May 3, 1977

MEMORANDUM

TO: Honorable E. Alvey Wright
Director, Department of Transportation

SUBJECT: Environmental Impact Statement for Pillani Highway

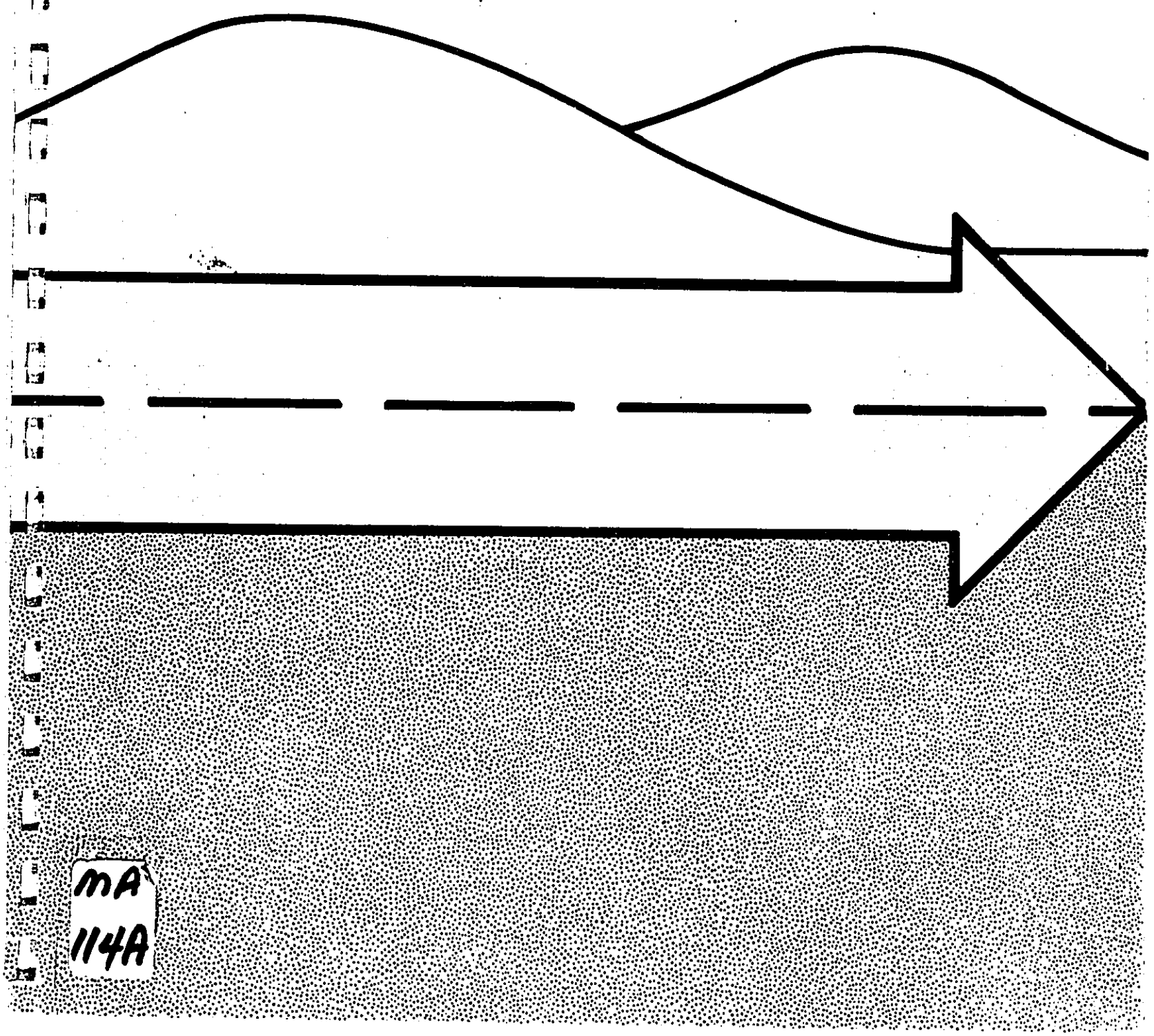
Based upon the recommendation of the Office of Environmental Quality Control, I am pleased to accept the subject document as satisfactory fulfillment of the requirements of Chapter 343, Hawaii Revised Statutes, and the Executive Order of August 23, 1971. This environmental impact statement will be a useful tool in the process of deciding whether or not the action described therein should or should not be allowed to proceed. My acceptance of the statement is an affirmation of the adequacy of that statement under the applicable laws, and does not constitute an endorsement of the proposed action.

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

George R. Ariyoshi

cc: ✓ Dr. Richard E. Marland

piilani highway



FHWA-HI-EIS-73-02-F

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Office of the Governor
550 Halekauwila Street
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PIILANI HIGHWAY

PROJECT NUMBERS F-031-1(4), F-031-1(1), AND F-037-1(10)
Kihei to Makena Road/Kula Highway
Maui, Hawaii

ADMINISTRATIVE ACTION

FINAL

ENVIRONMENTAL IMPACT STATEMENT

U.S. DEPARTMENT OF TRANSPORTATION
Federal Highway Administration

AND

STATE OF HAWAII DEPARTMENT OF TRANSPORTATION
Highways Division

Submitted Pursuant to 42 U.S.C. 4332(2)(C)
and 23 U.S.C. 128(a)

15 FEB 1977
Date

FOR R V White
Regional Administrator
Federal Highway Administration

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I. INTRODUCTION

Plans for the proposed Piilani Highway in Kihei, Maui was formulated in 1968 as a result of the County of Maui's insight to the development potential of that area as a resort community. The highway became a part of the Kihei Civic Development Plan, as amended, to meet the needs of the rapidly growing community. Starting from the Maalaea area, the 12.6 mile long highway will traverse south to the higher slopes of Makena-Kula (Fig. 1).

This report analyzes the adverse and beneficial effects of the highway and discusses the problems encountered in the formulation of the final alignment design.

II. SUMMARY SHEET

A. Administrative Action for Final Environmental Statement

This final Environmental Impact Statement contains no Section 4(f) statement.

B. Project Description

The new Piilani Highway will be located in the Kihei-Makena area on the Island of Maui, Maui County, Hawaii. The 12.6 mile long highway will be a paved, 2-lane highway with a basic 100 feet wide right-of-way. The terminal points will be at the vicinity of Mokulele Highway-Kihei Road intersection and the Makena Road-Kula Road intersection. The general alignment will pass mainly through agricultural grazing land and be about 3,000 feet from the shoreline running north-south through Kaonoulu Ranch, Haleakala Ranch and Ulupalakua Ranch. A small portion of the highway will run through existing residential areas and sugar cane fields.

C. Need for Improvement

Purpose and justification for the new highway were based on the following:
1) Compliance with the Kihei Civic Development Plan, as amended, to provide a faster and safer route between Mt. Haleakala, Lahaina and Wailuku; 2) Incorporating a

planned highway design for the area in its initial stage of development; 3) A fifty-fold expected increase in population within the next 20 years in the Kihei area; and 4) Substandard condition of the existing road which is often subjected to flooding.

Plans for improving the existing Kihei Road in lieu of a new highway were abandoned because: 1) Improvement of existing Kihei Road would have subjected property owners to high speed traffic in front of their homes; 2) Numerous private driveways would also be a significant hazard and impediment to through and local traffic; 3) In the Kamaole to Wailea area, existing Kihei Road has only limited sight distance restricting desirable traffic speeds; and 4) With the existing road being close to choice beach lots, the right-of-way cost would be substantially higher.

D. Environmental Impact

The new highway was considered in the formulation of the Kihei Civic Development Plan, as amended, and the highway will help to accommodate the present rate of urbanization of the area by providing greater accessibility to present properties served by Kihei Road and Makena Road.

Displacement of families will be kept to a minimum. One residential dwelling may be affected by the proposed new highway. Relocatees will be assisted through the State Highways Division Relocation Assistance Program.

It is expected that the new highway will not have a significant effect on the air or water quality in the area. Noise levels will not be excessive to the surrounding communities. Dust and sedimentation problems during construction will be minimized with the application of the Hawaii State's Standard Construction Specification to control dust, erosion and semimentation.

E. Alternatives

Three highway alternate corridors A, B, and C were studied and presented by the State Highways Division at the April 1968 corridor public hearing. Alternate C was selected and adopted because of its greater benefit-cost ratio and in view of favorable testimonies received during the corridor public hearing. This highway corridor follows the alignment recommended in the Kihei Civic Development Plan.

After the highway corridor was selected, it was found that the highway alignment had to deviate slightly from the Kihei Civic Development Plan alignment to provide adequate access to the properties on Kailoa Road in the Waiakoa Homestead. In this area, three alignments, Alternates D, E and F (Fig. 7) were studied and Alternate D proved to be the best selection in terms of engineering and economics. All three alignments meet at approximately the same end points and they all require the removal of two wooden structures used for storage. Alternate D displaces no families but requires a compound curve. Alternate E displaces one occupied residential dwelling, but this house could be relocated on the same property. Alternate F displaces three completed residential dwellings in the Arilani Subdivision and three more scheduled to be constructed before 1979 in the same development.

Three highway alignment alternates called G, H and I were studied. These alignments are located east of the proposed Kihei Educational Cluster so that the school children will not have to cross the highway from the residential districts to the school.

Alternate alignment H is in conformance with the amended Kihei Civic Development Plan.

F. Distribution List of Draft Environmental Impact Statement

Federal, State and Local agencies and other organizations from which comments regarding the proposed highway have been requested are shown in Appendix II. The draft EIS was mailed to the Council on Environmental Quality on June 21, 1974.

G. Action Required by Other Federal Agencies

Corps of Engineers - Section 404 Permit

H. Persons to be Contacted for Additional Information

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III. DESCRIPTION OF THE AREA

The new highway will be located on the southern coastline of Central Maui at the bottom slope of Mt. Haleakala between Kihei and Makena. At one time a small farming and fishing community, this semi-arid land is fast developing into a resort community endowed with a sunny climate and 13 miles of white sand beaches. Several subdivisions, such as Maui Meadows and Arilani, are fast developing along with hotels and condominiums.

A. Topography

The terrain is described as nearly level to gently sloping. Elevation ranges from 20 feet at the beginning of the project at Kihei to 1,800 feet at the Makena-Kula end of the project. Slope of land within the project area averages from 3 to 5 percent.

B. Soils

Volcanic rocks (either aa or pahoehoe), cinders and ash form the basic materials from which the soils developed. Soils are generally deep, well-drained, and non-stony, and are well adapted for the cultivation of irrigated crops. The dominant Great Soil Groups are the Low Humic Latosal, Alluvial, Reddish Brown, and Regosol(Ref. 20). Soils are rated "slight" - a condition requiring only the normal investigation and precautions during planning and construction (Ref. 23).

C. Climate

The area is endowed with a sunny climate with median annual rainfall of 10.5 inches. Annual air temperatures average 75 degrees at sea level with a 3 degree decrease for each 1,000 feet rise in elevation. Tradewinds from the northeast prevail approximately 80-85% of the time, broken by intermittent southerly or Kona wind patterns.

D. Vegetation

Due to a dry climate, the area has little vegetation of scenic value. Besides dense growths of Kiawe trees (prospcpis pallida), which fare well in arid areas, vegetation consists of lowland shrubs, such as koa haole (leucaena glauca), finger grass (chloris inflata), pili grass and bristly foxtail (verticillata) (Ref. 21). Irrigated crops consist of sugar cane and small gardens.

E. Wildlife

Wildlife is typical of the low lying coastal areas of the island. There are many sparrows (passer domesticus), doves (laced-necked dove, streptopilia chinensis; and barred dove,geopelia striata), mynahs (acridotheres tristis), and mongooses (herpestes auropunctatus), as well as rodents such as mice(mus musculus) and rats (Hawaiian rat, rattus exulans awaiiensis;black rat, rattus rattus rattus; gray or Alexander rat, rattus rattus alexandrinus; and Norway rat, rattus

norvegicus). However, these are not endangered species within the highway corridor and are not listed as such in the 1973 edition of Threatened Wildlife of the United States (Ref.28). As noted by the Department of Land and Natural Resources, the project area contains no game life (Appendix I). Kealia Pond, which is located approximately three thousand feet from the beginning of the project towards Maalaea, is a possible breeding or nesting ground for waterfowl; however, the highway would cause no adverse effects on this habitat due to its distance from the pond and its relative position.

IV. DESCRIPTION OF THE PROPOSED HIGHWAY

A. Type of Facility

The proposed facility is an undivided 100' minimum right-of-way, two-lane highway which represents the final segment of a paved all-points connector highway system linking Kahului, Puunene, Pukalani, Kula, Ulupalakua, Wailea and Kihei. Completion of the new Piilani Highway will provide: (1) a fast, safe and efficient transportation system for motorists between Kamaole and Ulupalakua; (2) a much improved, tourist oriented, sight-seeing south alternate route; (3) improved regional beef and agricultural produce-hauling conditions; (4) access for planned Kihei-Makena area residential and commercial development outlined in County general plans (Ref. 13); and (5) allowance of a wide strip of land between the highway and beach, thus permitting a more desirable land use for this area.

B. Project Location

Plans for the new Piilani Highway outline a 12.6 mile highway proposed for the Kihei-Makena area on the Island of Maui. The new highway alignment extends between the Mokulele Highway-Kihei Road intersection and the Makena Road merger with Kula Highway (Fig. 1).

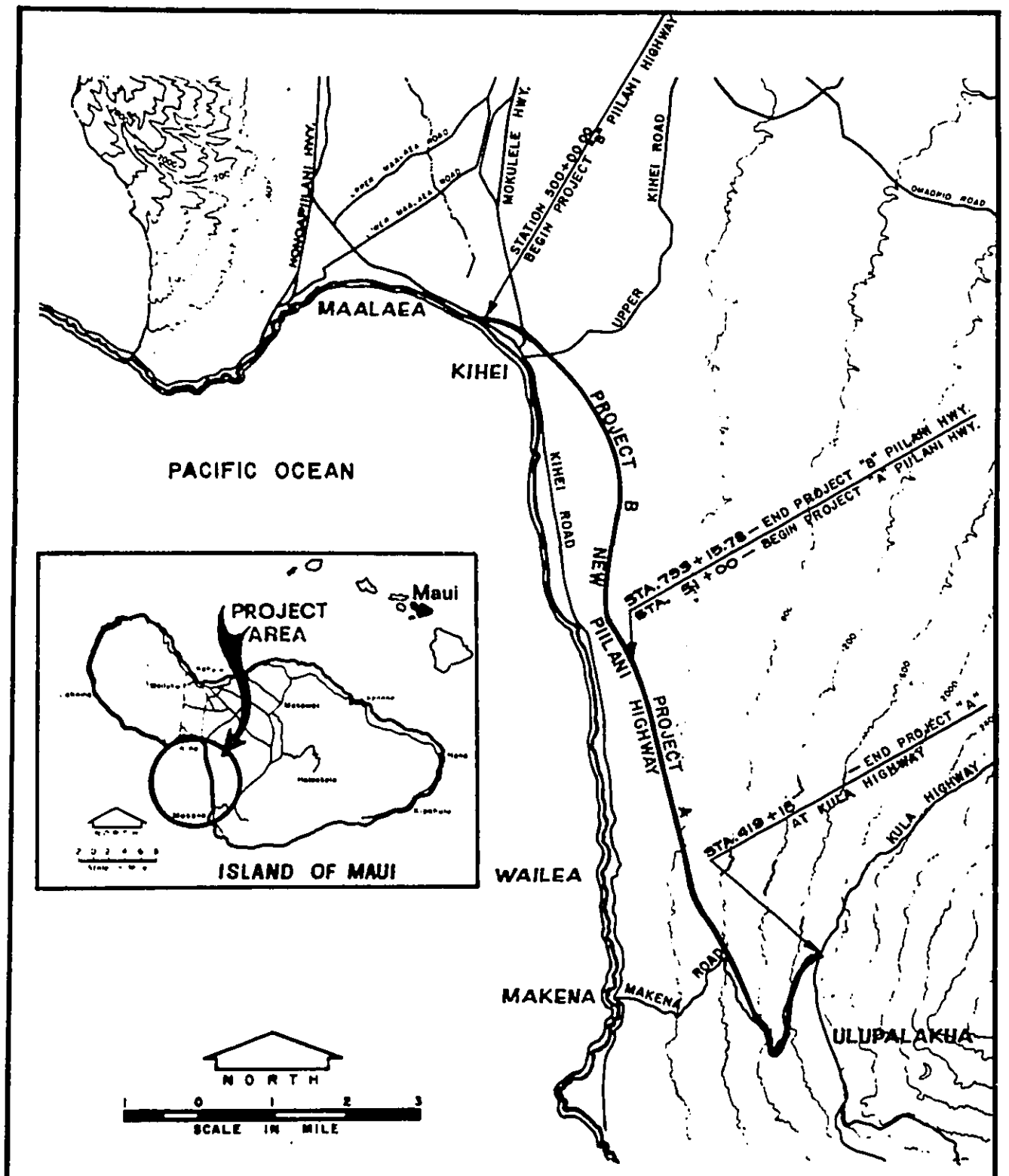


FIG. 1

NEW PIILANI HIGHWAY ALIGNMENT

The project is separated into two design-construction phases, Projects A and B.

Project B, the most northerly phase, begins at Kihei Road Station 500+00, near the Mokulele Highway intersection, and extends south to Station 793+15.78, or Project A Station 0+51. Project A, extending south-easterly from that point, eventually intersects and aligns with Makena Road to merge with Kula Highway, at Station 419+00.

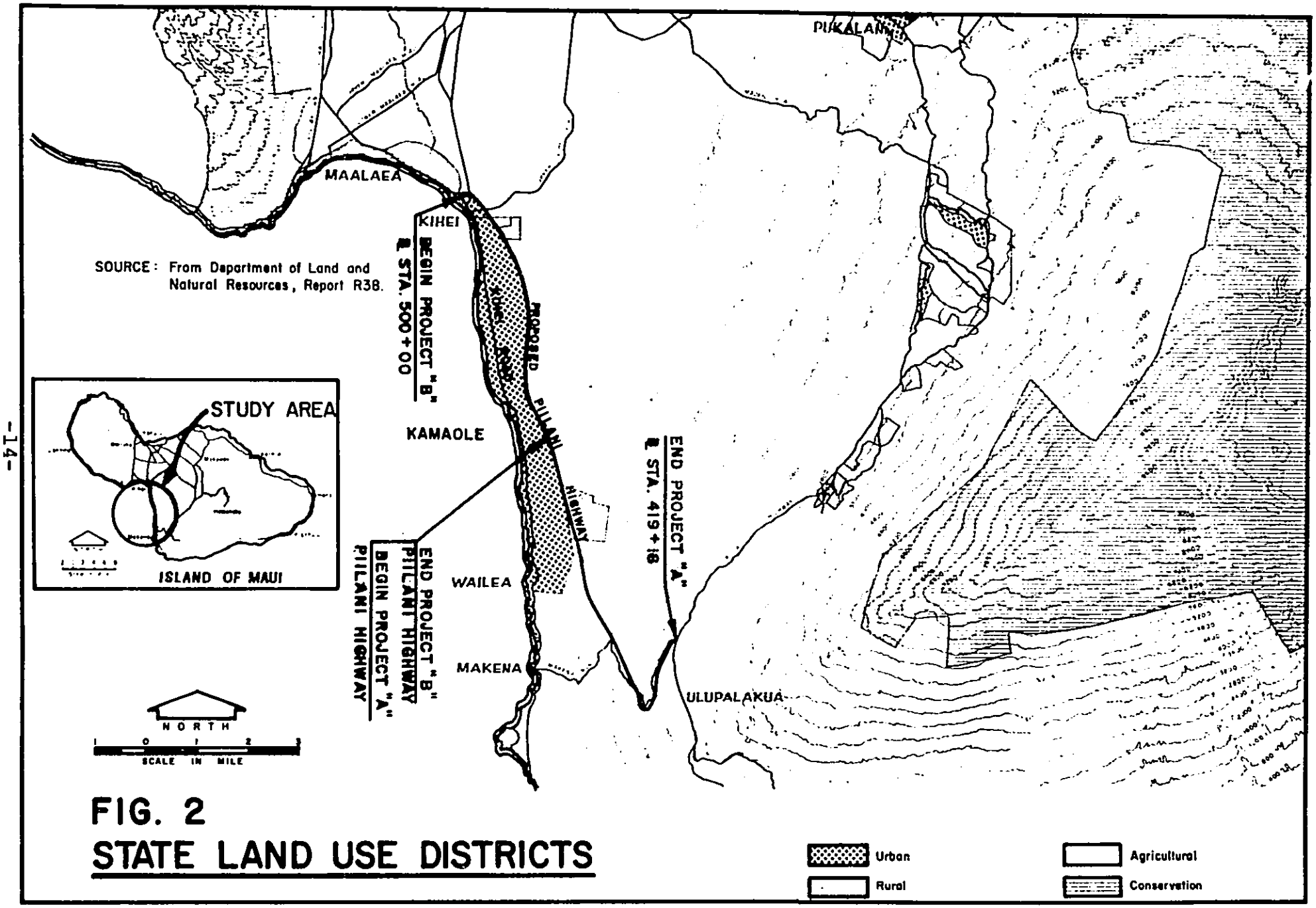
For its first mile, the Project B alignment crosses Alexander & Baldwin cane fields and several smaller, privately owned land parcels in Waiakoa Homestead. Continuing southward, it then intersects Uwapo, Kailoa, Moi, and Ohukai Roads, crosses the Kaonoulu Ranch and bypasses the eastern boundary of the proposed school site in Haleakala Ranch lands. In the Waiakoa Homesteads area, the proposed highway alignment for Project B is routed east of the present Ohukai Road-Kailoa Place intersection to avoid La Palma Park Subdivision and retain Kailoa Place as a frontage road. Beyond the Waiakoa Homestead area, the new highway alignment extends in a southeast, then a southwest direction. The alignment runs east of a two-mile segment of the boundary between the Wailuku and Makawao Districts. In Kamaole, it

bears southeast to connect with the highway alignment for Project A.

To limit access near its beginning, the Project A alignment is placed parallel to and outside of the Kanakanui Road right-of-way. The proposed alignment is then routed between Maui Meadows Subdivision and Wailea Land Development property in Paeohea,and merges with the highway corridor adopted in the County of Maui General Plan (Ref. 13). A winding reverse curve between Stations 320+00 and 360+00 is proposed to offset massive earth cuts and fills otherwise required along that segment of new highway.

C. Land Use and Ownership

Although most Kihei-Makena area property is presently dedicated to agriculture, some lands shown in the present State Land Use Maps for Maui are reserved for urban, rural and conservation use. Property west of the adopted Piilani Highway corridor, for example, is generally zoned urban. Table 1 below, summarizes the State Regional Zoning Plans by areas and percentages. Figure 2 graphically represents the existing State planned land use for the Kihei-Makena area.



SOURCE: From Department of Land and Natural Resources, Report R38.

FIG. 2

STATE LAND USE DISTRICTS

TABLE 1

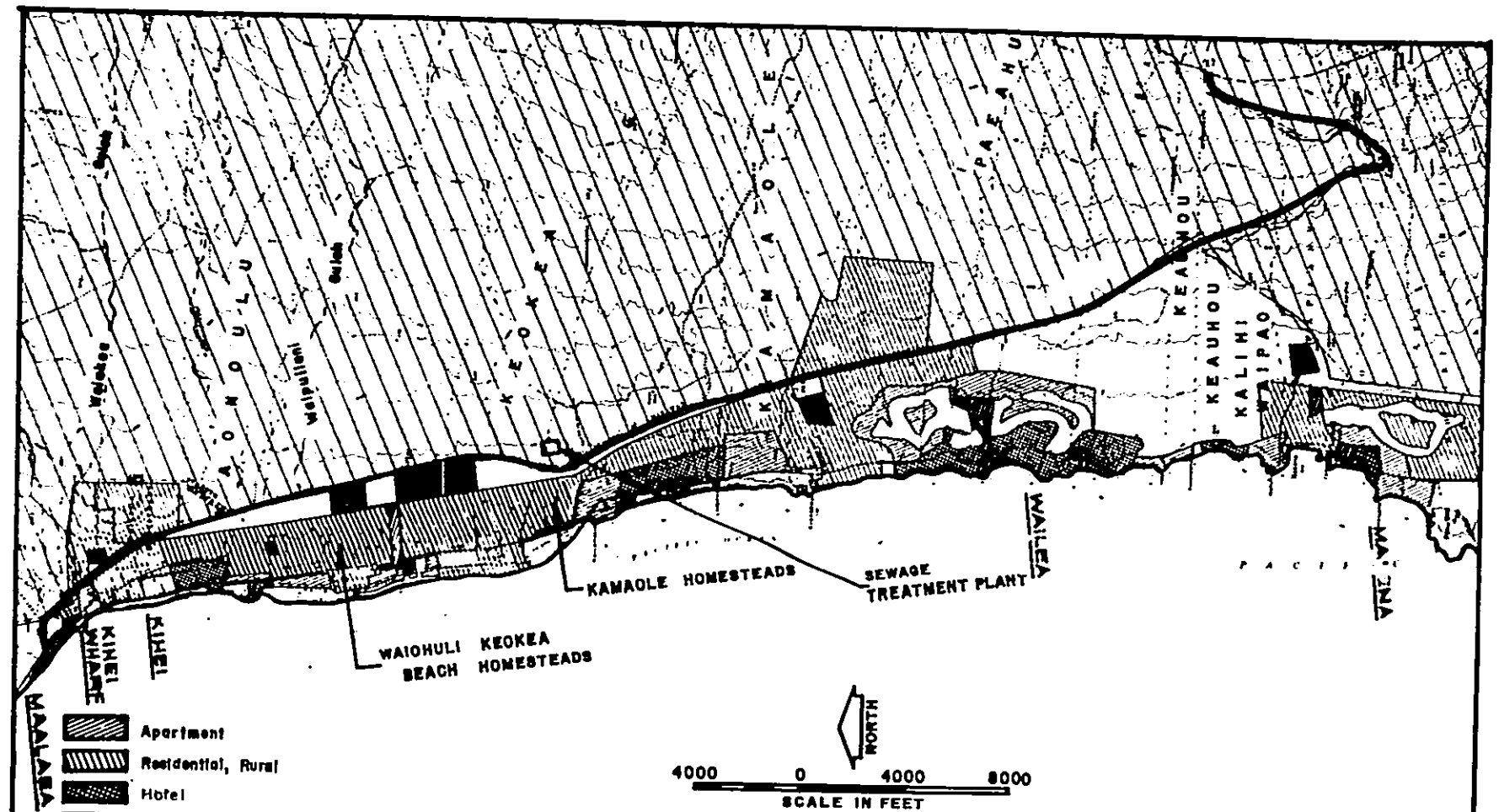
LAND USE PERCENTAGE CHART

District	Area (Sq. Mi.)	Percentage
Agriculture	65.27	84.85
Conservation	9.49	12.34
Urban	0.22	0.29
Rural	1.95	2.52

The Kihei-Makena area land development plan, shown on Fig. 3, has been approved and adopted as a component of the Maui County Master Plan in the proposed development of the Maalaea, Kihei Wharf, Wailea, Makena and Kamaole regions (Ref. 13).

The Kihei Civic Development Plan calls for a 20 year development period. Indications are that the multitude of various developments in the Maalaea, Kihei Wharf, Kamaole and Wailea areas are to be realized in accordance with the master plan. However, resorts such as those being planned in Makena are based on a general ten-year development period with an annual rate of units to be constructed. Below are some of these planned developments:

1. Maalaea has been planned for single and multiple family residential uses,



SOURCE: KIHEI CIVIC DEVELOPMENT PLAN, AS AMENDED 1970, AVAILABLE FOR REVIEW AND PUBLIC INSPECTION AT THE MAUI COUNTY PLANNING COMMISSION AND THE STATE HIGHWAY DIVISION MAUI DISTRICT OFFICES.

FIG. 3
REGIONAL PLAN

surrounding the boat harbor and its related industrial usage.

2. Kihei Wharf in Kalepoleko is planned for resort, hotel, residential, beach and park area expansion.
3. Hotel and major resort is planned for Kamaole.
4. Alexander & Baldwin, Inc., operating through the subsidiary Wailea Land Development, plans a 1500-acre resort site at Wailea.

Properties east of the adopted corridor are owned by Haleakala, Kaonoulu and Ulupalakua Ranches, Maui Land & Pineapple Company, Inc., Hawaiian Home Lands and smaller interest, such as Maui Meadows Subdivision. Owners west of the adopted corridor between Kihei and Makena consist of smaller interests such as Alexander & Baldwin, Inc.(Figure 4)outlines the approximate relationship of properties adjoining one another and the adopted Piilani Highway corridor.

D. Traffic Assignment

In 1971 the Hawaii State Department of Transportation Highway Planning Branch conducted a traffic assignment study for Kihei Road and the new Piilani Highway for the years 1973 and 1993 in view of the development of the Kihei area. The study shown below (Table 2) indicated

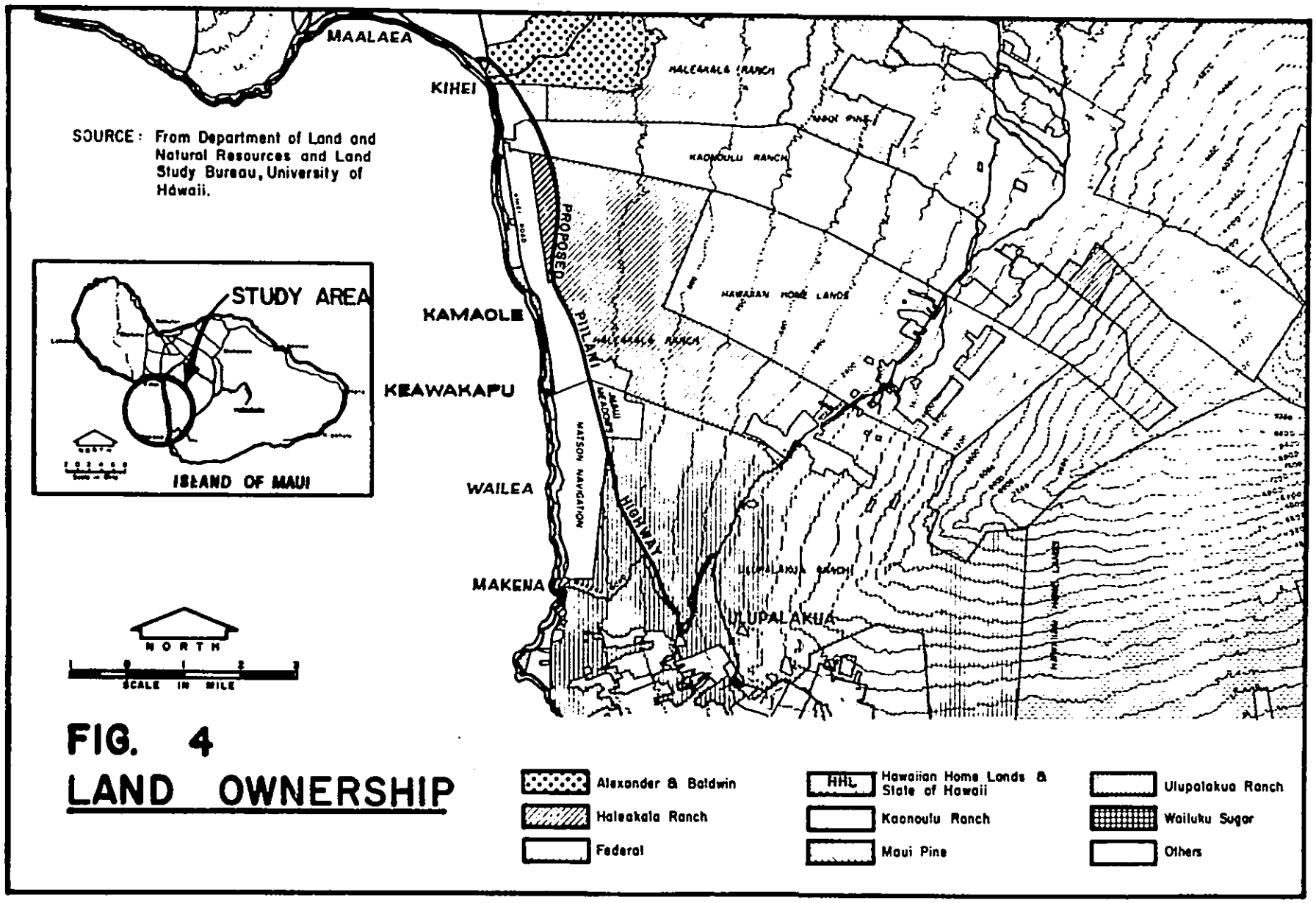


FIG. 4
LAND OWNERSHIP

that the 1973 average daily traffic (ADT) along Kihei Road is 2300 vehicles per day and the ADT projected to 1993 will be 5500 vehicles per day in addition to the traffic on the new Piilani Highway (Ref. 11).

TABLE 2

KIHEI TO MAKENA ROAD PROJECTED TRAFFIC FLOW

Location	Time	Kihei Road				Proposed Highway			
		1973		1993		1973		1993	
		West	East	West	East	West	East	West	East
Kihei to Kalama Park		2300		5500		3100		7400	
	AM	150	70	360	160	210	90	500	210
	PM	70	160	170	380	90	220	220	520
Kalama Park to Route 31/37 Jct.		1300		3000		2600		6300	
	AM	80	40	200	90	180	70	420	180
	PM	40	90	90	210	80	180	190	440
Route 31/37 Jct. to Makena Rd./ Kula Hwy.Jct.		1400		3400		1400		3400	
	AM	90	40	220	100	90	40	220	100
	PM	40	100	100	240	40	100	100	240

Construction of Piilani Highway, contingent upon the availability of funds, is anticipated to start in 1977. If the highway is completed by 1979, the ADT at that time is projected to be 4400 vehicles per day. In 1993, the design year for Piilani Highway, the ADT is expected to reach 7400 vehicles per day (Ref. 11). Piilani Highway would, of course, be designed to accommodate these projected traffic volumes.

E. Major Design Features

1. General

The new Piilani Highway plan proposes a 44-foot wide roadway consisting of two 12-foot,undivided paved lanes bordered by 10-foot paved shoulders as shown in Fig. 5.

Safety features considered in the highway design include: (1) asphalt concrete gutters for high embankments where slopes may be susceptible to erosion; (2) gutters and cutoff ditches lined to withstand runoff, if required; (3) traffic signs; (4) emergency exit lanes at steep downgrades; (5) guardrails; and (6) slope roundings wherever they become necessary.

Basically, the right-of-way will be 100 feet wide but varies depending upon the topography. No left turn lanes are being provided.

In general, design criteria for the new highway stipulate: (1) 50 miles per hour design speeds in conformance with the American Association of State Highway and Transportation Officials (AASHTO) standards. (Lower design speeds of 40 miles per hour will be used for the highway along the proposed school area and the reversal alignment following approximately the exist-

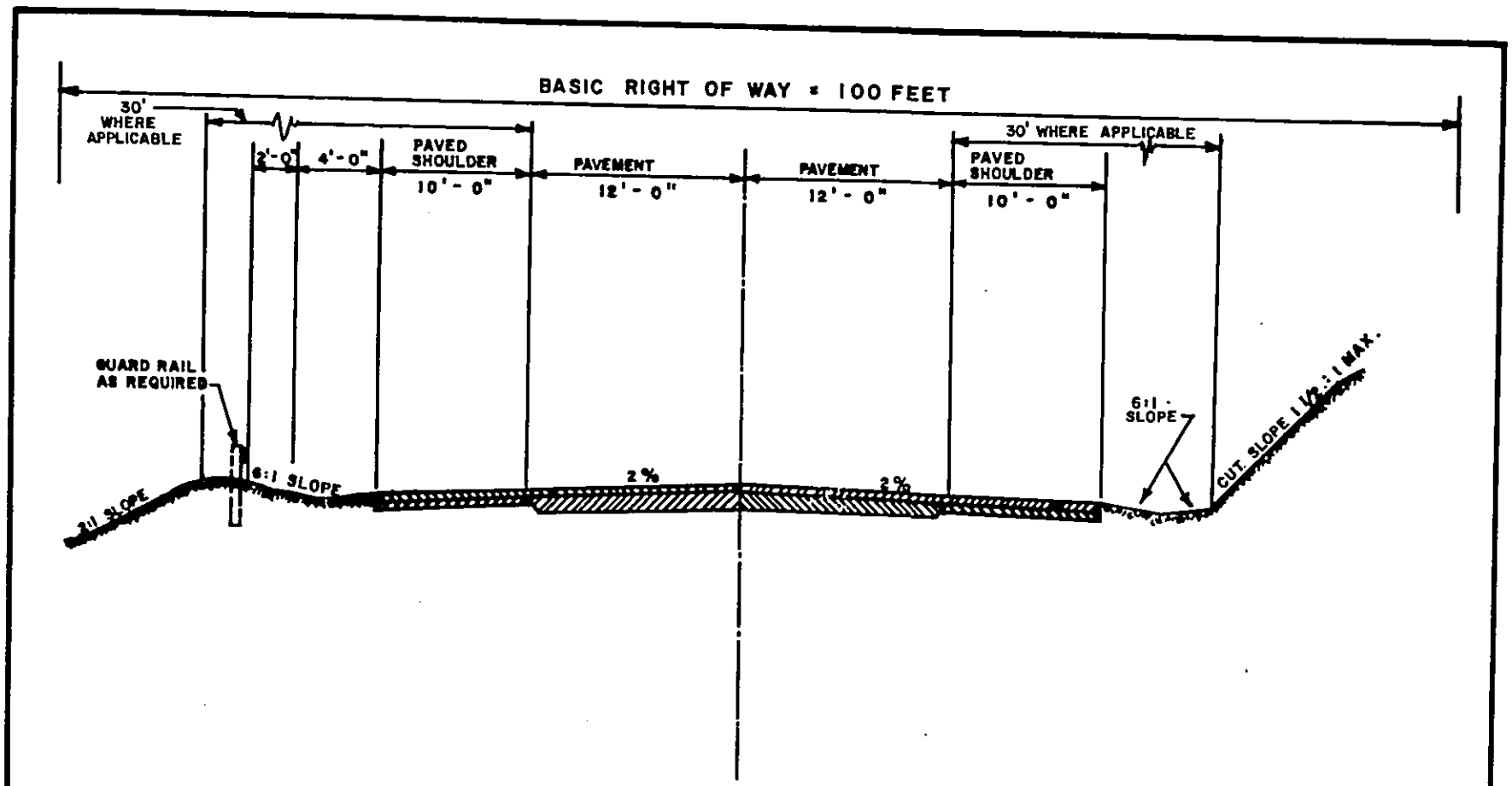


FIG. 5

TYPICAL HIGHWAY SECTION

PIILANI HIGHWAY
KIHEI TO ULUPALAKUA

ing Makena Road toward the end of the highway. The posted speed limits on the highway may be lower than the design speeds where lower speeds are considered necessary for safety); (2) strict design requirements and provisions for a highway drainage system; (3) maximum 7 percent highway profile grade allowances; and (4) scenic vista point and cattle crossing requirements (Ref. 10).

2. Profile

The roadway profile proposed for the new system is set to maintain a smooth grade which develops gradual changes consistent with the character of the terrain. In addition to satisfying required design controls, the profile permits new easy highway connections to surrounding roadway networks. Grades approaching the allowable maximum of 7 percent are set to minimize excavation requirements along a segment of the new highway crossing rugged ranch land terrain.

3. Intersections

Approximate access locations to the highway are presently proposed at Project A stations:

58+00	Haleakala Ranch - Mendonca Access and Keonekai Road
70+00	Mendonca Access and Maui Land Investors Access
85+00	Mapu Place and Kilohana Street
103+00	Kupulau Drive
123+00	Mikioi Place and Wailea Access #2
160+00	Ulupalakua Ranch Access #1 and Wailea Access #3
195+00	Ulupalakua Ranch Access #2 and Wailea Access #4
225+00	Ulupalakua Ranch Access #3 and Wailea Access #5
243+00	Ulupalakua Ranch Access #4 and Makena Road
257+00	Ulupalakua Ranch Access #5
295+00	Ulupalakua Ranch Access #6
339+80	Ulupalakua Ranch Access #7
392+00	Ulupalakua Ranch Access #8

and at Project B stations:

513+00	Mokulele Highway and Kihei Road
535+00	Uwapo Road
550+00	Moi Place
562+00	Kailoa Place and Ohukai Road
600+00	Kaonoulu Ranch Access
611+00	Haleakala Ranch Access #1
635+00	Haleakala Ranch Access #2 and Waipuilani Road

663+00	Lipoa Street, and Haleakala Ranch Access #3 and Kihei Educational Cluster Access
694+00	Welakahao Road, and Haleakala Ranch Access #4 and Kihei Educational Cluster Access
738+00	Kanani Road
754+00	Auhana Road and Kanakanui Road
773+00	Haleakala Ranch Access #5 and Kanakanui Road

Project B access roads are to be aligned with 1) the future roadway system of Kihei Civic Development Plan, as amended (Ref. 13); 2) the County's sewage treatment plant; and 3) other Haleakala Ranch service roads.

4. Structures

The structures to be built in conjunction with the highway include culvert crossings or bridges located at all stream crossings along the highway. At this time, bridge structures are being considered for crossings at Kulanihakoi and Waipuilani Streams. These streams which are intermittent and dry most of the year contain no aquatic life and carry high volumes and velocities of flood waters during winter months. In some ranch land areas, drainage culverts are also being considered to be used as cattle crossings.

5. Landscape

Roadside plantings, topsoil stock-piling, maintenance for erosion control and other forms of landscaping and sprinkling will be considered in the detail design phase.

F. Existing Roadway Conditions

Conditions along the existing roadway between Kihei and Makena are below minimum County and State requirements when compared to present day roadway standards (Ref. 8). The paved portion of Kihei Road from Mokulele Junction to Kamaole is 6.4 miles. Roadway pavement is approximately 20 feet wide with shoulders varying from 2 to 4 feet. The right-of-way width varies from 40 to 60 feet. Access is uncontrolled with numerous private driveways along the existing road. Grades are flat, ranging from 0-3 percent. The condition of the pavement is recognizably deteriorated with numerous potholes.

The unpaved portion of Kihei Road and Makena Road from Wailea to Ulupalakua is approximately 9.0 miles. The average roadway width is 14 feet. The road profile grades range up to 12 percent. Limited sight distances, dust, and unimproved road surfaces make this portion of the roadway unsuitable for all but jeep and

truck traffic. The lack of an adequate drainage system along the coast from Kihei to Makena exposes the roadway and abutting properties to flooding during storm water runoff from Mt. Haleakala.

The north terminal of the proposed Piilani Highway is located at the existing Kihei Road in the vicinity of Kealia Pond. Most of Kihei Road runs through land designated "agricultural" and traffic is not as heavy as that portion of the road in the Kihei-Kamaole area. Presently, no State sponsored improvements are planned for the 4-mile segment of Kihei Road connecting the north terminus of Piilani Highway and the existing Honoapiilani Highway. This section of existing roadway is currently under Maui County jurisdiction and was recently resurfaced in summer 1976. Plans for this segment to be turned over to the State are presently underway.

The south terminal is located at the old Kula Highway which consists of a narrow macadam road with little or no shoulder areas. Steep and undulating grades with numerous blind and sharp curves make it a hazard to travel along this portion of the old Kula Highway which joins with the new improved two-lane Kula Highway at Waiohuli-Keokea. A Planning Report

of Kula Highway (Ulupalakua to Keokea) for improvement of this portion of Kula Highway was issued by the State Highways Division in August 1976 (Ref. 12a). Planning concepts call for a new alignment with roadway and shoulder widths which would be compatible with Piilani Highway. The proposed Kula Highway will be an undivided two-lane primary facility about 4.6 miles in length. The tentative construction schedule for this segment of highway is late 1979, providing funding is available.

G. Economic Factors

1. General - Completion of the new Piilani Highway will most certainly have a marked impact on the Kihei-Makena area of Maui. Tourism and sightseeing should be greatly enhanced. The transportation of agricultural goods from outlying communities to central market places may be more readily accomplished. A direct Kamaole to Ulupalakua route will be established. Construction equipment and materials required for land development may be conveniently transported to otherwise remote or inaccessible sectors of the Kihei-Makena area (Ref. 13).

2. Economic Activity - With the exception of passing through a small portion of the Trojan corn field, Alexander & Baldwin sugar field and some existing residential areas, the proposed highway alignment will be on ranchland owned by Kaonoulu Ranch, Haleakala Ranch and Ulupalakua Ranch (Fig. 4 and 7).

The alignment is not expected to adversely affect existing employment. Agricultural operations will be modified by the division of property caused by the alignment. For instance, cattle will have to use certain culverts to cross the alignment. Beneficially, the highway will provide easier and faster transportation of goods. The approximate acreage of land by use that is affected by the proposed alignment and the 100-foot right-of-way is given in Table 3 below:

TABLE 3

LAND USE AREA OVER HIGHWAY ALIGNMENT

Classification	Use	Acres
Agriculture	Crop	2.40
	Pasture	106.94
Urban	Residential	41.36
	TOTAL	150.70

3. Employment - Justification for the Kihei Civic Development Plan, as amended, which includes extensive residential, hotel and complementary business and school development, depends to some extent upon completion of the new Piilani Highway (Ref. 13). The highway will provide a safer and more efficient route for development of the area, expedite construction of houses, hotels and other structures, and thus, generate employment considerably.

Expected population increases inevitably evolving from project completion should create a strong demand for community-supporting business development which, in turn, will cause a rise in local employment rates (Ref. 13).

4. Taxes - The proposed highway, when completed, should have measurable effects on local government. Indirectly, property tax-base evaluations will probably be influenced through the improved access. Directly, taxable lands purchased for highway right-of-way would be withdrawn from the tax revenue structure (Ref. 7). The estimated tax revenue loss due to right-of-way acquisition would be approximately $10,600 per year. But the loss

of taxable agricultural, pasture and residential lands should be offset by the increased tax rolls of proposed urban and resort developments in accordance with the General Plan that are promoted by the new highway facilities.

The area's subsequent settlement and development should increase government spending as a result of escalated public demands for water distribution and sewage collection treatment systems, and fire and police protection services.

H. Schedule

1. Design Schedule - The final design of the entire Piilani Highway including the preparation of the drawings, specifications, cost estimates, contract documents, and right-of-way requirements will take approximately one year. Design of Project A and Project B will each take approximately 8 months with 4 months overlap in the design periods for each project.

2. Right-of-Way Acquisition - Right-of-way acquisition will proceed upon design approval.

3. Construction Schedule - Construction of the proposed highway is to be done in two separate phases. In 1968 after the corri-

dor hearing, it was felt that Project A, the section between Kalama and Ulupalakua, should be built first to provide an all points connector system at the earliest possible date. At that time, the existing Kihei Road was considered adequate to handle the traffic for a few more years.

Recently, however, there have been many opinions from the Kihei community that Project B, the section from Kihei to Kalama, should have priority in construction because of the rapid development in the area. Construction of the Project A section is expected to take approximately 18 months and the Project B section approximately 15 months.

Revised construction scheduling now provides for initial construction of Project B.

The anticipated schedule for design, right-of-way acquisition and construction is shown in Table 4 below:

TABLE 4

SCHEDULE

	Start	Completion
Design	- - -	December 1977
Right-of-way Acquisition	July 1977	August 1978
Project A	September 1978	March 1980
Project B	February 1978	May 1979

V. ALTERNATES

A. General

The Kihei Civic Development Plan, as amended and adopted in 1975, shows a specific highway alignment which is part of the General Plan. Any deviation from this alignment will require an amendment to the development plan. Alternate routes were considered on three sections of the highway alignment. One section is located in the portion designated as "Project A" and two other sections are located in the "Project B" section (Fig. 6). Besides studying alternate routes of the proposed highway, the alternative of no highway construction is also considered below.

B. Alternates in Project A

Three alternate alignments were developed for the general highway corridor and presented at the April 1968 corridor public hearing. The differences between the three alignments in the Project A section were their locations and terminal points. The following were presented in the 1968 corridor public hearing:

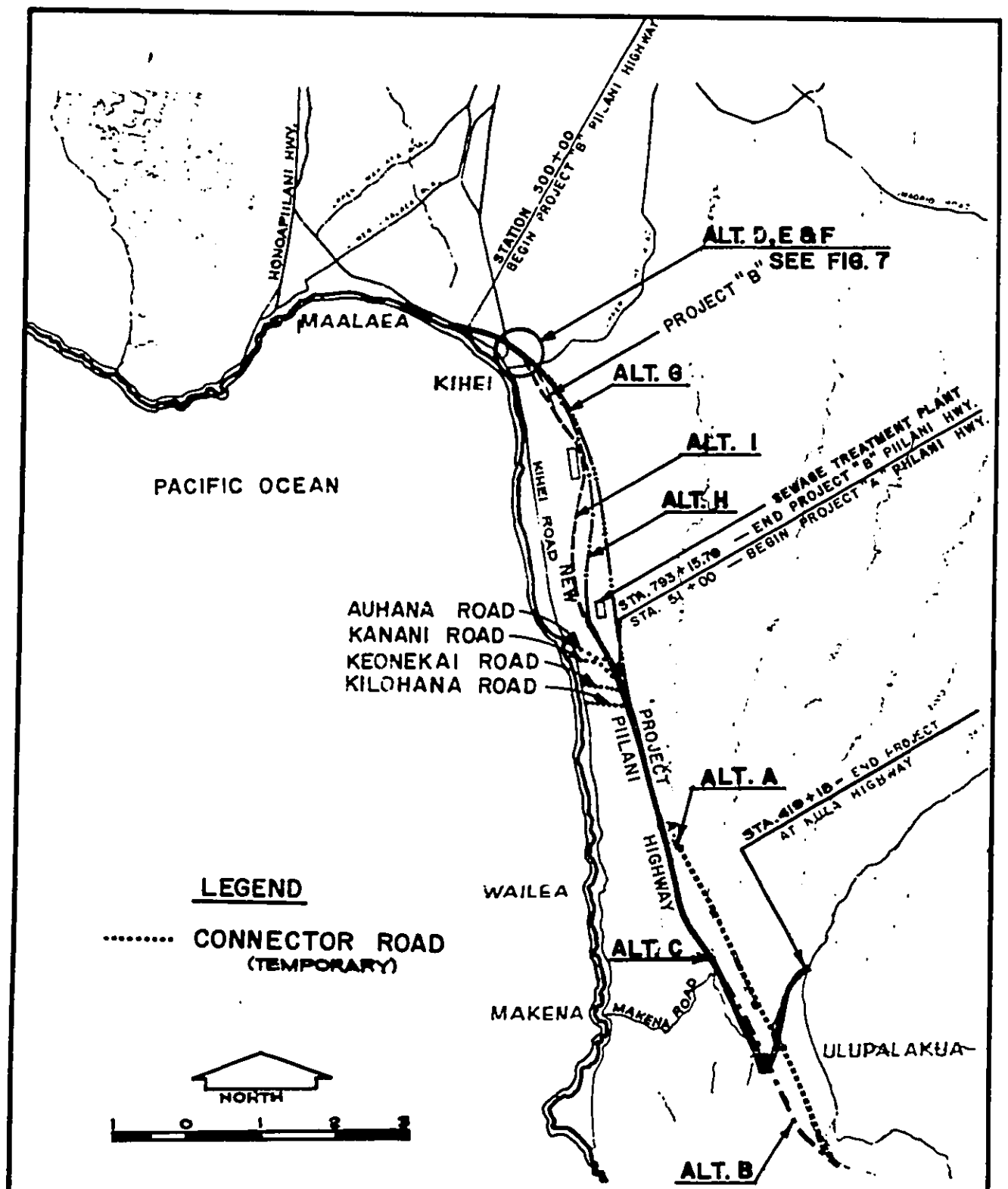


FIG. 6

ALTERNATE ALIGNMENTS

1. Alternate A

This 12.5-mile alignment from Kihei to Ulupalakua began at the same point as the presently proposed alignment and ran southeasterly to end west of Ulupalakua at the present point of termination. Its construction called for unusually deep earth cuts.

2. Alternate B

12.6 miles long, this alternate with similar features of design was routed parallel to and at an elevation below Alternate A. The final 1.5 miles assimilated most of Kanaio-Kalama Park Road. Alternate B also involves extremely deep earth cuts.

3. Alternate C

The 12.6 miles of Alternate C alignment paralleled Alternate B for 10.4 miles, then curved northward along Makena Road to terminate north of Ulupalakua at Kula Highway.

Table 5 compares the construction and right-of-way costs with each alternate. The engineering costs are not included and are $335,600, $330,000 and $317,700 respectively for Alternates A, B and C.

TABLE 5

ALTERNATE COST SUMMARY

Item	Alternates		
	A	B	C
Pavement	$3,213,000	$3,279,000	$3,259,000
Grade, Drainage, Structures	3,595,000	3,420,000	3,858,000
Right-of-Way	707,000	712,000	710,000
Total	$7,515,000	$7,411,000	$7,827,000

The estimated cost of Alternate C is greater than Alternate A or B; however, its benefit-cost ratio is higher than the other Alternates (Table 6). The cost shown is for the entire highway using a common alignment in the Kihei residential area.

TABLE 6

BENEFIT-COST RATIO SUMMARY **

Alternate	Total Road/User Cost/Year	Annual Road/User Savings	Annual Cost	Benefit-Cost Ratio*
A	$6,339,674	$1,497,000	$312,000	4.80
B	6,347,551	1,489,000	308,000	4.83
C	6,244,000	1,593,000	324,000	4.92

* Maintenance cost considered insignificant.
** Reference 10

C. Alternates in Project B

1. Alternate D

Cuts through the Roy Chong properties, crosses Moi Place and bisects the George Kukahiko property before proceeding through the Equity Capital Corp. and T. Hashimoto properties (Fig. 7). A portion of the Roy Chong properties, previously designated "public use" is now designated "residential" by the amended Kihei Civic Development Plan.

This alignment displaces a quonset hut warehouse and an old, uninhabited, wooden frame house both of which can be relocated within the remaining property. However, it requires a compound curve with approximately a 7000-foot radius, which is not a desirable engineering feature.

In 1974, the State Highways Division made an estimate of the right-of-way acquisition and relocation costs for this alternate. The estimate was $441,500.

2. Alternate E

Placed approximately 200 feet below Alternate D, cuts through the Roy Chong properties, the George Kukahiko, Charles Plunkett, R. Hondo, Equity Capital Corp. and T. Hashimoto properties (Fig. 7).

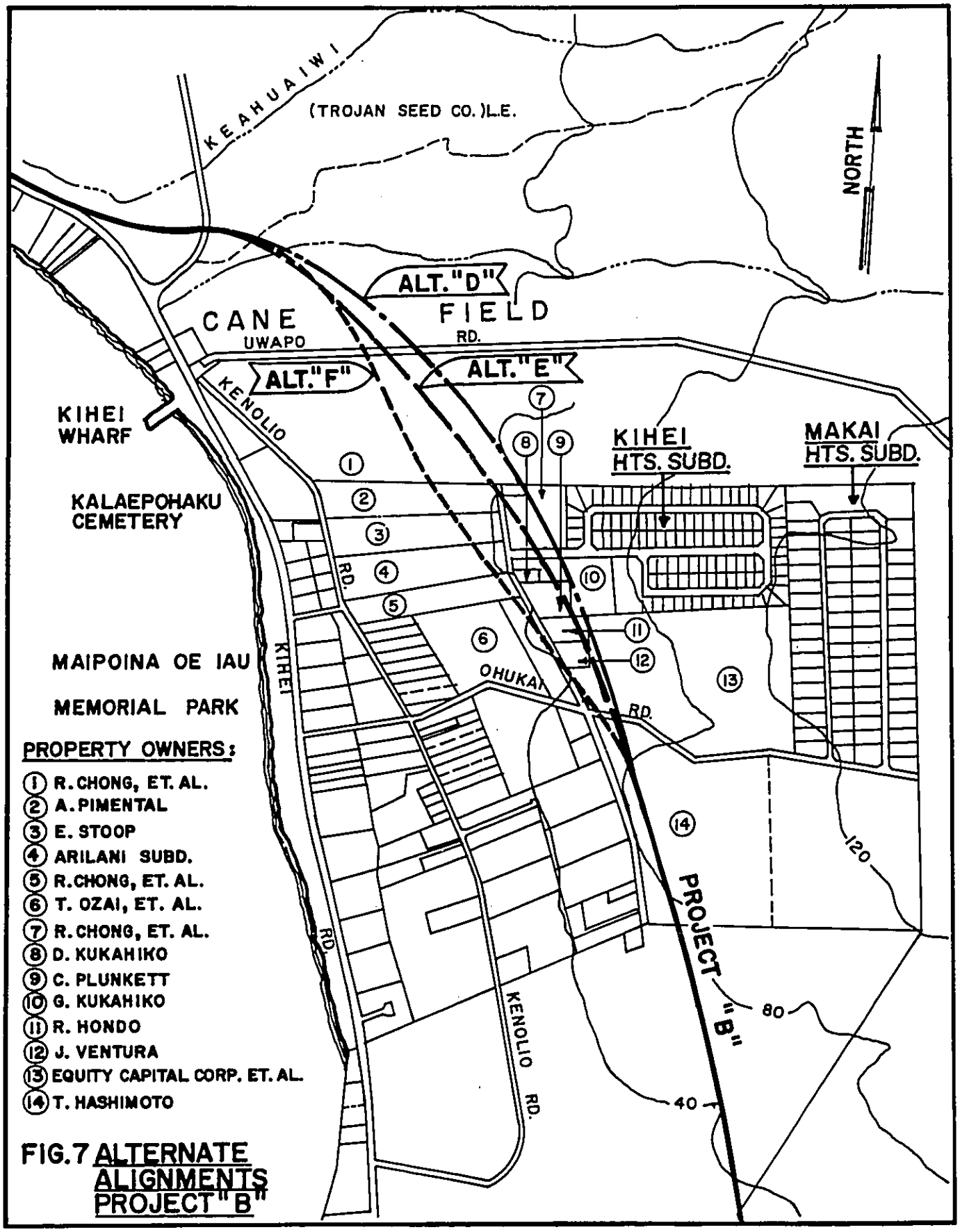


FIG.7 ALTERNATE ALIGNMENTS PROJECT "B"

This alignment requires the displacement of one residential dwelling and two storage structures. Also, it affects more parcels than Alternate D.

An estimate of right-of-way acquisition and relocation costs for this alternate made in 1974 by the State Highways Division was $533,000.

3. Alternate F

Located approximately 300 feet below Alternate E, crosses the Roy Chong property and the eastern portion of the August Pimental and Emery Stoop properties. It then cuts across the east quarter of the Arilani Subdivision and the upper portion of two other parcels before crossing Kailoa Place, Ohukai Road and joining the same general corridor on the T. Hashimoto property (Fig. 7).

Alternate F displaces three completed residential dwellings in the Arilani Subdivision and possibly three more scheduled to be completed before 1979. Like Alternate D, Alternate F also displaces the two wooden storage structures mentioned. It has the most desirable combination of vertical and horizontal alignments.

The right-of-way acquisition and relocation costs for this alternate as determined by the State Highways Division in 1974 was $807,500 (based on completion of dwellings in the Arilani Subdivision), or $637,000 (based on subdivided vacant lots in the Arilani Subdivision).

4. Alternate G

Running above the proposed school site, was examined in view of the staff study prepared by the State's Department of Accounting and General Services (D.A.G.S.) recommending that Piilani Highway be located east of the proposed Kihei Educational Cluster. D.A.G.S. favored this alignment to prevent the school children from having to cross the highway where the speed limit is expected to be posted at 25 m.p.h. However, D.A.G.S. recommended that a pedestrian overpass could be constructed as an alternate if relocation of the highway alignment was not feasible.

This alternate alignment was located approximately 1,200 feet east of the Wailuku-Makawao District boundary (Fig. 6). The profile of this alignment was plotted and, in general, had characteristics similar to the proposed alignment regarding earthwork and drainage structures. Its length was

approximately the same as the proposed alignment of 3.5 miles. Alternate G would not have as many access and intersection requirements as the adopted highway corridor. However, construction of connections to existing roads through the Haleakala Ranch property would be an added County expense. This alignment is not in conformance with the Kihei Civic Development Plan as amended.

As the result of a request by the Kihei Community Association, two alternate highway alignments called Alternates H and I were studied and presented with the other alternatives at the Public Informational Meeting held on April 24, 1974, and at the Design Public Hearing conducted on July 31, 1974, at the Kihei School Cafetorium on Maui.

5. Alternate H

Passes east of the proposed school site but is aligned below the proposed sewage treatment plant (Fig. 6) and is in conformance with the amended Kihei Civic Development Plan. This alignment would add an additional curve in the highway, but as in Alternate G, the curve would be gentle and smooth. The distance from the highway to the treatment

plant would be reduced from 600 feet for the originally proposed alignment to about 150 feet for Alternate H. The vertical alignment for Alternate H is fairly gentle and is below the recommended maximum of 5%.

Both Alternates G and H have the following advantages: (1) Direct route consistent with topography having a desirable combination of horizontal and vertical alignments;
(2) Eliminates the need for school children to cross a major thoroughfare. These alternates also have the following disadvantages:
(1) Existing collector streets will have to be extended to meet the new highway; (2) A secondary road following the proposed highway alignment must be constructed to provide efficient traffic circulation in this area; (3) Additional cost and time will be required for mapping and engineering; (4) Possible rezoning of existing agricultural land makai of the alternate alignment will place additional burden on the new sewage treatment plant.
(5) Possible slowing of traffic flow on Piilani Highway adjacent to the school because of on and off ramp vehicles. However, this disadvantage applies to all alternate routes.

A highway alignment east of the school site requires extensions of collector streets from Welakahao, Lipoa, Waipuilani, and other streets for optimum use of the new highway facility by the local community. This improvement and added costs will be the responsibility of Maui County.

Comparative costs of the alternate alignments G & H are shown on Table 7 below:

TABLE 7

COMPARATIVE COSTS OF ALTERNATES G AND H

Alternate	G	H
Basic Construction Cost	$1,622,000**	$1,622,000**
Pedestrian Overpass	- - *	- - *
Extension of Collector Roads (by Maui County)	382,000	209,000
Total	$2,004,000	$1,831,000

* To be State funded.
** Including additional Engineering and Surveying

An alignment east of the school site will delay the completion schedule of engineering design for the highway because of the additional time required for planning and surveying the new corridor.

6. Alternate I

Approximately 4.23 miles long and bypasses above the proposed school site and below the treatment plant (Fig. 6). In bypassing this area, the alignment has two reverse or S-shaped curves. These curves are not desirable from an engineering viewpoint and therefore, this alignment was discarded as an acceptable alternate.

D. Alternatives for Temporary Connection

Because the highway is expected to be constructed in phases, a temporary connection from the first phase of the highway to the existing Kihei Road is needed. Four planned access locations for the first phase are Auhana Road, Kanani Road, Keonekai Road and Kilohana Street. These four locations could be considered for temporary connection. Kilohana Street has been selected as the temporary connection to existing Kihei Road pending availability of construction funds. The temporary connection will be in use for at least 18 months after Project B has begun. The adverse impact for the road that is chosen as a temporary connection is that additional traffic from the new highway would be routed through it to the existing Kihei Road.

For Auhana Road and Kanani Road where there are more residential developments than Keonekai

Road and Kilohana Street, the added traffic will mean more traffic noise and exhaust emissions than that being presently experienced. Paving and striping along Kanani Road will be a beneficial impact for that road. Auhana Road, if selected, would be widened and repaved. Keonekai and Kilohana are in good condition and do not need to be upgraded for use as a temporary connection. Presently, the areas along these two streets have few developments.

At the design public hearing, it was suggested that the new highway (first phase) be extended to reach Wailea instead of Kalama. If a connection is chosen at Wailea, it will be beneficial to the Wailea Resort by providing easier access to that area.

E. Improvement of Existing Facilities (Kihei Road)

Improvement of the existing Kihei Road along the coast was considered as an alternative to the new highway. However, this was felt to be neither feasible nor advantageous for the following reasons:

1) Improvement of Kihei Road would have subjected owners to high speed traffic in front of their homes.

2) Numerous private driveways would also be a significant hazard and an impediment to through traffic.

3) Because Kihei Road is only a few feet above

sea level, it would be exposed to frequent flooding and proper drainage would still be a major problem.

4) In the Kamaole to Wailea area, limited sight distance and adverse grades restrict desirable running speeds.

5) Being close to choice beach lots, the right-of-way cost would be substantially higher.

F. Effect of No New Construction

In the event that plans for the new highway are suspended, traffic will be forced to use the available roads which, when compared to County and State standards, will operate below stipulated requirements (Ref. 8). Kihei-Makena area land development would require at least a resurfacing program for the existing roadway. Although it would improve area access, such a step would not offset existing roadway problems of flooding, steep grades, lack of access control, and limited lateral clearance.

G. Other Than Highway Construction

As a step in the County of Maui master planning, the feasibility of an island mass transit system was reviewed in the General Plan, Lahaina District, County of Maui, 1969. The report stated that although an island mass transit system would satisfy human conveyance needs, it proved inadequate when compared to a new around-the-island highway capable also of accommodating trucks haul-

ing large agricultural produce and livestock shipments. It mentioned that a mass transit system on the Island of Maui would probably not be economically justified before the year 2000.

VI. PROBABLE IMPACT OF THE PROPOSED HIGHWAY

A. Social

1. Urbanization

Up until 1968, urban development in Kihei area has been minimal, but in the past few years the urbanization process has begun to move at a faster pace. New residences, subdivisions and other planned developments are either being constructed or are in the planning and design stages. The new highway will increase this tempo of urbanization until the Kihei Civic Development Plan, as amended, is realized in about 20 years by providing easier access to the Kihei area and by providing a more efficient means of transporting construction material.

Two impressive planned resort developments will have a significant impact on social and economic conditions in the area. These are: the Wailea project by Alexander and Baldwin, and the Makena project by Seibu, a Japan-based firm. The 1,500-acre Wailea site will be developed as a "City of Flowers". Presently, a completed 18-hole golf course is being used by both residents and visitors. Recently approved from agriculture to urban zoning, the Makena site will be developed into a huge

resort complex within the next 10 years. Plans include building 4,292 apartment units (more than the entire island has now), 477 homes and 1200 hotel rooms at an annual rate of 495 apartments and 150 hotel rooms. Seibu also plans to spend $6,682,000 for road development.

Approximately 1,350 directly related jobs and 2,260 indirectly related jobs will be created by this development (Ref. 21). Development and increase in population will inevitably generate need for service facilities and, thus, employment for the populace. A major objective of the Kihei Civic Development Plan, as amended, was to preserve the modern Hawaiian life style by encouraging intermingling of local residents, visitors and retirees in the resorts, beaches and other public places.

Traffic congestion and the accident rate on existing Kihei Road should be reduced by the new highway which is designed to meet the anticipated traffic needs from these proposed developments.

The proposed highway will also have an impact on future highway phases under planning, such as improvement of the old Kula Road in the section between the project

terminal point and the new Kula Highway.

Impact on present land use include the taking of agricultural grazing and cane field lands and several smaller privately-owned parcels in Waiakoa Homestead. Design of the highway will take into consideration an alignment whereby displacement of any family or employment will be minimal.

2. Population Displacement

Only Alternate E requires the relocation of a family. If this alternate is chosen, the displaced family will be eligible for relocation advisory assistance and relocation payments under the Hawaii State Department of Transportation Highways Division Relocation Assistance Program. It is anticipated that the existing dwelling of this displaced family can be relocated within the remaining property. Any other families that may be displaced due to unforseen circumstances not anticipated during the design phase of the project will also be eligible for such assistance. A brochure describing the program is entitled Hawaii State Department of Transportation Relocation Advisory Assistance and Relocation Payments.

Adequate housing in the Kihei area is available with the development of new subdivisions, condominiums and other planned housing developments. An availability study was conducted by the Hawaii State Department of Transportation Highways Division to see whether there were enough available houses for sale within the price range of the dwellings which may be affected by the new highway. The prices ranged from $42,500 to $70,000. As indicated by the survey, there are available houses for sale and within range of the dwelling to be acquired. Table 8 shows the available houses for sale at such time the inventory was made.

Piilani Highway is generally designed to have adequate lateral clearance from existing properties located in close proximity to the new highway. Access connections to the new highway are proposed at locations in conjunction with the Kihei Civic Development Plan, as amended, and therefore, are not anticipated to require any family displacements.

3. Public Health and Safety

One of the major considerations in the alignment of the new highway was to locate it above the flood and tsunami inundation plains, thus providing a vital communication and

TABLE 8

INVENTORY OF HOMES AVAILABLE FOR SALE
(December 11, 1974 to December 20, 1974)

Street (Kihei Area - Maui)	Tax Map Key No.	Bedroom	Bath	Land Area (Square Feet)	Asking Price	Source
231 Oe St.	3-9-26-53	3	1	21,932	$60,000	MidPac Properties
212 Ohukai St.	3-9-29-20	3	2	12,000	64,500	MidPac Properties
Moi Place	3-9-25-48	3	1-1/2	9,306	59,000	Sandwich Isles Realty
Kinoole Circle	3-9-29-10	3	2	8,544	59,500	Joseph Kealoha
Kinoole Circle	3-9-29-13	3	2	7,650	57,500	Amaral Cole
117 Alahela Pl.	3-9-31-5	3	2	7,230	65,000	Joseph Kealoha
Hoonani St.	3-9-34-25	3	2	10,239	65,000	C. Seong
1077 Kihei Rd.	3-9-2-129	3	2	10,120	65,750	Mike McCormack
1679 Aliniu St.	3-9-11-57	3	1-1/2	13,563	65,000	Island Shores Realty
1636 Kihei Rd.	3-9-11-48	2	2	14,139	68,500	Kan-Pak Realty,Inc.
Halona St.	3-9-17-48	2	1-3/4	9,006	68,000	Geo.Ezaki, Realty
---	3-9-03-36	3	1	10,000	70,000	Maui Realty
June to July 1976						
39 Alehele St.	3-9-31-03	3	1-1/2	7,600	58,500	Valley Isle Realty
Kinoole Circle	3-9-29-36	3	2	7,500	59,500	MidPac Realty
112 Kupalaiki (Townhouse)	3-9-02-24	3	1-1/2	6,249	46,247	Sandwich Isles Realty
Kauhale Nani (Townhouse)	3-9-02-24	3	1	5,295	42,500	Dyck Lawson Inc.

supply link from Wailuku and Kahului should water-related disasters occur. Besides that problem, the proposed highway will eliminate steep grades and numerous curves, uncontrolled access, restricted lateral clearances and generally provide faster, safer traffic conditions than do the present Kihei and Makena Roads.

4. Efforts to Minimize Impact

The Hawaii State Standard Construction Specifications (Ref. 8) will help to control dust, sediment and erosion during the construction phase of the highway. The Kihei Civic Development Plan (Ref. 13) will regulate land development in the Kihei-Makena area.

B. Economic

1. General

The new Piilani Highway will bypass the Kihei coastal areas where business activities are located. The offsetting of the highway from the coast will not significantly affect the general level of business activities to a great extent since the local businesses primarily are designed or intended to serve and cater to the needs of the residential community and to accommodate tourists. Connector roads to existing Kihei Road will

provide access to the business centers along the coast.

The new highway will provide the means to realize the development growth and economic potential planned for this area. The economic value of Kihei will be increased because of the improved transportation facility to existing and planned development. Improved access to Wailea and other resort facilities will benefit the local tourist industry and will enhance the economic viability of the ranching industry.

The general employment outlook in this sector will continue to improve with subsequent developments of the planned residential, business, recreational and resort activities. These developments will provide an upward trend for employment. The highway project itself will produce a short-term increase in employment level for construction personnel.

The new Piilani Highway will have some impact on ranching operations. Construction of cattle underpasses across the highway will be necessary to insure maximum use of the surrounding land.

2. Project Costs

Design and construction costs estimated for the new Piilani Highway (based on the alignment as proposed by the Kihei Civic Development Plan) are outlined in Table 9.

TABLE 9

DESIGN AND CONSTRUCTION COSTS

	Project A	Project B
Engineering	$ 172,000	179,000
Right-of-Way Acquisition	177,000	533,000
Construction	4,553,000	2,564,000
Sub-Total	4,902,000	3,276,000
TOTAL	$8,178,000	

3. Maintenance and Operating Features

The design will recognize the operational aspects of the existing roadway network both during and after construction. Construction phasing, temporary detours and other safety and public protection features will be treated specifically and as required in applicable plans.

4. Operation and Use of Existing Facilities

Kihei Road as part of the Maui County road system will continue to be used while construction of the proposed highway is in progress. During construction, the contractor will be held responsible for maintaining all private and public facilities such

as driveways, highways, roads, bridges, and underground and overhead utilities that may possibly be affected by the work (Ref. 8). In addition, Kihei Road will be a collector road for the Piilani Highway (Ref.13).

C. Environmental Effects

1. General

Certain key elements must be recognized in preparing ecological impact assessments. Engineering data, environmental data and ecosystem concepts must all be integrated in an interdisciplinary effort. The engineering data and abiotic factors of the physical environment are expressed elsewhere in the statement. Certain dimensions of the ecological impacts are listed with the best possible estimates using the current state-of-the-art:

a) Positive impact on terrestial biota by enhancing species diversity in the vicinity of the highway (creation of ecotone).

b) Negative impact on terrestial habitat due to possible secondary development.

c) Negative impact on the natural succession of plant life within the highway right-of-way only.

d) No impact on downstream biota due to construction of fills and cuts.

e) No impact on daily and/or seasonal migration of terrestial biota.

f) No impact on endangered or threatened species.

As stated earlier, the proposed highway will be a partially controlled access type highway which would tend to control secondary development. Also, land use controls according to the County's General Plan would be implemented.

The streams in the project area are intermittent and the area is quite dry most of the year. It could safely be said that there are no downstream biota within a reasonable distance from the project site.

The new highway will affect some plant and animal life, but to a minimal extent. Plants affected consist of Kiawe (prospopis pallida) trees and lowland shrubs. Migratory populations are non-existant in the immediate project area. Animals consist of local birds, such as sparrows (passer domesticus) and mynahs (acridotheres tristis), and rats (rattus exulans hawaiiensis, rattus rattus rattus, rattus rattus alexandrinus, rattus norvegicus) and mongooses (herpestes

auropunctatus); however, these animals will find shelter in the vast surroundings left intact. Thus, elaborate conservation measures are not necessary. The flora and fauna in the proposed highway project area are neither rare or endangered species. However, in the area of Kealia Pond at Maalaea, there are endangered indigenous bird species (Ref. 29) of Hawaiian stilt or aeo (himantopus himantopus knudseni), Hawaiian coot or alae Keokeo (fulica americana alai) and Hawaiian black-crowned night heron or aukuu (nycticorax nycticorax hoactli), which may become subject to more traffic noise upon completion of the Piilani Highway Project for traffic between West Maui and Kihei-Makena.

An inventory of waterfowl taken in winter, January 18, 1973 at Kealia Pond by the State Department of Land and Natural Resources, Division of Wildlife, showed that the following birds habitate there: pintail duck (anas acuta), shoveller (spatula clypeata), Hawaiian coot (fulica americana alai), Hawaiian stilt (himantopus himantopus knudseni), Pacific golden plover (pluvialis

dominica fulva), sanderling (crocethia alba), wandering tattler (heteroscelus brevipes),and night heron (nycticorax nycticorax hoactli).

Two of these waterfowls, the Hawaiian stilt (himantopus himantopus knudseni) and the Hawaiian coot (fulica americana alai), native only to Hawaii, are threatened with extinction according to the Department of Land and Natural Resources, Division of Fish and Game. They are also listed in Threatened Wildlife of the United States, 1973 edition by the U. S. Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife (Ref. 28). State conservationists are also showing concern over the welfare of the Hawaiian black-crowned night heron (nycticorax nycticorax hoactli) in considering endangered waterbirds in Hawaii (Ref. 29).

According to Hawaii's Endangered Waterbirds prepared by the Hawaii State Department of Land and Natural Resources, the privately-owned 950 acres of Kealia Pond is being considered as an area to be acquired, preserved and developed as a wildlife refuge for endangered and other species of waterfowl.

At present, the bird population fluctuates year round but increases during summer months when the pond contains shallow water (Ref.29).

Current Hawaii State standard design and construction measures, such as Section 639-Temporary Project Water Pollution Control (Soil Erosion) of the State's Standardized Special Provisions will be incorporated as a requirement for this project to minimize adverse environmental effects (Ref. 9).

2. Natural and Historical Landmarks

The new highway will not adversely affect any natural or historic landmarks. The State Historic Preservation Officer has determined that the proposed highway will have no effect upon any known historic or archaeological site within or likely to be eligible for inclusion in the Hawaii or National Register of Historic Places (Appendix I-Letter).

An archaeological survey was made along the Project A alignment and ten archaeological sites consisting of stone walls and rubbles, platforms and enclosures of which eight are outside of the proposed right-of-way, were located in 3 groups near Stations 210, 220 and 245, but considered of no major

importance because of their marginal values based on deteriorated site conditions and low research potentials (Ref. 17). However, two relatively undisturbed sites, located in the vicinity of Stations 222 and 223 west of the proposed alignment, were recommended to be preserved without excavation and to be incorporated in a proposed roadside stop and scenic vista point. These sites consist of platforms with heaped stone walls enclosing shelter areas historically used for resting places in journeys from upland to the shore.

A portion of the alignment requires no field work because preliminary studies conducted by the Hawaii State Department of Land and Natural Resources, Historic Sites Division (using aerial photos, discussions with property owners, and the factor of extensive usage of these lands by ranchers) indicate that archaeological value no longer exists in the area.

An archaeological survey was also made along the Project B alignment and six sites consisting of caves, walled shelters, house complexes and platforms were found with four sites concentrated at the beginning of Project B and two scattered sites at loca-

tions approaching the end of Project B. These were considered of limited value due to eradication of much archaeological evidence in the past by such operations as bull-dozing for controlling brush fires, and cattle grazing (Ref. 18). Of the six sites recorded during the survey, two were felt to require further investigation. These sites, the "ahu" near Station 545 and the dwelling cave near Station 740 were thoroughly checked out during archaeological salvage operations and no further work on them is deemed necessary.

The physical environment of the study area along the Project B alignment places severe limitations on those who attempt to exploit it. These limitations account for the sparse development of the area in both the pre- and post-contract eras, as well as at the present. In addition, long-term cattle ranching operations and the use of bulldozed fire-breaks have eradicated much of the archaeological evidence which might have been present here. The general paucity of sites and the apparently transient, seasonal nature of the few sites located are quite evident. For instance, the Palauea

area had a "dual use", with families or 'ohana moving between the upland agricultural zone and the coastal aquacultural zone, leaving the transitional zone between almost wholly unexploited. The findings bear out this theory of land utilization, and the area of our study falls largely within this marginally used transitional zone.

3. Multiple Use of Space

Maui Electric Company and Hawaiian Telephone Company will share the highway right-of-way where existing overhead transmission and distribution lines are located within the General Plan highway alignment. A combination roadside stop and scenic vista point overlooking the Wailea-Makena coast is proposed to be incorporated in the design of the highway.

Bikeways may be considered for sharing the highway right-of-way. However, a master plan for bike paths would have to be developed. A more scenic and desirable route would be to have a bikeway on the existing Kihei Road which would be safer and closer to the beaches and scenic coastline.

4. Waste Management

a. Air

It is not expected that the

construction of the new Piilani highway will present any adverse effect on area air pollution. Air quality problems caused by the highway construction will be minimized through: (1) zoned or limited sector excavation; (2) dust control measures such as sprinkling; and (3) non-burning techniques such as hauling discarded materials and other on-site refuse to County incinerators and County-approved dump sites.

The Environmental Protection Agency (EPA) has classified the State of Hawaii as a Priority III Region for auto-related pollutants (ie. carbon monoxide (CO) and, as such, must maintain an air quality level below the national secondary ambient air quality standard. Department of Health monitoring data for the year 1974 have shown that the present ambient air quality from auto related pollutants for the Kihei-Makena area have not exceeded these standards.

Study results obtained by the State of Hawaii Department of Transportation

Materials Testing and Research Branch in April 1976, based on the EPA prediction model "HIWAY", show that the proposed Piilani Highway will have no adverse effect to the air quality in the Kihei-Makena area (Ref. 25). Estimates of projected CO concentrations from the proposed highway were made for sensitive receptor locations along the route using the EPA prediction model "HIWAY". The projected 1979 and 1989 traffic volumes and emission factors were used in the analysis with the proposed roadway subjected to the worst possible and most probable meteorological conditions. CO concentrations were then determined at the receptor locations.

The ambient concentration of CO in the vicinity of the proposed roadway can be reasonably expected to be negligible. This rationale is based on the predominantly undeveloped and widely dispersed sources (residences) which generate very little CO. The distance of these sources to the immediate study area would allow ample dispersion and the measured concentrations would not be significant (Ref. 25).

The complete CO analysis is available in the Air Quality Report. Below is a summary of the maximum estimated CO concentration at the highway right-of-way:

Condition	1-hr. CO Concentration at highway ROW
Worst Case	1.342 ppm
Most Probable (Daytime)	0.543 ppm
Most Probable (Nighttime)	0.543 ppm

The CO concentrations expected to occur as a result of the proposed project are below the Federal 1-hour standard of 35.0 ppm and below the State of Hawaii 1-hour standard of 9.0 ppm and is not expected to have any adverse effects on the ambient air quality of this community.

The Hawaii State Department of Health has concluded that: (1) this proposed Piilani Highway project is consistent with the control strategy as specified in the State Implementation Plan, and (2) the project is not likely to interfere with attaining State Ambient Air Quality Standards under free flow traffic conditions (Appendix I-Letter).

The beneficial effects to the air quality in the more populous developed sections of Kihei due to rerouting of the traffic on the new section were not evaluated and no discussion is presented. (Ref. 25)

b. Noise

Noise from construction equipment and machinery will be audible especially during the grading, concrete pouring and asphalt placing stages of the new highway construction. Trucks hauling soil, rock, asphalt and ready-mix concrete will be traveling between supply sources and the project site. Necessary blasting and drilling operations will be conducted in several locations. These noises will have an impact on the community along with other construction noises of nearby developments; however, they are temporary and will be affecting a somewhat small segment of the total population at any one time.

Three sets of factors affect highway noise levels: (1) traffic (volume, speed and truck traffic); (2) topography (vegetation, barriers, height of road above or below grade); and (3) roadway (configuration, pavement types and distance). Since

traffic noise varies both spatially and temporally and is studied on a statistical basis, traffic noise is most meaningfully described as a "statistical time distribution" of noise levels. Some useful values of distribution are the noise levels that are exceeded for 10%, 50% and 90% of the time. The L_{50} and L_{10} noise levels are used as the principal noise parameters for highway design by the FHWA and other interested associated groups. In a very general sense, the L_{50} noise level is a statistical value that is representative of near average noise and the L_{10} noise level is a statistical value that is representative of the peak noise. (Ref. 24).

The curves shown in Fig. 8 relate the 1973 and 1993 L_{50} traffic noise levels of the highway as a function of distance away from the highway. (L_{50} is defined as the noise level which is exceeded 50 percent of the time.) The curves were determined by the noise level prediction method outlined in the National Cooperative Highway Research Program (NCHRP) Report 117 (Ref. 12). This method is wholly empirical and the noise level equations were based on statistical measurements of noise levels near highways.

The traffic volume was taken from the State Highway Planning Division's traffic assignment study (Ref. 11) at the peak hour volume of 700 vehicles per hour, with 2.5 percent of these as trucks, and traveling at the design speed of 50 m.p.h. Except for grades greater than 4 percent, all factors tend to reduce the noise levels.

Design criteria recommended by NCHRP Report 117, Federal Highway Administration (FHWA) PPM 90-2 and FHPM 7-7-3 are listed in Table 10. Projected L_{50} values (Fig. 8) within criteria of Table 7 are at about 350 feet.

TABLE 10

NOISE LEVEL DESIGN CRITERIA

Reference	L_{50} (dBA)		L_{10} (dBA)	
	School	Residence	School	Residence
NCHRP Rpt. 117	55	50	61	56
FHWA PPM 90-2	-	-	70	70

In comparison with the design criteria, the Hawaii State Department of Health has issued a reduced noise control regulation for the Island of Oahu which will limit the the noise of light vehicles (less than 6,000 lbs.) traveling at 50 m.p.h., and heavy vehicles (6,000 lbs. and over)

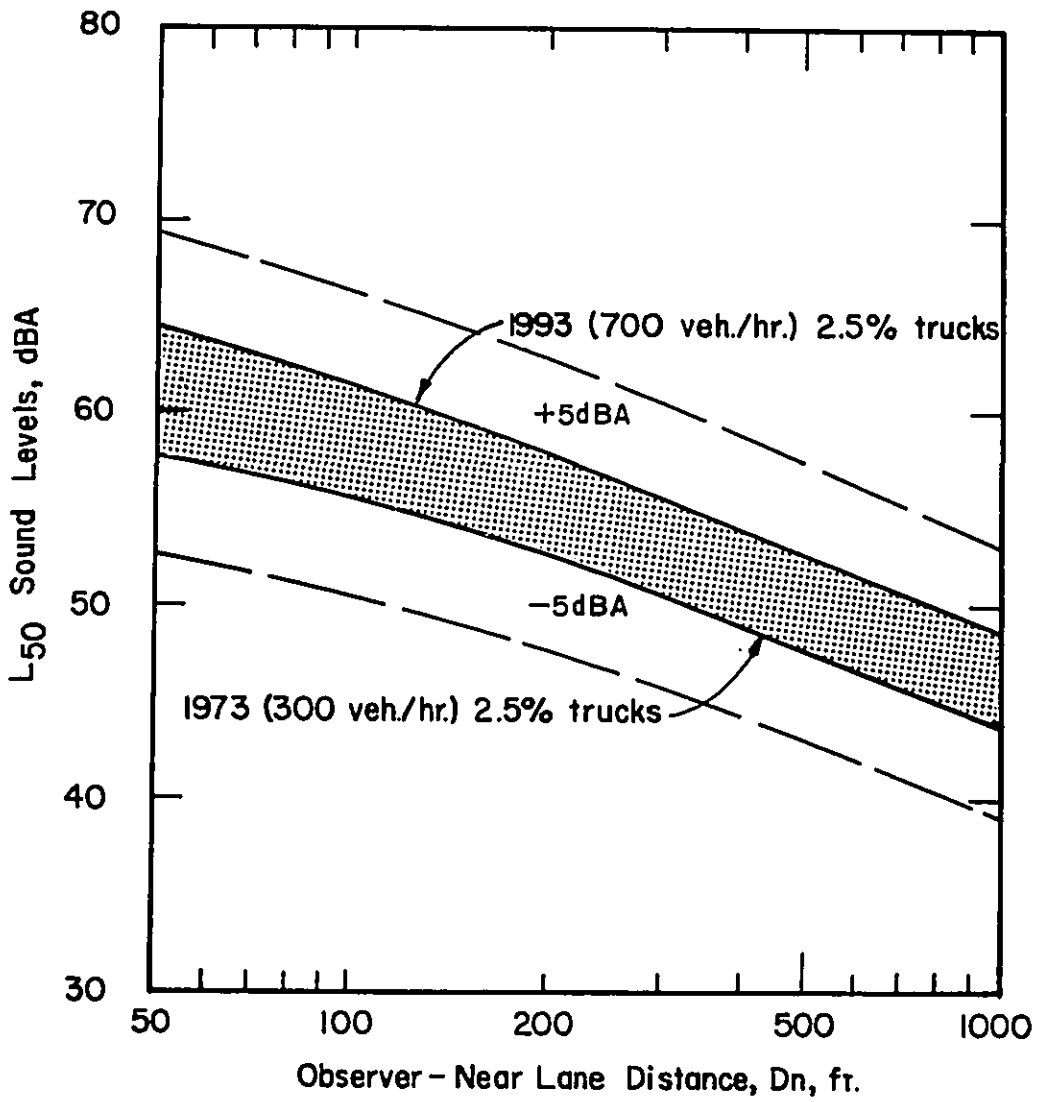


FIG. 8

NOISE LEVEL PREDICTION

1973 – 1993

traveling at 35 m.p.h. or more. The L_{50} noise levels measured at a distance of 50 feet are limited to 71 dBA and 75 dBA respectively for light vehicles and heavy vehicles. These limits are to be effective in 1977.

Several properties along the General Plan highway alignment were selected for noise level predictions because of their proximity to this alignment. The traffic volumes are the peak one hour traffic based on the traffic assignment study (Ref. 11). The predicted 1973 and 1993 L_{10} noise levels for various properties along the highway are listed in Table 11(Fig.9). The predicted noise levels shown do not include the reduction of noise due to acoustic barriers or to depressed or elevated highway cross sections.

The ambient noise of any area is the background noise made up of all the natural and man-made noises generally considered to be contained within the acoustical environment of the general area. In suburban and rural areas, barking dogs, rustling leaves, chirping birds, and crickets may be a significant part of the ambient. Near schoolgrounds, recreational areas, and parks, children's voices may be a part of the ambient noise.

Table 11

1973 and 1993 NOISE LEVEL PREDICTION

FOR PROPERTIES ALONG PIILANI HIGHWAY*

Station		Area Location	Dist. from E.P. to Property(ft)	Grade %	Traffic Volume		1973 Noise Level		1993 Noise Level	
					1973(Vph)	1993(Vph)	L_{50}(dBA)	L_{10}(dBA)	L_{50}(dBA)	L_{10} (dBA)
541+00	A**	Arilani Subdivision Lot 11	60	1.23	310	740	58	67	64	70
550+00	B	Independent Land Owner	100	1.23	310	740	56	63	62	65
555+60	C	La Palma Park Subdivision	100	2.41	310	740	56	63	62	66
560+10	D	Independent Land Owner	160	2.41	310	740	54	59	59	63
623+00	E	Ka Hinano Acres Subdivision	60	0.70	310	740	58	67	64	70
627+00	F	Kihei Estates Subdivision	65	0.70	310	740	58	66	64	69
655+50	G	Independent Land Owner	190	0.39	310	740	53	57	58	61
678+00	H	Proposed Kihei School	56	0.39	310	740	58	68	65	70
1+00	I	Proposed Connector Road	140	3.18	260	630	54	60	59	63
53+30	J	Portion of Kamaole Hmstd.	140	0.96	260	630	54	59	59	62
97+00	K	Maui Meadows	70	4.61	260	630	56	65	63	68

*Except for distance & Grade factors, no other noise reduction factor is included.
Design Speed = 50 m.p.h.
Data for the General Plan highway alignment.

** Refer to Fig. 9.

Similarly, near streets, major arteries and highways, traffic noise may be part of the ambient noise. Some ambient noises vary from day to night; some ambients differ by the day of the week and some ambients vary from summer to winter. Where ambients involve commuter traffic routes, these ambients can vary day by day.

According to the Kihei Civic Development Plan, a school site and a government complex are planned along the alignment of the highway. The school site is the Kihei Educational Cluster which is located at the end of Lipoa Street in Kihei.

For purposes of highway noise studies, ambient noise measurements are taken in order to establish a base for existing noise conditions. This makes it possible to have a reference for comparison when roadway changes, improvements, or new highways are contemplated for an area. The difference in noise levels "before" and "after" the change gives an indication of the impact of the noise on the affected area. In addition, the number of residences or noise sensitive sites, such as schools, churches and hospitals in the area affected by the change, represent another dimension of the extent of the impact (Ref. 24).

A noise survey was conducted by the State Materials Testing and Research Branch in March 1975, entitled Noise Level Readings, Piilani Highway, Kihei to Ulupalakua, Maui, to determine the ambient conditions along the existing Kihei Road as well as along the proposed corridor. The noise study has indicated that a number of residential and commercial properties along the existing Kihei Road are presently experiencing adverse affects to vehicular noise exceeding 70 dBA. The no-build alternate in which the present two-lane roadway is expected to carry all of the forecasted 1989 traffic volume will substantially increase the noise levels and have an impact on an area within 100 ft. of the roadway. The existing noise levels can be expected to reach 77 dBA (Table 12 and Figure 9).

The proposed Piilani Highway would not create any adverse noise effects on the

TABLE 12
NOISE LEVEL READINGS
March 1975
KIHEI ROAD, MAUI, HAWAII
NO BUILD ALTERNATE

Test Site	Test Location	Ambient Noise Levels (Average) dBA	Predicted L_{10} Noise Levels (dBA) 1979	1989
1	Suda Store - 50' from Kihei Rd.	72	74	76
2	Keolahou Congregation Church & Cemetary - 100' from Kihei Rd.	65	70	71
3	Memorial Park - 50' from Kihei Rd.	57	70	73
4	Maui Lu - 50' from Kihei Rd.	74	75	77
5	Beach - Menehune Shores -1000' from Kihei Rd.	59	59	60
6	Across Kihei Rd. from Menehune Shores - 50' from Kihei Rd.	70	73	75
7	St. Theresa Church - Lipoa and Kihei Rd.	70	73	75
8	Waiohuli and Kihei - 50' from Kihei Rd.	72	74	76
8A	Kihei Baptist Church - 50' East Side of Kihei Rd.	66	71	74
9	Fire Station - next to Assembly of God - 50' West Side of Kihei Rd.	68	72	74
10	Kalama Park - 100' West Side of Kihei Rd. in parking lot	64	69	70
11	Kamaole Park - 50' from East Side of Kihei Rd.	69	70	73
12	Kamaole III Park - 50' from West Edge of pavement (Kihei Rd)	66	67	72
13	Public parking lot-foot of Kilohana St.-50' East Side of Kihei Rd. - parking lot	70	71	74

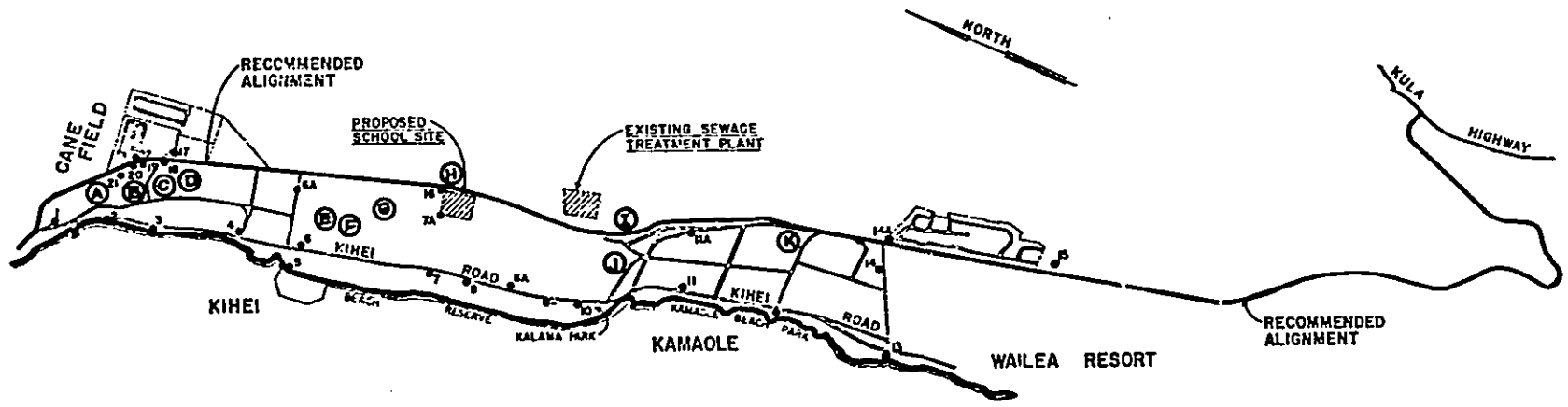


FIGURE 9

TESTING LOCATION PLAN

• Testing Site for Noise Level Readings (Table 12)

Ⓐ Area Location for Noise Level Prediction (Table 11)

community. By diverting a major portion of the trucks and through traffic away from the populated residential and commercial areas, the bypass route will help to eliminate a major source of traffic noise along the existing corridor. In addition, some beneficial effects would be experienced by the existing shoreline areas.

The projected noise levels along the proposed route are not expected to exceed the allowable noise levels 70 dBA (Table 13 and Figure 9). Therefore, noise abatement measures will not be necessary.

c. Water

The construction of the new Piilani Highway does not pose water table or supply pollution problems, since there are no significant creeks located within the project area and no downstream water use. If excavation should extend below the water table, backfills shall consist of inert, non-toxic materials only (Ref. 16). Water pollution studies will be coordinated with the Hawaii State Department of Public Health, if required.

Project plans including a highway drainage system, designed in accordance with applicable standards, will protect the new highway from storm water runoff and sediment

TABLE 13
NOISE LEVEL READINGS
March 1975
PIILANI HWY., MAUI, HAWAII
BYPASS ROUTE ALTERNATE

Test Site	Test Location	Ambient Noise Levels (Average) dBA	Projected** Ambient Noise Levels, dBA	PREDICTED L_{10} NOISE LEVEL			
				Projected 1979 Traffic Noise	Total 1979 Community Noise	Projected 1989 Traffic Noise	Total 1989 Community Noise
6A	Kilolani Church	*					
7A	End of Lipoa Street	46	49	47	51	48	52
11A	Auhana Rd. - in front of abandoned house	43	46	51	52	53	54
14	Across from water tank on Kilohana St. - 50' from North edge of pavement (Kilohana St.)	56	59	56	61	57	61
14A	Intersection Kilohana and Akala	54	57	58	61	60	62
15	650' from South end of Akala Rd.	51	54	52	56	54	57
16	Proposed Park, Gov. complex, school	48	51	60	61	64	64
17	Tony Hashimoto res.	55	58	58	61	61	63
18	Abandoned quonset home - Kailoa Place	51	54	60	61	64	64

TABLE 13 (Continuation)
NOISE LEVEL READINGS
PIILANI HWY., MAUI, HAWAII
BYPASS ROUTE ALTERNATE

Test Site	Test Location	Ambient Noise Levels (Average) dBA	Projected** Ambient Noise Levels, dBA	PREDICTED L_{10} NOISE LEVEL			
				Projected 1979 Traffic Noise	Total 1979 Community Noise	Projected 1989 Traffic Noise	Total 1989 Community Noise
19	Ralph Honda residence	58	61	57	62	59	63
20	Charles Plunkett residence	58	61	58	63	59	63
21	Moi Place and Kailoa Rd.	54	57	58	61	61	62
22	Cul De Sac - South end of Awa Street	49	52	60	61	64	64
*	Construction Activity at Immediate Vicinity of Church. No Ambient Noise Reading Available.						
**	Anticipated Increase in Ambient Noise Level from Community Activities as Area Begins to Develop. For this Study a +3 dBA increase.						

damage. Construction of the highway should have no significant effects upon the water supply of the area. However, while there are no perennial streams in the area, there can be considerable runoff in times of exceptionally heavy rainfall and provisions will be made to minimize the effects of voluminuous runoff.

The entire Kihei coastal area has been subjected to flash flooding from runoff developed within the large drainage basins on the western slopes of Haleakala. The high volumes and velocities of the flood waters are carried by four streams which cross Kihei Road overtopping nearly every drainage structure, and upon several occasions, washing vehicles into the ocean. Due to increasing developments in this area, flood losses have been greater as reported in the flood of March 24, 1967. Water rose eight inches over the flood plain and rapid stream flow caused erosion of soils which damaged lawns, pipelines and roads (Ref. 19).

The new alignment will lessen flood and tsunami inundation hazards to the highway. However, low annual rainfall and erodibility of soils will require intensive conservation practices to minimize soil erosion.

Drainage channels crossing the highway are usually dry. However, as watershed areas for drainage extend all the way up the slopes of Haleakala, the culverts and bridges corssing the highway will be of sufficient size to accommodate runoff for heavy Kona-type rainstorms.

The U.S. Army Corps of Engineers is conducting a survey of the Kihei area for flood control purposes. To insure compatibility with potential flood control improvements, hydrology and hydraulic design for the highway bridges will be coordinated with the Pacific Ocean Division, U.S. Army Corps of Engineers.

d. Soil

The northern section of the highway will be built in highly erosive soils while the central portion will be built in sandy soils subject to wind erosion; therefore, precautionary and conservation practices will be utilized to minimize soil erosion. Roadside landscaping can be aided by recycled water from the sewage treatment plant.

Cut and fill operations will be required for highway development which will alter the natural terrain. Earthwork quantities will be balanced as much as possible to minimize need for importing or exporting material.

Construction on graded areas will occur as soon as practicable to minimize adverse effects from dust and erosion.

Construction excavated soil excesses will be disposed of at an approved site provided by the contractor. Issuance of the State required highway grading and excavation permit will be contingent upon proof that the contractor has satisfied pertinent County of Maui grading ordinances in the selection of an excess-soils dumping site (Ref. 8).

Sedimentation problems due to erosion of excavation and embankment construction will be minimized with the judicious application of Section 639, Temporary Project Water Pollution Control (Soil Erosion) of Hawaii State Standard Construction Specifications (Ref. 8). It is expected that surface runoff quality entering and leaving the project limits will be approximately the same.

e. Energy Consumption

Increase in gas consumption is inevitable on a large scale with the increase in population and numbers of vehicles. However, the highway alignment will provide a faster route with less stops due to left turn movements existing on Kihei Road; thus, conserving rather than increasing gas consumption on an individual basis. Other means to conserve

fuel, such as mass transit and car pools can still be utilized; however, reserved lanes at peak hour for these vehicles are not feasible since the highway is only two lanes.

D. Public Facilities

1. Recreation and Parks

The adopted highway corridor does not conflict with existing parks or recreation sites of the area. It will provide ready access to areas proposed for open zones and golf courses as a component of the County master plan in the Kihei Civic Development Plan, as amended (Ref. 13). The proposed highway project will not require public use or open space for right-of-way.

2. Public Utilities

In the Kihei-Makena area, these consist of electrical, telephone, water and sewer services. The utility companies serving the area are Maui Electric Company, Hawaiian Telephone Company and the Maui County Board of Water Supply. Presently, Maui Electric Company and Hawaiian Telephone Company share overhead line supports located within the General Plan alignment of the new highway. If a highway alternate conforming to that of the Kihei Civic Development Plan, as amended,

is selected, approximately 13 of these supports will require relocation. The existing utility poles are now located seaward (west) of the Kihei Civic Development Plan highway corridor. Visual pollution may not be to some people as detrimental within a rural setting, however, considerations were given to placing some of the poles east of the alignment to provide the user of the highway an unobstructed view of the coast.

The Maui Electric transmission and distribution lines were considered for underground relocation; however, due to the high additional cost, this alternative will not be implemented. Underground installation of utilities will increase in project costs by an estimated $900,000. Maui Electric Company has converted the old 23 KV transmission circuits to 69 KV and completes a loop from Kahului through Kula, Wailea, Puunene and back to Kahului. The conversion was completed in 1975.

Constructed in 1958, the existing Maui Electric pole line system was sited to coordinate with the available information at that time on the location of the future highway. However, preliminary highway location studies within the adopted corridor

indicate that there is probable conflict between the highway and the pole line. The new highway corridor right-of-way will be adequate to accommodate any relocated supports. Maui Electric Company has indicated that artistic support arms will be used and that any new construction will be coordinated with the configuration of the highway and designed to be as aesthetically acceptable as possible.

Hawaiian Telephone Company, in reviewing the proposed highway alternates, proposed to relocate any affected aerial facilities in replica and in accordance with applicable Federal requirements. No adverse impact upon the existing environment is forseen as facilities to be constructed will be similar to those existing.

The County of Maui has an existing 18-inch water main feeding the Kihei area, and a portion of this main line is located near the adopted highway corridor. Preliminary studies indicated that elevation adjustments to the water line and its appurtenances may be required at various locations The County of Maui plans to install a 16-inch water line which is to be connected to the existing 18-inch water main at Ohukai Road and Kailoa

Place to serve the Makai Heights Subdivision area. The adopted highway corridor is anticipated to have minimal effect to this proposed installation.

Approximately 500 feet above the amended General Plan highway alignment in the Kamaole area, the County of Maui constructed a sewage treatment plan. The amended General Plan highway alignment will cross a pressure sewer line connecting this sewage treatment plant to the sewer lines running along Kihei Road. The adopted highway corridor is expected to have minimal effect to these proposed improvements.

3. Religious Institutions and Other Community Services

The existing religious organizations of the area will not be affected by the project. Other community services will also not be affected by the alternates of the adopted highway corridor.

4. Educational

An initial staff study by the Hawaii State Department of Accounting and General Services (D.A.G.S.) recommended that the proposed Kihei Educational Cluster be located at a site east of the old Kihei Civic

Development Plan highway corridor. However, this location of the site would necessitate that some of the school children cross the new highway to get to and from the residential sections. Therefore, a later study by D.A.G.S. and a petition from the Kihei Community recommended that the highway be realigned east of the proposed school site. The recommended highway alignment east of the school site will not require the construction of a pedestrian overpass or signalization at the Lipoa Street intersection to meet the minimum traffic criteria for school site selections. Construction of the new cluster is scheduled to commence in 1976 (Ref. 4).

VII. PROBABLE UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

The two-lane proposed Piilani Highway will intrude upon and modify the appearance of the surrounding natural terrain. The highway will cut through agricultural grazing lands and some residential lands. Cuts and fills necessary for safe highway construction will alter the natural terrain; however, these will be minimized with the highway running parallel to the natural grade of the land. The use of asphaltic concrete pavement and traffic signs, visual pollutants in a rural setting, will be unavoidable and limited to safety features.

Plant growths will be affected since the pavement will replace approximately 25 percent of the plants in the project area. These plants consisting of Kiawe (prosposis pallida) trees and sparse pasture grass are of some value to erosion control; however, the highway will replace this natural control with a more efficient drainage system. Wildlife such as local birds and rodents will lose their shelter in the dense Kiawe tree growths, but will have no trouble finding new homes in the surroundings left intact.

Kulanihakoi and Waipulani Streams will be affected by the highway during rainstorms when rainwaters collected on the highway surface will add to the streamflow. However, interceptor

channels and culverts will divert the tremendous flow of the flood waters and lessen the impact downstream. No biota in the streams will be affected since the stream beds are dry most of the year.

An increase in traffic noise levels is an inevitable result of projected increases in traffic volumes between 1973 and 1993. The increased volumes are the result of urbanization plans for the Kihei-Makena area.

Fire risk in dry areas may be increased with larger traffic volumes; however, the highway pavements and 10-foot paved shoulders should help preclude any fires from discarded cigarettes, etc. Highly improved access to the general area for fire fighting equipment will be enhanced.

VIII. RELATIONSHIP BETWEEN SHORT TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

Within the short term, safer and more convenient roadways would be made available to Kihei-Makena area residents and tourists through the new Piilani Highway. In addition, agricultural produce and livestock shipping from the slopes of Haleakala would be immeasurable enhanced.

Commitment of the new Piilani Highway construction, on the other hand, can be examined in long term productivity. Beneficially, the highway will have the following effects on the community:
(1) The area's economy will be expanded by increased visitation to the Kula District of Haleakala National Park (Ref. 10); a more efficient system of transporting agricultural products, livestock and construction materials; and a tremendous increase in urban growth in southern Maui through the construction of the highway which will foster the development of the lands in the Ulupalakua area to its fullest potential (Ref. 10). (2) The highway will increase pressure for a paved highway continuing east to Hana along a scenic coastline. (3) Natural and cultural resources of other coastal corridor lands, such as Lahaina, will be affected because this route will provide a faster and safer link in transporting goods and people between communities.

Adversely, the proposed highway will take away a small portion of the terrain plant life and rural setting which is gradually disappearing from the natural beauty of the islands. However, the creation of an entirely new wildlife habitat by the adjacent roadside area would tend to introduce new species of wildlife.

It should be noted that the major part of the proposed highway runs along the border of separation between agricultural ranch lands and urban zoned lands. Although the alignment requires taking more land from agricultural grazing, it is expected to provide greater safety, economic, and social benefits to both urban and agricultural zoned land uses than what now exist.

IX. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Land, labor and materials used in this and resulting area development projects, in part, represent irreversible and irretrievable commitments of resources to the function of the involved projects.

In exception, future abandonment of the highway would certainly open the rights-of-way reclamation. Some of the highway construction materials could be salvaged for projects involving large cuts and fills.

However, the labor and primary project expenses involved in this or other related projects in the Kihei-Makena area will represent total, irreversible commitments of resources.

X. PROBLEMS AND OBJECTIONS

General consensus from the July 31, 1974 public hearing favored the recommended Piilani Highway, which will not only relieve the hazardous condition of the existing roadway, but also be instrumental in the planned development of the community.

Two significant factors in the highway alignment which were agreed upon were: (1) Realignment of the highway above the Kihei Educational Site so that students will have a safer access to the school site; and (2) Start of construction at the Kihei end rather than at Makena, as previously proposed. Other comments heard at this public hearing are summarized below:

Favorable

1. The highway will enhance development of Hawaiian Homestead Lands.
2. It will relieve congestion in view of the large Wailea development underway.
3. Recycled water from the sewage treatment plant should be considered for highway landscaping.

Unfavorable

1. The highway will cut into private properties and adversely affect long time residents, such as the Kukahikos and Plunketts.

2. The new highway will add to the congestion and hazards at the Ulupalakua-Keokea end of the alignment which is in need of much improvement.

In addition to considering comments from the public, comments on the draft EIS by various responding agencies shown on the Distribution List in Appendix II were reviewed, analyzed, and incorporated into the report where applicable. Reasons why specific comments and suggestions could not be extensively expanded were due to factors of overriding importance to highway construction. For example, the area of noise pollution was expanded, but only to an extent that it would satisfy environmental concerns. Further expansion on this one area, in comparison to the other impacts, would have thrown the report out of context. An indepth study of any one area treated can be coordinated with a related agency, if necessary.

Letters of comments and responses are found in Appendices II and III.

XI. REFERENCES

1. Hawaii '71 Annual Economic Review, Bank of Hawaii, 1970.

2. Flood Plain Information, Kihei, Maui, U.S. Department of the Army, Corps of Engineers, Plates 2 and 4, 1970.

3. Personal Communication, E. H. Cox, U. S. Department of Agriculture, Soil Conservation Service, Soil Conservationist 1972.

4. A Staff--Study--For the Kihei Educational Cluster, Hawaii State Department of Accounting and General Services, 1971.

5. General Flood Control Plan for Hawaii, Hawaii State Department of Land and Natural Resources, Vol. II, 1963.

6. Hawaii State Department of Land and Natural Resources Letter dated Aug. 3, 1971 to Trans-Meridian Engineers and Surveyors, Inc., Subject: Piilani Highway Design, Kihei to Ulupalakua.

7. Tourism in Hawaii, Hawaii Tourism Impact Plan, Vol. 1 Statewide, Hawaii State Department of Planning and Economic Development, 1972.

8. Standard Construction Specifications, Hawaii State Department of Transportation, Highways Division, 1976.

9. Special Provisions (Standards) to Standard Specifications for Road and Bridge Construction, Hawaii State Department of Transportation, Highways Division, 1976.

10. Preliminary Report on Piilani Highway, Hawaii State Department of Transportation, Highway Planning Branch, July 1968.

11. Traffic Assignment Project TA 71-18, Kihei-Ulupalakua Road, Maui, Hawaii State Department of Transportation, Highway Planning Branch, Sept. 1971.

12. Highway Noise, A Design Guide for Highway Engineers, U. S. Highway Research Board, National Cooperative Highway Research Program Report, 1967.

12a. Planning Report of Kula Highway, Ulupalakua to Keokea, Island of Maui, Alignment Study, Hawaii State Department of Transportation, Highways Division, August 1976.

13. Civic Development Plan, Maui County Planning Commission, Section 701 of the Housing Act of 1954, as amended, 1970.

14. Highways and our Environment, John Robinson, McGraw-Hill, Inc., 1971.

15. Chapter 44A, Vehicular Noise Control for Oahu, Section 322, Hawaii Revised Statutes, Hawaii State Department Of Health, 1972.

16. Controlling Erosion on Construction Sites, U. S. Department of Agriculture, Soil Conservation Service, 1970.

17. Archaeological Survey, Palauea and Keauhou Section, Piilani Highway, Island of Maui, Beth Walton, State of Hawaii Department of Transportation, Oct.1972.

18. The Archaeology of Kula, Maui from Piilehu Nui Ahupua'a to Kama'ole Ahupua'a Surface Survey, Pi'ilani Highway, Archaeological Research Center Hawaii, Inc., Hawaii State Department of Transportation, July 1976.

19. Drainage Master Plan for the County of Maui, State of Hawaii, R. M. Towill Corp., October 1971.

20. Detailed Land Classification - Island of Maui, L.S.B., Bulletin No. 7, May 1967.

21. Atlas of Hawaii, The University Press of Hawaii, 1973.

22. The Maui Sun, 9-25/10-1, 1974.

23. Soil Survey Interpretations,Maui, Report R45, January 1972.

24. Fundamentals and Abatement of Highway Traffic Noise, U. S. Department of Transportation, June 1973.

25. Air Quality Study - EPA Model "HIWAY", Hawaii State Department of Transportation, Materials Testing and Research Branch, April 1976.

26. Fundamentals of Ecology, E.P. Odum, 3rd Edition, 1971.

27. American Wildlife and Plants - A Guide to Wildlife Food Habits, C. A. Martin and L. A. Nelson.

28. Threatened Wildlife of the United States, U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Resource Publication 114, March 1973.

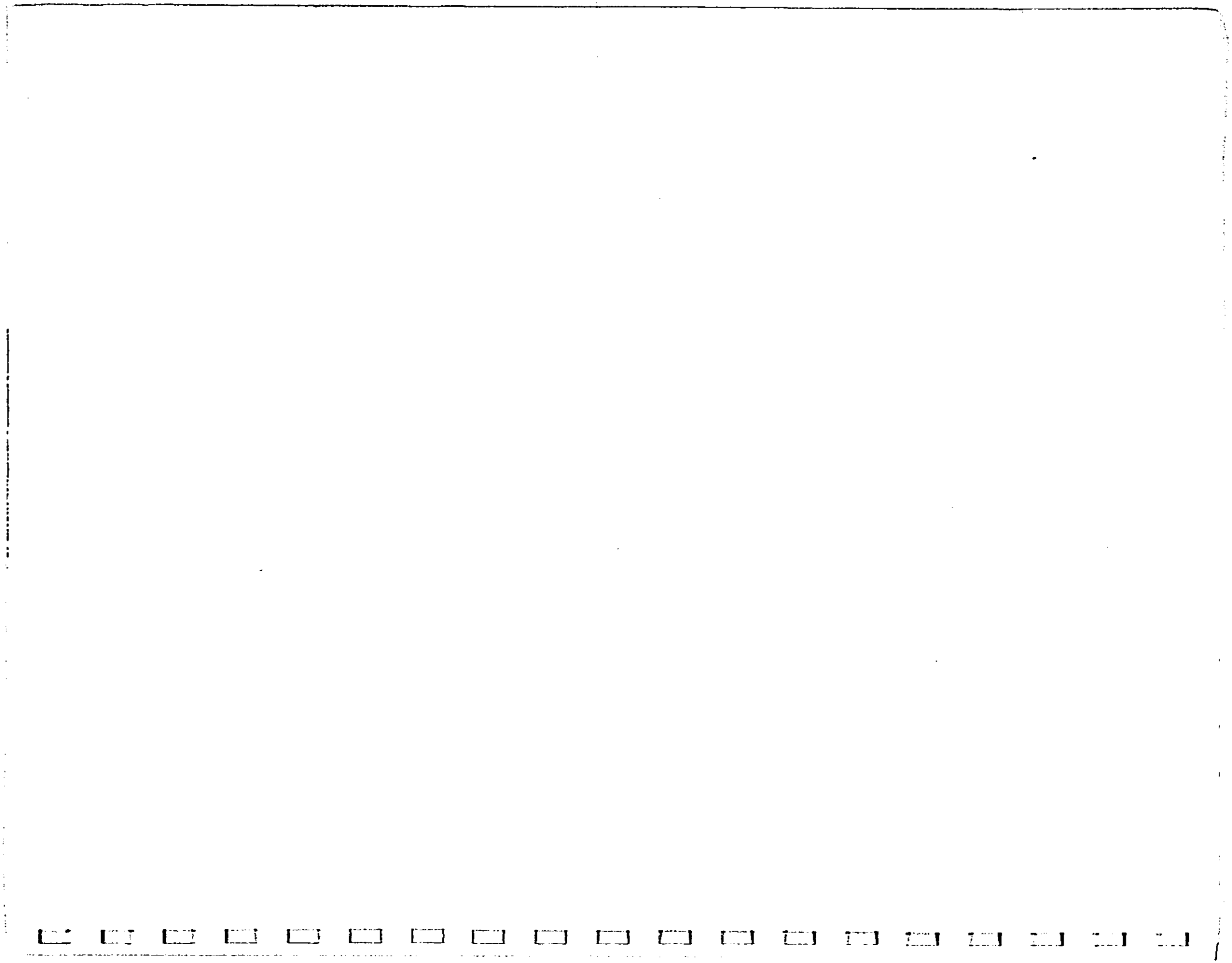
29. Hawaii's Endangered Waterbirds,U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, Sept. 1970.

XII. APPENDICES

I. LETTERS OF INQUIRY

II. LISTS OF DRAFT ENVIRONMENTAL IMPACT STATEMENT DISTRIBUTION AND RESPONDING AGENCIES

III. DESIGN PUBLIC HEARING COMMENTS AND RESPONSES (WRITTEN AND ORAL)



APPENDIX I

LETTERS OF INQUIRY

JOHN A. BURNS
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

DIVISIONS:
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

August 3, 1971

Mr. Wallace K. Endo, P. E.
Trans-Meridian Engineers &
Surveyors, Inc.
700 Bishop Street, Suite 707
Honolulu, Hawaii 96813

Dear Mr. Endo:

Subject: Piilani Highway Design, Kihei to Ulupalakua

Thank you for inviting our comments on the need for wildlife crossings in connection with the proposed highway.

There are no game mammals in the project area at the present time, nor do we plan to establish a population of game mammals there in future years.

Therefore, we do not anticipate the need for game crossings in the project site.

Yours truly,

BOARD OF LAND AND NATURAL RESOURCES

Sunao Kido

Sunao Kido, Chairman

JOHN A. BURNS
GOVERNOR OF HAWAII

DIVISIONS:
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FISH AND GAME
1179 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

November 25, 1974

RECEIVED
NOV 29 1974
~~Sam O. Hirota~~, Inc./Tes.
By

Mr. Denis T. Shiu
Trans-Meridian Engineers &
Surveyors, Inc.
Suite 707
700 Bishop Street
Honolulu, HI 96813

Dear Mr. Shiu:

SUBJECT: Final Environmental Impact Statement for the proposed Piilani Highway, Kihei to Makena Road/Kula Highway Project Nos. F-031-1(4), F-031-1(1) and F-037-1(10)

This responds to your request for comments on the impact of the proposed highway on endangered wildlife.

The proposed Piilani Highway at Kihei, Maui will have no direct impact on endangered species by virtue of its actual construction as the alignment does not pass through endangered species habitat. And assuming that during construction at the beginning of the project southeast of Kealia Pond precautions are taken to prevent the run-off of soil or fossil fuel contaminants into the pond system, including drainages into the pond, no adverse effects on endangered species in the pond are foreseen.

Yours truly,

Michio Takata

MICHIO TAKATA, Director
Division of Fish & Game

MT:RLW:rfm

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

CHRISTOPHER COBB, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

DIVISIONS:
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

July 16, 1976

Mr. T. Harano
Highways Division
Department of Transportation
869 Pucnhbowl Street
Honolulu, Hawaii

Dear Mr. Harano:

Subject: Pi'ilani Highway, Projects No. F-031-1(1), F-031-1(4) and F-037-1(10)

The proposed undertaking will have no effect upon any known historic or archaeological site on or likely to be eligible for inclusion to the Hawaii or National Registers of Historic Places. In the event that any unanticipated sites or remains are encountered, please inform the applicant to contact this office immediately.

Sincerely yours,

Jane L. Silverman

Jane L. Silverman
Historic Preservation
Officer
State of Hawaii

4788

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O.Box 3378
HONOLULU, HAWAII 96801

GEORGE A. L. YUEN
DIRECTOR OF HEALTH

Audrey W. Mertz, M.D., M.P.H.
Deputy Director of Health

James S. Kumagai, Ph.D., P.E.
Deputy Director of Health

Henry N. Thompson, M.A.
Deputy Director of Health

July 29, 1976

In reply, please refer to:
File: EPHS-SS

MEMORANDUM

To: Mr. T. Hirano, Chief, Highways Division
Department of Transportation

From: Chief, Environmental Protection & Health Services Division

Subject: Comments - Air Quality, Piilani Highway, Kihei to Ulupalakua, Maui, Project Nos. F-031-1(4), F-031-1(1), and F-037-1(10)

1. We conclude that this project, by virtue of the fact that motor vehicles will be subject to the federal motor vehicle control program, is consistent with the control strategy as specified in the State Implementation Plan.

2. We further conclude that if your tabulation of CO concentrations as contained in Appendix A, B, C and D were based on maximum one-hour traffic volumes and speed, that it is not likely that your proposed project will interfere with the attainment or maintenance of State Ambient Air Quality Standards under free flow traffic conditions.

SHINJI SONEDA

APPENDIX II

LISTS OF DRAFT ENVIRONMENTAL IMPACT STATEMENT

DISTRIBUTION AND RESPONDING AGENCIES

LIST OF DRAFT ENVIRONMENTAL IMPACT STATEMENT DISTRIBUTION

Governmental agencies and other organizations to whom draft environmental impact statements have been sent (#) copies and from whom comments have been requested through the Office of Environmental Quality Control, State of Hawaii, are listed below:

STATE AGENCIES

Dept. of Agriculture (1)

Dept. of Land and Natural Resources (3)
Sunao Kido

Dept. of Health (4)
Shinji Soneda

Dept. of Planning and Economic Development (1)
Shelly Mark

Dept. of Defense (1)
Clyde Woods

Dept. of Accounting and General Services (1)
Ke Nam Kim

Dept. of Social Services and Housing (1)
Ronald Lin

Dept. of Transportation (3)
Ah Leong Kam

Dept. of Education (1)
James Edington

UNIVERSITY OF HAWAII

Environmental Center (3)
Doak Cox

Water Resources Research Center (1)
Stephen Lau

FEDERAL

Environmental Protection Agency (2)
M. Koizumi

U.S. Army Corps of Engineers (1)

Bureau of Sport Fisheries and Wildlife (1)
Maurice Taylor

U. S. Dept. of Interior (1)
Burnham

Soil Conservation Service (1)
Lum

15 ABWg/DEE APO SF (1)
Honolulu, Hawaii 96553

Army (1
Commanding General

Navy (1)
John L. Butts

NEWS MEDIA

Honolulu Star Bulletin (1)
Duncan

Advertiser (1)
Chaplin

MAUI COUNTY AGENCIES

Planning Department (1)
Howard Nakamura

Dept. of Public Works (1)
Stanley Goshi

Dept. of Water Supply (1)
Kaima

Economic Development Agency (1)
Yasui

Dept. of Parks and Recreation (1)
Maehara

LIBRARIES

State Main Branch (1)
Mrs. Shirley Ng

Regional:

Kaimuki Regional Library (1)

Kaneohe Regional Library (1)

Pearl City Regional Library (1)

Hilo Regional Library (1)

Wailuku Regional Library (1)

Lihue Regional Library (1)

Branch:

MAUI

Kahului Branch (1)

Lahaina Branch (1)

Makawao Branch (1)

Lahaina Sun (1)
Maui

Maui News (1)
Maui

UNIVERSITY OF HAWAII

Sinclair Library, Pacific Collection (1)

State Archives (1)

Dept. of Planning and Economic Dvelopment Library (1)
Tony Oliver

Bishop Museum Library (1)
Legislative Reference Bureau Library (1)

LIST OF RESPONDING AGENCIES

RESPONDING AGENCY	DATE OF LETTER
FEDERAL	
U.S. Department of the Army, Corps of Engineers	July 19, 1974
*U.S. Department of the Air Force	July 22, 1974
U.S. Department of Agriculture Soil Conservation Service	July 25, 1974
*U.S. Senator Daniel K. Inouye	July 29, 1974
*U.S. Department of Transportation Federal Aviation Administration	August 2, 1974
*U.S. Department of Housing and Urban Development, Federal Housing Administration	August 19, 1974
U.S. Department of Agriculture, Forest Service	August 29, 1974
*U.S. Department of Health, Education and Welfare	Sept. 9, 1974
*U.S. Environmental Protection Agency	Sept. 13, 1974
U.S. Dept of the Interior, Office of the Secretary	Sept. 16, 1974
STATE	
Department of Accounting & General Services	July 3, 1974
Department of Health	July 18, 1974
*Department of Land & Natural Resources	August 6, 1974
*Department of Agriculture	August 7, 1974
UNIVERSITY OF HAWAII	
Environmental Center	July 18, 1974
Water Resources Research Center	June 27, 1974

* No Comment/Objection

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
BUILDING 96, FORT ARMSTRONG
HONOLULU, HAWAII 96813

PODED-P

19 July 1974

Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control
State of Hawaii
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

We have reviewed the draft Environmental Impact Statement for the New Piilani Highway Project Nos. F-031-1 (4), F-031-1 (1) & F-037-1 (10), Route 31/37, Kihei to Makena Road/Kula Highway, Maui, Hawaii. The following comments are offered for consideration during preparation of the final statement.

a. Although the statement describes the land use and ownership of the project area and the existing roadway conditions, it does not provide a discussion of the natural terrain, vegetation, wildlife, climate, or natural conditions associated with the area. A thorough description of the existing project setting would aid the reviewer in understanding the relative importance of adverse effects such as those described on page 38. 1

b. The U.S. Army Corps of Engineers has an approved survey study of the Kihei area for flood control purposes. To insure compatibility with potential flood control improvements, we request that hydrology and hydraulic design for the highway bridges be coordinated with the Pacific Ocean Division, U.S. Army Corps of Engineers. 2

Sincerely yours,

Elroy Chinn

ELROY CHINN
Acting Chief, Engineering Division

United States Department of the Army,
Corps of Engineers
July 19, 1974

COMMENT	RESPONSE
1. A thorough description of the natural surrounding conditions is not provided for.	For description of the existing natural conditions refer to Sec. III. Pg. 7-9.
2. Hydrology and hydraulic design for the highway bridges should be coordinated with the Corps in line with future flood control improvements.	Design will be coordinated with the Corps and its survey of the Kihei area for flood control measures. Refer to Section VI. C.4.c., Pg. 81.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 15th AIR BASE WING (PACAF)
APO SAN FRANCISCO 96553

REPLY TO ATTN OF: DEEE (Mr Kimura, 4492158)

22 JUL 1974

SUBJECT: Draft Environmental Impact Statement

TO: Office of Environmental Quality Control
Office of the Governor
550 Halekauwila Street
Tani Office Building, Third Floor
Honolulu, Hawaii 96813

This office has no comment to render relative to the draft environmental impact statements for the following projects:

a. New Piilani Highway, Maui, Hawaii

b. Kona Flood Control Project

ALLAN M. YAMADA
Asst Dep Comdr for Civil Engrg

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

440 Alexander Young Building, Honolulu, HI 96813

July 25, 1974

Dr. Richard E. Marland
Office of Environmental Quality Control
Office of the Governor
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

Re: Draft EIS - New Piilani Highway Project. Route 31/37, Kihei to Makena Road/Kula Highway. Maui, Hawaii.

We have reviewed the above-mentioned draft as you requested. The following comments are offered for the consideration of the planners:

1 a. Most of the soils along the highway right-of-way will require special attention where vegetative measures are planned. Irrigation will be needed to establish any planned, temporary or permanent vegetative erosion control measures.

2 b. Permanent vegetative measures to be developed in detailed designs for landscaping, including barrow areas, will also require special consideration for irrigation, fertilizer and suitable plant species.

3 c. Because of the limited amounts of topsoil at various points along the right-of-way, all topsoil should be stockpiled. It should be evenly respread after grading is completed. Erosion control measures should be utilized on the stockpiled soil.

4 d. The need for permanent erosion control structures, such as debris basins, along with landscaping considerations should be investigated early in the planning phase.

5 e. Large flow rates and velocities can be expected from the extensive watershed, which includes the slopes of Haleakala. For this reason, the adequacy of outlets downstream of the road should be determined.

Thank you for the opportunity to comment on this draft.

Sincerely,

Francis C. H. Lum
State Conservationist

United States Department of Agriculture,
Soil Conservation Service
July 25, 1974

COMMENT	RESPONSE
1. Irrigation and special attention to soils are needed where vegetation is planned.	Landscaping and sprinkling will be considered in the detail design phase of the project. Refer to Sec. IV. E.5, Pg.25 and Sec. VI. C.4.d., Pg. 81-82,and Sec. VI. C.4.c., Pg. 80.
2. Irrigation, fertilizer and plant species will require consideration where permanent vegetation is included in detailed landscaping designs.	Refer to Response #1 above.
3. Limited amounts of topsoil in the area require all topsoil to be stockpiled.	Topsoil stockpiling will be considered in the detail design phase. Refer to Sec. IV. E.5., Pg. 25.
4. Landscaping and permanent erosion control structures should be considered in the planning phase.	Special design features for high embankments susceptible to erosion are included. Refer to Sec. IV. E.1., Pg. 20 and also Response #1.
5. Adequacy of outlets downstream should be determined in considering large water volume flows and velocities from the extensive Haleakala watershed.	With the overtopping of nearly every drainage structure crossing Kihei Road during heavy rains, provisions will be made to minimize the effects of voluminous runoff. Refer to Sec. VI. C. 4.c., Pg. 80-81.

DANIEL K. INOUYE
HAWAII

United States Senate

WASHINGTON, D.C. 20510

July 29, 1974

Dr. Richard E. Marland
Interim Director
Office of Environmental Quality Control
State of Hawaii - Office of the Governor
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

Senator Inouye is currently in Hawaii and in his absence, I wish to acknowledge receipt of a copy of the Draft Environmental Impact Statement for the New Piilani Highway Project on Maui.

Your assistance in continuing to keep us informed is most appreciated.

Aloha,

PATRICK H. DE LEON, Ph.D., M.P.H.
Legislative Assistant

PD:jmpl

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

PACIFIC-ASIA REGION
P. O. BOX 4009
HONOLULU, HAWAII 96813

AUG 02 1974

Office of Environmental Quality Control
Office of the Governor
550 Halekauwila St., Room 301
Honolulu, Hawaii 96813

Gentlemen:

Receipt is acknowledged of the draft Environmental Impact Statement for the new Piilani Highway Project from Kihei to Makena Road/Kula Highway, Maui, Hawaii.

Our review indicates that the proposed project would have no impact on airport or aeronautical activities in this area.

Thank you for the opportunity to review the proposal.

Sincerely,

Herman C. Bliss

HERMAN C. BLISS
Chief, Airports Division, APC-600

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
FEDERAL HOUSING ADMINISTRATION
HONOLULU INSURING OFFICE
P.O. BOX 3377
HONOLULU, HAWAII 96801

REGION IX
450 Golden Gate Avenue
P.O. Box 36003
San Francisco, California 94102

August 19, 1974

IN REPLY REFER TO:
9.7U (Johnson/
546-5554)

Office of Environmental Quality Control
Office of the Governor
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Subject: Draft EIS-73-02D
New Piilani Highway
Project Nos. F-031-1 (4), F-031-1 (1)
and F-037-1 (10)

The Draft Environmental Impact Statement for the New Piilani Highway has been reviewed for adverse environmental impacts on HUD-FHA assisted programs in the project area.

This office finds that the subject project will have no adverse impacts on existing HUD-FHA projects based on design criteria contained in the Draft Environmental Impact Statement and information on file in this office.

Sincerely,

Alvin K. H. Pang
Director

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
630 Sansome Street
San Francisco, California 94111

8420

August 29, 1974

Office of Environmental Quality Control
Office of the Governor
550 Halehauwila St., Rm. 301
Honolulu, Hawaii 96813

Gentlemen:

We have reviewed the draft Environmental Impact Statement (FHWA-HI-EIS-73-02D) on the New Piilani Highway Project, Route 31/37, Maui, Hawaii, and have the following comments.

We feel that the environmental statement does not contain sufficient information about the natural environment for the reader to evaluate the effects of the proposed actions. From our limited knowledge of the area, we believe that the highway will pass through a kiawe (mesquite) - grass vegetation. 1

We presume that the improved highway will stimulate additional traffic. Fire risk in this woodland - grass type will thus be increased. 2

Also, rainfall is generally low - from 20 inches at sea level to about 35-40 inches at the upper end (south end) of the highway. Thus, the growing conditions for vegetation are harsh. Stabilization of road cuts and fills should take this into consideration. It will be difficult to revegetate steep cuts. 3

As this is not a distinctive or native forest type in Hawaii, we would assume that the project would have little effect on forest resources, other than those effects mentioned above. However, we recommend that the Forestry Division of the Hawaii Department of Land and Natural Resources be contacted for more specific comment on the above matters. 4

We appreciate the opportunity to review and comment.

Sincerely,

DOUGLAS R. LEISZ
Regional Forester

United States Department of Agriculture,
Forest Service
August 29, 1974

COMMENT	RESPONSE
1. Information on the natural environment is insufficient for evaluating the effects of the proposed highway.	For discussion on the existing environment refer to Sec. II. Pg. 7-9.
2. The highway will generate higher traffic volumes, thereby increasing fire risk to the woodland and grassy areas.	Unavoidable adverse effects of the highway include the risk of fire in dry areas, but measures to offset these effects are discussed in Sec. VII. Pg. 89.
3. Since certain areas are arid and growing conditions for vegetation are poor, special consideration is required for stabilization of road cuts and fills.	Refer to Sec. VI. C. 4.d., Pg. 81-82 for minimizing soil erosion.
4. Forestry Division of Hawaii State Department of Land and Natural Resources should be contacted for more specific comment on native vegetative resources.	Hawaii State Department of Land and Natural Resources has reviewed the project draft Environmental Impact Statement and has indicated by letter that there are no objections to the project. Refer to Department of Land and Natural Resources letter dated August 6, 1974 in Appendix II.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGIONAL OFFICE
50 FULTON STREET
SAN FRANCISCO, CALIFORNIA 94102

OFFICE OF
THE REGIONAL DIRECTOR

Office of Environmental Affairs

September 9, 1974

Richard E. Marland, Ph.D
Office of Environmental Quality Control
Office of the Governor
550 Halekauwila Street
Tani Office Building, Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

The Draft Environmental Impact Statement for the new Piilani Highway Project Nos. F-031-1 (4), F-031-1 (1) and F-037-1 (10) Route 31/37, Kihei to Makena Road/Kula Highway, Maui, Hawaii, has been reviewed in accordance with the interim procedures of the Department of Health, Education and Welfare as required by Section 102(2)(c) of the National Environmental Policy Act (PL 91-190).

The material provided appears to describe adequately the impacts of the proposed action as well as the alternatives that were presented. The major concerns of this department are related to possible impacts upon the health of the population, services to that population and changes in the characteristics of the population which would require a different level of extent of services.

We regret the delay in responding, however the statement was not received until August 14, 1974, although the envelope was postmarked July 23, 1974.

The opportunity to review this statement was appreciated.

James D. Knochenhauer
Regional Environmental Officer

(Hawaii 10.316 (

RECEIVED
SEP 27 12 REGION IX
100 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111

RECEIVED
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DEPT. OF TRANSPORTATION
HIGHWAYS DIVISION

DEPT. OF TRANSPORTATION
HIGHWAYS DIVISION

SEP 13 1974

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F. E. Hawley
Regional Administrator
Federal Highway Administration
450 Golden Gate Avenue
San Francisco CA 94102

Dear Mr. Hawley:

The Environmental Protection Agency has received and reviewed the draft environmental impact statement for the following proposed project, New Piilani Highway, Maui, Hawaii.

EPA's comments on the draft statement have been classified as Category LO-1. Definitions of the categories are provided on the enclosure. The classification and the date of EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and the adequacy of the impact statement at the draft stage.

EPA appreciates the opportunity to comment on this draft statement and requests two copies of the final statement when available.

Sincerely,

Paul De Falco, Jr.
Regional Administrator

Enclosure

cc: Council on Environmental Quality, Wash., D.C. 20460

RECEIVED
HI SEP 20 1974

(LO-1)

This copy sent to State from G. Yasui FHWA

Environmental Impact of the Action

LO--Lack of Objections

EPA has no objections to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER--Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU--Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1--Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2--Insufficient Information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3--Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft impact statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.

UNITED STATES
DEPARTMENT OF THE INTERIOR

OFFICE OF THE SECRETARY

PACIFIC SOUTHWEST REGION
BOX 36098 • 450 GOLDEN GATE AVENUE
SAN FRANCISCO, CALIFORNIA 94102
(415) 556-8200

ER-74/971

September 16, 1974

Dr. Richard E. Marland
Interim Director
Office of Environmental Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Dr. Marland:

The Department of the Interior has reviewed the draft environmental statement for Piilani Highway, Route 31/37, Maui County, Hawaii.

1 The Statement indicates that Alternates D and E to Project B would affect the Alexander and Baldwin property which has been designated for public use in the Kihei Civic Development Plan. We suggest the proposed public use be described and an indication made whether or not this land, if affected by the highway, would be replaced with other property of equal value and utility. Alternative F, which would not affect the Alexander and Baldwin property, appears to be rejected because it would remove six to seven undeveloped lots from the planned subdivision. Therefore, it seems the retention of the subdivision lots has a higher priority than preservation of the property dedicated to public use. We recommend that the final statement provide information on the nature and need of the proposed public use for the Alexander and Baldwin property and assess the impact of using this property in lieu of the subdivision lands.

2 The excerpt from the archeological survey report and the maps which are included in the draft statement indicate that the Project A alignment survey only included the Palauea and Keauhou sections of the proposed Piilani Highway. Since this portion of the highway only goes from approximately Station 200 + 00 to Station 250 + 00 and the Project A alignment goes from Station 0 + 50 to Station 419 + 18, it appears that a large portion of Project A has not been surveyed. Therefore, we suggest the Project A alignment from Station 0 + 50 to Station 200 + 00 and from Station 250 + 00 to Station 419 + 18 be intensively surveyed by

a competent, professional archeologist before a final alignment is selected. In addition, we recommend that an intensive survey rather than a walk-through archeological reconnaissance be conducted by a professional archeologist prior to the selection of a final Project B alignment, since such projects have entailed much destruction of archeological resources. The findings and recommendations of the archeologists who perform the recommended surveys should be included in the final statement. If significant archeological resources are identified, they should be described and evaluated for their National Register potential. If they qualify, they should be nominated to the Register in compliance with title 36 CFR 800. Decisions concerning the projects should then take into account the significance of any affected resources and professional recommendations concerning them.

The completion of this road will increase pressure for a paved highway continuing east to Hana along the south coast and could double or perhaps triple visitation to the Kipahulu District of Haleakala National Park. Also, it could affect the natural and cultural resources of other coastal corridor lands. Although some of these impacts can be considered beneficial, some are adverse, and these should all be considered on page 52 in the discussion of long-term productivity. We suggest this discussion be revised to consider in specific terms the growth-inducing nature of the proposed highway segment in relation to the southern portion of Maui. 3

Construction of the highway in the proposed alignment should have no significant effects upon the water supply of the area. However, while there are no perennial streams in the area, there can be considerable runoff in times of exceptionally heavy rainfall and provisions should be made to minimize the effects of concentrated runoff resulting from highway construction. 4

No information on geology of the area of proposed highway construction has been provided in the draft environmental statement, nor have related environmental impacts been evaluated. In addition, no information on required earthwork or structures has been provided, in spite of the fact that the alignment is partly across rugged terrain (page 12, paragraph 1). Although reference has been made to "essential earth cuts and fills" (page 38), no details have been provided on their locations, design, or environmental impacts.. It is suggested that these subjects be addressed in the final environmental statement, as the highway will be constructed on new alignment. 5

Under Part A, Description of the Proposed Highway and Its Surroundings, Section 2, Project Location, we suggest a more

detailed description of the environment be included. A map which describes existing plant communities, as well as agricultural crops and urban development, would be helpful. Associated fauna within the project area should be noted.

6 Also Part A, Section 5-d (page 13) should contain diagrams of the culvert crossings or bridges, as well as design capacity of these structures. More descriptive information on Kulanihakoi and Waipulani Streams would be helpful, particularly data on stream type (i.e., interrupted or perennial) and the associated biota. In addition, Section 5-e, Landscape (page 13), should include information on roadside plantings and their maintenance as an erosion control measure.

7 Under Part B, Probable Environmental Impact of the Proposed Highway, Section 3-a, Conservation (page 24), the first paragraph is misleading. The adverse effects on other plant and animal communities should be discussed. The occurrence of temporary habitat formed by pot holes during the winter months are of particular importance to the Hawaiian stilt. In Section 3-d, Waste Management (page 26), the sites of the county-approved refuse areas should be described in the final EIS. Environmental impacts of the dumping should be described. Section 3-d(3), Water (second paragraph, page 31), should be expanded to include diagrams in addition to a description of the capacity of the highway drainage system as it relates to estimated runoff within the project area.

8 We suggest that Part C, Probable Unavoidable Adverse Environmental Effects (page 38), be expanded to describe the type of plant communities and associated wildlife affected, as well as the modification of the natural terrain. It should, in addition, consider adverse effects of Kulanihakoi and Waipulani Streams and their associated biota. Also, Part E, Relationship Between Short-term Uses of Man's Environment, etc. (page 52), should note that the proposed project will destroy plant life and its associated animal community.

We appreciate the opportunity to review and comment on the draft statement.

Cordially,

Webster Otis
Special Assistant to the Secretary

cc: [illegible], Washington, D. C.
BR, BOR, San Francisco
RD, FWS, Portland
RD, NPS, San FRancisco
RD., USGS, Portland

United States Department of the Interior,
Office of the Secretary
September 16, 1974

COMMENT	RESPONSE
1. Alternates D and E would affect Alexander & Baldwin property that is designated "public use", while Alternate F was rejected in an effort to preserve 6 or 7 undeveloped lots in a planned subdivision.	The property in question that was previously designated "public use" has been rezoned "residential" in the Kihei Civic Development Plan, as amended, and in conformance with the General Plan Amendment.
2. Large sections of the proposed alignment are not included in the archaeological survey report. Findings and recommendations by the archaeologist after survey of the entire alignment should be included.	Refer to Sec. VI. C.2., Pg. 60-62 for descriptions of the archaeological sites located in the project area. The surveys and complete documents are noted by References 17 and 18.
3. Impacts of increased visitation to Kipahulu District and Haleakala National Park and affects to the natural and cultural resources in these areas should be discussed as part of the long term growth inducing nature of the proposed highway.	Refer to Sec. VIII. Pg. 90-91 for beneficial as well as adverse effects on the communities and resources of the area.
4. Effort should be made to minimize the effects of concentrated runoff during highway construction in times of heavy rainfall.	Provisions will be made to minimize the effects of voluminous runoff. Refer to Sec. VI. A.4., Pg. 53 and Sec. VI.C.4.c., Pg. 80.
5. Geological information should be provided and related impacts evaluated, along with design features and earthwork where the alignment crosses rugged terrain.	Refer to Sec. III. Pg. 7 for geology in the area. For minimizing earthwork along the rugged segment alignment, special requirements are set forth in Sec. IV.E.2.,Pg.22.

United States Department of the Interior,
Office of the Secretary
September 16, 1974

COMMENT	RESPONSE
6. More detailed description of the environment to include flora and fauna, agricultural crops and urban development is needed.	Refer to Sec. III. Pg. 7-9 for area description, using Figures 2 on Pg. 14, 3 on Pg. 16, and 4 on Pg. 18 as aids. Detailed descriptions of flora and fauna and the effects to them are in Sec. VI.C.1., Pg. 56-60.
7. Design and capacity of culvert crossings and bridges, with added information on streams and associated biota should be included. Discussion on landscaping should also include roadside plantings and erosion control maintenance measures.	Preliminary plans for these structures are on file with the Hawaii State Department of Transportation Highways Division. For stream data refer to Sec. IV.E.4.,Pg.24 and Sec. VI.C.1.,Pg. 56-57. For landscaping data refer to Sec. IV.E.4., Pg.25.
8. Adverse effects on plant and animal communities should be added. Sites of county approved refuse areas and impacts to the environment should be described. Design and capacity of the highway drainage system should also be included.	Effects to existing flora and fauna are discussed in Sec. VI.C.1.,Pg. 56-60. Refer also to Sec. VI.C.4.a., Pg. 63-64 for minimizing adverse effects to air quality by proper waste management of discarded materials. The highway drainage system will be accomplished in the detail design phase. Estimated runoff is included in the Hydrology Report which is on file with the Hawaii State Department of Transportation Highways Division.
Adverse effects should be expanded to include affected plant and wildlife, streams and associated life-supporting biota.	Refer to Sec. VI.C.1., Pg.56-60, Sec. VII.Pg.88-89, and Sec. VIII.Pg.91 for discussion on unavoidable adverse effects to plants, animals, streams and stream biota.

LETTER NO. (P)1801.4

KENAM KIM
COMPTROLLER

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

JUL 3 1974

Dr. Richard E. Marland
Interim Director
Office of Environmental Quality Control
State of Hawaii
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

Subject: Draft EIS for New Piilani Highway, Kihei to Makena Road/Kula Highway

We have reviewed the subject statement and the following are our comments:

Page 16 (Section A.7.c - 2nd Sentence)

The need for the Kihei Educational Cluster will not be postponed even without the regional settlement and development planned upon new highway completion. The cluster is initially being planned to replace the existing Kihei School. 1

Page 37 (Section B.4.d)

The possibility of signalization of the Lipoa Street intersection is not discussed in conjunction with the pedestrian overpass. This item was mentioned by the DOT in their review of our EIS for the Kihei Educational Cluster. 2

Page 47 (Section D.3.e.(6))

The "possible slowing of traffic flow on Piilani Highway adjacent to the school because of on and off ramp vehicles" 3

should not be a disadvantage to alternatives G and H when compared to the other makai alternative. This factor should be equal for all alternative routes.

Very truly yours,

KENAM KIM
State Comptroller

State of Hawaii Department of Accounting and General Services
July 3, 1974

COMMENT	RESPONSE
1. The need for Kihei Educational Cluster to replace the existing Kihei School will not be postponed.	The need for the cluster is recognized with the revision of statements referring to it. Refer to Sec. VI,D.4.,Pg.86-87.
2. Discussion of signalization at Lipoa Street intersection in conjunction with the pedestrian overpass for Kihei Educational Cluster school students is needed.	Relocation of the highway alignment has eliminated the requirement for a pedestrian overpass or signalization at Lipoa Street intersection. Refer to Sec. VI.D.4., Pg. 86-87.
3. Slowing of traffic flow on the highway with the utilization of on-off ramps should not be a disadvantage to only alternates G and H.	This factor of on-off ramps represents a disadvantage to all alternate routes. Refer to Sec. V.C.5., Pg. 42.

JOHN A. BURNS
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

WALTER B. QUISENBERRY, M.P.H., M.D.
DIRECTOR OF HEALTH

WILBUR S. LUMMIS JR., M.S., M.D.
DEPUTY DIRECTOR OF HEALTH

RALPH B. BERRY, M.P.H., M.D.
DEPUTY DIRECTOR OF HEALTH

HENRI P. MINETTE, M.P.H., DR.P.H.
DEPUTY DIRECTOR OF HEALTH

July 18, 1974

In reply, please refer to:
File: EPHS-PTR

To: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

From: Director of Health

Subject: Draft Environmental Impact Statement for New Piilani Highway Project, Route 31/37, Kihei to Makena Road, Maui, Hawaii

The subject draft statement has been reviewed by our staff engineers and evaluated to determine its adequacy in areas of our official concern. The following are comments relative to the subject statement:

Water Pollution

1 It is not anticipated that construction of the highway will have an effect more significant on water pollution than the present or proposed development of the Kihei-Makena area into a major resort destination. However, the draft statement does not address the problems associated with construction in sufficient detail to allow evaluation of the control procedures. If possible, the final Environmental Impact Statement (EIS) should address water pollution control in more detail in the major problem areas such as streams and steep inclines.

Air Pollution

2 Traffic flow and speeds for 24 hour averages and peak hours should be used to predict the air impact of the proposed project as compared to existing emissions and emissions anticipated without the new highway. These figures can then be applied to applicable diffusion equations and downwind concentrations determined. The text makes general statements concerning air quality but does not support them with data.

Noise

According to the data presented, and due to the type and location of adjacent residences, noise should not prove excessive provided all equipment and vehicles are supplied with adequate noise suppression devices.

In total, the draft EIS lacks supportive evidence for many of its points. Also, the effects of road construction on areas such as Kula are not detailed although it is apparent that the effect of the highway will be substantial on development patterns in "upcountry" areas.

WALTER B. QUISENBERRY, M.D.

State of Hawaii Department of Health
July 18, 1974

COMMENT	RESPONSE
1. Water pollution control during construction should be discussed in greater detail in major problem areas of the streams and steep inclines to allow evaluation of control procedures.	Sedimentation problems, soil erosion and water supply pollution are further discussed in Sec. VI.C.4.c & d, Pg. 77,80-82.
2. Statements concerning air quality are not supported by data. Air impact of the proposed project should be compared to existing emissions.	Conclusions taken from the Air Quality Study performed by the Hawaii State Department of Transportation Materials Testing and Research Branch are included and discussed in Sec. VI.C.4.a., Pg. 63-67. The study is noted by Reference 25.

JOHN A. BURNS
GOVERNOR OF HAWAII

DIVISIONS:
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

August 6, 1974

MEMORANDUM

To: R. E. Marland, Interim Director
Office of Environmental Quality Control

From: Sunao Kido, Chairman

Subject: Comments on the Following

Draft Environmental Impact Statement for New Piilani Highway Project, Kihei to Makena Road, Kula Highway, Maui, Hawaii

This Department has reviewed the subject draft EIS for the new Piilani Highway project.

We have no objections to the project.

EIS on the Proposed Zone of Mixing for the Hawaii-Kai Sewer Outfall

This report covers the establishment of a zone of mixing in the waters off of Sandy Beach as required under State of Hawaii's Department of Health, Public Health Regulations, Chapter 37A.

This Department has no objection to this report as presented.

EIS for the Realignment and Widening of Olohena Road, Kapaa Homesteads, Island of Kauai.

This EIS covers the proposed improvements to Olohena Road to eliminate a very sharp turn which is hazardous. The work will be done on land owned by the Lihue Plantation Co., Ltd.

We have no objections to this project.

SUNAO KIDO
Chairman and Member

JOHN A. BURNS
GOVERNOR

FREDERICK C. ERSKINE
CHAIRMAN, BOARD OF AGRICULTURE

WILLIAM E. FERNANDES
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF AGRICULTURE
1428 SO. KING STREET
HONOLULU, HAWAII 96814

August 7, 1974

MEMORANDUM

TO: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

SUBJECT: Environmental Impact Statement on Administrative Action
For New Piilani Highway Project Nos. F-031-1(4), Route 31/37,
Kihei to Makena Road/Kula Highway Maui, Hawaii

The Department has reviewed this draft statement for agricultural impact. The project will improve access to ranch lands improving ability to move livestock and supplies. The major environmental effects of construction have been considered and resolved.

Thank you for the opportunity to review this statement.

Frederick C Erskine

FREDERICK C. ERSKINE
Chairman, Board of Agriculture

University of Hawaii at Manoa

Environmental Center
Maile Bldg. 10 • 2540 Maile Way
Honolulu, Hawaii 96822
Telephone (808) 948-7361

Office of the Director

July 18, 1974

MEMORANDUM

TO: Richard E. Marland, Director, OEQC

FROM: Jerry M. Johnson

RE: Draft EIS for New Piilani Highway Project, Kihei to Makena Road/Kula Highway, Maui

Jacquelin Miller of the Environmental Center with the assistance of Tamotsu Sahara, Office of Physical Planning and Construction, has reviewed the above cited Environmental Impact Statement. The draft EIS has covered most of the general problem areas. We do have some comments on certain sections where enlargement or reexamination of the presentation seems warranted.

Pg. 1. 1. Type of facility: We note the itemization of four advantages for the new highway. A fifth point raised by Mr. Sahara which would be worthy of discussion is that "the new alignment will allow a wider strip of land between the highway and beach. This wider strip of land would permit a more desirable land use for this area. A major thoroughfare located close to the beach severely restricts effective land use." 1

Pg. 6. The planned development of the Maalaea, Kihei Wharf, Kamaole, and Wailea land as cited in sections 1-4 represents many thousands of units and similarly many thousands of people. No time schedule is indicated for the proposed developments. 2

It appears from the regional plan illustrated in fig. 3, pg. 7, that virtually all the land makai of the proposed highway is planned for multi-family units, ie. apartments or resort-hotel. In fact, we do not see any areas planned for single family residential use. It would seem that the ultimate population for 3

the land makai of the highway would generate significantly more vehicles per day than the projected 1993 number of 7400. We are concerned that the proposed road and 100 feet right-of-way will prove to be insufficient if the proposed maximum development is allowed to proceed. Certainly adequate roads are a necessity and safety should be the ultimate criteria in their construction. We are concerned over the frequent references and implications throughout the Environmental Impact Statement (pg. 1, 6, 15, 16, 17, 20, 51, 55, 56) that the proposed road will provide the "desired" or "needed" transportation feature to "promote economic growth and expansion." We strongly question the overall philosophy being promulgated that growth and development are somehow innately good or desirable. We firmly believe that growth and development must be evaluated in terms of the optimum carrying capacity as expressed in the 1973-74 Senate and House bills on carrying capacity and environmental overload. The construction of this highway will be the major impetus to greater development of the adjacent areas. We note that no residential, rural development is planned according to pg. 7, fig. 3, hence this highway will primarily serve the apartment-hotel developers and agricultural produce transportation.

4 Pg. 16. Mr. Sahara has suggested that a breakdown should be made of the crop land acreage and grazing acreage of the 109.34 areas of agricultural lands removed by the highway construction. A description of the soils, topography and irrigation status of the lands involved would also be desirable. The impact of the loss of these acreages to the agricultural industries should be discussed and the positive or negative impacts on employment or operations should be stated.

5 Pg. 17. We see a major environmental impact of the project to be the social and economic considerations cited on pg. 17, paragraph 2. These aspects should be discussed more fully in the section on Environmental Impact of the proposed project, page 20.

6 Pg. 22. The new alignment will lessen the flood and tsunami inundation hazards. On the other hand, the low annual rainfall and the erodibility of the soils will require intensive conservation practices to minimize soil erosion. The section of the highway in the northern portion will be built in soils that are highly erosive. The central portion of the highway will be built in sandy soils that can be subject to wind erosion.

7 The drainages crossing the highway are usually dry. However, as the watershed areas for these drainages extend all the way up the slopes of Haleakala, the culverts and bridges crossing the highway should be of sufficient size to accommodate runoff from heavy Kona-type rainstorms.

Pg. 25. We strongly urge the acquisition of a bicycle right-of-way at the time of land acquisition for this roadway. Experience on Oahu has more than demonstrated the need and desirability of safe, separate bike-ways, particularly along the coastal areas. 8

Pg. 26. We question the statement that "at any given traffic density, the emission levels might decrease because of the smoother traffic flow." If the development of this area proceeds as presently planned, we would expect traffic congestion and impairment in "smooth traffic flow" to occur within the next 10 years. Under these circumstances we would anticipate air and noise problems similar to those experienced for the past 10 years on Kalanianaole Highway on Oahu. 9

Pg. 32. It appears that the noise level predications expressed in table 5 exceed the noise level design criteria (pg. 30) in almost every case. 10

Pg. 34. There is essentially universal agreement by all concerned that utility poles, either electric or telephone, are an unsightly and undesirable addition to the environment. It is our judgment that this practice should be discontinued. Developers of housing sub-divisions have been required to provide underground utilities. Any relocation of overhead utility lines by Maui Electric and Hawaiian Telephone should be similarly required to be underground. The argument of "not economically feasible at this time" can be questioned on the basis of "when" can we expect it to be "economically feasible." We suspect that the underground relocation can never be economically justified, just as many other desirable environmental improvements can not be justified on a pure economic basis ie., parks, recreation facilities, scenic overlooks, etc. 11

Pg. 37. A major concern of the Environmental Center in the presentation of this EIS is the proposed school site east or west of the highway. Paragraph d, pg. 37, seems confusing as to who has recommended what. Pg. 45 further discusses this school crossing problem. It would certainly appear that a highway alignment east of the school would be far more desirable. A short resume on why D.A.G.S. withdrew their request for the realignment would be appropriate. If the ultimate alignment results in school children crossing the highway then the pedestrian overpass should be a required part of the highway contract. 12

Pg. 39-49. The time and background of the Environmental Center reviewers does not allow for an in-depth evaluation of the many alternative sites presented (Alternatives A-I). Judging from the preponderance of apartment-hotel land makai of the proposed highway, fig. 3, strong pressures may be generated by development interests to increase the land area on the makai side through realignment. It is our opinion that safety and long term adequacy 13

should be the overriding criteria for the ultimate alignment selection, not the immediate economic costs or relocations required. We also would urge a greater consideration of the mass transit system mentioned on pg. 50 in light of the current transportation deficiencies on Oahu, particularly in the Pearl City-Hawaii Kai corridor with the view toward avoiding the mistakes of Oahu through adequate, more enlightened long range planning on Maui.

Jerry M. Johnson
Acting Director

cc: T. Sahara

University of Hawaii, Environmental Center
July 18, 1974

COMMENT	RESPONSE
1. Permitting a larger land area between the beach and highway to provide effective land use for this area would seem to be an advantage for the new highway facility.	The advantage of having desirable land use for the area between beach and highway is included in Sec. IV.A.,Pg.10.
2. A time schedule should be indicated for proposed developments in the Maalaea, Kihei, Kamaole and Wailea areas.	Realization of these developments in accordance with the master plan are based on a general 10-year period. Refer to Sec.IV.C.,Pg.15.
3. Lands makai of the proposed highway have no areas planned for residential use, and also would seem to generage significantly more than 7400 vehicles by 1993. Promulgating the philosophy that growth and development are good and desirable features, and that the proposed highway will provide the desired or needed transportation feature, is questionable.	Figure 3 on Pg. 16 delineates areas planned for residential use in the Kihei Civic Development Plan, as amended. The Hawaii State Department of Transportation Highway Division has re-evaluated this projected volume and concluded that the traffic projection of 7400 is reasonable and that this traffic forecast for the year 1993 is an indication of traffic generated by the ultimate population for the area. Planners of the Kihei Civic Development Plan for the County of Maui approach the problem of uncontrolled growth in the Kihei area and the impact of tourism with the belief that orderly development is necessary for planned efficient growth.
4. Agricultural lands removed by the highway should be broken down into crop lands and grazing lands, and a discussion should be included of the impact that loss of these lands would have on the agricultural industries.	Table 3 on Pg. 28 breaks down the acreage by actual land usage. Economic impact of the loss of agricultural lands caused by the alignment is discussed in Sec. IV.G.2.,Pg.28.

University of Hawaii, Environmental Center
July 18, 1974

COMMENT	RESPONSE
5. Major social and economic impacts by the project should be fully discussed.	For probable impacts of the proposed highway, refer to Sec. VI.A. & B., Pg. 48-56.
6. Intensive conservation practices may be necessary to minimize soil erosion in northern areas that are highly erosive, and in sandy soils subject to wind erosion.	Precautionary measures to control soil erosion will be utilized by proper waste management. Refer to Sec. VI.C.4.c.& d. Pg. 77,80-82.
7. Culvert and bridge crossings should be of sufficient size to accommodate voluminous runoff from the watershed areas during heavy rainfall	Refer to Sec. VI.C.4.c.,Pg.77, 80-81. Detail design phase will include adequate sizing of pipes and crossings for sufficient drainage provisions.
8. Consider the acquisition of bike right-of-way at the time of highway right-of-way.	Consideration for bikeways is included in Sec. VI.c.3., Pg. 63, however, a master plan for an overall bikeway system would have to be formulated.
9. Traffic congestion is expected if development in the area proceeds as planned, thereby increasing emission levels.	The results of an air quality study by the Hawaii State Department of Transportation Materials Testing and Research Branch, noted by Reference 25, show that the proposed Piilani Highway will have no adverse effect to the air quality in the Kihei-Makena area. Refer to Sec. VI.C.4.a., Pg.63-66.
10. Noise level predictions seem to exceed the noise level design criteria in nearly every case.	Table 10 on Pg. 69 shows the results of a noise survey conducted by the Hawaii State Department of Transportation Materials Testing and Research Branch in concluding that projected noise levels along the proposed route are not expected to exceed allowable noise

	levels of 70 dBA. Refer to Sec. VI.C.4.b.,Pg. 74-77.
11. Relocation of existing overhead utility lines should be required to be placed underground,and the argument of "not economically feasible" will not suffice as such improvements cannot be justified on an economic basis alone.	Refer to Sec. VI.D.2.,Pg.62 for discussion on underground relocation of lines and the additional cost to the State project costs if this were implemented.
12. Various positions on highway alignment east or west of the school site are confusing. An alignment east of the school site seems most desirable.	Clarification of the Hawaii State Department of Accounting and General Services recommendations for a highway alignment east of the proposed school site is made in Sec. V.C.4.,Pg.36 and in Sec. VI,D.4.,Pg.64.
13. Safety and long term adequacy should be the criteria for ultimate alignment selection rather than pressures generated by development interests to increase usable land area makai of the highway.	With these factors supposedly having been considered in the Kihei Civic Development Plan of Maui County, the alignment selection will generally conform with this controlled growth plan for the area.
Provide greater consideration of a mass transit system to avoid the mistakes of Oahu by long range planning on Maui.	As an alternative solution to the transportation problems of the area other than new highway construction, the feasibility of an island mass transit system was discussed in Sec. V. G., Pg.46-47.

UNIVERSITY OF HAWAII

Water Resources Research Center
Office of the Director

MEMORANDUM

June 27, 1974

MEMO TO: Richard E. Marland
Interim Director, OEQC

FROM: Reginald H. F. Young RHFY
Asst. Director, WRRC

SUBJECT: Draft EIS, Kihei to Makena Road, Kula Highway

This draft EIS was reviewed in this office principally by Henry Gee and me and the following comments are submitted for your consideration:

1 Under Section 3 of Environmental Effects, subsections d-1 (air) and d-3 (water) the probable impact of other emissions from automobiles have not been considered. Various researchers have shown that significant amounts of heavy metals are released into the environment by autos from the exhaust system, tires and oil. The most significant of these is lead from gasoline containing alkyl lead additives. Lead, being cumulative, is stored in plants and animals along highway areas. Zinc is found in oil additives and tires.

2 Subsection d-3 of Section 3 also refers to a highway drainage system designed in accordance with Chapter 37A, Water Quality Standards of the State Department of Health. These are water effluent standards and drainage systems from highway designed to remove surface runoff from roadways and surrounding areas, not to treat or alter the waters to meet effluent quality limits.

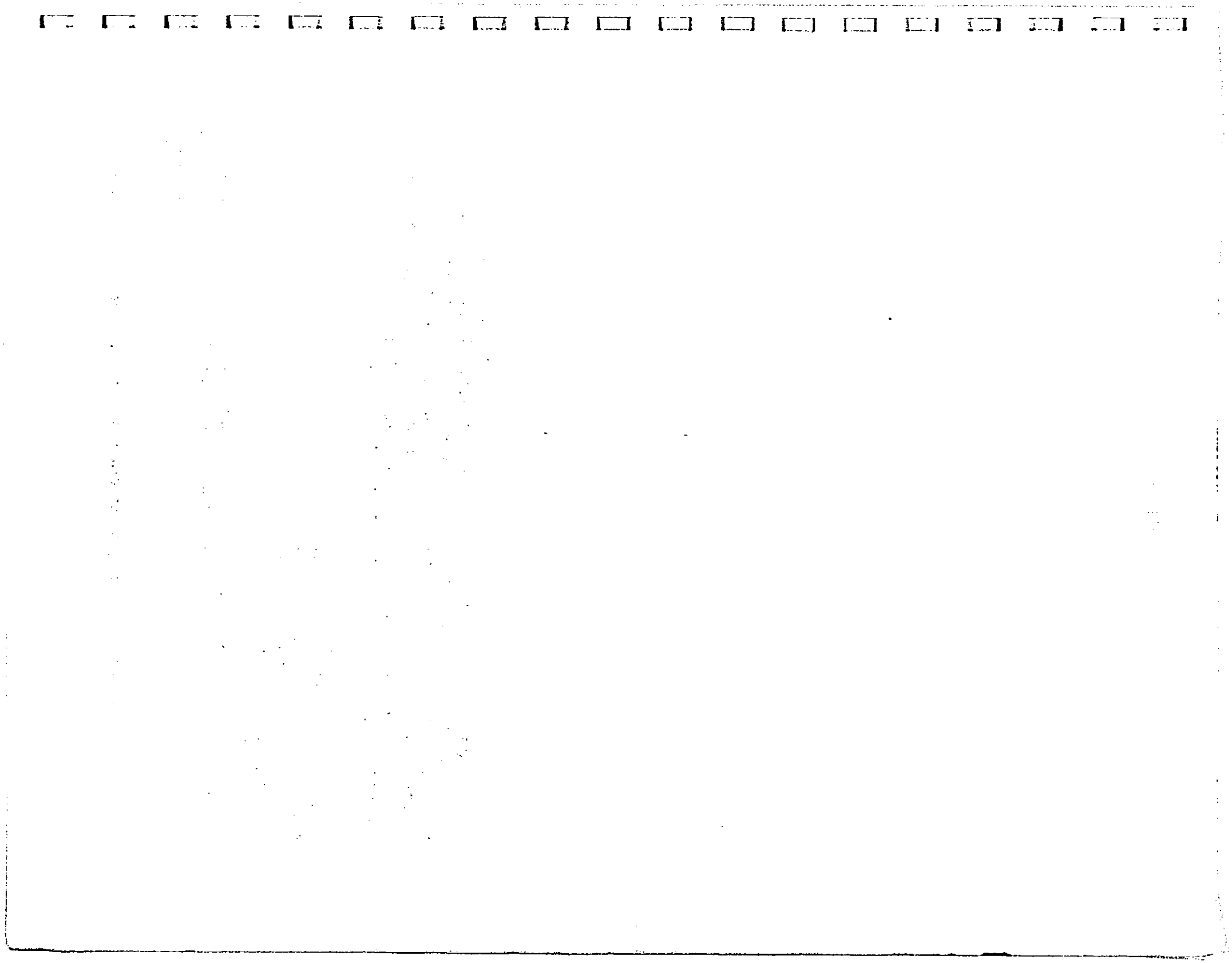
Typographical error is on page 10. The abbreviation for American Association of State Highway and Transportation Officials is AASHTO.

RHFY:jmn

cc: H. Gee
J. Johnson

University of Hawaii, Water Resources Research Center
June 27, 1974

COMMENTS	RESPONSE
1. Impact of automobile emissions has not been considered.	Refer to Sec. VI C.4,a.,Pg. 64 for discussion of the Air Quality Study results obtained by the Hawaii State Department of Transportation Materials Testing and Research Branch in its report, noted by Reference 25.
2. Reference to a highway drainage system designed according to Water Quality Standards of the Hawaii State Department of Health which alters waters to meet effluent quality standards is incorrect.	Clarification of statement to include a highway drainage system that is designed in accordance with applicable standards. Refer to Sec. VI. C.4.c.,Pg.77,80.



APPENDIX III

DESIGN PUBLIC HEARING COMMENTS AND RESPONSES

(WRITTEN AND ORAL)

DESIGN PUBLIC HEARING

The Design Public Hearing on the proposed Piilani Highway was held on July 31, 1974 at the Kihei Cafetorium on Maui, following a Public Informational Meeting held on April 24, 1974 which presented all alternate highway alignments. The Public Hearing required by FHPM 7-7-2 Par. 19.0(5) can be obtained from the State of Hawaii, Department of Transportation. Testimonies that were either received at or as a result of this hearing and the responses to them are included here.

ORAL COMMENTS REQUIRING DISCUSSION

	Comment:	Response:
1.	Mr. Toshio Ishikawa, Deputy Director Planning Department County of Maui	
	Mr. Ishikawa had four major comments on the proposed Piilani Highway: (1) Appropriate application for an amendment to the Kihei Civic Development Plan is required if the highway is to be located above the school site. (ii) Drainage facilites and access roads should be coordinated with the appropriate county agencies. (iii) Portion of highway from Mokulele Highway to Kalama Park should be given the construction priority. (iv) Highway landscaping using recycled water from the Kihei water facilities should be considered.	Subsequent to the Design Public Hearing, the General Plan was amended to include an alignment above the school. Appropriate County agencies will be contacted on the design of highway drainage facilities and access roads and given the chance to review the proposed plans in the course of the highway design. On the construction phasing of the highway, the State Highways Division, in view of the general concensus, is planning priority on that section of the highway from Kihei to Kalama Park. Landscaping of the highway will be seriously considered in the detail design phase. The possibility of utilizing recycled wastewater from the Kihei treatment facility for sprinkling will be investigated in the design stage.
2.	Mr. James Armitage, Vice President and Mgr. of Ulupalakua Ranch, representing Ulupalakua Ranch and the Ulupalakua Community Association	
	Mr. Armitage indicated that the Ulupalakua Ranch and its community haveno objection to the proposed Piilani Highway as far as Wailea. However, they strongly objected to the construction of that portion of the highway from Wailea to Ulupalakua unless that section of the unimproved road beyond	The State Highways Division in response to the written statement received after the Design Public Hearing Meeting, has selected a consultant for engineering services for the improvement of that section of unimproved road from Ulupalukua to Keokea. Design of the

Ulupalakua is coordinated and upgraded together with Piilani Highway from Wailea to Ulupalakua Ranch. Mr. Armitage also commented on the lack of water from the mauka water system for highway landscape purposes.	improvement is presently in progress. The shortage of water resources for highway landscaping will be evaluated in the design stage.
3. Mr. Michael Downing Downing and Associates	
Mr. Downing favored Alternate F because it duplicates existing Kaiola Place.	The proposed Alternate F does not follow the existing Kaiola Place for the reasons as outlined in our evaluation of written comments from Ms. Hope Kimura. (See discussion on written testimonies, No. 2).
4. Mr. Wendell Crockett Attorney-at-law, representing Kukahiko Estate	
Mr. Crockett indicated that the proposed Alternate E will encroach into the Kukahiko Estate which will be subdivided and inherited by the family.	The proposed Alternate E as shown on the preliminary plans will require acquisition of portion of the property. An evaluation of this Alternate E was made and the selection was justified despite the acquisition of portion of the Kukahiko property.
5. Mr. George Kukahiko, resident of Kihei.	
Mr. Kukahiko indicated that he has sold a portion of the Kukahiko Estate property through which Alternate E will traverse. The rationale on the selection of Alternate E was questioned.	Evaluation of Alternate E was made and justified the adoption of Alternate E.
6. Mr. Hannibal Tavares, Community Relations Director, Alexander and Baldwin.	
Mr. Tavares indicated his support for the alignment	Tentative construction schedule for the new Piilani

	above the proposed school site and had the following comments: (1) Construction of highway should commence as soon as possible. (ii) Initial phase of construction should be extended to Wailea. (iii) Section of the highway from Kihei should be constructed first.	Highway is presented on Page 32. The State Highways Division has indicated that the highway from Kihei to Kalama will be constructed first. Extent of this construction phase will be governed by the availability of funds.
7.	Mr. Gene Grounds, representing State House of Representative Mr. Rick Medina Mr. Grounds on behalf of Mr. Medina indicated support of the alignment above the school site and recommended that the highway be built as far down as Wailea. He also expressed that convenient access to and from the school should be considered.	The design of the Kihei School is presently in progress. The State Highways Division will coordinate the highway design with that of the school to assure proper design in the ingress and egress pattern. The State Highways Division will communicate with the Department of Accounting and General Services in the final design of the highway.
8.	Mr. Ron Vaught, President of the Kihei School PTA. Mr. Vaught expressed support of improvement of existing Kula Highway from Ulupalakua to Keokea.	See discussion on comment No. 2 by Mr. Armitage.
9.	Mr. Alvin Amoral, State House of Representative Mr. Alvin Amoral expressed support in consideration of landscaping of the highway, and a bikeway in conjunction with the design of the highway.	See discussion on comments by others in Appendix II. Bikeways may be considered in the sharing of the highway right-of-way, if, at the time of detail design, there is an approved Maui County bikeway system.

10. Councilman Mr. Marco Meyer, Maui County

Councilman Meyer commented on the flooding problems along the Waipulani Stream basin and suggested that the State, County and Corps of Engineers work together to alleviate the problems. He also mentioned a Maui bikeway master plan undertaken by the County. He suggested that the bikeway system be incorporated with the highway design.

See discussions on comments by others in Appendix II, regarding the flood problems in the Kihei area and consideration of a bikeway system.

11. Dr. Marvin Miura, resident of Maui.

Dr. Miura expressed his concern over the impact on the Keokea Community in the event of the improvement of the unimproved Kula Highway.

Improvement of that section of the Kula Highway from Ulupalakua to Keokea with the extension of the Piilani Highway unquestionably will affect the environmental, social and economical aspects of the Keokea Community. It is uncertain as to what extent this will occur. If there is any need for an Impact Study for highway improvement, the State Highways Division will be responsible in undertaking such a task to evaluate such effects.

COMMENTS REQUIRING NO DISCUSSION

1. Mr. Butch Arisumi resident of Maui and Developer of Arilani Subdivision.
2. Mr. August Pimental, resident of Kihei.
3. Mr. Tony Hashimoto, resident of Kihei.
4. Ms. Christine Teruya, resident of Kihei.
5. Mr. Joseph Donaghy, resident of Kihei.
6. Mr. David Beeman, resident of Kihei.

WRITTEN COMMENTS REQUIRING DISCUSSION

1. Comment:

Ms. Judy Dean
P. O. Box 583, Kihei Maui,
Hawaii 96753

Ms. Judy Dean has expressed concern over the closeness of the proposed highway with Maui Meadows Subdivision.

Response:

The proposed highway alignment abutting the Maui Meadows Subdivision follows a corridor set aside for highway prupose. This alignment is in conformance

with the Kihei Civic Development Plan*. Developers and/or buyers of properties in Maui Meadows subdivision were well aware of a future highway adjoining the subdivision. Relocation of the highway further away from the residential areas in Maui Meadows Subdivision will require an amendment to the Kihei Civic Development Plan*. Public Hearings on the Piilani Highway corridor was held in 1968 and this corridor was selected for study.

2. Ms. Hope W. Kimura,
297 Noe St., Kihei
Maui, Hawaii 96753

Ms. Kimura has registered a protest to the relocation of the proposed Piilani Highway away from Kaiola Street. It was her understanding five years ago that the highway alignment has been established and approved, based on an alignment following Kaiola Street. Ms. Kimura indicated her support for alignment Alternate F.

In July 1968 the State Highways Division conducted a hearing on the proposed corridor for the new highway. Other than the Kihei Civic Development Plan* in which a corridor for the new highway is shown following approximately Kaiola Street, a definite highway alignment has not been conceived. To use existing Kaiola Street as a highway corridor will require provision of numerous access for properties adjoining Kaiola Street. This is incompatible with the concept for a limited access highway which is a requirement for the new Piilani Highway.

Alternate F, as supported by Ms. Kimura cuts through existing Kaiola Street and Ohukai Road. It will not displace any existing dwelling structures other than the two wooden structures. However, it will take six to seven lots

away from the completed Arilani Subdivision.

3. Law Offices of Wooddell, Mukai and Ichiki, on behalf of Seibu Real Estate Co., Ltd., Prince Hotels of Hawaii, Inc., and Seibu Development (Hawaii), Inc.

   The above developers have expressed intention to develope their properties in Makena and requested consideration in extending the first phase construction of the new highway from Kihei to Makena, terminating at Station 256+00.

   Tentatively, four possible locations are being considered as temporary connection to Kihei Road for the first phase construction to be completed in July 1979.

   Second phase construction of the highway is anticipated to begin in February 1978 while the development of the Makena area is anticipated to take place from late 1975 through 1977. Justification for extending the limit of the first phase improvement for the additional construction traffic in the development of the Makena area would be difficult. However, if the Seibu development is expected to open in January 1978, construction of the second phase of the highway which is tentatively scheduled for February 1978 could be scheduled to begin in the Wailea area if the State Highways Division deems the necessity exists, and the constructed highway be opened for traffic in sections as it proceeds toward Ulupalakua.

   In the event that excess construction funds for the first phase improvement are available at the time when

	the design of the first phase is being finalized, location of the terminating point toward Wailea and Makena will be examined and re-evaluated and may be extended toward Ulupalakua as far as appropriate.
4. Mr. Meyer M. Ueoka, Attorney-at-Law, 2103 Wells Street, P. O. Box H, Wailuku, Maui, Hawaii 96793. Mr. Meyer M. Ueoka, representing Mr. and Mrs. Ralph Hondo, has expressed support for a plan that would go above Makai Heights Subdivision for the reason that small property owners will not be unnecessarily affected. If such a plan is not feasible, they would support the proposed Alternate D.	An alignment routing above Makai Heights will no doubt avoid affecting any small property owners in the Waiakoa Homestead areas. However, such a proposal is not acceptable for the following reasons: (i) Such alignment is non-conforming to the Kihei Civic Development Plan*. (ii) If adopted, this alignment proposal will require improvement and extension of existing collector streets for optimum use of the new highway facilities. Alternate D, as supported by Mr. and Mrs. Hondo, will not displace any existing dwelling structures other than two wooden storage structures. However, this alternate will affect the property belonging to Mr. John Kukahiko who is contemplating a subdivision development. Consideration in the selection of this alternate as the final alignment is being evaluated.

5. Mr. Francis White
5 Sedgwick Road, East
Hartford, Conn. 06108

Mr. White felt that the proposed highway is not needed and that existing Kihei Road can handle the traffic.	The proposed highway will relieve the congested Kihei Road and provide a safer and more efficient transportation system. This highway is needed to provide access to the fast growing Kihei area.

* The complete document of the Kihei Civic Development Plan, as amended in 1970, is available for review and public inspection at the Maui County Planning Commission and the State Highway Division Maui District Office.

PIILANI HIGHWAY

PROJECT NUMBERS F-031-1(4), F-031-1(1), AND F-037-1(10)
Kihei to Makena Road/Kula Highway
Maui, Hawaii

TECHNICAL APPENDICES

A. AIR QUALITY STUDY, PROPOSED PIILANI HIGHWAY

B. AMBIENT NOISE LEVEL READINGS, PIILANI HIGHWAY, KIHEI TO ULUPALAKUA, MAUI

C. NOISE STUDY, PROPOSED PIILANI HIGHWAY

U.S. DEPARTMENT OF TRANSPORTATION
Federal Highway Administration

AND

STATE OF HAWAII DEPARTMENT OF TRANSPORTATION
Highways Division

December 1976

PREFACE

This document has been prepared as part of the preparation of the environmental impact assessment of Piilani Highway from Kihei to Makena Road/Kula Highway Junction (Project Nos. F-031-1(4), F-031-1(1) and F-037-1(10)). It consists of analysis of air quality and noise conditions and impacts compiled as source material for the development of the Environmental Impact Statement (EIS). Other reports and studies such as the archaeological survey reports are not included as part of the technical appendices but are available at the Federal Highway Administration Office, Suite 613, 677 Ala Moana Boulevard, Honolulu, Hawaii 96813 or at the State Department of Transportation, Highways Division, 869 Punchbowl Street, Honolulu, Hawaii 96813.

TECHNICAL APPENDIX A

AIR QUALITY STUDY,

PROPOSED PIILANI HIGHWAY

Air Quality Study

PROPOSED PIILANI HIGHWAY

Island of Maui

Materials Testing & Research Branch

April 1976

GENERAL:

An Air Quality study was conducted to assess the probable effects of the proposed Piilani Highway to the community in the Kihei-Makena area on the island of Maui.

PROJECT DESCRIPTION:

A new Piilani Highway is proposed for the Kihei-Makena area to alleviate anticipated traffic congestion on the present Kihei Road. The Kihei and Wailea sections are experiencing rapid development which have significantly altered the population density of the area.

A 44 feet wide undivided roadway consisting of two 12' wide paved lanes with 10' shoulders is proposed. The roadway will be located within a 100 ft. right-of-way mauka (east) of the exisitng developed areas and constructed on undeveloped pasture land.

The proposed roadway is approximately 13 miles long and will be aligned parallel to the present Kihei road. This route begins at its northern connection at Kihei (Route 31) and proceeds south. It then swings eastwardly and winds its way up the lower slopes of Haleakala terminating at the intersection with Kula Highway (Route 37).

Topography and Meteorology:

The proposed Piilani Highway is located along a narrow coastline on the leeward side of the island of Maui at the foot of Haleakala. The terrain in this area features long, moderately steep slopes.

The predominant influence to the climate and weather for this area is Haleakala. Its massive form obstructs, deflects and accelerates the prevailing northeasterly trades around this area and creates a wind condition unique to the Kihei-Makena area.

Kihei, situated in the western side of the isthmus formed between Haleakala and Puu Kukui (West Maui Mountain), is generally subjected to wind velocities 50% greater than the normal wind velocity of the Wailuku area. This is the result of the prevailing northeasterly trades being funneled between these mountain masses and subjected to a venturi-like phenomenon. As the wind spreads out over Maalaea Bay, the inshore wind streams flow almost parallel to the coastline of Kihei. This wind stream meets the deflected trades off the slopes of Haleakala from the southeast. This mixing action generates unpredictable local winds from Kalama to Cape Kinau.

Diurnal temperature variations generate pronounced sea breeze during the day and drainage winds at night. This natural phenomena also contributes to the unstable wind patterns.

This complex and highly irregular wind system tends to favor the capacity to disperse pollutants. Winds are normally from 10 to 15 mph.

The Kihei-Makena area is also arid with less than 15 inches of rainfall annually. The temperature varies from 65° to 85° F throughout the year with occasional summer temperature, (above 90° F). The days are normally warm with clear skies, and the nights cool.

Through our search for historical wind and meteorological data maps indicating the surface tradewind streamlines of the area during daylight and night hours and an offshore wind diagram of the Kihei beach area were located. See figure numbers 1, 2, and 3. These maps and diagram exemplify the unique wind system of the area.

MATHEMATICAL ANALYSIS

A mathematical air quality study using EPA prediction model (HIWAY, Feb. 1975) was used to project concentration of carbon monoxide (CO) that may result from vehicles traveling along the proposed Piilani Highway.

This procedure assumes each traffic lane as a continuous uniform line-source of emitters subjected to the worst case and to the most probable wind conditions.

The study plan assumed the proposed roadway alignment to be an idealistic, straight, level roadway from Kihei to Wailea. This idealized straight roadway was divided into three segments according to distinct projected traffic densities along the proposed route. Receptors were located at each existing and proposed sensitive areas within this area.

A typical roadway segment was selected to represent the portion of the route East of Wailea.

The study plan subjected the proposed roadway to the possible "worst case" and the "most probable" meteorological conditions to determine CO concentrations at each sensitive receptor location. The irregular wind patterns required that several assumptions be made and the study plan considered the following cases:

a. "Worst case" condition (The most severe meteorological condition to cause the highest concentration levels): Winds parallel to the study alignment flowing at a very low velocity, with very little mixing.

b. "Most probable" daylight condition: The wind blowing in its most prevailing direction during the daylight hours.

c. "Most probable" night condition: The wind blowing in its most prevailing direction during night hours.

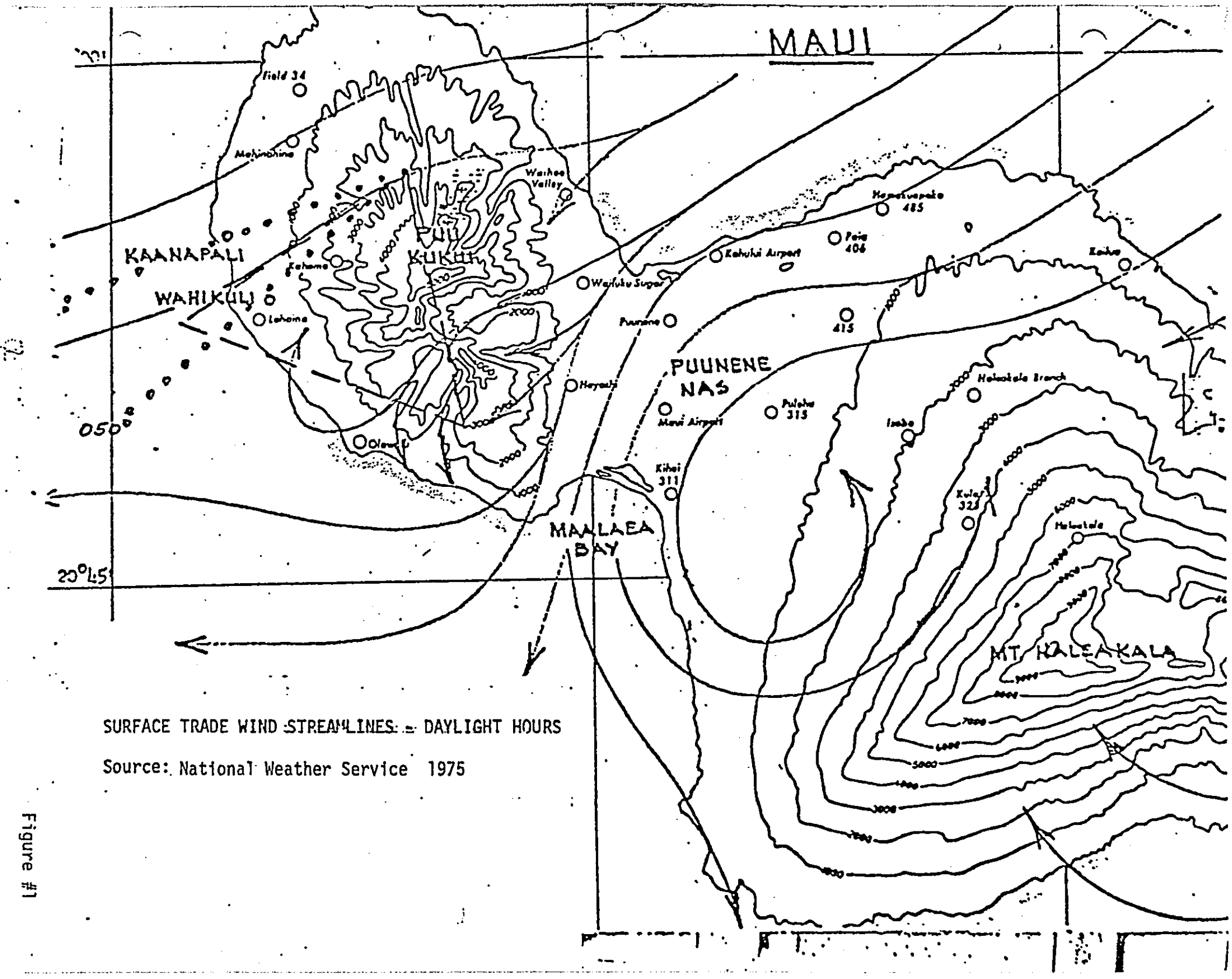
The analyses were made for projected 1979 and 1989 traffic volumes. The results are summarized and the highest CO readings along the highway rights-of-way (50 feet from the roadway centerline) are tabulated in Appendices A to C. Results for the study East of Wailea are tabulated in Appendix D.

CONCLUSION:

Ambient air quality data are not available, however, the ambient concentration of CO in the vicinity of the proposed roadway can be reasonably expected to be negligible. This rationale is based on the predominantly undeveloped and widely dispersed sources (residences) which generate very little CO. The distance of these sources to the immediate study area would allow ample dispersion and the measured concentrations would not be significant.

The beneficial effects to the air quality in the more populous developed sections of Kihei due to rerouting of the traffic on the new section were not evaluated and no discussion is presented.

The study results, based on the EPA prediction model "HIWAY", show that the proposed Piilani Highway will have no adverse effect to the air quality in the Kihei-Makena area.



SURFACE TRADE WIND STREAMLINES - DAYLIGHT HOURS

Source: National Weather Service 1975

Figure #1

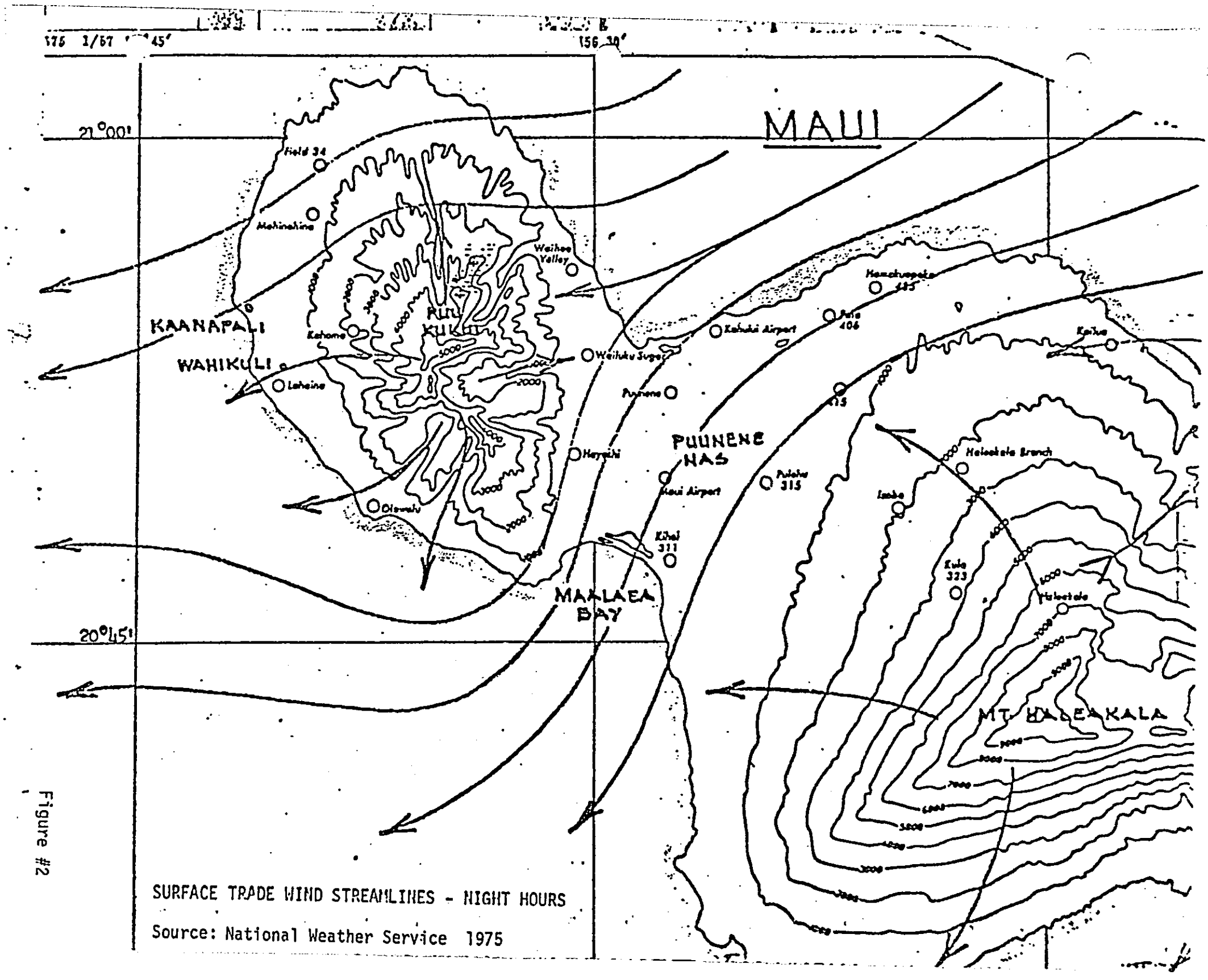
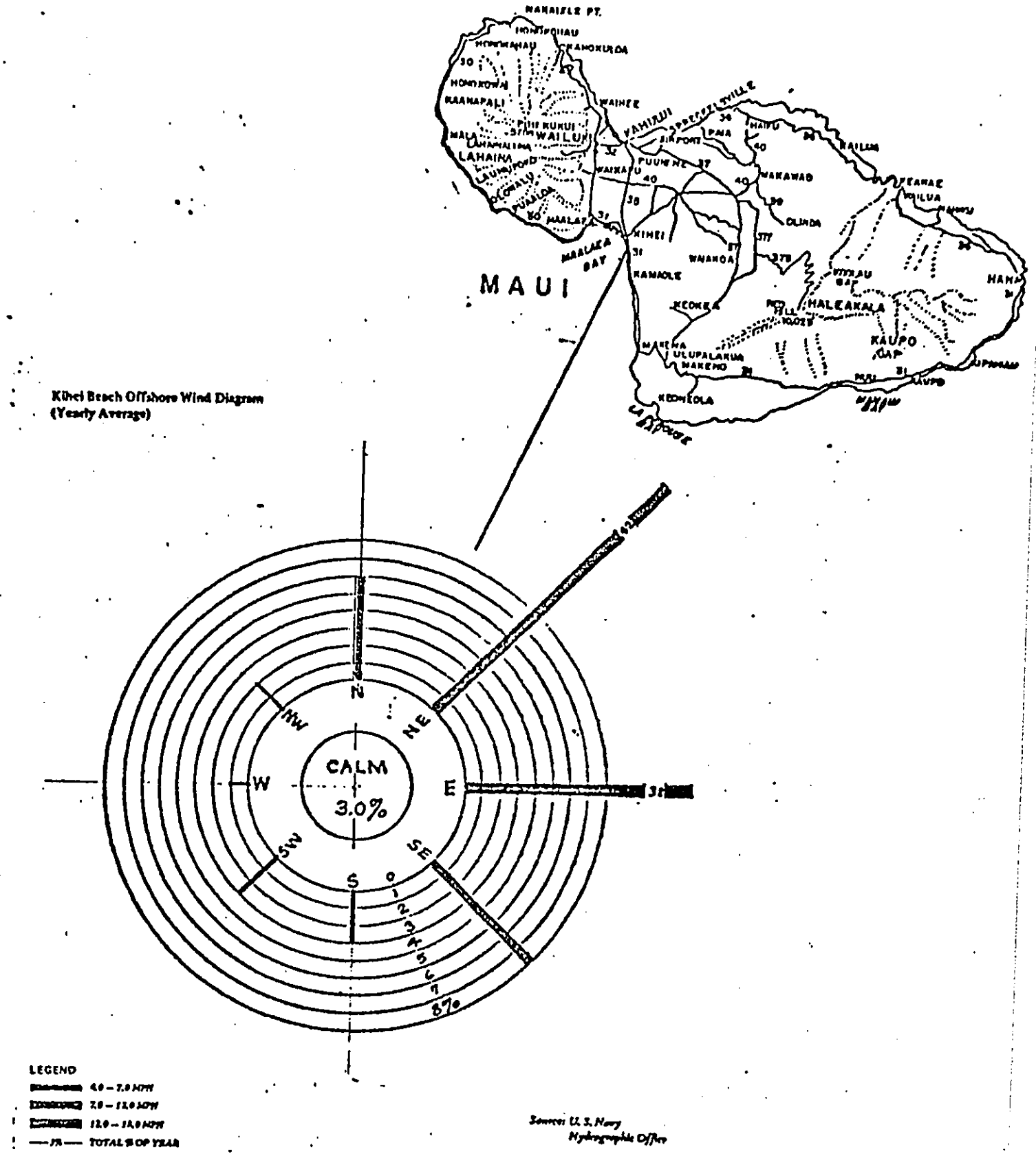


Figure #2

SURFACE TRADE WIND STREAMLINES - NIGHT HOURS

Source: National Weather Service 1975



Kihei Beach Offshore Wind Diagram
(Yearly Average)

Figure #3

"WORST CASE" CONDITION
CO CONCENTRATION AT RIGHT-OF-WAY

Receptor Location	Wind Direction**	CO CONCENTRATION (PPM)* AT HIGHWAY RIGHT-OF-WAY	
		ADT 1979	ADT 1989
1 North End of Study Area	90° (SOUTH)	1.342	1.123
2 Kihei Hgts. and La Palma Pk. Subdiv.		1.325	1.110
3 Vicinity of Kilolani Congreg. Church		1.300	1.089
4 Proposed School Site	▽	1.270	1.065
5 Kalama Park Subdivision	270° (NORTH)	1.218	1.073
6 Intersection of Proposed Hwy w/ Kanani Rd.		1.297	1.086
7 Intersection of Proposed Hwy w/ Keonekai Drive		1.157	0.976
8 Residential Area Along Akala Dr.		1.152	0.973
9 Wailea Resort Area		0.761	0.642
10 South End of Study Area	▽	0.706	0.596

*Maximum Allowable Carbon Monoxide Pollutants
Federal Standard - 35.0 ppm
State Standard - 9.0 ppm

** °Direction from Study North
( ) Direction from True North

Wind Speed : 1.0 METER/SEC Ave. Speed Limit: 50 MPH
Stability Class: E (5)

APPENDIX "A"

"MOST PROBABLE" CONDITION
. DAYLIGHT HOURS
CO CONCENTRATION AT RIGHT-OF-WAY

Receptor Location	Wind Direction**	CO CONCENTRATION (PPM)* AT HIGHWAY RIGHT-OF-WAY	
		ADT 1979	ADT 1989
1 North End of Study Area	225° (NORTHWEST)	0.000	0.000
2 Kihei Hgts. and La Palma Pk. Subdiv.		0.542	0.454
3 Vicinity of Kilolani Congreg. Church		0.542	0.455
4 Proposed School Site		0.542	0.454
5 Kalama Park Subdivision		0.542	0.455
6 Intersection of Proposed Hwy w/ Kanani Rd.		0.541	0.454
7 Intersection of Proposed Hwy w/ Keonekai Drive		0.456	0.385
8 Residential Area Along Akala Dr.		0.455	0.384
9 Wailea Resort Area		0.241	0.204
10 South End of Study Area	▽	0.241	0.203

*Maximum Allowable Carbon Monoxide Pollutants
Federal Standard - 35.0 ppm
State Standard - 9.0 ppm

** °Direction from Study North
( ) Direction from True North

Wind Speed : 1.0 METER/SEC. Ave. Speed Limit : 50 MPH
Stability Class : E (5)

"MOST PROBABLE" CONDITION
NIGHT HOURS
CO CONCENTRATION AT RIGHT-OF-WAY

Receptor Location	Wind Direction**	CO CONCENTRATION (PPM)* AT HIGHWAY RIGHT-OF-WAY	
		ADT 1979	ADT 1989
1 North End of Study Area	45° (SOUTHEAST)	0.542	0.454
2 Kihei Hgts. and La Palma Pk. Subdiv.		0.543	0.455
3 Vicinity of Kilolani Congreg. Church		0.543	0.455
4 Proposed School Site		0.543	0.455
5 Kalama Park Subdivision		0.543	0.455
6 Intersection of Proposed Hwy w/ Kanani Rd.		0.456	0.385
7 Intersection of Proposed Hwy w/ Keonekai Drive		0.457	0.385
8 Residential Area Along Akala Dr.		0.241	0.203
9 Wailea Resort Area		0.241	0.203
10 South End of Study Area		0.000	0.000

*Maximum Allowable Carbon Monoxide Pollutants
Federal Standard - 35.0 ppm
State Standard - 9.0 ppm

** °Direction from Study North
( ) Direction from True North

Wind Speed : 1.0 METER/SEC Ave. Speed Limit: 50 MPH
Stability Class: E (5)

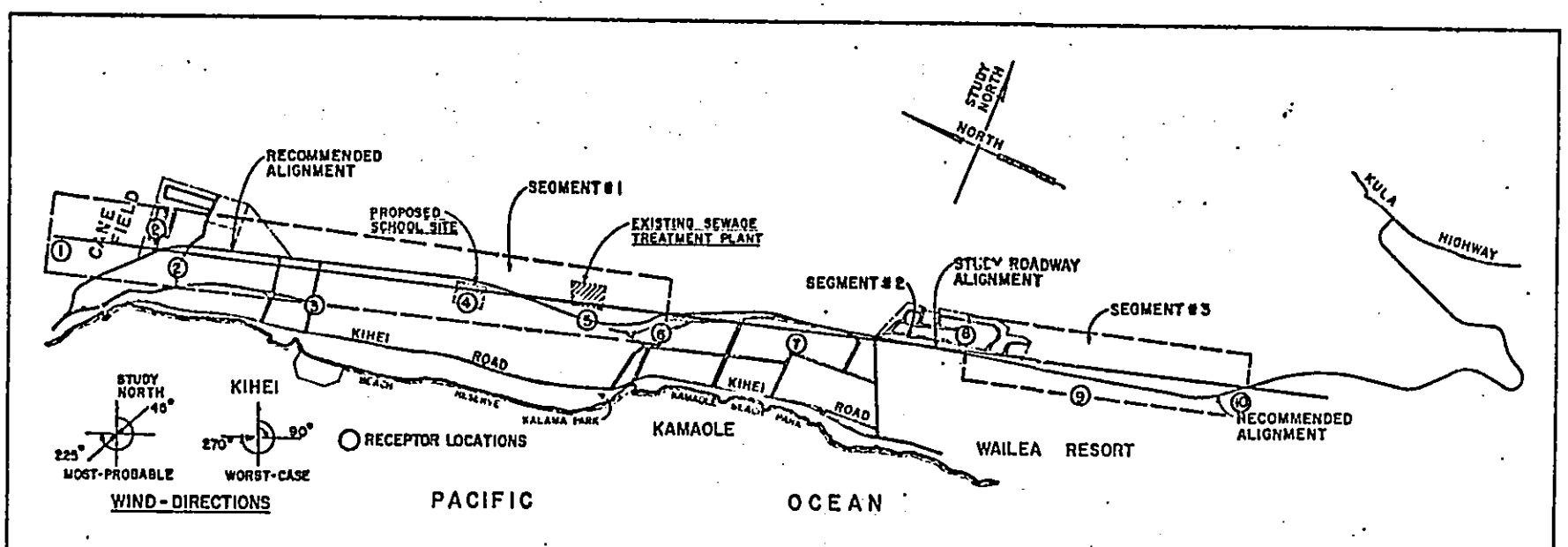
"WORST CASE" CONDITION
TYPICAL ROADWAY SEGMENT
PORTION OF PROPOSED ROADWAY EAST OF WAILEA

Receptor Location Distance (Ft.) From Highway Right-of-Way	CO CONCENTRATION (PPM)*	
	ADT 1979	ADT 1989
50	0.430	0.363
100	0.183	0.154
150	0.096	0.081
300	0.016	0.014
600	0.000	0.000

*Maximum Allowable Carbon Monoxide Pollutants
Federal Standard - 35.0 ppm
State Standard - 9.0 ppm

Wind Speed: 1.0 METER/SEC
Stability Class: E (5)

Ave. Speed Limit: 50 MPH
Wind Direction: Parallel to Roadway


STUDY NORTH
NORTH
RECOMMENDED ALIGNMENT
SEGMENT #1
PROPOSED SCHOOL SITE
EXISTING SEWAGE TREATMENT PLANT
CANE FIELD
KULA HIGHWAY
STUDY ROADWAY ALIGNMENT
SEGMENT #2
SEGMENT #3
KIHEI ROAD
KAMAOLE BEACH PARK
KAMAOLE BEACH PARK
KIHEI ROAD
RECOMMENDED ALIGNMENT
KIHEI
KAMAOLE
WAILEA RESORT
STUDY NORTH
45°
225°
MOST-PROBABLE
270°
90°
WORST-CASE
WIND-DIRECTIONS
RECEPTOR LOCATIONS
PACIFIC OCEAN

STUDY PLAN

PROJ NO. AIR QUALITY STUDY - PITTSBURG DEV
ENDPOINTS OF THE LINE SOURCE
0.0 , 0.0 AND25000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.626E-03 0.646E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 90. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	50.0000	0.0	1491.	1.297
5000.0000	50.0000	0.0	1457.	1.268
11000.0000	50.0000	0.0	1400.	1.218
16000.0000	50.0000	0.0	1317.	1.146
21000.0000	50.0000	0.0	1113.	0.968
25000.0000	50.0000	0.0	0.	0.0
0.0	75.0000	0.0	1066.	0.927
5000.0000	75.0000	0.0	1034.	0.899
11000.0000	75.0000	0.0	984.	0.856
16000.0000	75.0000	0.0	895.	0.779
21000.0000	75.0000	0.0	689.	0.600
25000.0000	75.0000	0.0	0.	0.0
0.0	100.0000	0.0	846.	0.736
5000.0000	100.0000	0.0	809.	0.703
11000.0000	100.0000	0.0	752.	0.654
16000.0000	100.0000	0.0	668.	0.581
21000.0000	100.0000	0.0	471.	0.410
25000.0000	100.0000	0.0	0.	0.0
0.0	250.0000	0.0	379.	0.330
5000.0000	250.0000	0.0	348.	0.302
11000.0000	250.0000	0.0	293.	0.255
16000.0000	250.0000	0.0	218.	0.189
21000.0000	250.0000	0.0	76.	0.066
25000.0000	250.0000	0.0	0.	0.0
0.0	500.0000	0.0	179.	0.156
5000.0000	500.0000	0.0	151.	0.131
11000.0000	500.0000	0.0	105.	0.092
16000.0000	500.0000	0.0	53.	0.046
21000.0000	500.0000	0.0	3.	0.002
25000.0000	500.0000	0.0	0.	0.0

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #1
ADT 1979
Refer to Study Plan for receptor locations.

ENDPOINTS OF THE LINE SOURCE
0.0 , 0.0 AND25000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.626E-03 0.646E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 270. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

Segment #1
ADT 1979
Refer to Study Plan for receptor locations.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	50.0000	0.0	0.	0.000
5000.0000	50.0000	0.0	1176.	1.023
11000.0000	50.0000	0.0	1355.	1.179
16000.0000	50.0000	0.0	1426.	1.240
21000.0000	50.0000	0.0	1475.	1.281
25000.0000	50.0000	0.0	1491.	1.297
30500.0000	50.0000	0.0	519.	0.270
36000.0000	50.0000	0.0	182.	0.158
40500.0000	50.0000	0.0	134.	0.117
45000.0000	50.0000	0.0	106.	0.092
0.0	75.0000	0.0	0.	0.000
5000.0000	75.0000	0.0	752.	0.654
11000.0000	75.0000	0.0	932.	0.811
16000.0000	75.0000	0.0	998.	0.868
21000.0000	75.0000	0.0	1041.	0.905
25000.0000	75.0000	0.0	1066.	0.928
30500.0000	75.0000	0.0	317.	0.275
36000.0000	75.0000	0.0	181.	0.158
40500.0000	75.0000	0.0	134.	0.117
45000.0000	75.0000	0.0	106.	0.092
5000.0000	100.0000	0.0	531.	0.462
11000.0000	100.0000	0.0	707.	0.615
16000.0000	100.0000	0.0	774.	0.674
21000.0000	100.0000	0.0	818.	0.712
25000.0000	100.0000	0.0	846.	0.736
30500.0000	100.0000	0.0	313.	0.272
36000.0000	100.0000	0.0	181.	0.157
40500.0000	100.0000	0.0	134.	0.116
45000.0000	100.0000	0.0	105.	0.092
5000.0000	250.0000	0.0	112.	0.098
11000.0000	250.0000	0.0	253.	0.220
16000.0000	250.0000	0.0	314.	0.273
21000.0000	250.0000	0.0	355.	0.309
25000.0000	250.0000	0.0	379.	0.330
30500.0000	250.0000	0.0	277.	0.241
36000.0000	250.0000	0.0	173.	0.150
40500.0000	250.0000	0.0	130.	0.113
45000.0000	250.0000	0.0	103.	0.090
5000.0000	500.0000	0.0	9.	0.008
11000.0000	500.0000	0.0	75.	0.066
16000.0000	500.0000	0.0	122.	0.106
21000.0000	500.0000	0.0	157.	0.137
25000.0000	500.0000	0.0	179.	0.156
30500.0000	500.0000	0.0	190.	0.165
36000.0000	500.0000	0.0	148.	0.128
40500.0000	500.0000	0.0	118.	0.103
45000.0000	500.0000	0.0	97.	0.084

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY

[illegible] AIR QUALITY STUDY - PITTSBURG
ENDPOINTS OF THE LINE SOURCE
0.0 , 0.0 AND25000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.626E-03 0.646E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 45. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	-50.0000	0.0	623.	0.542
5000.0000	-50.0000	0.0	624.	0.543
11000.0000	-50.0000	0.0	624.	0.543
16000.0000	-50.0000	0.0	624.	0.543
21000.0000	-50.0000	0.0	624.	0.543
25000.0000	-50.0000	0.0	2.	0.001
30500.0000	-50.0000	0.0	0.	0.0
36000.0000	-50.0000	0.0	0.	0.0
0.0	-75.0000	0.0	545.	0.474
5000.0000	-75.0000	0.0	545.	0.474
11000.0000	-75.0000	0.0	545.	0.474
16000.0000	-75.0000	0.0	545.	0.474
21000.0000	-75.0000	0.0	545.	0.474
25000.0000	-75.0000	0.0	0.	0.000
30500.0000	-75.0000	0.0	0.	0.0
36000.0000	-75.0000	0.0	0.	0.0
0.0	-100.0000	0.0	485.	0.422
5000.0000	-100.0000	0.0	485.	0.422
11000.0000	-100.0000	0.0	485.	0.422
16000.0000	-100.0000	0.0	485.	0.422
21000.0000	-100.0000	0.0	485.	0.422
25000.0000	-100.0000	0.0	0.	0.000
30500.0000	-100.0000	0.0	0.	0.0
36000.0000	-100.0000	0.0	0.	0.0
0.0	-250.0000	0.0	300.	0.261
5000.0000	-250.0000	0.0	300.	0.261
11000.0000	-250.0000	0.0	300.	0.261
16000.0000	-250.0000	0.0	300.	0.261
21000.0000	-250.0000	0.0	300.	0.261
25000.0000	-250.0000	0.0	0.	0.000
30500.0000	-250.0000	0.0	0.	0.0
36000.0000	-250.0000	0.0	0.	0.0
0.0	-500.0000	0.0	190.	0.165
5000.0000	-500.0000	0.0	190.	0.165
11000.0000	-500.0000	0.0	190.	0.165
16000.0000	-500.0000	0.0	190.	0.165
21000.0000	-500.0000	0.0	190.	0.165
30500.0000	-500.0000	0.0	0.	0.0
36000.0000	-500.0000	0.0	0.	0.0

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Segment #1
ADT 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PITTSBURG, CA
ENDPOINTS OF THE LINE SOURCE
0.0 , 0.0 AND25000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.626E-03 0.646E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 225. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 100.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	50.0000	0.0	2.	0.001
5000.0000	50.0000	0.0	623.	0.542
11000.0000	50.0000	0.0	623.	0.542
16000.0000	50.0000	0.0	623.	0.542
21000.0000	50.0000	0.0	624.	0.542
25000.0000	50.0000	0.0	622.	0.541
0.0	75.0000	0.0	0.	0.000
5000.0000	75.0000	0.0	545.	0.474
11000.0000	75.0000	0.0	545.	0.474
16000.0000	75.0000	0.0	545.	0.474
21000.0000	75.0000	0.0	545.	0.474
25000.0000	75.0000	0.0	545.	0.474
0.0	100.0000	0.0	0.	0.000
5000.0000	100.0000	0.0	485.	0.422
11000.0000	100.0000	0.0	485.	0.422
16000.0000	100.0000	0.0	485.	0.422
21000.0000	100.0000	0.0	485.	0.422
25000.0000	100.0000	0.0	485.	0.422
0.0	250.0000	0.0	0.	0.000
5000.0000	250.0000	0.0	299.	0.261
11000.0000	250.0000	0.0	299.	0.261
16000.0000	250.0000	0.0	299.	0.261
21000.0000	250.0000	0.0	299.	0.260
25000.0000	250.0000	0.0	299.	0.261
5000.0000	500.0000	0.0	190.	0.165
11000.0000	500.0000	0.0	190.	0.165
16000.0000	500.0000	0.0	190.	0.165
21000.0000	500.0000	0.0	190.	0.165
25000.0000	500.0000	0.0	190.	0.165

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Segment #1
ADT 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
0.0 , 0.0 AND25000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.522E-03 0.544E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 90. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5.
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	50.0000	0.0	1249.	1.086
5000.0000	50.0000	0.0	1221.	1.062
11000.0000	50.0000	0.0	1172.	1.020
16000.0000	50.0000	0.0	1103.	0.960
21000.0000	50.0000	0.0	932.	0.811
25000.0000	50.0000	0.0	0.	0.0
0.0	75.0000	0.0	893.	0.777
5000.0000	75.0000	0.0	866.	0.753
11000.0000	75.0000	0.0	824.	0.717
16000.0000	75.0000	0.0	750.	0.653
21000.0000	75.0000	0.0	577.	0.502
25000.0000	75.0000	0.0	0.	0.0
0.0	100.0000	0.0	709.	0.617
5000.0000	100.0000	0.0	677.	0.589
11000.0000	100.0000	0.0	630.	0.548
16000.0000	100.0000	0.0	560.	0.487
21000.0000	100.0000	0.0	395.	0.344
25000.0000	100.0000	0.0	0.	0.0
0.0	250.0000	0.0	318.	0.276
5000.0000	250.0000	0.0	291.	0.253
11000.0000	250.0000	0.0	245.	0.213
16000.0000	250.0000	0.0	182.	0.159
21000.0000	250.0000	0.0	64.	0.056
25000.0000	250.0000	0.0	0.	0.0
0.0	500.0000	0.0	150.	0.131
5000.0000	500.0000	0.0	127.	0.110
11000.0000	500.0000	0.0	88.	0.077
16000.0000	500.0000	0.0	44.	0.038
21000.0000	500.0000	0.0	2.	0.002
25000.0000	500.0000	0.0	0.	0.0

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #1
ADT 1989
Refer to study Plan for receptor locations.

ENDPOINTS OF THE LINE SOURCE
0.0 , 0.0 AND25000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.522E-03 0.544E-03
WIDTH OF AT-GRADE HIGHWAY IS 17.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 270. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

Segment #1
ADT 1989
Refer to Study
Plan for receptor
locations.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	50.0000	0.0	0.	0.000
5000.0000	50.0000	0.0	985.	0.857
11000.0000	50.0000	0.0	1135.	0.988
16000.0000	50.0000	0.0	1194.	1.039
21000.0000	50.0000	0.0	1234.	1.073
25000.0000	50.0000	0.0	1249.	1.086
30500.0000	50.0000	0.0	267.	0.233
36000.0000	50.0000	0.0	153.	0.133
40500.0000	50.0000	0.0	113.	0.098
45000.0000	50.0000	0.0	89.	0.077
0.0	75.0000	0.0	0.	0.000
5000.0000	75.0000	0.0	630.	0.548
11000.0000	75.0000	0.0	781.	0.679
16000.0000	75.0000	0.0	836.	0.727
21000.0000	75.0000	0.0	872.	0.759
25000.0000	75.0000	0.0	893.	0.777
30500.0000	75.0000	0.0	265.	0.231
36000.0000	75.0000	0.0	152.	0.132
40500.0000	75.0000	0.0	112.	0.098
45000.0000	75.0000	0.0	88.	0.077
5000.0000	100.0000	0.0	445.	0.387
11000.0000	100.0000	0.0	593.	0.516
16000.0000	100.0000	0.0	649.	0.564
21000.0000	100.0000	0.0	685.	0.596
25000.0000	100.0000	0.0	709.	0.617
30500.0000	100.0000	0.0	262.	0.228
36000.0000	100.0000	0.0	152.	0.132
40500.0000	100.0000	0.0	112.	0.098
45000.0000	100.0000	0.0	88.	0.077
5000.0000	250.0000	0.0	94.	0.082
11000.0000	250.0000	0.0	212.	0.184
16000.0000	250.0000	0.0	263.	0.229
21000.0000	250.0000	0.0	298.	0.259
25000.0000	250.0000	0.0	318.	0.276
30500.0000	250.0000	0.0	232.	0.202
36000.0000	250.0000	0.0	145.	0.126
40500.0000	250.0000	0.0	109.	0.095
45000.0000	250.0000	0.0	87.	0.075
5000.0000	500.0000	0.0	7.	0.007
11000.0000	500.0000	0.0	63.	0.055
16000.0000	500.0000	0.0	103.	0.089
21000.0000	500.0000	0.0	132.	0.115
25000.0000	500.0000	0.0	150.	0.131
30500.0000	500.0000	0.0	159.	0.139
36000.0000	500.0000	0.0	124.	0.108
40500.0000	500.0000	0.0	99.	0.086
45000.0000	500.0000	0.0	81.	0.070

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
0.0 , 0.0 AND25000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.522E-03 0.544E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 45. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	-50.0000	0.0	522.	0.454
5000.0000	-50.0000	0.0	523.	0.455
11000.0000	-50.0000	0.0	523.	0.455
16000.0000	-50.0000	0.0	523.	0.455
21000.0000	-50.0000	0.0	523.	0.455
25000.0000	-50.0000	0.0	1.	0.001
30500.0000	-50.0000	0.0	0.	0.0
36000.0000	-50.0000	0.0	0.	0.0
0.0	-75.0000	0.0	457.	0.398
5000.0000	-75.0000	0.0	457.	0.398
11000.0000	-75.0000	0.0	457.	0.398
16000.0000	-75.0000	0.0	457.	0.398
21000.0000	-75.0000	0.0	457.	0.398
25000.0000	-75.0000	0.0	0.	0.000
30500.0000	-75.0000	0.0	0.	0.0
36000.0000	-75.0000	0.0	0.	0.0
0.0	-100.0000	0.0	407.	0.354
5000.0000	-100.0000	0.0	406.	0.354
11000.0000	-100.0000	0.0	407.	0.354
16000.0000	-100.0000	0.0	407.	0.354
21000.0000	-100.0000	0.0	407.	0.354
25000.0000	-100.0000	0.0	0.	0.000
30500.0000	-100.0000	0.0	0.	0.0
36000.0000	-100.0000	0.0	0.	0.0
0.0	-250.0000	0.0	251.	0.218
5000.0000	-250.0000	0.0	251.	0.218
11000.0000	-250.0000	0.0	251.	0.218
16000.0000	-250.0000	0.0	251.	0.218
21000.0000	-250.0000	0.0	251.	0.218
25000.0000	-250.0000	0.0	0.	0.000
30500.0000	-250.0000	0.0	0.	0.0
36000.0000	-250.0000	0.0	0.	0.0
0.0	-500.0000	0.0	159.	0.139
5000.0000	-500.0000	0.0	159.	0.139
11000.0000	-500.0000	0.0	159.	0.139
16000.0000	-500.0000	0.0	159.	0.139
21000.0000	-500.0000	0.0	159.	0.139
30500.0000	-500.0000	0.0	0.	0.0
36000.0000	-500.0000	0.0	0.	0.0

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #1
ADT 1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI IND
ENDPOINTS OF THE LINE SOURCE
0.0 , 0.0 AND25000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.522E-03 0.544E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 225. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 100.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	50.0000	0.0	1.	0.001
5000.0000	50.0000	0.0	522.	0.454
11000.0000	50.0000	0.0	522.	0.455
16000.0000	50.0000	0.0	522.	0.454
21000.0000	50.0000	0.0	522.	0.455
25000.0000	50.0000	0.0	521.	0.454
0.0	75.0000	0.0	0.	0.000
5000.0000	75.0000	0.0	456.	0.397
11000.0000	75.0000	0.0	456.	0.397
16000.0000	75.0000	0.0	456.	0.397
21000.0000	75.0000	0.0	456.	0.397
25000.0000	75.0000	0.0	457.	0.397
0.0	100.0000	0.0	0.	0.000
5000.0000	100.0000	0.0	406.	0.353
11000.0000	100.0000	0.0	406.	0.353
16000.0000	100.0000	0.0	406.	0.353
21000.0000	100.0000	0.0	406.	0.353
25000.0000	100.0000	0.0	406.	0.353
0.0	250.0000	0.0	0.	0.000
5000.0000	250.0000	0.0	251.	0.218
11000.0000	250.0000	0.0	251.	0.218
16000.0000	250.0000	0.0	251.	0.218
21000.0000	250.0000	0.0	251.	0.218
25000.0000	250.0000	0.0	251.	0.218
5000.0000	500.0000	0.0	159.	0.139
11000.0000	500.0000	0.0	159.	0.139
16000.0000	500.0000	0.0	159.	0.139
21000.0000	500.0000	0.0	159.	0.139
25000.0000	500.0000	0.0	159.	0.139

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Segment #1
ADT 1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PITLANE HWY
ENDPOINTS OF THE LINE SOURCE
(25000.000, 0.0 AND36000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.525E-03 0.545E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 90. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS, 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	50.0000	0.0	40.	0.035
5000.0000	50.0000	0.0	51.	0.045
11000.0000	50.0000	0.0	76.	0.066
16000.0000	50.0000	0.0	120.	0.104
21000.0000	50.0000	0.0	255.	0.222
25000.0000	50.0000	0.0	1143.	0.994
30500.0000	50.0000	0.0	1011.	0.879
36000.0000	50.0000	0.0	0.	0.0
0.0	75.0000	0.0	40.	0.035
5000.0000	75.0000	0.0	51.	0.045
11000.0000	75.0000	0.0	76.	0.066
16000.0000	75.0000	0.0	119.	0.104
21000.0000	75.0000	0.0	251.	0.218
25000.0000	75.0000	0.0	783.	0.681
30500.0000	75.0000	0.0	654.	0.569
36000.0000	75.0000	0.0	0.	0.0
0.0	100.0000	0.0	40.	0.034
5000.0000	100.0000	0.0	51.	0.045
11000.0000	100.0000	0.0	76.	0.066
16000.0000	100.0000	0.0	119.	0.103
21000.0000	100.0000	0.0	246.	0.214
25000.0000	100.0000	0.0	597.	0.519
30500.0000	100.0000	0.0	467.	0.407
36000.0000	100.0000	0.0	0.	0.0
0.0	250.0000	0.0	39.	0.034
5000.0000	250.0000	0.0	50.	0.043
11000.0000	250.0000	0.0	72.	0.063
16000.0000	250.0000	0.0	109.	0.095
21000.0000	250.0000	0.0	192.	0.167
25000.0000	250.0000	0.0	213.	0.185
30500.0000	250.0000	0.0	108.	0.094
36000.0000	250.0000	0.0	0.	0.0
0.0	500.0000	0.0	37.	0.032
5000.0000	500.0000	0.0	46.	0.040
11000.0000	500.0000	0.0	62.	0.054
16000.0000	500.0000	0.0	83.	0.072
21000.0000	500.0000	0.0	93.	0.081
25000.0000	500.0000	0.0	63.	0.055
30500.0000	500.0000	0.0	11.	0.010
36000.0000	500.0000	0.0	0.	0.0

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #2
ADT 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
25000.000, 0.0 AND36000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
  0.525E-03 0.545E-03
WIDTH OF AT_GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 270. DEGREES
WIND SPEED IS 1.0 METERS?SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
25000.0000	50.0000	0.0	0.	0.000
30500.0000	50.0000	0.0	1011.	0.879
36000.0000	50.0000	0.0	1143.	0.994
40500.0000	50.0000	0.0	230.	0.200
45000.0000	50.0000	0.0	120.	0.104
25000.0000	75.0000	0.0	0.	0.000
30500.0000	75.0000	0.0	654.	0.569
36000.0000	75.0000	0.0	783.	0.681
40500.0000	75.0000	0.0	227.	0.198
45000.0000	75.0000	0.0	119.	0.104
30500.0000	100.0000	0.0	468.	0.407
36000.0000	100.0000	0.0	597.	0.519
40500.0000	100.0000	0.0	223.	0.194
45000.0000	100.0000	0.0	119.	0.103
30500.0000	250.0000	0.0	108.	0.094
36000.0000	250.0000	0.0	213.	0.185
40500.0000	250.0000	0.0	180.	0.157
45000.0000	250.0000	0.0	109.	0.095
30500.0000	500.0000	0.0	11.	0.010
36000.0000	500.0000	0.0	63.	0.055
40500.0000	500.0000	0.0	95.	0.083
45000.0000	500.0000	0.0	83.	0.072

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY!

Segment #2
ADT 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PITLANE HWY
ENDPOINTS OF THE LINE SOURCE
25000.000, 0.0 AND36000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.525E-03 0.545E-03
WIDTH OF AT-GRADE HIGHWAY IS /.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 45. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
25000.0000	-50.0000	0.0	524.	0.456
30500.0000	-50.0000	0.0	525.	0.457
36000.0000	-50.0000	0.0	1.	0.001
25000.0000	-75.0000	0.0	459.	0.399
30500.0000	-75.0000	0.0	459.	0.399
36000.0000	-75.0000	0.0	0.	0.000
25000.0000	-100.0000	0.0	408.	0.355
30500.0000	-100.0000	0.0	408.	0.355
36000.0000	-100.0000	0.0	0.	0.000
25000.0000	-250.0000	0.0	252.	0.219
30500.0000	-250.0000	0.0	252.	0.219
36000.0000	-250.0000	0.0	0.	0.000
25000.0000	-500.0000	0.0	160.	0.139
30500.0000	-500.0000	0.0	160.	0.139

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Segment #2
ADT 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PIILANI HWY
ENDPOINTS OF THE LINE SOURCE
25000.000, 0.0 AND36000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.525E-03 0.545E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 225. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 100.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
25000.0000	50.0000	0.0	1.	0.001
30500.0000	50.0000	0.0	524.	0.456
36000.0000	50.0000	0.0	523.	0.455
25000.0000	75.0000	0.0	0.	0.000
30500.0000	75.0000	0.0	458.	0.399
36000.0000	75.0000	0.0	458.	0.399
25000.0000	100.0000	0.0	0.	0.000
30500.0000	100.0000	0.0	408.	0.355
36000.0000	100.0000	0.0	408.	0.355
25000.0000	250.0000	0.0	0.	0.000
30500.0000	250.0000	0.0	252.	0.219
36000.0000	250.0000	0.0	252.	0.219
30500.0000	500.0000	0.0	160.	0.139
36000.0000	500.0000	0.0	160.	0.139

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #2
ADT 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PITTSBURG HWY
ENDPOINTS OF THE LINE SOURCE
25000.000, 0.0 AND36000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.446E-03 0.457E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 90. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	50.0000	0.0	34.	0.029
5000.0000	50.0000	0.0	43.	0.038
11000.0000	50.0000	0.0	64.	0.056
16000.0000	50.0000	0.0	101.	0.088
21000.0000	50.0000	0.0	215.	0.187
25000.0000	50.0000	0.0	965.	0.839
30500.0000	50.0000	0.0	854.	0.743
36000.0000	50.0000	0.0	0.	0.0
0.0	75.0000	0.0	34.	0.029
5000.0000	75.0000	0.0	43.	0.038
11000.0000	75.0000	0.0	64.	0.056
16000.0000	75.0000	0.0	101.	0.088
21000.0000	75.0000	0.0	212.	0.184
25000.0000	75.0000	0.0	661.	0.575
30500.0000	75.0000	0.0	552.	0.480
36000.0000	75.0000	0.0	0.	0.0
0.0	100.0000	0.0	33.	0.029
5000.0000	100.0000	0.0	43.	0.038
11000.0000	100.0000	0.0	64.	0.055
16000.0000	100.0000	0.0	100.	0.087
21000.0000	100.0000	0.0	207.	0.180
25000.0000	100.0000	0.0	504.	0.438
30500.0000	100.0000	0.0	395.	0.343
36000.0000	100.0000	0.0	0.	0.0
0.0	250.0000	0.0	33.	0.029
5000.0000	250.0000	0.0	42.	0.037
11000.0000	250.0000	0.0	61.	0.053
16000.0000	250.0000	0.0	92.	0.080
21000.0000	250.0000	0.0	162.	0.141
25000.0000	250.0000	0.0	179.	0.156
30500.0000	250.0000	0.0	92.	0.080
36000.0000	250.0000	0.0	0.	0.0
0.0	500.0000	0.0	31.	0.027
5000.0000	500.0000	0.0	39.	0.034
11000.0000	500.0000	0.0	53.	0.046
16000.0000	500.0000	0.0	70.	0.061
21000.0000	500.0000	0.0	79.	0.069
25000.0000	500.0000	0.0	54.	0.047
30500.0000	500.0000	0.0	9.	0.008
36000.0000	500.0000	0.0	0.	0.0

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #2
ADT 1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
25000.000, 0.0 AND36000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.446E-03 0.457E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 270. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
25000.0000	50.0000	0.0	0.	0.000
30500.0000	50.0000	0.0	854.	0.743
36000.0000	50.0000	0.0	965.	0.840
40500.0000	50.0000	0.0	194.	0.169
45000.0000	50.0000	0.0	101.	0.088
25000.0000	75.0000	0.0	0.	0.000
30500.0000	75.0000	0.0	552.	0.480
36000.0000	75.0000	0.0	661.	0.575
40500.0000	75.0000	0.0	192.	0.167
45000.0000	75.0000	0.0	101.	0.088
30500.0000	100.0000	0.0	395.	0.343
36000.0000	100.0000	0.0	504.	0.438
40500.0000	100.0000	0.0	188.	0.164
45000.0000	100.0000	0.0	100.	0.087
30500.0000	250.0000	0.0	92.	0.080
36000.0000	250.0000	0.0	179.	0.156
40500.0000	250.0000	0.0	152.	0.132
45000.0000	250.0000	0.0	92.	0.080
30500.0000	500.0000	0.0	9.	0.008
36000.0000	500.0000	0.0	54.	0.047
40500.0000	500.0000	0.0	80.	0.070
45000.0000	500.0000	0.0	70.	0.061

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #2
ADT 1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
25000.000, 0.0 AND36000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.446E-03 0.457E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 45. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM?METER**3	PPM *
25000.0000	-50.0000	0.0	442.	0.385
30500.0000	-50.0000	0.0	443.	0.385
36000.0000	-50.0000	0.0	1.	0.001
25000.0000	-75.0000	0.0	387.	0.337
30500.0000	-75.0000	0.0	387.	0.337
36000.0000	-75.0000	0.0	0.	0.000
25000.0000	-100.0000	0.0	344.	0.300
30500.0000	-100.0000	0.0	344.	0.300
36000.0000	-100.0000	0.0	0.	0.000
25000.0000	-250.0000	0.0	213.	0.185
30500.0000	-250.0000	0.0	213.	0.185
36000.0000	-250.0000	0.0	0.	0.000
25000.0000	-500.0000	0.0	135.	0.117
30500.0000	-500.0000	0.0	135.	0.117

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #2
ADT . 1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PITLANE HWY
ENDPOINTS OF THE LINE SOURCE
25000.000, 0.0 AND36000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.446E-03 0.457E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 225. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 100.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
25000.0000	50.0000	0.0	1.	0.001
30500.0000	50.0000	0.0	443.	0.385
36000.0000	50.0000	0.0	442.	0.384
25000.0000	75.0000	0.0	0.	0.000
30500.0000	75.0000	0.0	387.	0.336
36000.0000	75.0000	0.0	387.	0.337
25000.0000	100.0000	0.0	0.	0.000
30500.0000	100.0000	0.0	344.	0.299
36000.0000	100.0000	0.0	344.	0.299
25000.0000	250.0000	0.0	0.	0.000
30500.0000	250.0000	0.0	213.	0.185
36000.0000	250.0000	0.0	213.	0.185
30500.0000	500.0000	0.0	135.	0.117
36000.0000	500.0000	0.0	135.	0.117

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #2
ADT .1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
36000.000, 0.0 AND45000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.283E-03 0.283E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 90. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	50.0000	0.0	12.	0.010
5000.0000	50.0000	0.0	14.	0.012
11000.0000	50.0000	0.0	18.	0.016
16000.0000	50.0000	0.0	23.	0.020
21000.0000	50.0000	0.0	32.	0.028
25000.0000	50.0000	0.0	45.	0.040
30500.0000	50.0000	0.0	92.	0.080
36000.0000	50.0000	0.0	587.	0.510
40500.0000	50.0000	0.0	510.	0.444
45000.0000	50.0000	0.0	0.	0.0
0.0	75.0000	0.0	12.	0.010
5000.0000	75.0000	0.0	14.	0.012
11000.0000	75.0000	0.0	18.	0.016
16000.0000	75.0000	0.0	23.	0.020
21000.0000	75.0000	0.0	32.	0.028
25000.0000	75.0000	0.0	45.	0.039
30500.0000	75.0000	0.0	91.	0.079
36000.0000	75.0000	0.0	398.	0.346
40500.0000	75.0000	0.0	322.	0.280
45000.0000	75.0000	0.0	0.	0.0
0.0	100.0000	0.0	12.	0.010
5000.0000	100.0000	0.0	14.	0.012
11000.0000	100.0000	0.0	18.	0.016
16000.0000	100.0000	0.0	23.	0.020
21000.0000	100.0000	0.0	32.	0.028
25000.0000	100.0000	0.0	45.	0.039
30500.0000	100.0000	0.0	90.	0.078
36000.0000	100.0000	0.0	297.	0.259
40500.0000	100.0000	0.0	224.	0.195
45000.0000	100.0000	0.0	0.	0.0

Segment #3
ADT 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
36000.000, 0.0 AND45000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.283E-03 0.283E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 90. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	250.0000	0.0	11.	0.010
5000.0000	250.0000	0.0	14.	0.012
11000.0000	250.0000	0.0	18.	0.015
16000.0000	250.0000	0.0	23.	0.020
21000.0000	250.0000	0.0	31.	0.027
25000.0000	250.0000	0.0	42.	0.037
30500.0000	250.0000	0.0	75.	0.066
36000.0000	250.0000	0.0	97.	0.084
40500.0000	250.0000	0.0	42.	0.037
45000.0000	250.0000	0.0	0.	0.0
0.0	500.0000	0.0	11.	0.010
5000.0000	500.0000	0.0	13.	0.011
11000.0000	500.0000	0.0	16.	0.014
16000.0000	500.0000	0.0	21.	0.018
21000.0000	500.0000	0.0	27.	0.023
25000.0000	500.0000	0.0	34.	0.029
30500.0000	500.0000	0.0	43.	0.037
36000.0000	500.0000	0.0	23.	0.020
40500.0000	500.0000	0.0	2.	0.002
45000.0000	500.0000	0.0	0.	0.0

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Segment #3
ADT 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PIILANI HWY
ENDPOINTS OF THE LINE SOURCE
36000.000, 0.0 AND45000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.283E-03 0.283E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 270. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
36000.0000	50.0000	0.0	0.	0.000
40500.0000	50.0000	0.0	510.	0.444
45000.0000	50.0000	0.0	587.	0.510
36000.0000	75.0000	0.0	0.	0.000
40500.0000	75.0000	0.0	322.	0.280
45000.0000	75.0000	0.0	398.	0.346
40500.0000	100.0000	0.0	224.	0.195
45000.0000	100.0000	0.0	297.	0.259
40500.0000	250.0000	0.0	42.	0.037
45000.0000	250.0000	0.0	97.	0.084
40500.0000	500.0000	0.0	2.	0.002
45000.0000	500.0000	0.0	23.	0.020

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #3
ADT 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PITLANI IMY
ENDPOINTS OF THE LINE SOURCE
36000.000, 0.0 AND 45000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.283E-03 0.283E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 45. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
36000.0000	-50.0000	0.0	277.	0.241
40500.0000	-50.0000	0.0	278.	0.241
45000.0000	-50.0000	0.0	1.	0.001
36000.0000	-75.0000	0.0	243.	0.211
40500.0000	-75.0000	0.0	242.	0.211
45000.0000	-75.0000	0.0	0.	0.000
36000.0000	-100.0000	0.0	216.	0.188
40500.0000	-100.0000	0.0	216.	0.188
45000.0000	-100.0000	0.0	0.	0.000
36000.0000	-250.0000	0.0	133.	0.116
40500.0000	-250.0000	0.0	133.	0.116
45000.0000	-250.0000	0.0	0.	0.000
36000.0000	-500.0000	0.0	85.	0.074
40500.0000	-500.0000	0.0	85.	0.074

*--PPM-CONCENTRATIONS-CORRECT-FOR CARBON MONOXIDE ONLY,

Segment #3
ADT . 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PITLANI HWY
ENDPOINTS OF THE LINE SOURCE
36000.000, 0.0 AND45000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
  0.283E-03 0.283E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 225. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 100.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
36000.0000	50.0000	0.0	1.	0.001
40500.0000	50.0000	0.0	278.	0.241
45000.0000	50.0000	0.0	277.	0.241
36000.0000	75.0000	0.0	0.	0.000
40500.0000	75.0000	0.0	242.	0.211
45000.0000	75.0000	0.0	243.	0.211
36000.0000	100.0000	0.0	0.	0.000
40500.0000	100.0000	0.0	216.	0.188
45000.0000	100.0000	0.0	216.	0.188
36000.0000	250.0000	0.0	0.	0.000
40500.0000	250.0000	0.0	133.	0.116
45000.0000	250.0000	0.0	133.	0.116
40500.0000	500.0000	0.0	85.	0.074
45000.0000	500.0000	0.0	85.	0.074

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Segment #3
ADT 1979
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
36000.000, 0.0 AND45000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.239E-03 0.239E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 90. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	50.0000	0.0	10.	0.008
5000.0000	50.0000	0.0	12.	0.010
11000.0000	50.0000	0.0	15.	0.013
16000.0000	50.0000	0.0	20.	0.017
21000.0000	50.0000	0.0	27.	0.024
25000.0000	50.0000	0.0	38.	0.033
30500.0000	50.0000	0.0	78.	0.068
36000.0000	50.0000	0.0	495.	0.431
40500.0000	50.0000	0.0	431.	0.375
45000.0000	50.0000	0.0	0.	0.0
0.0	75.0000	0.0	10.	0.008
5000.0000	75.0000	0.0	12.	0.010
11000.0000	75.0000	0.0	15.	0.013
16000.0000	75.0000	0.0	20.	0.017
21000.0000	75.0000	0.0	27.	0.024
25000.0000	75.0000	0.0	38.	0.033
30500.0000	75.0000	0.0	77.	0.067
36000.0000	75.0000	0.0	336.	0.292
40500.0000	75.0000	0.0	272.	0.237
45000.0000	75.0000	0.0	0.	0.0
0.0	100.0000	0.0	10.	0.008
5000.0000	100.0000	0.0	12.	0.010
11000.0000	100.0000	0.0	15.	0.013
16000.0000	100.0000	0.0	20.	0.017
21000.0000	100.0000	0.0	27.	0.024
25000.0000	100.0000	0.0	38.	0.033
30500.0000	100.0000	0.0	76.	0.066
36000.0000	100.0000	0.0	251.	0.219
40500.0000	100.0000	0.0	189.	0.165
45000.0000	100.0000	0.0	0.	0.0

Segment #3
ADT 1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
36000.000, 0.0 AND45000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.239E-03 0.239E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 90. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	250.0000	0.0	10.	0.008
5000.0000	250.0000	0.0	12.	0.010
11000.0000	250.0000	0.0	15.	0.013
16000.0000	250.0000	0.0	19.	0.017
21000.0000	250.0000	0.0	26.	0.023
25000.0000	250.0000	0.0	36.	0.031
30500.0000	250.0000	0.0	64.	0.055
36000.0000	250.0000	0.0	82.	0.071
40500.0000	250.0000	0.0	36.	0.031
45000.0000	250.0000	0.0	0.	0.0
0.0	500.0000	0.0	9.	0.008
5000.0000	500.0000	0.0	11.	0.010
11000.0000	500.0000	0.0	14.	0.012
16000.0000	500.0000	0.0	17.	0.015
21000.0000	500.0000	0.0	23.	0.020
25000.0000	500.0000	0.0	28.	0.025
30500.0000	500.0000	0.0	36.	0.032
36000.0000	500.0000	0.0	20.	0.017
40500.0000	500.0000	0.0	2.	0.002
45000.0000	500.0000	0.0	0.	0.0

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Segment #3 **
ADT 1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
36000.000,. 0.0 AND45000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.239E-03 0.239E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 270. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
36000.0000	50.0000	0.0	0.	0.000
40500.0000	50.0000	0.0	431.	0.375
45000.0000	50.0000	0.0	495.	0.431
36000.0000	75.0000	0.0	0.	0.000
40500.0000	75.0000	0.0	272.	0.237
45000.0000	75.0000	0.0	336.	0.292
40500.0000	100.0000	0.0	189.	0.165
45000.0000	100.0000	0.0	251.	0.219
40500.0000	250.0000	0.0	56.	0.051
45000.0000	250.0000	0.0	82.	0.071
40500.0000	500.0000	0.0	2.	0.002
45000.0000	500.0000	0.0	20.	0.017

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Segment #3
ADT 1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PIILANI HWY
ENDPOINTS OF THE LINE SOURCE
36000.000, 0.0 AND45000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.239E-03 0.239E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 45. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 500.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
36000.0000	-50.0000	0.0	234.	0.203
40500.0000	-50.0000	0.0	234.	0.204
45000.0000	-50.0000	0.0	1.	0.001
36000.0000	-75.0000	0.0	205.	0.178
40500.0000	-75.0000	0.0	205.	0.178
45000.0000	-75.0000	0.0	0.	0.000
36000.0000	-100.0000	0.0	182.	0.159
40500.0000	-100.0000	0.0	182.	0.158
45000.0000	-100.0000	0.0	0.	0.000
36000.0000	-250.0000	0.0	113.	0.098
40500.0000	-250.0000	0.0	113.	0.098
45000.0000	-250.0000	0.0	0.	0.000
36000.0000	-500.0000	0.0	71.	0.062
40500.0000	-500.0000	0.0	71.	0.062

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Segment #3
ADT 1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY - PILANI HWY
ENDPOINTS OF THE LINE SOURCE
36000.000, 0.0 AND45000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.239E-03 0.239E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 225. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 100.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
36000.0000	50.0000	0.0	1.	0.001
40500.0000	50.0000	0.0	234.	0.204
45000.0000	50.0000	0.0	234.	0.203
36000.0000	75.0000	0.0	0.	0.000
40500.0000	75.0000	0.0	205.	0.178
45000.0000	75.0000	0.0	205.	0.178
36000.0000	100.0000	0.0	0.	0.000
40500.0000	100.0000	0.0	182.	0.158
45000.0000	100.0000	0.0	182.	0.159
36000.0000	250.0000	0.0	0.	0.000
40500.0000	250.0000	0.0	113.	0.098
45000.0000	250.0000	0.0	113.	0.098
40500.0000	500.0000	0.0	71.	0.062
45000.0000	500.0000	0.0	71.	0.062

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY,

Segment #3
ADT 1989
Refer to Study Plan for receptor locations.

PROJ NO. AIR QUALITY STUDY -- PIILANI HWY
ENDPOINTS OF THE LINE SOURCE
0.0 , 0.0 AND 4000.000, 0.0
EMISSION HEIGHT IS 0.600 METERS
EMISSION RATE (GRAMS/SECOND*METER) OF 2 LANE(S)
0.283E-03 0.283E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS . 0.0 M
WIND DIRECTION IS 90. DEGREES
WIND SPEED IS. 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 50.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/KM.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	-50.0000.	0.0	495.	0.430
0.0	-100.0000	0.0	210.	0.183
0.0	-150.0000	0.0	113.	0.096
0.0	-300.0000	0.0	19.	0.016
0.0	-600.0000	0.0	0.	0.000
2000.0000	-50.0000	0.0	384.	0.334
2000.0000	-100.0000	0.0	117.	0.102
2000.0000	-150.0000	0.0	40.	0.035
2000.0000	-300.0000	0.0	1.	0.001
2000.0000	-600.0000	0.0	0.	0.000

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Typical Roadway Segment
East of Wailea
ADT 1979

PROJ NO. AIR QUALITY STUDY -- PIILANI HWY
ENDPOINTS OF THE LINE SOURCE
0.0 , 0.0 AND 4000.000 , 0.0
EMISSION HEIGHT IS 0.000 METERS
EMISSION RATE (GRAMS/S-COND-METER) OF 2 LANE(S)
0.239E-03 0.239E-03
WIDTH OF AT-GRADE HIGHWAY IS 7.0 M
WIDTH OF CENTER STRIP IS 0.0 M
WIND DIRECTION IS 90. DEGREES
WIND SPEED IS 1.0 METERS/SEC
STABILITY CLASS IS 5
HEIGHT OF LIMITING LID IS 50.0 METERS
THE SCALE OF THE COORDINATE AXES IS 0.0003 USER UNITS/M.

RECEPTOR LOCATION X	Y	HEIGHT Z(M)	CONCENTRATION UGM/METER**3	PPM *
0.0	-50.0000	0.0	418.	0.353
0.0	-100.0000	0.0	177.	0.154
0.0	-150.0000	0.0	93.	0.081
0.0	-300.0000	0.0	16.	0.014
0.0	-600.0000	0.0	0.	0.000
2000.0000	-50.0000	0.0	325.	0.282
2000.0000	-100.0000	0.0	90.	0.076
2000.0000	-150.0000	0.0	34.	0.029
2000.0000	-300.0000	0.0	1.	0.001
2000.0000	-600.0000	0.0	0.	0.000

* PPM CONCENTRATIONS CORRECT FOR CARBON MONOXIDE ONLY.

Typical Roadway Segment
East of Wailea
ADT 1989

TECHNICAL APPENDIX B

AMBIENT NOISE LEVEL READINGS,

PIILANI HIGHWAY, KIHEI TO ULUPALAKUA, MAUI

(Final) M-79

HWY-TC-468

HWY-D

April 23, 1975

HWY-T

PIILANI HIGHWAY - KIHEI TO ULUPALAKUA, MAUI
PROJECT NOS. F-031-1(4), F-031-1(1) and F-037-1(10)

Transmitted herewith are the ambient noise readings in the vicinity of the proposed road and along the existing Kihei Road.

The numerous construction projects in this area contributed significantly to the L_{10} noise level readings and is probably not the normal levels for the area.

T. ARATANI

PH:cc
Enclosure

NOISE LEVEL READINGS

PIILANI HIGHWAY
KIHEI TO ULUPALAKUA, MAUI

(L_{10} NOISE LEVELS dBA, $\pm$ SIGNIFY 95% CONFIDENCE LIMITS)

Station No.	Location	Time	Tuesday 3/11/75	Wednesday 3/12/75	Thursday 3/13/75	Predominate Noise
1	Dirt driveway on North side of Suda Store - 50' from Kihei Rd. West Side	9:15 am	71^{+3}_{-2}			Trucks
		12:25 pm		73^{+3}_{-3}		Trucks
		4:35 pm			72^{+2}_{-2}	Cars
2	Keolahou Congregationa Church and Cemetary - Centerline of driveway 100' from Kihei Rd. and 50' perpendicular from front corner of church	8:40 am		65^{+0}_{-1}		Construction equipment
		12:25 pm		65^{+1}_{-1}		Construction equipment
3	Memorial Park - 50' from Kihei Rd East Side - foot of Ohukai Rd.	8:35 am	55^{+1}_{-1}			Waves breaking on shore
		12:50 pm		59^{+2}_{-2}		Waves breaking on shore
4	Maui Lu - Koonoulu and Kihei Rd 50' from Kihei Rd - West Side	7:55 am	76^{+3}_{-3}			Trucks
		12:50 pm		72^{+3}_{-2}		
5	Beach - Menehune Shores - 1000' from Kihei Rd - East Side	7:50 am		54^{+1}_{-1}		Waves breaking on shore
		1:05 pm		63^{+1}_{-2}		Waves breaking on shore
6	Across Kihei Rd. from Menehune Shores - 50' from Kihei Rd - West Side	7:50 am		71^{+3}_{-3}		Trucks
		1:30 pm		72^{+3}_{-3}		Trucks
		4:25 pm			67^{+3}_{-1}	Trucks
6A	Kilolani Church - West Side of Kihei Rd - 50' from end of dirt road. - 50' Northwest of centerline	10:15 am			72^{+0}_{-1}	Construction equipment
		1:05 pm			73^{+1}_{-0}	Construction equipment

Noise Level Readings (continued)
Piilani Highway, Kihei to Ulupalakua, Maui

Station No.	Location	Time	Tuesday 3/11/75	Wednesday 3/12/75	Thursday 3/13/75	Predominate Noise
7	St. Theresa Church - Lipoa and Kihei Rd. - East Side of Kihei Rd. 75' from edge of pavement - 50' from front of church.	11:00 am	69^{+3}_{-3}			Trucks
		12:55 pm			70^{+2}_{-2}	Trucks
7A	End of Lipoa at fence - West Side of Kihei Rd.	9:50 am			45^{+1}_{-0}	Construction equip. & bird
		2:50 pm			47^{+1}_{-0}	Construction equip. & birds
8	Waiohuli and Kihei - 50' East Side of Kihei Rd - 50' North Side of Waiohuli	10:55 am	72^{+2}_{-3}			Trucks
		1:30 pm		71^{+2}_{-1}		Trucks
8A	Kihei Baptist Church - 50' West Side of Kihei Rd.	11:25 am	67^{+2}_{-1}			Water pump on construction project.
		1:55 pm		65^{+3}_{-2}		" " " " "
9	Fire station - next to Assembly of God - South Side of fire station - 50' East Side of Kihei Rd.	11:30 am	69^{+2}_{-2}			" " " " "
		1:50 pm		67^{+1}_{-1}		" " " " "
10	Kalama Park - 100' East Side of Kihei Rd in parking lot	1:15 pm	62^{+3}_{-2}			Trucks
		8:20 am			65^{+2}_{-0}	Trucks
11	Kamaole I Park - 50' East Side of Kihei Rd.	12:50 pm	73^{+3}_{-3}			Trucks
		8:35 am			66^{+2}_{-2}	Trucks
		4:00 pm			67^{+3}_{-2}	Trucks

Noise Level Readings (continued)
Piilani Highway, Kihei to Ulupalakua, Maui

Station No.	Location	Time	Tuesday 3/11/75	Wednesday 3/12/75	Thursday 3/13/75	Predominate Noise
11A	Auhana Rd. - 50' East Side of road - directly in front of wire fence and abandoned house	3:25 pm		-40		Birds
		9:30 am			46^{+1}_{-0}	Local airline, birds
12	Kamaole III Park - 50' from east edge of pavement (Kihei Rd)	1:30 pm	68^{+3}_{-3}			Trucks, cars
		8:50 am			63^{+1}_{-1}	" "
13	Public parking lot - foot of Kilohana St. - 50' West Side of Kihei Rd - in parking lot	2:20 pm	75^{+1}_{-3}			Trucks, grader
		11:25 am		65^{+2}_{-2}		Trucks, airplane
		4:05 pm		68^{+3}_{-3}		Car
		9:05 am			64^{+2}_{-2}	Trucks
14	Across from water tank on Kilohana St - 50' from North edge of pavement (Kilohana St)	2:25 pm	54^{+1}_{-1}			Birds
		11:25 am		57^{+3}_{-2}		Birds
14A	Kilohana & Akala (near water tank) 50' from North edge of pavement (Kilohana St), 200' East Side of Akala	2:50 pm		54^{+3}_{-3}		Birds
15	Proposed Kihei - Ulupalakua Rd 650' from South end of Akala Rd.	7:50 am			51^{+3}_{-2}	Birds
16	Near Proposed Park, Gov. complex, school - 500' and 1000' from west end of Lipoa	10:25 am		48^{+1}_{-1}		Constn equip. and aircraft
17	Tony Hashimoto res. - centerline of dirt driveway - 50' from southeast corner of house and 25' from shack	9:45 am	54^{+2}_{-2}			Construction equipment
		4:00 pm	55^{+2}_{-1}			Construction equipment

Noise Level Readings (continued)
Piilani Highway, Kihei to Ulupalakua, Maui

Station No.	Location	Time	Tuesday 3/11/75	Wednesday 3/12/75	Thursday 3/13/75	Predominate Noise
18	Abandoned quonset home - Kailoa Place - centerline of driveway 20' from tree and 40' from centerline of Kailoa Place	10:05 am	55^{+1}_{-2}			Constn equip. and birds
		3:25 pm	47^{+2}_{-1}			Birds
19	Ralph Honda res. - 30' from southwest corner of house and 75' from centerline of Kailoa Pl.	9:25 am	70^{+2}_{-2}			Constn equip. and birds
		3:40 pm	46^{+2}_{-1}			Local airline, birds
20	Charles Plunkett res. - 30' from southwest corner of house and 125' from centerline of Kailoa Pl.	9:05 am	67^{+2}_{-0}			Construction equipment
		3:35 pm	48^{+1}_{-1}			Birds
21	Moi Place and Kailoa Rd. - 50' east from centerline of Kailoa Pl. and 50' south from centerline of Moi Place	8:35 am	58^{+1}_{-0}			Construction equipment
		4:05 pm		50^{+0}_{-2}		Construction equipment
22	Cul De Sac - proposed - 500' from south end of Awa Street	8:00 am	49^{+2}_{-1}			Birds
		4:05 pm		49^{+1}_{-2}		Children playing

TECHNICAL APPENDIX C

NOISE STUDY,

PROPOSED PIILANI HIGHWAY

NOISE STUDY

PROPOSED PIILANI HIGHWAY

Island of Maui

Materials Testing & Research Branch
July 1976

GENERAL:

A study was conducted to assess the effects of traffic noises to properties along the proposed Piilani Highway. This study evaluates the projected noise levels along the new route and compares the No-Build alternate with expected traffic changes on the existing Kihei Road. The results are tabulated in Tables I and II.

PROJECT DESCRIPTION:

A new bypass route is proposed to alleviate the expected traffic congestions on the only roadway through the rapidly developing shoreline corridor. The increased population density necessitates expanded capabilities since the carrying capacity of the two-lane roadway will shortly be exceeded.

The proposed route will be a two-lane roadway approximately 2500 feet east and roughly parallel to the existing Kihei Road from Kihei to Wailea. The southern portion from Makena will improve the alignment of the winding unimproved roadway and connect to Lower Kula Road (Route 37) at Mile Post 14.20.

The highway will be relatively flat except for that portion from Makena to Lower Kula Road. This segment is fairly steep rising from elevation 800 ft. to 1800 ft. in 3 miles.

The entire 100 ft. wide corridor will for the most part be through sparsely populated arid pasture land. The entire area is masterplanned for a mixed development of residential subdivisions, agricultural uses, and public facilities. This study considered the existing dwellings, proposed residential subdivision, park and the school complex as sensitive receptors and emphases were placed at these locations.

COMMUNITY NOISES:

The present Kihei Road is through an active, populated high density land use area with considerable numbers of new construction projects. The road services many permanent residences as well as vacation facilities. The heavy truck traffic primarily service the active construction projects and are the major sources of noise. These may be considered temporary and when construction activities subside, truck traffic will be limited to local deliveries. Other noises are typical community noises that can normally be expected of an active community.

The major noises along the proposed corridor are predominantly local traffic along the narrow roads and powered agricultural equipment. The few homes in the area are generally scattered and contribute very little to the community noise.

NOISE SURVEY:

A noise survey was conducted by the Materials Testing and Research Branch in March 1975 to determine the ambient conditions along the existing Kihei Road as well as along the proposed corridor. The procedures used were in accordance with procedures for Environmental Noise Measurements developed by Bolt, Beranek and Newman and U.S. DOT. Statistically, the L_{10} noise levels determined by this method is within the 95% confidence limits.

During the survey period, it was noted that numerous construction projects contributed significantly to the ambient noise levels for the area. Once removed from the immediate vicinity of Kihei Road and the areas of construction activities, the noise environment was greatly influenced and dominated by locally generated noise usually associated with rural activities.

NOISE STUDY:

The prediction method used in this study is based on mathematical models designated as NCHRP 117 and as revised by NCHRP 144. Comparative analyses are based on the criteria of acceptable noise levels mandated by U.S. DOT (FHWA) FHPM 7-7-3. Although it is known that computed values "overpredicts" noise levels for low traffic volume roads, especially with low truck volumes, no adjustments were made. The expected traffic volume on Piilani Highway is very low and the predicted noise level is probably "overpredicted". Traffic volumes expected on the No-Build alternate are considerably higher and the computed values should more closely approximate the linear line source models used in this study. NOTE: No detailed study was made to validate the models in this study.

This study was based on current traffic forecasts for 1979 and 1989. It is expected that by 1989 the peak traffic volume between Mokulele Hwy (Route 350) and Kanani Road to be 1150 vehicles per hour of which 2-1/2 percent will be trucks (GVW 10,000 lbs or eight passenger bus). The traffic from Kanani Road to Wailea is forecasted to be 830 vehicles per hour with 2-1/2 percent truck traffic. And the traffic volume beyond Wailea to Kula Hwy is expected to be 310 vehicles per hour with 2% trucks. The basic traffic flow was considered as follows:

NO-BUILD ALTERNATE: By retaining the present Kihei Road, it can be expected that all of the traffic forecasts for 1979 and 1989 will be carried by its present 2 lanes.

BY-PASS ROUTE ALTERNATE (Piilani Hwy): By providing an alternate bypass, the traffic along the existing route will be lessened to 490 vehicles per hour and the bypass route will attract 660 vehicles per hour and the major portion of the truck traffic.

ANALYSIS:

No-Build Alternate: The No-Build Alternate considers the situation along the Kihei Road if the present roadway is expected to accommodate the entire traffic forecast for 1989 without any improvements.

The present average L_{10} noise level along the existing route measured at the property line was 71.0 decibels (dBA). The primary noise sources are vehicular traffic, construction activities and basically noises common to any active community.

It can be expected that the present two lanes will carry the entire load of 12,426 cars and 254 trucks per day. Because of the significant increase in truck traffic within this alignment, the noise levels in 1989 can be expected to be 77 dBA, 50 feet from the road. Noise at this level would exceed the maximum allowable level for Category C land use. Every residential and commercial property along the route and within 100 feet of the roadway would be affected. Judging from the type of construction (single wall) and assuming the windows to be typically opened, the interior noise levels would be about 65-70 dBA. This indicates that interferences to normal conversation and audio enjoyment would be experienced.

Bypass Route Alternate (Piilani Hwy): The most desirable feature from the standpoint of noise environment is the removal of a major portion of the truck traffic from passing through the populated residential portion of Kihei. Secondly, the bypass is expected to attract all of the through traffic. Thus, the projected vehicular traffic on Kihei Road will be lower than the current traffic volumes. The future traffic mix will be substantially different in that there will be fewer trucks. Rerouting trucks will eliminate a major source of traffic noise from the residential areas. Consequently, a reduction in noise will be experienced by the residential and commercial property owners along the existing Kihei Road.

The area along the proposed corridor is sparsely pouplated and

therefore the ambient noise levels are relatively low. It can be reasonably expected that as the area is developed as master-planned, the noise generated by community activities will raise the ambient noise levels. This study considered a nominal increase of three decibels.

The noise generated by traffic on the proposed route is not expected to have an adverse affect on its surroundings. The total L_{10} noise levels which are combinations of the predicted traffic and community noises are not expected to exceed 65 dBA. This is well within the maximum 70 dBA limits established for Category B land use.

Furthermore, the use of the proposed bypass route would return the present Kihei Road to a local thoroughfare with most of the through traffic utilizing the bypass. Because of the anticipated drop in traffic volume and a noticeable reduction in the number of trucks, the expected noise levels along this route would be less than the present noise levels. There will be definite beneficial effects to the existing shoreline corridor.

Noise Barrier: In order to conform to Federal Noise Standards, abatement measures must be able to attenuate noise from 77 dBA to 70 dBA. Based on present technologies, the success of achieving a 7 dBA reduction is attainable but difficult. Noise barriers to be effective must interrupt the straight line path (line of sight) between the source of noise and the receiver. The barrier must be made of material with excellent acoustical characteristics and of sufficient height and length without breaks or openings that would permit noise leakage.

To reduce the noise impact along the existing corridor noise barriers for the no-build alternate would have to be from 10 to 15 ft. high and practically extend the length of the corridor from Kihei to Wailea. Such noise barriers would have practical limitations and would be economically unfeasible because of the numerous intersections and driveways located throughout the corridor. Furthermore, the limited right-of-way along the corridor would require high massive barrier walls running parallel on both sides of the roadway. These structures would be unsightly, aesthetically unpleasing and totally unacceptable to the residents and the community that attracts many vacationers.

Noise abatement measures along the proposed corridor will not be necessary.

SUMMARY:

The noise study has indicated that a number of residential and commercial properties along the existing Kihei Road are presently experiencing adverse affects to vehicular noise exceeding 70 dBA. The no-build alternate in which the present two-lane roadway is expected to carry all of the forecasted 1989 traffic volume will substantially increase the noise levels and have an impact on an area within 100 ft. of the roadway. The noise levels can be expected to reach 77 dBA. Barriers to reduce the noise impact would be impractical, uneconomical and aesthetically unpleasing.

The proposed Piilani Highway would not create any adverse noise affects on the community. By diverting a major portion of the trucks and through traffic away from the populated residential and commercial areas, the bypass route will help to eliminate a major source of traffic noise along the existing corridor. In addition, some beneficial effects would be experienced by the existing shoreline areas.

The projected noise levels along the proposed route are not expected to exceed the allowable noise levels for Category B land use (70 dBA). Therefore, noise abatement measures will not be necessary

NOISE LEVEL READINGS
KIHEI ROAD, MAUI, HAWAII
NO-BUILD ALTERNATE

TABLE I

Test Site	Test Location	Ambient Noise Levels (Average)dBA	Predicted L_{10} Noise Levels (dBA) 1979	1989
1	Suda Store - 50' from Kihei Rd.	72	74	76
2	Keolahou Congregation Church and Cemetary - 100' from Kihei Rd.	65	70	71
3	Memorial Park - 50' from Kihei Rd	57	70	73
4	Maui Lu - 50' from Kiehi Rd	74	75	77
5	Beach - Menehune Shores - 1000' from Kihei Rd	59	59	60
6	Across Kihei Rd from Menehune Shores - 50' from Kihei Rd	70	73	75
7	St. Theresa Church - Lipoa and Kihei Rd	70	73	75
8	Waiohuli and Kihei - 50' from Kihei Rd	72	74	76
8A	Kihei Baptist Church - 50' East Side of Kihei Rd	66	71	74
9	Fire Station - next to Assembly of God - 50' West Side of Kihei Rd	68	72	74
10	Kalama Park - 100' West Side of Kihei Rd in parking lot	64	69	70
11	Kamaole I Park - 50' East Side of Kihei Rd	69	70	73
12	Kamaole III Park - 50' from West Edge of pavement (Kihei Rd)	66	67	72
13	Public parking lot - foot of Kilohana St. - 50' East Side of Kihei Rd - in parking lot	70	71	74

SEE MAP FOR TEST LOCATIONS

NOISE LEVEL READINGS
PIILANI HWY, MAUI, HAWAII
BYPASS ROUTE ALTERNATE

TABLE II

Test Site	Test Location	Ambient Noise Levels (Average) dBA	Projected** Ambient Noise Levels, dBA	PREDICTED L_{10} NOISE LEVEL dBA Projected 1979 Traffic Noise	Total 1979 Community Noise	Projected 1989 Traffic Noise	Total 1989 Community Noise
6A	Kilolani Church	*					
7A	End of Lipoa St.	46	49	47	51	48	52
11A	Auhana Rd - in front of abandoned house	43	46	51	52	53	54
14	Across from water tank on Kilohana St - 50' from North edge of pavement (Kilohana St)	56	59	56	61	57	61
14A	Intersection Kilohana and Akala	54	57	58	61	60	62
15	650' from South end of Akala Rd	51	54	52	56	54	57
16	Proposed Park, Gov. complex, school	48	51	60	61	64	64
17	Tony Hashimoto res.	55	58	58	61	61	63
18	Abandoned quonset home - Kailoa Place	51	54	60	61	64	64

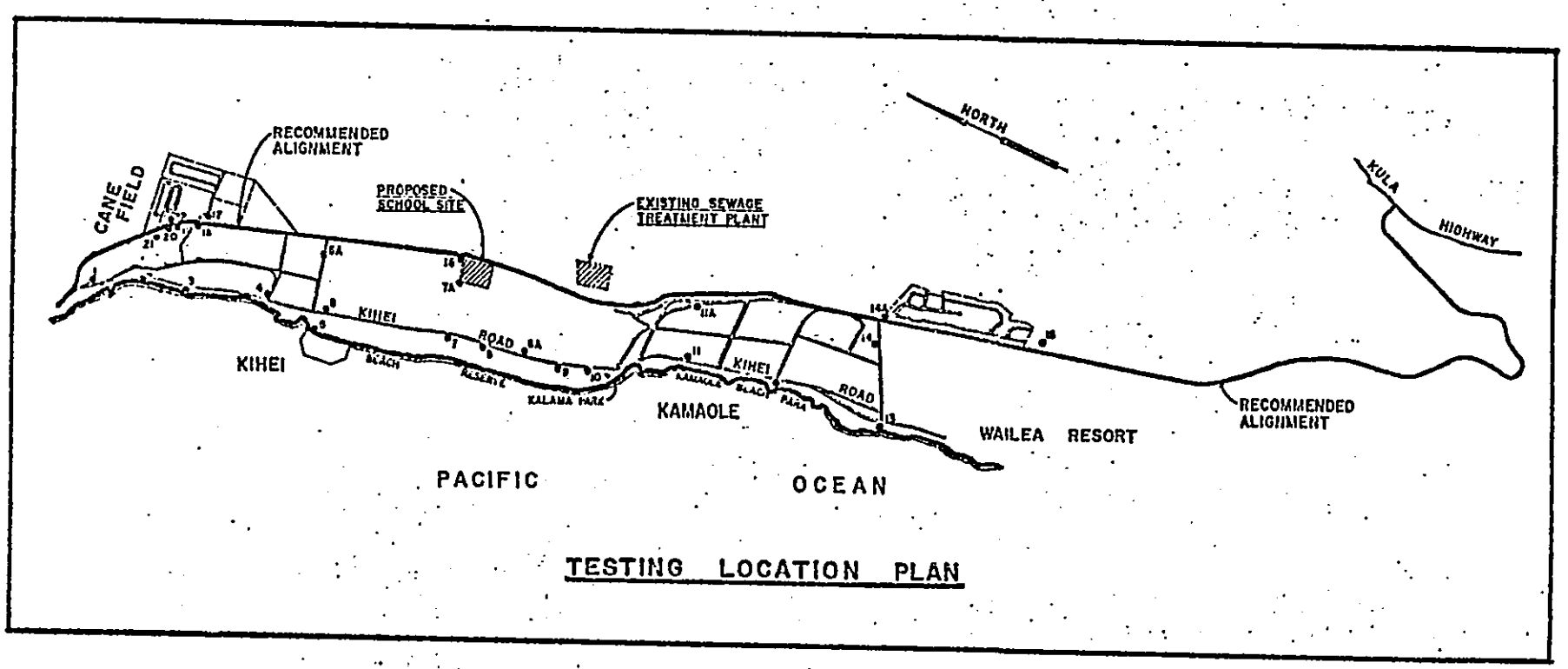
Noise Level Readings
Piilani Hwy, Maui, Hawaii
Bypass Route Alternate

Table II (continued)

Test Site	Test Location	Ambient Noise Levels (Average) dBA	Projected** Ambient Noise Levels, dBA	PREDICTED L_{10} NOISE LEVEL dBA: Projected 1979 Traffic Noise	Total 1979 Community Noise	Projected 1989 Traffic Noise	Total 1989 Community Noise
19	Ralph Honda residence	58	61	57	62	59	63
20	Charles Plunkett residence	58	61	58	63	59	63
21	Moi Place and Kailoa Rd	54	57	58	61	61	62
22	Cul De Sac - South end of Awa Street	49	52	60	61	64	64

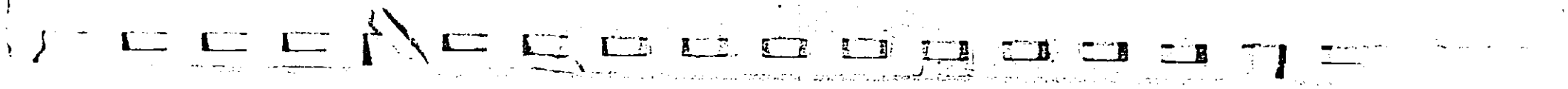
* Construction Activity at Immediate Vicinity of Church. No Ambient Noise Reading Available.
** Anticipated Increase in Ambient Noise Level from Community Activities as Area Begins to Develop, For this Study a +3 dBA increase

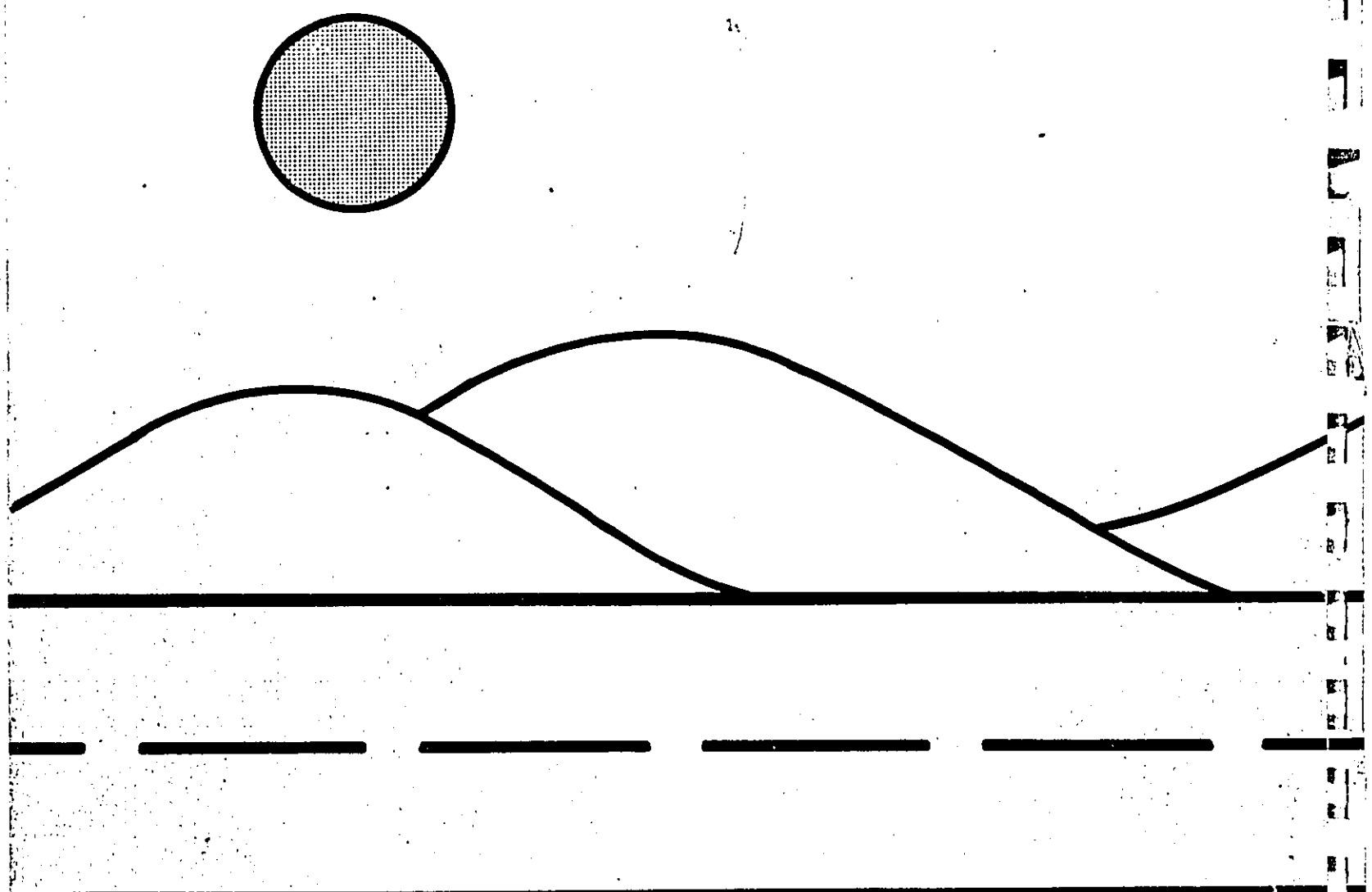
SEE MAP FOR TEST LOCATIONS



TESTING LOCATION PLAN

• Testing Site for Noise Level Readings





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