ANALYST.............. K. Okamoto
TIME OF ANALYSIS..... PM Peak
DATE OF ANALYSIS..... 11/21/96
OTHER INFORMATION.... Year 2020 No Build Near Puunene

A) ADJUSTMENT FACTORS

PERCENTAGE OF TRUCKS........................ 2
PERCENTAGE OF BUSES......................... 0
PERCENTAGE OF RECREATIONAL VEHICLES......... 0
DESIGN SPEED (MPH).......................... 60
PEAK HOUR FACTOR............................ .95
DIRECTIONAL DISTRIBUTION (UP/DOWN).......... 56 / 44
LANE WIDTH (FT)............................. 12
USABLE SHOULDER WIDTH (AVG. WIDTH IN FT.)... 5
PERCENT NO PASSING ZONES.................... 40

B) CORRECTION FACTORS

LEVEL TERRAIN

LOS	E T	E B	E R	f w	f d	f HV
A	2	1.8	2.2	1	.96	.98
B	2.2	2	2.5	1	.96	.98
C	2.2	2	2.5	1	.96	.98
D	2	1.6	1.6	1	.96	.98
E	2	1.6	1.6	1	.96	.98

C) LEVEL OF SERVICE RESULTS

INPUT VOLUME(vph): 3085
ACTUAL FLOW RATE: 3247

LOS	SERVICE FLOW RATE	V/C
A	238	.09
B	554	.21
C	949	.36
D	1588	.6
E	2646	1

LOS FOR GIVEN CONDITIONS: F

HCS: Signalized Intersection Version 2.4d 12-13-1996 1

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813 (808) 531-7094

Streets: (E-W) Piilani Hwy (N-S) Mokulele Hwy
Analyst: KO File Name: PIIMOK1A.HC9
Area Type: Other 11-20-96 AM Peak
Comment: Year 2020 No Build

Traffic and Roadway Conditions

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	<	1	1	1		> 1	1	1	1	1
Volumes	35	305	10	10	650	995	5	545	10	820	415	35
PHF or PK15	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane W (ft)	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0
Grade		0			0			0			0	
% Heavy Veh	2	2	2	2	2	2	2	2	2	2	2	2
Parking	(Y/N)	N		(Y/N)	N		(Y/N)	N		(Y/N)	N	
Bus Stops			0			0			0			0
Con. Peds			0			0			0			0
Ped Button	(Y/N)	Y	11.5 s	(Y/N)	Y	14.5 s	(Y/N)	Y	14.5 s	(Y/N)	Y	11.5
Arr Type	3	3		3	3	3		3	3	3	3	3
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Signal Operations

Phase Combination		1	2	3	4
EB	Left	*			
	Thru	*			
	Right	*			
	Peds				
WB	Left	*			
	Thru	*			
	Right	*			
	Peds				
NB	Right				
SB	Right				
Green		35.0A			
Yellow/AR		5.0			

		5	6	7	8
NB	Left	*			
	Thru	*			
	Right	*			
	Peds				
SB	Left	*			
	Thru	*			
	Right	*			
	Peds				
EB	Right				
WB	Right	*			
Green		75.0A			
Yellow/AR		5.0			

Cycle Length: 120 secs Phase combination order: #1 #5

HCS: Signalized Intersection Version 2.4d 12-13-1996 2

Streets: (E-W) Piilani Hwy (N-S) Mokulele Hwy
Analyst: KO File Name: PIIMOK1A.HC9
Area Type: Other 11-20-96 AM Peak
Comment: Year 2020 No Build

Volume Adjustment Worksheet

Direction/ Mvt	Mvt Vol	PHF	Adj Vol	Lane Grp	Lane Grp Vol	No. Ln	Lane Util Fact	Growth Fact	Adj Grp Vol	Prop LT	Prop RT
EB											
Left	35	0.95	37	L	37	1	1.000	1.000	37	1.00	0.00
Thru	305	0.95	321	TR	332	1	1.000	1.000	332	0.00	0.03
Right	10	0.95	11								
WB											
Left	10	0.95	11	L	11	1	1.000	1.000	11	1.00	0.00
Thru	650	0.95	684	T	684	1	1.000	1.000	684	0.00	0.00
Right	995	0.95	1047	R	1047	1	1.000	1.000	1047	0.00	1.00
NB											
Left	5	0.95	5								
Thru	545	0.95	574	LT	579	1	1.000	1.000	579	0.01	0.00
Right	10	0.95	11	R	11	1	1.000	1.000	11	0.00	1.00
SB											
Left	820	0.95	863	L	863	1	1.000	1.000	863	1.00	0.00
Thru	415	0.95	437	T	437	1	1.000	1.000	437	0.00	0.00
Right	35	0.95	37	R	37	1	1.000	1.000	37	0.00	1.00

Saturation Flow Adjustment Worksheet

Direction /LnGrp	Ideal Sat Flow	No. Lns	f_W	f_{HV}	f_G	f_p	f_{BB}	f_A	f_{RT}	f_{LT}	Adj Sat Flow
EB											
L	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.11	201
TR	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1853
WB											
L	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.25	466
T	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1863
R	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	0.85	1.00	1583
NB											
LT	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.99	1850
R	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	0.85	1.00	1583
SB											
L	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.17	322
T	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1863
R	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	0.85	1.00	1583

```
HCS:  Signalized Intersection     Version 2.4d              12-13-1996  3
===========================================================================
Streets: (E-W) Piilani Hwy
Analyst: KO                              (N-S) Mokulele Hwy
Area Type: Other                         File Name: PIIMOK1A.HC9
Comment: Year 2020 No Build              11-20-96 AM Peak
===========================================================================
Supplemental Permitted LT Worksheet

  APPROACH
Cycle Length, C                                              EB
Actual Green Time for Lane Group, G                          120
Effective Green Time for Lane Group, g                       35
Opposing Effective Green Time, go                            37
Number of Opposing Lanes, No                                 37
Number of Lanes in Lane Group, N                             1
Adjusted Left-Turn Flow Rate, Vlt                            1
Proportion of Left Turns in Lane Group, Plt                  37
Left Turns per Cycle: LTC=Vlt*C/3600                          1.00
Adjusted Opposing Flow Rate, Vo                               1.23
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600No           684
Opposing Platoon Ratio, Rpo                                  22.80
Lost time per phase, tl                                      1
gf=Gexp(-0.882*LTC^0.717)-tl                                 3
Opposing Queue Ratio: qro=1-Rpo(go/C)                         0.00
gq = Volc * qro / (.5 - Volc * (1 - qro) / go)-tl             0.69
gu=g-gq (or g-gf)                                            37.00
fs=(875-0.625Vo)/1000                                         0.00
Pl=Plt[1+{(N-1)g/(fs*gu+4.5)}]                                0.45
Ell                                                           1.00
fmin                                                          7.09
fm, (min=fmin;max=1.00)                                       0.11
flt=[fm+0.91(N-1)]/N                                          0.11
                                                              0.11
  APPROACH
Cycle Length, C                                              WB
Actual Green Time for Lane Group, G                          120
Effective Green Time for Lane Group, g                       35
Opposing Effective Green Time, go                            37
Number of Opposing Lanes, No                                 37
Number of Lanes in Lane Group, N                             1
Adjusted Left-Turn Flow Rate, Vlt                            1
Proportion of Left Turns in Lane Group, Plt                  11
Left Turns per Cycle: LTC=Vlt*C/3600                          1.00
Adjusted Opposing Flow Rate, Vo                               0.37
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600No           332
Opposing Platoon Ratio, Rpo                                  11.07
Lost time per phase, tl                                      1
gf=Gexp(-0.882*LTC^0.717)-tl                                 3
Opposing Queue Ratio: qro=1-Rpo(go/C)                         0.00
gq = Volc * qro / (.5 - Volc * (1 - qro) / go)-tl             0.69
gu=g-gq (or g-gf)                                            15.77
fs=(875-0.625Vo)/1000                                        21.23
Pl=Plt[1+{(N-1)g/(fs*gu+4.5)}]                                0.67
Ell                                                           1.00
fmin                                                          2.29
fm, (min=fmin;max=1.00)                                       0.11
                                                              0.25
```

flt=[fm+0.91(N-1)]/N	0.25

APPROACH	NB
Cycle Length, C	120
Actual Green Time for Lane Group, G	75
Effective Green Time for Lane Group, g	77
Opposing Effective Green Time, go	77
Number of Opposing Lanes, No	1
Number of Lanes in Lane Group, N	1
Adjusted Left-Turn Flow Rate, Vlt	5
Proportion of Left Turns in Lane Group, Plt	0.01
Left Turns per Cycle: LTC=Vlt*C/3600	0.17
Adjusted Opposing Flow Rate, Vo	437
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600No	14.57
Opposing Platoon Ratio, Rpo	1
Lost time per phase, tl	3
gf=Gexp(-0.882*LTC^0.717)-tl	55.76
Opposing Queue Ratio: qro=1-Rpo(go/C)	0.36
gq = Volc * qro / (.5 - Volc * (1 - qro) / go)-tl	10.79
gu=g-gq (or g-gf)	21.24
fs=(875-0.625Vo)/1000	0.60
Pl=Plt[1+{(N-1)g/(fs*gu+4.5)}]	0.01
El1	3.89
fmin	0.03
fm,(min=fmin;max=1.00)	0.99
flt=[fm+0.91(N-1)]/N	0.99

APPROACH	SB
Cycle Length, C	120
Actual Green Time for Lane Group, G	75
Effective Green Time for Lane Group, g	77
Opposing Effective Green Time, go	77
Number of Opposing Lanes, No	1
Number of Lanes in Lane Group, N	1
Adjusted Left-Turn Flow Rate, Vlt	863
Proportion of Left Turns in Lane Group, Plt	1.00
Left Turns per Cycle: LTC=Vlt*C/3600	28.77
Adjusted Opposing Flow Rate, Vo	579
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600No	19.30
Opposing Platoon Ratio, Rpo	1
Lost time per phase, tl	3
gf=Gexp(-0.882*LTC^0.717)-tl	0.00
Opposing Queue Ratio: qro=1-Rpo(go/C)	0.36
gq = Volc * qro / (.5 - Volc * (1 - qro) / go)-tl	17.39
gu=g-gq (or g-gf)	59.61
fs=(875-0.625Vo)/1000	0.51
Pl=Plt[1+{(N-1)g/(fs*gu+4.5)}]	1.00
El1	4.48
fmin	0.05
fm,(min=fmin;max=1.00)	0.17
flt=[fm+0.91(N-1)]/N	0.17

HCS: Signalized Intersection Version 2.4d 12-13-1996 4

Streets: (E-W) Piilani Hwy (N-S) Mokulele Hwy
Analyst: KO File Name: PIIMOK1A.HC9
Area Type: Other 11-20-96 AM Peak
Comment: Year 2020 No Build

Capacity Analysis Worksheet

Direction /LnGrp	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	Lane Group Capacity (c)	v/c Ratio	
EB							
L	37	201	0.184	0.308	62	0.597	
TR	332	1853	0.179	0.308	571	0.581	
WB							
L	11	466	0.024	0.308	144	0.077	
T	684	1863	0.367	0.308	574	1.191	*
R	1047	1583	0.661	1.000	1583	0.661	
NB							
LT	579	1850	0.313	0.642	1187	0.488	
R	11	1583	0.007	0.642	1016	0.011	
SB							
L	863	322	2.680	0.642	207	4.177	*
T	437	1863	0.235	0.642	1195	0.366	
R	37	1583	0.023	0.642	1016	0.036	

Sum (v/s) critical = 3.047
Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 3.208

Level of Service Worksheet

Direction /LnGrp	v/c Ratio	g/C Ratio	Delay d 1	Del Adj Fact	Lane Group Cap	Calib d 2	Delay d 2	Lane Grp Del	Lane Grp LOS	Delay By App	LOS By App
EB											
L	0.597	0.308	26.7	0.850	62	16	9.8	32.6	D	24.6	C
TR	0.581	0.308	26.6	0.850	571	16	1.1	23.7	C		
WB											
L	0.077	0.308	22.3	0.850	144	16	0.0	19.0	C	*	*
T	1.191	0.308	*	0.850	574	16	*	*	*		
R	0.661	1.000	0.0	0.850	1583	16	0.7	0.7	A		
NB											
LT	0.488	0.642	8.5	0.850	1187	16	0.3	7.5	B	7.5	B
R	0.011	0.642	5.9	0.850	1016	16	0.0	5.0	A		
SB											
L	4.177	0.642	*	0.850	207	16	*	*	*	*	*
T	0.366	0.642	7.6	0.850	1195	16	0.1	6.6	B		
R	0.036	0.642	6.0	0.850	1016	16	0.0	5.1	B		

Intersection Delay = * (sec/veh) Intersection LOS = *

* Delay and LOS not meaningful when any v/c is greater than 1.2 or 1/PHF

NS	Mokulele Highway
Date of Analysis:	12/12/96
Analyst:	L. Aburamen
Comments:	Year 2020, No Build, AM Peak Hour

		Vmeas	PHF	Va	Vgp	C	g/C	c	X = Vgp/c	d1	d2	PF	TD	LOS
	LT	35	0.95	37	37	120	0.31	62	0.597	26.7	9.8	0.85	62.6	F
EB	TH	305	0.95	321	332	120	0.31	571	0.581	26.6	1.1	0.85	23.7	C
	RT	10	0.95	11										
	LT	10	0.95	11	11	120	0.31	144	0.077	22.3	0.0	0.85	19.0	C
WB	TH	650	0.95	684	684	120	0.31	574	1.191	31.6	111.6	0.85	121.7	F
	RT	995	0.95	1047	1047	120	1	1583	0.661	0.0	0.7	0.85	0.7	A
	LT	5	0.95	5		120								
NB	TH	545	0.95	574	579	120	0.64	1187	0.488	8.5	0.3	0.85	7.5	B
	RT	10	0.95	11	11	120	0.64	1016	0.011	5.9	0.0	0.85	5.0	B
	LT	820	0.95	863	863	120	0.64	207	4.177	16.3	19331.0	0.85	16445.2	F
SB	TH	415	0.95	437	437	120	0.64	1195	0.366	7.6	0.1	0.85	6.6	B
	RT	35	0.95	37	37	120	0.64	1016	0.036	6.0	0.0	0.85	5.1	B

SUM Vgp 4037

INTERSECTION DELAY = 3541.67 F

HCS: Signalized Intersection Version 2.4d 12-13-1996 1

===

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813 (808) 531-7094

===

Streets: (E-W) Piilani Hwy (N-S) Mokulele Hwy
Analyst: KO File Name: PIIMOK1P.HC9
Area Type: Other 11-20-96 PM Peak
Comment: Year 2020 No Build

===

Traffic and Roadway Conditions

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	<	1	1	1	>	1	1	1	1	1
Volumes	65	645	30	10	480	1065	20	370	10	1015	505	110
PHF or PK15	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane W (ft)	12.0	12.0		12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0
Grade		0			0			0			0	
% Heavy Veh	2	2	2	2	2	2	2	2	2	2	2	2
Parking	(Y/N)	N		(Y/N)	N		(Y/N)	N		(Y/N)	N	
Bus Stops			0			0			0			0
Con. Peds			0			0			0			0
Ped Button	(Y/N)	Y	11.5 s	(Y/N)	Y	14.5 s	(Y/N)	Y	14.5 s	(Y/N)	Y	11.5
Arr Type	3	3		3	3	3		3	3	3	3	3
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Signal Operations

Phase Combination	1	2	3	4
EB Left	*			
Thru	*			
Right	*			
Peds				
WB Left	*			
Thru	*			
Right	*			
Peds				
NB Right				
SB Right				
Green	35.0A			
Yellow/AR	5.0			

	5	6	7	8
NB Left	*			
Thru	*			
Right	*			
Peds				
SB Left	*			
Thru	*			
Right	*			
Peds				
EB Right				
WB Right	*			
Green	75.0A			
Yellow/AR	5.0			

Cycle Length: 120 secs Phase combination order: #1 #5

Streets: (E-W) Piilani Hwy (N-S) Mokulele Hwy
Analyst: KO File Name: PIIMOK1P.HC9
Area Type: Other 11-20-96 PM Peak
Comment: Year 2020 No Build

Volume Adjustment Worksheet

Direc-tion/ Mvt	Mvt Vol	PHF	Adj Vol	Lane Grp	Lane Grp Vol	No. Ln	Lane Util Fact	Growth Fact	Adj Grp Vol	Prop LT	Prop RT
EB											
Left	65	0.95	68	L	68	1	1.000	1.000	68	1.00	0.00
Thru	645	0.95	679	TR	711	1	1.000	1.000	711	0.00	0.05
Right	30	0.95	32								
WB											
Left	10	0.95	11	L	11	1	1.000	1.000	11	1.00	0.00
Thru	480	0.95	505	T	505	1	1.000	1.000	505	0.00	0.00
Right	1065	0.95	1121	R	1121	1	1.000	1.000	1121	0.00	1.00
NB											
Left	20	0.95	21								
Thru	370	0.95	389	LT	410	1	1.000	1.000	410	0.05	0.00
Right	10	0.95	11	R	11	1	1.000	1.000	11	0.00	1.00
SB											
Left	1015	0.95	1068	L	1068	1	1.000	1.000	1068	1.00	0.00
Thru	505	0.95	532	T	532	1	1.000	1.000	532	0.00	0.00
Right	110	0.95	116	R	116	1	1.000	1.000	116	0.00	1.00

Saturation Flow Adjustment Worksheet

Direction /LnGrp	Ideal Sat Flow	No. Lns	f W	f HV	f G	f p	f BB	f A	f RT	f LT	Adj Sat Flow
EB											
L	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.11	201
TR	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	0.99	1.00	1850
WB											
L	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.11	201
T	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1863
R	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	0.85	1.00	1583
NB											
LT	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.90	1675
R	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	0.85	1.00	1583
SB											
L	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.32	602
T	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1863
R	1900	1	1.00	0.98	1.00	1.00	1.00	1.00	0.85	1.00	1583

flt=[fm+0.91(N-1)]/N	0.11

APPROACH	NB
Cycle Length, C	120
Actual Green Time for Lane Group, G	75
Effective Green Time for Lane Group, g	77
Opposing Effective Green Time, go	77
Number of Opposing Lanes, No	1
Number of Lanes in Lane Group, N	1
Adjusted Left-Turn Flow Rate, Vlt	21
Proportion of Left Turns in Lane Group, Plt	0.05
Left Turns per Cycle: LTC=Vlt*C/3600	0.70
Adjusted Opposing Flow Rate, Vo	532
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600No	17.73
Opposing Platoon Ratio, Rpo	1
Lost time per phase, tl	3
gf=Gexp(-0.882*LTC^0.717)-tl	34.88
Opposing Queue Ratio: qro=1-Rpo(go/C)	0.36
gq = Volc * qro / (.5 - Volc * (1 - qro) / go)-tl	15.04
gu=g-gq (or g-gf)	42.12
fs=(875-0.625Vo)/1000	0.54
Pl=Plt[1+{(N-1)g/(fs*gu+4.5)}]	0.05
El1	5.41
fmin	0.03
fm,(min=fmin;max=1.00)	0.90
flt=[fm+0.91(N-1)]/N	0.90

APPROACH	SB
Cycle Length, C	120
Actual Green Time for Lane Group, G	75
Effective Green Time for Lane Group, g	77
Opposing Effective Green Time, go	77
Number of Opposing Lanes, No	1
Number of Lanes in Lane Group, N	1
Adjusted Left-Turn Flow Rate, Vlt	1068
Proportion of Left Turns in Lane Group, Plt	1.00
Left Turns per Cycle: LTC=Vlt*C/3600	35.60
Adjusted Opposing Flow Rate, Vo	410
Opposing Flow per Lane, Per Cycle: Volc=VoC/3600No	13.67
Opposing Platoon Ratio, Rpo	1
Lost time per phase, tl	3
gf=Gexp(-0.882*LTC^0.717)-tl	0.00
Opposing Queue Ratio: qro=1-Rpo(go/C)	0.36
gq = Volc * qro / (.5 - Volc * (1 - qro) / go)-tl	9.68
gu=g-gq (or g-gf)	67.32
fs=(875-0.625Vo)/1000	0.62
Pl=Plt[1+{(N-1)g/(fs*gu+4.5)}]	1.00
El1	2.70
fmin	0.05
fm,(min=fmin;max=1.00)	0.32
flt=[fm+0.91(N-1)]/N	0.32

HCS: Signalized Intersection   Version 2.4d   12-13-1996 4

Streets: (E-W) Piilani Hwy   (N-S) Mokulele Hwy
Analyst: KO   File Name: PIIMOK1P.HC9
Area Type: Other   11-20-96 PM Peak
Comment: Year 2020 No Build

Capacity Analysis Worksheet

Direction /LnGrp	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	Lane Group Capacity (c)	v/c Ratio
EB						
L	68	201	0.338	0.308	62	1.097
TR	711	1850	0.384	0.308	570	1.246 *
WB						
L	11	201	0.055	0.308	62	0.177
T	505	1863	0.271	0.308	574	0.879
R	1121	1583	0.708	1.000	1583	0.708
NB						
LT	410	1675	0.245	0.642	1075	0.381
R	11	1583	0.007	0.642	1016	0.011
SB						
L	1068	602	1.774	0.642	386	2.765 *
T	532	1863	0.286	0.642	1195	0.445
R	116	1583	0.073	0.642	1016	0.114

Lost Time/Cycle, L = 6.0 sec   Sum (v/s) critical = 2.158
Critical v/c(x) = 2.272

Level of Service Worksheet

Direction /LnGrp	v/c Ratio	g/C Ratio	Delay d 1	Del Adj Fact	Lane Group Cap	Calib d 2	Delay d 2	Lane Grp Del	Lane Grp LOS	Delay By App	LOS By App
EB											
L	1.097	0.308	*	0.850	62	16	*	*	*	*	*
TR	1.246	0.308	*	0.850	570	16	*	*	*		
WB											
L	0.177	0.308	23.1	0.850	62	16	0.1	19.8	C	11.9	B
T	0.879	0.308	29.9	0.850	574	16	10.3	35.7	D		
R	0.708	1.000	0.0	0.850	1583	16	1.0	1.0	A		
NB											
LT	0.381	0.642	7.8	0.850	1075	16	0.1	6.7	B	6.7	B
R	0.011	0.642	5.9	0.850	1016	16	0.0	5.0	A		
SB											
L	2.765	0.642	*	0.850	386	16	*	*	*	*	*
T	0.445	0.642	8.2	0.850	1195	16	0.2	7.1	B		
R	0.114	0.642	6.3	0.850	1016	16	0.0	5.4	B		

Intersection Delay = * (sec/veh)   Intersection LOS = *

* Delay and LOS not meaningful when any v/c is greater than 1.2 or 1/PHF

[illegible] NS [illegible] Mc[illegible] H[illegible]y

Date of Analysis: 12/12/96
Analyst: L. Aburamen
Comments: Year 2020, No Build, PM Peak Hour

		Vmeas	PHF	Va	Vgp	C	g/C	c	X = Vgp/c	d1	d2	PF	TD	LOS
	LT	65	0.95	68	68	120	0.31	62	1.097	31.6	132.8	0.85	62.6	F
EB	TH	645	0.95	679	711	120	0.31	570	1.246	31.6	149.1	0.85	23.7	C
	RT	30	0.95	32										
	LT	10	0.95	11	11	120	0.31	62	0.177	23.1	0.1	0.85	19.8	C
WB	TH	480	0.95	505	505	120	0.31	574	0.879	29.9	10.3	0.85	35.7	D
	RT	1065	0.95	1121	1121	120	1	1583	0.708	0.0	1.0	0.85	1.0	A
	LT	20	0.95	21		120								
NB	TH	370	0.95	389	411	120	0.64	1075	0.381	7.8	0.1	0.85	6.7	B
	RT	10	0.95	11	11	120	0.64	1016	0.011	5.9	0.0	0.85	5.0	B
	LT	1015	0.95	1068	1068	120	0.64	386	2.765	16.3	4711.4	0.85	4018.6	F
SB	TH	505	0.95	532	532	120	0.64	1195	0.445	8.2	0.2	0.85	7.1	B
	RT	110	0.95	115	116	120	0.64	1016	0.114	6.3	0.0	0.85	5.4	B

SUM Vgp 4553

INTERSECTION DELAY = 953.52 F

CORRECTION

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

INS Md Highway

Date of Analysis: 12/12/96

Analyst: L. Aburamen

Comments: Year 2020, No Build, PM Peak Hour

		Vmeas	PHF	Va	Vgp	C	g/C	c	X = Vgp/c	d1	d2	PF	TD	LOS
	LT	65	0.95	68	68	120	0.31	62	1.097	31.6	132.8	0.85	62.6	F
EB	TH	645	0.95	679	711	120	0.31	570	1.246	31.6	149.1	0.85	23.7	C
	RT	30	0.95	32										
	LT	10	0.95	11	11	120	0.31	62	0.177	23.1	0.1	0.85	19.8	C
WB	TH	480	0.95	505	505	120	0.31	574	0.879	29.9	10.3	0.85	35.7	D
	RT	1065	0.95	1121	1121	120	1	1583	0.708	0.0	1.0	0.85	1.0	A
	LT	20	0.95	21		120								
NB	TH	370	0.95	389	411	120	0.64	1075	0.381	7.8	0.1	0.85	6.7	B
	RT	10	0.95	11	11	120	0.64	1016	0.011	5.9	0.0	0.85	5.0	B
	LT	1015	0.95	1068	1068	120	0.64	386	2.765	16.3	4711.4	0.85	4018.6	F
SB	TH	505	0.95	532	532	120	0.64	1195	0.445	8.2	0.2	0.85	7.1	B
	RT	110	0.95	115	116	120	0.64	1016	0.114	6.3	0.0	0.85	5.4	B

SUM Vgp 4553

INTERSECTION DELAY = 953.52 F

HCM: SIGNALIZED INTERSECTION SUMMARY Version 2.4d 12-13-1996
Parsons Brinckerhoff Quade & Douglas

Streets: (E-W) Kuihelani/Dairy Rd (N-S) Puunene
Analyst: KO File Name: PUUKUIAM.HC9
Area Type: Other 11-20-96 AM Peak
Comment: Year 2020 No Build

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	2	<	2	2	1	1	2	1	1	2	<
Volumes	100	800	25	600	875	240	50	840	575	200	325	200
Lane W (ft)	12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	
RTOR Vols			0			0			0			0
Lost Time	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Signal Operations

Phase Combination		1	2	3	4
EB	Left	*	*		
	Thru		*		
	Right		*		
	Peds				
WB	Left	*	*		
	Thru		*		
	Right		*		
	Peds		*		
NB	Right	*			
SB	Right				
Green		15.0P	55.0P		
Yellow/AR		5.0	5.0		

		5	6	7	8
NB	Left	*	*		
	Thru		*		
	Right		*		
	Peds		*		
SB	Left	*	*		
	Thru		*		
	Right		*		
	Peds				
EB	Right				
WB	Right	*			
Green		20.0P	40.0P		
Yellow/AR		5.0	5.0		

Cycle Length: 150 secs Phase combination order: #1 #2 #5 #6

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	Approach: LOS
EB	L	250	1770	0.420	0.513	19.7	C	28.7	D
	TR	1409	3709	0.646	0.380	29.8	D		
WB	L	726	3539	0.897	0.513	30.5	D	28.3	D
	T	1416	3725	0.683	0.380	30.6	D		
	R	865	1583	0.292	0.547	14.0	B		
NB	L	346	1770	0.153	0.447	19.2	C	45.1	E
	T	1043	3725	0.890	0.280	46.3	E		
	R	654	1583	0.925	0.413	45.5	E		
SB	L	309	1770	0.683	0.447	33.0	D	35.3	D
	TR	983	3512	0.591	0.280	36.1	D		

Intersection Delay = 34.5 sec/veh Intersection LOS = D
Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.843

```
HCM: SIGNALIZED INTERSECTION SUMMARY  Version 2.4d       11-20-1996
                  Parsons Brinckerhoff Quade & Douglas
=======================================================================
treets: (E-W) Kuihelani/Dairy Rd      (N-S) Puunene
Analyst: KO                           File Name: PUUKUIPM.HC9
rea Type: Other                       11-20-96 PM Peak
omment: Year 2020 No Build
=======================================================================
             |  Eastbound   |  Westbound   |  Northbound  |  Southbound
             | L    T    R  | L    T    R  | L    T    R  | L    T    R
             |---- ---- ----|---- ---- ----|---- ---- ----|---- ---- ----
No. Lanes    | 1    2  <    | 2    2    1  | 1    2    1  | 1    2  <
olumes       | 200 1050   50| 725  720  265|  50  675  505| 250  695  200
HF or PK15   |0.95 0.95 0.95|0.95 0.95 0.95|0.95 0.95 0.95|0.95 0.95 0.95
Lane W (ft)  |12.0 12.0     |12.0 12.0 12.0|12.0 12.0 12.0|12.0 12.0
rade         |      0       |      0       |      0       |      0
 Heavy Veh   |  2    2     2|  2    2     2|  2    2     2|  2    2     2
Parking      |(Y/N) N       |(Y/N) N       |(Y/N) N       |(Y/N) N
Bus Stops    |             0|             0|             0|             0
n. Peds      |             0|             0|             0|             0
d Button     |(Y/N) Y 20.5 s|(Y/N) Y 17.5 s|(Y/N) Y 23.5 s|(Y/N) Y 17.5
Arr Type     |  3    3      |  3    3     3|  3    3     3|  3    3
OR Vols      |             0|             0|             0|             0
st Time      |3.00 3.00 3.00|3.00 3.00 3.00|3.00 3.00 3.00|3.00 3.00 3.00
Prop. Share  |              |              |              |
Prop. Prot.  |              |            18|            53|
-----------------------------------------------------------------------
                          Signal Operations
Phase Combination 1    2    3    4 |              5    6    7    8
  Left            *    *           |NB  Left      *    *
  Thru                 *           |    Thru           *
  Right                *           |    Right          *
  Peds                             |    Peds           *
  Left            *    *           |SB  Left      *    *
  Thru                 *           |    Thru           *
  Right                *           |    Right          *
  Peds                 *           |    Peds
  Right           *                |EB  Right
SB Right                           |WB  Right     *
een             15.0P 55.0P        |Green     20.0P 40.0P
llow/AR          5.0   5.0         |Yellow/AR 5.0   5.0
Cycle Length: 150 secs  Phase combination order: #1 #2 #5 #6
-----------------------------------------------------------------------
                 Intersection Performance Summary
    Lane  Group:   Adj Sat   v/c     g/C                    Approach:
    Mvmts   Cap     Flow    Ratio   Ratio    Delay   LOS   Delay   LOS
    -----   ----   -------  -----   -----    -----   ---   -----   ---
    L       272     1770    0.776   0.513    33.0    D     36.3    D
    TR     1406     3700    0.865   0.380    36.8    D
    L      1002     3539    0.784   0.513    30.2    D     27.0    D
    T      1416     3725    0.562   0.380    28.3    D
    R       865     1583    0.322   0.547    14.3    B
NB  L       309     1770    0.172   0.447    22.4    C     36.5    D
    T      1043     3725    0.716   0.280    38.6    D
    R       654     1583    0.813   0.413    34.9    D
SB  L       309     1770    0.851   0.447    46.3    E     56.2    E
    TR     1008     3600    0.982   0.280    58.8    E
              Intersection Delay =  37.6 sec/veh Intersection LOS = D
Lost Time/Cycle, L =  12.0 sec   Critical v/c(x)     = 0.939
-----------------------------------------------------------------------
```

HCS: Unsignalized Intersections   Release 2.1d   MILLAM.HC0   Page 1

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813-
Ph: (808) 531-7094

Streets: (N-S) Puunene/Mokulele   (E-W) Road to Sugar Mill
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KO
Date of Analysis.......... 11/20/96
Other Information.........Year 2020 AM Peak Hour
Two-way Stop-controlled Intersection

	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R
No. Lanes	0	1	0	1	1	0	0	0	0	1	0	1
Stop/Yield			N			N						
Volumes		1555		115	1100					30		50
PHF		.95		.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	1637	
Potential Capacity: (pcph)	205	
Movement Capacity: (pcph)	205	
Prob. of Queue-Free State:	0.72	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	1637	
Potential Capacity: (pcph)	284	
Movement Capacity: (pcph)	284	
Prob. of Queue-Free State:	0.53	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	2916	
Potential Capacity: (pcph)	22	
Major LT, Minor TH Impedance Factor:	0.53	
Adjusted Impedance Factor:	0.53	
Capacity Adjustment Factor due to Impeding Movements	0.53	
Movement Capacity: (pcph)	12	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	35	12		*	3.6	F	
							575.0
WB R	58	205		24.3	1.1	D	
SB L	133	284		23.4	2.3	D	2.2

Intersection Delay = 17.1 sec/veh

* The calculated value was greater than 999.9.

```
CS: Unsignalized Intersections  Release 2.1d    MILLPM.HC0      Page 1
=====================================================================
Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI   96813-
 : (808) 531-7094
=====================================================================
Streets: (N-S) Puunene/Mokulele              (E-W) Road to Sugar Mill
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KO
Date of Analysis.......... 11/20/96
Other Information.........Year 2020 PM Peak Hour
Two-way Stop-controlled Intersection
=====================================================================
           | Northbound  | Southbound  | Eastbound   | Westbound
           | L   T   R   | L   T   R   | L   T   R   | L   T   R
           |---- ---- ---|---- ---- ---|---- ---- ---|---- ---- ----
No. Lanes  | 0   1   0   | 1   1   0   | 0   0   0   | 1   0   1
Stop/Yield |           N |           N |             |
Volumes    |     1455    |  25 1610    |             |  20      80
PHF        |     .95     | .95  .95    |             | .95     .95
Grade      |      0      |       0     |             |      0
   's (%)  |             |             |             |
SU/RV's (%)|             |             |             |
   's (%)  |             |             |             |
 E's       |             |1.10         |             |1.10    1.10
---------------------------------------------------------------------


                   Adjustment Factors

Vehicle
Maneuver                      Critical        Follow-up
                              Gap (tg)        Time (tf)
------------------------------------------------------------
L  t Turn Major Road            5.00            2.10
Right Turn Minor Road           5.50            2.60
Through Traffic Minor Road      6.00            3.30
L  t Turn Minor Road            6.50            3.40
```

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	1532	
Potential Capacity: (pcph)	232	
Movement Capacity: (pcph)	232	
Prob. of Queue-Free State:	0.60	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	1532	
Potential Capacity: (pcph)	319	
Movement Capacity: (pcph)	319	
Prob. of Queue-Free State:	0.91	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	3253	
Potential Capacity: (pcph)	14	
Major LT, Minor TH Impedance Factor:	0.91	
Adjusted Impedance Factor:	0.91	
Capacity Adjustment Factor due to Impeding Movements	0.91	
Movement Capacity: (pcph)	13	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	23	13		950.4	2.2	F	
							210.4
WB R	92	232		25.4	1.7	D	
SB L	29	319		12.4	0.2	C	0.2

Intersection Delay = 6.7 sec/veh

HCS: Unsignalized Intersections Release 2.1d PUUHANAM.HC0 Page 1

===

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813-
Ph: (808) 531-7094

===

Streets: (N-S) Puunene Ave (E-W) Hansen Rd
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KO
Date of Analysis.......... 11/20/96
Other Information.........Year 2020 AM Peak Hour
Two-way Stop-controlled Intersection

===

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	0	0	0	0	1	0	1
Stop/Yield			Y			Y						
Volumes		1415	190	50	900					315		50
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	1489	
Potential Capacity: (pcph)	244	
Movement Capacity: (pcph)	244	
Prob. of Queue-Free State:	0.76	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	1489	
Potential Capacity: (pcph)	335	
Movement Capacity: (pcph)	335	
Prob. of Queue-Free State:	0.83	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	2489	
Potential Capacity: (pcph)	38	
Major LT, Minor TH		
Impedance Factor:	0.83	
Adjusted Impedance Factor:	0.83	
Capacity Adjustment Factor		
due to Impeding Movements	0.83	
Movement Capacity: (pcph)	31	

Intersection Performance Summary

ovement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
B L	365	31		*	42.0	F	
							*
B R	58	244		19.3	0.9	C	
B L	58	335		13.0	0.6	C	0.7

Intersection Delay = 549.5 sec/veh

The calculated value was greater than 999.9.

HCS: Unsignalized Intersections Release 2.1d PUUHANPM.HC0 Page 1

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813-
Ph: (808) 531-7094

Streets: (N-S) Puunene Ave (E-W) Hansen Rd
Major Street Direction.... NS
Length of Time Analyzed... 15 (min)
Analyst................... KO
Date of Analysis.......... 11/20/96
Other Information.........Year 2020 PM Peak Hour
Two-way Stop-controlled Intersection

	Northbound			Southbound			Eastbound			Westbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	0	0	0	0	1	0	1
Stop/Yield			Y			Y						
Volumes		1180	355	50	1420					215		50
PHF		.95	.95	.95	.95					.95		.95
Grade		0			0						0	
MC's (%)												
SU/RV's (%)												
CV's (%)												
PCE's				1.10						1.10		1.10

Adjustment Factors

Vehicle Maneuver	Critical Gap (tg)	Follow-up Time (tf)
Left Turn Major Road	5.00	2.10
Right Turn Minor Road	5.50	2.60
Through Traffic Minor Road	6.00	3.30
Left Turn Minor Road	6.50	3.40

Worksheet for TWSC Intersection

Step 1: RT from Minor Street	WB	EB
Conflicting Flows: (vph)	1242	
Potential Capacity: (pcph)	325	
Movement Capacity: (pcph)	325	
Prob. of Queue-Free State:	0.82	

Step 2: LT from Major Street	SB	NB
Conflicting Flows: (vph)	1242	
Potential Capacity: (pcph)	439	
Movement Capacity: (pcph)	439	
Prob. of Queue-Free State:	0.87	

Step 4: LT from Minor Street	WB	EB
Conflicting Flows: (vph)	2790	
Potential Capacity: (pcph)	26	
Major LT, Minor TH Impedance Factor:	0.87	
Adjusted Impedance Factor:	0.87	
Capacity Adjustment Factor due to Impeding Movements	0.87	
Movement Capacity: (pcph)	23	

Intersection Performance Summary

Movement	Flow Rate (pcph)	Move Cap (pcph)	Shared Cap (pcph)	Avg. Total Delay (sec/veh)	95% Queue Length (veh)	LOS	Approach Delay (sec/veh)
WB L	249	23		*	28.5	F	
WB R	58	325		13.5	0.6	C	*
SB L	58	439		9.4	0.4	B	0.3

Intersection Delay = 312.3 sec/veh

The calculated value was greater than 999.9.

HCS: Multilane Highways Release 2.3d Page 1

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813-
Ph: (808) 531-7094

File Name MOKAM.HC7
Facility Section..... Mokulele Highway
From/To.............. Kahului/Kihei
Analyst.............. KO
Time of Analysis..... Yr 2020 AM Peak Hour (BUILD)
Date of Analysis..... 11/20/96
Other Information....

A. Geometrics and Traffic Input	Direction 1	Direction 2
Volume	1130	1555
Peak-Hour Factor or Peak 15 Minutes	0.90	0.90
Number of Lanes	2	2
Percentage of Trucks and Buses	2	2
Percentage of Recreational Vehicles	0	0
Ideal Free-Flow Speed (mph)	60.0	60.0
Type of Median	D	D
Lane Width (ft)	12.0	12.0
Distance from Roadway Edge (ft)	10.0	10.0
Access Points per Mile	4.0	4.0

B. Adjustment Factors

	Terrain Type	E T	E R	F HV	F M	F LW	F LC	F A
Dir 1	LEVEL	1.50		0.99	0.00	0.00	0.40	1.00
Dir 2		1.50		0.99	0.00	0.00	0.40	1.00

C. Level of Service Results	Direction 1	Direction 2
Service Flow Rate (Vp)	634	873
Free Flow Speed (mph)	58.6	58.6
Average Passenger Car Speed (mph)	58.6	58.6
Density (pcpmpl)	10.8	14.9
Level of Service (LOS)	A	B

HCS: Multilane Highways Release 2.3d Page 1

Parsons Brinckerhoff Quade & Douglas
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813-
Ph: (808) 531-7094

File Name MOKPM.HC7
Facility Section..... Mokulele Highway
From/To............. Kahului/Kihei
Analyst.............. KO
Time of Analysis..... Yr 2020 PM Peak Hour (BUILD)
Date of Analysis..... 11/20/96
Other Information....

A. Geometrics and Traffic Input

	Direction 1	Direction 2
Volume	1630	1455
Peak-Hour Factor or Peak 15 Minutes	0.90	0.90
Number of Lanes	2	2
Percentage of Trucks and Buses	2	2
Percentage of Recreational Vehicles	0	0
Ideal Free-Flow Speed (mph)	60.0	60.0
Type of Median	D	D
Lane Width (ft)	12.0	12.0
Distance from Roadway Edge (ft)	10.0	10.0
Access Points per Mile	4.0	4.0

B. Adjustment Factors

	Terrain Type	E T	E R	F HV	F M	F LW	F LC	F A
Dir 1	LEVEL	1.50		0.99	0.00	0.00	0.40	1.00
Dir 2		1.50		0.99	0.00	0.00	0.40	1.00

C. Level of Service Results

	Direction 1	Direction 2
Service Flow Rate (Vp)	915	816
Free Flow Speed (mph)	58.6	58.6
Average Passenger Car Speed (mph)	58.6	58.6
Density (pcpmpl)	15.6	13.9
Level of Service (LOS)	B	B

```
HCM: SIGNALIZED INTERSECTION SUMMARY   Version 2.4d       11-21-1996
                  Parsons Brinckerhoff Quade & Douglas
=========================================================================
Streets: (E-W) Kihei Road                  (N-S) Mokulele/Piilani
Analyst: KO                                File Name: MOKPITAM.HC9
Area Type: Other                           11-20-96 AM Peak
Comment: Year 2020 Build - Realigned T intersection configuration
=========================================================================
             |  Eastbound  |  Westbound   |  Northbound  |  Southbound
             | L    T    R | L    T    R  | L    T    R  | L    T    R
             |---- ---- ----|---- ---- ----|---- ---- ----|---- ---- ----
No. Lanes    | 2         1 |              | 2    2       |      2    1
Volumes      | 280     315|               | 660 1295     |     1020  250
PHF or PK15  |0.95     0.95|              |0.95 0.95     |     0.95 0.95
Lane W (ft)  |12.0     12.0|              |12.0 12.0     |     12.0 12.0
Grade        |      0      |              |      0       |      0
% Heavy Veh  |  2        2|               |  2    2      |        2    2
Parking      |(Y/N) N      |              |(Y/N) N       |(Y/N) N
Bus Stops    |           0|               |             0|            0
Con. Peds    |           0|             0|              0|            0
Ped Button   |(Y/N) Y 20.5 s|             |(Y/N) Y  4.0 s|(Y/N) Y 11.5
Arr Type     |  3        3|               |  3    3      |        3    3
RTOR Vols    |           0|               |             0|            0
Lost Time    |3.00     3.00|              |3.00 3.00     |     3.00 3.00
Prop. Share  |             |              |              |
Prop. Prot.  |          48|               |              |           40
-------------------------------------------------------------------------
                          Signal Operations
Phase Combination 1    2    3    4 |            5    6    7    8
EB  Left          *                |NB  Left    *
    Thru                           |    Thru    *    *
    Right         *                |    Right
    Peds          *                |    Peds
WB  Left                           |SB  Left
    Thru                           |    Thru         *
    Right                          |    Right        *
    Peds                           |    Peds         *
NB  Right                          |EB  Right   *
SB  Right         *                |WB  Right
Green          25.0P               |Green    35.0P 45.0P
Yellow/AR       5.0                |Yellow/AR 5.0   5.0
Cycle Length: 120 secs  Phase combination order: #1 #5 #6
-------------------------------------------------------------------------
                  Intersection Performance Summary
     Lane  Group:   Adj Sat    v/c     g/C                  Approach:
     Mvmts   Cap     Flow     Ratio   Ratio   Delay  LOS   Delay   LOS
     -----  ----   -------    -----   -----   -----  ---   -----   ---
EB   L       796     3539     0.382   0.225    30.1   D    20.3     C
     R       884     1583     0.376   0.558    11.4   B
NB   L      1091     3539     0.656   0.308    28.4   D    13.3     B
     T      2701     3725     0.530   0.725     5.8   B
SB   T      1459     3725     0.773   0.392    26.1   D    22.5     C
     R      1016     1583     0.259   0.642     7.1   B
               Intersection Delay =  17.4 sec/veh Intersection LOS = C
Lost Time/Cycle, L =   9.0 sec   Critical v/c(x)    = 0.639
-------------------------------------------------------------------------
```

```
HCM: SIGNALIZED INTERSECTION SUMMARY   Version 2.4d       11-21-1996
                Parsons Brinckerhoff Quade & Douglas
=======================================================================
Streets: (E-W) Kihei Road               (N-S) Mokulele/Piilani
Analyst: KO                             File Name: MOKPITPM.HC9
Area Type: Other                        11-20-96 PM Peak
Comment: Year 2020 Build - Realigned T intersection configuration
=======================================================================
           |  Eastbound  |  Westbound  |  Northbound  |  Southbound
           | L    T    R | L    T    R | L    T    R | L    T    R
           |---- ---- ----|---- ---- ----|---- ---- ----|---- ---- ----
No. Lanes  | 2         1 |             | 2    2       |      2    1
Volumes    | 285     655|             | 490 1215     |    1315  315
PHF or PK15|0.95     0.95|             |0.95 0.95     |    0.95 0.95
Lane W (ft)|12.0     12.0|             |12.0 12.0     |    12.0 12.0
Grade      |      0      |             |      0       |      0
% Heavy Veh|  2         2|             |  2    2      |      2    2
Parking    |(Y/N) N      |             |(Y/N) N       |(Y/N) N
Bus Stops  |            0|             |            0|           0
Con. Peds  |            0|            0|            0|           0
Ped Button |(Y/N) Y 20.5 s|            |(Y/N) Y  4.0 s|(Y/N) Y 11.5
Arr Type   |  3         3|             |  3    3      |      3    3
RTOR Vols  |            0|             |            0|           0
Lost Time  |3.00     3.00|             |3.00 3.00     |    3.00 3.00
Prop. Share|             |             |              |
Prop. Prot.|           48|             |              |          40
-----------------------------------------------------------------------
                        Signal Operations
Phase Combination 1    2    3    4 |          5    6    7    8
EB  Left          *                |NB  Left  *
    Thru                           |    Thru  *    *
    Right         *                |    Right
    Peds          *                |    Peds
WB  Left                           |SB  Left
    Thru                           |    Thru       *
    Right                          |    Right      *
    Peds                           |    Peds       *
NB  Right                          |EB  Right *
SB  Right         *                |WB  Right
Green         15.0P                |Green    35.0P 55.0P
Yellow/AR      5.0                 |Yellow/AR 5.0   5.0
Cycle Length: 120 secs  Phase combination order: #1 #5 #6
-----------------------------------------------------------------------
                Intersection Performance Summary
     Lane  Group:   Adj Sat   v/c    g/C                   Approach:
     Mvmts   Cap     Flow    Ratio  Ratio   Delay   LOS   Delay   LOS
     -----  ----   -------   -----  -----   -----   ---   -----   ---
EB   L       501    3539    0.616  0.142    38.4    D     35.2     D
     R       752    1583    0.916  0.475    33.7    D
NB   L      1091    3539    0.487  0.308    25.9    D      9.3     B
     T      3011    3725    0.446  0.808     2.7    A
SB   T      1769    3725    0.821  0.475    22.9    C     20.0     C
     R      1016    1583    0.327  0.642     7.5    B
             Intersection Delay =  19.0 sec/veh Intersection LOS = C
Lost Time/Cycle, L =   6.0 sec   Critical v/c(x)    = 0.869
-----------------------------------------------------------------------
```

```
HCM: SIGNALIZED INTERSECTION SUMMARY   Version 2.4d        11-21-1996
                  Parsons Brinckerhoff Quade & Douglas
======================================================================
Streets: (E-W) Hansen Rd                  (N-S) Mokulele Hwy
Analyst: KO                               File Name: MOKHANAM.HC9
Area Type: Other                          11-21-96 AM Peak
Comment: Year 2020 Build-Realigned Mokulele, ext. Hansen
======================================================================
             |  Eastbound   |  Westbound   |  Northbound  |  Southbound
             | L    T    R  | L    T    R  | L    T    R  | L    T    R
             |---- ---- ----|---- ---- ----|---- ---- ----|---- ---- ----
No. Lanes    |   > 1  <     | 1  > 1    1  | 1    2    1  | 1    2  <
Volumes      |  10   10   10| 345   10  100|  10 1365  190| 165  785   10
PHF or PK15  |0.95 0.95 0.95|0.95 0.95 0.95|0.95 0.95 0.95|0.95 0.95 0.95
Lane W (ft)  |     12.0     |12.0 12.0 12.0|12.0 12.0 12.0|12.0 12.0
Grade        |       0      |       0      |       0      |       0
% Heavy Veh  |   2    2    2|   2    2    2|   2    2    2|   2    2    2
Parking      |(Y/N) N       |(Y/N) N       |(Y/N) N       |(Y/N) N
Bus Stops    |             0|             0|             0|             0
Con. Peds    |             0|             0|             0|             0
Ped Button   |(Y/N) N       |(Y/N) N       |(Y/N) N       |(Y/N) N
Arr Type     |       3      |   3    3    3|   3    3    3|   3    3
RTOR Vols    |             0|             0|             0|             0
Lost Time    |3.00 3.00 3.00|3.00 3.00 3.00|3.00 3.00 3.00|3.00 3.00 3.00
Prop. Share  |              |  50          |              |
Prop. Prot.  |              |              |              |
----------------------------------------------------------------------
                          Signal Operations
Phase Combination 1    2    3    4 |           5    6    7    8
EB  Left          •                |NB  Left   •
    Thru          •                |    Thru             •
    Right         •                |    Right            •
    Peds                           |    Peds
WB  Left               •           |SB  Left   •    •
    Thru               •           |    Thru        •    •
    Right              •           |    Right       •    •
    Peds                           |    Peds
NB  Right                          |EB  Right
SB  Right                          |WB  Right
Green          10.0P 30.0P         |Green     10.0P 15.0P 65.0P
Yellow/AR        5.0   5.0         |Yellow/AR 5.0   0.0   5.0
Cycle Length: 150 secs  Phase combination order: #1 #2 #5 #6 #7
----------------------------------------------------------------------
                 Intersection Performance Summary
     Lane  Group:  Adj Sat   v/c    g/C                   Approach:
     Mvmts   Cap    Flow    Ratio  Ratio   Delay  LOS    Delay   LOS
     -----  ----  -------   -----  -----   -----  ---    -----   ---
EB   LTR     125    1567    0.263  0.080    49.6   E      49.6    E
WB   L       378    1770    0.482  0.213    40.1   E      39.8    D
     LT      380    1779    0.506  0.213    40.5   E
     R       338    1583    0.311  0.213    38.0   D
NB   L       142    1770    0.078  0.080    48.6   E      33.2    D
     T      1664    3725    0.907  0.447    34.9   D
     R       707    1583    0.283  0.447    20.0   C
SB   L       319    1770    0.546  0.180    44.0   E      20.2    C
     TR     2033    3718    0.432  0.547    15.4   C
             Intersection Delay =  30.2 sec/veh Intersection LOS = D
Lost Time/Cycle, L =  12.0 sec   Critical v/c(x)     = 0.687
----------------------------------------------------------------------
```

```
HCM: SIGNALIZED INTERSECTION SUMMARY   Version 2.4d        11-21-1996
                  Parsons Brinckerhoff Quade & Douglas
=======================================================================
Streets: (E-W) Hansen Rd                    (N-S) Mokulele Hwy
Analyst: KO                                 File Name: MOKHANPM.HC9
Area Type: Other                            11-21-96 PM Peak
Comment: Year 2020 Build-Realigned Mokulele, ext. Hansen
=======================================================================
           |  Eastbound   |  Westbound   |  Northbound  |  Southbound  |
           | L    T    R  | L    T    R  | L    T    R  | L    T    R  |
           |---- ---- ----|---- ---- ----|---- ---- ----|---- ---- ----|
No. Lanes  |    > 1  <    | 1  > 1    1  | 1    2    1  | 1    2  <
Volumes    |  10   10   10| 235   10  130|  10 1100  355|  75 1395   10
PHF or PK15|0.95 0.95 0.95|0.95 0.95 0.95|0.95 0.95 0.95|0.95 0.95 0.95
Lane W (ft)|     12.0     |12.0 12.0 12.0|12.0 12.0 12.0|12.0 12.0
Grade      |       0      |       0      |       0      |       0
% Heavy Veh|   2    2    2|   2    2    2|   2    2    2|   2    2    2
Parking    |(Y/N) N       |(Y/N) N       |(Y/N) N       |(Y/N) N
Bus Stops  |             0|             0|             0|             0
Con. Peds  |             0|             0|             0|             0
Ped Button |(Y/N) N       |(Y/N) N       |(Y/N) N       |(Y/N) N
Arr Type   |       3      |   3    3    3|   3    3    3|   3    3
RTOR Vols  |             0|             0|             0|             0
Lost Time  |3.00 3.00 3.00|3.00 3.00 3.00|3.00 3.00 3.00|3.00 3.00 3.00
Prop. Share|              |  50          |              |
Prop. Prot.|              |              |              |
-----------------------------------------------------------------------
                            Signal Operations
Phase Combination 1     2     3     4 |             5     6     7     8
EB  Left          *                   |NB  Left     *
    Thru          *                   |    Thru                 *
    Right         *                   |    Right                *
    Peds                              |    Peds
WB  Left                *             |SB  Left     *     *
    Thru                *             |    Thru           *     *
    Right               *             |    Right          *     *
    Peds                              |    Peds
NB  Right                             |EB  Right
SB  Right                             |WB  Right
Green          10.0P 30.0P            |Green    10.0P 15.0P 65.0P
Yellow/AR       5.0   5.0             |Yellow/AR 5.0   0.0   5.0
Cycle Length: 150 secs  Phase combination order: #1 #2 #5 #6 #7
-----------------------------------------------------------------------
                   Intersection Performance Summary
     Lane  Group:  Adj Sat   v/c    g/C                   Approach:
     Mvmts   Cap    Flow    Ratio   Ratio   Delay  LOS    Delay  LOS
     -----  ----  -------   -----   -----   -----  ---    -----  ---
EB   LTR     125    1567    0.263   0.080    49.6   E      49.6    E
WB   L       378    1770    0.328   0.213    38.1   D      38.5    D
     LT      380    1781    0.353   0.213    38.4   D
     R       338    1583    0.406   0.213    39.1   D
NB   L       142    1770    0.078   0.080    48.6   E      26.4    D
     T      1664    3725    0.731   0.447    27.1   D
     R       707    1583    0.529   0.447    23.5   C
SB   L       319    1770    0.248   0.180    40.2   E      22.3    C
     TR     2034    3721    0.763   0.547    21.4   C
              Intersection Delay =  26.1 sec/veh Intersection LOS = D
Lost Time/Cycle, L =  12.0 sec   Critical v/c(x)    = 0.577
-----------------------------------------------------------------------
```

```
HCM: SIGNALIZED INTERSECTION SUMMARY   Version 2.4d       11-21-1996
                 Parsons Brinckerhoff Quade & Douglas
=======================================================================
Streets: (E-W) Kuihelani/Dairy Rd       (N-S) Puunene
Analyst: KO                             File Name: PUUKUIAM.HC9
Area Type: Other                        11-20-96 AM Peak
Comment: Year 2020 Build
=======================================================================
            |  Eastbound    |  Westbound    |  Northbound   |  Southbound   |
            | L    T    R   | L    T    R   | L    T    R   | L    T    R   |
            |---- ---- ----|---- ---- ----|---- ---- ----|---- ---- ----
No. Lanes   | 1    2  <     | 2    2    1   | 1    2    1   | 1    2  <
Volumes     | 100  800   25| 600  875  240|  50  840  545| 200  325  200
PHF or PK15|0.95 0.95 0.95|0.95 0.95 0.95|0.95 0.95 0.95|0.95 0.95 0.95
Lane W (ft)|12.0 12.0     |12.0 12.0 12.0|12.0 12.0 12.0|12.0 12.0
Grade       |       0       |       0       |       0       |       0
% Heavy Veh|   2    2    2|   2    2    2|   2    2    2|   2    2    2
Parking     |(Y/N) N        |(Y/N) N        |(Y/N) N        |(Y/N) N
Bus Stops   |             0|             0|             0|             0
Con. Peds   |             0|             0|             0|             0
Ped Button |(Y/N) Y 20.5 s|(Y/N) Y 17.5 s|(Y/N) Y 23.5 s|(Y/N) Y 17.5
Arr Type    |   3    3      |   3    3    3|   3    3    3|   3    3
RTOR Vols   |             0|             0|             0|             0
Lost Time   |3.00 3.00 3.00|3.00 3.00 3.00|3.00 3.00 3.00|3.00 3.00 3.00
Prop. Share|               |               |               |
Prop. Prot.|               |            30|            32|
-----------------------------------------------------------------------
                          Signal Operations
Phase Combination 1    2    3    4 |             5    6    7    8
EB  Left          *    *           |NB  Left     *    *
    Thru               *           |    Thru          *
    Right              *           |    Right         *
    Peds                           |    Peds          *
WB  Left          *    *           |SB  Left     *    *
    Thru               *           |    Thru          *
    Right              *           |    Right         *
    Peds               *           |    Peds
NB  Right         *                |EB  Right
SB  Right                          |WB  Right    *
Green          15.0P 55.0P         |Green    20.0P 40.0P
Yellow/AR        5.0   5.0         |Yellow/AR 5.0   5.0
Cycle Length: 150 secs  Phase combination order: #1 #2 #5 #6
-----------------------------------------------------------------------
                  Intersection Performance Summary
     Lane  Group:   Adj Sat    v/c     g/C                 Approach:
     Mvmts   Cap      Flow    Ratio   Ratio   Delay  LOS   Delay  LOS
     -----  ----   -------   -----   -----   -----  ---   -----  ---
EB   L       250      1770   0.420   0.513    19.7   C     28.7   D
     TR     1409      3709   0.646   0.380    29.8   D
WB   L       726      3539   0.897   0.513    30.5   D     28.3   D
     T      1416      3725   0.683   0.380    30.6   D
     R       865      1583   0.292   0.547    14.0   B
NB   L       346      1770   0.153   0.447    19.2   C     43.0   E
     T      1043      3725   0.890   0.280    46.3   E
     R       654      1583   0.877   0.413    39.9   D
SB   L       309      1770   0.683   0.447    33.0   D     35.3   D
     TR      983      3512   0.591   0.280    36.1   D
            Intersection Delay =  33.8 sec/veh Intersection LOS = D
Lost Time/Cycle, L =   6.0 sec   Critical v/c(x)    = 0.823
-----------------------------------------------------------------------
```

```
HCM: SIGNALIZED INTERSECTION SUMMARY   Version 2.4d        11-21-1996
                 Parsons Brinckerhoff Quade & Douglas
=======================================================================
Streets: (E-W) Kuihelani/Dairy Rd        (N-S) Puunene
Analyst: KO                              File Name: PUUKUIPM.HC9
Area Type: Other                         11-20-96 PM Peak
Comment: Year 2020 Build
=======================================================================
           |  Eastbound   |  Westbound   |  Northbound  |  Southbound  |
           | L    T    R  | L    T    R  | L    T    R  | L    T    R  |
           |---- ---- ----|---- ---- ----|---- ---- ----|---- ---- ----|
No. Lanes  | 1    2    <  | 2    2    1  | 1    2    1  | 1    2    <
Volumes    | 200 1050   50| 725  720  265|  50  675  505| 250  695  200
PHF or PK15|0.95 0.95 0.95|0.95 0.95 0.95|0.95 0.95 0.95|0.95 0.95 0.95
Lane W (ft)|12.0 12.0     |12.0 12.0 12.0|12.0 12.0 12.0|12.0 12.0
Grade      |      0       |      0       |      0       |      0
% Heavy Veh|  2    2     2|  2    2     2|  2    2     2|  2    2    2
Parking    |(Y/N) N       |(Y/N) N       |(Y/N) N       |(Y/N) N
Bus Stops  |             0|             0|             0|             0
Con. Peds  |             0|             0|             0|             0
Ped Button |(Y/N) Y 20.5 s|(Y/N) Y 17.5 s|(Y/N) Y 23.5 s|(Y/N) Y 17.5
Arr Type   |  3    3      |  3    3     3|  3    3     3|  3    3
RTOR Vols  |             0|             0|             0|             0
Lost Time  |3.00 3.00 3.00|3.00 3.00 3.00|3.00 3.00 3.00|3.00 3.00 3.00
Prop. Share|              |              |              |
Prop. Prot.|              |            30|            32|
-----------------------------------------------------------------------
                          Signal Operations
Phase Combination 1    2    3    4 |           5    6    7    8
EB  Left          *    *           |NB  Left   *    *
    Thru               *           |    Thru        *
    Right              *           |    Right       *
    Peds                           |    Peds        *
WB  Left          *    *           |SB  Left   *    *
    Thru               *           |    Thru        *
    Right              *           |    Right       *
    Peds               *           |    Peds
NB  Right         *                |EB  Right
SB  Right                          |WB  Right  *
Green          15.0P 55.0P         |Green    20.0P 40.0P
Yellow/AR        5.0   5.0         |Yellow/AR  5.0   5.0
Cycle Length: 150 secs  Phase combination order: #1 #2 #5 #6
-----------------------------------------------------------------------
                   Intersection Performance Summary
     Lane  Group:  Adj Sat   v/c     g/C                  Approach:
     Mvmts  Cap     Flow    Ratio   Ratio   Delay  LOS   Delay  LOS
     -----  ----  -------   -----   -----   -----  ---   -----  ---
EB   L       272    1770    0.776   0.513    33.0   D     36.3   D
     TR     1406    3700    0.865   0.380    36.8   D
WB   L      1002    3539    0.784   0.513    30.2   D     27.0   D
     T      1416    3725    0.562   0.380    28.3   D
     R       865    1583    0.322   0.547    14.3   B
NB   L       309    1770    0.172   0.447    22.4   C     36.5   D
     T      1043    3725    0.716   0.280    38.6   D
     R       654    1583    0.813   0.413    34.9   D
SB   L       309    1770    0.851   0.447    46.3   E     56.2   E
     TR     1008    3600    0.982   0.280    58.8   E
           Intersection Delay =  37.6 sec/veh Intersection LOS = D
Lost Time/Cycle, L =  12.0 sec   Critical v/c(x)    = 0.939
-----------------------------------------------------------------------
```

INVENTORY SURVEY OF ARCHAEOLOGY

APPENDIX B

SCS Project Number 060-5

INVENTORY SURVEY OF PUUNENE BYPASS/MOKULELE HIGHWAY IMPROVEMENTS CORRIDOR PULEHUNUI, AND WAILUKU AHUPUA`A WAILUKU DISTRICT, ISLAND OF MAUI, HAWAI`I TMK: 3-8: 04, 05, 06, 07

By:

Berdena Burgett, B.A.

and

Robert L. Spear, Ph.D.

Revised February 1997

Prepared for:

PBR Hawaii

SCIENTIFIC CONSULTANT SERVICES Inc.

711 Kapiolani Blvd. Suite 777 Honolulu, Hawai`i 96813

TABLE OF CONTENTS

FIGURES

INTRODUCTION

At the request of PBR Hawaii, Scientific Consultant Services, Inc., (SCS) conducted an Archaeological Inventory Survey of the proposed Pu`unene Bypass and Mokulele Highway Improvements Corridors. The two objectives of the survey were: 1) to locate and identify any archaeological features that might be present in the road corridors; and 2) determine whether the eastern extent of Kealia Pond was near, or within, the road corridor.

The field work consisted of a pedestrian survey of the southern corridor section that did not pass through sugarcane fields, and a vehicular inspection of the corridors that pass through existing cane fields. The survey was conducted on August 7, 1995, by Field Archaeologist John Risedorf and Project Director Berdena Burgett.

PHYSICAL SETTING

The project area is located in Pulehunui and Wailuku *ahupua`a*, Wailuku District, Maui Island (Figures 1 and 2) and consists of approximately 10 miles of existing and proposed road corridors. The corridors extend across the isthmus from northern Kihei to a junction with Kuihelani Highway c. 3000 feet south of Kahului; an area approximately 9.59 miles long by 200 to 1,570 ft. wide. Mokulele Improvements corridor, at the south end, includes 3.45 miles of the existing highway; the three Pu`unene Bypass alternative corridors, and connections to Mokulele Highway, cover the remaining c. 6.15 miles.

With the exception of a c. 0.75 mile long section extending north from the junction of Mokulele and Pi`ilani Highways, most of the area bordering the road corridors is under sugar-cane cultivation. The short section at the southern end of the corridor is occupied by an experimental agricultural station on the east side, and by Hawaiian Foliage and Landscape Co. and several fenced fields of pasture land on the west.

Excluding the plantings at the experimental agricultural station and Hawaiian Foliage and Landscape Company, sugarcane (*Saccarum sp.*) is the dominant vegetation within the project area. Also present are *koa haole* (*Lecucaena leucocepharia* [Lam.] deWit), occasional *kiawe* (*Prosopis pallida*), and various weeds and grasses.

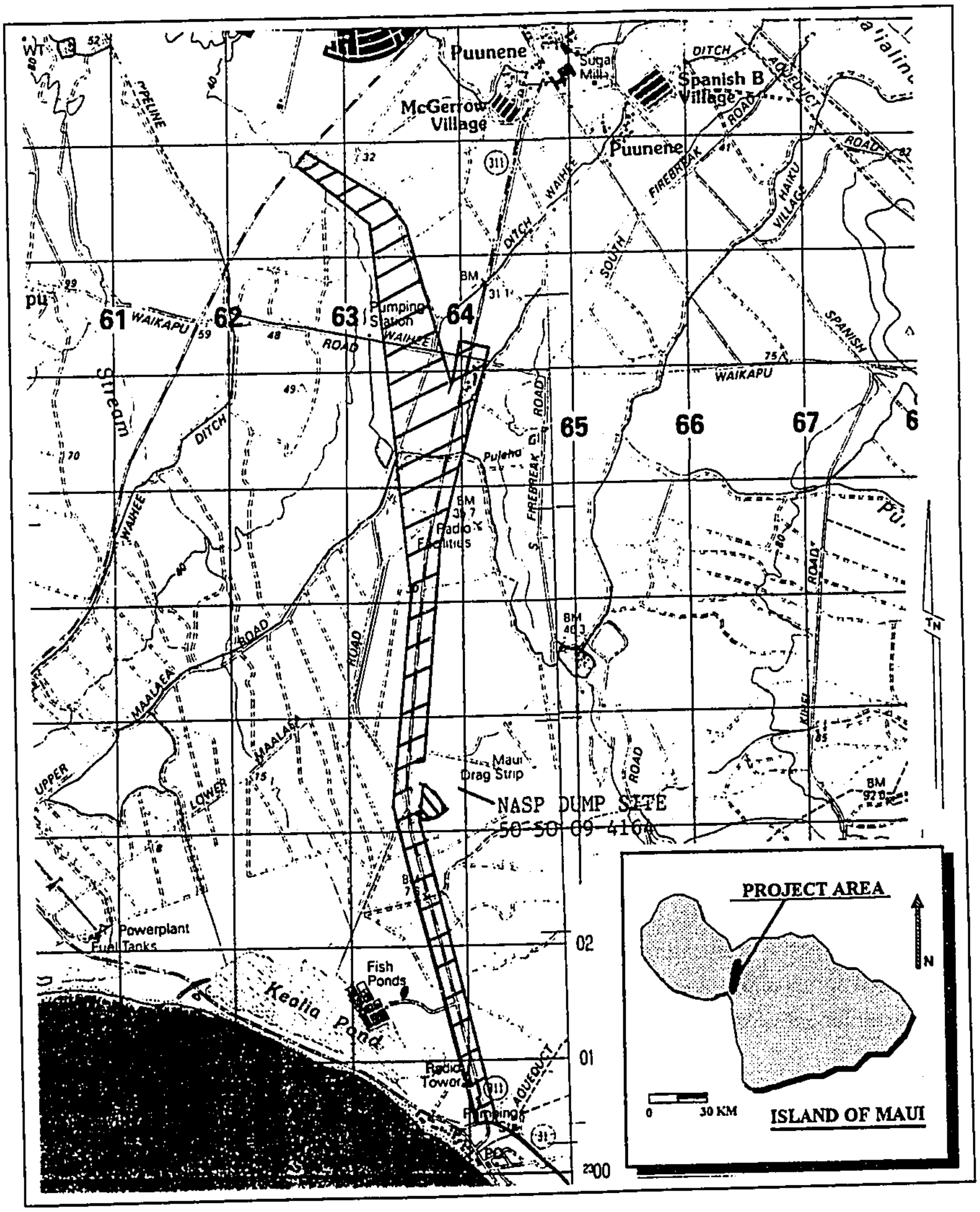


FIGURE 1: USGS WAILUKU AND MAKAWAO QUADRANGLE SHOWING PROJECT AREA.

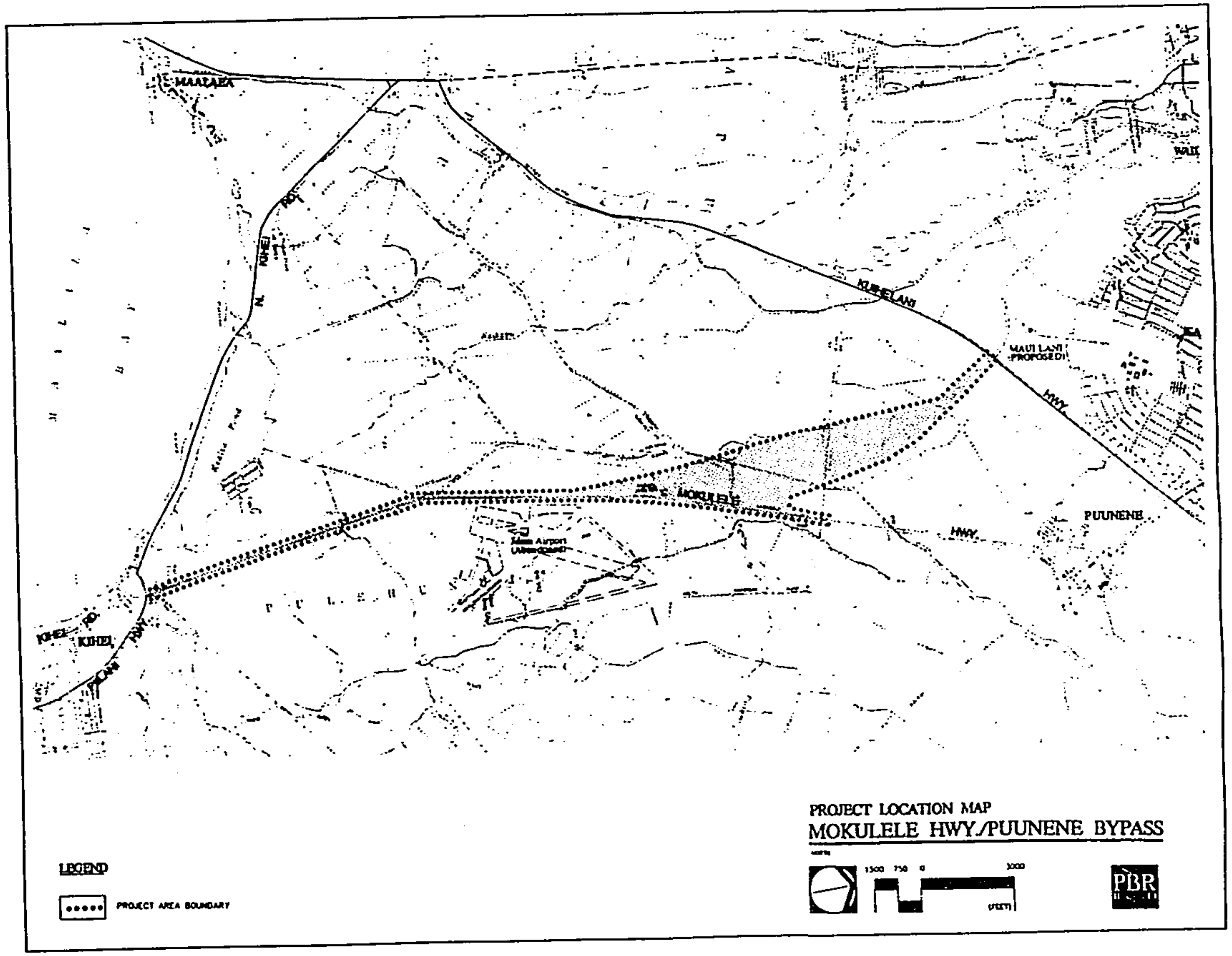


FIGURE 2: PROJECT AREA MAP SHOWING BY-PASS CORRIDOR. (MAP BY PBR, HAWAII 1994)

Elevation of the project area ranges from 40 to 100 feet above mean sea level. Annual rainfall averages less than 10 inches, with most precipitation occurring between March and December (Armstrong 1983).

Soils in the area consist of Pulehu Silt loam, well drained with slow run-off and slight erosional hazard. These soils are commonly used for sugar cane cultivation and occur on low, flood prone areas with 0 to 3% slopes (Foote et al. 1972)

HISTORICAL BACKGROUND

During the 1840s the central plain of Maui held free ranging cattle that were causing problems for agriculturalists "...fences being either non-existent or inadequate, the cattle invaded the cultivated slopes of Haleakala and in the valleys on the other side of the plain and caused a great amount of damage" (Kuykendall 1938: 181, 314-18).

Prior to the Māhele of 1848-53, nearly all lands in Hawai`i had been held by the king and chiefs. The events of the Māhele land redistribution program, which gave both natives and aliens the opportunity to acquire and own lands, led to foreign acquisition and development of large areas of the state. Six sugar mills were in operation on Maui in 1846. By the late 1800s land use in Wailuku District was largely devoted to the sugar industry (ibid: 296, 316; Speakman 1978: 120-129).

Passage of the Reciprocity Treaty in 1876 assured a fair market for Hawaiian sugar in the United States. California sugar baron Claus Spreckels arrived in Hawai`i at the same time as news of passage of the treaty. Before a price rise had taken effect Spreckels had bought over 1/2 of the 1877 sugar crop. In 1878, through his friendship with King Kalakaua, Spreckels was able to lease and purchase 40,000 acres of Crown Lands in central Maui. He then acquired water rights to the northern slope of Haleakala and the right to transport the water to his lands on the isthmus by means of a ditch (Speakman 1978).

Spreckels' holdings were incorporated as the Hawaiian Commercial Company and construction of a large sugar complex was begun at Spreckelsville. By 1882 the company was reorganized as the Hawaiian Commercial and Sugar Company. Control of HC&S passed to Alexander and Baldwin in 1899 (Conde and Best 1973: 208-210).

With the exception of the property owned by Hawaiian Foliage and Landscape Company, the experimental agricultural fields at the south end of Mokulele Highway, and several private residences, tax maps show that the lands bordering the project area are owned by Alexander and Baldwin, Inc. Sugarcane cultivation continues as the primary land usage in the area.

Tax maps identify one LCA within the survey area. LCA 5230, located between the Mokulele Highway and Mehameha Loop, was awarded to Keaweamahi on September 28, 1853. On March 16, 1855, after a payment of $5.00, Royal Patent 8140 was issued to Keaweamahi. The Native Register records Keaweamahi's testimony as follows: "The name of the place is Pulehu. The land is at Kula. I am the one with the right there, forever".

PREVIOUS ARCHAEOLOGY

Although a number of archaeological investigations have been conducted along the southwestern coast of Maui, no previous studies have been conducted in the current project area. However, two recent studies have taken place south of the Mokulele-Piilani Highway intersection at the southern end of the current project area:

Sinoto (1992) conducted an archaeological inventory survey of a proposed location for the Kihei Gateway Complex, on the *makai* side of the Piilani-Mokulele Highway junction. One historic site, the remains of concrete footings from a bridge across Waiakoa Stream, was identified. The bridge, Site 50-50-09-31, was probably related to a narrow gauge cane railroad that ran through the area and/or to Kihei Camp 1.

Rotunno-Hazuka (1991) conducted an inventory survey for the Kai Makani project, north of Kihei Road. The survey and sub-surface testing, including backhoe trenching, identified no archaeological remains or subsurface deposits in the extensively disturbed project area.

Prior to the two recent studies noted above, a State Site Number of 50-50-09-4164 was assigned to the former Naval Air Station Puunene (NASP). NASP was developed and expanded just prior to and during the Second World War. At the height of its operations the air station consisted of numerous facilities including personnel quarters, training facilities, a dispensary, a chapel, a movie theater, and a miniature golf course. Also constructed were two runways of 6,000 ft. or longer, taxiways, aviation gasoline tanks, and weapons magazines.

Remnants of NASP remain today in the form of abandoned bunkers and magazines, a runway (now used as a drag strip), and a buried dump site which is reported to contain the remains of World War II era military equipment (pers. comm. Sara Collins)(see Figure 1).

METHODOLOGY

Pedestrian sweeps were made along the west side of Mokulele Highway, starting at the fenced pasture area adjoining the southern end of the planted cane fields, 0.75 miles north of the highway intersection. The fenced fields continued south for a distance of only 500 feet, stopping at the roadway leading west to the fish ponds at Kealia Pond. The sweeps extended 75-80 feet (c. 23 to 24.9 m.) west of a fence paralleling the highway shoulder and continued a short distance into the Hawaiian Foliage and Landscape gardens; a total north-south distance of approximately 585 feet. A road through Hawaiian Foliage and Landscape Company, was followed west to Kealia Pond. The remaining length of the highway corridors was observed while driving the highway and visually inspecting the proposed routes.

SURVEY EXPECTATIONS

It was expected that if any evidence of archaeological remains was still present in the project area, that evidence would be located in the southern portion of the corridor, which is relatively close to the shoreline. After reviewing area tax maps, historical accounts, and the extent of recent and past land modifications, both within and bordering the narrow road corridors, it was considered likely that little, if any, evidence of archaeological features would be identified during the survey.

FIELDWORK RESULTS

No evidence of archaeological remains was encountered during the survey. The entire route of the Highway Improvements and Pu`unene Bypass corridors crosses previously altered terrain. Most of the extensive alteration in the area has been the result of sugarcane cultivation.

An exploration of the area near the southwest end of Mokulele Highway, between the Roadway Improvements corridor and Kealia Pond, disclosed that the eastern most extension of the pond is located c. 600 feet west of the roadway corridor, and will not be impacted by construction activities.

DISCUSSION AND CONCLUSION

Although no sites were identified the absence was not unexpected; other archaeological studies in the general area identified no prehistoric remains. Several factors may account for the lack of archaeological remains: extensive disturbance associated with prior sugarcane cultivation, highway and private construction activities at the southern end of the Improvements corridor, and/or little or no prehistoric occupation or use of the area. The absence of documentary references to prehistoric occupation, and the single LCA, located on the inland portion of the project area crossing the isthmus, would seem to indicate that the region was not populated or cultivated prehistorically.

An initial review of this report by the State Historic Preservation Division (SHPD) requested that further information be provided regarding the Naval Air Station Puunene Hibbard 1996: DOC NO. 9512SC09). More information regarding the NASP was sought in general, and a more exact location of a rumored military dump site in the vicinity of the Puunene bypass highway corridor was requested specifically.

To obtain that information a number of inquires were directed to Mr. Burl Burlingame at the Honolulu Star Bulletin, and to Mr. Alan DeCoite and Mr. Gary Moore of the Maui Military Museum.

The general consensus of opinion was that very little in the way of useful military records regarding NASP and its various architectural components exist, and none are known to exist in civilian hands. Mr. Moore of the Maui Military Museum stated that the loan of a 1940 era map was made to Mr. Chubby Vicens, of Alexander and Baldwin, Maui. That map, however has been misplaced. Alexander and Baldwin's historian, Mr. Ken Numara, did provide SCS with a large map of the Naval Air Station as it appeared in 1944. This map does not specifically show a dump site on this parcel of land adjacent to the highway corridor.

In the ensuing months that the dump site location question has remained unresolved, an aerial photograph was obtained from R. M. Towill dated 1950 showing the dump site as it appeared after WWII (Figure 3). A careful overlay of the current project area corridor shows conclusively that though the road corridor will skirt the edge of the dump site, it will not directly impact it.

The placement of the military dump site on Figure 1 earlier in this report has been modified to reflect the new information provided in Figure 3.

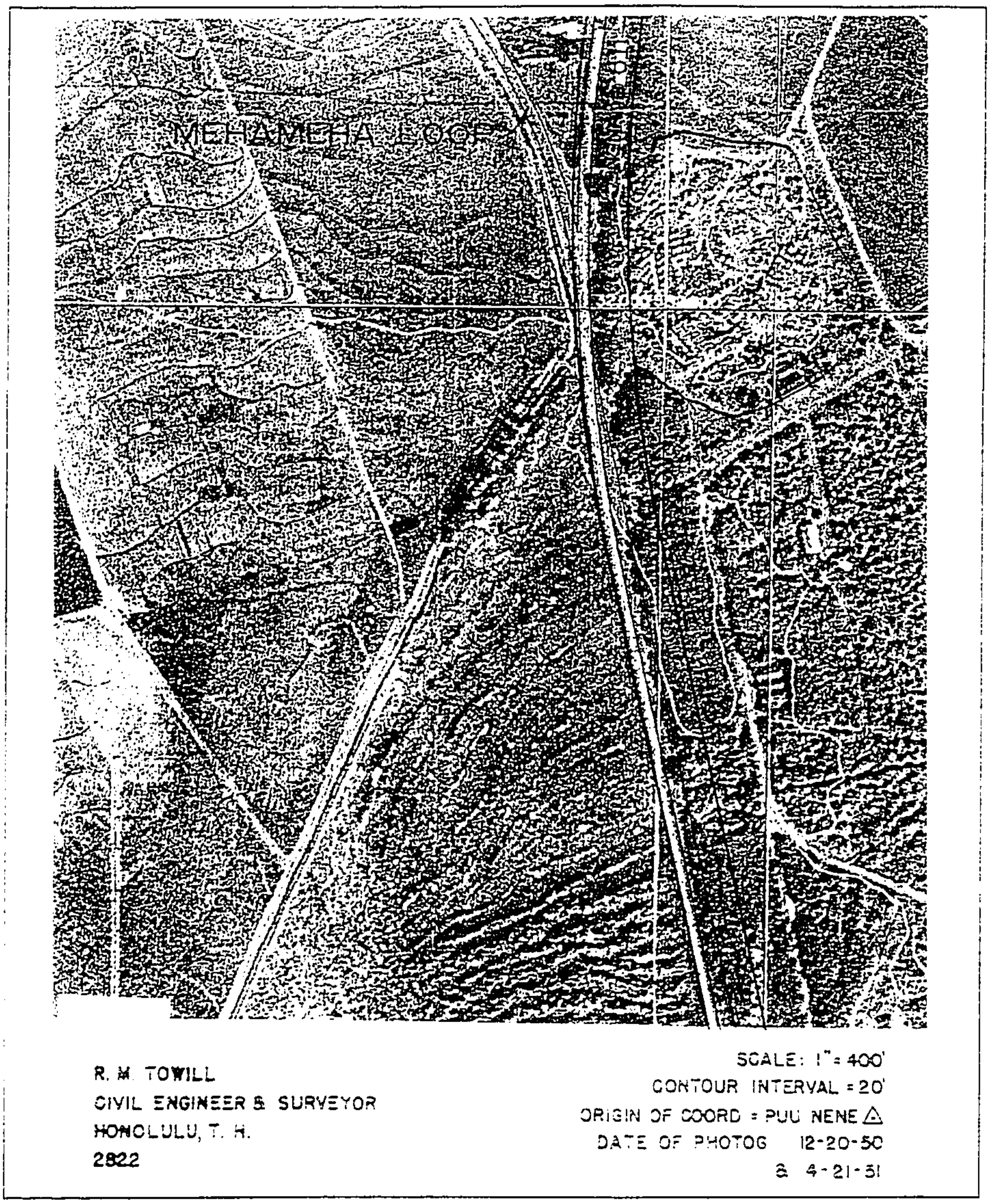


FIGURE 3: 1950 AERIAL PHOTOGRAPH SHOWING A MILITARY ERA DUMP SITE 50-50-09-4164 AND THE PROPOSED HIGHWAY CORRIDOR.

SIGNIFICANCE ASSESSMENTS.

Significance categories are based on the National Register criteria for evaluation, as outlined in the Code of Federal Regulations (36CFR Part 60). Site 50-50-09-4164, NASP, is interpreted as being significant under Criteria A and D. Criterion A defines a significant resource as having an "association with events that have made an important contribution to the broad patterns of our history". Criterion D defines significant resources as ones "which have yielded, or may be likely to yield, information important in prehistory or history." The Puunene Air Station would qualify under these categories because of its association with WWII in Hawai`i and the Pacific.

RECOMMENDATIONS

No pre-historic archaeological sites or features were identified within, or adjacent to, the areas of highway widening and alternative alignments.

The 1950 aerial photograph obtained from R. M. Towill shows the boundaries of the military dump site after WWII. Since the superimposition on that photograph of the current project area road corridor shows that the dump site will not be impacted, it is recommended that no further work needs to be conducted at this site.

As no pre-historic sites were discovered, and no sugar-era or WWII-era site will be impacted in the project area, it is determined that the presently proposed road corridor work will have "no adverse affect" on historic sites.

REFERENCES

Armstrong, R.W., (ed)
1983 *Atlas of Hawaii*. University Press of Hawaii: Honolulu. (Second Edition)

Board of Commissioners
1929 *Indices of Awards Made by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands*. Star Bulletin Press: Honolulu.

Conde J. C., and G. M. Best
1973 *Sugar Trains Narrow Gauge Rails of Hawaii*. Glenwood Publishing.

Foote, D., et al.
1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*. U.S. Department of Agriculture - Soil Conservation Service and University of Hawaii Agricultural Experiment Station. Washington D.C.: Government Printing Office.

Hawaii State Archives
n.d. *Native and Foreign Testimonies for Land Commission Awards*. Interior Department Files.

Kuykendall, R.S.
1938 *The Hawaiian Kingdom Vol. I, 1778-1854, Foundation and Transformation*. University Press of Hawaii: Honolulu.

Rotunno-Hazuka, L.
1991 *Archaeological Inventory Survey of the Kai Makani Project Parcel*. Ms. Report, Bishop Museum.

Sinoto, A. and J. Pantaleo
1992 *Archaeological Inventory Survey of the Proposed Kihei Gateway Complex*. Aki Sinoto Consulting, Honolulu.

Speakman, C.E., Jr.
1978 *Mowee: An Informal History of the Hawaiian Island*. Pueo Press: San Rafael.

SCS Project No. 060-Add-1

ADDENDUM TO: INVENTORY SURVEY OF PUUNENE BYPASS/MOKULELE HIGHWAY IMPROVEMENTS CORRIDOR PULEHUNUI, AND WAILUKU AHUPUA`A WAILUKU DISTRICT, ISLAND OF MAUI, HAWAI`I

TMK: 3-8: 04, 05, 06, 07

By:
Berdena Burgett, B.A.
and
Robert L. Spear, Ph.D.

November, 1996

Prepared for:
PBR Hawaii

SCIENTIFIC CONSULTANT SERVICES Inc.

711 Kapiolani Blvd. Suite 777 Honolulu, Hawai`i 96813

ADDENDUM

Burgett and Spear (1995) conducted an inventory level archaeological survey to determine the impact, if any, of construction activities on significant cultural resources in the corridor of the proposed Mokulele Highway and Puunene Bypass Improvements Corridor project. Since that time, a revision to the corridor plans indicated that an additional segment of proposed corridor should be surveyed and recorded. The area included in this additional phase of work is the Plantation Camp of McGerrow Village (Figures 1, 2, and 3).

On October 12, 1995 a letter was written to Mr. Gerald Moore of Hawaii Commercial and Sugar Company requesting permission to record a number of buildings at McGerrow Village. The recording was to include those buildings that could be impacted by proposed construction activities associated with the Mokulele Highway Improvements Corridor project. Permission for entry was granted and on October 19, 1995 SCS Project Directors Amy Dunn and Bee Burgett surveyed the remaining c. 2.00 mile length of the corridor between Waikapu Road, Puunene Avenue, and Kuihelani Highway.

Between Waikapu Road and McGerrow Village the corridor passes through existing cane fields and would impact only a cane haul road on the northeast side of the corridor. North of McGerrow Village the corridor impact zone affects cane fields on the west side of Puunene Avenue but should not impact existing buildings on the east side.

At least four extant houses in the village were maintained and showed signs of current occupation. An undetermined number of dwellings and outbuildings had been razed; large piles of building debris lined the south side of the unsurfaced road bordering the south end of the village.

Four of the houses were located at the Puunene Avenue end of the village and four faced Mokulele Highway at the south end. The houses appeared to have be constructed from a limited number of basic plans, with small variations resulting from later additions and alterations.

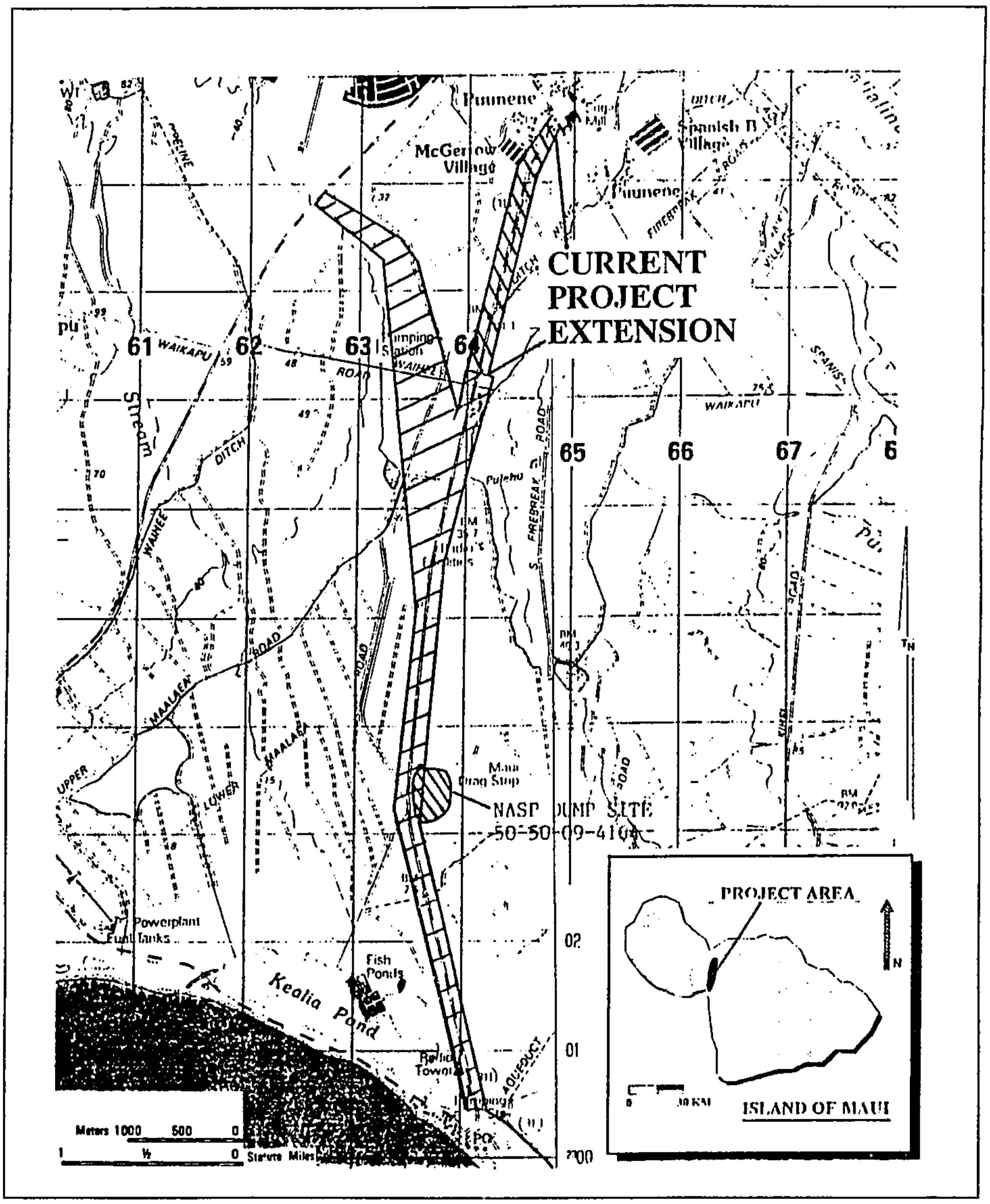


FIGURE 1: USGS WAILUKU AND MAKAWAO QUADRANGLE SHOWING PROJECT AREA.

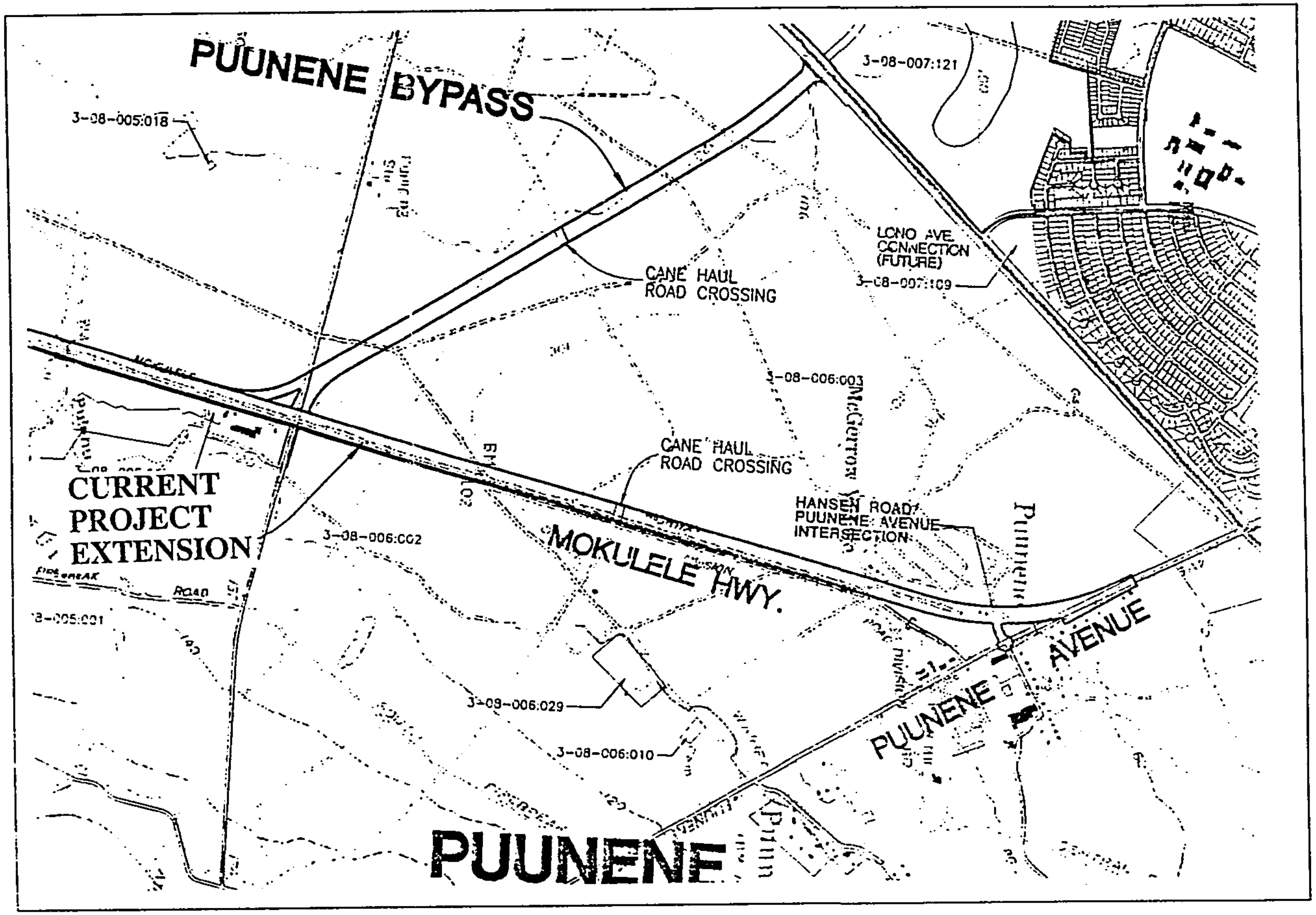


FIGURE 2: MOKULELE HIGHWAY PROJECT EXTENSION SHOWING PROXIMITY OF McGERROW VILLAGE.

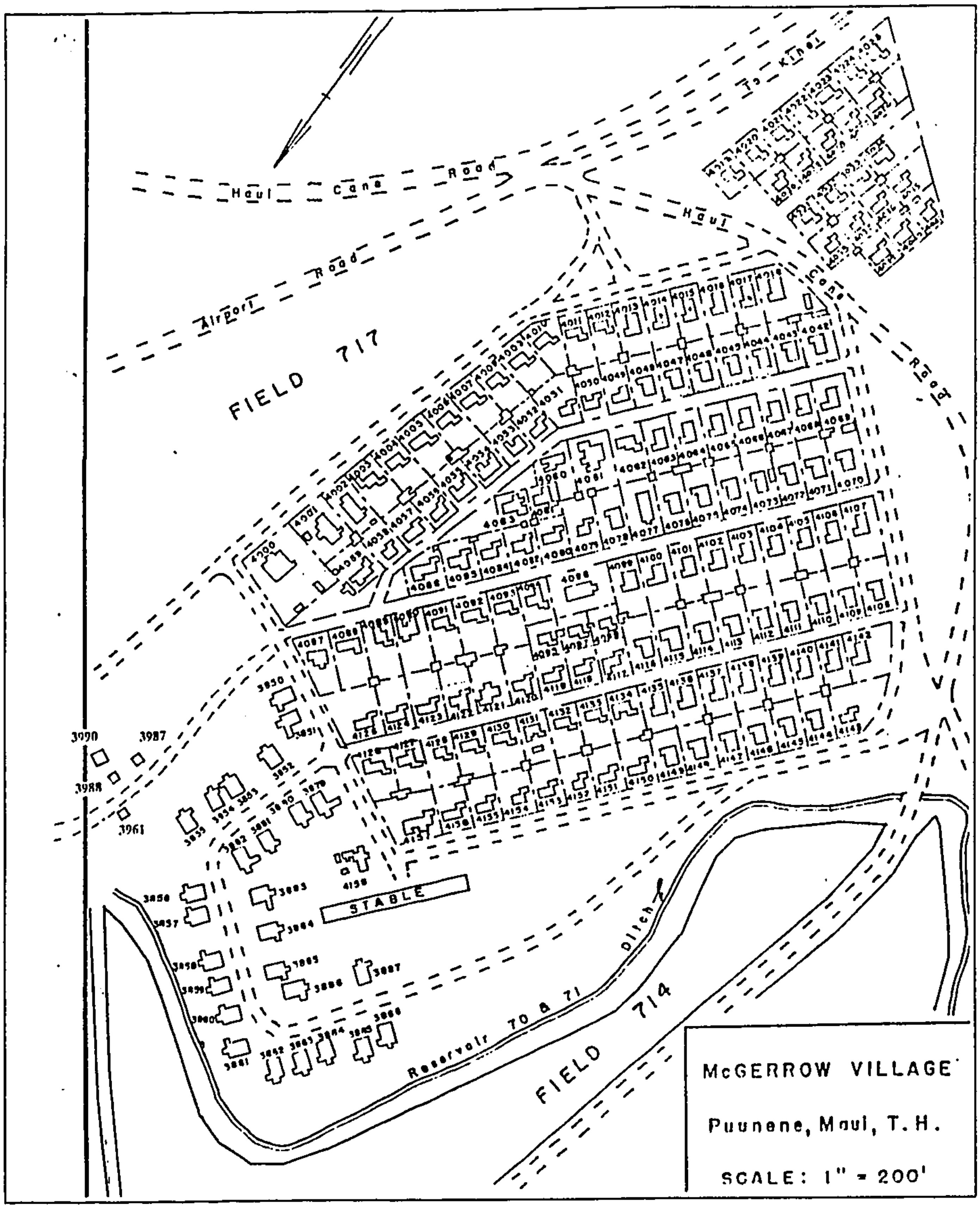


FIGURE 3: McGERROW VILLAGE, PUUNENE, MAUI, TERRITORY OF HAWAII. (HCSC MAP).

Exterior plans were drawn of three representative building types, and one building foundation (Figures 4 and 5). Although entry was not possible, the exteriors of eight vacant dwellings were photographed, described, and dimensions recorded. Figures 6 through 17 are photographs of selected buildings and are shown in Appendix A. The structures in the Appendix A photographs have been destroyed or moved and are no longer in place.

All of the buildings were single story constructions, elevated above the ground, and had lattice or boards partially covering the air spaces. Houses at the south end of the village, all of the same basic plan, appeared to be single wall, vertical board and batten constructions (4013, 4014, 4015, 4017). These houses had been modified with lean-to additions and/or small enclosed porches. Building #4014 is to be moved to The Sugar Museum and will be restored.

The buildings at the north end of the village (3990, 3988, 3987, 3961) are larger than those at the south end and appear to be later additions to the village: they are not shown on the available maps. Three of the buildings face the street entering the village from Puunene Ave. Building 3990 is located east of 3988 and faces Puunene Avenue. These four buildings have shingle or horizontal siding and double wall construction. Three of the buildings are rectangular with double doors at the front or street end, and a second entrance at the rear. Buildings 3988 and 3990 are divided into two apartments; one apartment in 3988 is currently occupied. Building 3987 has a sign identifying it as a special learning center, but appears to be vacant.

Building 3961 is an abandoned residence on the west side of the street opposite 3987 and 3988. The house has entrances and windows on the east, west, and north sides. An irrigation ditch passes close to the northwest corner of the building and several collapsed outbuildings, near the southwest end, lie between the house and the irrigation ditch.

Since the time of the survey, all of the buildings in the proposed road corridor impact zone have been razed. Building 4014 was preserved and moved to the the Sugar Museum grounds.

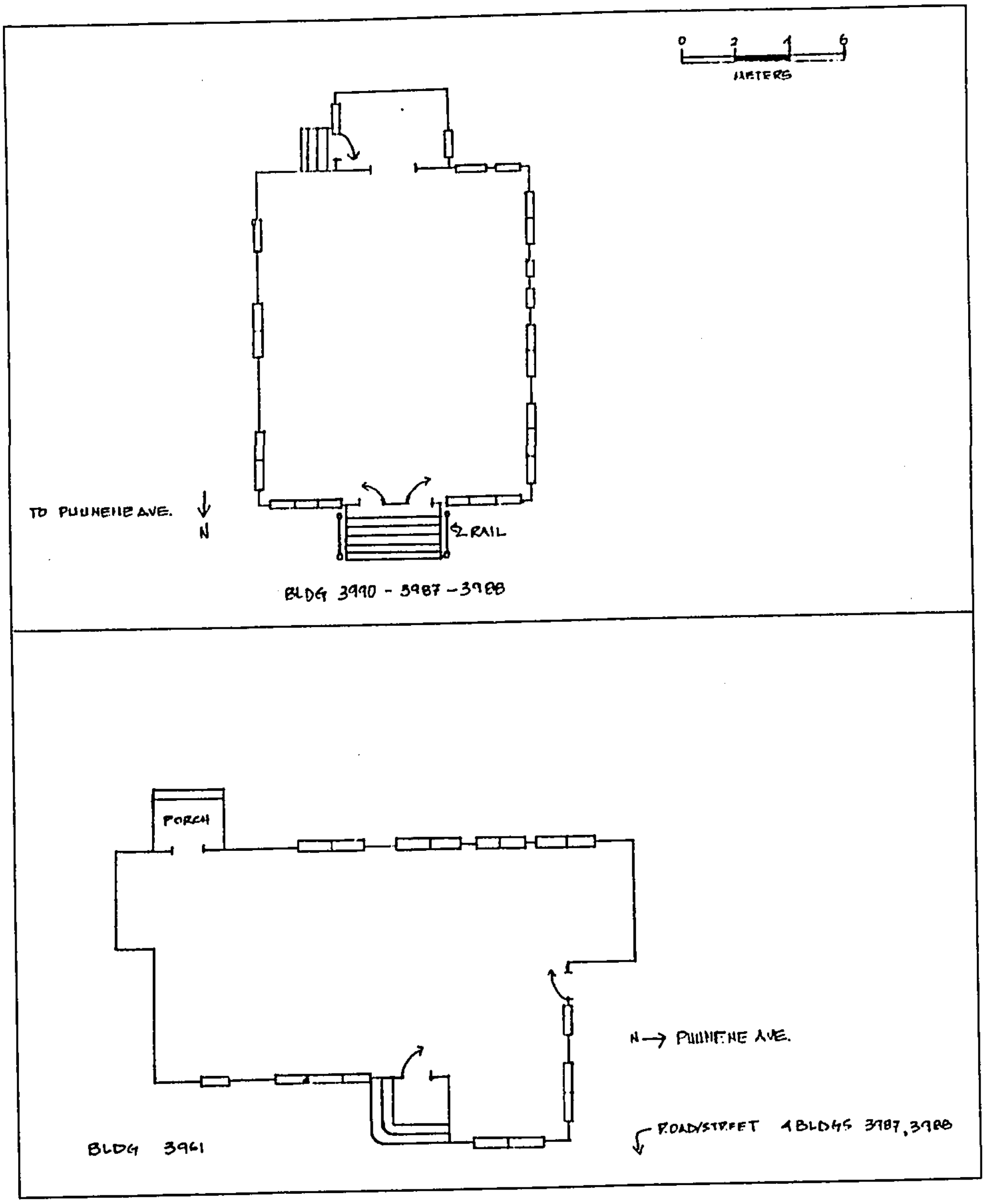
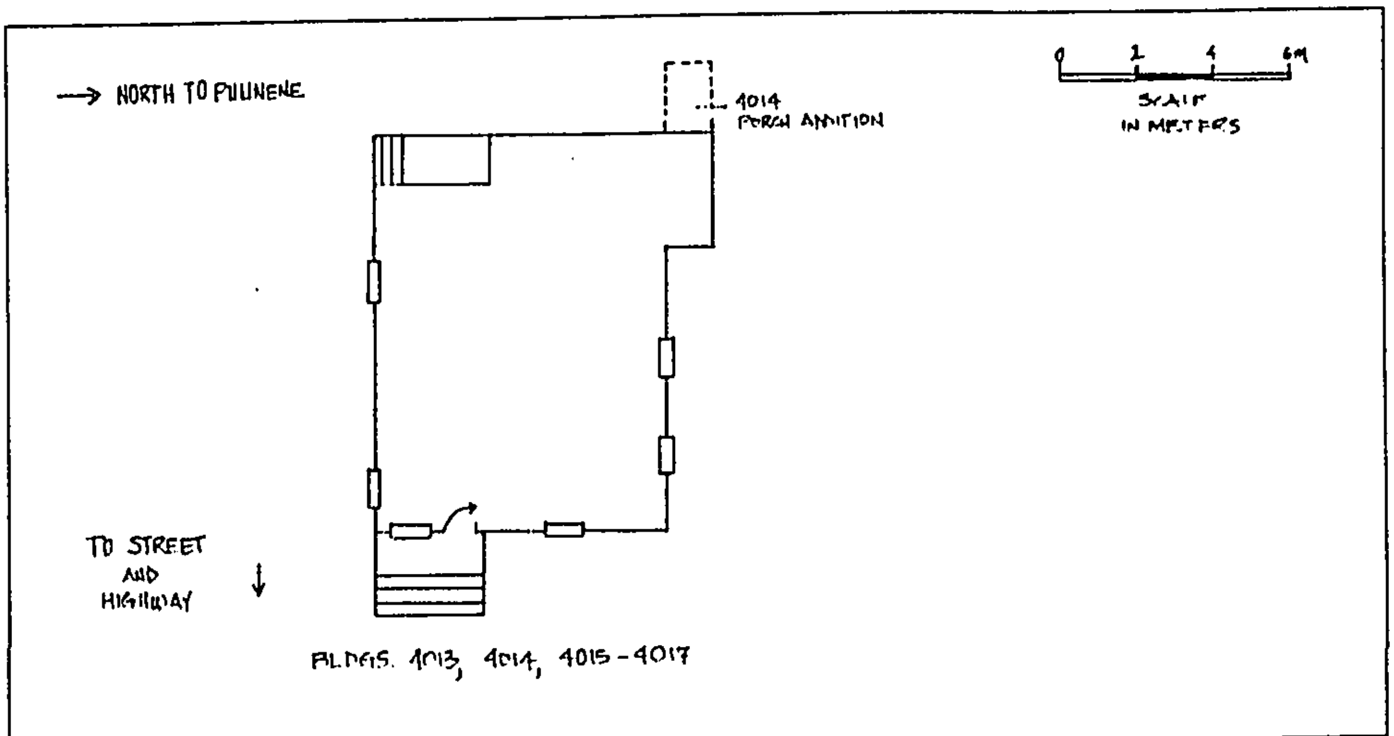


FIGURE 4: McGERROW VILLAGE HOUSE FOOTPRINTS FOR BUILDING NOS. 3961, 3987, 3988, AND 3990.



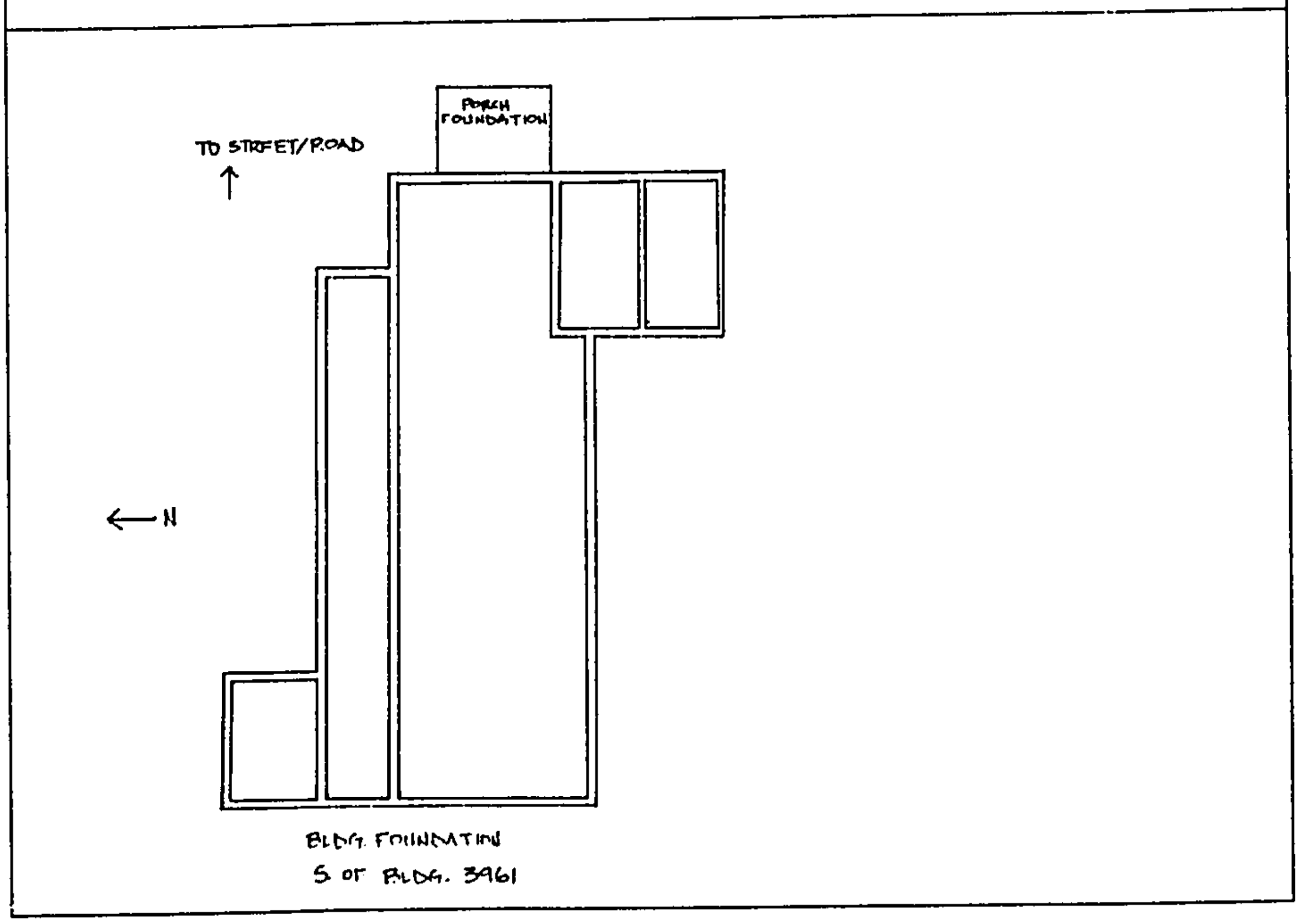


FIGURE 5: McGERROW VILLAGE HOUSE FOOTPRINTS FOR BUILDING NOS. 4013, 4014, 4015 TO 4017 AND BUILDING FOUNDATION SOUTH OF BLDG. NO. 3961.

APPENDIX A

SELECTED BUILDING PHOTOGRAPHS

(These structures have been razed or moved and are no longer in place)

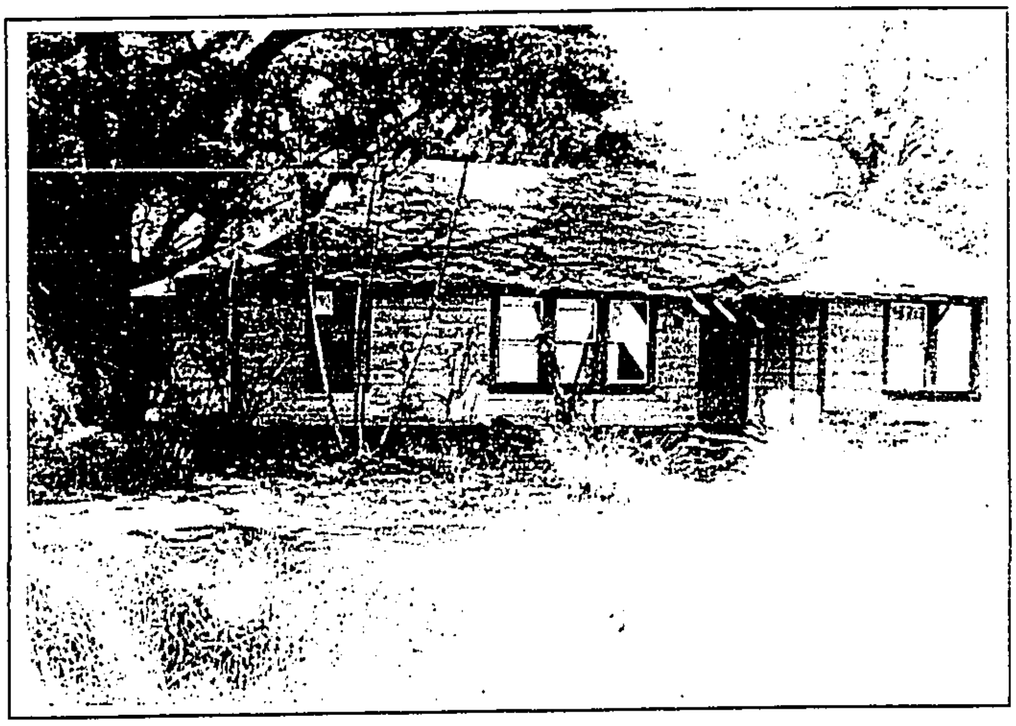


FIGURE 6: EAST SIDE OF BUILDING NO. 3961.
VIEW TO WEST/NORTHWEST.

FIGURE 7: NORTH SIDE OF BUILDING NO. 3961.
VIEW TO SOUTHWEST.

FIGURE 8: FOUNDATION OF BUILDING SOUTH OF BLDG. NO. 3961.
VIEW TO NORTHWEST.

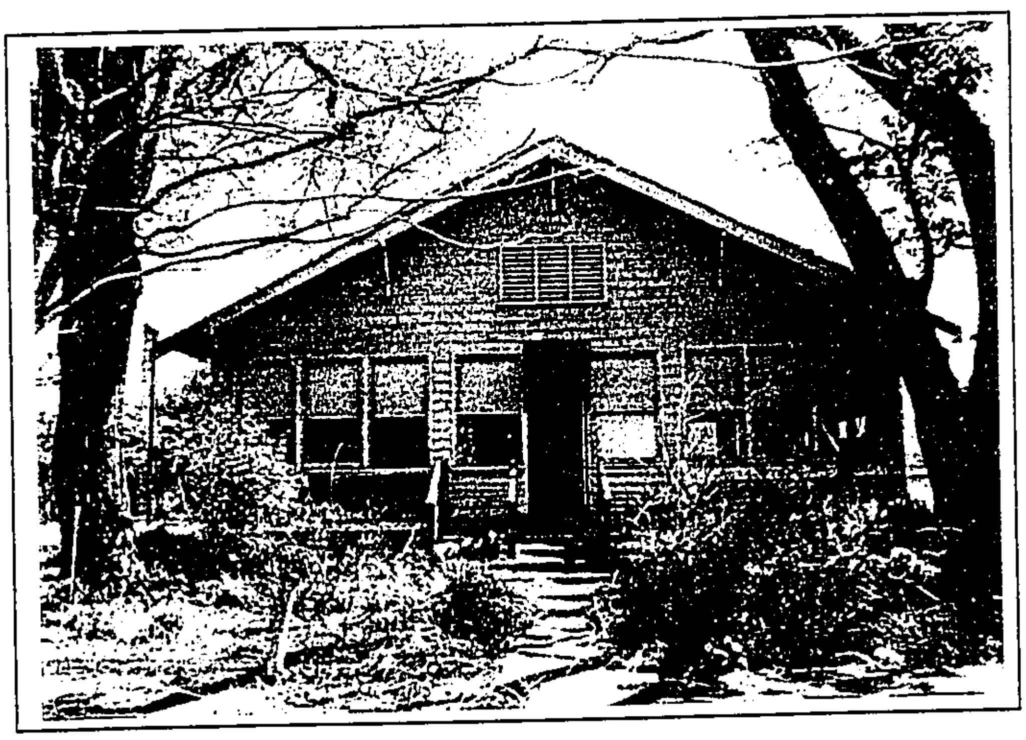


FIGURE 9: FRONT OF BUILDING NO. 3987.
VIEW TO EAST.

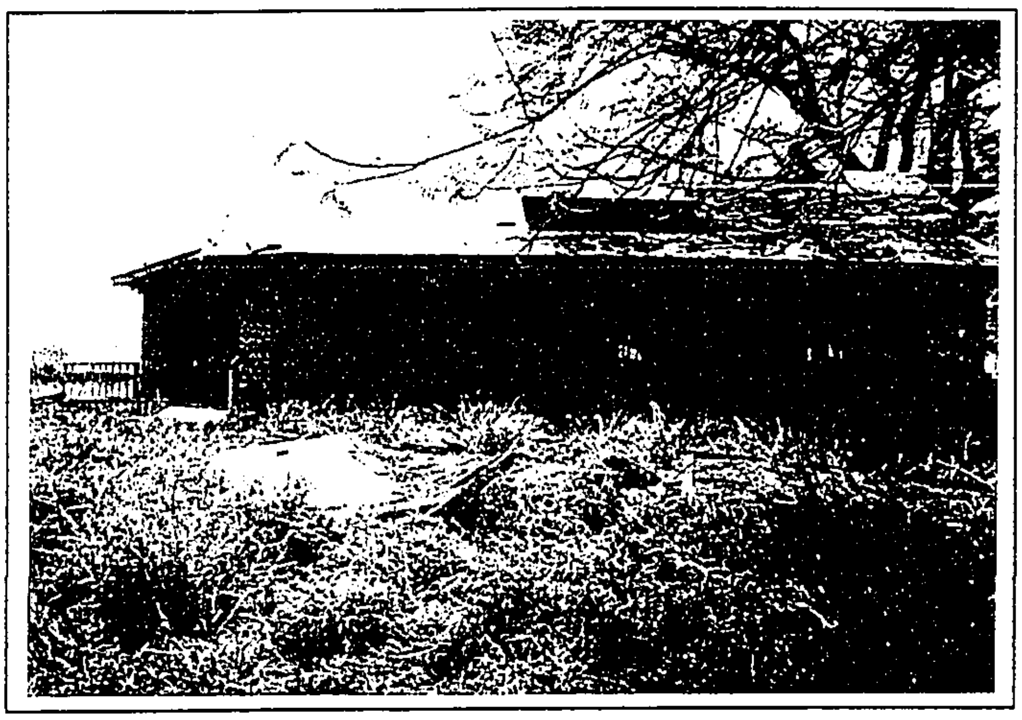


FIGURE 10: NORTH SIDE OF BUILDING NO. 3987.
VIEW TO SOUTH.

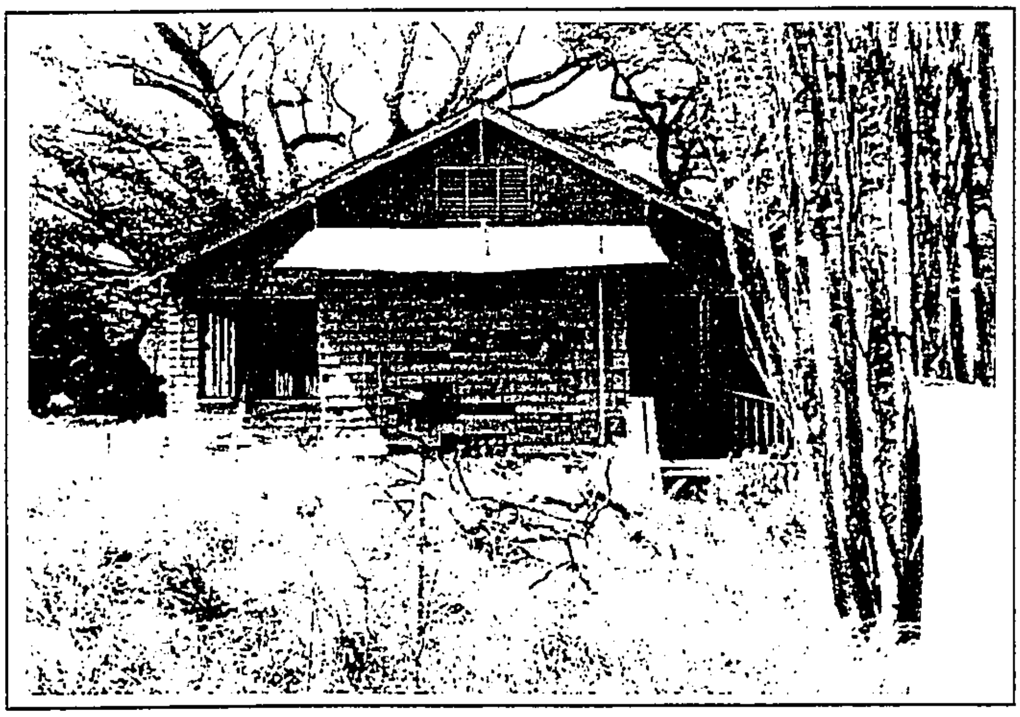


FIGURE 11: EAST SIDE OF BUILDING NO. 3987.
VIEW TO WEST.

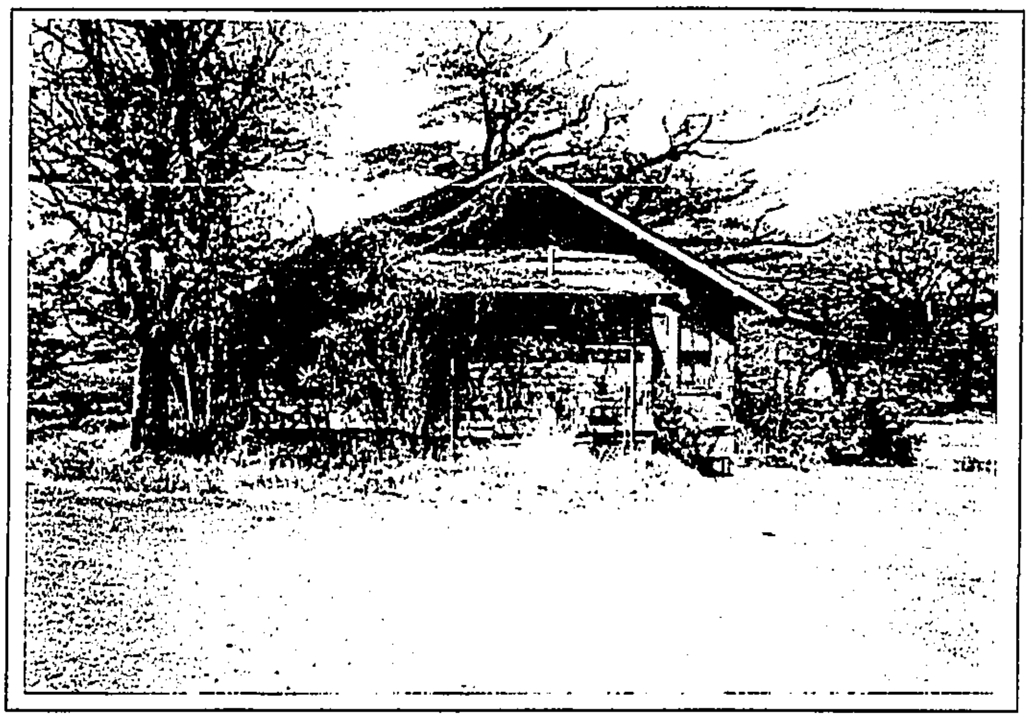


FIGURE 12: BACK OF BUILDING NO. 3998 A&B.
VIEW TO NORTHWEST.

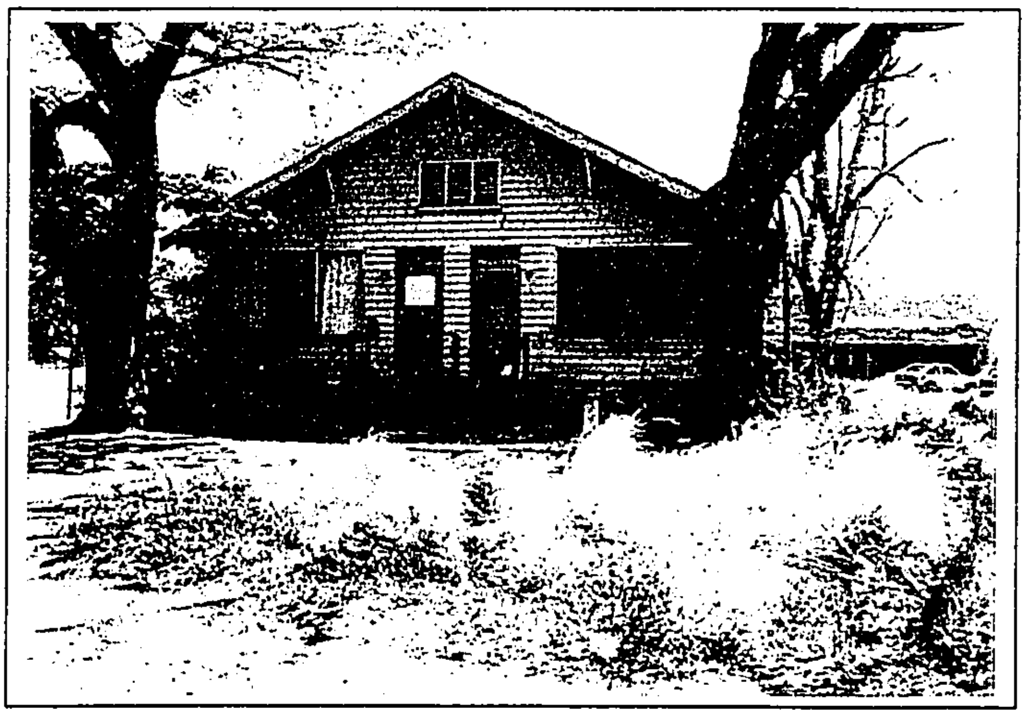


FIGURE 13: FRONT OF BUILDING NO. 3998 A&B.
VIEW TO SOUTHEAST.

FIGURE 14: BUILDING NO. 4013 SHOWING ENCLOSED PORCH.
VIEW TO EAST.

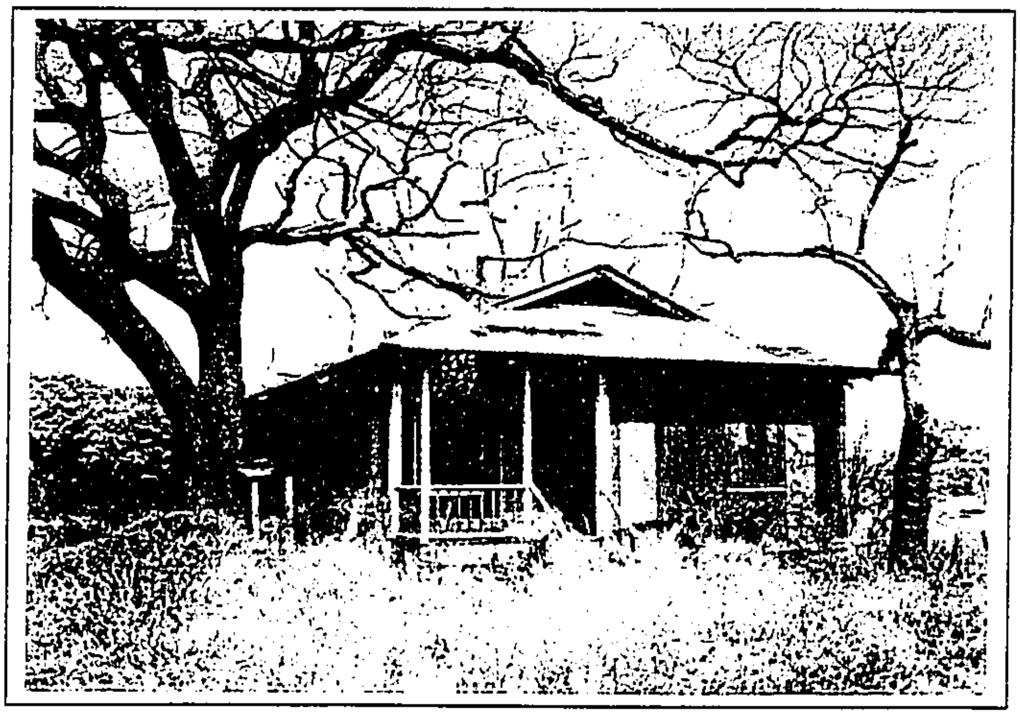


FIGURE 15: FRONT AND SOUTH SIDE OF BUILDING NO. 4013.
VIEW TO NORTHWEST.

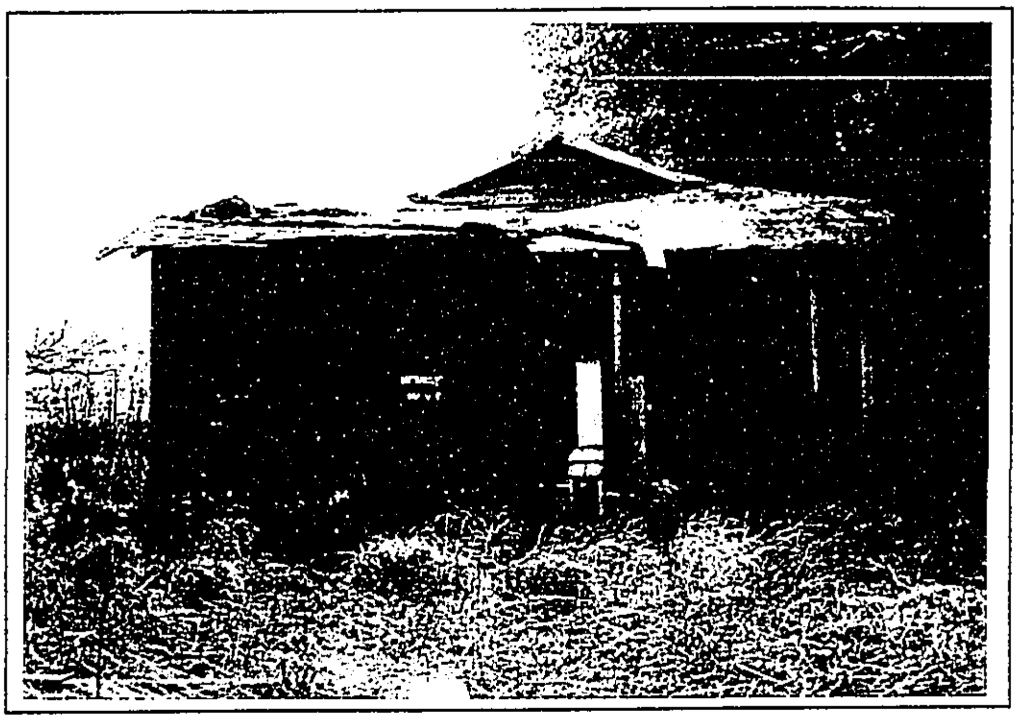


FIGURE 16: BACK OF BUILDING NO. 4017.
VIEW TO EAST.

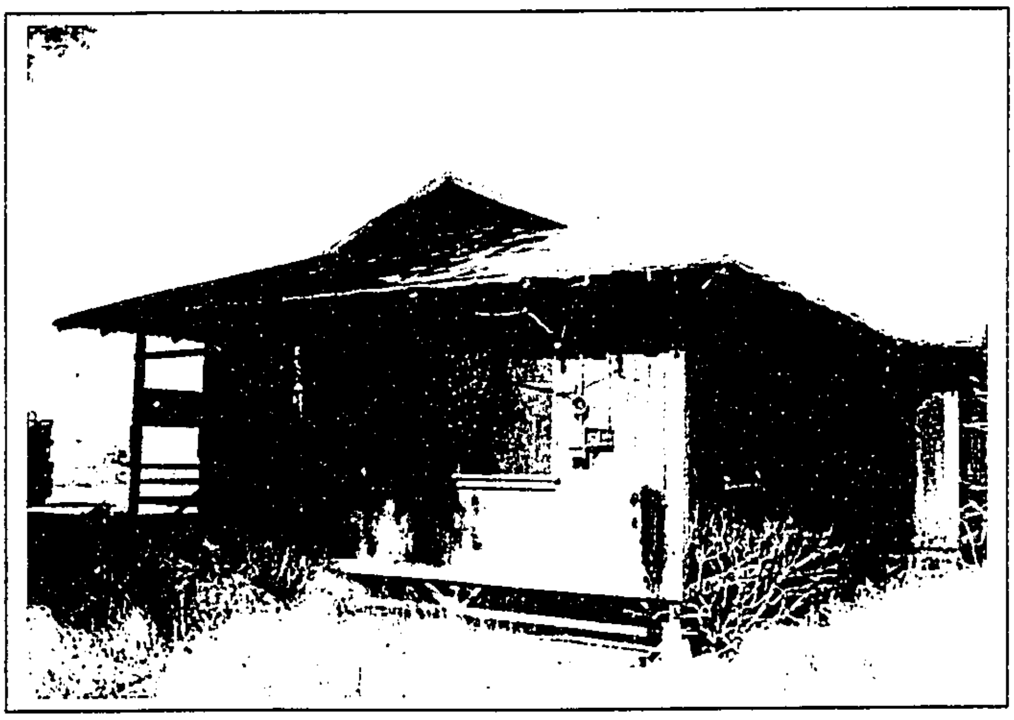


FIGURE 17: FRONT AND NORTH SIDE OF BUILDING NO. 4017.
VIEW TO WEST.

BOTANICAL SURVEY

APPENDIX C

BOTANICAL SURVEY
MOKULELE HIGHWAY WIDENING
WAILUKU DISTRICT, ISLAND OF MAUI

by

Winona P. Char

CHAR & ASSOCIATES
Botanical Consultants
Honolulu, Hawai'i

Prepared for: PBR HAWAII

August 1996

BOTANICAL SURVEY
MOKULELE HIGHWAY WIDENING
WAILUKU DISTRICT, ISLAND OF MAUI

INTRODUCTION

Mokulele Highway is proposed to be widened from two lanes to four lanes between Pi'ilani Highway and Pu'unene. A portion of Pu'unene Avenue is also included in the alignment. From its Kihei terminus at Pi'ilani Highway to about where it intersects Pulehu Gulch, the widening will be taken on the mauka (easterly and south-easterly) side of the existing highway. From about Pulehu Gulch on, widening shifts to the northwesterly (Wailuku) side of Mokulele Highway.

Field studies to assess the botanical resources found along a portion of the highway widening project, from the Pi'ilani Highway terminus to the proposed Pu'unene Bypass Road, were conducted on 01 and 02 February 1995. Later, the project was revised to include the area from the bypass road to a portion of Pu'unene Avenue. Additional botanical field studies were conducted on 14 August 1996.

The primary objectives of the field studies were to provide a general description of the major vegetation types; inventory the flora; search for threatened and endangered plant species as well as rare and vulnerable plants; and identify areas of potential environmental problems or concerns and propose appropriate mitigation measures. A team of two botanists was used to gather the data contained in this report.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted on the adjacent areas. Topographic maps of the proposed highway widening project (1" = 1,200') were examined to determine areas under cultivation, terrain characteristics, crossroads, and other reference points.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, drainage, exposure, past and present disturbances, topography, etc. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the herbarium and for comparison with the taxonomic literature. The less disturbed uncultivated areas dominated by scrub vegetation were more intensively surveyed as these areas were more likely to harbor native plants.

The species recorded are indicative of the season ("rainy" vs. "dry") and the environmental conditions at the time of the field studies. A survey taken at a different time of the year and under varying environmental conditions would no doubt yield slight variations in the species list, especially of the weedy, annual plants.

DESCRIPTION OF THE VEGETATION

Deep nearly level, well-drained soils of the Pulehu-Ewa-Jaucus association (Foote et al. 1972) are found along the project corridor. These soils occur on alluvial fans and in basins, and are used primarily for sugar cane cultivation.

The roadside vegetation is largely Bermuda grass with a varied assortment of weedy species commonly associated with disturbed areas. Rows of "Tropic Coral" trees line both sides of the highway where it passes through the sugar cane fields. Sugar cane is cultivated by HC&S on most of the lands along the highway, with a smaller acreage in seed corn production (Trojan Farms) near the Kihei terminus. Uncultivated areas support a scrub vegetation composed of buffel grass and koa haole shrubs with scattered kiawe trees.

A more detailed description of the three vegetation types follows. All of the plants inventoried during the field studies is presented in the checklist at the end of the report.

Roadside vegetation: This vegetation type occurs as a narrow band alongside the existing highway and Pu'unene Avenue. In most places, it is maintained and periodically mowed. Bermuda grass or manienie (Cynodon dactylon) is the most abundant species, forming a low grassy cover. Scattered through the Bermuda grass are patches of common, weedy roadside species which include creeping indigo (Indigofera spicata), swollen fingergrass (Chloris barbata), red-flowered boerhavia (Boerhavia coccinea), pitted beardgrass (Bothriochloa pertusa), false mallow (Malvastrum coromandelianum), Cuba jute (Sida rhombifolia), Calyptocarpus vialis, nodeweed (Synedrella nodiflora), etc. Where the roadside vegetation is overgrown, pluchea (Pluchea symphytifolia), Indian pluchea (Pluchea indica), Guinea grass (Panicum maximum), and buffel grass (Cenchrus ciliaris) form lumpy patches, 2 to 6 ft. tall.

On both sides of the highway where it crosses through the sugar cane fields, there are rows of "Tropic Coral" trees, an Erythrina variegata cultivar. These fast-growing, columnar-shaped trees are often used in windbreaks and hedges. Between the "Tropic Coral" trees, shrubs of the two Pluchea species and clumps of buffel grass are common. Although rare, there are a few young trees of ironwood (<u>Casuarina equisetifolia</u>), Java plum (<u>Syzygium cumini</u>), kiawe (<u>Prosopis pallida</u>), and autograph tree (<u>Clusia rosea</u>), as well as Christmas berry (<u>Schinus terebinthifolius</u>) and guava (<u>Psidium guajava</u>) shrubs tucked in among the rows of "Tropic Coral" trees.

Very large, old specimens of elephant's ear (<u>Enterolobium cyclocarpum</u>), 80 to 100 ft. tall, and a few large monkeypod trees (<u>Samanea saman</u>) line Pu'unene Avenue. Around the base of the trees is a weedy ground cover composed of buffel grass, Guinea grass, spiny amaranth (<u>Amaranthus spinosus</u>), false mallow, golden crown-beard (<u>Verbesina encelioides</u>), Spanish needle (<u>Bidens pilosa</u>), etc. Landscape plantings which include oleander (<u>Nerium oleander</u>) and hibiscus (<u>Hibiscus rosa-chinensis</u>) hedges, bougainvillea (<u>Bougainvillea spectabilis</u>) and <u>Vitex trifolia</u> shrubs, tropical almond trees (<u>Terminalia catappa</u>), etc., are found in a few areas of the proposed alignment corridor, usually associated with nearby buildings and other plantings.

<u>Cultivated Lands</u>: Most of the land along the highway and Pu'unene Avenue is under sugar cane (<u>Saccharum officinarum</u>) cultivation. The sugar cane plants grow quickly, forming a dense, closed cover which tends to shade out the smaller weedy species. Thus, the weedy plants tend to be found along the margins of the fields and also along the sides of the canehaul roads; these areas may occasionally be treated with herbicides. Some weedy plants observed in these areas include nutgrass (<u>Cyperus rotundus</u>), swollen fingergrass, hairy spurge (<u>Chamaesyce hirta</u>), sow thistle (<u>Sonchus oleraceus</u>), wild bitter melon (<u>Momordica charantia</u>), and spiny amaranth.

The corn fields are actively cultivated, so again the weeds tend to be found on the margins of fields and along the dirt roads.

Some of the more commonly observed species are pigweed (Portulaca oleracea), wiregrass (Eleusine indica), Bermuda grass, and apple of Peru (Nicandra physalodes).

The composition of the weedy species on the cultivated lands will vary with the stage of cultivation, maturity of the crops, and, of course, with the season, that is, "rainy" vs. "dry". Many of the weedy plants found on the cultivated lands are also components of the roadside vegetation.

Scrub Vegetation: The proposed widening project will cross over several uncultivated areas which front the highway. These include a few parcels adjacent to the cane fields on which boulders from the fields have been piled, former village sites, and the old Pu'unene airport. Scrub vegetation on most of these parcels consists of dense mats of buffel grass, 2 to 3 ft. tall, with scattered clumps of koa haole shrubs (Leucaena leucocephala), 3 to 12 ft. tall. The koa haole may form dense thickets in places. Kiawe trees occur as scattered individuals or small stands of trees, 15 to 25 ft. tall, with tree cover ranging from 3 to 5%. Kiawe forms an open-canopied forest along the highway by Kealia Pond, but this is outside of the proposed corridor.

On the old Pu'unene airport parcel, now the Maui Raceway Park, there are overgrown concrete pads and foundations, asphalt roadways, fences, etc., scattered through the scrub vegetation. Where the corridor approaches Pu'unene Avenue, it crosses over a plantation village site. There are a few homes which are occupied, but most of the homes are gone and the lots overgrown by buffel grass, koa haole, and Guinea grass. Remnant landscape plantings mark former homesites; these include mango trees (Mangifera indica), Java plum, royal poinciana (Delonix regia), monkeypod, hibiscus shrubs, and Mexican creeper (Antigonon leptopus).

DISCUSSION AND RECOMMENDATIONS

The proposed highway widening project will impact vegetation dominated by introduced or alien species. Introduced species are all those plants which were brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact, that is, Cook's discovery of the islands in 1778. The project will impact mostly cultivated lands, sugar cane fields and a smaller acreage in seed corn production. Scrub vegetation composed of a buffel grass/koa haole association with scattered kiawe trees occupies the uncultivated areas. A band of weedy, roadside vegetation occurs alongside the highway.

Of a total of 85 plant species inventoried within the project corridor, 81 (95%) are introduced and 4 (5%) are native. The native species are all indigenous or presumably indigenous, that is, they are native to the Hawaiian Islands and also elsewhere. No plants native only to the Hawaiian Islands (endemic) were found.

None of the plants is a listed, proposed, or candidate threatened and endangered species; nor is any plant considered a species of concern or rare and vulnerable (U.S. Fish and Wildlife Service 1992, 1996; Wagner *et al*. 1990). This is not surprising as there are few remnants of native vegetation left in coastal and lowland zones after more than a millenium of human occupation and activity (Cuddihy and Stone 1990). After continuous sugar production over many, many years, there is little likelihood of any of the lowland forest and shrubland components surviving. Only the more widespread indigenous species such as 'uhaloa (*Waltheria indica*), popolo (*Solanum americanum*), and 'ilima (*Sida fallax*), which prefer open, disturbed places, survive and then usually in the alien-dominated scrub vegetation.

Given the findings above, the proposed highway widening project will not have a significant negative impact on the botanical resources as it is dominated by introduced or alien species. There are no reasons to impose any restrictions, impediments, or conditions to its construction. It is recommended that some of monkeypod trees impacted by the project be transplanted, if suitable, and used for landscaping, especially the area along Pu'unene Highway.

PLANT SPECIES LIST -- Mokulele Highway Widening, Maui

The following checklist is an inventory of all the plant species observed within the proposed highway alignment corridor during the field studies. The plants are arranged alphabetically by families into two groups: Dicots and Monocots. The taxonomy and nomenclature of the flowering plants follow Wagner et al. (1990). Cultivated plant names are in accordance with St. John (1973).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:
   - I = indigenous = occurring naturally in the Hawaiian Islands and also elsewhere throughout the Pacific and/or tropics.
   - I? = questionably indigenous = data not clear if dispersal to the islands by natural or human-related mechanisms, but weight of evidence suggests probably indigenous.
   - X = introduced or alien = all those plants brought to the islands by humans, intentionally or accidentally, after Western contact, that is, Cook's discovery of the islands in 1778.
   - X? = questionably introduced = dates of introduction unclear or very early, may be indigenous or of Polynesian introduction.
4. Presence (+) or absence (-) of a particular species within each of three vegetation types recognized within the highway corridor (see text for discussion):
   - r = Roadside Vegetation
   - c = Cultivated Lands
   - s = Scrub Vegetation

CORRECTION

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

PLANT SPECIES LIST -- Mokulele Highway Widening, Maui

The following checklist is an inventory of all the plant species observed within the proposed highway alignment corridor during the field studies. The plants are arranged alphabetically by families into two groups: Dicots and Monocots. The taxonomy and nomenclature of the flowering plants follow Wagner et al. (1990). Cultivated plant names are in accordance with St. John (1973).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:
   - I = indigenous = occurring naturally in the Hawaiian Islands and also elsewhere throughout the Pacific and/or tropics.
   - I? = questionably indigenous = data not clear if dispersal to the islands by natural or human-related mechanisms, but weight of evidence suggests probably indigenous.
   - X = introduced or alien = all those plants brought to the islands by humans, intentionally or accidentally, after Western contact, that is, Cook's discovery of the islands in 1778.
   - X? = questionably introduced = dates of introduction unclear or very early, may be indigenous or of Polynesian introduction.
4. Presence (+) or absence (-) of a particular species within each of three vegetation types recognized within the highway corridor (see text for discussion):
   - r = Roadside Vegetation
   - c = Cultivated Lands
   - s = Scrub Vegetation

Scientific name	Common name	Status	Vegetation type r	c	s
DICOTS					
AMARANTHACEAE (Amaranth family)					
Amaranthus spinosus L.	spiny amaranth, pakai kuku	X	+	+	+
Amaranthus viridus L.	slender amaranth, pakai	X	+	+	-
ANACARDIACEAE (Mango family)					
Mangifera indica L.	mango, manako	X	-	-	+
Schinus terebinthifolius Raddi	Christmas berry, welelaiki	X	+	-	+
APOCYNACEAE (Dogbane family)					
Nerium oleander L.	oleander, 'oleana	X	+	-	-
ARISTOLOCHIACEAE (Bitterwort family)					
Aristolochia littoralis Parodi	Dutchman's pipe	X	+	-	+
ASTERACEAE (Sunflower family)					
Bidens pilosa L.	Spanish needle, ki, ki nehe	X	+	+	+
Calyptocarpus vialis Less.	hierba del cabello	X	+	-	-
Conyza bonariensis (L.) Cronq.	hairy horseweed, ilioha	X	+	+	-
Pluchea indica (L.) Less.	Indian pluchea	X	+	+	+
Pluchea symphytifolia (Mill.) Gillis	pluchea, sourbush	X	+	-	-
Sonchus oleraceus L.	sow thistle, pua-lele	X	+	+	+
Synedrella nodiflora (L.) Gaertn.	nodeweed	X	+	-	-
Tridax procumbens L.	coat buttons	X	+	-	+
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	X	+	-	+
BORAGINACEAE (Borage family)					
Ehretia acuminata R. Br.	ehretia	X	+	-	-
Heliotropium procumbens var. depressum (Cham.) Fosb.		X	+	-	-
BRASSICACEAE (Mustard family)					
Coronopus didymus (L.) Sm.	swinecress	X	+	-	-
Lepidium virginicum L.	peppergrass	X	+	-	-

Scientific name	Common name	Status	Vegetation type r	c	s
CAPPARACEAE (Caper family)					
Cleome gynandra L.	wild spider flower, honohina	X	–	+	–
CASUARINACEAE (Ironwood family)					
Casuarina equisetifolia L.	common ironwood, paina	X	+	–	–
CLUSIACEAE (Mangosteen family)					
Clusia rosea Jacq.	autograph tree, copey	X	+	–	–
COMBRETACEAE (Indian almond family)					
Terminalia catappa L.	tropical almond, false kamani	X	+	–	–
CONVOLVULACEAE (Morning glory family)					
Merremia aegyptia (L.) Urb.	hairy merremia, koali kua hulu	X?	–	–	+
CUCURBITACEAE (Gourd family)					
Cucurbita sp.	squash	X	–	+	–
Momordica charantia L.	wild bittermelon	X	+	+	+
EUPHORBIACEAE (Spurge family)					
Chamaesyce hirta (L.) Millsp.	hairy spurge	X	+	+	–
Chamaesyce hypericifolia (L.) Millsp.	graceful or garden spurge	X	+	–	–
Chamaesyce prostrata (Aiton) Small	prostrate spurge	X	+	+	–
Euphorbia cyathophora J.A. Murray	false poinsettia	X	+	+	+
Euphorbia heterophylla L.	Mexican fireweed	X	–	–	+
Ricinus communis L.	castor bean, koli	X	+	–	+
FABACEAE (Pea family)					
Crotalaria incana L.	fuzzy rattlepod, kukaehoki	X	+	–	+
Delonix regia (Boj.) Raf.	royal poinciana, flame tree	X	–	–	+
Desmanthus virgatus (L.) Willd.	virgate or slender mimosa	X	+	–	+
Desmodium tortuosum (Sw.) DC	Florida beggarweed	X	+	–	–
Enterolobium cyclocarpum (Jacq.) Griseb.	elephant's ear, earpod	X	+	–	–
Erythrina variegata L. cv. "Tropic Coral"		X	+	–	–
Indigofera spicata Forssk.	creeping indigo	X	+	–	–
Leucaena leucocephala (Lam.) de Wit	koa haole, ekoa	X	+	+	+
Macroptilium lathyroides (L.) Urb.	wild bushbean, cowpea	X	+	–	+

Scientific name	Common name	Status	Vegetation type r	c	s
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe, algaroba	X	+	−	+
Samanea saman (Jacq.) Merr.	monkeypod	X	+	−	+
LAMIACEAE (Mint family)					
Leonotis nepetifolia (L.) R. Br.	lion's ear	X	−	−	+
MALVACEAE (Mallow family)					
Abutilon grandifolium (Willd.) Sweet	hairy abutilon, mao	X	+	−	+
Hibiscus rosa-sinensis L.	red hibiscus	X	+	−	+
Hibiscus shizopetalus (Mast.) J.D. Hook.	coral hibiscus, aloalo ko'ako'a	X	+	−	−
Malva parviflora L.	cheese weed	X	+	+	+
Malvastrum coromandelianum (L.) Garcke	false mallow, hauuoi	X	+	+	+
Sida fallax Walp.	'ilima	I	−	−	+
Sida rhombifolia L.	Cuba jute	X	+	−	+
MYRTACEAE (Myrtle family)					
Psidium guajava L.	guava, kuawa	X	+	−	−
Syzygium cumini (L.) Skeels	Java plum	X	+	−	+
NYCTAGINACEAE (Four-o'clock family)					
Boerhavia coccinea Mill.	red-flowered boerhavia	X	+	−	−
Bougainvillea spectabilis Willd.	purple bougainvillea	X	+	−	−
Mirabilis jalapa L.	four-o'clock, marvel of Peru, naniahiahi	X	+	−	+
POLYGONACEAE (Buckwheat family)					
Antigonon leptopus Hook. & Arnott	Mexican creeper, chain-of-hearts	X	−	−	+
PORTULACACEAE (Purslane family)					
Portulaca oleracea L.	pigweed, common purslane, 'ihi	X	+	+	+
SOLANACEAE (Nightshade family)					
Datura stramonium L.	Jimson weed, la'au hano	X	−	−	+
Nicandra physalodes (L.) Gaertn.	apple of Peru	X	−	+	−
Solanum americanum Mill.	popolo	I?	−	+	−

Scientific name	Common name	Status	Vegetation type r	c	s
STERCULIACEAE (Cacao family)					
Waltheria indica L.	'uhaloa, hi'aloa, kanakaloa	I?	+	+	+
VERBENACEAE (Verbena family)					
Citharexylum caudatum L.	fiddlewood	X	+	-	-
Lantana camara L.	lantana, lakana	X	+	-	-
Vitex trifolia var. subtrisecta (Ktze.) Mold.	vitex, polinalina	X	+	-	+
MONOCOTS					
CYPERACEAE (Sedge family)					
Cyperus rotundus L.	nutgrass, nut sedge	X	-	+	-
POACEAE (Grass family)					
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	X	+	-	-
Brachiaria subquadriparia (Trin.) Hitchc.		X	-	+	-
Cenchrus ciliaris L.	buffelgrass	X	+	+	+
Chloris barbata (L.) Sw.	swollen fingergrass, mau'ulei	X	+	+	+
Chloris virgata Sw.	feather fingergrass	X	-	-	+
Cynodon dactylon (L.) Pers.	Bermuda grass, manienie	X	+	+	-
Digitaria insularis (L.) Mez ex Ekman	sourgrass	X	+	+	+
Digitaria radicosa (Presl) Miq.		X	+	-	-
Digitaria setigera Roth.	itchy crabgrass, kukaepua'a	I?	+	+	-
Digitaria sp.	crabgrass	X	-	+	-
Eleusine indica (L.) Gaertn.	wiregrass, goosegrass	X	+	+	-
Eragrostis cilianensis (All.) Link	stinkgrass	X	-	+	-
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	lovegrass	X	-	+	-
Panicum maximum Jacq.	Guinea grass	X	+	+	+
Panicum maximum var. trichoglume Eyles ex Robyns	green panicgrass	X	+	-	+
Paspalum urvillei Steud.	Vasey grass	X	+	-	-

Scientific name	Common name	Status	Vegetation type r	Vegetation type c	Vegetation type s
Rhynchelytrum repens (Willd.) Hubb.	Natal redtop, Natal grass	X	-	-	+
Saccharum officinarum L.	sugar cane, ko	X	-	+	-
Setaria verticillata (L.) P. Beauv.	bristly foxtail	X	+	+	+
Zea mays L.	corn, maize	X	-	+	-

LITERATURE CITED

Cuddihy, L.W. and C.P. Stone. 1990. Alteration of native Hawaiian vegetation: Effects of humans, their activities and introductions. Cooperative National Park Resources Studies Unit, University of Hawai'i, Manoa.

Foote, D.E., E.L. Hill, S. Nakamura, and F. Stephens. 1972. Soil survey of the islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C.

St. John, H. 1973. List and summary of the flowering plants in the Hawaiian Islands. Pacific Tropical Botanical Garden, Memoir No. 1, Lawai, Kauai, Hawaii.

U.S. Fish and Wildlife Service. 1992. Endangered and threatened wildlife and plants; Determination of endangered or threatened status for 15 plants from the island of Maui, HI. Final rule. Federal Register 57(95): 20772-20788.

__________ . 1996. Hawaiian Islands Plants: Updated March 1, 1996. Listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished list prepared by Pacific Islands Office, Honolulu.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1990. Manual of the flowering plants of Hawai'i. 2 vols. University of Hawai'i Press and B.P. Bishop Museum Press, Honolulu. B.P. Bishop Museum Special Publication 83.

AVIFAUNAL AND FERAL MAMMAL REPORT

APPENDIX D

AVIFAUNAL AND FERAL MAMMAL SURVEY FOR THE PUUNENE BYPASS/MOKULELE HIGHWAY, PROJECT NO. 311A-02-92, MAUI

Prepared for

PBR-Hawaii

by

Phillip L. Bruner
Assistant Professor of Biology
Director, Museum of Natural History
BYU-Hawaii
Environmental Consultant Faunal (Bird & Mammal) Surveys

1 March 1995

INTRODUCTION

The purpose of this report is to present the findings of a two day (25-26 February 1995) bird and mammal field survey for the proposed Puunene Bypass/Mokulele Highway, Project No. 311A-02-92, Maui (Fig. 1). Also included are references to pertinent literature and unpublished reports.

The objectives of the field survey were to:

1- Document what bird and mammal species occur on the property or may likely be found there given the type of habitats available.

2- Provide some baseline data on the relative abundance of each species.

3- Determine the presence or likely occurrence of any native fauna particularly any that are considered "Endangered" or "Threatened". If such occur or may likely be found on the property identify what if any features of the habitat may be important for these species.

4- Determine if the property contains any special or unique habitats that if lost or altered by development might result in a significant negative impact on the birds and mammals in this region of the island.

GENERAL SITE DESCRIPTION

Figure One contains the area covered by this faunal survey. Three alternative alignments were investigated. sugarcane fields with grass and weed lined ditches and irrigation reservoirs; parkland with dry grass and scattered trees, mostly kiawe; and some small agricultural development near Kihei (Hawaiian Foliage and Landscape, DEKALB Plant Genetic) comprise the available habitats. Kealia Pond lies to the west of the proposed project.

Weather during the survey was clear and calm. Human disturbance in the cane fields was minimal (no harvesting or planting). Traffic along Mokulele Highway was busy as usual.

STUDY METHODS

Field observations were made with the aid of binoculars and by listening for vocalizations. These observations were concentrated during peak bird activity periods of early morning/late afternoon.

At various locations eight minute counts were made of all birds seen or heard (Fig. 1). Between these count (census) stations any special or unusual observations of birds were also noted. These data provide the basis for the relative abundance estimates given in this report. Unpublished reports of birds known from similar habitat elsewhere on Maui were also consulted in order to acquire a better perspective of the possible fauna that could occur and their potential relative abundance (Bruner 1991, 1992a, 1992b, 1993). Observations of feral mammals were limited to visual sightings and evidence in the form of scats and tracks. No attempts were made to trap mammals in order to obtain data on their relative abundance and distribution.

Scientific names used herein follow those given in Hawaii's Birds (Hawaii Audubon Society 1993); Thirty-ninth Supplement to the *American Ornithologists' Union Check-list of North American Birds* (AOU 1993); A field guide to the birds of Hawaii and the Tropical Pacific (Pratt et al. 1987) and Mammal species of the World (Honacki et al. 1982).

RESULTS AND DISCUSSION

Resident Endemic and Indigenous (Native) Land Birds:

No native land birds were recorded on the survey. Short-eared Owl or Pueo (Asio flammeus sandwichensis) forage in agricultural fields as well as in forested upland habitats (Hawaii Audubon Society 1993). Pueo are listed by the State of Hawaii as endangered on the island of Oahu but are fairly common on Maui, particularly on the slopes of Haleakala. This is the only native land bird that might occur on the property.

Resident Endemic and Indegenous (Native) Waterbirds:

Two Black-crowned Night Heron (*Nycticorax nycticorax*) were recorded at an irrigation pond located NW of the Animal Shelter Facility located along Mokulele Highway. This indigenous species is the only native waterbird that is not presently listed as endangered. Kealia Pond located west of that project supports three endangered species: Black-necked Stilt (*Himantopus mexicanus*); Hawaiian Coot (*Fulica alai*) and Hawaiian Duck or Koloa (*Anas wyvilliana*). These species can also be seen at irrigation reservoirs and ditches.

Migratory Indigenous (Native) Birds:

Migratory shorebirds winter in Hawaii between the months of August through May. Some juveniles will stay over the summer months as well (Johnson et al. 1981, 1983, 1989). The most abundant shorebird species which winters in Hawaii is the Pacific Golden Plover (*Pluvialis fulva*). Plover forage in open areas such as mud flats, lawns, pastures, plowed fields and roadsides. They arrive in Hawaii from their breeding grounds in the arctic during early August. Their departure back to the arctic takes place in late April. Bruner (1983) has also shown plover are extremely site-faithful and many establish foraging territories which they defend vigorously. Such behavior makes it possible to acquire a fairly good estimate of the abundance of plover in any one area. These populations likewise remain relatively stable over many years (Johnson et al. 1989). Seventeen plover were tallied on the survey. Six Ruddy Turnstone (*Arenaria interpres*) were also seen in the sugarcane fields. Wandering Tattler (Heteroscelus incanus) were not recorded but could occur in this area. Turnstones will forage in plowed fields and tattler will utilize irrigation ditches and reservoirs (Hawaii Audubon Society 1993; Bruner 1991, 1992a, 1992b, 1993). None of these shorebirds are listed as endangered or threatened. An Osprey (Pandion haliaetus) was seen flying over Kealia Pond on 26 February. This species is an infrequent visitor to Hawaii (Hawaii Audubon Society 1993).

Resident Indigenous (Native) Seabirds:

No seabirds were recorded nor would any be expected at this location. Predators such as dogs, cats and the Small Indian Mongoose (Herpestes auropunctatus), along with human disturbance inhibit seabird nesting at all but a few isolated and protected locations on the main Hawaiian Islands.

Exotic (Introduced) Birds:

A total of 16 species of exotic birds were recorded during the field survey. Table One shows the relative abundance of each species. In addiion to these species other exotic birds which potentially could occur in this region include: Barn Owl (Tyto alba); Ring-necked Pheasant (Phasianus colchicus) and Northern Mockingbird (Mimus polyglottus) (Pratt et al. 1987; Hawaii Audubon Society 1993; Bruner 1991, 1992a, 1992b, 1993).

Feral Mammals:

Small Indian Mongoose were observed on the survey. Feral cats were also noted. The endemic and endangered Hawaiian Hoary Bat (Lasiurus cinereus semotus) is known from Maui (Tomich 1986; Kepler and Scott 1990; Duvall and Duvall 1991). None were observed on this field survey. This species is known to roost solitarily in trees and often is observed foraging over ponds and bays. The life history of this species is poorly known. Kepler and Scott (1990) suggest that bats occur on Maui only as a "migrant, probably from the Big Island". Other (Duvall and Duvall 1991), report evidence that would suggest there may be resident breeding population of bats on Maui.

CONCLUSION

A short field survey can only provide a limited view of the wildlife that may use the site. Not all species will necessarily be found and information on their use of the area must be drawn together from observations, the available literature and from unpublished reports. The number of species and the relative abundance of each species may vary throughout the year due to resource availability and reproductive success. Species which are migratory will only be an important part of the faunal picture at certain times during the year. Exotic species sometimes prosper for a time only to later disappear or become a less significant part of the faunal community (Williams 1987; Moulton 1990). Thus only long term studies can provide an indept view of the bird and mammal populations in a particular area. However, some general conclusions related to bird and mammal activity at this site can be made.

1- Sugarcane and parkland habitat of dry grass and scattered trees dominate this region of Maui. Seventeen exotic species of birds were recorded.

2- The only native species recorded were the Black-crowned Night Heron, Pacific Golden Plover and Ruddy Turnstone. These birds are common in agricultural lands. Pueo (Hawaiian Owl) may also forage in this area. Black-necked Stilt, Hawaiian Coot and Koloa can be seen at Kealia Pond.

3- Several Mongoose and cats were recorded on the survey. No trapping was conducted in order to determine their relative abundance. However, no unusual concentrations were noted. No endangered species such as the Hawaiian Hoary Bat were observed.

4- No particularly unusual or exceptional wildlife habitat were found on the survey. Parkland habitat composed of dry grass and scattered Kiawe trees along with sugarcane fields are abundant in this region of Maui.

5- I found no obvious differences in the variety of species or their relative abundance in the three alternative route alignments. Regardless which alternative route is finally chosen the data in this report are applicable.

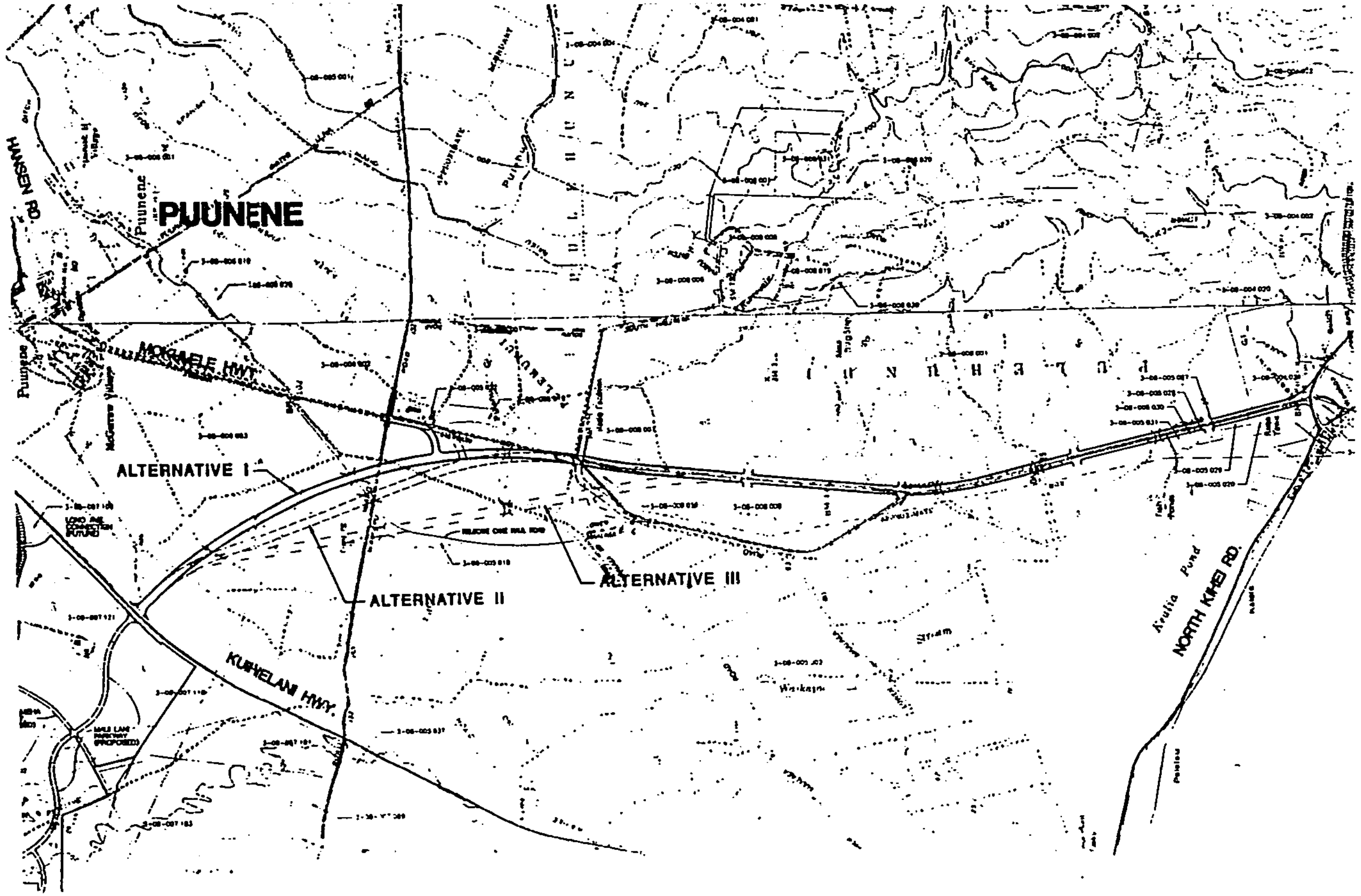


Fig. 1. Location of faunal (bird & mammal) survey. Census stations shown as solid circles.

TABLE 1

Exotic species of birds recorded on the Puunene Bypass/Mokulele Highway Project, Maui.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE
Cattle Egret	Bulbus Ibis	U = 2
Black Francolin	Francolinus francolinus	U = 4
Gray Francolin	Francolinus pondicerianus	C = 6
Spotted Dove	Streptopelia chinensis	C = 8
Zebra Dove	Geopelia striata	A =10
Rock Dove	Columba livia	R = 1
Common Myna	Acridotheres tristis	A =15
Northern Cardinal	Cardinalis cardinalis	C = 6
Red-crested Cardinal	Paroaria coronata	U = 2
Eurasian Skylark	Alauda arvensis	C = 8
Japanese White-eye	Zosterops japonica	C = 6
Nutmeg Mannikin	Lonchura punctulata	A =20
Warbling Silverbill	Lonchura malabarica	C = 7
House Finch	Carpodacus mexicanus	C = 5
House Sparrow	Passer domesticus	A =15
Orange-cheeked Waxbill	Estrilda melpoda	R = 1

(see page 10 for key to symbols)

KEY TO TABLE 1

Relative abundance = Number of times observed during the survey or frequency on eight minute counts in appropriate habitat.

A = abundant (ave. 10+)

C = common (ave. 5-10)

U = uncommon (less than 5)

R = recorded (seen or heard on one count only or at times other than on 8 min. counts. Number which follows is the total number of individuals seen or heard).

SOURCES CITED

American Ornithologist's Union (AOU). 1993. Thirty-ninth supplement to the American Ornithologists' Union Check-list of North American Birds. Auk 110(3):675-682.

Bruner, P. L. 1983. Territorial behavior of wintering Pacific Golden Plover in Hawaii. Ms. (Paper presented at 100th meeting of the Amer. Ornth. Union).

______ 1991. Survey of the avifauna and feral mammals at Lahaina, Maui for the Lahaina HFDC Master Plan Project/Offsite sewer and water improvements. Unpubl. ms.

______ 1992a. Survey of the avifauna and feral mammals at the proposed site of Puukolii Village, Lahaina, Maui. Unpubl ms.

______ 1992b. Survey of the avifauna and feral mammals for the MECO 1995 unit addition, Maui. Unpubl. ms.

______ 1993. Avifaunal and feral mammal survey of lands involved in the East Maui Water Development Project, Maui. Unpubl. ms.

Duvall, F. and R. G. Duvall. 1991. No Bats on Maui? Look again. 'Elepaio 51(3):1-2.

Hawaii Audubon Society. 1993. Hawaii's Birds. Fourth Edition. Hawaii Audubon Society, Honolulu.

Honacki, J. H., K. E. Kinman and j. W. Koeppl ed. 1982. Mammal species of the World: A taxonomic and geographic reference. Allen Press, Inc. and the Association of Systematic Collections, Lawrence, Kansas.

Johnson, O. W., P. M. Johnson and P. L. Bruner. 1981. Wintering behavior and site-faithfulness of Golden Plovers on Oahu. 'Elepaio 41(12):123-130.

Johnson, O. W. and P. M. Johnson. 1983. Plumage-molt-age relationships in "over-summering" and migratory Lesser Golden-Plovers. Condor 85:406-419.

Johnson, O. W., M. L. Morton, P. L. Bruner and P. M. Johnson. 1989. Winter range fat cyclicity in Pacific Goldne-Plovers (*Pluvialis fulva*) and predicted migratory flight ranges. Condor 91:156-177.

Kepler, C. B. and J. M. Scott. 1990. Notes on distribution and behavior of the endangered Hawaiian Hoary Bat (Lasiurus cinereus semotus). 'Elepaio 50(7):59-64.

Moulton, M. P., S. L. Pimm and M. W. Krissinger. 1990. Nutmeg Mannikin (Lonchura punctulata): a comparison of abundance in Oahu vs. Maui sugarcane fields: evidence for competitive exclusion? 'Elepaio 50(10):83-85.

Pratt, H. D., P. L. Bruner, and D. G. Berrett. 1987. A field guide to the birds of Hawaii and the tropical Pacific. Princeton Univ. Press.

Tomich, P. Q. 1986. Mammals in Hawaii. Bishop Museum Press. Honolulu.

Williams, R. N. 1987. Alien Birds on Oahu 1944-1985. 'Elepaio 47(9):87-92.

SUPPLEMENTAL AVIFAUNAL AND FERAL MAMMAL REPORT FOR THE PUUNENE BYPASS/MOKULELE HIGHWAY, PROJECT NO. 311A-02-92, MAUI

Prepared for

PBR-Hawaii

by

Phillip L. Bruner
Assistant Professor of Biology
Director, Museum of Natural History
BYU-Hawaii
Environmental Consultant Faunal (Bird & Mammal) Surveys

19 August 1996

INTRODUCTION

The purpose of this supplemental report is to present the findings of a one day (15 August 1996) bird and mammal field survey of additional lands for the proposed Puunene Bypass/Mokulele Highway, Project No. 311A-02-92, Maui (Fig. 1). Also included are references to the original 1995 report.

The objectives of the field survey were to:

1- Document what bird and mammal species occur on this property or may likely be found there given the type of habitats available.

2- Provide some baseline data on the relative abundance of each species.

3- Determine the presence or likely occurrence of any native fauna particularly any that are considered "Endangered" or "Threatened". If such occur or may likely be found on the property identify what if any features of the habitat may be important for these species.

4- Determine if the property contains any special or unique habitats that if lost or altered by development might result in a significant negative impact on the birds and mammals in this region of the island.

GENERAL SITE DESCRIPTION AND STUDY METHODS

Figure One indicates the areas of focus on this faunal survey. Lands adjoining Mokulele Highway and the sugarcane fields in the region of the proposed Bypass were examined. Tallies of all birds and mammals seen or heard were kept. Wetland habitats in the form of reservoirs and ditches were checked for waterbirds.

Weather during the survey was clear and relatively calm. The water level in the reservoir neat the Animal Shelter was fairly high.

RESULTS AND DISCUSSION

Resident Endemic and Indigenous (Native) Land Birds:

No native land birds were recorded on this survey. As noted in the 1995 survey Short-eared Owl or Pueo (*Asio flammeus sandwichensis*) occur on Maui and could be found in this area. This is the only native land bird that might occur on the property.

Resident Endemic and Indigenous (Native) Birds:

Migratory shorebirds winter in Hawaii between the months of August through May. The most abundant shorebird species in Hawaii is the Pacific Golden-Plover (*Pluvialis fulva*). Twenty four plover were counted along roadsides within and immediately around the area covered by this report. This compares with 17 seen on the 1995 survey.

No Ruddy Turnstone (Arenaria interpres) were seen on this survey but six were tallied in 1995. Wandering Tattler (Heteroscelus incanus) were not recorded but could also occur in this area. Turnstone forage in plowed fields and tattler utilize irrigation ditches and reservoirs. None of these shorebirds are listed as endangered or threatened.

Resident Indigenous (Native) Seabirds:

No seabirds were recorded nor would any be expected at this location. Predators such as dogs, cats and the Small Indian Mongoose (Herpestes auropunctatus), along with human disturbance inhibit seabird nesting to a relatively few isolated and protected locations on the main Hawaiian Islands.

Exotic (Introduced) Birds:

A total of 11 species of exotic birds were recorded during the field survey. Sixteen species were recorded in 1995. Table One shows the relative abundance of each species for both surveys. In addition to these species other exotic birds which potentially could occur in this region include: Barn Owl (Tyto alba); Ring-necked Pheasant (Phasianus colchicus) and Northern Mockingbird (Mimus polyglottus).

Feral Mammals:

Five Small Indian Mongoose were observed on this survey. Two feral cats were also seen. The endemic and endangered Hawaiian Hoary Bat (Lasiurus cinereus semotus) was not recorded but does occur on Maui. As noted in the 1995 report data on this species are limited and there seems to be some question as to its breeding status on Maui.

CONCLUSION

This supplemental report provides the findings of a one day survey of additional lands involved in the Puunene Bypass/ Mokulele Highway Project. Data from this survey are compared with 1995 results. In summary the findings of this 1996 survey are:

1- No native land birds were recorded but one species of native waterbird (Black-crowned Night Heron) was observed. This bird is not endangered.

2- Pacific Golden-Plover was the only migratory bird seen. They frequented roadsides and open fields.

3- Eleven species of introduced birds were tallied. This compares to sixteen species found in 1995.

4- The endangered Hawaiian Hoary Bat was not observed. Mongoose and cats were seen.

5- No unusual or unique habitats were found on this survey. The irrigation ponds and ditches are used by native waterbirds. Wetlands and roadsides as well as open fields are used by migratory birds.

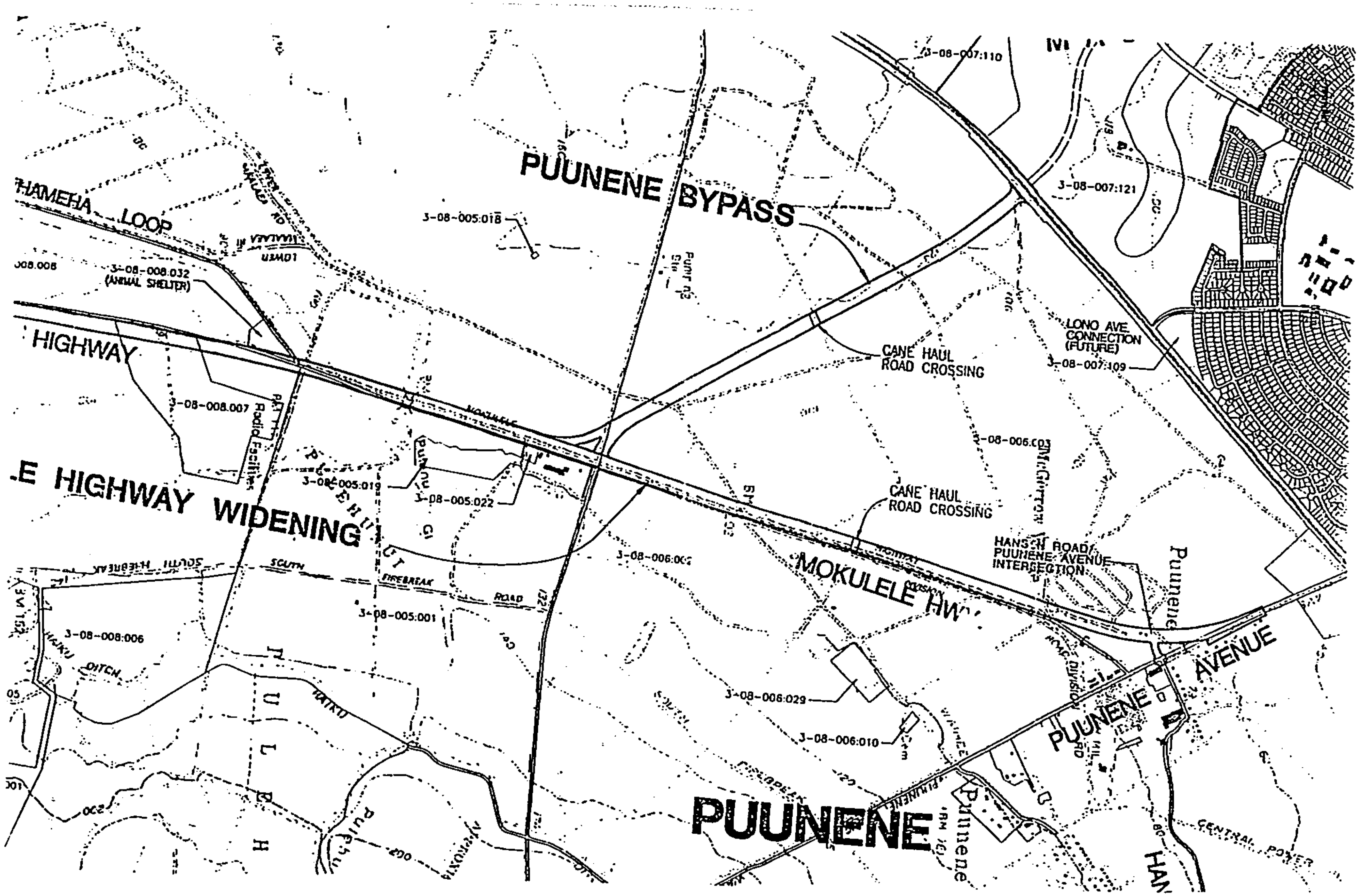


Fig. 1. Location of faunal (bird and mammal) field survey, 1996.

TABLE 1

Exotic species of birds recorded on the Puunene Bypass/Mokulele Highway Project, Maui

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE 1995	RELATIVE ABUNDANCE 1996
Cattle Egret	*Bubulcus ibis*	U = 2	___
Black Francolin	*Francolinus francolinus*	U = 4	R = 2
Gray Francolin	*Francolinus pondicerianus*	C = 6	R = 4
Spotted Dove	*Streptopelia chinensis*	C = 8	C = 9
Zebra Dove	*Geopelia striata*	A = 10	A = 12
Rock Dove	*Columba livia*	R = 1	___
Common Myna	*Acridotheres tristis*	A = 15	C = 6
Northern Cardinal	*Cardinalis cardinalis*	C = 6	C = 6
Red-crested Cardinal	*Paroaria coronata*	U = 2	R = 4
Eurasian Skylark	*Alauda arvensis*	C = 8	U = 3
Japanese White-eye	*Zosterops japonica*	C = 6	C = 7
Nutmeg Mannikin	*Lonchura punctulata*	A = 20	A = 11
Warbling Silverbill	*Lonchura malabarica*	C = 7	___
House Finch	*Carpodacus mexicanus*	C = 5	A = 22
House Sparrow	*Passer domesticus*	A = 15	___
Orange-cheeked Waxbill	*Estrilda melpoda*	R = 1	___

(see page 8 for key to symbols)

KEY TO TABLE 1

Relative abundance = Number of times observed during the survey or frequency on eight minute counts in appropriate habitat.

A = abundant (ave. 10+)

C = common (ave. 5-10)

U = uncommon (less than 5)

R = recorded (seen or heard on one count only or at times other than on 8 min. counts. Number which follows is the total number of individuals seen or heard).

——— = not recorded

AIR QUALITY STUDY

APPENDIX E

AIR QUALITY STUDY
FOR THE PROPOSED
MOKULELE HIGHWAY WIDENING PROJECT

MAUI, HAWAII

Prepared for:

PBR HAWAII

JANUARY 1997

B. D. NEAL & ASSOCIATES
Applied Meteorology • Air Quality • Computer Science
P.O. BOX 6239, OCEAN VIEW, HAWAII 96737-6239
TELEPHONE (808) 939-9317 • FAX (808) 939-7390

AIR QUALITY STUDY
FOR THE PROPOSED
MOKULELE HIGHWAY WIDENING PROJECT

MAUI, HAWAII

Prepared for:

PBR HAWAII

JANUARY 1997

B. D. NEAL & ASSOCIATES
Applied Meteorology • Air Quality • Computer Science
P.O. BOX 6239, OCEAN VIEW, HAWAII 96737-6239
TELEPHONE (808) 939-9317 • FAX (808) 939-7390

1.0 SUMMARY

The State of Hawaii Department of Transportation is proposing highway improvements in central Maui. These improvements involve widening Mokulele Highway to four lanes between Piilani Highway and Puunene Avenue. The proposed improvements are needed to provide additional highway capacity to accommodate the projected increase in traffic volume to the year 2020.

This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed highway facilities. Mitigative measures are suggested where possible and appropriate to lessen any impacts from the project.

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. Hawaii state 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.

Before assessing potential air quality impacts from the proposed project, the existing environment was characterized. Mokulele Highway runs in a nearly north-south direction on the island of Maui in the valley between the two large mountain masses that form the island. The predominant land uses along the highway are 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. 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 inevitable that some short- and long-term impacts on air quality will unavoidably occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction equipment and from the disruption of traffic may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the project boundary. Hence, an effective dust control plan should 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 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. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Excess exhaust emissions from traffic disruption can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours and by minimizing road closures during peak traffic periods.

To assess the potential long-term impact of emissions from vehicles operating on roadways within the project corridor, both mesoscale and microscale analyses were performed. The mesoscale analysis was designed to provide estimates of air pollution emissions from traffic for the entire highway corridor, while the microscale analyses assessed ambient air quality impacts near selected intersections within the project study area. Both mesoscale and microscale analyses considered an existing (1996) case and two future alternatives for the year 2020: one without the project and the other with the project.

The mesoscale analysis indicated that in 1996 the emission burden for Mokulele Highway was 814 tons of carbon monoxide, 106 tons of hydrocarbons and 108 tons of nitrogen oxides. Without the project in the year 2020, the emission burden would increase to 4211 tons of carbon monoxide, 441 tons of hydrocarbons and 135 tons of nitrogen oxides. Compared to the 2020 without-project case, the with project alternative would reduce carbon monoxide emissions by about 82 percent and hydrocarbon emissions by about 73 percent. Nitrogen oxides emissions would increase by about 10 percent. These changes in emissions would be due to the higher travel speeds possible with the highway improvements.

The microscale analyses performed for this project involved the use of computerized emission and dispersion models to estimate current worst-case ambient concentrations of carbon monoxide during peak travel hours at several intersections along the Mokulele Highway corridor in 1996 and to predict future levels in the year 2020 with and without the project. Worst-case carbon monoxide concentrations for 1996 in the project vicinity were estimated to be within both the 1-hour and 8-hour national ambient air quality standards but were found to exceed the more stringent state 1-hour and 8-hour standards at three of the five locations studied. However, because the state standards are set at such stringent levels, it is likely that they are currently exceeded at many locations in the state that have even moderate traffic volumes. In the year 2020 without the project, worst-case concentrations were predicted to increase in comparison to present levels, especially near the intersection of Hansen Road and Puunene Avenue. The state 1-hour and 8-hour standards were predicted to be exceeded at all five locations studied, while the national 1-hour standard was predicted to be exceeded at one location (Hansen Road at Puunene Avenue) and the national 8-hour standard at four locations. For the 2020 with-project alternative, the roadway realignment associated with the highway widening reduced the number of intersections studied to three. Estimated worst-case concentrations were either lower or unchanged in comparison to the 2020 without-project scenario at all three locations, but they were predicted to continue to exceed the state 1-hour and 8-hour standards. The national 1-hour standard was predicted to be met at all locations studied, but exceedance of the national 8-hour standard was forecast at one location (Kuihelani Highway/Dairy Road at Puunene Avenue). Due to the methodologies involved, the 8-hour concentration estimates are probably less reliable than the 1-hour estimates, and all concentration estimates should be considered conservatively high.

Based on the results of the analyses of the potential long-term effects of the project, it may be concluded that the proposed highway widening will have a positive impact on both the mesoscale and microscale air quality of the area. Any negative impacts will be minimal. Although options are available to mitigate long-term traffic-related air quality impacts, requiring these be implemented is probably unwarranted in this case.

2.0 INTRODUCTION AND PROJECT DESCRIPTION

The State of Hawaii Department of Transportation is proposing highway improvements in the central isthmus portion of the island of Maui. These improvements involve widening Mokulele Highway to four lanes between Piilani Highway and Puunene Avenue, a distance of approximately 6 mi (10 km). Mokulele Highway (Hawaii Route 311) is a minor arterial highway aligned in the north-south direction and linking the Kuihelani and Piilani Highways. A project location map is provided as Figure 1. The proposed improvements are needed to provide additional highway capacity to accommodate the projected increase in traffic volume to the year 2020 between Wailuku-Kahului, Maui's primary urban center, and the rapidly growing areas of Kihei, Wailea and Makena along Maui's leeward shore.

The purpose of this study was to evaluate the potential air quality impacts of the proposed project and recommend mitigative measures, if possible and appropriate, to reduce or eliminate any project-related degradation of air quality in the area. Before examining the potential impacts of the project, a discussion of ambient air quality standards is presented and background information concerning the regional and local climatology and the present air quality of the project area is provided.

3.0 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 Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national AAQS have been established for six air pollutants. These nationally regulated air pollutants include: 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, the Hawaii 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.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit, and the Hawaii 1-hour limit for ozone is more than two times as stringent as the federal standard.

The 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.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

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.

The outstanding features of the climate of the central Maui 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, near the northern terminus of the proposed project, 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 wet 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 in the area and give it 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 Kahului Airport, about 3 mi (5 km) northeast of the project area. Occasional strong winds from the south (kona winds) occur with the passage of storms during the winter months.

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 often 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 central Maui area, stability classes 5 or 6 are generally the highest stability classes that occur, 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 the sea breeze.

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).

5.0 PRESENT 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 2 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

The emission estimates given in Table 2 include only manmade sources of air pollution. Natural sources of air pollution emissions that also could affect the project area but cannot be quantified 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 3 shows annual summaries of air quality measurements that were made on Maui by the Department of Health for the period 1988 through 1993. 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 2 mi (3 km) south of the southern end of Mokulele Highway on the leeward side of Maui. Monitoring consisted of measurements of 24-hour average sulfur dioxide concentration every six to 12 days between 1988 and 1990. Monitoring was suspended for two years and commenced again in 1993. There were no exceedances of the state/national 24-hour AAQS for sulfur dioxide during this period. Concentrations monitored were consistently low with daily mean values 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 during the same years that it monitored sulfur dioxide there. Twenty-four hour average PM-10 concentrations monitored at this location ranged from 6 to 51 $\mu g/m^3$. Average daily concentrations were approximately 22 $\mu g/m^3$. 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 15 mi (24 km) west of the project corridor on the leeward coast of Maui. Twenty-four hour average PM-10 concentrations monitored at this location ranged from 1 to 34 $\mu g/m^3$ between 1988 and 1993. Average daily concentrations were approximately 16 $\mu g/m^3$. All values reported were within the state/national AAQS.

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 also collected ambient air quality data during recent years at several locations on Maui to support expansion projects. Table 4 is a summary of air quality data collected 2 mi (3 km) west of the project corridor 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 mi (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.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur during project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during 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 from slow-moving construction equipment traveling to and from the project site and from the disruption of traffic due to road construction.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with land clearing and 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 [1] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of

1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions in the project area would likely be somewhere near this level or possibly higher due to the high silt content of the soil in the area and the dry and windy climate. In any case, State of Hawaii Air Pollution Control Regulations [2] prchibit visible emissions of fugitive dust from construction activities at the project boundary, and thus an effective dust control plan for the project construction phase 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 open-bodied 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. Paving and/or 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.

Indirectly, slow-moving construction vehicles on roadways leading to and from the project site could obstruct the normal flow of traffic to such an extent that overall vehicular emissions are increased, but this impact can be mitigated by moving heavy construction equipment during periods of low traffic volume. Likewise, road closures during peak traffic periods should be avoided to the extent possible to minimize air pollution impacts from traffic disruption. Thus, with careful planning and attention to dust control, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

After construction is completed, the proposed widening along Mokulele Highway should result in a more efficient flow of motor vehicle traffic on roadways in the project vicinity and, in general, bring about favorable long-term impacts on ambient air quality in the immediate area. To quantify the potential long-term, ambient air quality impact of the proposed project, both mesoscale and microscale analyses were performed for each of three scenarios. The three scenarios studied included: year 1996 with present conditions, year 2020 without the project (the no-build alternative), and year 2020 with the project. The following two subsections of this report describe in detail the study methodologies and the results of these analyses.

7.1 Mesoscale Analysis

To evaluate the potential mesoscale impact of the proposed project, an "emission burden" analysis was prepared. The emission burden analysis was designed to quantify project-related emissions of carbon monoxide, nitrogen oxides and hydrocarbons occurring within the study area for the existing case and for the future with- and without-project scenarios. The emission burden for any given section of roadway is a function of the traffic volume, the distance of travel and the average travel speed.

The mesoscale emission burden estimates were made by first obtaining both southbound and northbound average daily traffic (ADT) volumes along Mokulele Highway from the project traffic consultants. The vehicle miles traveled (VMT) per day were then estimated based on the roadway length. Due to significant differences in average travel speeds caused by delays at the Puunene Avenue and Piilani Highway intersections with Mokulele Highway, Mokulele Highway was divided into two equal segments. One segment was designated the "Puunene Segment", and the other was designated as the "Piilani Segment". The resulting estimates of VMT per day for each segment are presented in Table 5. These were obtained by multiplying the 3-mile length of each highway segment by the ADT for each segment. In 1996, the total VMT per day along the Mokulele Highway study corridor were estimated to total 137,799. In 2020, it was estimated that the VMT would increase to 216,984 with or without the project.

As indicated above, in addition to the amount of traffic and the distance of travel, the emission burden analysis is also a function of the average travel speed (ATS) of traffic on the subject roadway. Typically, ATS's are not directly available and must be estimated from peak-hour travel speeds. The estimated morning and afternoon peak-hour travel speeds as provided by the project traffic engineers are presented in Table 6. Conservative estimates of the ATS's were obtained by averaging the estimated morning and afternoon peak-hour travel speeds. The resulting ATS's are indicated in Table 7. Average daily travel speeds are actually probably somewhat higher.

Emission estimates were then prepared for each scenario based on the estimated VMT's, ATS's and U.S. EPA emission factors obtained using the computer model MOBILE5A [3]. MOBILE5A is the most recently released version of the EPA mobile emission model. Aside from vehicle speed, several other key inputs are required by the model. One of these is vehicle mix. Based on recent vehicle registration figures, the present and projected vehicle mix in the project area is estimated to be 91.9% light-duty gasoline-powered vehicles, 5% light-duty gasoline-powered trucks and vans, 0.5% heavy-duty gasoline-powered vehicles, 0.6% light-duty diesel-powered vehicles, 1% heavy-duty diesel-powered trucks and buses, and 1% motorcycles.

Other key inputs to the MOBILE5A emission model are the cold- and hot-start fractions. 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 about 21 percent of all vehicles would be operating in the cold-start mode and that about 27 percent would be operating in the hot-start mode. These are typical default (national average) values. Average annual ambient temperature, also a MOBILE5A input, was assumed to be 75 degrees F. This is based on several years of temperature data for Kahului Airport [4].

The resulting emission factors generated by MOBILE5A and used in the mesoscale analyses are presented in Table 8. These are given in terms of grams of hydrocarbons, carbon monoxide and nitrogen oxides emitted per vehicle mile. As suggested by the information presented in the table, hydrocarbon and carbon monoxide emission factors are inversely proportional to vehicle speed. This is also true of nitrogen oxides emission factors when speeds are under approximately 20 mph. However, at speeds above that level they begin to rise slightly as speeds increase. It should also be noted that at a given vehicle speed emission factors are generally lower for future years due to the effects of older, more-polluting vehicles being retired.

Based on the calculated emission factors and the current and projected vehicle miles traveled along Mokulele Highway, annual emissions of hydrocarbons, carbon monoxide and nitrogen oxides were estimated for each of the three scenarios. The final results of this analysis are given in Table 9. It should be mentioned that the emission estimates given in the table may be somewhat overstated since they are based on the averages of the peak-hour average travel speeds and not actual daily average traffic speeds which may be somewhat higher. However, since the same procedures were used for all three scenarios, the validity of comparisons is maintained.

During 1996, it was estimated that hydrocarbon emissions from traffic traveling on Mokulele Highway amounted to 106 tons. Carbon monoxide emissions were estimated to have amounted to 814 tons while nitrogen oxides emissions were calculated at 108 tons. Without the project in the year 2020, estimated hydrocarbon and carbon monoxide emissions increased by about 400 percent and 500 percent, respectively, while nitrogen oxides emission estimates increased by about 25 percent. The "build" alternative would bring about significant reductions in hydrocarbon and carbon monoxide emissions compared to 2020 without the proposed highway widening. Specifically, hydrocarbons would be reduced by about 73 percent and carbon monoxide by about 82 percent, reducing these emissions to levels comparable to the estimated 1996 levels. Nitrogen oxides emissions, however, would increase by about 10 percent over the "no-build" alternative. The reduced hydrocarbon and carbon monoxide emissions and the increased nitrogen oxides emissions with the project compared to the without project are due to the higher travel speeds permitted after the highway widening.

7.2 Microscale Analyses

In most traffic-related air quality assessments, roadway intersections are one of the primary concerns because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. To investigate potential air quality impacts near roadway intersections within the project area, microscale analyses were performed for selected locations using computerized emission and atmospheric dispersion models to estimate worst-case ambient carbon monoxide concentrations. Carbon monoxide was selected for the microscale analyses because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas other air pollutants most often are regional issues that cannot be addressed by a single highway improvement.

The selected locations for microscale analyses in the 1996 and 2020 without-project scenarios included five representative intersections along the project corridor. These included:

Kuihelani Highway/Dairy Road at Puunene Avenue; Hansen Road at Puunene Avenue; Puunene Avenue/Mokulele Highway at the road to the sugar mill; Piilani Highway at Mokulele Highway; and Mokulele Highway at South Kihei Road. Roadway realignments associated with the highway widening reduced the number of study intersections included in the 2020 with-project scenario to three. These were: Kuihelani Highway/Dairy Road at Puunene Avenue; Hansen Road at Mokulele Highway; and Piilani Highway/Mokulele Highway at Kihei Road.

The main objective of the microscale analyses was to estimate worst-case 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 be made. A comparison of the estimated values to the national and state AAQS will provide another measure of significance.

Traffic estimates for the project indicate that traffic volumes generally are or will be higher during the afternoon peak hour than during the morning peak period. However, worst-case emission and 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.

As for the mesoscale emission burden analysis, the EPA computer model MOBILE5A was used to calculate vehicular emissions for each year/scenario studied in the microscale analyses. Vehicle mix and cold/hot-start fractions, inputs to MOBILE5A, were assumed to be the same as those used for the emission burden estimates. For the microscale modeling analyses, ambient temperatures of 59 and 68 degrees Fahrenheit 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.

After computing vehicular carbon monoxide emissions through the use of MOBILE5A, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [5] currently recommend that the computer model CAL3QHC [6] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [7]. 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 subject project. However, all vehicle queuing estimates involving signalized intersections 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. This 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 and vehicle speeds for the existing case were obtained from the project traffic consultants. Vehicle speed limits for the future scenarios were assumed to remain the same. Deceleration and acceleration times were calculated from these speeds.

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Presently, either paved or unpaved pedestrian walkways exist very close to most of the roadways within the study corridor. Concentrations predicted by air quality models generally are not considered valid within the roadway mixing zone. The roadway mixing zone is usually taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within 10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied. All receptor heights were placed at 1.8 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 5 was assumed for morning scenarios and stability category 4 was assumed for afternoon cases. These are the most conservative stability categories that are generally used for estimating pollutant dispersion at suburban locations for these time periods. For all cases, a surface roughness length of 100 cm was assumed and a mixing height of 300 meters was used. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at relatively low levels. Hence, 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 1.0 ppm to all predicted concentrations for 1996. Although at least moderate development and increased traffic are expected to occur within the project area within the next few years, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time. Hence, a background value of 1.0 ppm was assumed to persist for the 2020 scenarios.

Predicted Worst-Case 1-Hour Concentrations

Table 10 summarizes the final results of the microscale modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations for 1996 and for each of the two 2020 alternatives. 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 highest estimated 1-hour concentration within the project vicinity for the present (1996) case was 23.6 mg/m^3. This was projected to occur during the afternoon peak traffic hour near the intersection of Hansen Road and Puunene Avenue. The majority of this concentration is attributable to the queuing of westbound left turn traffic on Hansen Road. The next highest value, 21.4 mg/m^3, was estimated to occur during the morning peak traffic hour near the intersection of Kuihelani Highway/Dairy Road and Puunene Avenue. Much of this concentration is due to emissions from northbound traffic queuing on Puunene Avenue. Concentrations at other locations and times studied ranged between about 3 and 20 mg/m^3. All predicted worst-case 1-hour concentrations for the 1996 scenario were within the national AAQS, but concentrations at three of the five intersections studied exceeded the more stringent state standard.

In the year 2020 without the proposed project, a worst-case 1-hour concentration of 109.9 mg/m^3 was predicted to occur during the morning peak-traffic hour near the intersection of Hansen Road and Puunene Avenue. As with the 1996 case, most of this predicted concentration came from queuing of westbound left turn traffic on Hansen Road. This is more than a 500 percent increase compared to the 1996 concentration at this time and location and is indicative of the extreme over-capacity condition which may exist at this intersection in the future. A concentration of 57.4 mg/m^3 was estimated for the afternoon at the same intersection and was attributable again to westbound left turn traffic. Peak-hour morning and afternoon worst-case values at the other locations studied for the 2020 without-project scenario ranged between about 9 and 32 mg/m^3. Predicted worst-case 1-hour concentrations for this scenario exceeded the state AAQS at all of the five locations studied. The national 1-hour standard was predicted to be exceeded at the intersection Hansen Road and Puunene Avenue.

Predicted 1-hour worst-case concentrations for the 2020 with-project scenario ranged from 15.6 mg/m^3 during the morning at the Piilani Highway/Mokulele Highway and Kihei Road intersection to 32.1 mg/m^3 during the morning at the Kuihelani Highway/Dairy Road and Puunene Avenue intersection. The Hansen Road and Puunene Avenue intersection, which yielded the extremely high predicted concentrations in the 2020 without-project scenario, is replaced in the with-project case due to roadway realignment. The new intersection of Hansen Road and Mokulele Highway produced predicted worst-case concentrations which were the same or lower than the worst-case concentrations predicted at the Hansen Road and Puunene Avenue intersection for 1996. All of the locations studied were predicted to meet the national AAQS but not the more stringent state 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 persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One recent study based on modeling [8] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from about 0.4 to 0.5. EPA guidelines [9] recommend using a value of 0.6 to 0.7 unless a locally derived persistence factor is available. Recent monitoring data for Honolulu reported by the Department of Health [10] suggest that this factor may range between about 0.35 and 0.55 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations. However, it should be noted that the 8-hour concentration estimates are generally less reliable than the 1-hour values due to the prediction methodology involved.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 11. For the 1996 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the five locations studied ranged from 1.9 to 11.8 mg/m^3. Three of these estimated values exceed the state standard of 5 mg/m^3 and two are over the national limit of 10 mg/m^3. For the year 2020 without-project scenario, all of the five locations produced significantly higher estimated values compared to 1996. All of the estimates exceeded the state 8-hour standard and four of the five were over the national limit. For the 2020 with-project scenario, two of the three predicted 8-hour concentrations were within the national AAQS but all exceeded the more stringent state AAQS once again. The intersection which exhibited the highest predicted concentration, Kuihelani Highway/Dairy Road at Puunene Avenue, was unchanged compared to the without-project case.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is extremely unlikely and may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. The 8-hour estimates are also conservative in that it is unlikely that anyone would occupy the assumed receptor sites (within 3 m of the roadways) for a period of 8 hours.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Although relatively little ambient air quality data are available to characterize existing conditions, it is likely that state and federal ambient air quality standards are currently being met in the project area, except perhaps for occasional exceedances of the state carbon monoxide standards within small areas near traffic-congested locations.

The major potential short-term impact of the project on air quality will occur from the emission of fugitive dust during construction. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month or more, depending on rainfall. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall. Use of wind screens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the project that have been disturbed could be controlled by mulching or chemical stabilization. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Establishment of landscaping early in the construction schedule will also help to control dust.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from the disruption of normal traffic flow. Increased vehicular emissions due to the disruption of traffic can be alleviated by minimizing road closures during peak traffic hours.

Without the project by the year 2020, mesoscale analysis indicates that emissions from motor vehicles using Mokulele Highway would increase substantially compared to 1996 emissions due to the increase in traffic volumes and traffic congestion, even with the elimination of older more-polluting vehicles from the roadways by this time. Carbon monoxide emissions would increase by about 500 percent to 4211 tons per year, while hydrocarbons, at 441 tons per year, and nitrogen oxides, at 135 tons per year, would mean increases of about 400 percent and 25 percent, respectively. With the proposed widening project completed, all but nitrogen oxides emissions within the project area in the year 2020 would be reduced substantially compared to the without-project case. Carbon monoxide emissions, for example, were estimated to amount to 760 tons per year with the widening, less than one fifth of the without-project amount and also less than the 1996 carbon monoxide estimate.

Without the project, microscale analyses of five representative intersections along the project corridor for the year 2020 indicate that the state 1-hour and 8-hour air quality standards for carbon monoxide would likely be exceeded at all locations studied. Additionally, the national 1-hour standard would be exceeded by a wide margin at the intersection of Hansen Road and Puunene Avenue and the national 8-hour standard would also be exceeded at that intersection and three others. This is based on the projected peak-hour traffic volumes and roadway configurations and laneages and worst-case meteorological conditions. For the 2020 with-project scenario, worst-case carbon monoxide concentrations in the project area will either improve or remain substantially unchanged compared to the without-project case. The potential exceedance of the national 8-hour limit would continue to exist at the intersection of Kuihelani Highway/Dairy Road and

Puunene Avenue since this intersection is unaffected by the highway widening. The predicted concentrations at the other two with-project study intersections indicate that the national 1-hour and 8-hour AAQS should be met in the year 2020. However, the state 1-hour and 8-hour AAQS could be exceeded during worst-case conditions. Due to the low levels at which the state carbon monoxide standards are set, it may not be possible to achieve continuous compliance with the state standards, at least within small hot-spot areas near high-volume intersections included in the project corridor. With the project, a substantial problem at the intersection of Hansen Road and Puunene Avenue will be eliminated.

Options available to mitigate long-term, traffic-related air pollution are generally to further improve roadways, to reduce traffic or to reduce individual vehicular emissions. Aside from providing added roadway improvements, air pollution impacts from vehicular emissions could conceivably be additionally mitigated by reducing traffic volumes through the promotion of bus service and car pooling and/or by adjusting local school and business hours to begin and end during off-peak times. This mitigation measure is generally considered only partially successful. Reduction of emissions from individual vehicles would have to be achieved through the promulgation of local, state or federal air pollution control regulations. For example, Hawaii currently does not require annual inspections of motor vehicle air pollution control equipment. However, at the present time there is no indication that the state is contemplating adopting such rules.

Another potential mitigation measure might be to provide added buffer zones between walkways and roadways, although technically, the public would have to somehow be excluded from the buffer zones. The predicted worst-case concentrations in this report are based on a separation distance of 10 ft (3 m) between walkways and roadways. Doubling this distance to about 20 ft (6 m) would reduce maximum concentrations by about 10 to 15 percent.

From a mesoscale viewpoint, the highway widening as proposed would provide substantial mitigation of long-term air quality impacts compared to the without-project case by improving traffic flow within the project area. The microscale impacts of the project are favorable as well, mainly because completion of the highway widening will include roadway realignments that will eliminate or improve two problem intersections within the project corridor. Any further mitigation to alleviate air quality impacts is probably unwarranted.

REFERENCES

1. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.

2. State of Hawaii. Hawaii Administrative Rules, Chapter 11-60, Air Pollution Control.

3. User's Guide to MOBILE5A (Mobile Source Emission Factor Model), U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Mobile Sources, Emission Control Technology Division, Test and Evaluation Branch, Ann Arbor, Michigan, May 1994.

4. Atlas of Hawaii, Second Edition, Department of Geography, University of Hawaii, University of Hawaii Press, Honolulu, 1983.

5. Guideline on Air Quality Models (Revised), Including Supplements A and B, EPA-450/2-78-027R, U.S. Environmental Protection Agency, Research Triangle Park, NC, July 1986.

6. User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections, U.S. Environmental Protection Agency, November 1992.

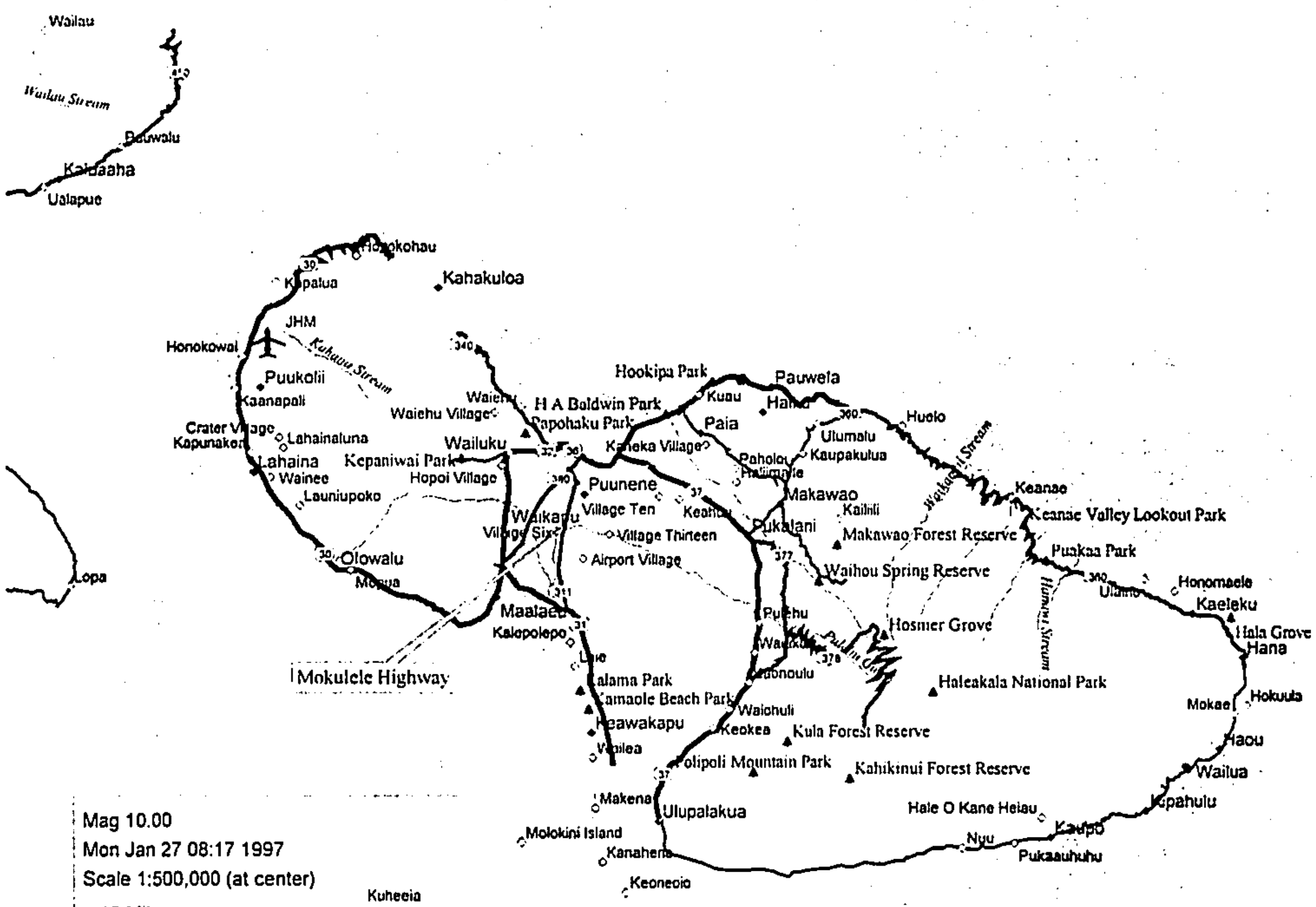
7. CALINE4 - A Dispersion Model for Predicting Air Pollutant Concentrations Near Roadways, FHWA/CA/TL-84/15, California State Department of Transportation, November 1984 with June 1989 Revisions.

8. "Persistence Factors for Mobile Source (Roadway) Carbon Monoxide Modeling", C. David Cooper, Journal of the Air & Waste Management Association, Volume 39, Number 5, May 1989.

9. Guidelines for Air Quality Maintenance Planning and Analysis: Indirect Sources, Volume 9 Revised, U.S. Environmental Protection Agency, September 1978.

10. Hawaii Air Quality Data for the Period of January 1988 to December 1990, State of Hawaii Department of Health.

Figure 1 - Project Location Map



Mag 10.00
Mon Jan 27 08:17 1997
Scale 1:500,000 (at center)
10 Miles
10 KM

Major Connector
State Route
Primary State Route
County Seat
Small Town
Park/Reservation

© 1996 DeLorme Street Atlas USA

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 2

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 3

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR DEPARTMENT OF HEALTH MONITORING STATIONS LOCATED ON MAUI ISLAND 1988-1993

Parameter / Location	1988	1989	1990	1991	1992	1993
Sulfur Dioxide / Kihei						
No. of 24-Hr Samples	30	39	8	-	-	47
Range of 24-Hr Values (µg/m3)	<5-5	<5-5	<5-5	-	-	0-9
Average Daily Value (µg/m3)	<5	<5	<5	-	-	2
No. of State AAQS Exceedances	0	0	0	-	-	0
PM-10 / Kihei						
No. of 24-Hr Samples	33	37	9	-	-	57
Range of 24-Hr Values (µg/m3)	17-46	9-51	6-42	-	-	4-25
Average Daily Value (µg/m3)	28	24	22	-	-	14
No. of State AAQS Exceedances	NA	NA	NA	-	-	0
PM-10 / Lahaina						
No. of 24-Hr Samples	22	39	42	45	38	55
Range of 24-Hr Values (µg/m3)	9-34	6-25	5-31	10-30	7-23	1-23
Average Daily Value (µg/m3)	19	15	17	16	13	14
No. of State AAQS Exceedances	NA	NA	NA	NA	NA	0

Source: State of Hawaii Department of Health

Table 4

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 5

AVERAGE DAILY TRAFFIC VOLUMES AND VEHICLE MILES TRAVELED
FOR MOKULELE HIGHWAY WIDENING PROJECT

Mokulele Hwy: Puunene Ave to Piilani Hwy	Segment Length (miles)	1996		2020 Without Project		2020 With Project	
		ADT	VMT	ADT	VMT	ADT	VMT
Southbound Puunene Segment	3	11,462	34,386	17,433	52,299	17,433	52,299
Southbound Piilani Segment	3	11,462	34,386	17,433	52,299	17,433	52,299
Northbound Piilani Segment	3	11,555	34,665	18,731	56,193	18,731	56,193
Northbound Puunene Segment	3	11,454	34,362	18,731	56,193	18,731	56,193
Total		45,933	137,799	72,328	216,984	72,328	216,984

Notes: ADT = average daily traffic volume

VMT = vehicle miles traveled per day

Table 6

ESTIMATED TRAVEL SPEEDS ON MOKULELE HIGHWAY
DURING PEAK TRAFFIC PERIODS
(miles per hour)

Mokulele Highway	1996		2020 Without Project		2020 With Project	
	AM	PM	AM	PM	AM	PM
Southbound Puunene Segment	49	45	10	10	53	52
Southbound Piilani Segment	36	33	5	5	52	53
Northbound Piilani Segment	47	48	10	10	55	56
Northbound Puunene Segment	50	48	10	10	50	51

Source: Personal communication from Jayson Imai, Parsons Brinckerhoff, to Barry D. Neal, B.D. Neal & Associates, January 2, 1997.

Table 7

ESTIMATED AVERAGE TRAVEL SPEEDS
ON MOKULELE HIGHWAY

Mokulele Hwy: Puunene Ave to Piilani Hwy	Average Travel Speed (mph)		
	1996	2020 Without Project	2020 With Project
Southbound Puunene Segment	47	10	53
Southbound Piilani Segment	35	5	53
Northbound Piilani Segment	48	10	56
Northbound Puunene Segment	49	10	51

Table 8

EMISSION FACTORS FOR
MOKULELE HIGHWAY WIDENING PROJECT
(GRAMS PER VEHICLE MILE)

	1996			2020		
Speed (mph)	Hydro-carbons	Carbon Monoxide	Nitrogen Oxides	Hydro-carbons	Carbon Monoxide	Nitrogen Oxides
5	-	-	-	7.75	68.74	1.69
10	-	-	-	4.18	41.72	1.49
35	2.25	17.44	1.87	-	-	-
47	1.82	13.91	1.94	-	-	-
48	1.79	13.70	1.95	-	-	-
49	1.78	13.70	2.02	-	-	-
51	-	-	-	1.39	8.51	1.61
53	-	-	-	1.38	8.52	1.70
56	-	-	-	1.38	9.30	1.83

Table 9

HYDROCARBONS, CARBON MONOXIDE AND NITROGEN OXIDES EMISSIONS
FOR MOKULELE HIGHWAY WIDENING PROJECT
(TONS PER YEAR)

Mokulele Hwy: Puunene Ave to Piilani Hwy	1996			2020 Without Project			2020 With Project		
	HC	CO	NOX	HC	CO	NOX	HC	CO	NOX
Southbound Puunene Segment	25	193	27	88	878	31	29	179	36
Southbound Piilani Segment	31	241	26	163	1447	36	29	179	36
Northbound Piilani Segment	25	191	27	95	943	34	31	210	36
Northbound Puunene Segment	25	189	28	95	943	34	31	192	41
Total	106	814	108	441	4211	135	120	760	149

Table 10

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS
NEAR INTERSECTIONS INCLUDED WITHIN
MOKULELE HIGHWAY WIDENING PROJECT
(milligrams per cubic meter)

Roadway Intersection	Year/Scenario					
	1996/Present		2020/Without Project		2020/With Project	
	AM	PM	AM	PM	AM	PM
Kuihelani Hwy./ Dairy Road at Puunene Ave.	21.4	19.8	32.2	29.4	32.1	29.4
Hansen Road at Puunene Avenue	19.6	23.6	109.9	57.4	-	-
Hansen Road at Mokulele Highway	-	-	-	-	19.6	16.8
Puunene Ave./Mokulele Highway at Road to Sugar Mill	3.8	3.5	13.2	8.7	-	-
Piilani Highway at Mokulele Highway	16.9	15.6	23.2	18.6	-	-
Mokulele Highway at South Kihei Road	5.9	7.5	27.6	20.6	-	-
Piilani Hwy./Mokulele Hwy. at Kihei Road	-	-	-	-	15.6	15.9

Hawaii State AAQS: 10
National AAQS: 40

Table 11

ESTIMATED WORST CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS
NEAR INTERSECTIONS INCLUDED WITHIN
MOKULELE HIGHWAY WIDENING PROJECT
(milligrams per cubic meter)

Roadway Intersection	Year/Scenario		
	1996/Present	2020/Without Project	2020/With Project
Kuihelani Hwy./ Dairy Road at Puunene Ave.	10.7	16.1	16.1
Hansen Road at Puunene Avenue	11.8	55.0	-
Hansen Road at Mokulele Highway	-	-	9.8
Puunene Ave./Mokulele Highway at Road to Sugar Mill	1.9	6.6	-
Piilani Highway at Mokulele Highway	8.5	11.6	-
Mokulele Highway at South Kihei Road	3.8	13.8	-
Piilani Hwy./Mokulele Hwy. at Kihei Road	-	-	8.0

Hawaii State AAQS: 5
National AAQS: 10

NOISE QUALITY

APPENDIX F

D. L. ADAMS ASSOCIATES, LTD.
dba
DARBY & ASSOCIATES
ACOUSTICAL CONSULTANTS

#95-01

ENVIRONMENTAL NOISE ASSESSMENT
MOKULELE HIGHWAY/PUUNENE AVENUE WIDENING
MAUI, HAWAII

February, 1997

Prepared for
PBR Hawaii
Honolulu, Hawaii

PALI PALMS PLAZA • 970 NO. KALAHEO AVENUE • SUITE A-311
KAILUA, HAWAII 96734 • (808) 254-3318 • FAX (808) 254-5295

TABLE OF CONTENTS

1.0 SUMMARY

1.1 The increase in future traffic noise levels from existing levels, at 100 feet from the roadway centerlines, are expected to range from 2.0 dB along Puunene Avenue to 2.7 dB along Mokulele Highway with the proposed project only contributing a maximum of 0.2 dB.

1.2 No existing residences are expected to be impacted by the traffic noise from either roadway. If future residence are located no closer than about 180 feet from the Mokulele Highway centerline and about 97 feet from the Puunene Avenue centerline, no additional attenuation other than that provided by normal local construction will be needed to attenuate traffic noise.

1.3 The only existing noise sensitive locations are an animal shelter adjacent to Mokulele Highway and the Kealia Pond National Wildlife Refuge approximately 500 feet west of the southern end of Mokulele Highway. At the wildlife refuge, the Future Build traffic noise levels are expected to be slightly less, about 0.9 dB, than the Future No-Build traffic noise levels. This decrease is due to the realignment of Mokulele Highway to the east of the existing alignment. The increase in traffic noise levels due to the proposed project is not expected to exceed about 0.1 dB at the animal shelter.

1.4 Noise due to the construction of the proposed project may impact the noise sensitive locations, however, as the noise will be transient no long term adverse effects are expected.

2.0 PROJECT DESCRIPTION

The proposed project site is located on the island of Maui, as shown on Figure 1, and involves the widening of Mokulele Highway and a portion of Puunene Avenue from a two lane, to a four lane highway. South of the old Puunene Airport, the widening of Mokulele Highway will occur on the east side of the existing highway, and north of the airport boundary the widening would shift to the west side of the existing highway as shown on Figure 2.

Lands to the south and west of Puunene Avenue and Mokulele Highway are currently utilized for sugarcane agriculture. With the exception of a sugar mill and an abandoned airport, the lands to the north and east are mostly undeveloped.

3.0 NOISE STANDARDS AND GUIDELINES

Standards and guidelines promulgated by the various local, state and federal agencies use different noise descriptors to express noise levels. To better understand the various noise descriptors used, a brief description of some common acoustical terminology is presented as Appendix A.

3.1 U.S. Federal Highway Administration

The Federal Highway Administration (FHWA) has established a set of design goals for traffic noise exposure [Reference 1]. The FHWA defines four land use categories and assigns corresponding maximum hourly equivalent sound levels, L_{eq}, which are listed in Table 1. For example, Category B, defined as picnic and recreation areas, parks, residences, motels, schools, churches, libraries, and hospitals, has a corresponding maximum exterior L_{eq} of 67 dBA and a maximum interior L_{eq} of 52 dBA. These limits are viewed as design goals, and all projects which are developed to meet theses limits are deemed in conformance with the FHWA noise standards.

3.2 U.S. Department of Housing and Urban Development

The U.S. Department of Housing and Urban Development (HUD) has established Site Acceptability Standards for interior and exterior noise for housing [Reference 2]. These standards are based on day-night average sound levels, L_{dn}, and identify the need for noise abatement, either at the site property line or in the building construction. HUD Site Acceptability Criteria rank sites as Acceptable, Normally Unacceptable, or Unacceptable. "Acceptable" sites are those where noise levels do not exceed an L_{dn} of 65 dBA. Housing on acceptable sites do not require additional noise attenuation other than that provided in customary building techniques. "Normally Unacceptable" sites are those where the L_{dn} is above 65 dBA, but does not exceed 75 dBA. Housing on normally unacceptable sites requires some means of noise abatement, either at the property line or in the building construction, to assure the interior noise levels are acceptable. "Unacceptable" sites are those where the L_{dn} is 75 dBA or higher. The term "unacceptable" does not necessarily mean that housing cannot be built on these sites, but rather that more sophisticated sound attenuation would likely be needed.

3.3 U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) has identified a range of yearly day-night average sound levels, L_{dn}, sufficient to protect public health and welfare from the effects of environmental noise [Reference 3]. The EPA has established a goal to reduce exterior environmental noise to an L_{dn} not exceeding 65 dBA and a future goal to reduce exterior environmental noise to an L_{dn} not exceeding 55 dBA. Additionally, the EPA states that to protect against hearing damage, one's 24-hour equivalent sound level exposure, $L_{eq(24)}$, at the ear should not exceed 70 dBA. The EPA emphasizes that these goals are not intended as regulations as they have no authority to regulate noise levels, but rather these goals are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

3.4 State of Hawaii Department of Transportation

The Hawaii Department of Transportation has not officially adopted any standards or guidelines categorizing impacts and mitigation due to traffic noise. However, a draft of such standards has been created and is awaiting approval pending further revisions. It is expected that, when approved, these standards should meet or exceed those adopted by the FHWA.

4.0 EXISTING ACOUSTICAL ENVIRONMENT

On Thursday morning and afternoon, May 18, 1995, noise levels were sampled at six locations in the vicinity of the project site. Noise level measurements were taken using a Larson-Davis Model 700 Sound Level Meter. The weather during the measurements were partly sunny skies with temperatures in the upper-80's and tradewinds blowing at 5 to 10 mph. The measurement locations are shown on Figure 3 and the results are presented in Table 2 together with the comments noting the identifiable noise sources.

Continuous 15-minute measurements of the noise environment were conducted at all locations and, except for Location 4, the corresponding traffic volume and directions were noted. This information was then used to calibrate the Federal Highways Administration Traffic Noise Prediction Model, Stamina 2.0. The data obtained at Location 4 represents the ambient noise levels typical for this area. The ambient noise levels at Location 4, taken as the 90-Percentile Exceedence Sound Level, L_{90}, was 40.0 dBA which is typical for quiet, rural areas.

5.0 POTENTIAL IMPACT DUE TO THE PROJECT

5.1 Traffic

Traffic noise levels radiating from Mokulele Highway and Puunene Avenue were calculated for the existing and future morning and afternoon peak-hour travel periods. The traffic noise levels were estimated using the Federal Highways Administration Traffic Noise Prediction Model [Reference 4] in conjunction with existing and predicted peak-hour traffic volumes [Reference 5]. The predicted existing and future peak-hour traffic noise levels, and the increases in future peak-hour traffic noise levels due to the project, at 100 feet from the Mokulele Highway and Puunene Avenue centerlines are summarized in Table 3.

In addition to defining acceptable land uses according to the annual average day-night sound level, L_{dn}, HUD has developed a procedure to estimate traffic generated L_{dn}s for sites in the vicinity of major roadways. An estimate of the L_{dn} can be made from the peak hour L_{eq}, provided heavy trucks do not exceed 10 percent of the total traffic flow in vehicles per 24 hours, and the traffic flow between 10 pm and 7 am does not exceed 15 percent of the average daily traffic flow in vehicles per 24 hours [Reference 2]. The applicability of the HUD procedure was verified by a review of traffic patterns taken from the Hawaii Department of Transportation Traffic Survey Data for the Island of Maui [Reference 6].

As stated in Section 3.2, HUD has established Site Acceptability Standards for exterior noise exposure at housing areas. These standards are based on L_{dn}s and identify the need for noise abatement. Traffic noise from adjacent roadways should be considered in determining the use for lands contiguous to these roadways.

It is important to note that the differences between the Future No-Build and Build traffic noise contours are due to the physical differences between the existing roadways and the proposed widened roadways, and not to changes in traffic volumes, mix, or speeds.

As can be seen from Table 3, the largest increase in the future traffic noise levels with respect to the existing conditions, occurs at locations adjacent to Mokulele Highway. To the west of Mokulele Highway, an increase of 2.7 dB at 100 feet from the centerline is expected for the Future Year (2020) Build condition . The minimal change in noise levels perceptible to the average listener is generally taken to be 3 dB, therefore, the increases at these locations will not be significant. Even without the proposed widening, the traffic noise levels are projected to increase by 2.6 dB, implying a neglible increase of only 0.1 dB attributable to the project.

Kealia Pond National Wildlife Refuge and an animal shelter are the only existing potentially noise sensitive locations that have been identified in the vicinity of the proposed project. At its closest point, Kealia Pond National Wildlife Refuge is situated approximately 500 feet west of the southern end of the Mokulele Highway right-of-way, and the animal shelter is located at the northern intersection of Mehameha Loop and Mokulele Highway.

The noise levels based on land use identified by the Federal Highway Administration in Table 1 does not specifically address any maximum that may impact animals, either domesticated or wild. Lacking any guidelines, the Future No-Build peak-hour traffic noise level was calculated 500 feet west of Mokulele Highway and compared to the Future Build peak-hour traffic noise levels at the same location. Because the proposed widening is to be to the east of this section of Mokulele Highway, the Future Build peak-hour traffic noise level is projected to be 0.9 dB less than for the Future No-

Build condition. Thus, the proposed widening is expected to have a beneficial, if minor, effect on the wildlife refuge.

The alignment of Mokulele Highway at the Animal Shelter is approximately the same for the existing and proposed widened highway. Any increase in noise levels due to the proposed project should, therefore, not exceed more than about 0.1 dB--an insignificant increase.

5.2 Construction Noise

The construction of the proposed project will involve excavation, grading and possibly blasting. The various construction phases could generate significant noise, which could impact the nearby noise sensitive areas. The actual noise levels produced are dependent on the construction methods employed during each phase of the construction process. Typical noise level ranges produced by various types of construction equipment are shown on Figure 4. Earth moving equipment, e.g., diesel engine powered bulldozers, trucks, backhoes, front-end loaders, graders, etc., will probably be the noisiest equipment used during construction. However, as the noise will be temporary, no lasting impact due to the construction of the proposed project is expected.

REFERENCES:

1. *Department of Transportation, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise*, Title 23, CFR, Chapter 1, Subchapter J, Part 772, 38 FR 15953, June 19, 1973, Revised at 47 FR 29654, July 8, 1982.

2. *HUD Environment Criteria and Standards*, 24 CFR 51, Federal Register, Volume 44, No. 135, July 12, 1979; Amended 49 FR 880, January 6, 1984.

3. *Toward a National Strategy for Noise Control*, U.S. Environmental Protection Agency, April 1977.

4. *FHWA Highway Traffic Noise Prediction Model*, FHWA - DP - 58 - 1; U.S. Department of Transportation, April 1982.

5. Traffic data, Parsons Brinkerhoff Quade and Douglas, Received from PBR Hawaii, December 16, 1996.

6. 1995 Traffic Survey Data, Islands of Maui and Molokai, Station No. 10, Hawaii Department of Transportation, Highways Division.

TABLE 1

FEDERAL HIGHWAY ADMINISTRATION RECOMMENDED EQUIVALENT HOURLY SOUND LEVEL BASED ON LAND USE

Activity Category	$L_{eq(h)}$	Description of Activity Category
A	57 (Exterior)	Lands on 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.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	---	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

TABLE 2

PROJECT VICINITY NOISE LEVEL MEASUREMENTS

Location*	Duration	Comments / Noise Source(s)	L_{eq} (dBA)
1	15 min	Dominant noise due to traffic on N. Kihei Rd. Ocean surf and jet skis audible during traffic lull.	68.4
2	15 min	Dominant noise due to traffic on Kuihelani Hwy. Occasional overflight by commercial airliner and rustling foliage.	67.0
3	15 min	Dominant noise due to traffic on Mokulele Hwy. Occasional overflight by commercial airliner.	71.0
4	15 min	Sugar cane leaves rustling, chirping birds, rooster at animal shelter, distant traffic (Mokulele Hwy) and distant helicopter.	44.4
5	15 min	Dominant noise due to traffic on Mokulele Hwy.	67.9
6	15 min	Dominant noise due to traffic on Mokulele Hwy and sugar mill plant, e.g., heavy trucks, cranes and exhaust stacks. Occasional overflight by commercial airliners.	

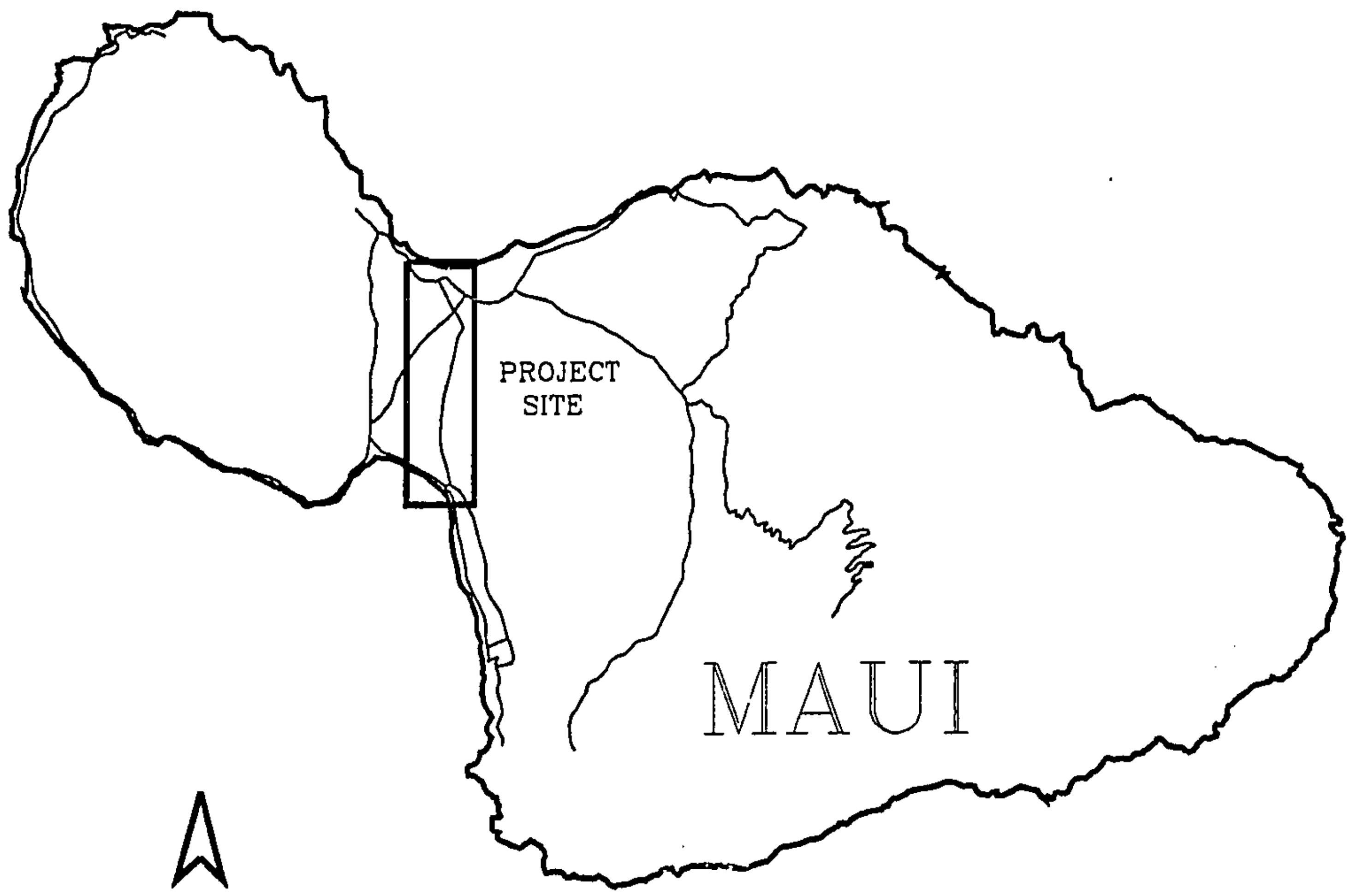
** As shown in Figure 3.*

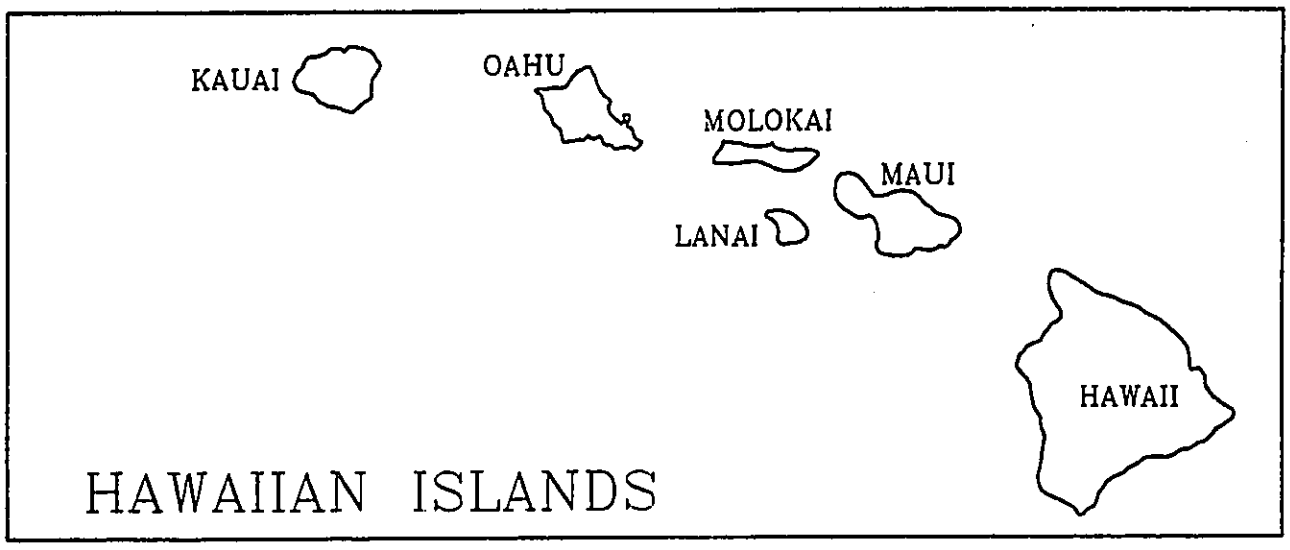
TABLE 3

ESTIMATED FUTURE HOURLY EQUIVALENT SOUND LEVELS DUE TO PEAK-HOUR TRAFFIC AT 100 FEET FROM THE PUUNENE AVENUE AND MOKULELE HIGHWAY ROADWAY CENTERLINES

Location	Existing, (1996), $L_{eq(h)}$	Future, (2020), $L_{eq(h)}$ w/o Project	Future, (2020), $L_{eq(h)}$ w/ Project	Increase Due to Project
North of Puunene Ave.	62.5	64.6	64.6	0
South of Puunene Ave.	62.6	64.6	64.8	0.2
West of Mokulele Hwy.	66.4	69.0	69.1	0.1
East of Mokulele Ave.	66.4	69.0	69.0	0

Note: Noise levels shown were calculated for morning or afternoon peak-hour traffic; whichever was greater.





D.L. ADAMS ASSOCIATES, LTD.
dba
DARBY & ASSOCIATES
ACOUSTICAL CONSULTANTS
PALI PALMS PLAZA
970 N. KALAHEO AVENUE, SUITE A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

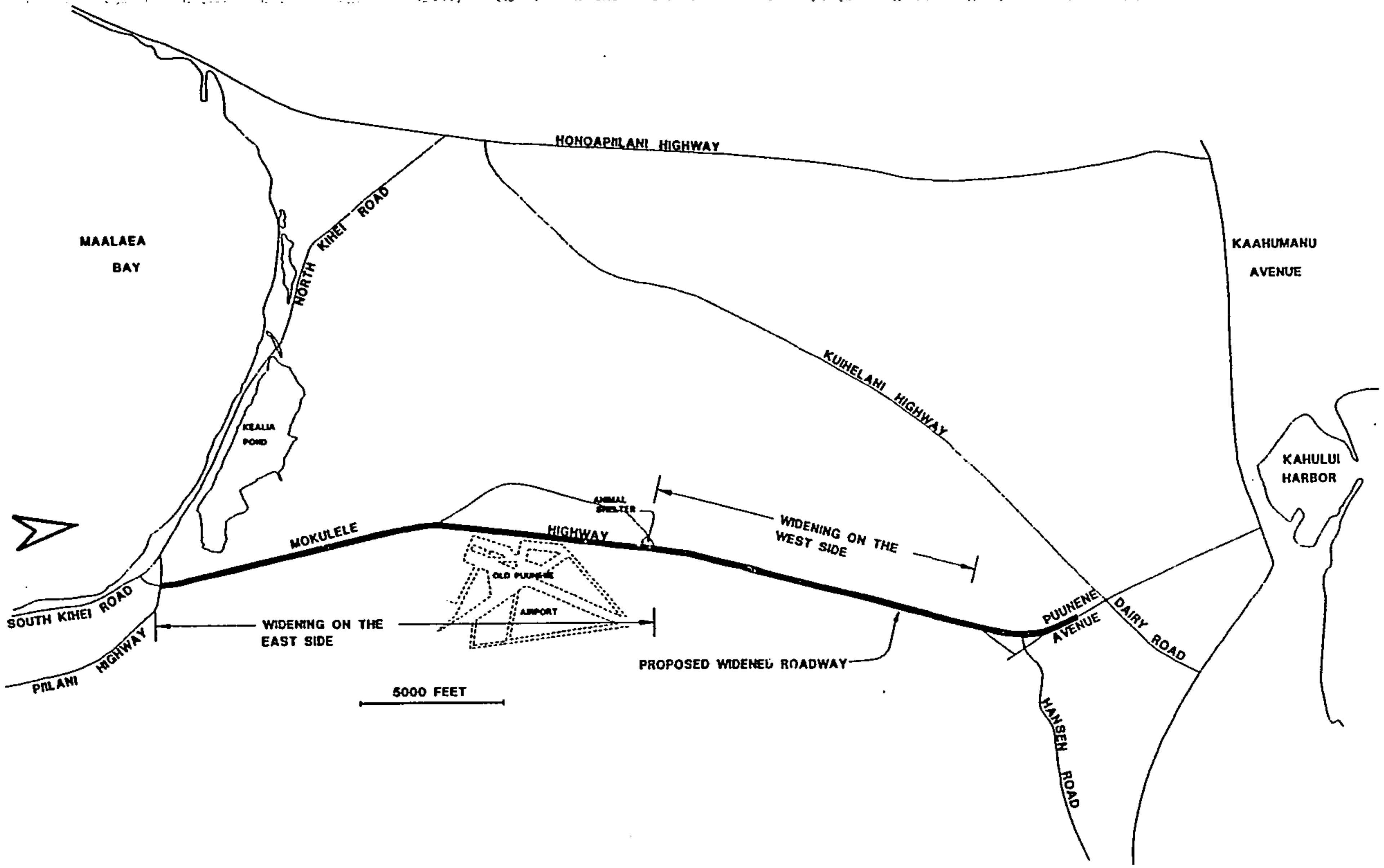
LOCATION OF PROPOSED PROJECT

Puunene Avenue/Mokulele Highway Widening

No Scale

Date	Project No.	Drawn By
February 1997	95-01	SSB

Figure No.
1

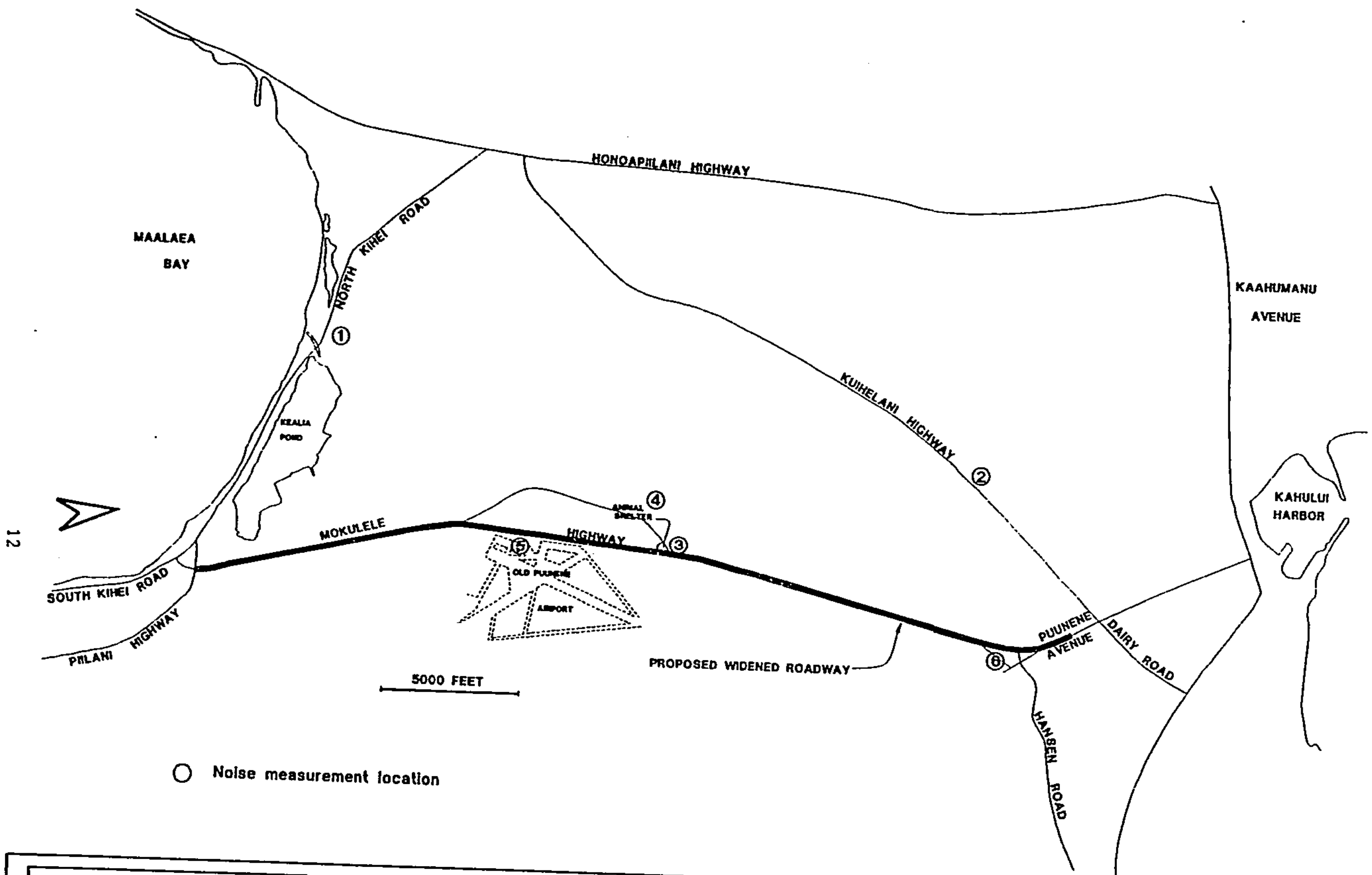


D.L. ADAMS ASSOCIATES, LTD.
dba
DARBY & ASSOCIATES
ACOUSTICAL CONSULTANTS
PALI PALMS PLAZA
970 N. KALAHEO AVENUE, SUITE A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

PROJECT SITE AND VICINITY

Puunene Avenue/Mokulele Highway Widening

Date	Project No.	Drawn By	Figure No.
February 1997	95-01	SSB	2



D.L. ADAMS ASSOCIATES, LTD.
dba
DARBY & ASSOCIATES
ACOUSTICAL CONSULTANTS

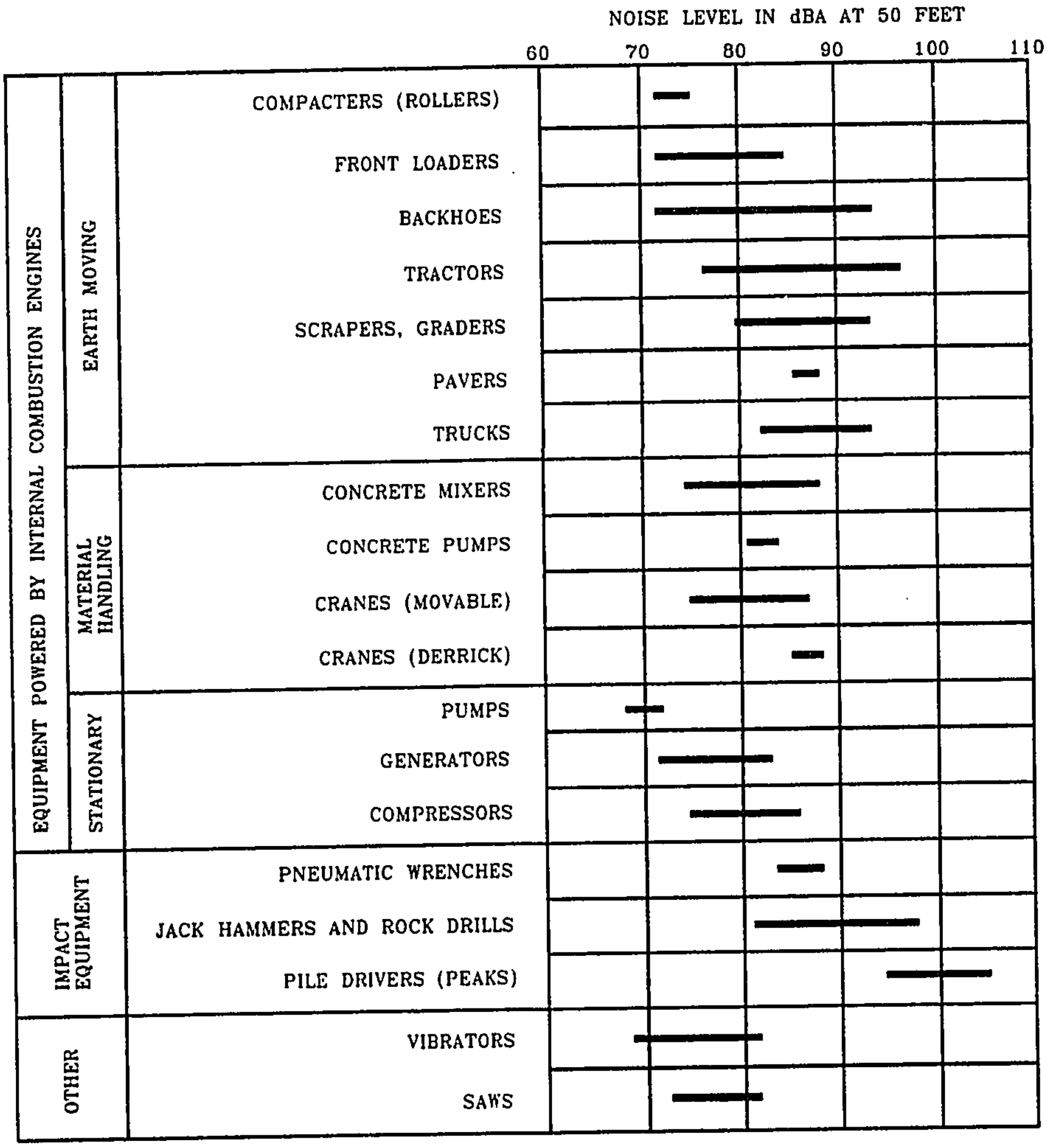
PALI PALMS PLAZA
970 N. KALAHEO AVENUE, SUITE A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

NOISE MEASUREMENT LOCATIONS

Puunene Avenue/Mokulele Highway Widening

Figure No. 3

Date	Project No.	Drawn By
February 1997	95-01	SSB



NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

D.L. ADAMS ASSOCIATES, LTD.
dba
DARBY & ASSOCIATES
ACOUSTICAL CONSULTANTS
PALI PALMS PLAZA
970 N. KALAHEO AVENUE, SUITE A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

CONSTRUCTION EQUIPMENT NOISE LEVELS

Puunene Avenue/Mokulele Highway Widening

U.S. Environmental Protection Agency 1972

Date	Project No.	Drawn By	Figure No.
February 1997	95-01	PTN	4

APPENDIX A

ACOUSTICAL TERMINOLOGY

Sound Pressure Level

Sound or noise consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. It is measured in terms of decibels (dB) using precision instruments known as sound level meters. Noise is defined as "unwanted" sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/Pref) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and Pref is the reference pressure, 20 micropascals, which is approximately the lowest sound pressure that can be detected by the human ear. For example, if P is 20 micropascals, then SPL = 0 dB, or if P is 200 micropascals, then SPL = 20 dB. The relation between sound pressure in micropascals and sound pressure level in decibels (dB) is shown in Figure A-1.

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound levels, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined level of 53 dB, not 100 dB; two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of a sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 5 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

The human ear is more sensitive to sound in the frequency range of 250 Hertz (Hz) and higher, than in frequencies below 250 Hz. Due to this type of frequency response, a frequency weighting system, was developed to emulate the frequency response of the human ear. This system expresses sound levels in units of A-weighted decibels (dBA). A-weighted sound levels de-emphasizes the low frequency portion of the spectrum of a signal. The A-weighted level of a sound is a good measure of the loudness of that sound. Different sounds having the same A-weighted sound level are perceived as being about equally loud. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

Statistical Sound Levels

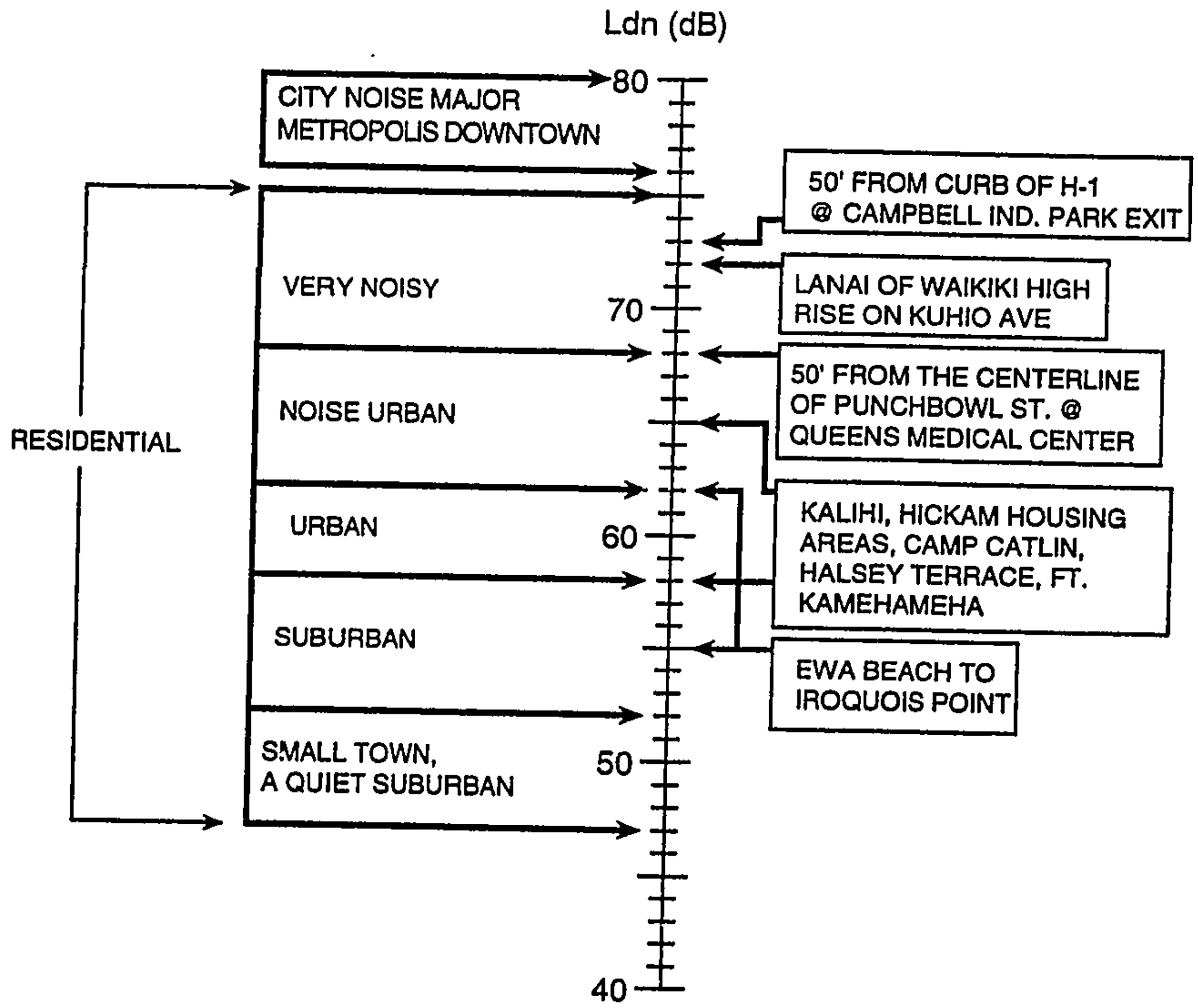
The sound levels of long-term noise producing activities, such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels developed. It is known as the Exceedence Level, L_n. The Exceedence Level, L_n, represents the sound level which is exceeded for n% of the measurement time period. For example, $L_{10} = 60$ dBA indicates that for the duration at the measurement period, the sound level exceeded 60 dBA 10% of the time. Commonly used Exceedence Levels include L_1, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. Figure A-2 illustrates the relationship between selected statistical noise levels.

Equivalent Sound Level

The Equivalent Sound Level, L_{eq}, represents a constant level of sound having the same total acoustic energy as that contained in the actual time-varying sound being measured over a specific time period. L_{eq} is commonly used to describe community noise, traffic noise, and hearing damage potential. It has units of dBA and is illustrated in Figure A-2.

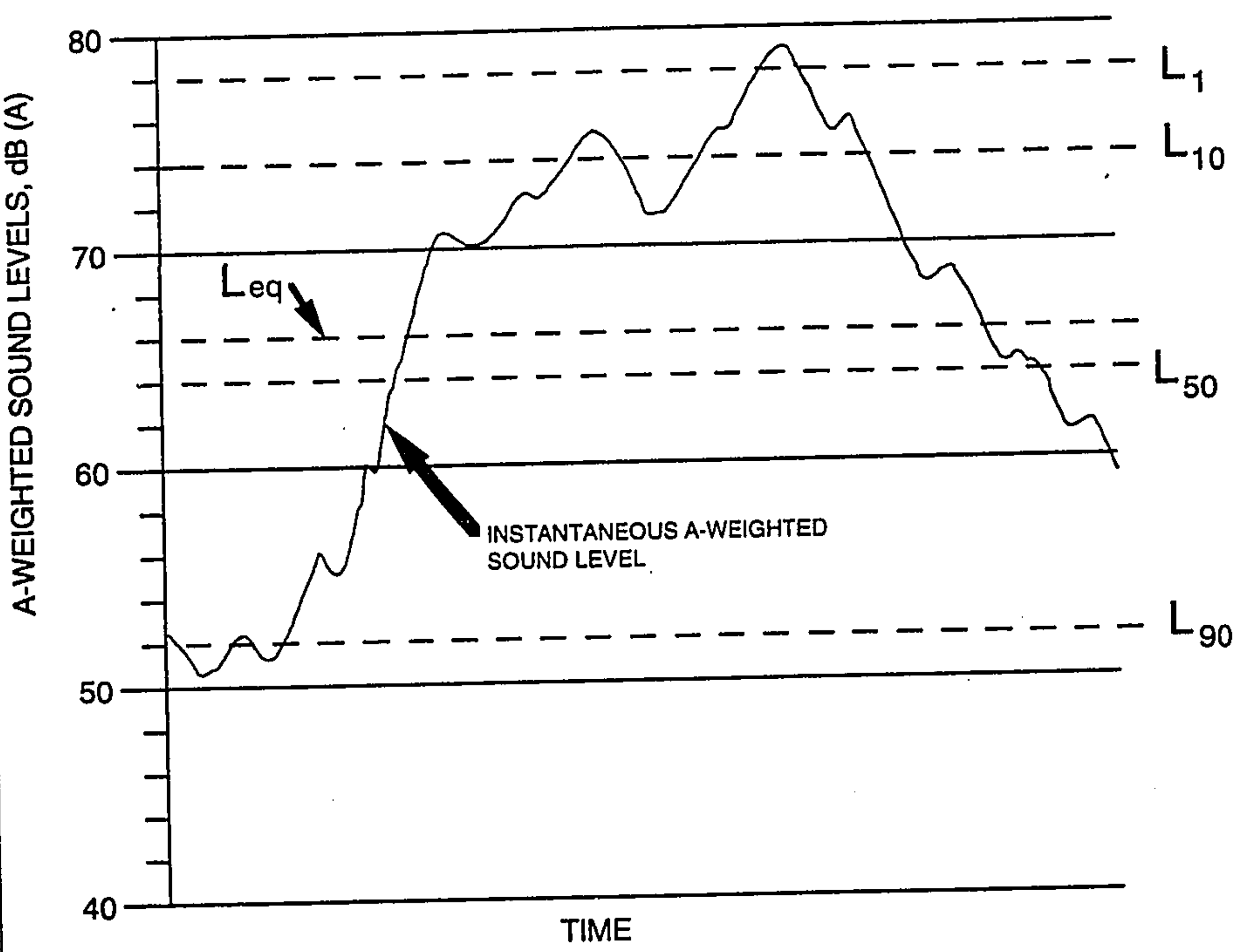
Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 pm and 7 am to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations. Qualitative descriptions, as well as local examples of L_{dn}, are shown in Figure A-3.



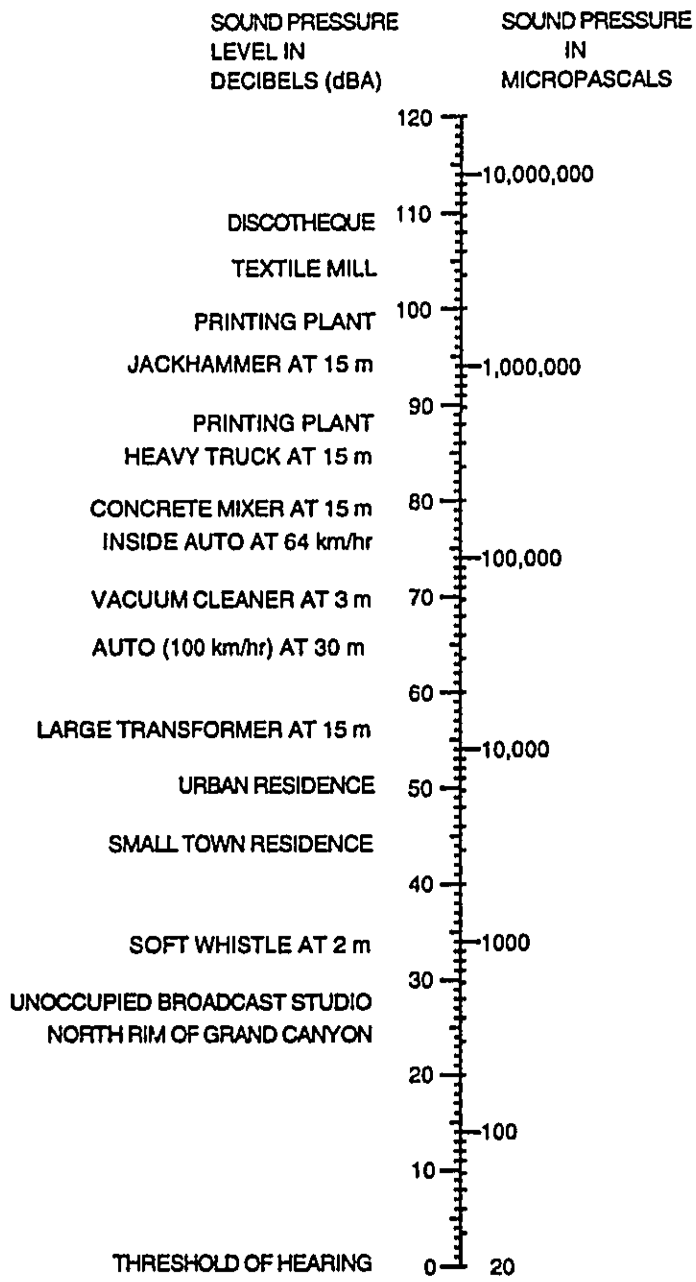
D.L. ADAMS ASSOCIATES, LTD.
dba
DARBY
& ASSOCIATES
ACOUSTICAL CONSULTANTS

FIGURE A-3 QUALITATIVE DESCRIPTION OF THE DAY-NIGHT EQUIVALENT SOUND LEVELS (Ldn) AND EXAMPLE Ldn's AT SELECTED LOCATIONS ON OAHU



D.L. ADAMS ASSOCIATES, LTD.
dba
DARBY & ASSOCIATES
ACOUSTICAL CONSULTANTS

FIGURE A-2 COMPARISON OF AN INSTANTANEOUS SOUND LEVEL AND THE CORRESPONDING STATISTICAL SOUND LEVELS



D.L. ADAMS ASSOCIATES, LTD.
dba
DARBY & ASSOCIATES
ACOUSTICAL CONSULTANTS

FIGURE A-1 THE RELATION BETWEEN SOUND PRESSURE, P, AND SOUND PRESSURE LEVEL, SPL. ALSO SHOWN ARE TYPICAL VALUES OF A-WEIGHTED SOUND LEVELS OF VARIOUS NOISE SOURCES.

FLOOD INSURANCE RATE MAP

APPENDIX G

Federal Emergency Management Agency

Washington, D.C. 20472

1?92 AUG

OFFICE

AUG 5 1992

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
116

Case No.: 92-09-074P

The Honorable Linda Crockett Lingle
Mayor, Maui County
250 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mayor Lingle:

On April 3, 1992, you received notification of modified base flood elevation (BFE) determinations affecting the Flood Insurance Rate Map (FIRM) for the unincorporated areas of Maui County, Hawaii. The 90-day appeal period that was initiated on April 30, 1992, when the Federal Emergency Management Agency (FEMA) published a notification of modifications of the BFEs for Maui County, in the Maui News, has elapsed.

FEMA has received no valid requests for changes in the BFEs; therefore, the modified BFEs that became effective on April 3, 1992, remain valid and revise the FIRM that was in effect prior to that date.

These modifications are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. The community number is unaffected by this revision. The suffix codes for individual map panels may be determined by referring to the most recent index map for your community. The community number and appropriate suffix code will be used by the National Flood Insurance Program (NFIP) for all flood insurance policies and renewals issued for your community.

FEMA has developed criteria for floodplain management under the above-mentioned Acts of 1968 and 1973. To continue participation in the NFIP, your community must use the modified BFEs to carry out the floodplain management measures for the NFIP. The modified BFEs will also be used to calculate the appropriate flood insurance premium rates for all new buildings and their contents and for the second layer of insurance on existing buildings and their contents.

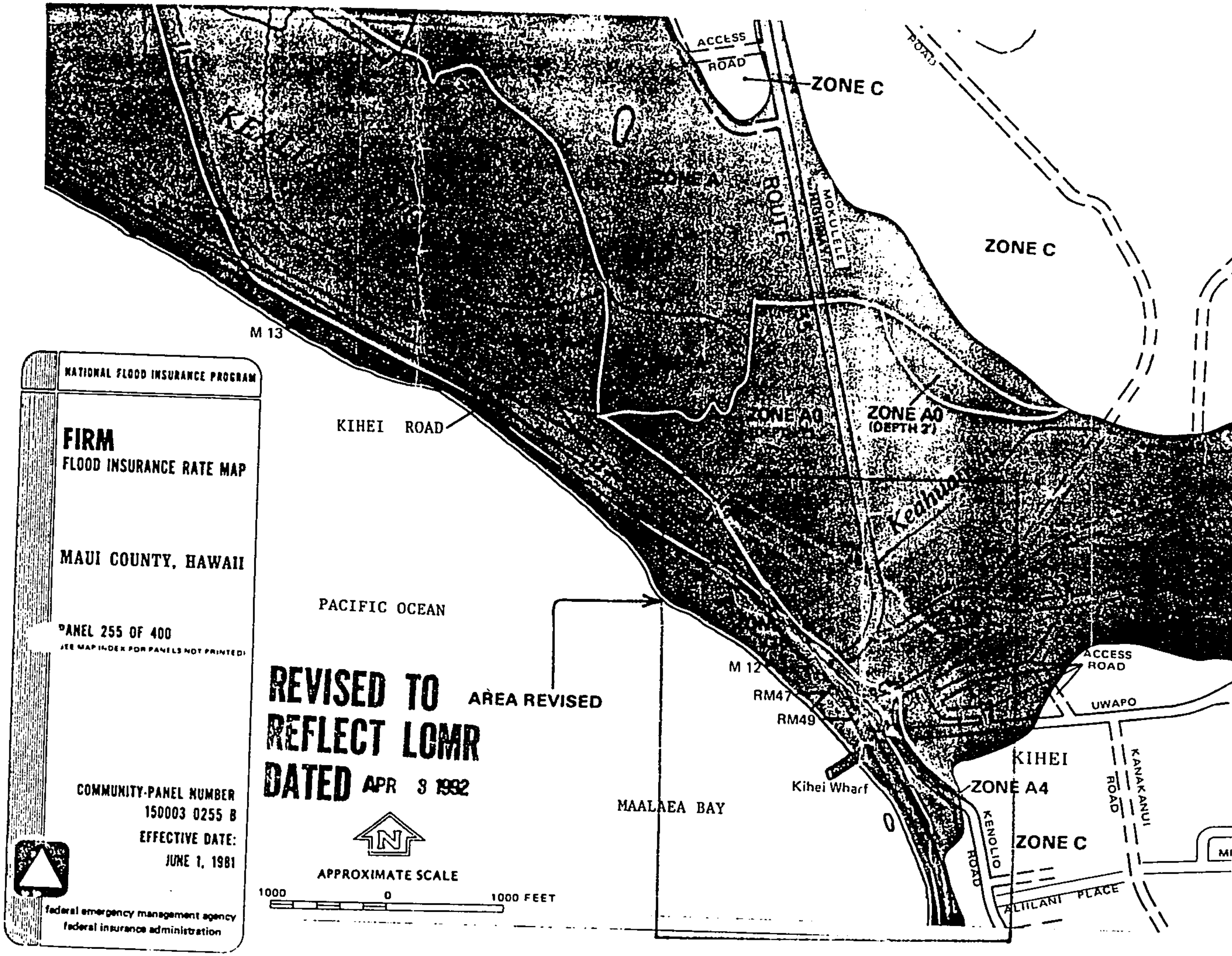
If you have any questions regarding the BFE determinations, please contact the Chief, Natural and Technological Hazards Division, FEMA in San Francisco, California, at (415) 923-7177 or Mr. Karl Mohr of my staff in Washington, D.C., at (202) 646-2770.

RECEIVED
AUG 17 1992
LAND USE & CODES ADM.
COUNTY OF MAUI

Sincerely,

William R. Locke
Chief, Risk Studies Division
Federal Insurance Administration

cc: Edward K. Noda, Ph.D., P.E.
Edward K. Noda & Associates, Inc.
Mr. Richard M. Sato
Richard M. Sato & Associates, Inc.
Mr. George N. Kaya
Director of Public Works
Maui County


ZONE C
ACCESS
ROAD
ROUTE
MOKULELE
HIGHWAY
ZONE C
ROAD
ZONE A0
ZONE A0
(DEPTH 2')
Keahua
M 13
KIHEI ROAD
PACIFIC OCEAN
M 12
RM47
RM49
Kihei Wharf
AREA REVISED
MAALAEA BAY
ACCESS
ROAD
UWAPO
KANAKANUI
ROAD
KIHEI
ZONE A4
ZONE C
KENOLIO
ROAD
ALIILANI PLACE
REVISED TO
REFLECT LOMR
DATED APR 3 1992
N
APPROXIMATE SCALE
1000
0
1000 FEET
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
MAUI COUNTY, HAWAII
PANEL 255 OF 400
(SEE MAP INDEX FOR PANELS NOT PRINTED)
COMMUNITY-PANEL NUMBER
150003 0255 B
EFFECTIVE DATE:
JUNE 1, 1981
federal emergency management agency
federal insurance administration

If you have any questions regarding the modifications described herein, please call the Chief, Natural and Technological Hazards Division, Federal Emergency Management Agency, in San Francisco, at (415) 923-7177, or Mr. Karl F. Mohr of my staff in Washington, D.C., at (202) 646-2770.

Sincerely,

William R. Locke
Chief, Risk Studies Division
Federal Insurance Administration

Enclosure

cc: Edward K. Noda, Ph.D., P.E.
Edward K. Noda & Associates, Inc.

Mr. Richard M. Sato
Richard M. Sato & Associates, Inc.

Mr. George N. Kaya
Director of Public Works
County of Maui

Because of current funding constraints, we must limit the number of physical map revisions. Consequently, we will not publish a revised FIRM for Maui County to reflect modifications at this time. However, if in the future, we revise and republish the FIRM panel affected by this LOMR, we will incorporate the previously described modifications at that time.

This modification has been made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR, Part 65. Public notification of modifications to the base (100-year) flood elevations (BFEs) along the coast of Maui will be given in the Maui News on or about April 23, 1992, and April 30, 1992. In addition, a Notice of Changes will be published in the Federal Register.

As required by the legislation, a community must adopt and enforce floodplain management measures to ensure continued eligibility to participate in the National Flood Insurance Program (NFIP). Therefore, your community must enforce these regulations using, at a minimum, the BFEs, zone designations, and floodways in the SFHAs shown on the FIRM and Flood Boundary and Floodway Map for your community, including the previously described modifications.

This response to your request is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all proposed floodplain developments, including this request, and for ensuring that necessary permits required by Federal or State law have been received. With knowledge of local conditions and in the interest of safety, State and community officials may set higher standards for construction, or may limit development in floodplain areas. If the State of Hawaii or Maui County has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP requirements.

The community number and suffix code listed above will be used for all flood insurance policies and renewals issued for your community on and after the effective date listed above.

The modifications described herein are effective as of the date of this letter. However, within 90 days of the second publication in the Maui News, your community may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. All interested parties are hereby notified that, until the 90-day period elapses, the determination may be modified.

Federal Emergency Management Agency
Washington, D.C. 20472

DEPT OF PUBLIC WORKS

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
102

The Honorable Linda Crockett Lingle
Mayor, Maui County
250 South High Street
Wailuku, Maui, Hawaii 96793

Community: Maui County, Hawaii
Map Panel Number: 150003 0255 B
Effective Date
of This Revision: APR 3 1992

Dear Mayor Lingle:

This is in response to a letter dated January 8, 1992, from Mr. George N. Kaya, Director of Public Works, Maui County, Hawaii, regarding the effective Flood Insurance Rate Map (FIRM) for Maui County, Hawaii. Mr. Kaya requested that we revise the effective FIRM to show the effects of new topographic information along the coastline of the Island of Maui in the vicinity of Kihei. All data necessary to review this request were submitted by Mr. Kaya with his January 8, 1992, letter, and by Edward K. Noda, Ph.D., P.E., Edward K. Noda and Associates, Inc., with his letter report dated February 24, 1992.

We have completed our review of the submitted data with regard to the data used to produce the effective FIRM, and have revised the FIRM to modify the elevations, floodplain boundary delineations, and zone designations of a flood having a 1-percent probability of being equaled or exceeded in any given year (base flood) along the coast of Maui in the Kihei area. The extent of the Special Flood Hazard Area (SFHA), identified as Zone V18, was reduced from about 800 feet to about 400 feet in width between Mokulele Highway and Uwapo Road. This area is now designated as Zone AO (Depth 1 foot).

The modification is shown on the enclosed annotated copy of FIRM Panel 150003 0255 B. This Letter of Map Revision (LOMR) hereby revises this panel of the effective FIRM dated June 1, 1981.

The following table is a partial listing of former and modified 100-year flood elevations.

Location	Existing Base Flood Elevation *(feet)	Modified Base Flood Elevation *(feet)
At the intersection of Kihei Road and Mokulele Highway	*12	*8
At the intersection of Uwapo Road and Kenolio Road	*12	*8
Along the coastline of Maui between Mokulele Highway and Uwapo Road	*12	*12

*National Geodetic Vertical Datum, rounded to the nearest whole foot.

CORRECTION

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

Federal Emergency Management Agency
Washington, D.C. 20472

DEPT OF PUBLIC WORKS

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
102

The Honorable Linda Crockett Lingle
Mayor, Maui County
250 South High Street
Wailuku, Maui, Hawaii 96793

Community: Maui County, Hawaii
Map Panel Number: 150003 0255 B
Effective Date of This Revision: APR 3 1992

Dear Mayor Lingle:

This is in response to a letter dated January 8, 1992, from Mr. George N. Kaya, Director of Public Works, Maui County, Hawaii, regarding the effective Flood Insurance Rate Map (FIRM) for Maui County, Hawaii. Mr. Kaya requested that we revise the effective FIRM to show the effects of new topographic information along the coastline of the Island of Maui in the vicinity of Kihei. All data necessary to review this request were submitted by Mr. Kaya with his January 8, 1992, letter, and by Edward K. Noda, Ph.D., P.E., Edward K. Noda and Associates, Inc., with his letter report dated February 24, 1992.

We have completed our review of the submitted data with regard to the data used to produce the effective FIRM, and have revised the FIRM to modify the elevations, floodplain boundary delineations, and zone designations of a flood having a 1-percent probability of being equaled or exceeded in any given year (base flood) along the coast of Maui in the Kihei area. The extent of the Special Flood Hazard Area (SFHA), identified as Zone V18, was reduced from about 800 feet to about 400 feet in width between Mokulele Highway and Uwapo Road. This area is now designated as Zone AO (Depth 1 foot).

The modification is shown on the enclosed annotated copy of FIRM Panel 150003 0255 B. This Letter of Map Revision (LOMR) hereby revises this panel of the effective FIRM dated June 1, 1981.

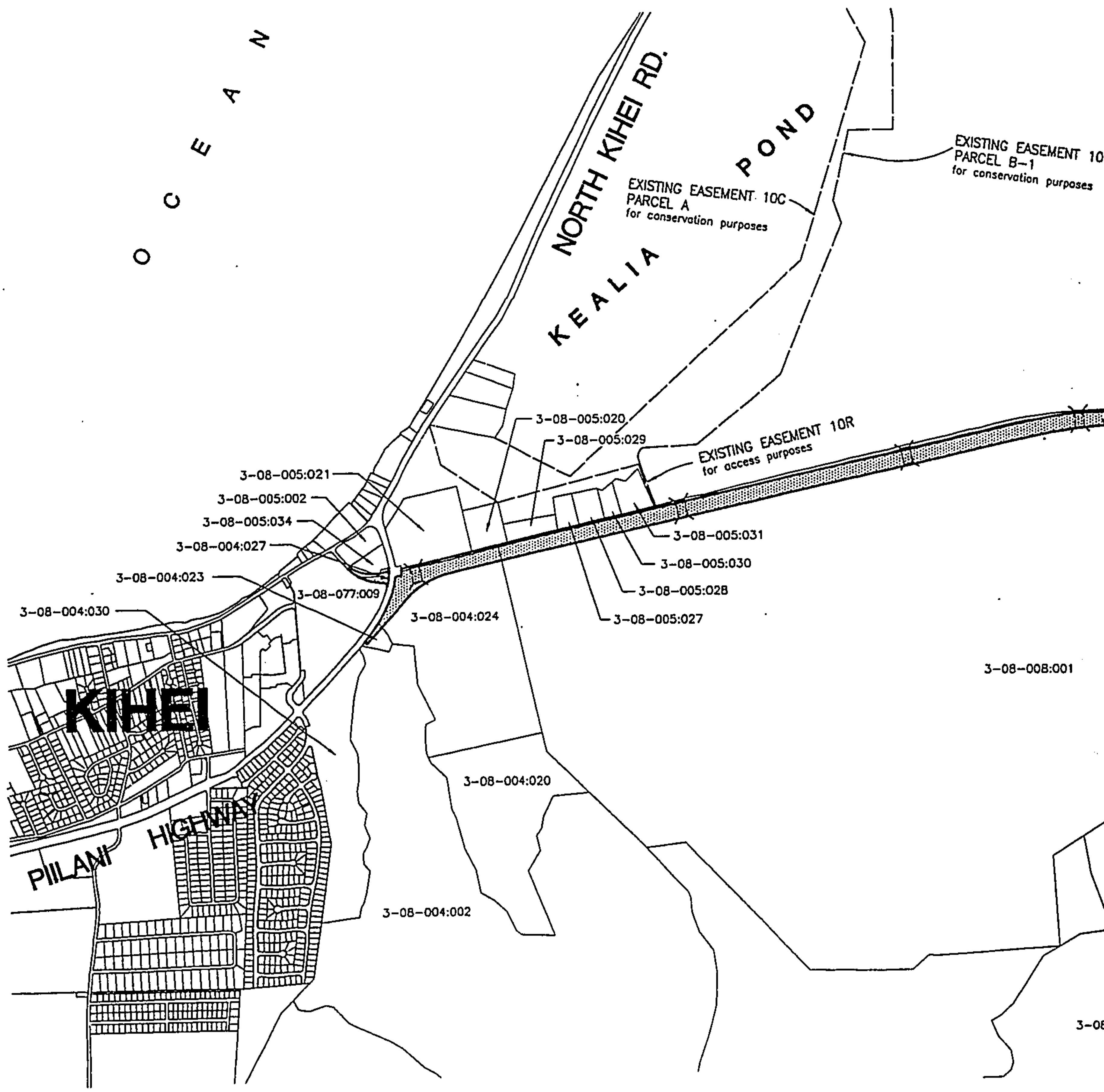
The following table is a partial listing of former and modified 100-year flood elevations.

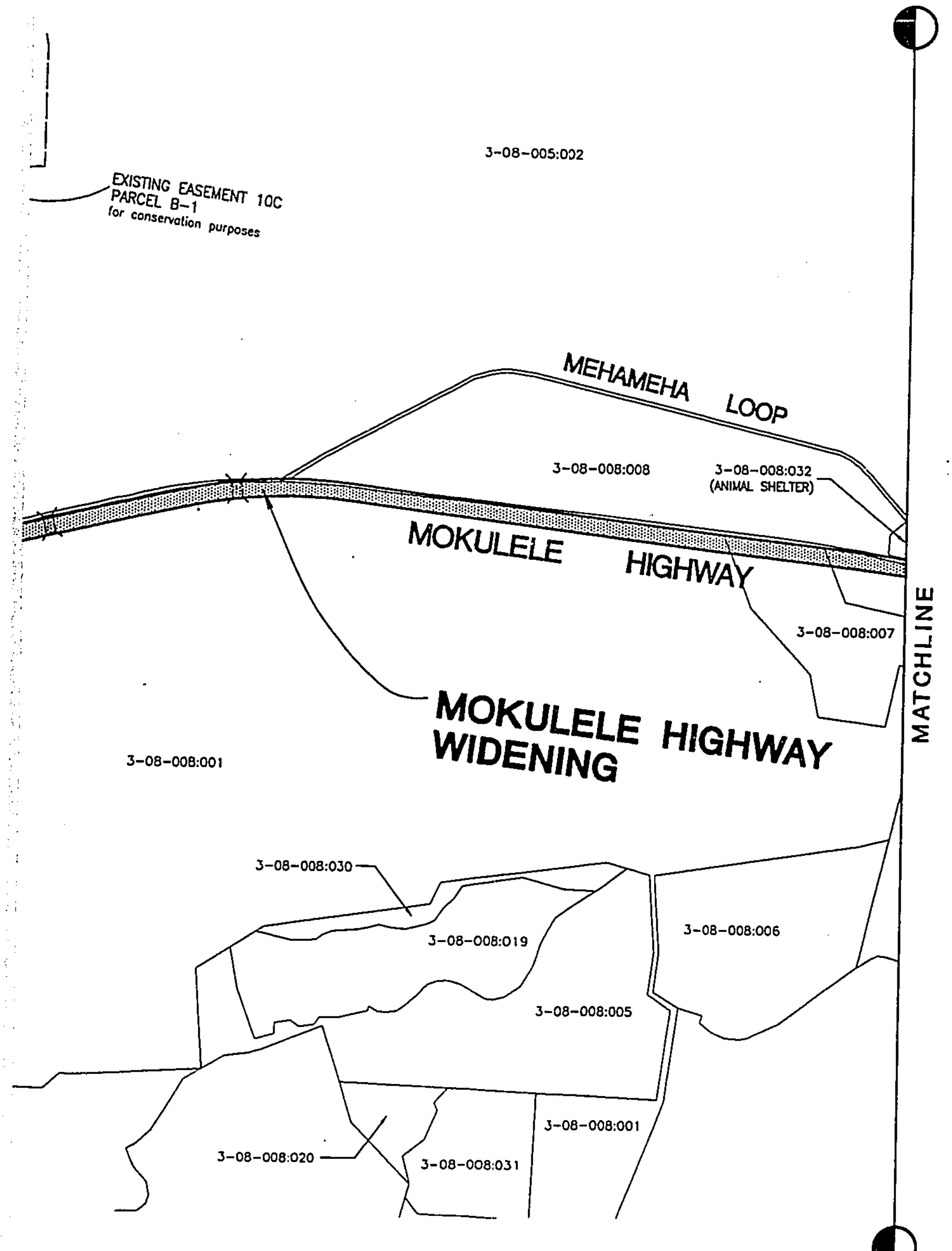
Location	Existing Base Flood Elevation *(feet)	Modified Base Flood Elevation *(feet)
At the intersection of Kihei Road and Mokulele Highway	*12	*8
At the intersection of Uwapo Road and Kenolio Road	*12	*8
Along the coastline of Maui between Mokulele Highway and Uwapo Road	*12	*12

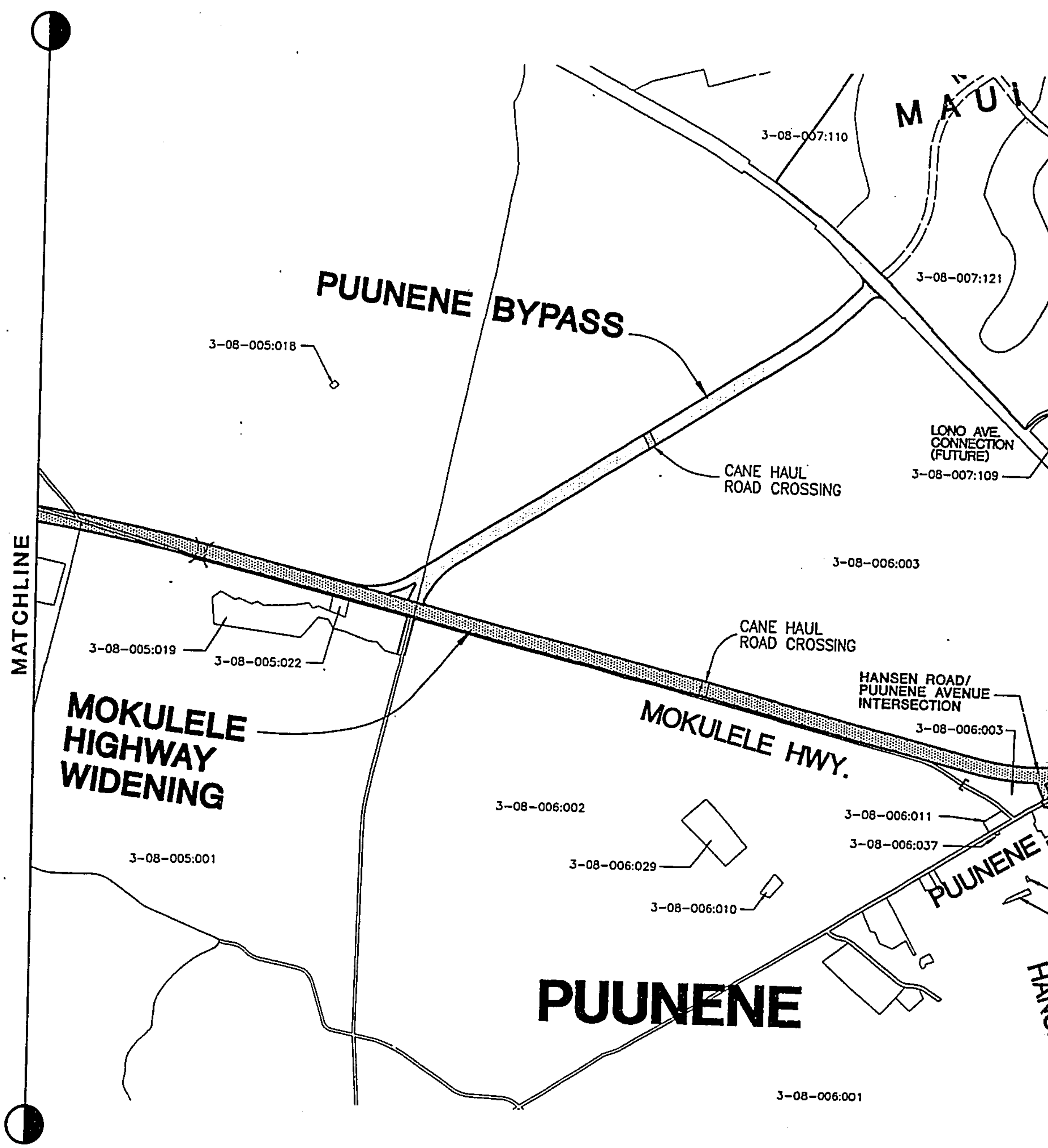
*National Geodetic Vertical Datum, rounded to the nearest whole foot.

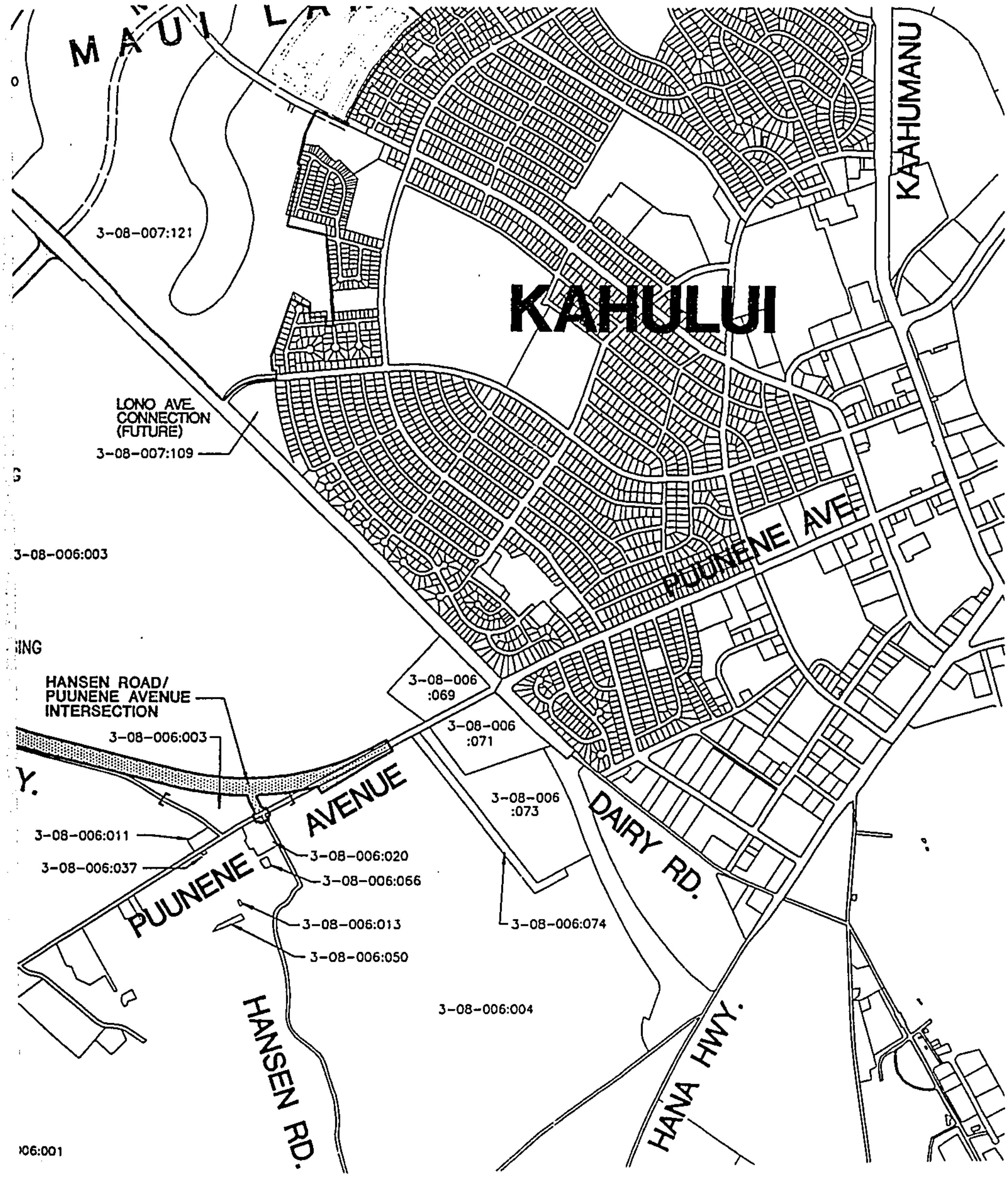
VISUAL ANALYSIS

APPENDIX H


OCEAN
NORTH KIHEI RD.
KEALIA POND
EXISTING EASEMENT 10C
PARCEL A
for conservation purposes
EXISTING EASEMENT 10
PARCEL B-1
for conservation purposes
EXISTING EASEMENT 10R
for access purposes
3-08-005:020
3-08-005:029
3-08-005:021
3-08-005:002
3-08-005:034
3-08-004:027
3-08-004:023
3-08-077:009
3-08-004:030
3-08-005:031
3-08-005:030
3-08-005:028
3-08-005:027
3-08-004:024
3-08-008:001
3-08-004:020
3-08-004:002
KIHEI
PIILANI HIGHWAY


3-08-005:002
EXISTING EASEMENT 10C
PARCEL B-1
for conservation purposes
MEHAMEHA LOOP
3-08-008:008
3-08-008:032
(ANIMAL SHELTER)
MOKULELE HIGHWAY
3-08-008:007
MATCHLINE
MOKULELE HIGHWAY
WIDENING
3-08-008:001
3-08-008:030
3-08-008:019
3-08-008:006
3-08-008:005
3-08-008:001
3-08-008:020
3-08-008:031

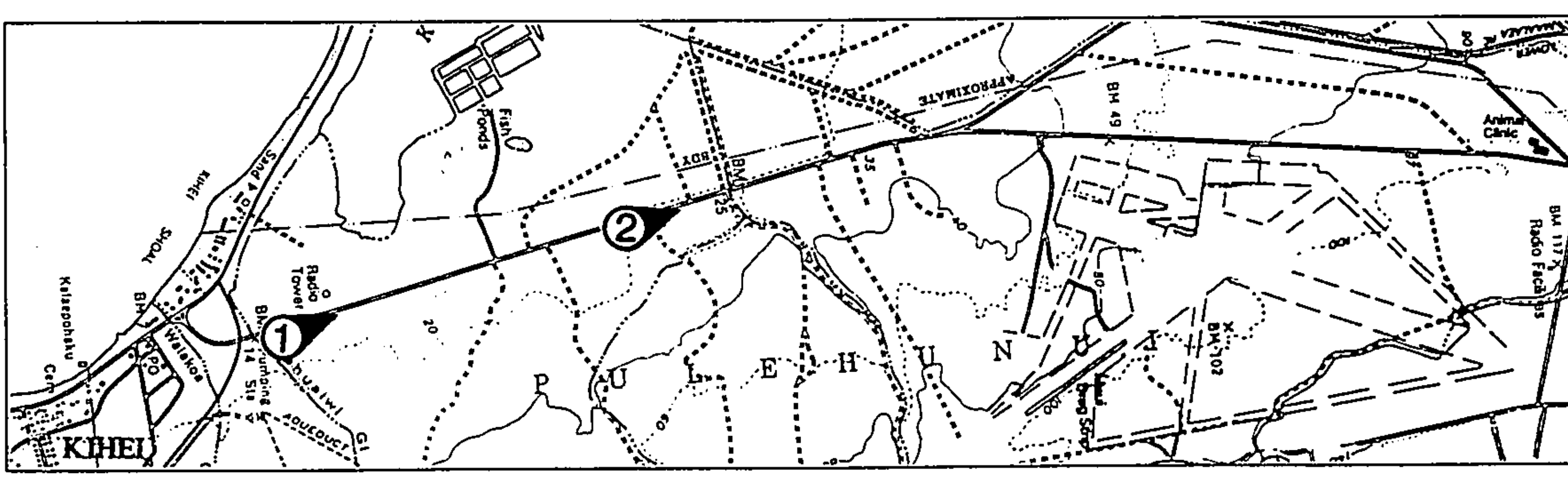

MAUI
3-08-007:110
3-08-007:121
PUUNENE BYPASS
3-08-005:018
LONO AVE. CONNECTION (FUTURE)
3-08-007:109
CANE HAUL ROAD CROSSING
3-08-006:003
MATCHLINE
3-08-005:019
3-08-005:022
CANE HAUL ROAD CROSSING
HANSEN ROAD/ PUUNENE AVENUE INTERSECTION
MOKULELE HIGHWAY WIDENING
MOKULELE HWY.
3-08-006:003
3-08-006:002
3-08-006:011
3-08-006:037
3-08-005:001
3-08-006:029
PUUNENE
3-08-006:010
PUUNENE
3-08-006:001



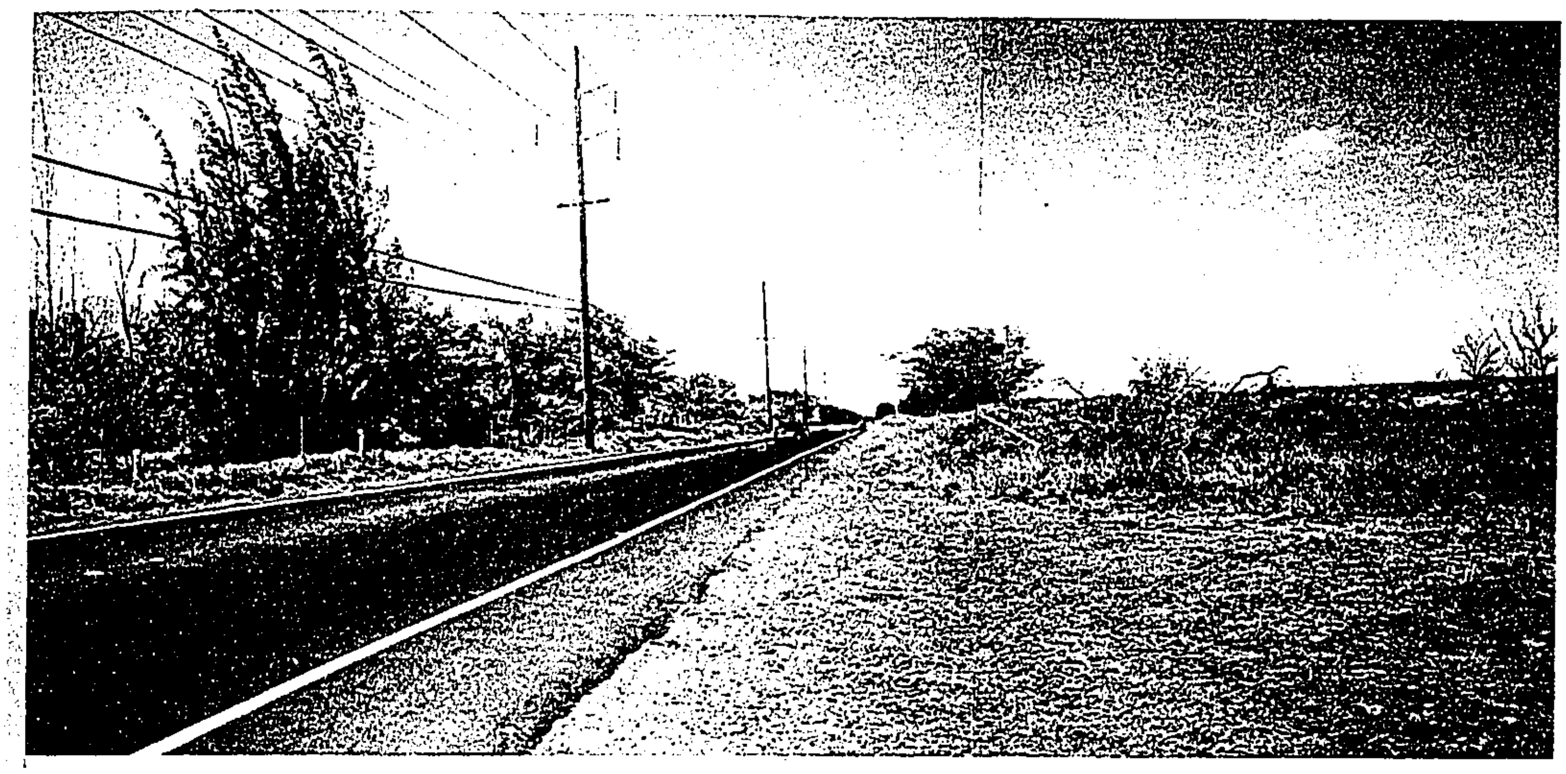
MAUI LA
KAAHUMANU
3-08-007:121
KAHULUI
LONO AVE. CONNECTION (FUTURE)
3-08-007:109
3-08-006:003
PUUNENE AVE.
HANSEN ROAD/ PUUNENE AVENUE INTERSECTION
3-08-006 :069
3-08-006:003
3-08-006 :071
3-08-006 :073
AVENUE
DAIRY RD.
3-08-006:011
3-08-006:020
3-08-006:037
3-08-006:066
PUUNENE
3-08-006:013
3-08-006:074
3-08-006:050
HANSEN RD.
3-08-006:004
HANA HWY.

1 Looking north along Mokulele Highway from the intersection of Mokulele and Piilani Highways. Hawaiian Foliage Company on the left and the West Maui Mountains in the background.

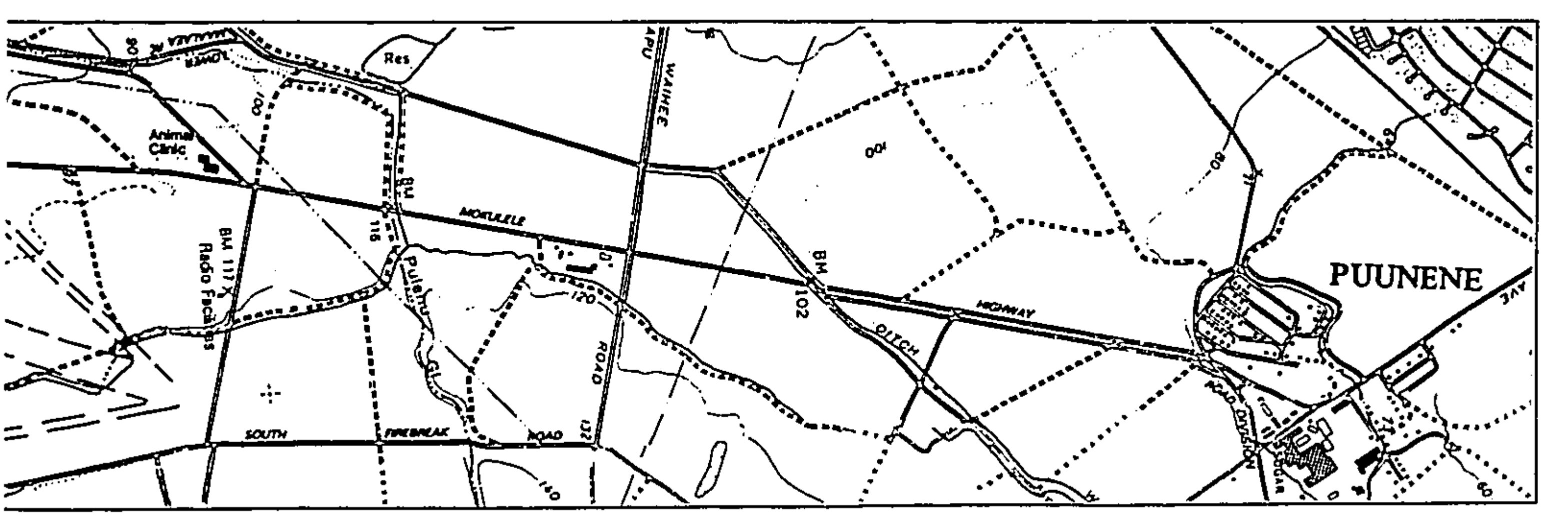
2 Looking north along Mokule



KEY MAP - Site Photographs



north along Mokulele Highway.

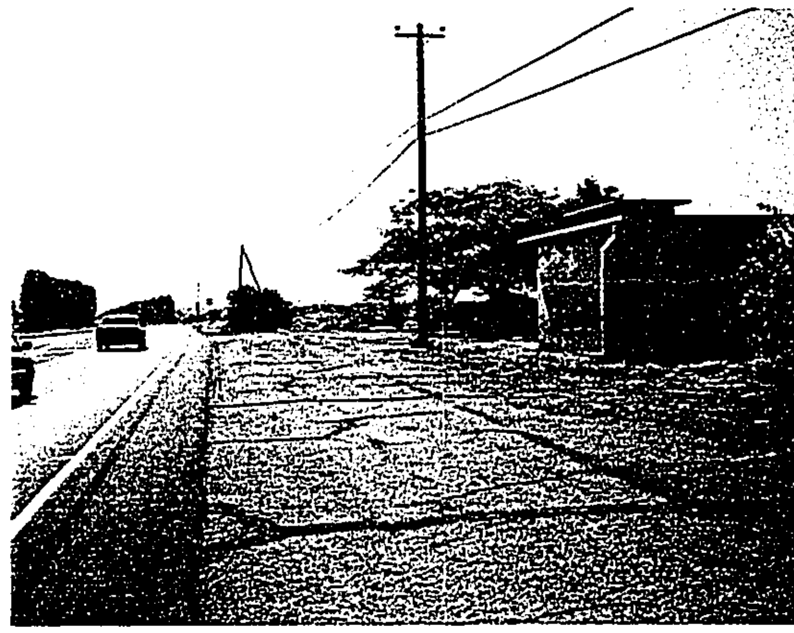


February, 1997

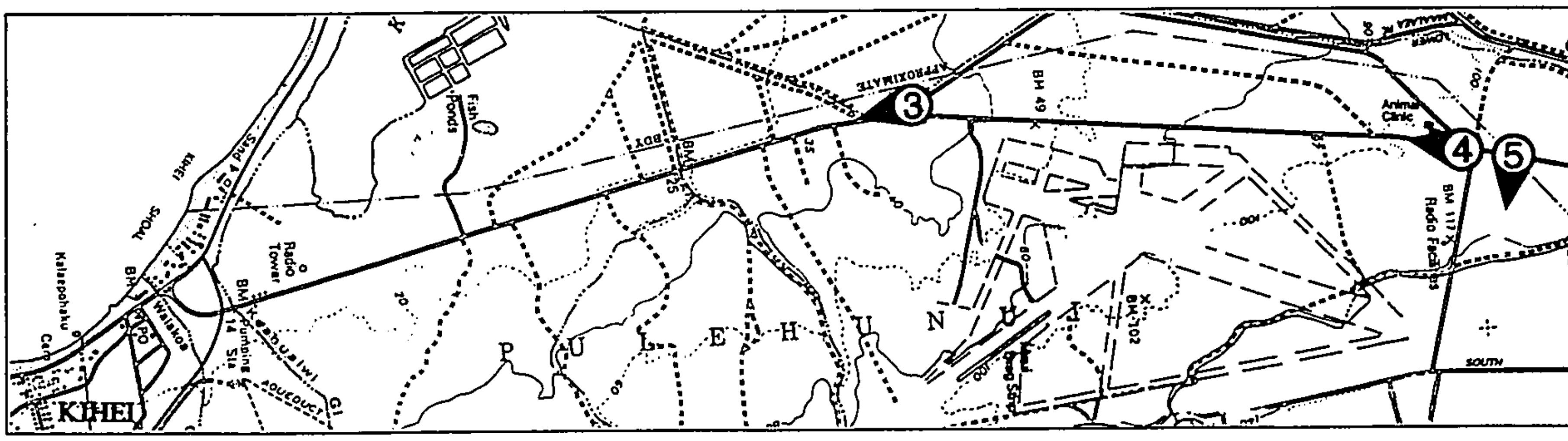
VISUAL RESOURCES

MOKULELE HIGHWAY / PUUNENE BYPASS

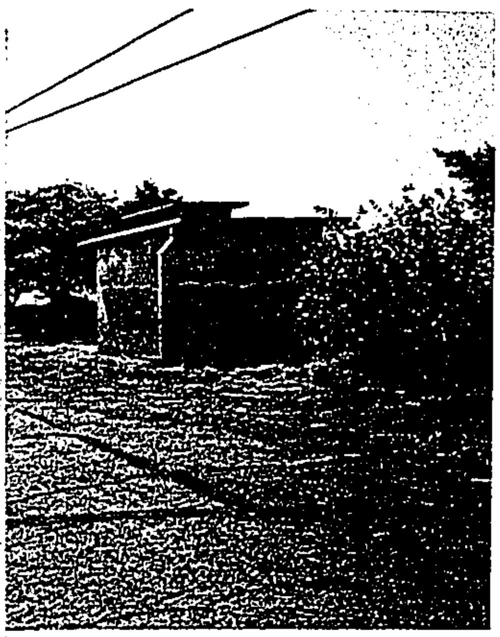
(3) Looking south at the intersection of Mokulele Highway and Mehameha Loop (southern portion); Haleakala in the background.



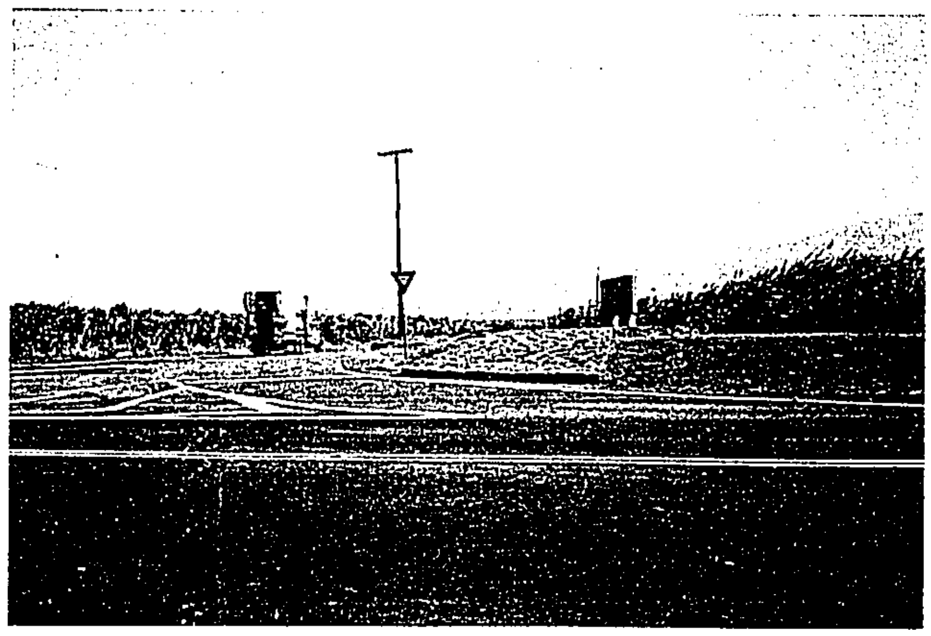
(4) Old bunker near the Humane Society.



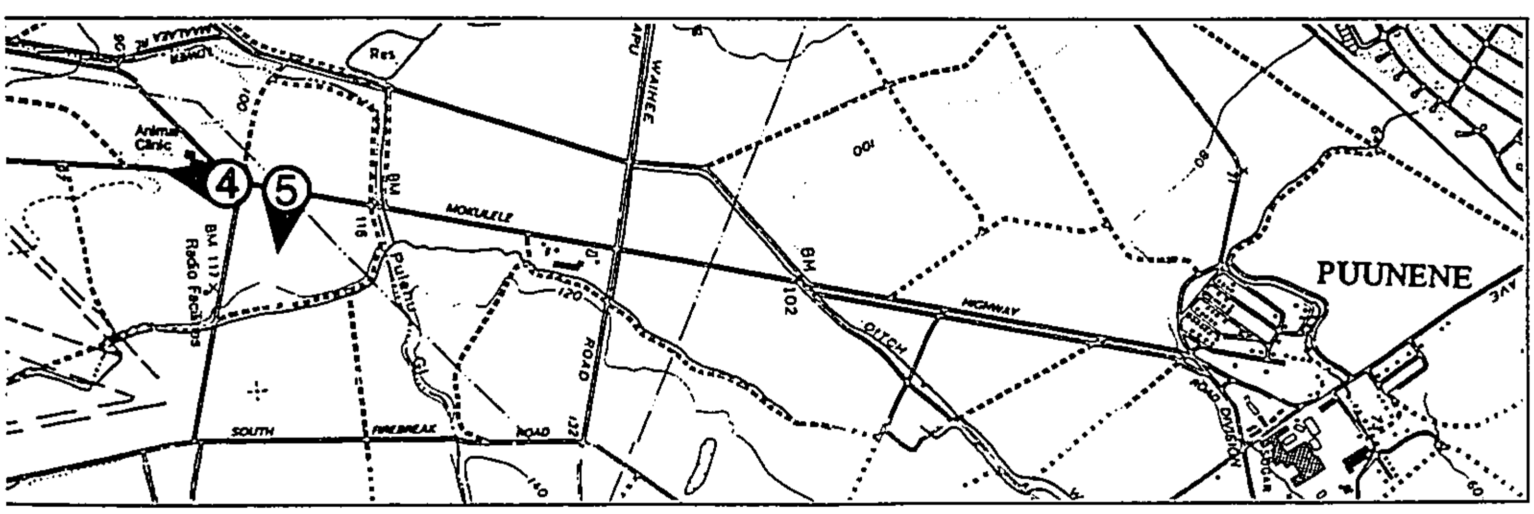
KEY MAP - Site Photographs



ne Society.



⑤ Looking east at the intersection of Mokulele Highway and the unnamed road leading to the Hawaiian Cement facility; Haleakala in the background.



February, 1997

VISUAL RESOURCES
MOKULELE HIGHWAY/ PUUNENE BYPASS

PBR HAWAII

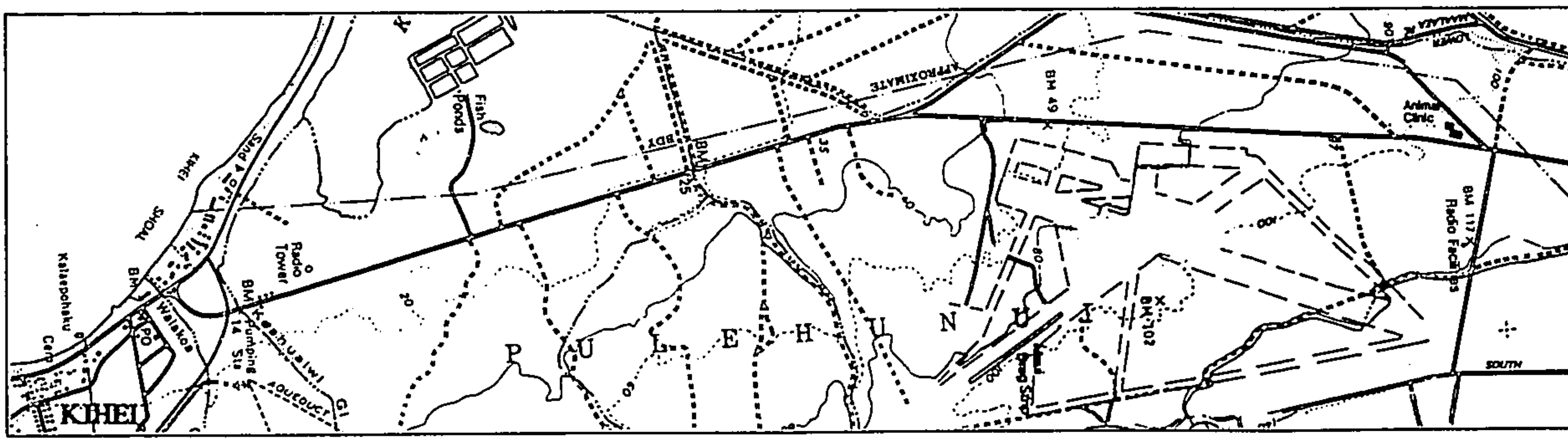
TAX MAP KEY PARCELS

APPENDIX I

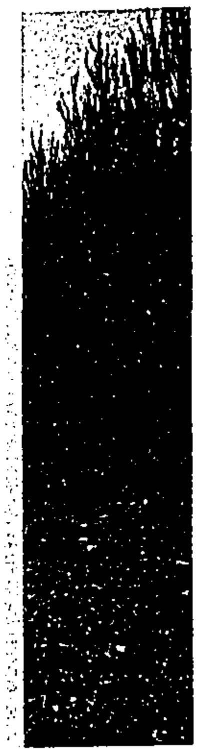
TAX MAP KEY PARCELS
AFFECTED BY THE PROPOSED
IMPROVEMENTS

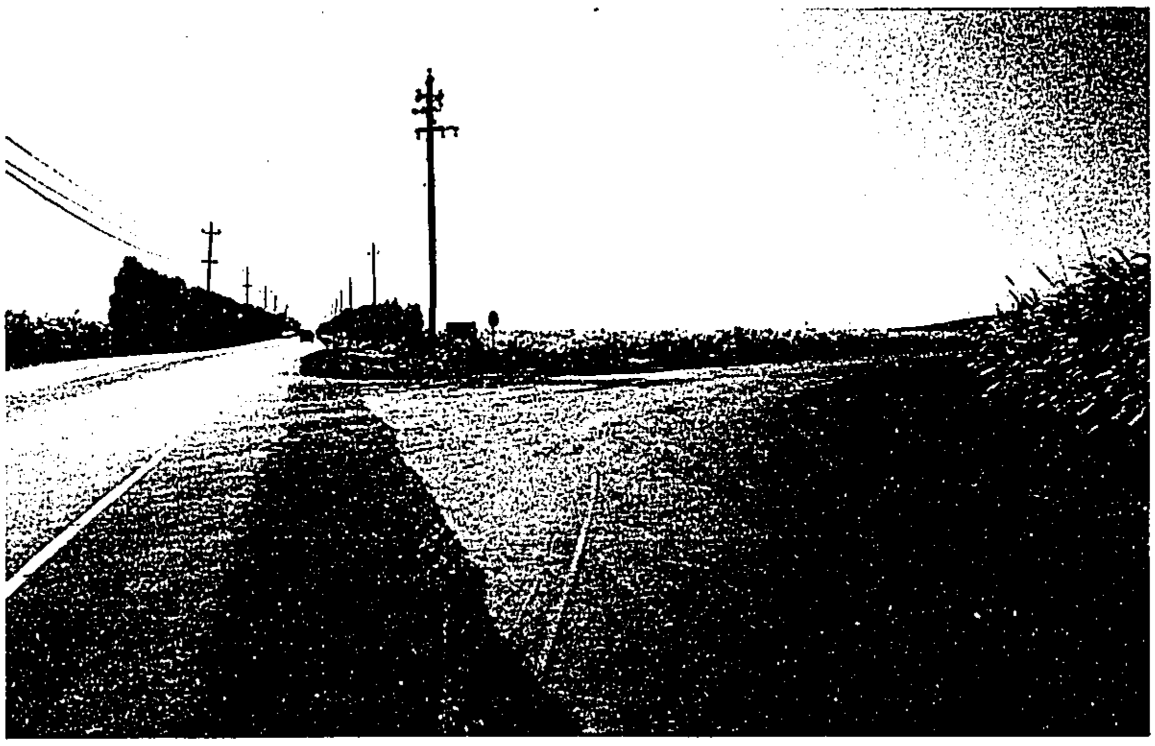
3-08-004: 023 (Por.)
3-08-004: 024 (Por.)
3-08-004: 027 (Por.)
3-08-005: 002 (Por.)
3-08-005: 019 (Por.)
3-08-005: 020 (Por.)
3-08-005: 021 (Por.)
3-08-005: 022 (Por.)
3-08-005: 027 (Por.)
3-08-005: 028 (Por.)
3-08-005: 029 (Por.)
3-08-005: 030 (Por.)
3-08-005: 031 (Por.)
3-08-005: 034 (Por.)
3-08-006: 002 (Por.)
3-08-006:003 (Por.)
3-08-006:004 (Por.)
3-08-006:020 (Por.)
3-08-008: 001 (Por.)
3-08-008: 007 (Por.)
3-08-008: 008 (Por.)
3-08-008: 032 (Por.)
3-08-077: 009 (Por.)

(6) Southerly view along Mokulele Highway at the industrial complex.

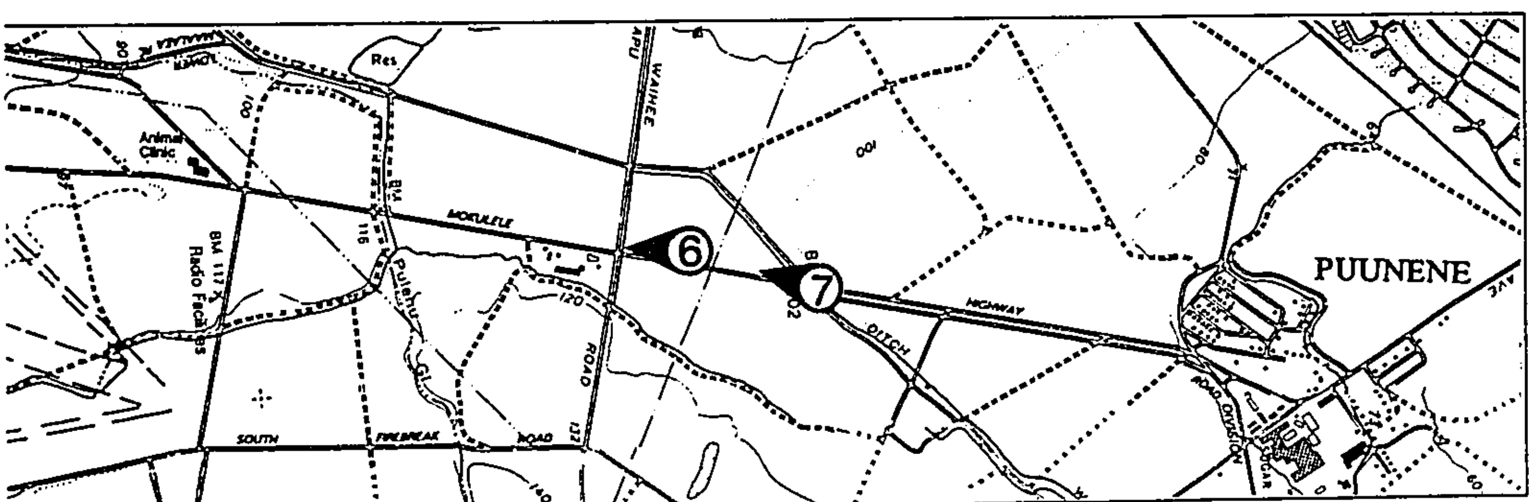


KEY MAP - Site Photographs



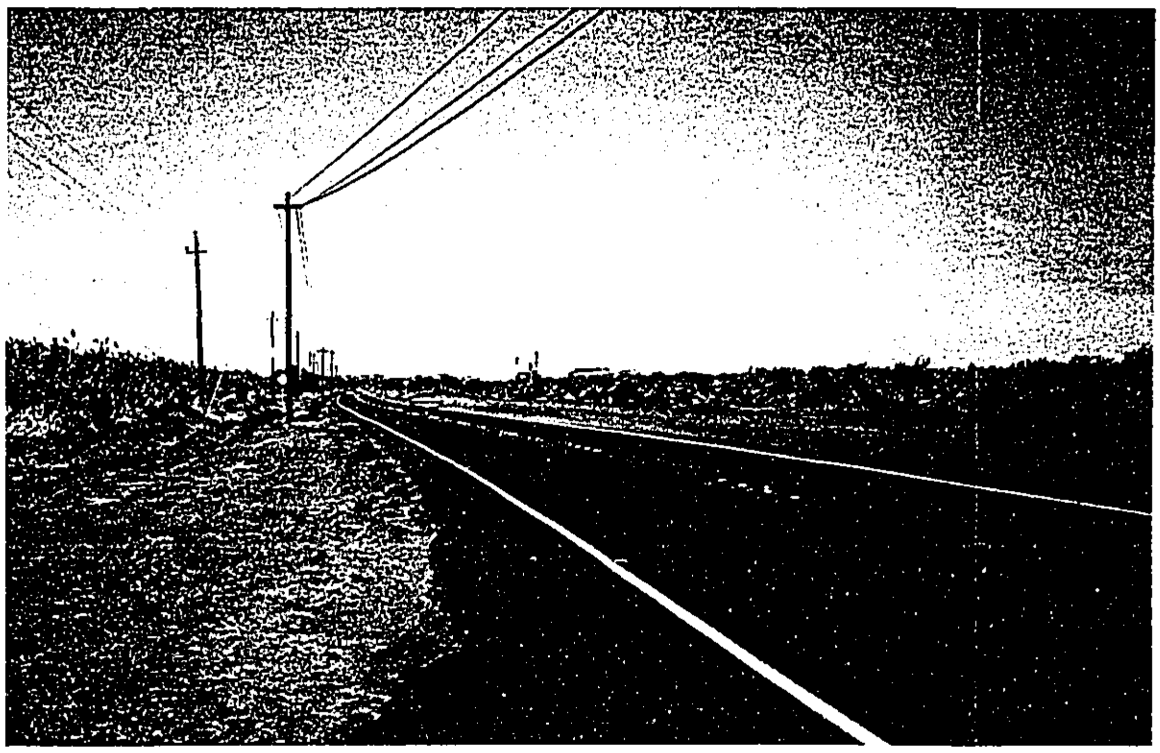


(7) Southerly view from the intersection of Mokulele Highway and Upper Maalaea Road with the West Maui Mountains to the far right.

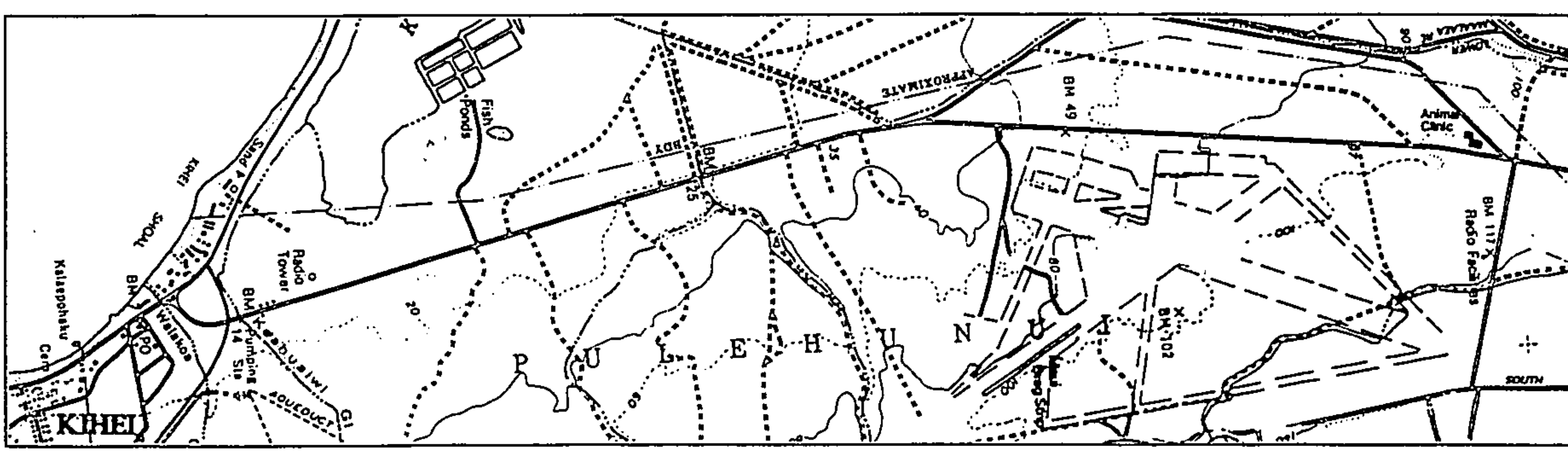


February, 1997

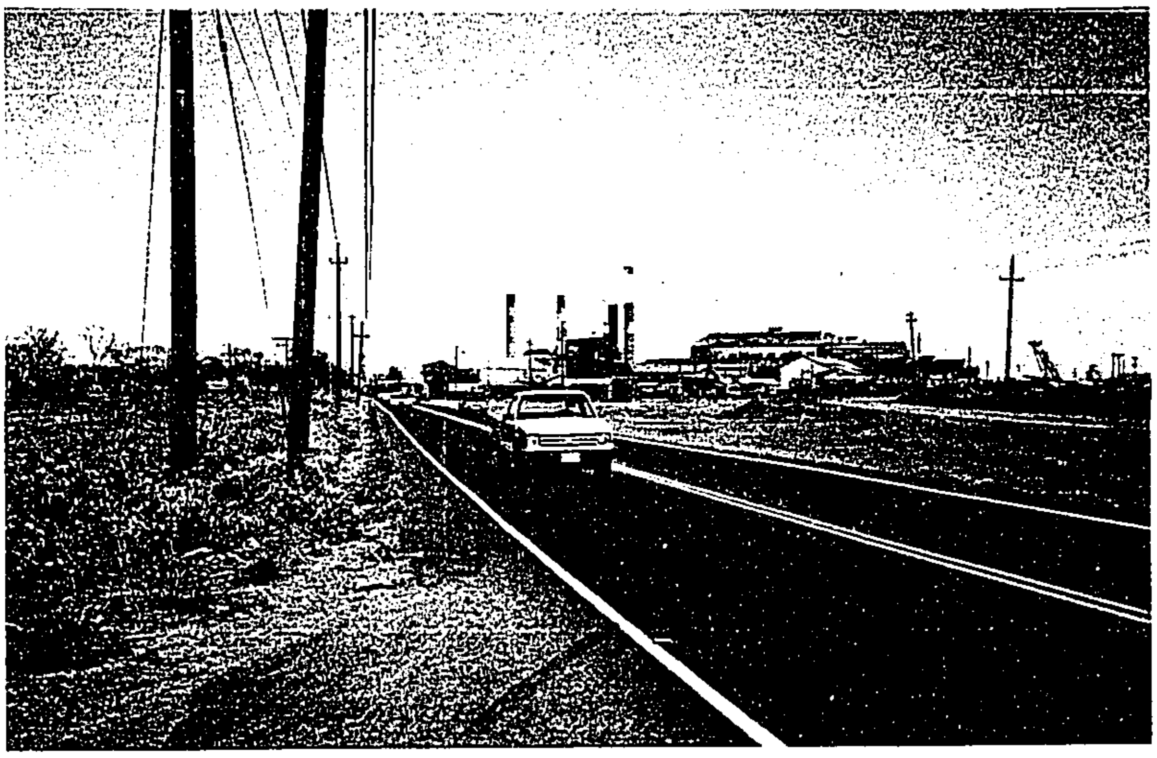
VISUAL RESOURCES
MOKULELE HIGHWAY / PUUNENE BYPASS



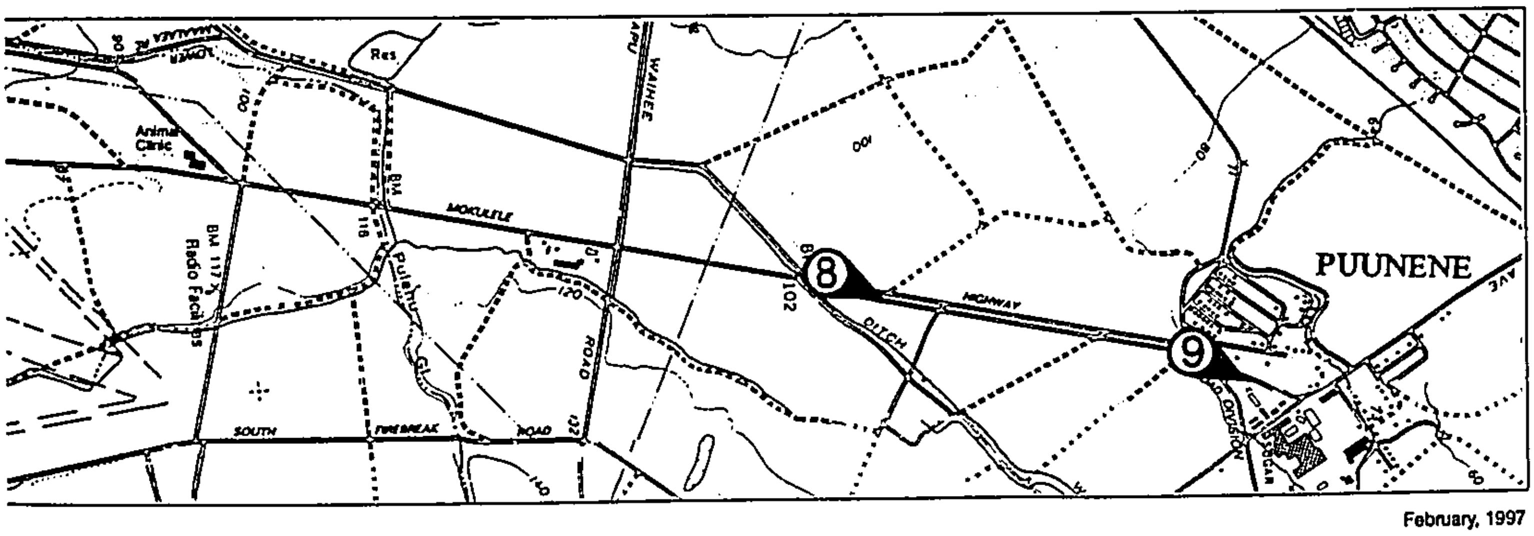
(8) Northerly view along Mokulele Highway; sugar mill in background.



KEY MAP - Site Photographs



(9) Looking north towards the Hawaiian Commercial and Sugar Co. (HCSC) sugar mill from Mokulele Highway.



February, 1997

VISUAL RESOURCES
MOKULELE HIGHWAY/ PUUNENE BYPASS

PBR

AGENCY COMMENTS AND PUBLIC PARTICIPATION

APPENDIX J

COMMENT LETTER HISTORY REGARDING DRAFT ENVIRONMENTAL ASSESSMENT FOR MOKULELE HIGHWAY/PUUNENE BYPASS

Checklist of Responses, Effective: July 16, 1997

	AGENCY	DEA MAIL DATE	DATE COMMENTS RECEIVED	RESPONSE DATE
	STATE			
1	Office of Environmental Quality Control	3/18/97	4/15/97	7/16/97
2	Dept. of Accounting and General Svcs.	3/18/97		
3	Dept. of Agriculture	3/18/97		
4	Dept. of Business, Econ. Dev. and Tourism	3/18/97		
5	Dept. of Business, Econ. Dev. & Tourism (Energy)	3/20/97		
6	Dept. of Defense	3/20/97		
7	Dept. of Education	3/18/97	4/3/97	5/28/97
8	Dept. of Hawaiian Home Lands	3/18/97	4/8/97	5/28/97
9	Dept. of Health (Environmental)	3/18/97	5/2/97	5/28/97
10	Dept. of Land & Natural Resources (Preservation)	3/18/97	5/1/97	5/28/97
11	Dept. of Land & Natural Resources	3/18/97		
12	State Planning Office	3/18/97	4/21/97	5/28/97
13	State Dept. of Public works	3/18/97	4/22/97	5/28/97
14	Dept. of Transportation	3/27/97		
15	Office of Hawaiian Affairs	3/18/97	4/7/97	7/16/97
16	State Dept. of Defense - Civil Defense	3/18/97	4/17/97	5/28/97
17	University of Hawaii - Environmental Center	3/18/97		
18	University of Hawaii - Water Resources	3/18/97		
	FEDERAL			
19	US Army Corps of Engineers	3/18/97	4/15/97	5/28/97
20	Dept. of Agriculture	3/18/97	4/21/97	5/28/97
21	Dept. of the Interior Fish and Wildlife (Kihei, Maui)	3/18/97		
22	Dept. of the Interior Fish and Wildlife	3/18/97	4/25/97	5/28/97
23	Federal Highways Administration	3/18/97		
24	Dept. of the Interior US Geological Survey	3/18/97		
	ELECTED OFFICIALS			
25	Avery Chumbly	3/18/97		
26	Linda Lingle	3/18/97		
27	County Council Chair	3/18/97		
	NON-GOVERNMENTAL AGENCIES/INDIVIDUALS			
28	Mr. Isacc Hall	4/9/97	4/22/97	7/16/97
29	DeKalb Genetics	4/9/97		
30	Kahului Regional Library	3/18/97		
31	Hawaii Audubon Society	3/27/97		
32	Hawaiian Commercial & Sugar Company	3/18/97		
33	Maui Humane Society	3/18/97		
34	Kihei Community Association	3/18/97	5/8/97	5/28/97
35	Elizabeth Russell		5/18/97	6/3/97
36	Maui Electric Company	3/18/97	4/5/97	5/28/97
37	Hawaiian Commercial & Sugar Company		5/22/97	6/24/97
38	Community Informational Meeting	5/7/97	5/7/97	5/28/97
39	Informational Meeting with Condo Associations - Nani Kai Hale, Kihei Kai, Maalea Surf, Kihei Beach Resort	5/6/97	5/6/97	5/28/97
	COUNTY OF MAUI			
40	Office of the Mayor	3/18/97	5/30/97	6/12/97 7/3/97
41	Board of Water Supply	3/18/97	4/30/97	5/28/97
42	Dept. of Parks and Recreation	3/18/97	4/2/97	5/28/97
43	Dept. of Public Works	3/18/97	5/7/97	5/28/97
44	Planning Department	3/18/97		

COPY

BENJAMIN J. CAYETANO
GOVERNOR

GARY GILL
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

April 15, 1997

Kazu Hayashida, Director
Department of Transportation
869 Punchbowl St.
Honolulu, HI 96813

Attn: Robert Siarot

Dear Mr. Hayashida:

Subject: Draft Environmental Assessment (EA) for Mokulele Highway/Puunene Bypass, Maui

We have the following comments to offer:

1. Consult with the neighbors nearest to the project site and interested community groups and document your contacts in the final EA.

2. State policy (HRS Chapters 26, 226, 264, 344) requires the promotion of alternative forms of transportation systems that reduce reliance on the private automobile, conserve energy, reduce pollution and provide safe accommodations for their users. Pursuant to this policy, what provisions are being made to create bicycle lanes or facilities, promote pedestrian safety and/or encourage other non-motorized modes of transportation?

3. The Maui Wood Treating Hazardous Waste Storage Area is located on Mokulele Highway. Will the proposed project encroach on an area which may contain hazardous wastes? If so what mitigation measures are planned?

If you have any questions, call Nancy Heinrich at 586-4185.

Sincerely,

GARY GILL
Director

c: Warren Unemori

BENJAMIN J. CAYETANO
GOVERNOR

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

IN REPLY REFER TO

July 16, 1997

Mr. Gary Gill, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96816

Dear Mr. Gill:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of April 15, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass and for participating in the environmental review process. We offer the following response to each of the numbered topics addressed.

1. On May 7, 1997, the State Department of Transportation held an informational meeting at the Kihei School to inform the public and affected agencies of the State's plans for the proposed project. The notice of this meeting was published in the local newspaper and at least 19 persons were in attendance (not all provided their names on the sign-up sheet). A listing of those in attendance and excerpts of testimony is provided in Appendix J of the Final Environmental Assessment. Property owners with land adjacent to the project have also been notified of the proposed project.

2. Section 3.4 of the Final Environmental Assessment discusses "Transportation systems Management" alternatives that may be available which could reduce reliance on the private automobile for transportation purposes.

   In addition, during the detailed design phase, the feasibility of a bikelane facility within the project limits will be explored. Phased bikelane improvements may be feasible in terms of grading, signage, and provisions for future improvements. Bikelane improvements outside of the project area are not included within the scope of this project.

3. The Maui Wood Treating Hazardous Waste Storage Area is located near the Puunene Sugar Mill. The proposed improvements in this area, however, will move the Mokulele Highway further away from the Maui Wood Treating Hazardous Waste Storage Area. As much, the proposed project will in no way impact the hazardous waste storage associated with this facility.

Very truly yours,

ROBERT O. SIAROT
District Engineer, Maui

Benjamin J. Cayetano
GOVERNOR

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

OFFICE OF THE SUPERINTENDENT

HERMAN M. AIZAWA, Ph.D.
SUPERINTENDENT
[redacted]
FACILITIES' COPY

March 31, 1997

MEMO TO: Mr. Robert Siarot, Maui District Engineer
Department of Transportation

FROM: Herman M. Aizawa, Ph.D., Superintendent
Department of Education

SUBJECT: Draft EA for Mokulele Highway/Puunene Bypass
Project No. 311A-02-92

The Department of Education has no comment on the subject draft environmental assessment.

Thank you for the opportunity to respond.

HMA:SB:jml

cc: A. Suga, OBS
W. Unemori
D. Hulse
G. Gill, OEQC
R. Murakami, MDO

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Dr. Herman Aizawa, Superintendent
Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

Dear Dr. Aizawa:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of March 31, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass and for participating in the environmental review process.

Very truly yours,

For ROBERT O. SIAROT
District Engineer, Maui

BENJAMIN J. CAYETANO
GOVERNOR
STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

KALI WATSON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

JOBIE M. K. M. YAMAGUCHI
DEPUTY TO THE CHAIRMAN

PBR HAWAII
RECEIVED
APR 9 1997
Project
Project No.

April 8, 1997

Mr. Robert Siarot
District Engineer
Department of Transportation
650 Palapala Drive
Kahului, Hawaii 96732

Dear Mr. Siarot:

Subject: MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for allowing our review of the draft environmental assessment for the subject project.

Please note that portions of the planned highway right-of-way include State lands in the process of being subdivided for conveyance to the Department of Hawaiian Home Lands (DHHL) pursuant to a Land Board action on October 28, 1994. Specifically, approximately 646 acres of the southern portion of TMK: 3-8-08: por. 1 and approximately 80 acres of the northern portion of TMK: 3-8-08: por. 8, are being conveyed. (See Exhibit-A)

We request that the project include the maximum number of access points from the new DHHL properties onto the proposed highway at appropriate locations, as well as details on intersection improvements required.

DHHL has enclosed copies of maps of the old Naval Air Station that indicate that remnant building foundations, underground storage tanks and cast iron pipes may be situated within the proposed 200' ROW for the project. (See Exhibit-B)

Rather than a 200' ROW, would a 120' ROW be adequate to meet the traffic demands anticipated in long-range highway planning studies? According to design standards for primary arterials, a 120' ROW would be adequate for a divided highway with at least two travel lanes in each direction. This may save more land for other uses, and reduce land acquisition and development costs.

Thank you for the opportunity to provide our comments. Should you have any questions, please call Mr. Darrell Yagodich of our Planning Office at 586-3847.

Aloha,

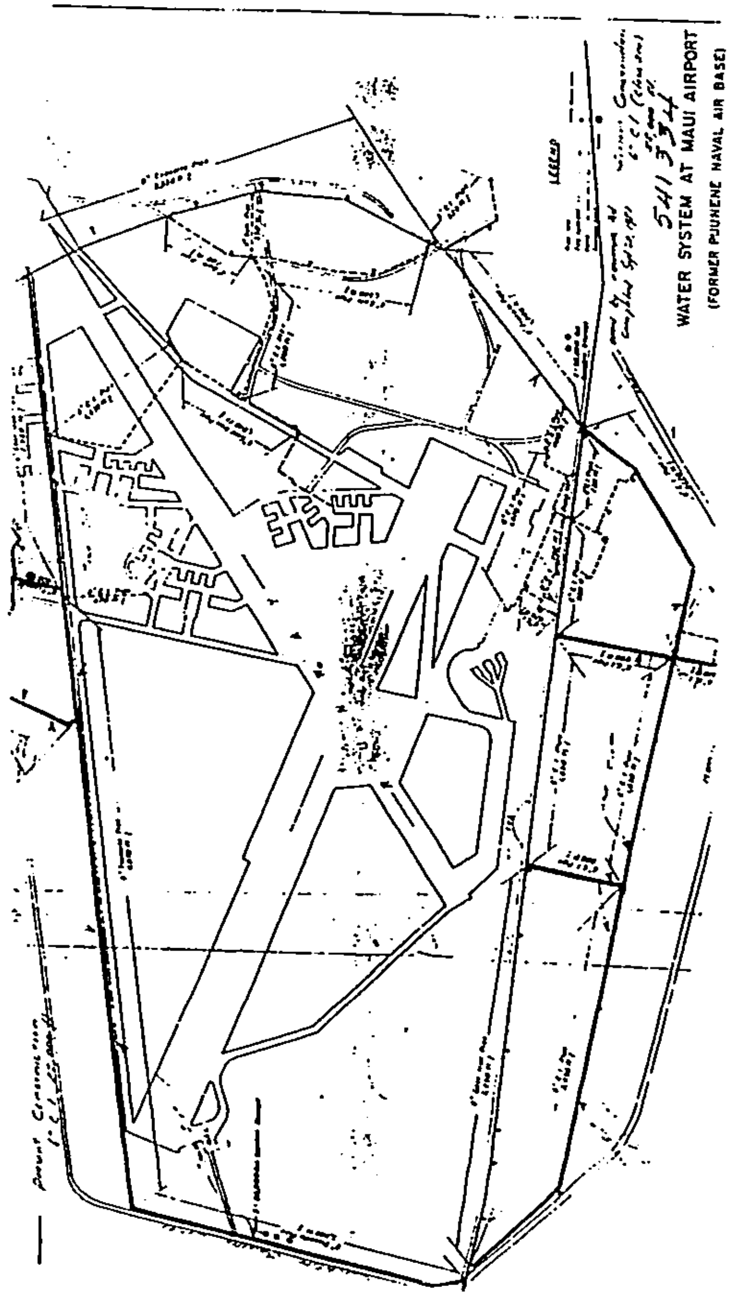
Kali Watson

KALI WATSON, Chairman
Hawaiian Homes Commission

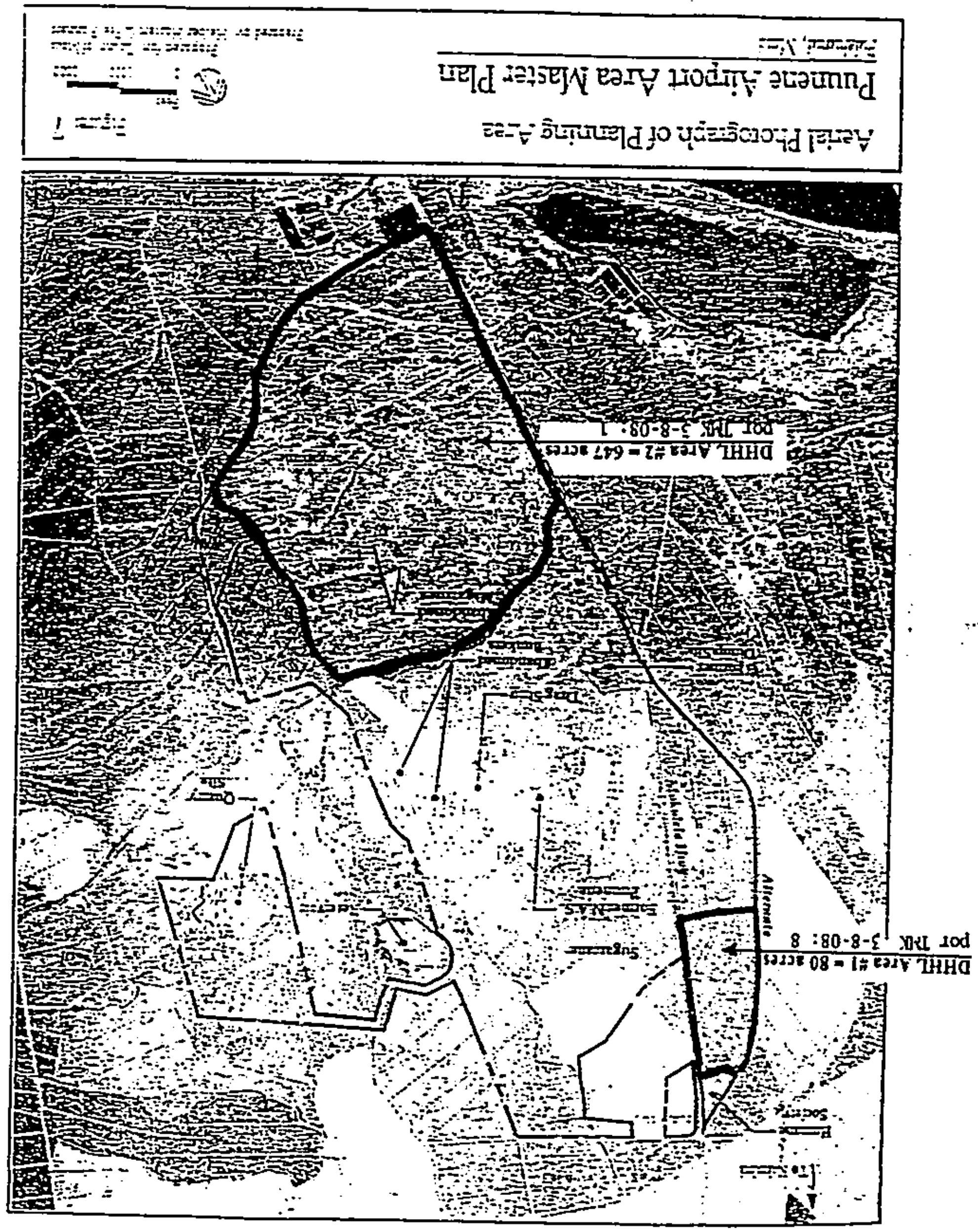
Enclosures

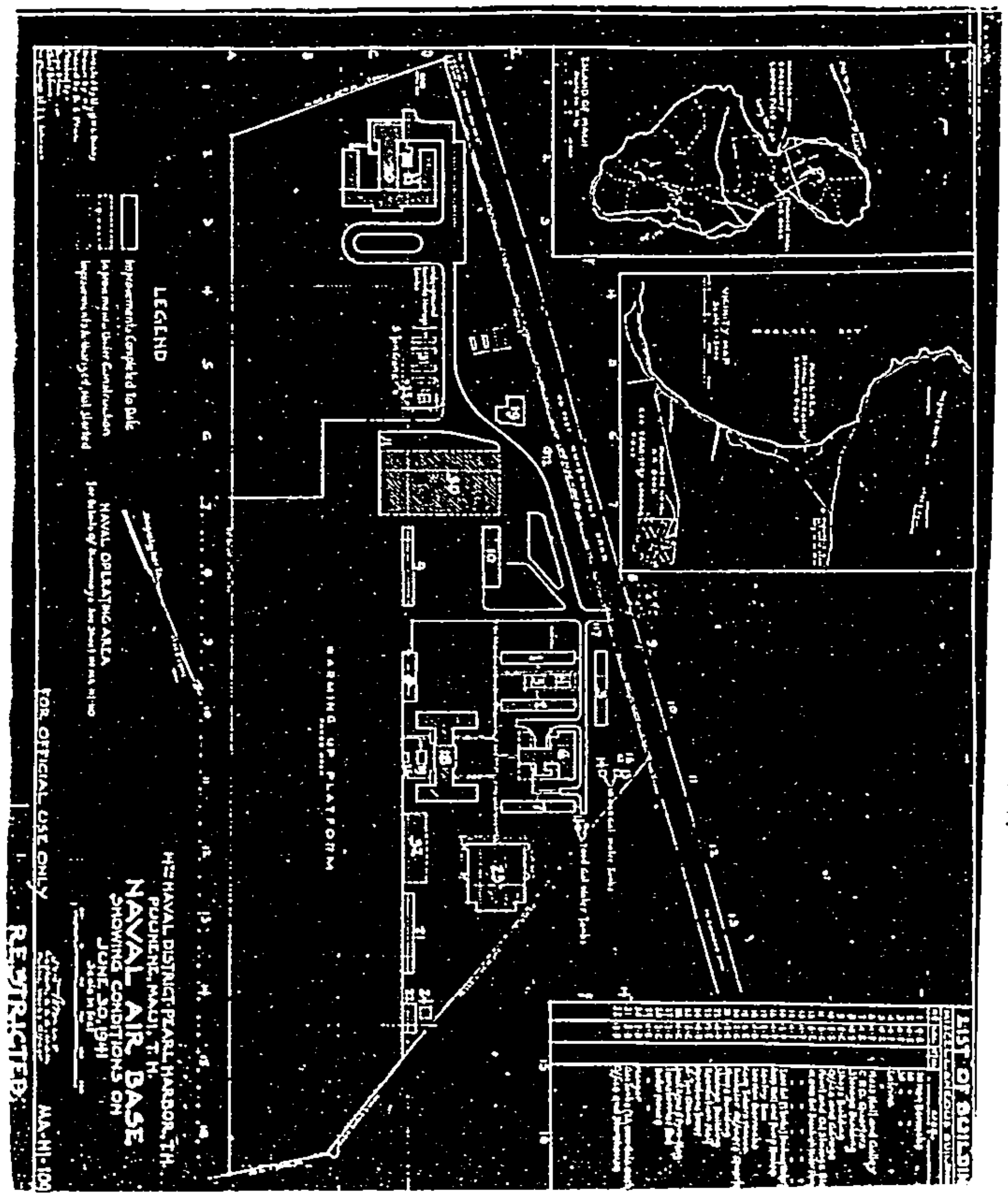
c: Office of Environmental Quality Control
PBR Hawaii
Warren S. Unemori Engineering, Inc.

ATTACHMENT Exhibit-B Page 1



ATTACHMENT Exhibit-A





BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO:
HWY-M 2.148-97

May 28, 1997

Mr. Kali Watson, Chairman
Hawaiian Homes Commission
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, Hawaii 96805

Dear Mr. Watson:

SUBJECT: **COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT MOKULELE HIGHWAY/PUUNENE BYPASS PROJECT NO. 311A-02-92**

Thank you for your comments of April 8, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We have reviewed your comments and offer the following.

1. We concur that the Department of Hawaiian Home Lands will receive state owned land pursuant to the Board of Land and Natural Resources action of October 28, 1994. This information and your comments will be contained in the Final Environmental Assessment to clarify the status of this parcel.

   Access into the parcel will be designed in accordance with design standards applicable to limited access highways which permit access points every half mile. Required intersection improvements are based on the land uses proposed for the property and traffic levels generated.

2. We have reviewed the enclosed Exhibit B depicting the old Naval Air Station improvements. Presently, there is no surface indication that remnant foundations or other facilities exist within the project's 200' right-of-way. Should these remnant improvements be uncovered during project construction, appropriate measures will be employed in accordance with State and County regulations to remove the remnant facilities if necessary.

3. A 160' right-of-way is the minimum suitable for the improvements proposed. During the project design phase, every effort will be made to minimize the amount of land area required to reduce land acquisition and development costs as recommended in your comments.

Once again, thank you for participating in the environmental review process.

Very truly yours,

For ROBERT O. SIAROT
District Engineer, Maui

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

LAWRENCE MIIKE
DIRECTOR OF HEALTH

PBR HAWAII
RECEIVED
MAY 13 1997
Project
Project No.

In reply, please refer to:

May 2, 1997

97-063/epo

Mr. Robert Siarot, District Engineer
State of Hawaii Department of Transportation
650 Palapala Drive
Kahului, Maui, Hawaii 96732

Dear Mr. Siarot:

Subject: DRAFT ENVIRONMENTAL ASSESSMENT (DEA)
Project: Mokulele Highway/Puunene Bypass
PBR Project No. 311A-02-92
Location: Wailuku, Maui, Hawaii
TMK: 3-8-4: Por. 23, 24, 27

Thank you for allowing us to review and comment on the subject project. We have the following comments to offer:

Control of Fugitive Dust

The proposed project provides for the widening of the existing two-lane Mokulele Highway to a four-lane highway between Piilani Highway and Puunene Avenue and for a connection to the Mokulele Highway with the proposed construction of a highway bypass of Puunene Town, intersecting Kuiheleani Highway with the proposed Maui Lani Parkway.

In the past, there have been numerous fugitive dust complaints received by the Clean Air Branch in Maui from various locations along Mokulele Highway. In addition, the arid climatic conditions and fairly strong wind conditions that exist in the area may create unforeseen dust problems. With these concerns and problems as indicators, there is a significant potential for fugitive dust emissions to be generated during construction activities associated with the proposed project. It is suggested that a dust control management plan be developed which identifies and addresses activities having a potential to generate fugitive dust. Implementation of adequate dust control measures during all phases of construction is warranted. Construction activities must comply with provisions of Hawaii Administrative Rules, Chapter 11-60.1, "Air Pollution Control," Section 11-60.1-33 on Fugitive Dust.

The contractor should provide adequate means to control dust from road areas and during the various phases of construction activities. These means include, but are not limited to:

a. planning the different phases of construction, focusing on minimizing the amount of dust-generating materials and activities, centralizing material transfer points and on-site vehicular traffic routes, and locating potentially dusty equipment in areas of the least impact;

b. providing an adequate water source at the site *prior* to start up of construction activities;

c. landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;

d. controlling of dust from shoulders, project entrances, and access roads; and

e. providing adequate dust control measures during weekends, after hours, and prior to daily start up of construction activities.

If you have any questions regarding fugitive dust, please contact Mr. Timothy Carvalho of the Clean Air Branch at 586-4200.

Noise Concerns

1. Construction activities must comply with the provisions of Hawaii Administrative Rules, Chapter 11-46, "Community Noise Control".

   a. The contractor must obtain a noise permit if the noise levels from the construction activities are expected to exceed the maximum permissible sound levels of the regulations as stated Section 11-46-6(a).

   b. Construction equipment and on-site vehicles requiring an exhaust of gas or air must be equipped with mufflers as stated in Section 11-46-6(b)(1)(A).

   c. The contractor must comply with the conditional use of the permit as specified in the regulations and the conditions issued with the permit as stated in Section 11-46-7(d)(4).

Should there be any questions regarding this matter, please contact Mr. Jerry Haruno, Environmental Health Program Manager of the Noise, Radiation & Indoor Air Quality Branch at 586-4701.

Water Pollution

1. The applicant should contact the Army Corps of Engineers to identify whether a federal permit (including a Department of Army permit) is required for this project. If a federal permit is required, then a Section 401 Water Quality Certification is required from the State Department of Health, pursuant to Section 401 (a)(1) of the federal Water Pollution Control Act (commonly known as the Clean Water Act).

2. A National Pollutant Discharge Elimination System (NPDES) permit is required for any discharge to waters of the State including the following:

   a. Storm water discharges relating to construction activities for projects equal to or greater than five acres;
   b. Storm water discharges from industrial activities;
   c. Construction dewatering activities;
   d. Cooling water discharges less than one million gallons per day;
   e. Groundwater remediation activities; and
   f. Hydrotesting water.

   Any person requesting to be covered by a NPDES general permit for any of the above activities should file a Notice of Intent with the Department's Clean Water Branch at least 30 days prior to commencement of any discharge to waters of the State.

Any questions regarding these comments should be directed to Mr. Denis Lau, Branch Chief, Clean Water Branch at 586-4309.

Sincerely,

Bruce S. Anderson

BRUCE S. ANDERSON, Ph.D.
Deputy Director for Environmental Health

c: CAB
NR&IAQB
CWB

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Dr. Bruce Anderson, Ph.D.
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Anderson:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of May 2, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We offer the following response to each of the topics addressed.

Control of Fugitive Dust

Control of fugitive dust has been and will continue to be a high priority during all planning, design, and construction activities in regard to the Mokulele Highway/Puunene Bypass project. We concur that implementation of adequate dust control measures during all phases of construction is warranted. We wish to emphasize, however, that the overall air quality from vehicular emissions after project development will be improved when compared to the "no-build" air quality condition.

Although a contractor has not been selected for the project, the State Department of Transportation's (SDOT) contractors for the improvements will implement Best Management Practices (BMP) will contain a dust control management plan to identify and address activities having a potential to generate fugitive dust. The dust control measures established by the Best Management Practices will reflect those provided in your comments as well as those listed in Section 5.3.13 of the Draft Environmental Assessment.

Noise Concerns

We concur that noise associated with the proposed project can cause conflicts especially from construction activities proximate to residential areas. Noise during construction will be mitigated by compliance with all applicable noise regulations related to noise permits, mufflers for construction equipment, and implementation of conditional use permits as specified in the regulations and referenced in your comments.

Water Pollution

The proposed Mokulele Highway/Puunene Bypass project will comply with all applicable Federal, State, and City regulations regarding potential work within waterways. At the appropriate time in the planning and development process, the State Department of Transportation will work with the Corps to obtain all applicable permits. The Army Corps of Engineers has reviewed the subject Draft Environmental Assessment and provided comments regarding the project's permitting requirements.

We also concur that a National Pollutant Discharge Elimination System (NPDES) permit is required for any discharge to waters of the State. These permits will be applied for at least 30 days prior to commencement of any discharge by the SDOT contractors.

Thank you once again for participating in the environmental review process.

Very truly yours,

For ROBERT O. SIAROT
District Engineer, Maui

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
DEPUTIES
Gilbert Coloma-Agaran

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

RECEIVED
DOT-HWYS
MAUI DISTRICT OFFICE
1997 MAY -7 PM 3:08

May 1, 1997

Mr. Robert Siarot, District Engineer
State of Hawaii Department of Transportation
650 Palapala Drive
Kahului, Maui, Hawaii 96732

LOG NO: 19217 ✓
DOC NO: 9704SC35

Dear Mr. Siarot:

SUBJECT: **Chapter 6E-8 Historic Preservation Review of a Draft Environmental Assessment Prepared for the Proposed Mokulele Highway/Puunene Bypass, Project No. 311A-02-92, Wailuku District, Maui**
TMKs: 3-8-004: Portions of 23, 24 & 27; 3-8-005: Portions of 02, 19, 20, 21, 22, 27, 28, 29, 30, 31 & 34; 3-8-006: Portions of 02 03, 04, & 20; 3-8-008: Portions of 01, 07, 08 & 32; 3-8-077: Portion of 09

Thank you for the opportunity to comment on the draft Environmental Assessment (EA) prepared for the proposed Mokulele Highway/Puunene Bypass project. The subject undertaking will consist of two phases of roadway improvements: the widening of Mokulele Highways and Puunene Avenue from two-lane to four-lane roadways; and the future construction of the "Puunene Bypass" by the County of Maui. Our review is based on historic reports, maps, and aerial photographs maintained at the State Historic Preservation Division; no field inspection was made of the subject parcels.

We have previously reviewed an archaeological inventory survey of the proposed Mokulele Highway/Puunene Bypass Corridor, and concurred with the findings of the survey (*Inventory Survey of Puunene Bypass/Mokulele Highway Improvements Corridor, Pulehunui and Wailuku Ahupua'a, Wailuku District, Island of Maui, Hawai'i.* [TMK: 3-8: 04, 05, 06, 07]. 1996. Burgett & Spear). At the time our office concluded its review of the inventory survey, it appeared that the proposed widening of Mokulele Highway would have an "adverse effect" on a significant historic site (SIHP No. 50-50-04-4164, Naval Air Station Puunene) known to lie just to the east of the existing roadway. Site 4164 includes what may be a large dump site for abandoned aircraft and machinery which lies just to the east of the existing Mokulele Highway corridor. Thus, we advised the archaeological consultants that an acceptable mitigation plan would be needed in order to ensure that the proposed widening of Mokulele Highway would have "no adverse effect" on Site 4164.

Subsequent to our previous determination of "adverse effect" on Site 4164 and the recommendation to prepare a mitigation plan (see attached copy of Hibbard to Spear, dated July 8, 1996, DOC NO: 9606SC22); we received copies of 1951 aerial photographs taken of the vicinity of the dump site. The aerial photographs clearly show existing topographic features such as the highway, railroad berm, and the margins of the dump site. Our review of these photographs indicates that the proposed widening of Mokulele Highway at this point will not, in fact, adversely affect the dump site.

Additionally, an addendum to the archaeological inventory survey report was prepared (*Addendum to: Inventory Survey of Puunene Bypass/Mokulele Highway Improvements Corridor, Pulehunui and Wailuku Ahupua'a, Wailuku District, Island of Maui, Hawai'i. [TMK: 3-8, 04, 05, 06, 07]*. 1996. Burgett & Spear). This addendum documents several representative structures from the Plantation Camp at McGerrow Village since the village may be under impact from the proposed highway improvements. Subsequent to the field work conducted pursuant to the subject undertaking, all buildings in the proposed corridor impact zone have been razed, and one structure (Building 4014) was preserved and moved to the grounds of The Sugar Museum.

Consequently, in view of these facts, we can now say that the proposed undertakings will have "no effect" on significant historic sites known to be in the vicinity of the project site.

Should you have any questions, please feel free to call Sara Collins at 587-0013.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

SC:jen

cc: Ms. Elizabeth Anderson, Cultural Resources Commission, Maui Planning Department, 250 S. High Street, Wailuku, HI 96793

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO

HWY-M 2.148-97

May 28, 1997

Department of Land and Natural Resources
State Historic Preservation Division
33 South King Street, 6th Floor
Honolulu, Hawaii 96813

Dear Mr. Hibbard:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of May 1, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We offer the following response regarding your comments.

We concur with your assessment of our archaeological inventory surveys and report, and that the proposed project will result in "no significant effect" on historic sites that may be in the vicinity of the project site.

Thank you once again for participating in the environmental review process.

Very truly yours,

For ROBERT O. SIAROT
District Engineer, Maui

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Flr., Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

BENJAMIN J. CAYETANO, GOVERNOR
SEIJI F. NAYA, DIRECTOR
BRADLEY J. MOSSMAN, DEPUTY DIRECTOR
RICK EGGED, DIRECTOR, OFFICE OF PLANNING

Tel.: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-6592

April 3, 1997

PBR HAWAII
RECEIVED
APR 1 6 1997
Project
Project No.

Mr. Robert Siarot
District Engineer
Highways Division
Department of Transportation
State of Hawaii
650 Palapala Drive
Kahului, Hawaii 96731

Dear Mr. Siarot:

Subject: Draft Environmental Assessment, Mokulele Highway/ Puunene Bypass, Project No. 311A-02-92

We have reviewed the above assessment and do not have any comments on the document.

If you have any questions, please contact Christina Meller of our CZM Program at 587-2845.

Sincerely,

Rick Egged
Director
Office of Planning

cc: Warren S. Unemori Engineering, Inc.
PBR Hawaii
OEQC

BENJAMIN J. CAYETANO, GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA, DIRECTOR
DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Mr. Rick Egged, Director
Office of Planning
Department of Business, Economic Development & Tourism
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Egged:

SUBJECT: **COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT MOKULELE HIGHWAY/PUUNENE BYPASS PROJECT NO. 311A-02-92**

Thank you for your comments of April 3, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass and for participating in the environmental review process.

Very truly yours,

For ROBERT O. SIAROT
District Engineer, Maui

BENJAMIN J. CAYETANO
GOVERNOR
SEIJI F. NAYA
DIRECTOR
BRADLEY J. MOSSMAN
DEPUTY DIRECTOR
RICK EGGED
DIRECTOR, OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
OFFICE OF PLANNING
235 South Beretania Street, 6th Flr., Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Tel.: (808) 587-284
Fax: (808) 587-282

RECEIVED MAY 5 3 16 PM '97 DEPT. OF TRANSPORTATION HIGHWAYS DIVISION

RECEIVED DOT-HWYS MAUI DISTRICT OFFICE 1997 MAY -7 PM 3 08

Ref. No. P-6633

April 21, 1997

MEMORANDUM

TO: Kazu Hayashida, Director
Department of Transportation

FROM: Rick Egged
Director, Office of Planning

SUBJECT: Draft Environmental Assessment for Mokulele Highway/Puunene Bypass, Project No. 311A-02-92, Maui

We have reviewed the subject document and have the following comments.

The proposed project is needed to support existing and future growth in the area. In addition to widening, there will also be other drainage improvements that may have environmental or ecological impacts. We note in particular the statement that the existing drainage facilities under Mokulele Highway are inadequate to handle the 100-year flood that would flow to Kealia Pond. We are concerned about the potential polluted runoff and degradation of the receiving coastal waters. In this regard, the environmental impact statement should clarify in detail the improvements and their likely environmental impacts.

If there are any questions, please contact Howard Fujimoto of our Coastal Zone Management Program at 587-2898.

DIRECTOR'S OFFICE DEPT. OF TRANSPORTATION MAY 2 9 00 AM '97

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Mr. Rick Egged, Director
Office of Planning
Department of Business, Economic Development & Tourism
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Egged:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of April 3, 1997 and April 21, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We offer the following response regarding your April 21, 1997 comments.

We concur that the project is needed to support existing and future growth in the area. We also agree that drainage improvements will be required to mitigate the inadequacy of existing drainage facilities and provide for the future drainage requirements associated with the Mokulele Highway Widening improvements.

Presently, the elevation of Mokulele Highway and the size of existing drainage culverts restricts heavy surface flows mauka of Mokulele Highway. During intense storms, this water can overflow the existing highway essentially isolating the Kihei, Wailea, and Makena areas from Kahului. However, with development of the proposed highway widening and drainage improvements, this condition will be mitigated by raising the roadway surface and directing surface flows to a system of larger culverts adequately sized to limit potential flooding of the highway and to permit better control of surface flows.

Therefore, it is the current condition that can potentially degrade the coastal receiving waters by restricting natural flows and permitting uncontrolled discharge of water and debris over the highway into the Kealia Pond receiving waters. During the engineering design process, officials from the Fish and Wildlife Service will be consulted to ensure that future improvements are designed to permit the maximum control of surface flows while mitigating potential water quality impacts. Best Management Practices will also be incorporated during construction to mitigate potential soil erosion of exposed areas.

Thank you once again for participating in the environmental review process.

Very truly yours,

fr- ROBERT O. SIAROT
District Engineer, Maui

PBR HAWAII
RECEIVED
APR 23 1997
Project
Project No. ______

(P)1302.7

APR 22 1997

Department of Transportation
State of Hawaii
650 Palapala Drive
Kahului, Maui, Hawaii 96732

Attention: Mr. Robert Siarot

Gentlemen:

Subject: Mokulele Highway/Puunene Bypass
Draft Environmental Assessment
Wailuku, Maui, Hawaii

Thank you for the opportunity to review the subject document. We have no comments to offer.

If there are any questions, please have your staff contact Mr. Ralph Yukumoto of the Planning Branch at 586-0488.

Sincerely,

Gordon Matsuoka

GORDON MATSUOKA
State Public Works Engineer

RY:jk
c: Warren. S. Unemori Engineering, Inc.
✓ PBR Hawaii
OEQC

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

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

Dear Mr. Matsuoka:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT MOKULELE HIGHWAY/PUUNENE BYPASS PROJECT NO. 311A-02-92

Thank you for your comments of April 22, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass and for participating in the environmental review process.

Very truly yours,

For ROBERT O. SIAROT
District Engineer, Maui

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

RECEIVED
'97 APR 30 P3:52
OFC. OF ... QUALITY CO...

April 07, 1996

State of Hawaii Department of Transportation
650 Palapala Drive
Kahului, Maui HI 96732

Subject: Draft Environmental Assessment (DEA) for the Mokulele Highway/Puunene Bypass, Island of Maui.

Dear Sir/Madam:

Thank you for the opportunity to review the Draft Environmental Assessment (DEA) for the Mokulele Highway/Puunene Bypass, Island of Maui. The Department of Transportation proposes the improvement of Mokulele Highway between Puunene Avenue and Piilani Highway to a high quality four-lane highway. The eventual construction of the Puunene Bypass, which could connect Mokulele Highway to Kuihelani Highway, is also planned.

The Office of Hawaiian Affairs has no objections to the proposed road improvement at this time. Based on information contained in the DEA, the development apparently bears no significant long-term adverse impacts on either adjacent ecosystems or upon existing farmland. There are no known rare, endangered, or threatened wildlife species and no known archaeological remains exist in the area. Furthermore, the proposed improvement will neither significantly affect scenic resources nor air quality or noise level.

Please contact Lynn Lee, Acting Officer of the Land and Natural Resources Division, or Luis A. Manrique, should you have any questions on this matter.

Sincerely yours,

Martha Ross

Martha Ross
Deputy Administrator, Programs

LM:lm

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

IN REPLY REFER TO

July 16, 1997

Ms. Martha Ross, Deputy Administrator, Programs
State of Hawaii
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

Dear Ms. Ross:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT MOKULELE HIGHWAY/PUUNENE BYPASS PROJECT NO. 311A-02-92

Thank you for you comments of April 7, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass and for participating in the environmental review process.

Very truly yours,

ROBERT O. SIAROT
District Engineer, Maui

BENJAMIN J. CAYETANO
GOVERNOR

MAJOR GENERAL EDWARD V. RICHARDSON
DIRECTOR OF CIVIL DEFENSE

ROY C. PRICE, SR.
VICE DIRECTOR OF CIVIL DEFENSE

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

PBR HAWAII
RECEIVED
APR 22 1997
Project
Project No.

PHONE (808) 733-4300
FAX (808) 733-4287

April 17, 1997

TO: Department of Transportation
650 Palapala Drive
Kahului, Maui, HI 96732

ATTN: Mr. Robert Siarot

FROM: Roy C. Price, Sr.
Vice Director of Civil Defense

SUBJECT: MOKULELE HIGHWAY/PUUNENE BYPASS DRAFT ENVIRONMENTAL IMPACT STATEMENT

We appreciate the opportunity to comment on the subject project, Wailuku, Maui, Hawaii, TMKs: 3-8-4:portions of 23, 24, and 27; 3-8-5:portions of 2, 19, 20, 21, 22, 27, 28, 29. 30, 31, and 34; 3-8-6:portions of 2, 3, 4, and 20; 3-8-8:portions of 1, 7, 8, and 32; 3-8-077:portion of 9.

We do not have negative comments specifically directed at the proposed highway upgrade. Portions of the highway upgrade are located in areas not covered by existing outdoor warning devices (sirens). Using the information presented, State Civil Defense would recommend at least two sirens be added and one siren be relocated and upgraded. These sirens are annotated in red, those sirens in black are existing sirens in the area, and those in dashed/black are to be upgraded and relocated. These mitigation measures are recommended for public health and safety. Development plans should be coordinated with both State and county civil defense at the latter stages of the development process to determine the need and possible installation of these solar powered outdoor warning sirens by the petitioner.

Our State Civil Defense planners and technicians are available to discuss this further if there is a requirement. Please have your staff call Mr. Norman Ogasawara at 733-4300.

Enc.

c: Warren S. Unemori Engineering, Inc.
2145 Wells Street, Suite 403
Wailuku, Maui, Hawaii 96793
Attn: Warren Unemori

PBR Hawaii
Pacific Tower, Suite 650
1001 Bishop Street
Honolulu, Hawaii 96813
Attn: David Hulse

Office of Environmental Quality Control
235 South Bertania Street, Room 702
Honolulu, Hawaii 96813

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO:
HWY-M 2.148-97

May 28, 1997

Mr. Roy C. Price, Sr.
Vice Director of Civil Defense
Office of the Director of Civil Defense
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Dear Mr. Price:

SUBJECT: **COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT MOKULELE HIGHWAY/PUUNENE BYPASS PROJECT NO. 311A-02-92**

Thank you for your comments of April 17, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We have reviewed your comments and offer the following.

We concur that future development plans should be coordinated with Civil Defense at the latter stages of the development process. At the appropriate time in the development process, the State Department of Transportation will coordinate and make provisions for emergency warning systems in accordance with applicable rules and regulations.

Thank you once again for participating in the environmental review process.

Very truly yours,

For ROBERT O. SIAROT
District Engineer, Maui

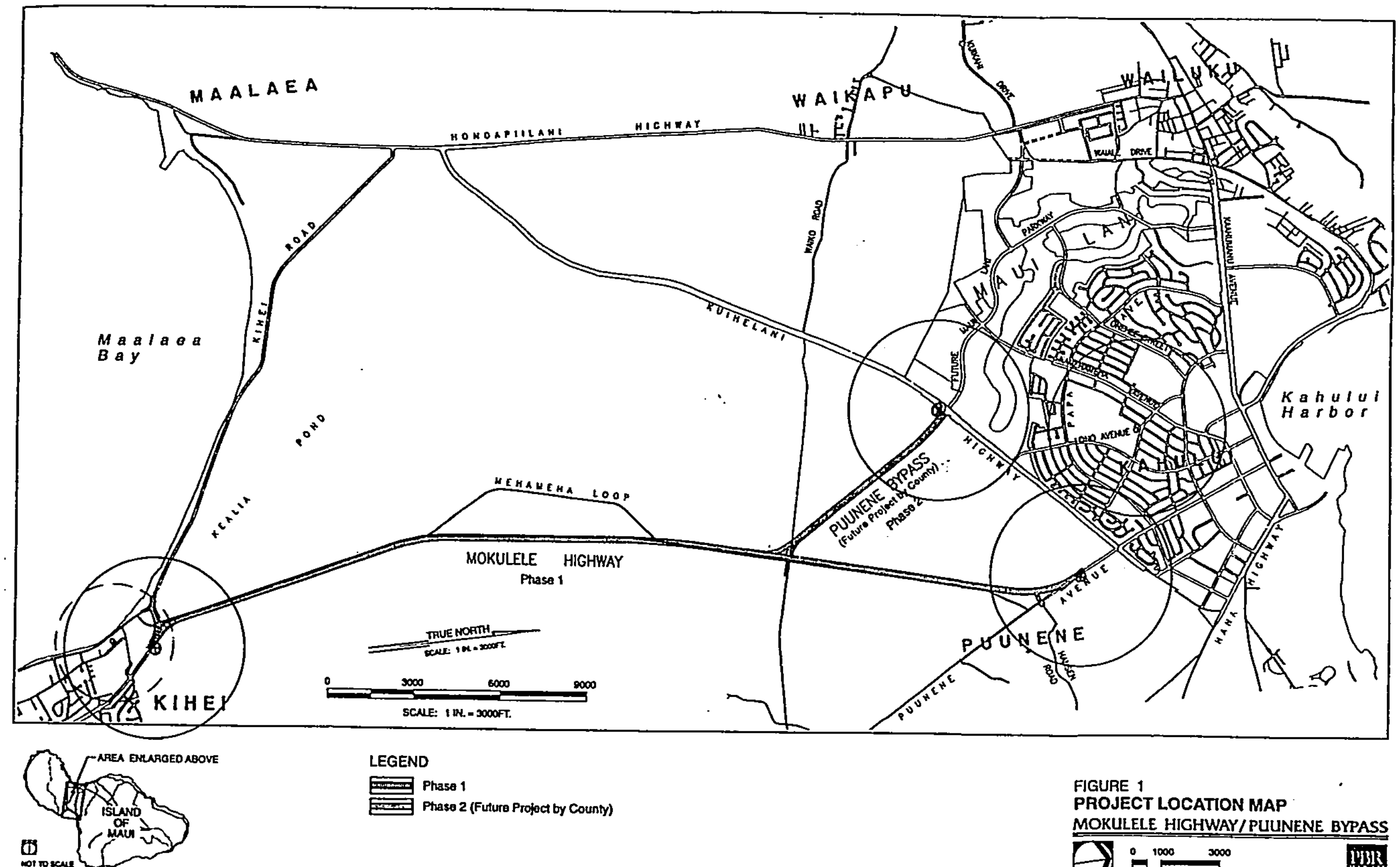


FIGURE 1
PROJECT LOCATION MAP
MOKULELE HIGHWAY/PUUNENE BYPASS

0 1000 3000 FEET

February, 1997

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

April 15, 1997

PBR HAWAII
RECEIVED
APR 16 1997
Project
Project No.

Planning and Operations Division

Mr. Robert Siarot, District Engineer
State of Hawaii
Department of Transportation
650 Palapala Drive
Kahului, Maui, Hawaii 96732

Dear Mr. Siarot:

Thank you for the opportunity to review and comment on the Draft Environmental Assessment (DEA) for the Mokulele Highway and Puunene Bypass Project, Wailuku, Maui (Project No. 311A-02-92). The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. Based on the information provided, the proposed work may involve work within several waterways marked on the U.S. Geological Service quadrangle maps. If work will occur in or adjacent to these waterways, the project may require a DA permit. Please contact Mr. Benton Ching of our Regulatory Section at 438-9258 (extension 13) for further consultation and refer to file number 970000156.

b. The flood hazard information provided on page 17 of the DEA is correct.

Sincerely,

Paul Mizue, P.E.
Acting Chief, Planning
and Operations Division

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Mr. Paul Mizue, P.E.
Acting Chief, Planning and Operations Division
Department of the Army
Pacific Ocean Division, Corps of Engineers
Fort Shafter, Hawaii 96858-5440

Dear Mr. Mizue:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT MOKULELE HIGHWAY/PUUNENE BYPASS PROJECT NO. 311A-02-92

Thank you for your comments of April 15, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We have reviewed your comments and offer the following.

The proposed Mokulele Highway/Puunene Bypass project will comply with all applicable Federal, State, and City regulations regarding potential work within waterways. At the appropriate time in the planning and development process, the State Department of Transportation will work with the Corps to obtain all applicable permits.

Thank you once again for participating in the environmental review process.

Very truly yours,

for ROBERT O. SIAROT
District Engineer, Maui

USDA

United States Department of Agriculture

Natural Resources Conservation Service

P.O. Box 50004
Honolulu, HI
96850

Our People...Our Islands...In Harmony

PBR HAWAII RECEIVED
APR 2 2 1997
Project
Project No.

April 21, 1997

Mr. Robert Siarot
District Engineer
650 Palapala Drive
Kahului, Hawaii 96732

Dear Mr. Siarot:

Subject: Draft Environmental Assessment (DEA) - Mokulele Highway/Puunene Bypass, Project No. 311A-02-92

We have reviewed the above mentioned document and offer the following comment:

The project cuts through prime farm land as well as dissecting the agricultural parcel thus making the smaller parcel economically non-feasible to farm.

Thank you for the opportunity to review the above document.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

cc:
Mr. Warren S. Unemori, Warren S. Unemori Engineering, Inc. 2145 Wells Street, Suite 403, Wailuku, HI 96793
Mr. David Hulse, PBR Hawaii, Pacific Tower, Suite 650, 1001 Bishop Street, Honolulu, HI 96813
Mr. Gary Gill, Director, Office of Environmental Quality Control, 235 S. Beretania St., Rm. 702, Honolulu, HI 96813

The Natural Resources Conservation Service works hand-in-hand with the American people to conserve natural resources on private lands. AN EQUAL OPPORTUNITY EMPLOYER

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Mr. Kenneth M. Kaneshiro, State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, Hawaii 96850

Dear Mr. Kaneshiro:

SUBJECT: **COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT MOKULELE HIGHWAY/PUUNENE BYPASS PROJECT NO. 311A-02-92**

Thank you for your comments of April 21, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We have reviewed your comments and offer the following.

Although the future Puunene Bypass will utilize prime agricultural land and create a smaller parcel, the future economic feasibility of plantation agriculture on the smaller parcel is difficult to determine at this time. When the Puunene Bypass is built, the economic feasibility of plantation agriculture on the smaller parcel may no longer exist and smaller diversified agricultural operations may be more feasible.

Thank you once again for participating in the environmental review process.

Very truly yours,

for ROBERT O. SIAROT
District Engineer, Maui

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Pacific Islands Ecoregion
300 Ala Moana Blvd., Room 3108
P.O. Box 50088
Honolulu, Hawaii 96850
Telephone: (808)541-3441; Fax: (808)541-3470

APR 28 1997

In reply refer to: CMR

Mr. Robert Siarot, District Engineer
State of Hawaii Department of Transportation
650 Palapala Drive
Kahului, Maui, Hawaii 96732

APR 25 1997

Dear Mr. Siarot,

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Environmental Assessment for Mokulele Highway/Puunene Bypass (Project No. 311A-02-92). The Mokulele Highway widening project consists of the addition of two lanes to establish a four-lane, divided arterial between Piilani Highway and the existing Puunene Avenue. The Puunene Bypass would bypass Puunene Town and intersect Kuiheleani Highway at the proposed Maui Lani Parkway. The Service provides the following comments for your consideration.

Page 8, Third full paragraph, Project Overview, 2.2 Landownership. The discussion on impacts to Kealia Pond National Wildlife Refuge (NWR) should be expanded to mention that the proposed drainage structures would likely increase flooding to the access road and Refuge facilities at mile 6 Mokulele Highway during heavy rainstorms (see below).

Page 10, Fourth paragraph, Alternative, 3.1 Widening Mokulele Highway and Puunene Avenue. We request that turn lanes to access public lands at Kealia Pond NWR (Mile 6 Mokulele Highway) be incorporated in your project design in consideration of public safety.

Page 23, First paragraph, Description of the Affected Environment, 4.2.6 Drainage. The proposed drainage structure, located about 500 ft northeast of the refuge access road (mile 6), would direct more flows onto the Refuge, likely resulting in flood damage to the access road and the Refuge's shop and equipment storage area.

Without sediment control structures, increased silt loads would likely reduce the water retention capacity of Kealia Pond and extend the period during which the pond is dry. Prolonged drying of the basin would contribute to dust problems at nearby condominiums and along N. Kihei Road.

We strongly recommend that this structure be relocated to protect refuge facilities. If the structure cannot be relocated, we request that mitigative measures such as diversion ditches and retention basins be included in your drainage plan. Engineering designs of drainage structures should be included in your final environmental assessment.

Page 29, Third paragraph, Potential Impacts and Mitigative Measures, 5.1.2 Drainage. Mitigative measures should be implemented to avoid flooding of Refuge facilities (see above).

Page 35 Third Paragraph, Potential Impacts and Mitigative Measures, 5.3.7 Topography/Drainage. We suggest that construction near refuge property be avoided during the rainy season to minimize accelerated sedimentation.

Thank you for the opportunity to comment on this project. Please contact Wildlife Biologist Mike Nishimoto (808) 875-1582 if there are questions on the above comments.

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

cc: Warren S. Unemori Engineering, Inc.
PBR Hawaii
Office of Environmental Quality Control
Jerry Leinecke, FWS, Honolulu
Kathy Smith, FWS, Maui

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

United States Department of the Interior
Fish and Wildlife Service
Pacific Islands Ecoregion
300 Ala Moana Blvd., Room 3108
P.O. Box 50088
Honolulu, Hawaii 96850

Dear Mr. Harper:

SUBJECT: **COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT MOKULELE HIGHWAY/PUUNENE BYPASS PROJECT NO. 311A-02-92**

Thank you for your comments of April 25, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We have reviewed your comments and offer the following.

Page 8 - As described in Appendix G of the Draft Environmental Assessment, the entire project area in the vicinity of Kealia Pond National Wildlife Refuge (NWR) is located within Federal Emergency Management Area (FEMA) Flood Zone A, A3, A4, and AO. As such, the proposed project will not increase the flood potential since the project area is already susceptible to flooding. At mile 6, we assume that access road and Refuge facilities were constructed above flood levels in accordance with the applicable flood hazard ordinance and will not be impacted by the project.

Page 10 - The proposed Right-of-Way at mile 6 allows sufficient capacity for the future development of a turn lane into Kealia Pond NWR. This facility could be constructed if warranted in the future.

Page 23 - Presently, flood waters pass over Mokulele Highway toward Kealia Pond during intense storms. After construction, drainage improvements will permit more water to flow under the roadway within new and existing drainage structures. Consequently, potential flood damage to the access road and the Refuge's shop and equipment storage area should not be increased compared to the current condition.

During construction, retention basins and other mitigation measures as described in the Environmental Assessment will be utilized to collect silt before it can enter Kealia Pond. Silt accumulation up slope of Mokulele Highway is not significant. After project construction, Kealia Pond will continue to function as a naturally occurring sedimentation basin and the amount of silt entering Kealia Pond should not increase. Similarly, drying of the Kealia Pond basin will not increase since the water retention capacity of Kealia Pond will not be reduced from increased siltation.

As applicable, the proposed Mokulele Highway/Puunene Bypass project will comply with all applicable Federal, State, and City regulations regarding erosion control and work within waterways. At the appropriate time in the planning and development process, the State Department of Transportation will work with the FWS to obtain all applicable permits. Design of drainage structures will be available for public review once they are completed.

Page 29 - As described above, the probability of flooding of Refuge facilities will not increase with development of the proposed project. Therefore, no mitigation measures in addition to the mitigation measures described in the Environmental Assessment are proposed.

Page 35 - The erosion control measures proposed will be designed to minimize or eliminate sedimentation during intense storm events. Therefore, construction of the proposed improvements will implemented to most efficiently utilize the limited financial resources available while protecting the quality of water which could potentially enter Kealia Pond.

Thank you once again for participating in the environmental review process.

Very truly yours,

For ROBERT O. SIAROT
District Engineer, Maui

ISAAC DAVIS HALL
ATTORNEY AT LAW
2087 WELLS STREET
WAILUKU, MAUI, HAWAII 96793
(808) 244-9017
FAX (808) 244-8775

OF COUNSEL
G. RICHARD GESCH

RECEIVED

'97 APR 23 P1:37

OFC. OF ENVIRONMENTAL QUALITY

April 22, 1997

Via Facsimile and U.S. Mail
808-586-0006

Governor Benjamin Cayetano
State of Hawaii
Office of the Governor
Hawaii State Capitol
Honolulu HI 96813

Re: Comments on the Draft Environmental Assessment for the Mokuleie Highway/Puunene Bypass

Dear Governor Benjamin Cayetano:

This letter is written on behalf of Maui Malama Pono, Inc., Dana Naone Hall and Mary Evanson. Infrastructural improvements such as this one to the Mokulele Highway are welcome and necessary on Maui so long as compliance is achieved with federal, state and county laws and all necessary permits are obtained after full public participation. We have the following concerns about the Draft Environmental Assessment ("DEA") which should dictate that an Environmental Impact Statement ("EIS") Preparation Notice be issued rather than a Negative Declaration.

1. Segmentation/Cumulative Impacts
This project is only one segment of a much larger roadway improvement project being undertaken in Central Maui. This project should have been analyzed in conjunction with and at the same time as such projects as the new airport access road, the new Maui Lani Parkway system and other roadway projects undertaken in Central Maui with federal, state and county funds.

2. Growth Inducement
The EIS Regulations make it clear that infrastructural improvements such as roadways induce growth. The DEA should address the extent to which this roadway project will induce growth and should also analyze the impacts of this induced growth. If the roadway does not induce growth, what are the growth inducers here? Is it that the extension of Runway 2-20 brings more visitors and causes the need for more hotel rooms and wider roads? These issues should have been fully addressed.

3. Demand Figures
Some remarkable demand figures are included in this DEA which are not consistent with demand figures used in such documents as the Kihei/Makena Community Plan. The DEA states that visitor arrivals will increase from 2,987,500 in 1995 to 4,000,000 in 2020. The DEA states that by the year 2020 there will be a need for 8,700 more hotel rooms. The DEA does not disclose the source for these figures. What is the source document for the figure used in the DEA that 8,700 new hotel rooms will be needed by the year 2020? What is the source for the figure used in the DEA that visitor arrivals will increase to 4,000,000 by the year 2020?

This DEA should be clarified to provide documentation as to why the figure of 4,000,000 arrivals was included. The DEA should also disclose any assumptions that were made in using the 4,000,000 figure. If the preparers of the DEA have assumed that Runway 2-20 will be extended to 9,600 feet, that the Kahului Airport will be internationalized and that there will be direct flights from Japan and other Asian countries, this assumption should be directly stated and the preparers should substantiate why they have adopted these assumptions.

There is a moratorium on the construction of hotels on Maui. The DEA states that by the year 2020 there will be a need for 8,700 more hotel rooms. This would essentially double the existing hotel room inventory. The DEA does not disclose where these 8,700 new hotel rooms would be constructed. Since the DEA concerns expansion of the Mokulele Highway it must be assumed that these hotel rooms would be in the area of the Highway, most probably in the Kihei/Makena region. The DEA does not discuss the inconsistency of constructing 8,700 new hotel rooms with the Kihei/Makena Community Plan.

We do not believe that any environmental document has yet been prepared which analyzes the impacts of 4,000,000 visitors and 8,700 new hotel rooms on Maui. Whether this roadway project is a direct or indirect cause of these increases, the impact of these increases must be studied in this document. These impacts must be addressed at the earliest practicable time according to our environmental regulations. This time is now and this study of impacts cannot be deferred until applications to construct these new hotel rooms are received.

These commenters hereby adopt and incorporate by reference all other comments received on this DEA. The DEA cannot support a Negative Declaration. It must be extensively revised and resubmitted for public comment. An EIS is required.

Thank you for the opportunity to comment on this DEA.

Sincerely yours,

Isaac Hall

IH/jp
cc: OEQC
Maui Malama Pono

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

IN REPLY REFER TO:

July 16, 1997

Mr. Isaac Davis Hall
Attorney at Law
2037 Wells Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Hall:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of April 22, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass and for participating in the environmental review process. We offer the following response to each of the numbered topics addressed.

1. The proposed project was initiated in response to the Maui Long Range Land Transportation Plan and an update to this study entitled Draft Final Report Maui Long Range Land Transportation Plan, February, 1996, by Kaku and Associates. These studies were prepared for the State Department of Transportation and County of Maui. The purpose of this long-range transportation planning effort, is to address the cumulative need for island-wide transportation system. Your statement that the proposed project is part of a larger roadway improvement program is correct because the project represents the State's effort to comprehensively plan for new transportation improvements in the future to accommodate projected island-wide population growth.

2. The EIS Rules state "Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems."

   Based on this definition of "indirect effects" there are clearly two aspects which must be considered before indirect effects of an action can be evaluated. These include (1) the indirect effects of development constraints established by applicable State and County land use planning policies along the roadway corridor and (2) the existing and planned capacity of public infrastructure.

   Clearly, the proposed project will not change land use planning policies as established by the County's Community Plans and zoning ordinances. It is these planning policies that will ultimately induce changes in the pattern of land use, population density or growth rate and related effects on air and water and other natural systems, including ecosystems. Although the proposed improvements will increase the capacity of the Mokulele Highway, it is being planned to provide more efficient and safe transportation between Kihei-Makena and Wailuku-Kahului, not to open-up new lands to development or induce growth within Central Maui. Inasmuch as the Mokulele Highway is already in place, development has not occurred due to State and County land use plans and policies even though access is presently available to these lands. Therefore, land use patterns and population densities along the highway corridor will be determined by State and County land use policies and not the widening of an existing highway.

   In addition, the project will improve projected impacts to the ecosystem that would occur if the project were not built. For example, air, noise, safety, and drainage impacts will be significantly improved after project development is completed compared to the negative impacts that would occur with the "no build" alternative. It would be wasteful not to fully utilize the existing infrastructure investment vested in Mokulele Highway by making the necessary safety and capacity improvements as warranted by traffic growth.

3. As stated in Section 4.4 of the Draft Environmental Assessment, the visitor projections were obtained from the Maui Long Range Land Transportation Plan (February, 1996) which utilized figured provided by the State Department of Transportation and County of Maui Planning Department (Page 47, Table 12). Projections for needed hotel rooms is also provided on page 49, Table 13, which shows a growth of 8,644 island wide hotel rooms between 1990 and the year 2020.

   These projections were utilized by the Maui Long Range Land Transportation Plan to derive island wide growth in traffic levels and to make specific recommendations for transportation improvements in response to the population growth projected. Making any assumptions regarding the socio-economic impact of the proposed runway 2-20 extension was beyond the scope of the proposed highway widening project.

   Continuation of the moratorium on construction of new hotels on Maui is a policy decision that will be made by the county Council and Mayor similar to the land use policy decision making process described in #1 above. The 8,700 hotel rooms cited in the Maui Long Range Land Transportation Plan are on an island wide basis and will likely not occur entirely within the Kihei/Makena Community Plan area as stated in your comments. However, the overall growth in the visitor industry, as regulated by County of Maui policies, will likely increase island-wide traffic levels necessitating the need for comprehensive planning to determine cumulative impacts to efficiently plan for transportation improvements needed in the future.

Mr. Isaac Hall
Page 3
July 16, 1997

Based on the Significance Criteria established by the EIS Rules used to determine whether significant environmental impacts will occur as a result of the project, a Finding of No significant Impact will be determined for the project and an EIS will not be required.

Very truly yours,

ROBERT O. SIAROT
District Engineer, Maui

Post Office Box 662 KIHEI COMMUNITY ASSOCIATION KCA Kihei, Maui 96753

RECEIVED
MAY 12 11 21 AM '97
DEPT. OF TRANSPORTATION
HIGHWAYS DIVISION

May 8, 1997

Mr. Kazu Hayashida, Director
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Dear Mr. Hayashida;

Re: Mokulele Highway Improvements - Maui, Hawaii
Your File: HWY-M 2.131-97

Thank you for the opportunity to testify regarding the planned expansion of Mokulele Highway from 2 to 4 lane-divided Puunene to Kihei. The Board of Directors for the Kihei Community Association made the following points at the informational meeting which was held May 7, 1997 at the Kihei School Cafetorium.

1. The project is supported. Traffic generation is continuing with more population in Kihei and more traffic generators/attractors. Failure of the existing Mokulele facility is very near.
2. Ensure that continuous traffic flow is maintained on the facility during the entire construction phase. If there is any interruption in even the current capacity, the results will be disastrous.
3. Provide a bikelane facility either within the project or outside the project limits.
4. Start the planning process to continue four-lane upgrades into the Piilani Highway as well.

Thank you again for the opportunity to comment.

Sincerely,

Brian Miskae, President
Kihei Community Association

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Mr. Brian Miskae, President
Kihei Community Association
Post Office Box 662
Kihei, Maui 96735

Dear Mr. Miskae:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of May 8, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We offer the following response to each of the numbered topics addressed.

1. Thank you for your support of the proposed project. We concur that the project will address present and future traffic concerns.

2. The project design, phasing, and construction will be implemented in a manner consistent with your concerns that continuous traffic flow is maintained during the entire construction phase. Every effort to maintain current capacity during the construction phase will be made and required of project contractors.

   To ensure that traffic impacts on South Kihei Road are minimized, the State Department of Transportation will meet with the County of Maui before and during and construction design phase to develop explicit details agreeable to both agencies. However, at this phase of the planning and design process, the specific timing of future funding and actual construction has not been determined.

3. During the detailed design phase, the feasibility of a bikelane facilitie within the project limits will be explored. Phased bikelane improvements may be feasible in terms of grading, signage, and provisions for future improvements. Bikelane improvements outside of the project area are not included within the scope of this project.

4. The planning process to continue four-lane upgrades into the Piilani Highway are underway.

Thank you once again for participating in the environmental review process.

Very truly yours,

for ROBERT O. SIAROT
District Engineer, Maui

Elizabeth Russell
559 Kuikahi Dr.
Wailuku, Hawaii 96793

'97 MAY 20 PM 3:16

Mr. Bob Siarot
Highways Division, Maui Office
Department of Transportation
650 Palapala Dr.
Kahului, HI 96732

May 18, 1997

Re: Mokulele Highway Widening

Dear Mr. Siarot,

As an officer and board member of Bikeways Maui, I'd like to encourage the Department of Transportation to include a separate, dedicated bicycle and pedestrian path in conjunction with the highway widening. Included within the highway right-of-way, this path could be graded concurrent with highway widening, and surfaced at a later date, possibly with ISTEA enhancement funds. Even a graded rough-surface path would offer an immediate alternative to busy Mokulele Highway for many bicyclists, and would serve to encourage bicycle transportation.

Bikeways Maui would appreciate the opportunity to comment on the Draft Environmental Assessment. Could you please send me a copy of it when it is ready? Thank you for your attention and your continued support of bicycle transportation over these last years. It has made a difference for the better!

Sincerely yours,

Elizabeth Russell

Elizabeth Russell

Post-it® Fax Note 7671		Date	# of pages
To David Hulse		From H. Unemori	
Co./Dept. PBR Hi		Co. Wilson	
Phone #		Phone # 244-4463	
Fax # 575-1602		Fax #	

BENJAMIN J. CAYETANO
GOVERNOR

COPY

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

June 3, 1997

PBR HAWAII
RECEIVED
JUN 5 1997
Project
Project No.

Ms. Elizabeth Russell
559 Kuikahi Drive
Wailuku, Hawaii 96793

Dear Ms. Russell:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS, PROJECT NO. 311A-02-92

Thank you for your comments of May 18, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We offer the following response to each of the topics addressed.

During the detailed design phase, the feasibility of a bikelane facility within the project limits will be explored. Phased bikelane improvements may be feasible in terms of grading, signage, and provisions for future improvements. Bikelane improvements outside of the project area are not included within the scope of this project.

Although the Draft Environmental Assessment has been completed, we will be happy to provide you with a copy of the Final Environmental Assessment upon its completion. All comment letters and applicable responses will be provided in the Final EA.

Thank you once again for participating in the environmental review process.

Very truly yours,

for ROBERT O. SIAROT
District Engineer, Maui

Maui Electric Company, Ltd. • 210 West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96733-6898 • (808) 871-8461

PBR HAWAII
RECEIVED
APR 10 1997
Project
Project No.

April 5, 1997

Mr. Robert Siarot, District Engineer
State of Hawaii
Department of Transportation
650 Palapala Drive
Kahului, HI 96732

Dear Mr. Siarot:

Subject: Mokulele Highway/Puunene Bypass
Project No. 311A-02-92

Thank you for allowing us to comment on the subject project.

In reviewing the information transmitted and our records, we have no objection to the subject project. We encourage the state's electrical consultant to meet with us as soon as practical to establish early dialogue to ensure proper and timely planning for any action to change existing pole locations and configurations.

If you have any questions or concerns, please call Dan Takahata at 871-2385.

Sincerely,

Edward L. Reinhardt

Edward L. Reinhardt
Manager, Engineering

DT:rt

cc: Warren Unemori, Warren S. Unemori Engineering, Inc.
PBR Hawaii
Office of Environmental Quality Control

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Mr. Edward L. Reinhardt, Manager Engineering
Maui Electric company, Ltd.
210 West Kamehameha Avenue
P.O. Box 398
Kahului, Maui, HI 96733-6898

Dear Mr. Reinhardt:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of April 5, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass and for participating in the environmental review process. As requested, the State's electrical consultant will meet with representatives of your office as soon as practical to establish early dialogue to ensure proper and timely planning for relocation of poles and electrical configuration.

Very truly Yours,

For ROBERT O. SIAROT
District Engineer, Maui

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109

PBP HAWAII
MAY - 5 1997
Project
Project No.

April 30, 1997

State of Hawaii
Department of Transportation, Highways Division
650 Palapala Drive
Kahului, Maui, Hawaii 96732

Attn: Mr. Robert Siarot, District Engineer

Re: Draft Environmental Assessment - Mokulele Highway/Puunene Bypass.

Dear Mr. Siarot,

Thank you for the opportunity review this assessment. The Board of Water Supply has the following comments.

Source and System

The Board of Water Supply owns and maintains a several transmission lines, including major 18" and 36" lines, within the right-of-way along the length of highway improvements. These lines provide the vast majority of public water to Kihei, Wailea, and Makena. The applicants should contact our engineering division at 243-7835 to coordinate construction details, possible pipeline relocation, and to minimize the potential for disruption of water service. We have included a copy of our water system map of the project area for your reference.

Water Resources Generally

To protect both surface and groundwater resources in the area, we ask that the applicant and/or contractor consider best management practices (BMPs) for the design and construction of roads, highways, and bridges. We have attached sample BMPs for these activities from the EPA guidance document for coastal nonpoint pollution control programs as a reference to the applicant and contractor.

Conservation

Use Non-Potable Water: - The applicants have stated that non-potable water will be used if potable water is not available. We ask that the applicants assist in water conservation of potable supplies by making arrangements to use non-potable water, where possible, for all construction-related activities.

Use Climate-adapted Plants: When the highway corridor is revegetated, the applicants should consider revegetating with native or Polynesian climate-adapted and salt-tolerant plants, where applicable. Native plants adapted to the area, conserve water and further protect the watershed from degradation due to invasive alien species. The project site is located in "Maui County Planting Plan" - Plant Zone 3. Please refer to the "Maui County Planting Plan", and to the attached documents, "XERISCAPE: Water Conservation Through Creative Landscaping" and "Some of Maui's Native and Polynesian Plants."

Sincerely,

David Craddick
Director

wef

cc: Warren Unemori, Warren Unemori Engineering, Inc.
David Hulse, PBR Hawaii
Gary Gill, Office of Environmental Quality Control

attachments:
"Some of Maui's Native and Polynesian Plants" - Maui
"XERISCAPE - Water Conservation through Creative Landscaping"
Sample BMPs from "Guidance Specifying Management Measures For Sources of Nonpoint Pollution In Coastal Waters." EPA.
"Fire Protection and Water Distribution Map - Puunene." Maui Board of Water Supply.

"By Water All Things Find Life"

Printed on recycled paper

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Mr. David Craddick, Director
County of Maui
Board of Water Supply
P.O. Box 1109
Wailuku, Maui, Hawaii 96793-7109

Dear Mr. Craddick:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of April 30, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We have reviewed your comments and offer the following.

Source and System

Thank you for the copy of the County's water system map within the project area. We acknowledge that the Board of Water Supply owns and maintains the several water transmission lines, including major 18" and 36" lines, within the right-of-way. We concur that coordination with the BWS Engineering Division is clearly necessary and will be initiated prior to development of the construction plans. All necessary measures will be implemented to ensure that no disruption to water service results during construction of the project.

Water Resources Generally

Best Management Practices (BMP) will be employed as applicable during project construction in accordance with the illustrative Environmental Protection Agency guidelines provided by your office. As described in the Draft Environmental Assessment, Section 5.3.13 Summary of Mitigation Measures, many of the BMP's identified have been recommended in the Environmental Assessment to mitigate potential water quality impacts.

Conservation

Non-potable Water - Non-potable water use will be utilized where possible for all construction related activities, however, agreements for the non-potable water have not yet been negotiated at this stage in the planning process with adjoining landowners. We assume that irrigation water used on surrounding sugarcane lands could be available with permission from affected landowners.

Climate-adapted Plants - It is the State Department of Transportation's intent to require the use of native and non-native plants that are climate-adapted and salt-tolerant where appropriate. We concur that native plants can conserve water and help to protect the watershed by taking the place of invasive alien species. The Maui County Planting Plan and xeriscape landscaping techniques will be utilized to achieve these water conservation goals.

Thank you once again and for participating in the environmental review process.

Very truly yours,

For ROBERT O. SIAROT
District Engineer, Maui

DEPARTMENT OF
PARKS AND RECREATION
COUNTY OF MAUI

1580-C Kaahumanu Avenue, Wailuku, Hawaii 96793

LINDA CROCKETT LINGLE
Mayor
CHARMAINE TAVARES
Director
LEE DODSON
Deputy Director

(808) 243-7230
FAX (808) 243-7934

April 2, 1997

PBR HAWAII
RECEIVED
APR 10 1997
Project
Project No.

Mr. Robert Siarot, District Engineer
State of Hawaii
Department of Transportation
650 Palapala Drive
Kahului, Maui, Hawaii 96732

Subject: **Draft Environmental Assessment**
Mokulele Highway/Puunene Bypass
Project No. 311A-02-92

Dear Mr. Siarot:

Thank you for the opportunity to comment on the Draft Environmental Assessment for Mokulele Highway/Puunene Bypass.

We are in support of the project and have no comments to submit. Thank you for the opportunity to review the Draft EA.

Sincerely,

Henry Oliwa

HENRY OLIWA
Director

HO:PTM:ecq

cc: Warren S. Unemori Engineering, Inc.
PBR Hawaii
Office of Environmental Quality Control

mokudrftea.wpd

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Mr. Henry Oliwa, Director
County of Maui
Department of Parks and Recreation
1580-C Kaahumanu Avenue
Wailuku, Hawaii 96793

Dear Mr. Oliwa:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of April 2, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass and for participating in the environmental review process.

Very truly yours,

For ROBERT O. SIAROT
District Engineer, Maui

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

AARON SHINMOTO, P.E.
Chief Staff Engineer

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Division

MAY 12 12 46 PM '97
RECEIVED
DEPT. OF TRANSPORTATION
HIGHWAYS DIVISION

HWY 2012

May 7, 1997

Mr. Kazu Hayashida
Director
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 Punchbowl Street
Honolulu, HI 96813-5097

SUBJECT: ENVIRONMENTAL ASSESSMENT FOR MOKULELE HIGHWAY WIDENING IMPROVEMENTS
REF. HWY-M 2.131-97

Dear Mr. Hayashida:

Thank you for your letter dated April 25, 1997 notifying the County on the availability of the Environmental Assessment (EA) for the proposed widening of Mokulele Highway and portions of Puunene Avenue.

We reviewed your EA and would like to offer the following comments:

1. The County of Maui, Department of Public Works and Waste Management is in support of your project to widen Mokulele Highway and portions of Puunene Avenue to four (4) lanes to address present and future traffic concerns.

2. On page 2 and 4 in the EA document, reference is being made that the County of Maui would be constructing the Puunene Bypass. Please amend all statements in the EA to reflect that the County is not planning to pay for the construction of this bypass. We do agree as stated in the last sentence on page 3 that "The future Puunene Bypass will also significantly improve the connection between Maui Lani and Kihei-Makena." However, the County will not be responsible to construct this bypass road.

3. Our last concern deals with the future closure of the County's portion of Mokulele Highway between South Kihei Road and Piilani Highway. We realize this proposed closure is part of the updated Kihei Traffic Master Plan, dated October 1996, but we are concerned how the construction phasing will impact South Kihei Road. A meeting with the State and the County should be held to have a more detailed discussion so that the EA can provide explicit details agreeable with both agencies.

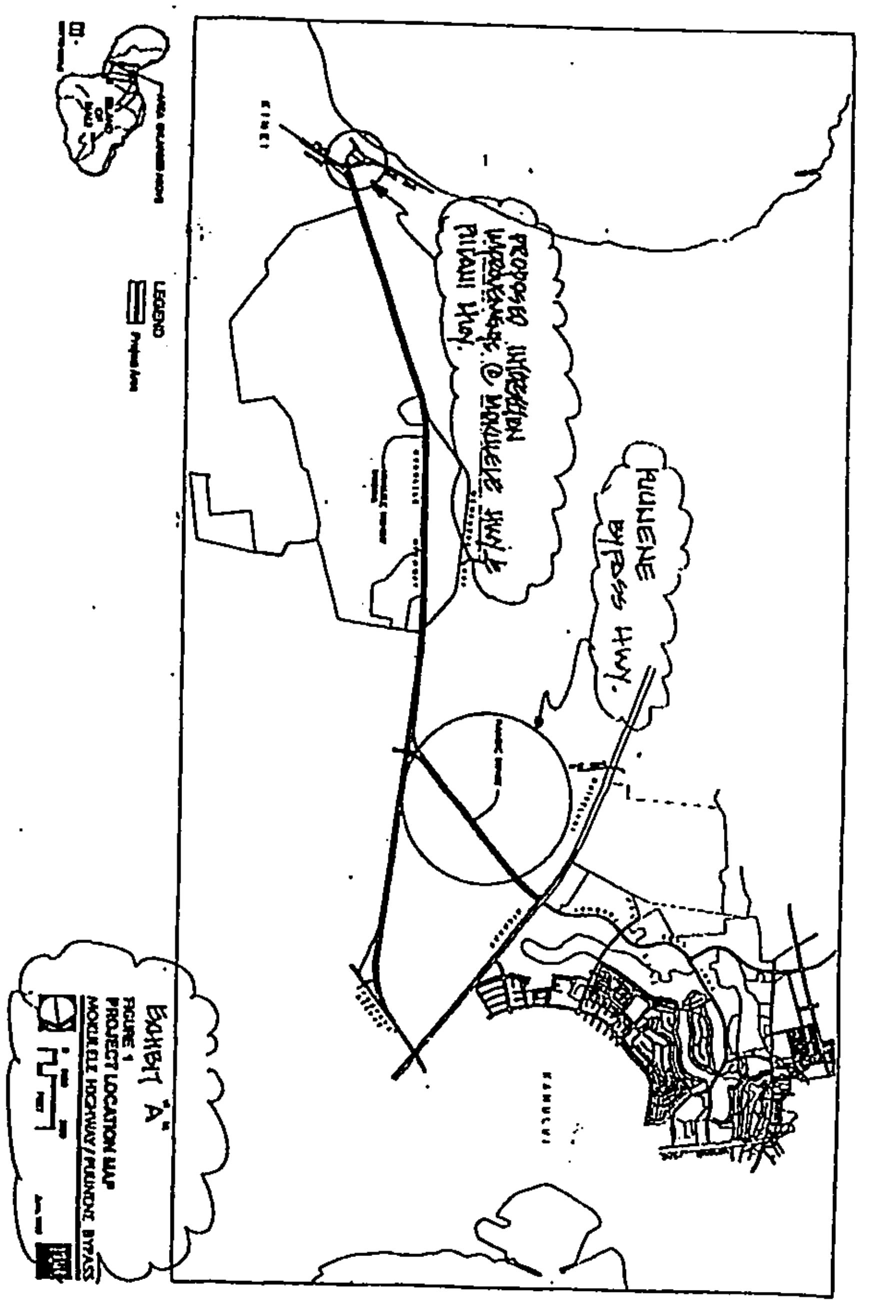
Thank you for this opportunity to comment. Please call me or Lloyd Lee, Engineering Division Chief at 243-7745 if you need further explanations.

Very truly yours,

Charles Jencks
Director of Public Works and Waste Management

LL:mku(ED97-558)

Attachments



BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO
HWY-M 2.148-97

May 28, 1997

Mr. Charles Jencks
Director of Public Works and Waste Management
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Jencks:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT MOKULELE HIGHWAY/PUUNENE BYPASS PROJECT NO. 311A-02-92

Thank you for your comments of May 7, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We offer the following response to each of the numbered topics addressed.

1. Thank you for your support of the proposed project. We concur that the project will address present and future traffic concerns.

2. We will revise the Final Environmental Assessment to state that "the County of Maui is not planning to pay for the construction of the proposed Puunene Bypass and that future funding for the project is not determined at this time." We concur with your assessment that the future Puunene Bypass will also significantly improve the connection between Maui Lani and Kihei-Makena.

3. The construction design and phasing for the project has been planned on the basis that Piilani Highway will continue accommodate a greater percentage of the total traffic between Kihei and Wailuku-Kahului, thereby reducing the amount of traffic entering South Kihei Road in the future. This intersection will also be signalized and timing of the lights synchronized with the signalization at Mokulele Highway and Piilani Highway.

   To ensure that traffic impacts on South Kihei Road are minimized, the State Department of Transportation will meet with the County of Maui before and during and construction design phase to develop explicit details agreeable to both agencies. However, at this phase of the planning and design process, the specific timing of future funding and actual construction has not been determined.

HWY-M 2.148-97

Thank you once again for participating in the environmental review process.

Very truly yours,

for ROBERT O. SIAROT
District Engineer, Maui

LINDA CROCKETT LINGLE
Mayor

DEPT. OF TRANSPORTATION
STATEWIDE TRANS.
PLANNING OFFICE
MAY 30 3 16 PM '97

DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION
MAY 30 11 34 AM '97

OFFICE OF THE MAYOR
COUNTY OF MAUI
WAILUKU, MAUI, HAWAII 96793

May 23, 1997

Kazu Hayashida, Director
State of Hawaii Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear ~~Mr. Hayashida~~: Kazu,

Thank you for the opportunity to express our concerns at the public hearing held on May 7 for the proposed Mokulele Highway widening project. We strongly support the proposed widening; however, we note the following issues:

1. The recommendation to close the direct connection between Mokulele Highway and South Kihei Road will require traffic to make right turns at Uwapo and Ohukai connector roads to South Kihei Road, or negotiate a right turn and a left turn to South Kihei Road. These moves appear to be less efficient than maintaining the existing connection. The Connection proposed to be closed is under County jurisdiction and should require the participation and consent of the Department of Public Works and Waste Management.

2. The design of this project should take into consideration the possible future realignment of North Kihei Road mauka of the Kealia Pond National Wildlife Refuge. We believe strongly in this project and have written to your department about it previously.

3. The provision of a single underpass for agricultural vehicles may be preferable to the proposed signalized intersection. The State should discuss the feasibility of this option with Hawaiian Commercial and Sugar Company, the major agricultural operator in this area, and the major landowner along much of the proposed new alignment.

4. The County notes that the proposed Puunene bypass (which would connect the proposed Maui Lani Parkway at Kuihelani Highway) is incorrectly identified on the State's plans as a future County roadway project.

Printed on recycled paper

Kazu Hayashida, Director
May 23, 1997
Page two

Thank you again for the opportunity to show our support for the proposed project and to pass on our comments.

Please call me if we can be of any assistance to you.

Sincerely,

LINDA CROCKETT LINGLE
Mayor, County of Maui

c: David Blane, Director, Maui County Department of Planning
Charles Jencks, Director, Maui County Department of Public Works and Waste Management

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO:
STP 8.7997

June 12, 1997

The Honorable Linda Crockett Lingle
Mayor
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Dear Mayor Lingle:

Subject: Mokulele Highway Widening Project

Thank you for your letter of May 23, 1997, expressing several concerns related to the subject project. We have the following comments:

1. The proposed reconfiguration of the Mokulele Highway/Piilani Highway intersection, including the closure of the lower segment of Mokulele Highway under County jurisdiction, was a recommendation which evolved through the development of the Kihei Traffic Master Plan. This was considered to be the most viable operational concept for the location.

   The plan was initiated at the request of the Department of Public Works; and was coordinated and developed cooperatively with the departments of Planning and Public Works, the DOT and a Citizens Advisory Committee. We will continue to work with your Public Works department as we proceed with the project planning to address your concerns.

2. The discussions on the intersection improvement did consider a possible future mauka realignment of North Kihei Road. Our traffic engineers felt that the proposed reconfiguration would better accommodate the realignment than the existing connections. This consideration, in fact, further supported the decision to pursue the reconfiguration.

3. The option of an underpass for agricultural vehicles will be coordinated and investigated with the Hawaiian Commercial and Sugar Company.

4. Under the effort to develop the Maui Long Range Land Transportation Plan, both the State and County had concurred with the recommendation that the State would pursue the widening of the existing Puunene Avenue/Mokulele Highway; and that the proposed Puunene Bypass would function as an extension of the proposed Maui Lani Parkway, to be implemented as a county road when the development in the area warranted it. To this end, we have redirected our efforts and our project is intended to improve the existing facilities.

We will continue to work with your Public Works department to assure that your concerns are adequately addressed.

Very truly yours,

KAZU HAYASHIDA
Director of Transportation

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

IN REPLY REFER TO
HWY-M 2.177-97

July 3, 1997

The Honorable Linda Crockett Lingle
Office of the Mayor
County of Maui
Wailuku, Hawaii 96793

Dear Mayor Crockett Lingle:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS, PROJECT NO. 311A-02-92

Thank you for your comments of May 23, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We offer the following responses to each of your issues.

Issue 1 - Closure of Direct Connection Between Mokulele Highway and South Kihei Road

The direct connection between Mokulele Highway and South Kihei Road is proposed to be eliminated as part of the reconfiguration of the Mokulele Highway/Piilani Highway intersection. This reconfiguration will allow traffic to flow directly between southbound Mokulele Highway and southbound Piilani Highway instead of forcing this major traffic movement to make a left turn at the Mokulele/Piilani Intersection as it now does. Conversely, northbound Piilani Highway to northbound Mokulele Highway traffic will also be allowed to flow directly between the two roadways instead of being forced through a right turn as in the existing condition.

We believe that this reconfiguration offers the best solution to both existing and future traffic patterns forecasted as part of the Maui Long Range Land Transportation Plan (MLRLTP). Manual traffic counts were conducted at the intersection of Piilani Highway and Mokulele Highway in June 1996 during the morning and afternoon commuter peak periods. These counts show high levels of traffic making the transition between Mokulele Highway and Piilani Highway. In particular, 497 vehicles were observed executing the southbound left turn movement between Mokulele Highway and Piilani Highway during the morning peak hour while 674 vehicles were observed during the afternoon peak hour. Analysis of these volumes revealed that the demand for this movement exceeds its capacity, causing it to operate poorly at LOS F during both peak periods.

Land use inputs in the MLRLTP indicate that population within the Kihei-Makena area will

increase 76% by the year 2020. Consistent with this forecast, traffic volumes traveling southbound between Mokulele Highway and Piilani Highway are projected to increase significantly to 820 and 1015 vehicles during the A.M. and P.M. peak hours respectively in the year 2020. Given that existing volumes cause the southbound left-turn movement to operate at LOS F, future volumes will also cause the movement to operate at LOS F.

An alternative to the realignment that would make Mokulele Highway/Piilani Highway a direct movement is to modify the existing intersection by providing a double left turn for the Mokulele to Piilani movement. This alternate configuration would maintain the direct connection between Mokulele Highway and South Kihei Road. Intersection analysis results comparing the performance of the two alternatives are summarized in Table 1.

Table 1-Summary of the Year 2020 Analysis at the Mokulele/Piilani Intersection

Time Period	Double Left-Turn Alternative	Realigned Mokulele/Piilani Alternative
A.M. Peak Hour	LOS C (24.3 sec/veh)	LOS C (17.4 sec/veh)
P.M. Peak Hour	LOS D (33.3 sec/veh)	LOS C (19.0 sec/veh)

Results show that the Alternative Configuration will not operate as efficiently as the Recommended Alternative and would not achieve the desired LOS C level of operation. Given the potential of a realignment of North Kihei Road north of the Kealia Pond National Wildlife Refuge and the resulting increase in the left turn demand, it is concluded that the realignment is a better configuration alternative.

Providing a direct connection between Mokulele Highway and Piilani Highway mandates a reconfiguration of the Mokulele/Piilani intersection. To avoid an awkward and potentially unsafe intersection, the existing intersection is proposed to be converted from a signalized 4-legged intersection to signalized "T"-intersection. The leg that intersects the major Mokulele/Piilani roadway is North Kihei Road. The segment of Mokulele Highway between Piilani Highway and South Kihei Road will be eliminated. Under the existing configuration, drivers must wait for a green signal before proceeding through the Piilani Highway/Mokulele Highway Intersection, traversing the roadway segment and turning onto South Kihei Road. Under the proposed configuration, drivers would be able to turn right at the Piilani Highway/Mokulele Highway intersection and travel a short distance on North Kihei Road before turning left on to South Kihei road, thereby reducing their delay. The realignment of the intersection legs that is proposed as part of the reconfiguration of this intersection will result in minimal vehicle redirection when compared to the path of existing traffic flow for this movement.

The reconfiguration may allow implementation of alternative access schemes for residents living along the segment of South Kihei Road between North Kihei Road and the existing Mokulele connection. Alternatives that would provide more protected access have been identified, but they would be more appropriately addressed during the design phase of the project.

Issue 2 - Potential Realignment of North Kihei Road

The potential realignment of North Kihei Road mauka of the Kealia Pond National Wildlife Refuge strengthens the need for a direct connection between Mokulele Highway and Piilani Highway. The closure of North Kihei Road will redirect traffic that currently travels between North Kihei Road and Piilani Highway instead. This will increase the already large traffic demand forecasted to occur between Piilani Highway and Mokulele Highway, thereby making the proposed intersection reconfiguration even more beneficial.

Issue 3 - Underpass for Agricultural Vehicles

We have received comments from Hawaiian Commercial and Sugar Company (HC&S) regarding their desire for an underpass for agricultural vehicles. While we understand their concern, we believe that the cost of such an underpass is not warranted, given the ability for signalized crossing to adequately handle the projected crossing.

Issue 4 - Puunene Bypass

The Puunene Bypass has been redesignated a County of Maui project as part of the Maui Long-Range Land Transportation Plan. As we understand it, because of delays in implementing the proposed Maui Lani Parkway, the effectiveness of a Puunene Bypass in the medium-term future would be much less. Given the uncertainty for implementation for the Maui Lani Parkway, it was decided that the State of Hawaii will be responsible for the widening of Mokulele Highway, and the Puunene Bypass, as an extension of the Maui Lani Parkway, will be a County of Maui responsibility.

Thank you again for your comments and your participation in the environmental review process. If you have further questions, please call.

Very truly yours,

State Department of Transportation

ROBERT O. SIAROT
Maui District Engineer

A&B-HAWAII, INC.
HONOLULU, HI
G. STEPHEN HOLADAY
SR. VICE PRESIDENT

HAWAIIAN COMMERCIAL & SUGAR CO.
G. STEPHEN HOLADAY
PLANTATION GENERAL MANAGER
TELEPHONE: (808) 877-0081

HAWAIIAN COMMERCIAL & SUGAR COMPANY

P.O. BOX 266, PUUNENE, MAUI, HAWAII 96784

RECEIVED

MAY 26 1997

WARREN S. UNEMORI ENGINEERING, INC.

May 22, 1997

Mr. Kazu Hayashida, Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

RE: Draft Environmental Assessment: Proposed Mokulele Highway/Puunene Bypass;
Project No. 311A - 02 - 92

Dear Mr. Hayashida:

Thank you for providing the Draft Environmental Assessment (DEA) on the Proposed MokuleleHighway/Puunene Bypass, Project No. 311A-02-92 for our review and comment.

HC&S is extremely concerned that the DEA has failed to fully identify the impacts the proposed roadway project will have on HC&S' operations--serious negative impacts which, unless adequately mitigated, will significantly increase HC&S' operating costs, decrease its efficiencies and threaten its survival. The rerouting of HC&S vehicular traffic to a single crossing at station 262 (near the present Wailuku Sugar Road crossing), the elevated design of the highway and the inclusion of a 30 ft. median will seriously restrict our ability to cross the highway throughout the year, result in lost farm land, and would require you to reimburse HC&S for the significant amount of money to build new connector roads.

HC&S has approximately 6,300 acres of sugar cane on the Waikapu side of Mokulele Highway while our mill is on the other side of the highway. We currently utilize fourteen (14) different crossings, three (3) cane hauler crossings, seven (7) truck and light vehicle crossings and four (4) public access roadways to transverse the existing two-lane Mokulele Highway from our private road system. The necessity of crossing Mokulele Highway is highlighted by these statistics: 1) Canehauler's average 16 - 20 crossings per hour for 24 hours for several weeks at a time during harvesting season or approximately 20,000 hauler crossings a year; 2) Other large semi-trucks (lowbeds, fertilizer delivery trucks, seed hauling trucks, etc.) must cross the highway approximately 20,000 times a year; and 3) other smaller trucks, approximately 250 in total, cross the highway an estimated 75,000 times a year.

We must emphasize that changes to our traffic patterns will adversely affect HC&S' operating efficiency as has been shown with traffic pattern changes which resulted from the Haleakala Highway widening project (addition of a third lane). Reduction to a single crossing in either

highway widening project would cripple our transportation system and cause an increase in costs, from which we may not be able to recover. In addition, we believe that underpasses would significantly improve safety for the public as well as the employees at HC&S.

HC&S must emphasize that delays in getting our crop to the mill caused by difficulty in crossing Mokulele Highway and longer hauling routes will have negative economic and efficiency impacts to HC&S--not only in terms of increased transportation costs, increased costs associated with operating the mill at Puunene, but also reduced sugar recovery (i.e. yields). These crossing delays will have serious cost and safety impacts to HC&S, such as: (1) a 5% increase in harvesting costs would approximate $365,000/year, (2) each minute of delay per load of cane delivered to the mill, HC&S' costs would increase approximately $33,000/year, (3) mill delays approximate $11,250/hour, (4) and the loss of sugar quality and quantity due to cane deterioration reduces our revenue. In the current economics of the sugar industry, such increases in cost coupled with lost sugar production could not be made up and would be a serious threat to HC&S' viability.

Therefore, it would seem apparent that alternative mitigative measures should be evaluated, which includes the construction of one (1) underpass and one (1) at grade crossing with appropriate traffic lights to provide a free flow of plantation traffic for the cane haulers and other plantation equipment across Mokulele Highway. Although, this will not make HC&S whole (as we will be reducing from 14 crossings to 2), it will provide some relief from long-delays and inefficient transportation options and improve safety. We have identified potential locations for the proposed underpass and at grade crossing and will be happy to transmit them to you at your convenience.

Discussions relating to these and other impacts on HC&S are necessary and we are hopeful that we will be hearing from you prior to the issuance of a final EA. We believe that a continued cooperative working relationship will provide viable solutions, for both the State and HC&S. Such solutions must mitigate the finance and safety impacts for HC&S resulting from the HC&S highway widening project as well as provide the safe traffic flow for the public.

Thank you again for this opportunity to comment on this DEA and we look forward to hearing from you in the near future.

Sincerely yours,

G. Stephen Holaday
Plantation General Manager

cc: Warren S. Unemori Engineering, Inc.
PBR Hawaii
M. J. Ching
R. C. Moore

BENJAMIN J. CAYETANO
GOVERNOR

COPY

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
MAUI DISTRICT
650 PALAPALA DRIVE
KAHULUI, HAWAII 96732

PBR HAWAII
RECEIVED
JUN 2 6 1997
Project
Project No. ______

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO

June 24, 1997

Mr. G. Stephen Holaday, Plantation General Manager
Hawaiian commercial and Sugar Company
P.O. Box 266
Puunene, Maui, Hawaii 96784

Dear Mr. Holaday:

SUBJECT: COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT
MOKULELE HIGHWAY/PUUNENE BYPASS
PROJECT NO. 311A-02-92

Thank you for your comments of May 22, 1997 regarding the Draft Environmental Assessment for the Mokulele Highway/Puunene Bypass. We offer the following response to each of the topics addressed.

We concur that Hawaiian Commercial and Sugar Company (HC&S) will be reimbursed for associated repair and replacement of agricultural infrastructure, reconstruction and/or relocation of canehaul roads, and land acquisition costs. However, we believe our proposal to consolidate all three canehaul road crossings into one single traffic light-controlled crossing does not appear to be unreasonable. Provisions have also been made in our preliminary cost estimates to reroute the canehaul roads leading to the proposed single crossing.

The profile of the new highway at the canehaul road crossing will also be kept to close to existing grade. Therefore, contrary to your contention, the canehaul road approaches to the highway will be at a fairly flat grade and not at an embankment. The proposed median will also be at grade.

Although the seven truck and light vehicle crossings and four public access roadways which presently cross the Mokulele Highway will be altered or relocated, several new access points will be designed into the improved roadway to enhance safety for the motoring public and agricultural workers alike. The four public access roadways referenced in your comments that cross Mokulele Highway will remain.

During the land acquisition negotiations, HC&S will be fully compensated for any increased costs associated with adjustments to your agricultural transportation system. Considering the significant increase in traffic levels projected for the Mokulele Highway and the significant public benefits involved with the increased capacity associated with the widening project, we believe that the project is clearly in the public's best interest. Reimbursement of costs incurred by HC&S should mitigate your concerns regarding reductions in efficiency of the agricultural transportation system. In addition, the increased capacity of the improved roadway and enhanced safety associated with the redesigned locations, will likely increase the real estate value of HC&S land holdings adjacent to the highway.

The existing three canehaul crossings are located within a one-mile section of Mokulele Highway between Puunene Avenue and Waiko Road. The intersections are currently operating under signalized conditions with police officers being used to stop traffic on Mokulele Highway when canehaul trucks need to cross.

It is proposed to consolidate these unsignalized crossings into one signalized crossing. Because the existing crossings are located within close proximity of each other, the amount of relocations towards the proposed consolidated crossing will be, at most, half a mile.

Additionally, proper signalization of the crossing will increase the efficiency and safety and minimize delays for both the traveling public and your agricultural operations. With the use of techniques like automated vehicle identification (AVI), we believe that the signalized crossing could be made more efficient than the current situation. In such a concept, properly equipped canehaul trucks could be detected well before they reach the crossing. The detector could then notify the traffic signal which could be programmed to make the canehaul crossing as efficient as possible, thereby minimizing delays.

As previously described, we believe that mitigative measures are available to provide a free flow of plantation traffic for the cane haulers and other plantation equipment across Mokulele Highway. We also wish to emphasize that the improved Mokulele Highway will reduce the travel time and increase the efficiency of plantation owned passenger vehicles and small trucks. This improved safety and efficiency of the proposed project garnered significant support for the project from the public.

Although the construction design phase for the project has not begun, we concur that discussions with HC&S are necessary to cooperatively develop viable solutions for both the State and HC&S. This will ensure that the finance and safety impacts affecting HC&S will provide for the safe traffic flow for the public.

Thank you once again for participating in the environmental review process.

Very truly yours,

Robert O. Siarot
District Engineer

RECORD OF CITIZEN PARTICIPATION AND PUBLIC INVOLVEMENT

- The following list of attendees and excerpts of testimony reflects those in attendance at the May 7, 1997 public informational meeting held at Kihei School, Kihei, Maui, conducted by the state department of transportation to solicit input from the community regarding the proposed project.

- The Department of Transportation Memorandum for the Record reflects the concerns expressed by adjoining property owners regarding access issues.

LIST OF ATTENDEES
AT PUUNENE BYPASS/MOKULELE HIGHWAY WIDENING
PUBLIC INFORMATIONAL MEETING
(May 7, 1997)

NAME	ADDRESS	PHONE	ORGANIZATION
David Hulse	1001 Bishop St., Honolulu	521-5631	PBR Hawaii
Wayne Yoshioka	1001 Bishop St., Ste. 3000 Honolulu	531-7094	PBQD
Alan Unemori	526 Polulani Drive, Wailuku	242-4403	WSUE
Mike Munekiyo	305 High St., Suite 104, Wailuku	244-2015	Munekiyo & Arakawa
Tony Cancel	2777 So. Kihei Rd., B103, Kihei	874-9344	KCA
Brian Miskae	268 Mehani Circle, Kihei	879-2784	KCA
Msg. Dunn Llego	175 Puunene Ave., Kahului	877-6228	HIARNG
John Terhorst	936 Kupulau Dr., Kihei	879-3349	
Robert Nichols	2737 S. Kihel Road	874-8375	HKHA
Kenny Barr	P.O. Box 1637, Kihei	879-6050	Kihei/Wailea Taxi
Chris Halford	P.O. Box 1703, Kihei	878-3650	Legislature
Joe Krueger	200 S. High St., Wailuku	243-7745	Maui DPW
Larry Bernades	371 Ani Street, Kahului	871-2360	MECo
Ed Reinhardt	P.O. Box 398, Kahului	871-2364	MECo
Bill Medeiros	250 S. High Street, Wailuku	243-7735	Maui Planning Dept.
Helen Felsing	2846A Puu Ho'ola'i Street, Kihei	875-8227	S. Maui Heritage Corridor
Joseph Bertram	2619 S. Kihei Rd., A-311	879-2501	Self
Gene Thompson	2531 S. Kihel Road	879-2758	South Shore Weekly
Brian Perry		242-6340	Maui News

EXCERPTS OF TESTIMONY AT MOKULELE HIGHWAY WIDENING PROJECT INFORMATIONAL HEARING

Place: Kihei School Cafeteria
Date: May 7, 1997
Time: 7:00 pm to 8:00 pm

(1) Brian Miskae - President, Kihei Community Association

(a) Strongly supports Mokulele Widening Project

(b) Requested that SDOT takes appropriate steps to maintain continuous traffic flow during Construction

(c) Raised question about whether there is any problem with acquiring the Rights-of-Way near the old Puunene Airport

(d) Commented that he thinks the State should also initiate plans to widen Piilani Highway to alleviate the growing congestion there

(2) Robert Nulls (spelling?)

(a) Expressed two primary points as follows:

- o Wind mitigation by the existing trees along Mokulele Highway
- o Planning for future Bikeways along Mokulele Highway

(b) Wind - Pointed out that the existing trees now serve as a good buffer against the strong winds that exist there daily. He requested that the SDOT either make plans to move the existing trees along the new highway, or, if that is not possible, plant new trees to block the winds in the future. Pointed out that the existing trees are also helpful in blocking smoke during Cane Harvesting season

(c) Bikeway - Requested that the SDOT make provisions to allow for construction of future bikeways along Mokulele Highway since bikers will inevitably use the Highway itself if no bikeways exist - a potentially dangerous situation. Suggested that if Highway funds did not currently include construction of bikeways that perhaps the highway prism could be graded to allow for expedient construction of bikeway along but offset from the highway when funds do become available

(3) Kenneth Barr

(a) Stated that he thought the planned design of the Intersection at Hansen Road (Puuenene) is good.

(b) Brought up the question of the Phasing of Construction if Construction Funds were not available for the entire Project. He stated that if this were the case, he would prefer that the SDOT give higher priority to construct the Mokulele-Hansen Road Intersection rather than the Puunene Bypass Roadway going to Maui Lani

(c) Bob Siarot clarified that the Puunene Bypass Roadway connecting Maui Lani to Mokulele Highway is expected to be funded by the County, and not the SDOT. Therefore, the Mokulele Highway improvements will be constructed all the way to Puunene (Hansen Road) first.

(4) George Kaya

(a) Requested that with respect to the signalized intersection with the Cane Haul Road between the Animal Shelter and Puunene (Hansen Road) that the traffic signals be set to favor the Highway traffic during peak hours rather than the Cane Haul trucks

(5) Helen Felsing - Chairman, South Maui Heritage Corridor

(a) Also supported a separate pedestrian path/bikeway along Mokulele Highway and believes it would serve as a beneficial Recreation Corridor for both Kahului and Kihei residents. Stated that safety issues exist with the current roadway as bikers presently use Mokulele Highway

(b) Raised the question as to whether or not A&B's long term plan to put a roadway near Kealia pond would be precluded by the widening of Mokulele Highway

(c) Stated that the current plans for widening Mokulele Highway "looks great"

(6) Joseph Bertram

(a) Questioned whether the median strip between the North-Bound and South-Bound lanes would cause problems for cars that need to cross Mokulele Highway from the mauka-side in order to merge into the South-Bound lanes

(b) SDOT stated that this would be addressed in the final Design of the Mokulele Highway

Meeting adjourned at 8:00 pm

DEPARTMENT OF TRANSPORTATION
MEMORANDUM FOR THE RECORD

HIGHWAY
DIVISION

Date May 13, 1997

MAUI DISTRICT
BRANCH OR SECTION

PURPOSE OF MEETING: Meeting with Kihei Kai Condo residents, including Bob Jones as coordinator, to discuss the proposed improvement to South Kihei Rd and Piilani Hwy Intersection.

DATE, TIME & PLACE: May 6,1997; 2:00 pm; Hwy-M's Office

PARTICIPANTS: Bob Jones, Nani Kai Hale, 879-1423
Jim Olson, Kihei Kai, 879-2357
Carol Olson " "
Mr & Mrs Bear, Maalea Surf, 879-2357
David Stagno, Kihei Kai, 874-5486
Norm Castellani, Kihei Kai, 874-8339
Ken Morin, Kihei Beach Resort, 874-0169
Robert O. Siarot, Hwy-M

BRIEF SUMMARY OF MEETING: Presented the group with the proposed intersection plan. Their concern was ingress/egress. The general feeling was that our plan would increase traffic congestion on South Kihei Rd.making exiting left is difficult. Presently it is difficult to make a left turn out on to South Kihei Rd.

Resolving the left turn would mitigate the concern. Resident feel that providing a 4-four lane at the intersection would be a solution.

Ensured the committee we woukd look into their concern and will return to discuss the mitigation plan for their review.

A report of a meeting on Tuesday, May 6, 1997 with Bob Siarot of the State Highway Dept. on Maui.

The proposed intersection at the junction of the new 4 lane Mokulele Highway at Piilani Highways will resemble a broad "T". The majority of the traffic will sweep in 2 lanes to the left traveling south towards Wailea. The other traffic will move right towards Lahaina. The short piece of Mokulele Highway which now connects to South Kihei Road will be eliminated.

Traffic along Kihei Road will join Piilani Highway at a new traffic signaled junction about 100 ft south and inland of the present intersection. A short spur road between Kihei road and the beach will serve the condominiums and residence between Kealia Beach Plaza and Maalaea Surf.

The overall plan appeared agreeable to those living in this area and attending the meeting. They were:
* Bob J. Jones, owner Nani Kai Hale 808-879-1423
Joe Olson, owner Sugar Beach & Nani Kai Hale Tel.509-924-1274
Jim & Carol Olson, mgrs. Kihei Kai Tel. 808-879-2357
Mr. & Mrs. Bear, owners Maalaea Surf. 808-879-2835
David Stagno, owner Kihei Kai 808-874-5486 — He will be contacting you on this proposal
Norm Castellani owner & Board member Kihei Kai 808-874-8339
Ken Morin, architect, Kihei Beach Resort 808-874-0169

Full Time [illegible]

Imput from the owners centered on the importance of adding lanes to the existing 2 lane North Kihei Road to take the additional traffic created by the closing of the Mokulele connecting road and increased traffic created by the Rainforest Village Project.

Bob Siarot emphasized the long range plan calls for a 4 lane Piilani Highway in 2006, additional connector roads from Kihei Road to Piilani Highway and more traffic lights along Kihei Road. These improvements will make Piilani Highway the major road for traffic in and out of Kihei. Enforcing the 30 MPH speed limit along Kihei Road will also discourage through traffic.

As a near term improvement Bob Siarot said he will work on the installation of yellow barriers at the Piilani/North Kihei Road junction. The plastic barriers will direct traffic into the right hand turn and help prevent the danger of broadside collisions when rights turns are not made.

Attention was also directed to Waiakoa Gulch culverts. It was hoped the North Kihei Road improvement could include this low area to reduce the danger of road flooding during big rain storms.

Bob Siarot closed the meeting by saying he will continue to seek our imput as this proposed plan moves into the design stage.

[illegible] 212-7222

Bob J. Jones 879-1423

* I'll be back in touch after July 20th - leave Maui, May 24th