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COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS  
AND WASTE MANAGEMENT

200 SOUTH HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

April 16, 1996

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OFFICE OF ENVIRONMENTAL  
QUALITY CONTROL

Mr. Gary Gill, Director  
State of Hawaii  
Office of Environmental Quality Control  
220 South King Street, 4th Floor  
Honolulu, Hawaii 96813

SUBJECT: LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE III  
DRAFT ENVIRONMENTAL ASSESSMENT  
(NEGATIVE DECLARATION ANTICIPATED)  
TAX MAP KEY: 4-3-06:POR. 41, 4-3-08: POR 83 & 84  
4-3-10:POR. 5 & 6  
LAHAINA, MAUI, HAWAII

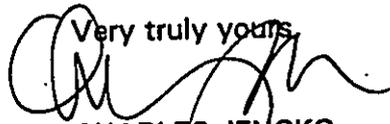
Dear Mr. Gill:

The County of Maui, Department of Public Works and Waste Management is please to submit four (4) copies of the subject Draft Environmental Assessment (Negative Declaration anticipated) in compliance with Chapter 343 of the Hawaii Revised Statutes. Also, enclosed is a completed OEQC Document Publication Form and a copy of the Draft Environmental Assessment Distribution List.

We ask that notice of this filing be published in the May 8, 1996 issue of your Environmental Newsletter. Distribution to government and public agencies is currently in progress.

If you have any questions, please call Joe Krueger of our Engineering Division at (808) 243-7745.

Very truly yours,



CHARLES JENCKS  
Director of Public Works  
and Waste Management

CY/JK:ch(ED96-363)  
HPL/EO.EQC

Attachments

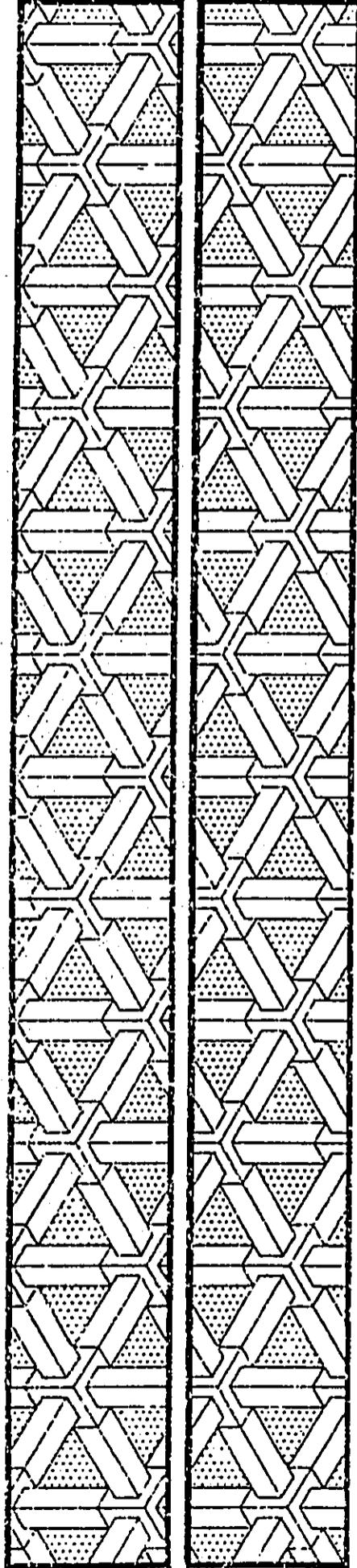
xc: Rodney Funakoshi, Wilson Okamoto & Associates

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1996-08-08-MA-~~FEA~~ FEA - Lower Honoapiilani Road Improvement Phase III

AUG - 8 1996

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**FINAL  
ENVIRONMENTAL  
ASSESSMENT  
FOR  
LOWER HONOAPIILANI ROAD  
IMPROVEMENTS, PHASE III  
LAHAINA, MAUI, HAWAII**

Prepared for:

County of Maui  
Department of Public Works  
and Waste Management

Prepared by:

Wilson Okamoto & Associates, Inc.

July 1996

**FINAL  
ENVIRONMENTAL ASSESSMENT  
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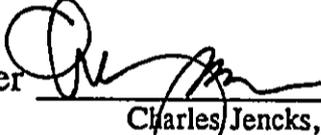
County of Maui  
Department of Public Works and Waste Management

Prepared by:

Wilson Okamoto & Associates, Inc.  
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July 1996

Final  
Environmental Assessment  
for  
Lower Honoapiilani Road Improvements, Phase III  
Lahaina, Maui, Hawaii

Responsible Officer  Date 7/26/96  
Charles Jencks, Director  
Dept. of Public Works and Waste Management

Prepared for:  
County of Maui  
Department of Public Works and Waste Management

Prepared by:  
Wilson Okamoto & Associates, Inc.

July 1996

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## PREFACE

Chapter 343, Hawaii Revised Statutes (HRS), requires that proposed actions be assessed to determine potential adverse environmental impacts, and that these impacts be documented. State of Hawaii Department of Health Administrative Rules Title 11, Chapter 200, Environmental Impact Statements, sets forth the requirements for documentation of environmental impacts.

This Environmental Assessment (EA) has been prepared pursuant to the requirements of Chapter 343 HRS and Chapter 200 of Title 11 in order to document the environmental effects from the proposed County of Maui roadway improvements for Lower Honoapiilani Road, Phase III in Lahaina, island of Maui, Hawaii. The proposed project is an agency action by the County of Maui, Department of Public Works and Waste Management. The preparation of the EA arises from the use of county funds for project site acquisition and improvements. The proposed action is not anticipated to generate any significant adverse impacts on the environment.

**SUMMARY SHEET**

**Applicant:** County of Maui  
Department of Public Works and Waste Management

**Landowner:** County of Maui

**Proposing Agency:** County of Maui  
Department of Public Works and Waste Management

**Project Location:** Lahaina, Maui, Hawaii

**Tax Map Keys:** 4-3-06: portion of 41  
4-3-08: portions of 83 and 84  
4-3-10: portions of 5 and 6

**Land Area:** Approximately 5.02 acres (approximately 1-mile long roadway from Mahinahina Stream to Hoohui Road)

**State Land Use District:** Urban

**Community Plan:** Single-Family (SF), Multi-Family (MF), Hotel/Resort (H), Business/Commercial (B), Park (PK), Open Space (OS)

**Zoning:** A-1, A-2 Apartment; B-2 Business; H-2, H-M Hotel; and R-2, R-3 Residential

**Existing Use:** Roadway, residential, business, hotel, beach park, open space

**Proposed Use:** Roadway improvements

**Consulted Agencies:** County of Maui Department of Public Works and Waste Management  
County of Maui Department of Planning  
State of Hawaii Department of Health  
Clean Water Branch  
Maui Electric Company, Inc.  
(See Appendix A)

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## 1. INTRODUCTION

### 1.1 Project Location

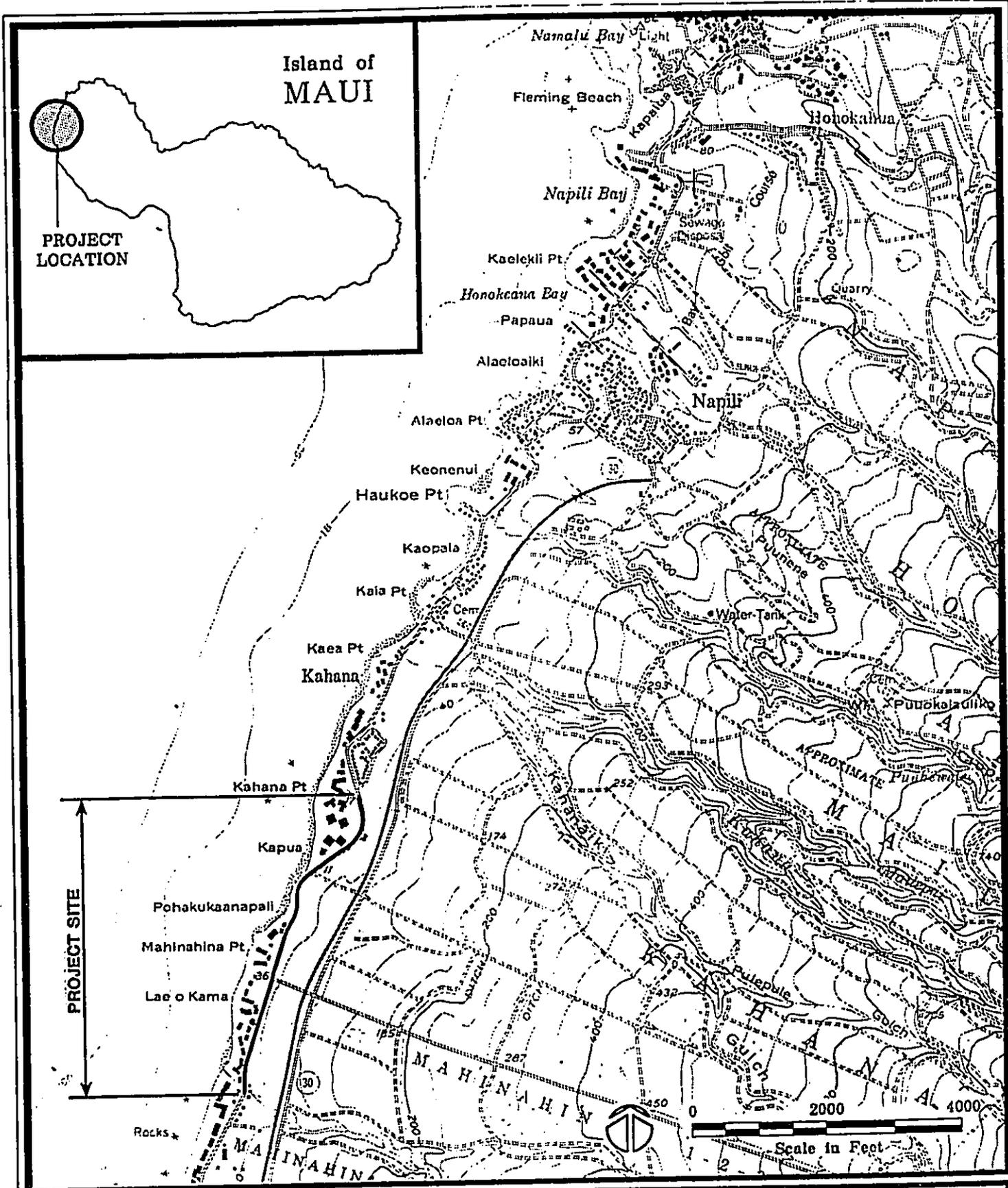
The proposed project is located in the Lahaina District of Maui. The town of Lahaina lies to the south of the site, while the community of Kahana is immediately north. The project is bordered by the West Maui mountain range to the east and the Pacific Ocean to the west. The Kapalua-West Maui Airport lies mauka of Honoapiilani Highway. The approximately 1-mile long site can be accessed from Honoapiilani Highway and is located on Lower Honoapiilani Road between Mahinahina Stream and Hoohui Road. (See Figure 1-1). The project site is located at elevations between 5 feet and 40 feet above mean sea level (MSL). Portions of the project site to be acquired are located within Tax Map Keys (TMKs) 4-3-06: portion of 41, 4-3-08: portion of 83 and 84, and 4-3-10: portion of 5 and 6.

### 1.2 Land Ownership

The existing Lower Honoapiilani Road and right-of-way are owned by the County of Maui. The roadway is used to access the residential, hotel, business, park, open space and undeveloped uses within the area.

### 1.3 Existing and Surrounding Uses

The project site is a paved roadway consisting of two 11-foot lanes located within a variable 40 to 60-foot wide right-of-way. It is located adjacent to residential, hotel, business, park, open space and undeveloped land uses. A sewage pump station is located mauka of Lower Honoapiilani Road within an undeveloped area between the Kahana Villa and single-family residences.



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**Fig. 1-1  
LOCATION MAP**

Generally, curbs and gutters have been constructed on portions of the mauka roadway shoulder with other portions mauka and makai of the existing roadway shoulders landscaped with grasses, trees and shrubs or paved with sidewalks. However, some areas are left undeveloped with weeds typical of rural areas.

Major developments in the area include single-family homes, condominium, hotels, resorts and shopping centers.

## **2. PROJECT DESCRIPTION**

### **2.1 Project Need**

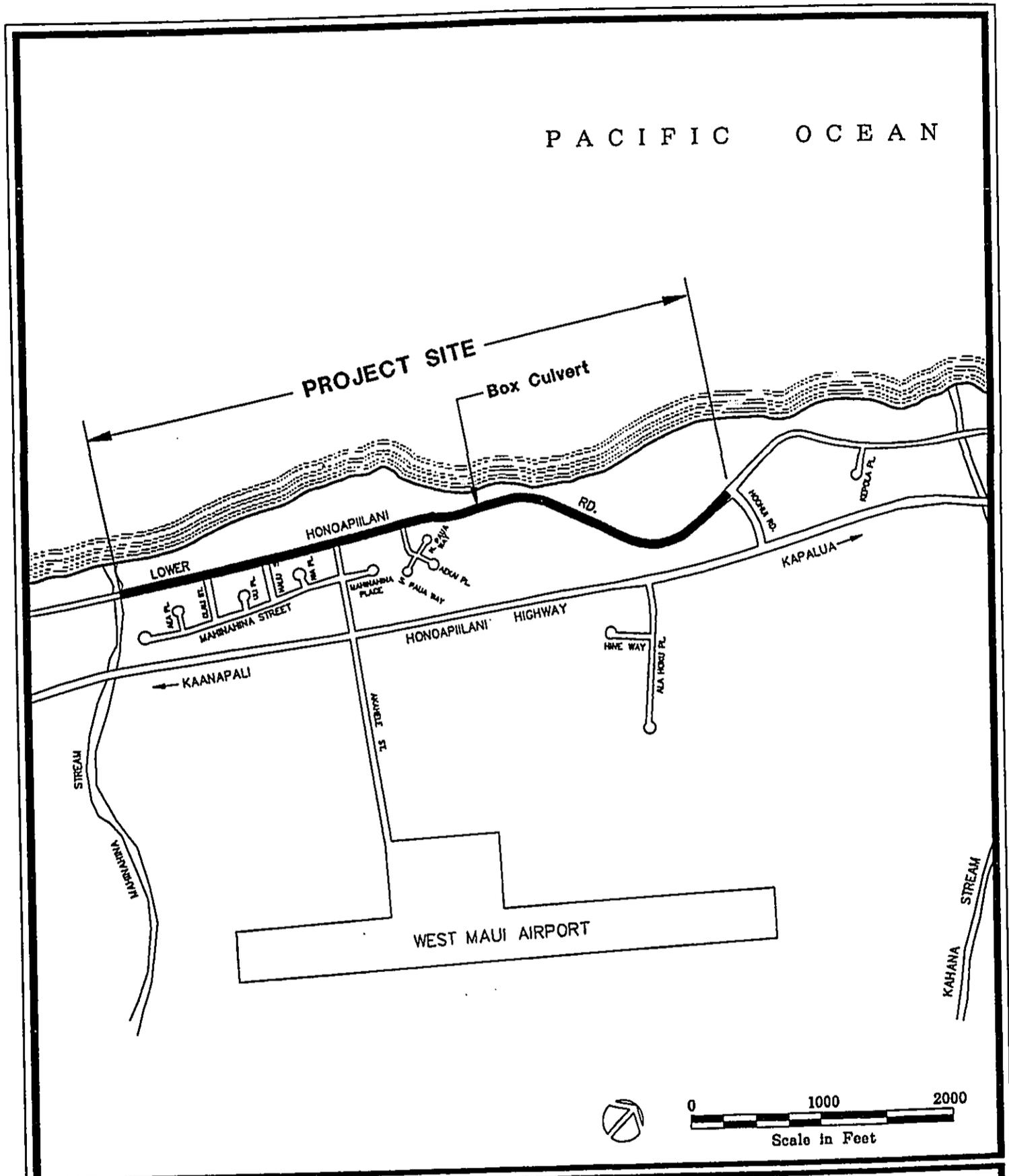
The County of Maui Department of Public Works and Waste Management (DPWWM) proposes roadway and drainage improvements for an approximately 1-mile long portion of Lower Honoapiilani Road located between Mahinahina Stream and Hoohui Road in Lahaina, Maui. The project constitutes the third phase of improvements for Lower Honoapiilani Road. The first phase of road improvements is located between the north side of Honokowai Stream and the south side of an existing ditch near Honokowai Beach Park. Phase II extends from this ditch to Mahinahina Stream. The first two phases of road improvements are located southeast of the proposed Lower Honoapiilani Road Improvements, Phase III project site.

Recent growth in the project area has increased vehicular and pedestrian traffic. Safety is a concern on portions of the project area where there are no pedestrian sidewalks and wheelchair access. The proposed improvements will provide visitors and residents of the area with safer walkways, better driving conditions, on-street parking and improved drainage conditions.

### **2.2 Proposed Improvements**

The proposed improvements of the Lower Honoapiilani Road Improvements, Phase III project will affect the existing roadway and portions of nearby parcels. Specific improvements to the approximately 1-mile long roadway (see Figure 2-1) consist of:

- o The existing two-lane roadway which has pavement widths ranging from 22 to 32 feet will be widened by 6 feet. Roadway right-of-way which has a current width ranging from 29 to 48 feet will be widened by up to 9 feet to accommodate the proposed improvements.



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**Fig. 2-1  
PROJECT SITE**

- o On-street parking - Parallel parking will be provided intermittently and primarily on the makai side of the roadway.
- o Resurfacing and replacement of asphalt concrete (AC) pavement will be provided.
- o Buffer - A paved buffer, typically 3 feet wide, will be provided on either side of the roadway.
- o Swale - A buffer/swale up to 8 feet wide will be constructed on the makai side of the roadway.
- o New sidewalks, concrete curbing, and 15 catch basins at unimproved locations along the roadway will be constructed where necessary.
- o Addition of a new subsurface drainage collection system - A box culvert will be designed to convey stormwater runoff from the undeveloped parcel (TMK: 4-3-09: 52), owned by Maui Land and Pineapple Company, across Lower Honoapiilani Road to the ocean. Flow from an existing 72-inch by 44-inch culvert will be diverted to the proposed culvert. A new drain outlet will also be constructed. The new drainage collection system will require the relocation of existing 8-inch and 16-inch waterlines, a 16-inch sewer forcemain, and an 8-inch sewerline.
- o Relocation of existing utility systems - Telephone poles and fire hydrants will be relocated, as necessary to accommodate the road shoulders. Waterlines and sewerlines will be realigned where drainage improvements conflict with existing lines. Drainage improvements will also include relocation of existing drainlines.

The proposed improvements will involve the existing County of Maui-owned Lower Honoapiilani Road located between Mahinahina Stream and Hoohui Road. Approximately 1,992 square feet of land from 5 privately-owned parcels will need to be acquired by the County of Maui Department of Public Works and Waste Management for road improvements. Table 2-1 shows the affected parcels:

TMK	Project Name	Acquisition Area (Square Feet)
4-3-06: por. 41	Hale Mahina Beach Resort	1,346
4-3-08: por. 83	Mahinahina Ventures Subdivision	138
4-3-08: por. 84	Mahinahina Ventures Subdivision	223
4-3-10: por. 5	Valley Isle Resort	6
4-3-10: por. 6	Valley Isle Resort	279
		1,992

Hale Mahina Beach Resort, designated by TMK: 4-3-06: 41, is located makai of Lower Honoapiilani Road between Hoyochi Nikko condominium and Mahinahina Stream. TMKs: 4-3-08: 83 and 84 are located within the Mahinahina Ventures Subdivision, mauka of Lower Honoapiilani Road, between Mahinahina Stream and the intersection of Olali Street and Lower Honoapiilani Road. TMKs: 4-3-10: 5 and 6 are currently a part of the Valley Isle Resort parcel located makai of Lower Honoapiilani Road near the intersection of Hoohui Road and Lower Honoapiilani Road.

Construction easements of approximately 10 feet will also be obtained as needed from property owners along the affected area of road improvements.

### 2.3 Estimated Project Schedule/Cost

Commencement of improvements is contingent upon satisfying license and permit requirements and upon acquisition of land. Construction is expected to begin in the later half of 1997 and is expected to be completed sometime in mid-1998. Development cost for the proposed project is preliminarily estimated at \$2,000,000. Funding will be provided by the County of Maui and Federal Highway Administration (FHWA).

### 2.4 Government Permits

The following permits and approvals may be required for the project:

- o County of Maui - Special Management Area (SMA) Permit
- o County of Maui - Shoreline Setback Variance
- o County of Maui - Grading/Grubbing Permit
- o County of Maui - Floodway Certification
- o State of Hawaii Department of Health - National Pollutant Discharge Elimination System (NPDES) Permit

Since construction activities are anticipated to be confined mauka of the shoreline, no other permits are expected to be required at this time.

### 3. DESCRIPTION OF THE EXISTING ENVIRONMENT

#### 3.1 Geology and Topography

The island of Maui is composed of two volcanic mountains; the older West Maui Volcano, and the younger Haleakala Volcano. These two dormant shield volcanoes are linked by a broad plain which formed when lava flows from Haleakala Volcano joined the West Maui Mountains land mass.

The island of Maui is comprised of two major volcanoes, from which three different series of volcano rock exist. The Wailuku Volcanic series (the oldest series) consist of basaltic flows that formed the major shield. The Honolua Volcanic Series followed and covered the Wailuku Volcanic Series with thin, discontinuous andesitic and trachytic flows, domes and pyroclastic deposits. The flows and cones of the Lahaina Series, (the last of the series) followed the Honolua Series.

The Wailuku Volcanic Series consists primarily of thin pahoehoe and a'a lava flows of tholeiite, olivine tholeiite, and oceanite. The major shield formed by this series reached a height of approximately 7,000 feet above sea level before collapsing. As a result, a caldera that spans roughly two miles in diameter was formed. Dikes tend to radiate in all directions from the summit, which contribute to the circular ground plan of the volcano.

Most of the flows from the Honolua Series are a'a, although some pahoehoe flows exist. The lava consists primarily of mugearite, with some trachyte and hawaiiite. The dikes formed by the mugearite are relatively thin, while the thickness of trachyte dikes can range up to 25 feet.

Following the final Honolua eruptions, a long period of erosion occurred. The flows from the Lahaina Volcanic Series were picrite-basalt which is predominantly phenocrysts of brownish-green olivine.

The project site is located at the base of the West Maui volcanic mountain, near the shoreline, between the Mahinahina Stream and Hoohui Road on Lower Honoapiilani Road.

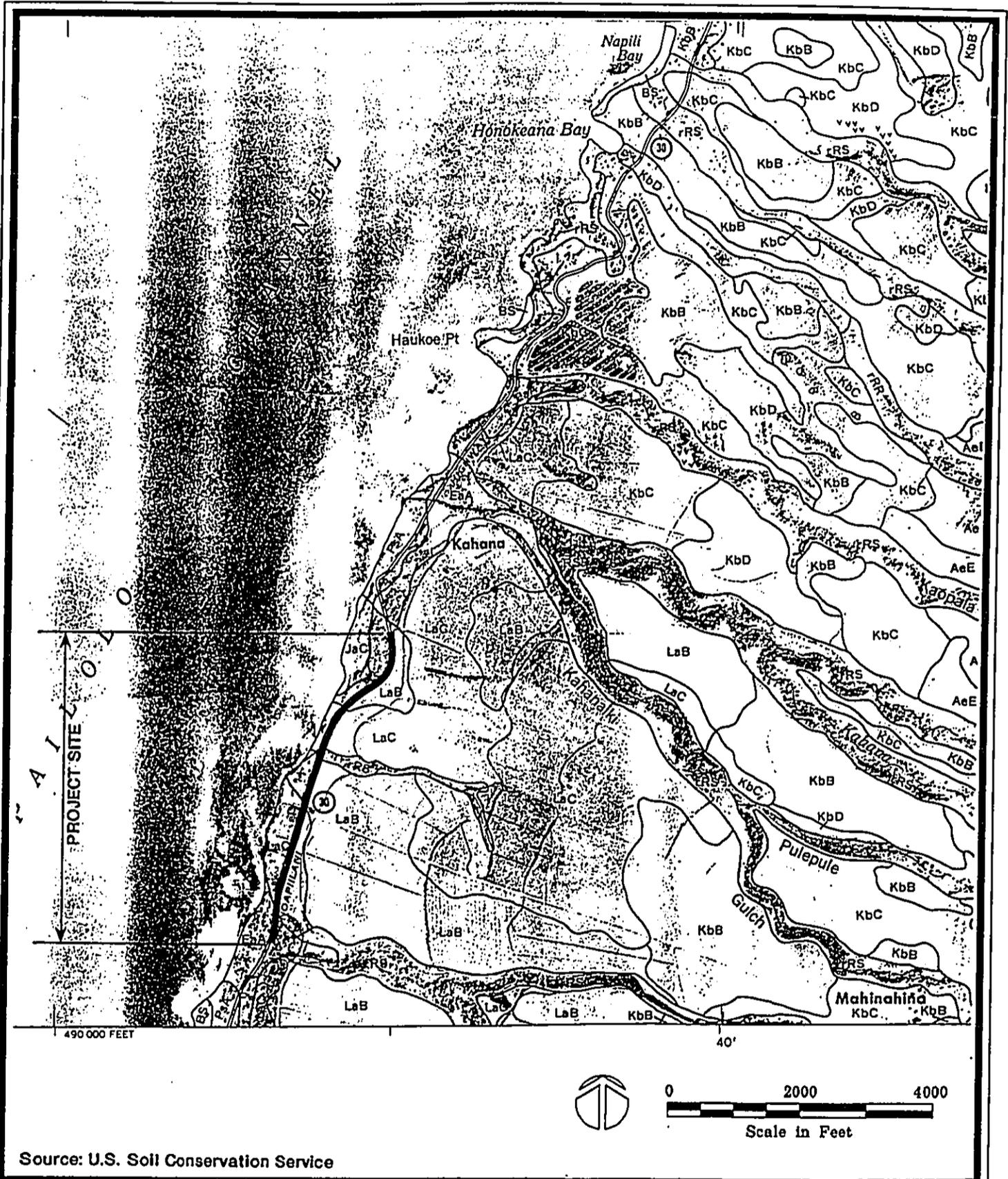
The topography of the project site is generally flat on the northern portion of the project site between the beach park and Hoohui Road. The southern portion of the site is hilly with less than 10 percent slopes. Elevations within the site range from roughly 5 feet MSL to 40 feet MSL.

### 3.2 Soils

The U.S. Department of Agriculture Soil Conservation Service's *Soil Survey of the Island of Kauai, Oahu, Maui, Molokai and Lanai*, classifies soils within the project site as Ewa Silty Clay Loam (EaA), Lahaina Silty Clay (LaC and LaB), and Rough Broken and Stony Land (rRS) as shown in Figure 3-1.

Ewa Silty Clay Loam (EaA). This soil type consists of well-drained soils in basins and on alluvial fans. Runoff is very slow and the erosion hazard is no more than slight with 0 to 3 percent slopes. These soils are used for sugarcane, truck crops, and pasture.

Lahaina Silty Clay (LaB). This soil is located on smooth uplands with 3 to 7 percent slopes. Fragments of coral, stones, gravel or sand are located in some soil profiles near the coastal plains. The surface layer is dark reddish-brown, silty clay about 15 inches thick. The subsoil, about 45 inches thick, is dusty-red and dark reddish-brown subangular blocky silty clay and silty clay loam. The substratum is soft, weathered, basic igneous rock. These soils have medium acidity in the surface layer and are slightly acid to medium acid in the subsoil. Permeability is moderate. Runoff is slow and erosion hazard is slight. The available water capacity is about 1.3 inches per foot in the surface layer and about 1.4 inches per foot in the subsoil. Roots penetrate to a depth of 5 feet or more in certain areas. This soil type is used for sugarcane and pineapple



Source: U.S. Soil Conservation Service

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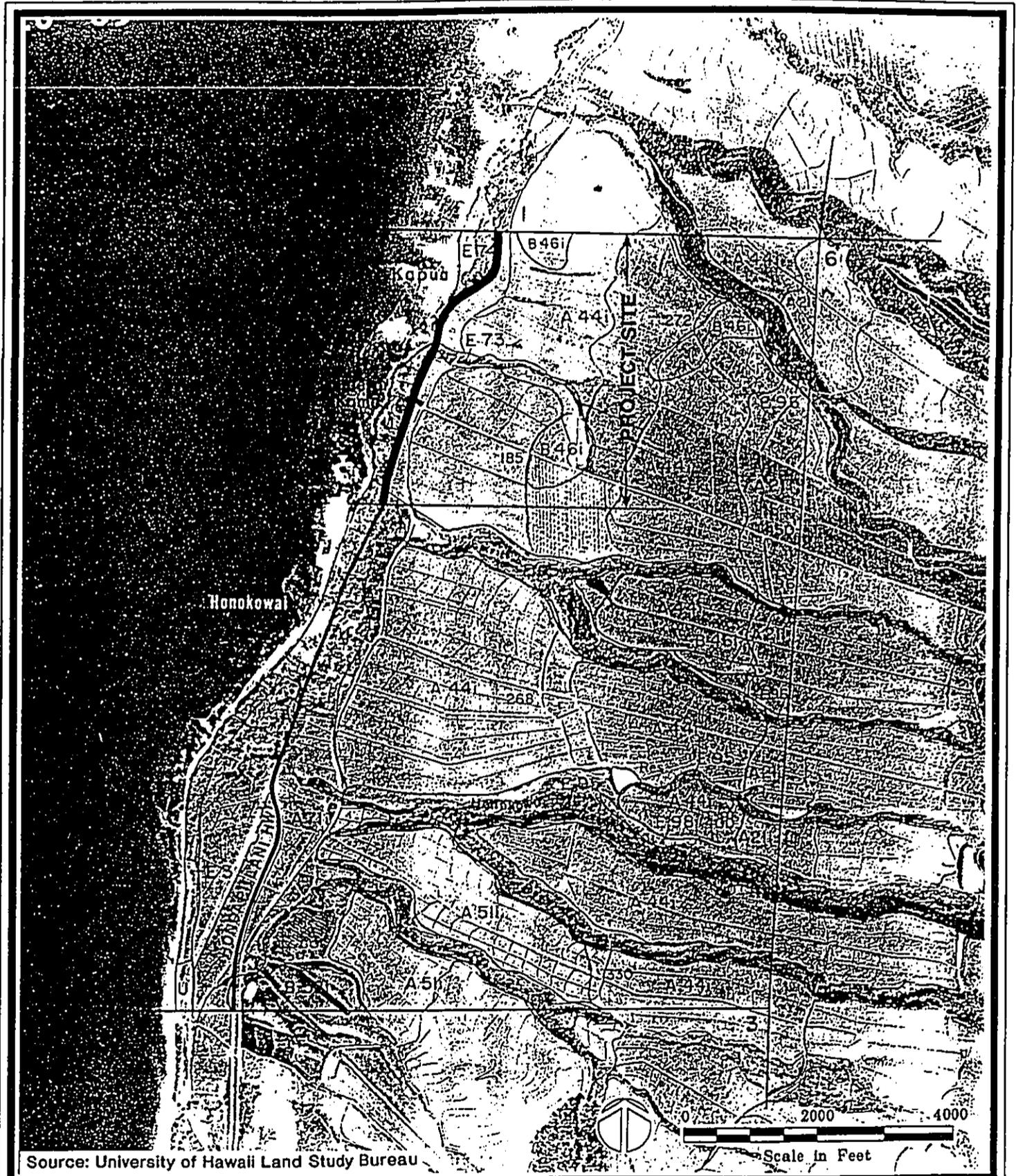
**Fig. 3-1  
SOILS  
CLASSIFICATION  
MAP**

cultivation. Small areas are used for truck crops, pasture, homesites, and wildlife habitat.

Lahaina Silty Clay (LaC). This soil type occurs in areas with 7 to 15 percent slopes. Runoff is medium and erosion hazard is moderate. This soil type occurs on small, steep areas and areas where few cobblestones and stones are on the surface. It consists of well-drained soils used for sugarcane and pineapple. Small areas are used for truck crops, pasture, homesites, and wildlife habitat.

Rough Broken and Stony Land (rRS). This soil type consists of very steep stony gulches with 40 to 70 percent slopes. Runoff is rapid, and geologic erosion is active. The soil material is generally less than 20 inches deep over saprolite or bedrock. About 3 to 25 percent of the surface is covered with stones, and there are a few rock outcrops. This land type is used for pasture, wildlife habitat and watershed.

The University of Hawaii Land Study Bureau *Detailed Land Classification--Island of Maui* classifies soil located on the Mahinahina Stream portion of the project site as E95 (see Figure 3-2), soil which is well-drained, nonstony to rocky and unsuitable for agricultural tilling. The area north of Mahinahina Stream and west of Lower Honoapiilani Road is classified as urban (U). The soil type located northeast of this area, west of Lower Honoapiilani Road, E74, is classified as poorly-drained, nonstony, and poorly suited to agricultural tilling. The soil type classified as I85, stony, well-drained soil, moderately suited to agricultural tilling, is located north of Mahinahina Stream, northeast of Lower Honoapiilani Road. Well-drained, rocky soils which are not suited to agricultural tilling are classified as E73 and are located northeast of the soils classified as I85. Soil which is well-drained, nonstony and well-suited to agricultural tilling, A44i, is located east of Lower Honoapiilani Road at the northernmost portion of the project site.



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Fig. 3-2  
DETAILED LAND  
CLASSIFICATION MAP

### 3.3 Flood Hazard

According to the Federal Insurance Rate Maps (FIRM) administered by the Federal Emergency Management Agency (FEMA), the southern portion of the project site around Mahinahina Stream is classified as Zone A5 and Zone B. (See Figure 3-3). Zone A5 represents areas inundated by a 100-year flood, with base flood elevations determined by FEMA to be 13 to 25 feet. Zone B represents areas between the limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than 1 foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. An approximately 300-linear foot portion of the Lower Honoapiilani Road project site, located oceanside of the sewage pump station, is designated Zone A4, areas inundated by a 100-year flood, with base flood elevations determined to be 13 to 14 feet. The remainder of the project site falls under a Zone C classification, or areas of minimal flooding.

### 3.4 Earthquake Hazard

The island of Maui is classified as a Seismic Zone 2B area by the 1991 *Uniform Building Code*. Zone O is considered to be the least active zone, while Zone 4 is considered to be the most active.

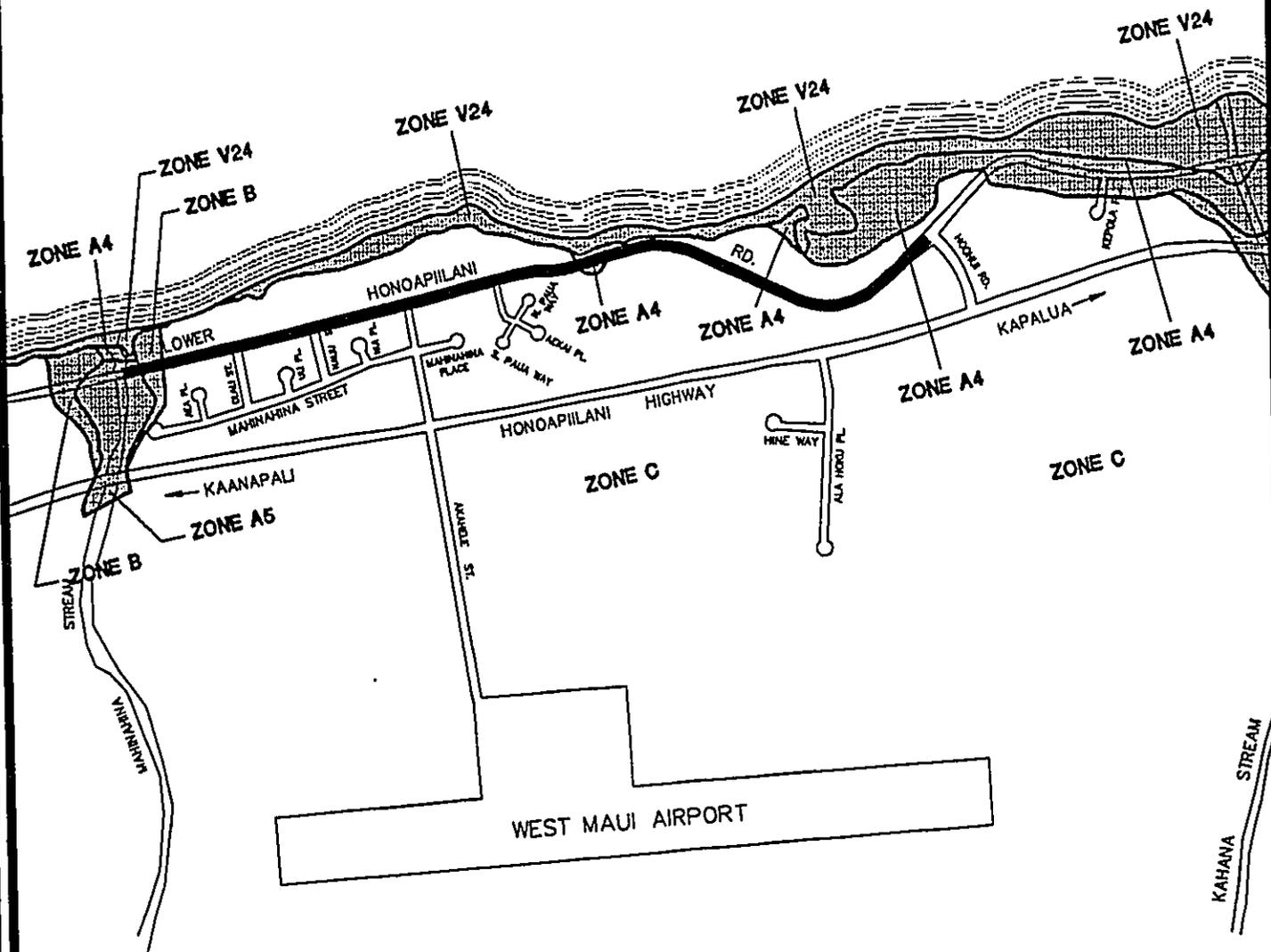
### 3.5 Flora and Fauna

The project site and its surrounding area are developed with roadways, utilities, and landscaping in conjunction with residential, resort and business areas. There is little natural flora in the area, limited to weedy and scrub vegetation in the vicinity of the sewer pump station. Existing wildlife are those common to urbanized areas such as dogs, cats, mongoose, rats, and common birds such as the sparrow, mynah and dove. There are no rare, threatened or endangered species known within the project boundaries.

**LEGEND**

- ZONE A4, A5** Areas of 100-year flood; base flood elevations and flood hazard factors determined.
- ZONE B** Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.
- ZONE C** Areas of minimal flooding.
- ZONE V24** Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.

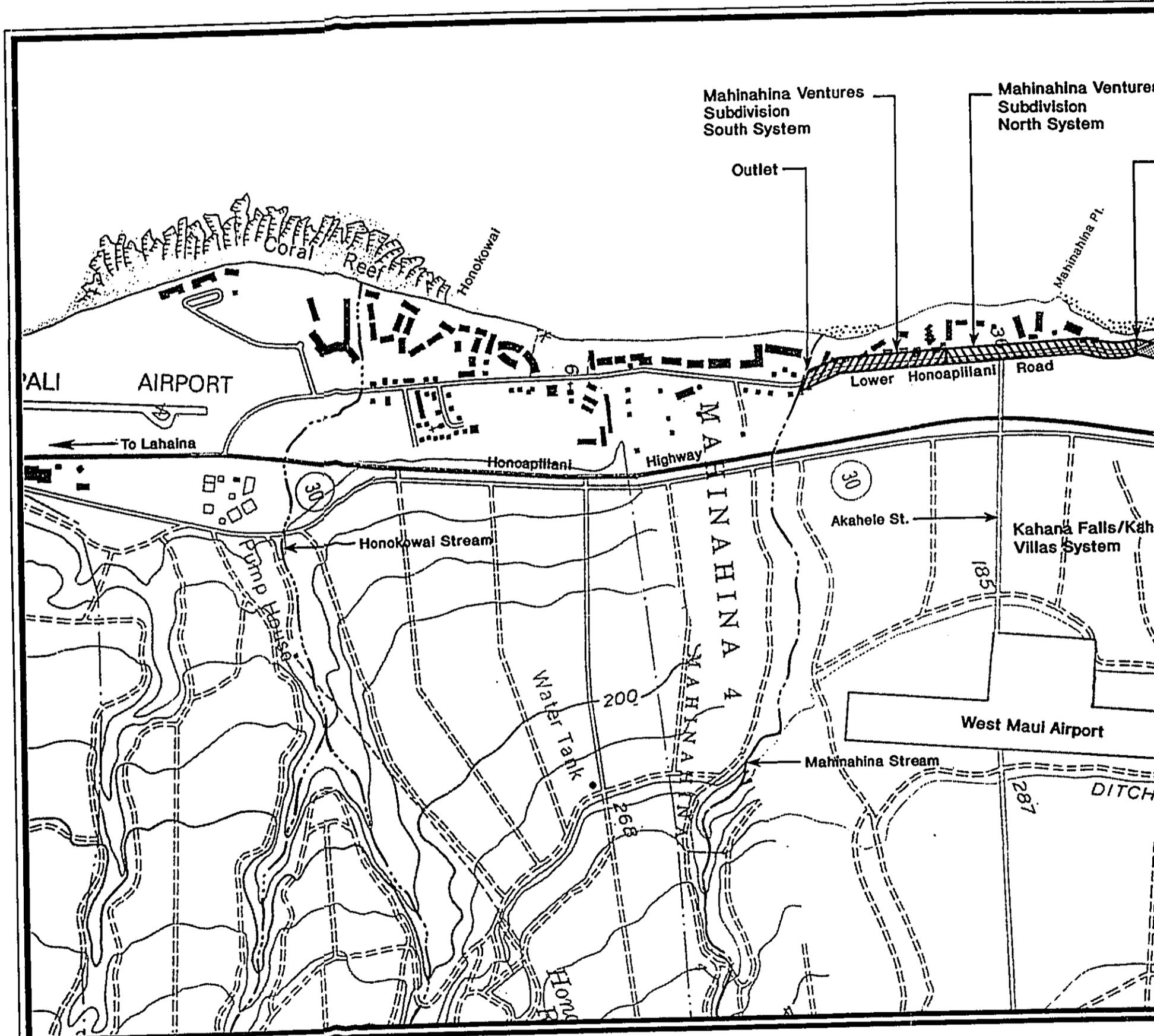
PACIFIC OCEAN



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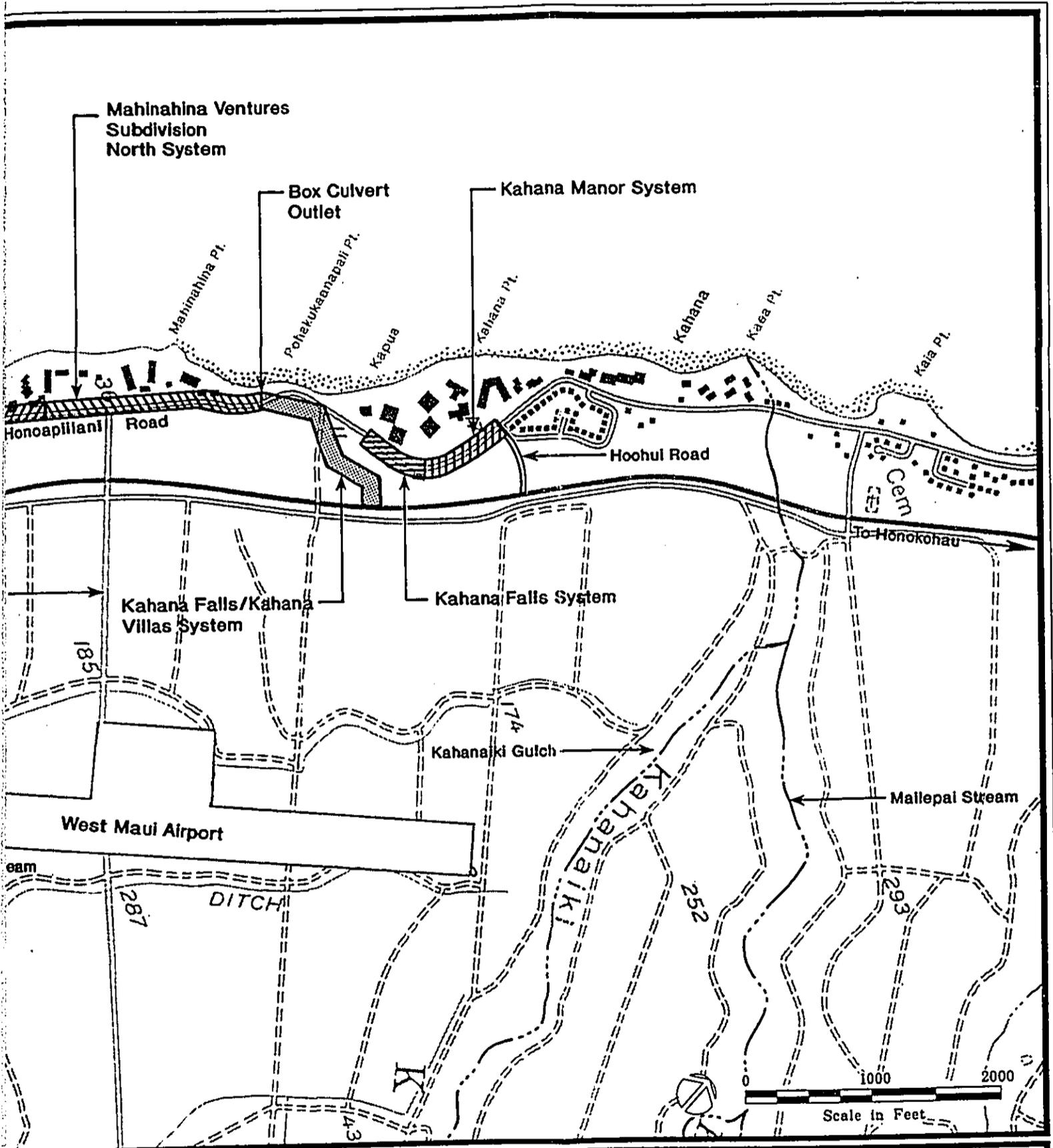
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& Waste Management  
  
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**Fig. 3-3  
FLOOD HAZARD MAP**



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Environmental Assessment  
Lahaina, Maui, Hawaii

**EXISTING DRAINAGE SYSTEM**



<p><b>STEM</b></p>	<p>Prepared for :          County of Maui          Dept. of Public Works          &amp; Waste Management</p> <p>Prepared by :          Wilson Okamoto &amp; Associates, Inc.</p>	<p><b>Fig. 3-4</b></p> <p><b>EXISTING DRAINAGE SYSTEM</b></p>
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A major system extends through Kahana Falls and Kahana Villas and runs roughly parallel to Lower Honoapiilani Road. This system conveys runoff from above the Highway as well as local drainage. The system parallel to Lower Honoapiilani Road consists of 60 and double 60-inch drainlines. These lines also connect to the box culvert at the park.

A smaller system also runs through the Kahana Falls development. This system collects local drainage and conveys it across Lower Honoapiilani Road. Catch basins on either side of the road provide road drainage at this crossing.

Another major system runs through Kahana Manor. This system conveys runoff from across the Highway as local drainage. This system has a 60-inch drainline that crosses Lower Honoapiilani Road to run along the north boundary of the Sands of Kahana. A catch basin to the south of this line is connected by an 18-inch drainline. A 36-inch system that runs along Lower Honoapiilani Road to the north also connects to the 60-inch line. This sub-system drains Hoohui Road and the parcels north of Hoohui Road.

Flow from the Pohakukaanapali watershed which is located above the project area crosses Honoapiilani Highway through a 120-inch culvert and discharges to a lot on the west side of the Highway. This area is undeveloped except for a sewer pump station located along Lower Honoapiilani Road. This area has been identified on the FIRM as Zone A4 (area of 100-year flood) and although a desilting basin above the Highway reduces the sediment load, it does not eliminate flooding.

The primary means for protecting groundwater from pollution is the Underground Injection Control (UIC) program, Title 11 *Hawaii Administrative Rules*. Honoapiilani Highway marks the UIC boundary for the area. Since the project site is located seaward of Honoapiilani Highway, it is exempt from Title 11 of the HAR.

See Appendix for Drainage Report on the proposed roadway improvements.

### 3.8 Climate

Maui's climate varies according to altitude with climatic conditions influenced by leeward/windward locations. Lowland areas tend to have a semi-tropical climate, while higher elevations are characterized by temperate climates. The climate of the Lahaina area is usually sunny throughout the year, with average annual temperatures ranging from 71.5°F during the coolest months to 78.0°F in the warmest months. Relative humidity averages 75 percent. The median annual rainfall in the project area is approximately 20 to 29 inches.

Tradewinds are fairly strong and constant from the northeast direction approximately 70 percent of the time and range in speed from 12 to 15 miles per hour. Topographical features such as hills and trees can alter wind speed and direction, creating turbulence.

### 3.9 Air Quality

Due to its location and the absence of air polluting industries, the air quality is well within the State's ambient air quality standards. In 1992, total suspended particulates in the Lahaina District was tabulated at an average of 13 micrograms of total suspended particulates per day per cubic meter (State of Hawaii Department of Business and economic Development and Tourism).

### 3.10 Population

The County of Maui is the third most populous in the State with a resident population of 113,030 in July 1994 (First Hawaiian Bank, 1995). The resident population in 1990 was 100,504.

The Lahaina District has experienced substantial growth since 1970, when the resident population was 5,524. The population increased by 86.2 percent to 10,284 in 1980, and another 41.7 percent to 14,574 in 1990. Visitor units increased by 193.3 percent from

1,826 units in 1970 to 5,357 units in 1980. In 1990, visitor units in the area numbered 9,285, an increase of 73.3 percent.

According to the proposed *West Maui Community Plan (1995)*, resident population for the year 2010 is projected at 21,149. The number of visitor units is projected to be 31,775 for the same time period.

### 3.11 Economy

The County of Maui's economy is based on tourism and the construction and agricultural industries. Infrastructure developments have been on-going in response to the increased urbanization and population growth which has occurred over the past decade.

In 1994, total visitors to the State were 6,455,000, 5.4 percent above 1993. Through 1994, Maui's hotel occupancy rate was 0.8 percent higher than in 1993 (DBEDT, 1995).

The construction industry has showed a general decline on Maui in the last several years. However, in the last year, construction put-in-place increased 0.5 percent to \$208 million. Public contracts awarded through the same period increased by 42.3 percent to \$101 million. Private permits increased slightly by 2.0 percent to \$203 million in 1993.

Maui's pineapple, diversified crops and livestock have experienced an approximately 9 percent growth from 1990 to 1991. For the same period, Maui's sugar industry experienced an approximately 9 percent decline in production.

#### 4. RELATIONSHIP TO PLANS, POLICIES AND CONTROLS

##### 4.1 State Land Use District

Pursuant to Chapter 205, Hawaii Revised Statutes (HRS), all lands in the State of Hawaii are classified into one of four land use designations: Urban, Rural, Agricultural, and Conservation. The proposed roadway improvements are located within lands designated for Urban use (see Figure 4-1). The proposed improvements are compatible with the Urban District designation.

##### 4.2 County of Maui General Plan

The County of Maui General Plan is a narrative document which sets forth strategies to shape the County's physical, social and economic environments. These strategies are expressed as statements of objectives and policies which are used by the County in decision-making and in developing and implementing plans and programs.

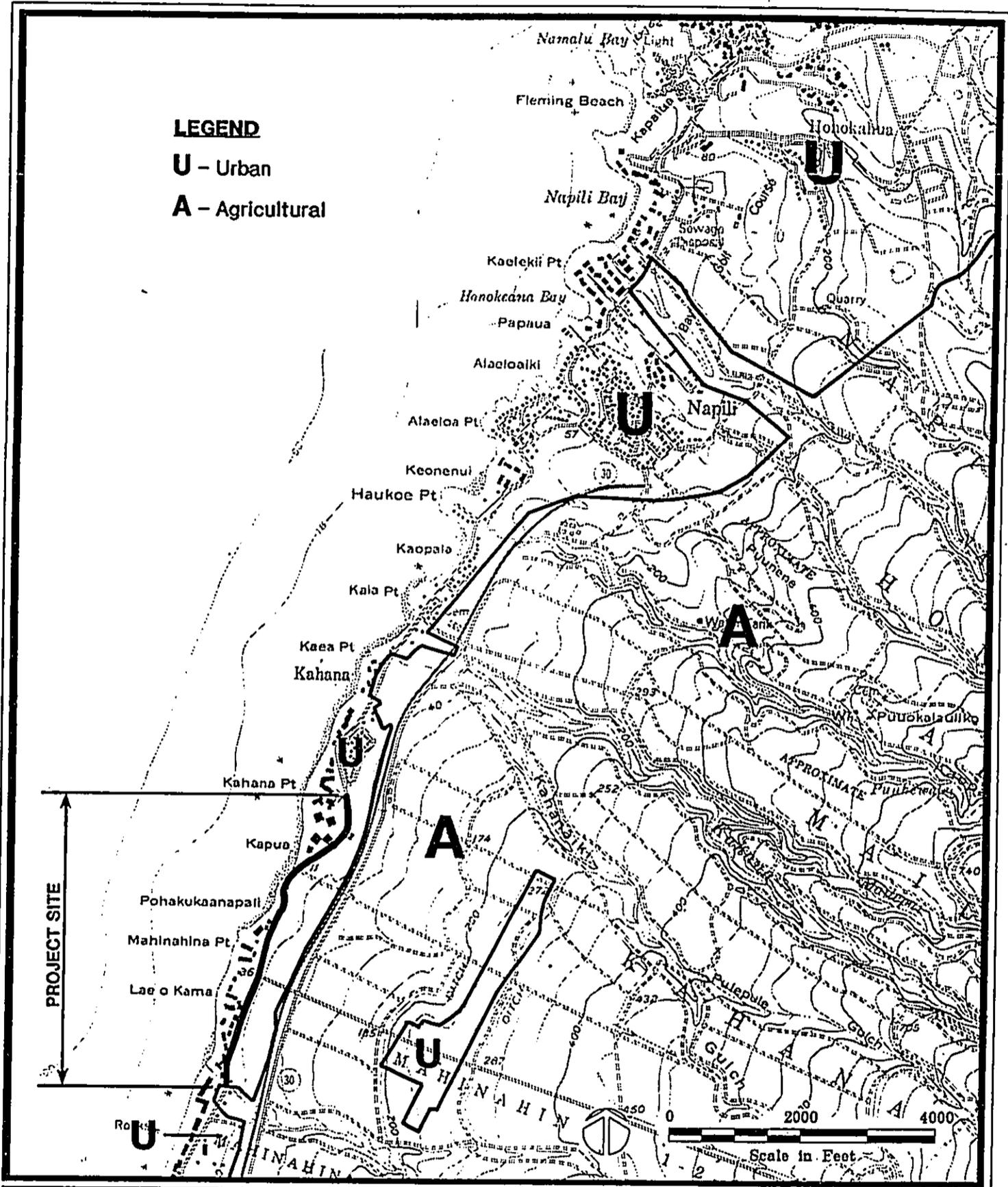
The following County of Maui goal, objective and policy concern the proposed improvements:

##### TRANSPORTATION

**GOAL:** *To perpetuate the rural scale of Maui County's highway and street systems and significantly improve their functional and visual quality, while planning for timely development, greater efficiency and creative alternatives to automobile dependency.*

**OBJECTIVE:** *To develop a program for anticipating and enlarging our local street and highway systems in a timely response to planned growth.*

**POLICY:** *Ensure that transportation facilities are anticipated and programmed for construction in order to support planned growth.*



**LOWER HONOAPIILANI ROAD  
 IMPROVEMENTS PHASE III**  
 Environmental Assessment  
 Lahaina, Maui, Hawaii

Prepared for :  
 County of Maui  
 Dept. of Public Works  
 & Waste Management  
 Prepared by :  
 Wilson Okamoto & Associates, Inc.

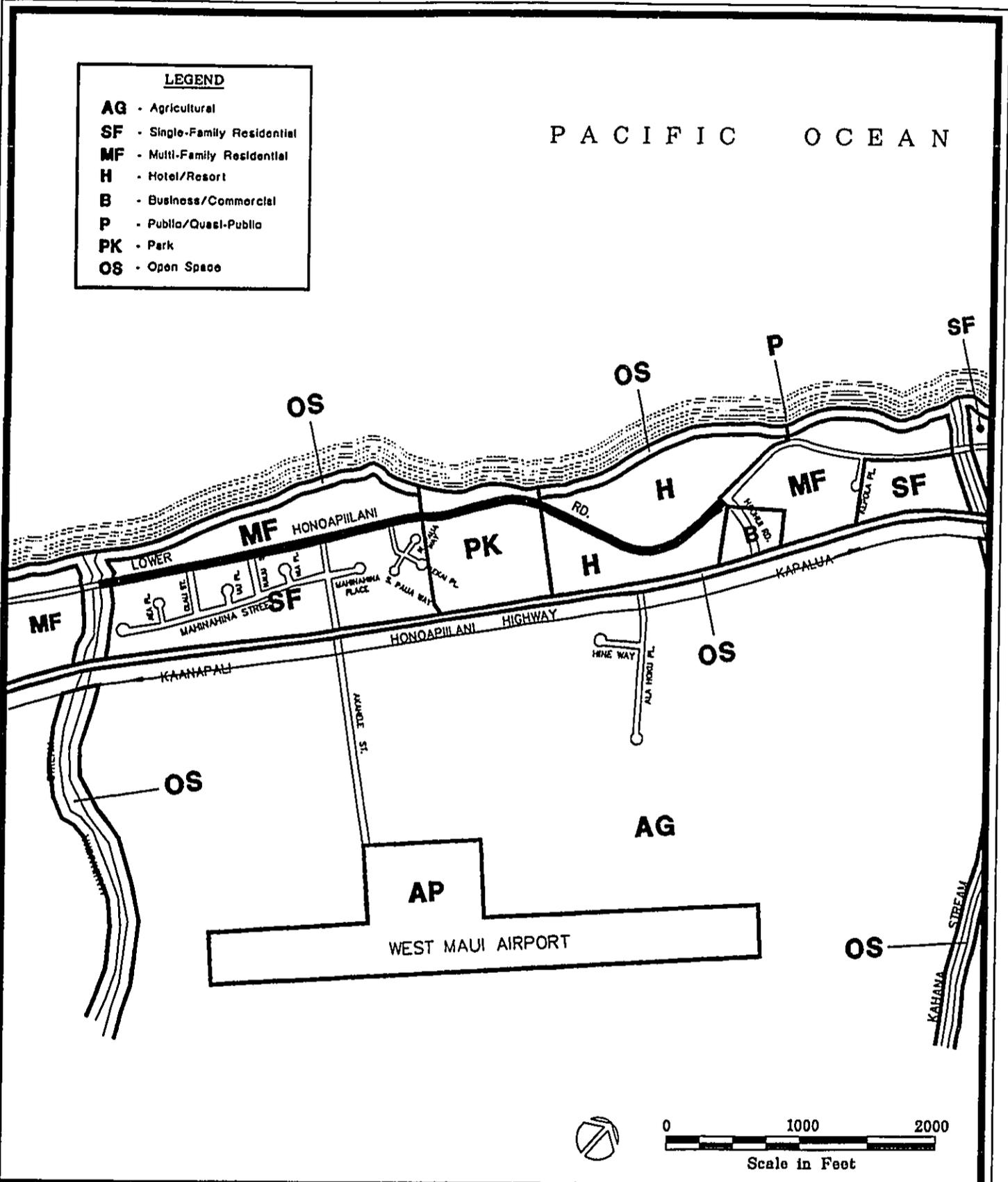
**Fig. 4-1  
 LAND USE MAP**

The proposed project is located within the Lahaina District which has experienced substantial growth since 1970. The population in the area has continued to increase by 86.2 percent to 10,284 in 1980, and another 41.7 percent to 14,574 in 1990. Improvements such as on-street parking, and resurfacing and replacement of pavement, new concrete curbing and sidewalks at specified locations, are proposed to accommodate the increased traffic generated by the area's growing population.

#### 4.3 Lahaina Community Plan

The Lahaina Community Plan, adopted in December 1983, is the primary decision making tool used by the County for implementing the County General Plan. The Lahaina Community Plan land use map designates land uses within the project site as Single-Family Residential (SF), Multi-Family Residential (MF), Hotel/Resort (H), Business/Commercial (B), Park (PK) and Open Space (OS) (see Figure 4-2). The use of the site for improvements to the existing Lower Honoapiilani Road would be in accord with the Lahaina Community Plan's designations. The proposed improvements will provide safer and more efficient access to adjacent areas.

Proceedings are underway to update the 1983 Lahaina Community Plan with the 1995 West Maui Community Plan. The West Maui Community Plan proposes redesignation of approximately 11 acres of land (TMK 4-3-9: 52) located within the project site from Park (PK) to Single-Family Residential (SF) for the Napili Regional Park Employee Housing. Except for a sewer pump station, the parcel is undeveloped.



**LOWER HONOAPIILANI ROAD IMPROVEMENTS PHASE III**  
**Environmental Assessment**  
 Lahaina, Maui, Hawaii

Prepared for:  
 County of Maui  
 Dept. of Public Works  
 & Waste Management

Prepared by:  
 Wilson Okamoto & Associates, Inc.

**Fig. 4-2**  
**LAHAINA COMMUNITY PLAN MAP**

#### 4.4 Zoning

The County of Maui's zoning designations are provided to encourage the most appropriate use of land; conserve and stabilize property value; prevent certain uses that are detrimental to existing uses; and promote the health, safety and the general welfare of the district. The following are designations within the proposed project area: A-1, A-2 Apartment; B-2, Business; H-2 and H-M, Hotel; and R-2 and R-3 Residential (see Figure 4-3).

#### 4.5 Coastal Zone Management Program

The State of Hawaii Coastal Zone Management (CZM) Program, Chapter 205A, HRS, provides for the beneficial use, protection, and development of Hawaii's coastal zone. The objectives and policies of the CZM Program cover seven areas, which relate to the proposed improvements as follows:

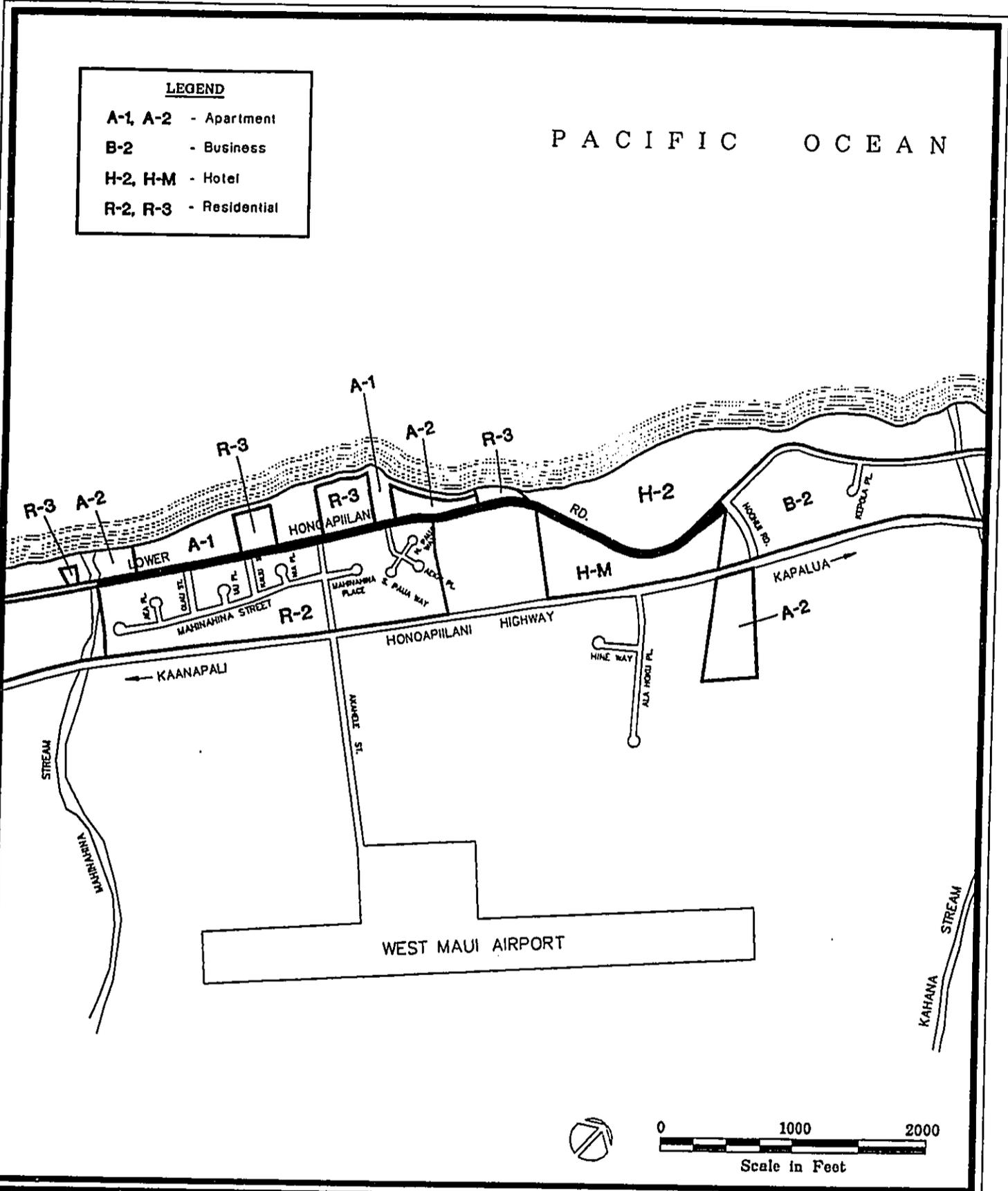
##### Recreational Resources:

##### Objective:

*Provide coastal recreational opportunities accessible to the public.*

##### Policies:

- (B) *Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:*
  - (iii) *Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value.*
  - (iv) *Adopting water quality standards and regulating point and nonpoint sources of pollution to protect and where feasible, restore the recreational value of coastal waters.*



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IMPROVEMENTS PHASE III**  
Environmental Assessment  
Lahaina, Maui, Hawaii

Prepared for :  
County of Maui  
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& Waste Management

Prepared by :  
Wilson Okamoto & Associates, Inc.

**Fig. 4-3  
ZONING MAP**

The project site provides direct access to the nearby shoreline and beach recreational areas. The proposed project will improve pedestrian and vehicular access to these areas. Project improvements also include the addition of a drainage system in conformance with water quality standards to improve current drainage conditions as well as provide adequate service for future developments within the area.

Historic Resources:

Objective:

*Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.*

Policy:

(C) *Support state goals for protection, restoration, interpretation, and display of historic resources.*

The project site is not part of the Maui County Historic District. The existence of natural landmarks is not anticipated since the site is considered to be significantly disturbed by existing developments. However, if an archaeological site is discovered during construction, activity in the immediate area shall cease and the State Department of Land and Natural Resources Historic Preservation Division and appropriate agencies will be notified immediately. Archaeological data recovery work recommended by the Division shall be completed by a qualified archaeologist prior to commencement of work in the area. Completion of mitigative work shall be confirmed by the Division and a report of findings shall be prepared and submitted for review and acceptance in accordance with the HRS 6E-43.6.

Scenic and Open Space Resources:

Objective:

*Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.*

Policy:

- (C) *Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources.*

The project will improve a portion of the existing Lower Honoapiilani Road located near or adjacent to the shoreline. The project's design provides a pleasing and inviting pedestrian areas and street frontages which will promote a more compatible working, residential and recreational environment.

Coastal Ecosystems:

Objective:

*Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.*

Policy:

- (D) *Promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate state water quality standards.*

The proposed project will adhere to all County of Maui, State of Hawaii and Federal water quality standards. The following permits and approvals will be sought to mitigate the potential for adverse impacts to the coastal ecosystem:

- o County of Maui - Special Management Area (SMA) Permit
- o County of Maui - Shoreline Setback Variance (SSV)
- o County of Maui - Grading/Grubbing Permit

- o State of Hawaii Department of Health - National Pollutant Discharge Elimination System (NPDES) Permit

Economic Uses:

Objective:

*Provide public or private facilities and improvements important to the State's economy in suitable locations.*

Policy:

- (C) *Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas...*

The proposed improvements will create short-term and some indirectly related long-term employment opportunities. Short-term employment will be available during the construction period. In the long-term, increased social and economic opportunities will result with the development of an improved roadway system (additional parking and improved walkways) and drainage infrastructure to accommodate existing and future businesses, residents and visitors of the area.

Coastal Hazards:

Objective:

*Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence.*

Policy:

- (A) *Develop and communicate adequate information on storm wave, tsunami, flood, erosion, and subsidence hazard.*

Portions of the proposed improvements are located within Zones A5 and B, areas inundated by a 100-year flood, with base flood elevations of 13 to 25 feet and 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than 1 foot or where the contributing drainage area is less than one square mile; or areas protected from levees from the base flood, respectively. Portions of the project site is located in Zone A4, areas inundated by a 100-year flood, with base flood elevations determined to be 13 to 14 feet.

The proposed improvements will not significantly affect existing tsunami, storm waves, stream flooding, erosion and subsidence conditions.

Managing Development:

Objective:

*Improve the development review process, communication, and public participation in the management of coastal resources and hazards.*

Policies:

- (C) *Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life-cycle and in terms understandable to the general public to facilitate public participation in the planning and review process.*

The proposed improvements may temporarily inconvenience businesses, residents and visitors of the area during utility hookups and in the event of lane closure during construction. However, no adverse long-term impacts are anticipated as a result of the project.

Public Participation:

Objective:

*Stimulate public awareness, education, and participation in coastal management.*

The public participation objectives will be addressed during the processing of the Special Management Area Permit by the County of Maui for the road improvements, including notice and public hearings.

Beach Protection:

Objective:

*Protect beaches for public use and recreation.*

Policies:

- (A) *Locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;*
- (C) *Minimize the construction of public erosion-protection structures seaward of the shoreline.*

A new drainage culvert will need to be constructed to outlet at the shoreline, but the outlet will be placed in a rocky section of the shoreline which would not be subject to erosion.

Marine Resources:

Objective:

*Implement the State's ocean resources management plan.*

Policy:

- (B) *Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial.*

The proposed road improvements will not adversely affect the environmental and economic character of the area's coastal resources.

#### 4.6 Special Management Area

The Special Management Area (SMA) Rules and Regulations of the County of Maui were established to regulate development along the shoreline in order to preserve, protect and where possible, restore the natural resources of the coastal zone.

The project site is located within the boundaries established pursuant to the County of Maui's SMA rules and regulations and the State Coastal Zone Management Law. The SMA boundary in the project area is located seaward of Honoapiilani Highway. An SMA Use permit will be required for the proposed project.

Specific SMA guidelines are discussed as follows:

*All development in the special management area shall be subject to reasonable terms and conditions set by the authority in order to ensure:*

- (A) *Adequate access, by dedication or other means, to publicly owned or used beaches, recreation areas, and natural reserves is provided to the extent consistent with sound conservation principles.*

Lower Honoapiilani Road provides direct access to the shoreline and a beach park located within the project area. Shoreline accessibility will be enhanced by the proposed road improvements.

- (B) *Adequate and properly located public recreation areas and wildlife preserves are reserved.*

Existing public recreational areas have been established and will not be adversely impacted by the proposed improvements.

- (C) *Provisions are made for solid and liquid waste treatment, disposition, and management which will minimize adverse effects upon special management area resources.*

The project is not expected to generate solid waste requiring treatment. Adverse effects resulting from dewatering or hydrotesting will be mitigated in accordance with National Pollutant Discharge Elimination System (NPDES) guidelines for treatment and disposal of liquid waste.

- (D) *Alterations to existing land forms and vegetation, except crops, and construction of structures shall cause minimum adverse effect to water resources and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of earthquake.*

Earthwork operations for the improvements will temporarily remove vegetative cover along most of the roadway shoulder and on portions of adjacent parcels during earthwork operations. Improvements including landscaping or paving will be provided to mitigate any adverse effects to water resources caused by runoff.

The proposed action is not expected to generate any significant adverse impacts on the environment. No potential cumulative impacts are expected from the development.

#### 4.7 Shoreline Setback Variance

The State of Hawaii's Shoreline Setback Law, Chapter 205, HRS prohibits development of shoreline structures located within 40 feet of the shoreline without a Shoreline Setback Variance (SSV) from the County. A Shoreline Setback Variance will be pursued from the County of Maui Planning Department as may be required. A small portion of the roadway improvements are in proximity to the shoreline, notably where the sewer pump station is located and proposed new box drain and drain outlet are to be constructed.

## 5. POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

### 5.1 Short-Term Impacts

Short-term impacts are those associated with construction activities such as removing vegetation, grading, excavation and construction. Short-term impacts associated with these construction activities include potential impacts on water quality and soils, flora and fauna, archaeological resources, noise, air quality, traffic and utilities.

#### 5.1.1 Water Quality and Soils

Clearing and grading operations at the project site will temporarily expose the underlying soil to rain. However, no significant impacts on water quality are anticipated during development of the project site from erosion or surface runoff.

Discharge from hydrotesting procedures is also expected for relocated waterlines. All discharged water shall be in compliance with State of Hawaii Department of Health National Pollutant Discharge Elimination System (NPDES) standards, County of Maui and federal regulations.

#### 5.1.2 Flora and Fauna

Earthwork operations for the proposed improvements will temporarily remove vegetative cover along the roadway shoulder and on portions of adjacent parcels during earthwork operations. However, there are no Federal or State of Hawaii listed or candidate threatened or endangered species of flora or fauna on the project site. No significant impacts to flora or fauna are expected as a result of the proposed project construction.

### 5.1.3 Archaeological Resources

The project site is entirely developed and the presence of archaeological resources is unlikely. However, if an archaeological site is discovered during construction, activity in the immediate area shall cease and the State Department of Land and Natural Resources Historic Preservation Division and appropriate agencies will be notified immediately. Archaeological data recovery work recommended by the Division shall be completed by a qualified archaeologist prior to commencement of work in the area. Completion of mitigative work shall be confirmed by the Division and a report of findings shall be prepared and submitted for review and acceptance in accordance with the Chapter 6E-43.6, HRS.

### 5.1.4 Noise

A temporary increase in local noise levels can be anticipated during construction of the facilities. Since a significant portion of the area around the project site is primarily in residential and resort use, all efforts will be made to minimize noise impacts from construction-related activities. Sources of noise include construction vehicles and equipment operating to, from and on the site.

Mitigative measures include compliance with the State Department of Health Administrative Rules on Vehicular Noise Control for Oahu (Title 11, Chapter 42) and Community Noise Control for Oahu (Title 11, Chapter 43). The State of Hawaii Department of Health's noise control regulation requires a permit for construction activities which emit noise in excess of 95 dB. Other mitigation measures to minimize construction noise include the use of muffled equipment and adherence to the guidelines for the hours of heavy equipment operation as set forth by the State Department of Health noise control regulations.

#### 5.1.5 Air Quality

Ambient air quality is expected to temporarily decline in the immediate vicinity during construction due to dust and emissions from construction vehicles and equipment.

The short-term effects on air quality during construction will be mitigated by compliance with the Department of Health Administrative Rules, Title 11, Chapter 60, Air Pollution Control. Control measures to reduce fugitive dust include frequent wetting down of loose soil areas with water, use of wind screens, covering of open-bodied trucks during materials transport, and the washing down of roads and tires on construction equipment. Establishment of landscaping early in the construction schedule will also help to control dust.

#### 5.1.6 Traffic

Due to the ingress and egress of construction workers and materials, there will be a slight temporary increase in local traffic along Lower Honoapiilani Road during the construction period. Visitors and residents may be temporarily inconvenienced by re-routing of traffic in the immediate area of construction. Access to residential dwellings and businesses may be temporarily affected due to construction on certain driveways.

#### 5.1.7 Utilities

Water. Existing water lines along the project site include a 16-inch and an 8-inch line. Water line segments may need to be relocated so that the new drainage system can be installed. After relocation of the waterlines, the lines will be flushed and tested prior to distribution to ensure potable water quality.

Sewer. The sewer line is located at a significant depth beneath Lower Honoapiilani Road such that it is not expected to be affected by project improvements.

Electrical. Electrical lines may need to be relocated as a result of roadway improvements. Electrical relocation will be done in accordance with Maui Electrical Company, Inc. requirements with minimal disruption to services.

Telephone.

Telephone lines may also need to be relocated. Telephone line relocation will be in accordance with Maui Telephone Company, Inc. requirements with minimal disruption to service.

## 5.2 Long-Term Impacts

Long-term impacts are those associated with the operation and maintenance of the improved roadway. They include potential impacts on noise, air quality, economy, traffic, water and drainage.

### 5.2.1 Noise

Long-term noise quality will not be significantly altered by the proposed project. No adverse impacts are anticipated on any current or future noise-sensitive uses.

### 5.2.2 Air Quality

No adverse long-term air quality conditions generated by the project are anticipated. However, the proposed road improvements are expected to improve traffic flow within the area, reducing traffic congestion. This is anticipated to result in improved air quality for the area.

### 5.2.3 Economy

Economic impacts involve acquisition of portions of parcels adjoining the existing roadway for constructing road shoulders and other improvements. These parcels include small portions of land with existing trees, shrubbery, garden walls and driveways.

Roadway improvements may indirectly increase sales for businesses in the area by providing greater accessibility from roadway improvements. No significant adverse long-term impacts from roadway improvements are anticipated.

### 5.2.4 Traffic

Vehicular traffic may be increased as a result of the road improvements. However, any increase is expected to be negligible since the area is already built-up.

### 5.2.5 Water Quality

No significant long-term impacts on water quality are anticipated as a result of the proposed improvements. However, the following permits will be obtained for the proposed improvements to further ensure conformance to water quality standards:

- o County of Maui - Special Management Area (SMA) Permit
- o State of Hawaii Department of Health - National Pollutant Discharge Elimination System (NPDES) Permit

### 5.2.6 Drainage System

The proposed roadway improvements are anticipated to increase rainfall runoff very slightly by increasing the roadway pavement area. Runoff from the site will be accommodated by existing sheetflow patterns and the proposed drainage improvements. See Appendix for proposed drainage improvements.

### 5.3 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitment of resources involve construction materials, funds and human resources used during the design and construction of the project. Air and noise quality will be affected from construction activities. However, these impacts will be minimized through compliance with applicable Federal, State and County standards.

## 6. ALTERNATIVES TO THE PROPOSED ACTION

Alternatives to the proposed project are "no action" and "delayed action". The consequences for both alternatives are not favorable since road and drainage improvements along Lower Honoapiilani Road are needed.

### 6.1 No Action Alternative

A "no action" alternative will not be practical or beneficial for motorists and the community. The deteriorating conditions of the project site warrant the need for improvements. These improvements are needed to accommodate increasing traffic, improve insufficient drainage infrastructure, and to provide safer pedestrian travel. If the "no action" alternative is implemented, the problems with traffic, drainage and pedestrian safety will persist. The existing roadway will be unable to provide adequate access for the growing community. The "no action" alternative is not a feasible option to the development of the proposed project.

### 6.2 Delayed Action Alternative

A "delayed action" alternative will have similar consequences as a "no action" alternative. The problems with traffic, drainage and pedestrian safety will continue to increase. Delaying improvements to the site could also result in higher construction costs from inflation.

**7. AGENCIES CONSULTED IN THE PREPARATION OF THE FINAL EA**

County of Maui

County of Maui Public Works and Waste Management  
Engineering Division  
County of Maui Public Works and Waste Management  
Land Use and Codes Administration  
County of Maui Planning Department

State of Hawaii

Department of Transportation  
Highways Division  
Department of Health  
Environmental Management Division - Clean Water Branch  
Office of Environment and Quality Control

Federal

Department of the Army  
U.S. Army Corps of Engineers

Other

Maui Electric Company  
Hawaiian Telephone Company, Inc.  
Gasco  
Hawaiian Cablevision  
Destination Maui, Inc.

**FINAL EA DISTRIBUTION LIST**

County

Department of Public Works  
County of Maui  
200 South High Street  
Wailuku, Hawaii 96793

Planning Department  
County of Maui  
250 South High Street  
Wailuku, Hawaii 96793

Department of Parks and Recreation  
County of Maui  
1580 C Kaahumanu Avenue  
Wailuku, Hawaii 96793

Economic Development Agency  
County of Maui  
200 South High Street  
Wailuku, Hawaii 96793

Councilmember Alice L. Lee  
County of Maui  
200 South High Street  
Wailuku, Hawaii 96793

State

Department of Agriculture  
State of Hawaii  
1428 South King Street  
Honolulu, Hawaii 96814

Department of Business,  
Economic Development and Tourism  
State of Hawaii  
250 South King Street, 9th Floor  
Honolulu, Hawaii 96813

Department of Land and Natural Resources  
State of Hawaii  
1151 Punchbowl Street  
Honolulu, Hawaii 96813

State Historic Preservation Division  
Department of Land and Natural Resources  
State of Hawaii  
33 South King Street, 6th Floor  
Honolulu, Hawaii 96813

Department of Health  
State of Hawaii  
1251 Punchbowl Street  
Honolulu, Hawaii 96813

Department of Health  
Environmental Mgmt. Division  
State of Hawaii  
919 Ala Moana Boulevard, 3rd Floor  
Honolulu, Hawaii 96813

Department of Transportation  
State of Hawaii  
869 Punchbowl Street  
Honolulu, Hawaii 96813

Office of State Planning  
State of Hawaii  
415 S. Beretania Street, Room 409  
Honolulu, Hawaii 96813

Department of Hawaiian Home Lands  
State of Hawaii  
335 Merchant Street  
Honolulu, Hawaii 96813

University of Hawaii  
Water Resources Research Center  
2540 Dole Street, Holmes Hall 283  
Honolulu, Hawaii 96822

University of Hawaii  
Environmental Center  
2550 Campus Road, Crawford 317  
Honolulu, Hawaii 96822

Federal

U.S. Department of Agriculture  
Soil Conservation Service  
PO Box 50004  
300 Ala Moana Boulevard  
Honolulu, Hawaii 96850

U.S. Army Corps of Engineers  
Pacific Ocean Division  
CEPOD-ET-E, Building T-1  
Fort Shafter, Hawaii 96858

U.S. Department of the Interior  
Fish and Wildlife Services  
Ecological Services-Pacific Island Office  
300 Ala Moana Boulevard, Room 3108  
Box 50088  
Honolulu, Hawaii 96850

**8. NEGATIVE DECLARATION DETERMINATION**

No significant adverse impacts are anticipated as a result of the proposed project. Therefore, a negative declaration is anticipated for the proposed Lower Honoapiilani Road, Phase III project.

Potential short-term impacts are associated with construction activities and include potential impacts on water quality and soils, flora and fauna, archaeological resources, noise, air quality, traffic and utilities. The impacts will be minimized by mitigation measures discussed in Section 5 Impacts and Mitigation Measures. No adverse long-term impacts are anticipated.

The proposed project is expected to improve accessibility, drainage, air quality and economy for the area.

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U.S. Department of Agriculture Soil Conservation Service. *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*. August 1972.

Wilson Okamoto & Associates, Inc. *Maui Community Plan Update - Infrastructure Assessment*. Prepared for County of Maui Planning Department. September 1992.

**APPENDIX A**

Agency/Public Comments  
on Draft EA

LINDA CROCKETT LINGLE  
Mayor

CHARLES JENCKS  
Director

DAVID C. GOODE  
Deputy Director

AARON SHINMOTO, P.E.  
Chief Staff Engineer



COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS  
AND WASTE MANAGEMENT  
200 SOUTH HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.  
Land Use and Codes Administration

EASSIE MILLER, P.E.  
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.  
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.  
Highways Division

June 24, 1996

Mr. Ken Kaneshiro, State Conservationist  
U.S. Department of Agriculture  
Soil Conservation Service  
P.O. Box 50004  
300 Ala Moana Boulevard  
Honolulu, Hawaii 96850

SUBJECT: LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE III  
DRAFT ENVIRONMENTAL ASSESSMENT  
TMK: 4-3-06: POR. 41, 4-3-08: POR. 83 & 84, 4-3-10: POR. 5 & 6  
LAHAINA, MAUI, HAWAII

Dear Mr. Kaneshiro:

Thank you for your review on the Draft Environmental Assessment for the subject project. This is to acknowledge your indication of no comments on the proposed road improvements.

If you have any questions please call Joe Krueger at 243-7745.

Very truly yours,

  
LLOYD LEE  
Engineering Division Chief

LL/WOA:c(ED96-710)  
RESP-LTR.DEA

xc: Gary Gill, OEQC  
Rodney Funakoshi, WOA



United States  
Department of  
Agriculture

Natural  
Resources  
Conservation  
Service

P. O. Box 50004  
Honolulu, HI  
96850-0001

April 30, 1996

Mr. Joe Kruger  
County of Maui  
Department of Public Works and Waste Management  
Engineering Division  
200 South High Street  
Wailuku, Hawaii 96793

RECEIVED  
MAY 01 1996

WILSON OKAMOTO & ASSOC., INC

Dear Mr. Kruger:

Subject: Draft Environmental Assessment (DEA) - Lower Honoapiilani Road Improvements,  
Phase III, Lahaina, Maui, Hawaii

We have reviewed the above-mentioned document and have no comments to offer at this time.

We thank you for the opportunity to review this document.

Sincerely,

KENNETH M. KANESHIRO  
State Conservationist

cc:

Mr. Gary Gill, Director, Office of Environmental Quality Control, State of Hawaii,  
220 South King Street, 4th Floor, Honolulu, Hawaii 96813

Mr. Rodney Funakoshi, Project Planner, Wilson Okamoto & Associates, Inc.,  
1907 South Beretania Street, Suite 400, Honolulu, Hawaii 96826

The Natural Resources Conservation Service  
formerly the Soil Conservation Service, works  
hand-in-hand with the American people to  
conserve natural resources on public lands.



**DEPARTMENT OF BUSINESS,  
ECONOMIC DEVELOPMENT & TOURISM**

BENJAMIN J. CAYETANO  
Governor  
SEIJI F. NAYA  
Director  
RICK EGGED  
Deputy Director

No. 1 Capital District, 250 South Hotel Street, 5th Floor, Honolulu, Hawaii 96813  
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 586-2355  
Fax: (808) 586-2377

April 26, 1996

Mr. Joe Kruger  
County of Maui  
Department of Public Works and Waste Management  
Engineering Division  
200 South High Street  
Wailuku, Hawaii 96793

**RECEIVED**  
MAY 16 1996

WILSON OKAMOTO & ASSOC., INC.

Dear Mr. Kruger:

Subject: Draft Environmental Assessment for Lower Honoapiilani Road  
Improvements, Phase III Lahaina, Maui

Thank you for the opportunity to review and comment on the Draft Environmental Assessment for the subject project. The proposed project involves roadway and drainage improvements for an approximately one-mile portion of Lower Honoapiilani Road to provide for improved driving conditions, safer walkways and improved drainage. Proposed improvements include widening and resurfacing of the roadway, construction of surface drainage improvements, addition of a new subsurface drainage collection system, relocation of utilities and construction of new sidewalks and concrete curbs.

The Draft Environmental Assessment does not indicate that any landscaping will be provided as part of the project. It would be useful if the plan for the proposed improvements would include the provision of appropriate landscaping (i.e., trees and shrubs) where possible in order to enhance the area.

Also, please note that the Department of Business, Economic Development and Tourism's mailing address has changed. Please address future correspondence to P.O. Box 2359, Honolulu, Hawaii 96804.

Sincerely,

Seiji F. Naya

cc: Mr. Gary Gill, Director, OEQC  
Mr. Rodney Funakoshi, Wilson Okamoto & Associates

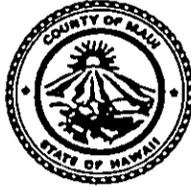
RYF

LINDA CROCKETT LINGLE  
Mayor

CHARLES JENCKS  
Director

DAVID C. GOODE  
Deputy Director

AARON SHINMOTO, P.E.  
Chief Staff Engineer



COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS  
AND WASTE MANAGEMENT

200 SOUTH HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

May 21, 1996

RALPH NAGAMINE, L.S., P.E.  
Land Use and Codes Administration

EASSIE MILLER, P.E.  
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.  
Engineering Division

BRIAN HASHIRO, P.E.  
Highways Division

Solid Waste Division

Mr. Seiji F. Naya  
State of Hawaii  
Department of Business, Economic  
Development & Tourism  
P. O. Box 2359  
Honolulu, Hawaii 96804

RECEIVED  
JUN 23 1996

WILSON OKAMOTO & ASSOCIATES, INC.

SUBJECT: LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE III  
JOB NO. 94-79

Dear Mr. Naya:

Thank you for your comments on the Draft Environmental Assessment for the subject project.

The only landscaping shown on the plans are where we are relocating the existing trees and hedges to accommodate the road widening. Also, we are planting grass at the pavement edge and behind the sidewalk. The narrow road right-of-way does not permit enough room to provide a full landscaping plan. We are limiting our road right-of-way because most of the adjoining lots are occupied with condominiums with parking lots, and the road widening for landscaping would infringe into the parking areas.

If you have any further comments or questions, please call Joe Krueger at 243-7745.

Very truly yours,

  
LLOYD LEE  
Engineering Division Chief

LL/JK:ch(ED96-550)  
LHP:lan, DBE

xc: Gary Gill, OEQC  
Rodney Funakoshi, WOA



BENJAMIN J. CAYETANO  
GOVERNOR OF HAWAII



LAWRENCE MIKE  
DIRECTOR OF HEALTH

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

In reply, please refer to:

June 13, 1996

96-066/epo

Mr. Joe Kruger  
County of Maui  
Department of Public Works and  
Waste Management  
Engineering Division  
200 South High Street  
Wailuku, Hawaii 96793

RECEIVED  
JUN 13 1996

WILSON OKAMOTO & ASSOC., INC.

Dear Mr. Kruger:

Subject: Draft Environmental Assessment (DEA)  
Lower Honoapiilani Road Improvements, Phase III  
Lahaina, Maui

Thank you for allowing us to review and comment on the subject project. We have the following comments to offer:

Control of Fugitive Dust

Due to the nature and location of the project, there is a significant potential for fugitive dust emissions during the removal, grading, excavation, and construction activities for the proposed project. In addition, the arid climatic conditions, the fairly strong wind conditions and the close proximity to existing residential subdivisions may create unforeseen dust problems. Therefore, implementation of adequate dust control measures during all phases of construction is warranted. Construction activities must comply with provisions of Chapter 11-60.1, Hawaii Administrative Rules, Section 11-60.1-33 on Fugitive Dust.

The contractor should provide adequate means to control dust from road areas and during the various phases of construction activities. These means include, but are not limited to:

- a. planning the different phases of construction, focusing on minimizing the amount of dust generating materials and activities, centralizing material transfer points and onsite vehicular traffic routes, and locating potentially dusty equipment in areas of the least impact;
- b. providing an adequate water source at the site, prior to startup of construction activities;

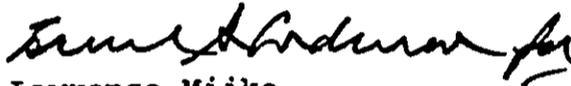
Mr. Joe Kruger  
June 13, 1996  
Page 2

96-066

- c. landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;
- d. control of dust from shoulders, project entrances, and access roads; and
- e. providing adequate dust control measures during weekends, after hours, and prior to daily startup of construction activities.

If you have any questions regarding fugitive dust, please contact Mr. Timothy Carvalho of the Clean Air Branch at 586-4200.

Sincerely,



Lawrence Miike  
Director of Health

c: Wilson Okamoto & Associates, Inc. ✓  
OEQC  
CAB

LINDA CROCKETT LINGLE  
Mayor

CHARLES JENCKS  
Director

DAVID C. GOODE  
Deputy Director

AARON SHINMOTO, P.E.  
Chief Staff Engineer



COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS  
AND WASTE MANAGEMENT  
200 SOUTH HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.  
Land Use and Codes Administration

EASSIE MILLER, P.E.  
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.  
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.  
Highways Division

June 24, 1996

Mr. Lawrence Miike, Director  
Department of Health  
State of Hawaii  
1251 Punchbowl Street  
Honolulu, Hawaii 96813

SUBJECT: LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE III  
DRAFT ENVIRONMENTAL ASSESSMENT  
TMK: 4-3-06: POR. 41, 4-3-08: POR. 83 & 84, 4-3-10: POR. 5 & 6  
LAHAINA, MAUI, HAWAII

Dear Mr. Miike:

Thank you for comments on the Draft Environmental Assessment for the subject project.

The mitigation measures you have suggested for controlling fugitive dust emissions during construction activities will be considered for incorporation in the construction notes for the project.

If you have any further comments or questions, please call Joe Krueger at 243-7745.

Very truly yours,

  
LLOYD LEE  
Engineering Division Chief

LL/WOA:c(ED96-712)  
RESP-LTR.OEA

xc: Gary Gill, OEQC  
Rodney Funakoshi, WOA

BENJAMIN J. CAYETANO  
GOVERNOR OF HAWAII



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
STATE HISTORIC PRESERVATION DIVISION  
33 SOUTH KING STREET, 6TH FLOOR  
HONOLULU, HAWAII 96813

MICHAEL D. WILSON, CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
DEPUTY  
GILBERT COLOMA-AGARAN

AQUACULTURE DEVELOPMENT  
PROGRAM  
AQUATIC RESOURCES  
CONSERVATION AND  
ENVIRONMENTAL AFFAIRS  
CONSERVATION AND  
RESOURCES ENFORCEMENT  
CONVEYANCES  
FORESTRY AND WILDLIFE  
HISTORIC PRESERVATION  
DIVISION  
LAND MANAGEMENT  
STATE PARKS  
WATER AND LAND DEVELOPMENT

May 14, 1996

Mr. Joe Kruger  
Engineering Division  
Department of Public Works and Waste Management  
200 South High Street  
Wailuku, Hawaii 96793

RECEIVED  
MAY 24 1996

LOG NO: 17025  
DOC NO: 9605KD05

WILSON OKAMOTO & ASSOC. INC.

Dear Mr. Kruger:

**SUBJECT: County of Maui, Historic Preservation Review of a Draft Environmental Assessment -  
Lower Honoapiilani Road Improvements, Phase III  
Kahana, Lahaina District, Island of Maui  
TMK: 4-3-06: 41, 4-3-08: 83 & 84, 4-3-10: 5 & 6**

Thank you for the opportunity to review the draft Environmental Assessment for the Lower Honoapiilani Road, Phase III improvements in Kahana. The proposed one mile long improvement project area is located between Mahinahina Stream and Hoohui Road, along Lower Honoapiilani Road. The improvements include widening of the existing paved roadway, paving the road shoulder, construction of curbs, gutters and sidewalks where they are not present, construction of a new box culvert and drainage collection system, and relocation of existing utility systems and drainlines.

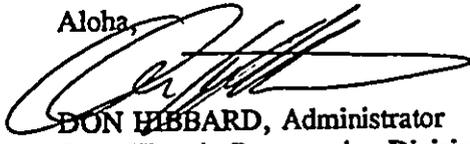
As indicated in the draft EA, all of the proposed improvements, with the exception of a box culvert, are to occur within the existing road corridor or in the shoulder area. The proposed box culvert is to be located in a former pineapple field, adjacent to Lower Honoapiilani Road.

Our records indicate that there are no known historic sites within or near to proposed project. A field inspection of the box culvert location was conducted by State Historic Preservation Division staff, and no evidence of historic sites was found in this area.

Based on the extent of prior disturbance during construction of the existing roadway, and by previous agricultural disturbance, it appears unlikely that intact cultural deposits or features are present beneath the surface in this area. We believe that this project will have "no effect" on historic sites.

Please contact Ms. Theresa Donham at 243-5169 if you have any questions.

Aloha,

  
DON HIBBARD, Administrator  
State Historic Preservation Division

KD:jen

cc: Gary Gill, OEQC  
Rodney Funakoshi, Wilson Okamoto & Associates (1907 S. Beretania St., Suite 400, Honolulu 96826)

LINDA CROCKETT LINGLE  
Mayor

CHARLES JENCKS  
Director

DAVID C. GOODE  
Deputy Director

AARON SHINMOTO, P.E.  
Chief Staff Engineer



COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS  
AND WASTE MANAGEMENT  
200 SOUTH HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.  
Land Use and Codes Administration

EASSIE MILLER, P.E.  
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.  
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.  
Highways Division

June 24, 1996

Dr. Don Hibbard, Ph.D.  
State of Hawaii  
State Historic Preservation Division  
Department of Land and Natural Resources  
33 South King Street, 6th Floor  
Honolulu, Hawaii 96813

RECEIVED  
JUL 03 1996

WILSON OKAMOTO & ASSOC

SUBJECT: LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE III  
DRAFT ENVIRONMENTAL ASSESSMENT  
TMK: 4-3-06: POR. 41, 4-3-08: POR. 83 & 84, 4-3-10: POR. 5 & 6  
LAHAINA, MAUI, HAWAII

Dear Dr. Hibbard:

Thank you for your comments on the Draft Environmental Assessment for the subject project. We very much appreciate your review of the historic records, field inspection, and confirmation of our assessment that there are unlikely to be any effects on historic sites by the proposed road improvements.

If you have any further comments or questions, please call Joe Krueger at 243-7745.

Very truly yours,

  
LLOYD LEE  
Engineering Division Chief

LL/WOA:c(ED96-707)  
Resp-Ltr.DEA

xc: Gary Gill, OEQC  
Rodney Funakoshi, WOA

State of Hawaii  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
Commission on Water Resource Management  
Honolulu, Hawaii

APR 30 1996

April 29, 1996

TO: Mr. Dean Uchida, Administrator  
Land Division

FROM: Rae M. Loui, Deputy Director *RML*  
Commission on Water Resource Management (CWRM)

SUBJECT: Honoapiilani Highway (FAP Route 30) Puamana to Honokowai, Lahaina, Maui.

FILE NO.: PM-96-006

Thank you for the opportunity to review the subject document. Our comments related to water resources are marked below.

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas which are important for the maintenance of streams and the replenishment of aquifers.

- We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.
- We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.
- A Well Construction Permit and a Pump Installation Permit from the CWRM would be required before ground water is developed as a source of supply for the project.
- The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the CWRM would be required prior to use of this source.
- Groundwater withdrawals from this project may affect streamflows. This may require an instream flow standard amendment.
- We recommend that no development take place affecting highly erodible slopes which drain into streams within or adjacent to the project.
- If the proposed project diverts additional water from streams or if new or modified stream diversions are planned, the project may need to obtain a stream diversion works permit and petition to amend the interim instream flow standard for the affected stream(s).
- Based on the information provided, it appears that a Stream Channel Alteration Permit pursuant to Section 13-169-50, HAR will be required before the project can be implemented.
- Based on the information provided, it does not appear that a Stream Channel Alteration Permit pursuant to Section 13-169-50, HAR will be required before the project can be implemented.
- An amendment to the instream flow standard from the CWRM would be required before any streamwater is diverted.
- Any new development that is permitted along a stream that is not yet channelized should be based on the express condition that no streams will be channelized to prevent flooding of the development. Development in the open floodplain should not be allowed; other economic uses of the floodplain should be encouraged.
- OTHER:  
From extent and nature of the project indicate that construction may take place in several stream channels for flood control and or road work. Examples from the document include - "installation of a floodwater diversion channel in the vicinity of the Bypass south of Lahainaluna Road (NRCS, 1991)... pg.56" and "two proposed channel outlets would be located in the vicinity of Kauaula Stream...pg.56" Stream Channel Alteration Permits must be approved by the Commission prior to any construction work.

If there are any questions, please contact Roy Hardy at 587-0274.

LINDA CROCKETT LINGLE  
Mayor

CHARLES JENCKS  
Director

DAVID C. GOODE  
Deputy Director

AARON SHINMOTO, P.E.  
Chief Staff Engineer



COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS  
AND WASTE MANAGEMENT  
200 SOUTH HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.  
Land Use and Codes Administration

EASSIE MILLER, P.E.  
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.  
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.  
Highways Division

June 24, 1996

Mr. Michael Wilson, Director  
Department of Land and Natural Resources  
1151 Punchbowl Street  
Honolulu, Hawaii 96813

Attention: Ms. Rae M. Loui, Deputy Director  
Commission on Water Resource Management

SUBJECT: LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE III  
DRAFT ENVIRONMENTAL ASSESSMENT  
TMK: 4-3-06: POR. 41, 4-3-08: POR. 83 & 84, 4-3-10: POR. 5 & 6  
LAHAINA, MAUI, HAWAII

Dear <sup>Mike</sup> Mr. Wilson:

Thank you for your comments on the Draft Environmental Assessment for the subject project. Although the road improvements extend to Mahinahina Stream, the stream channel itself will not be modified and a Stream Channel Alteration Permit will therefore not be required for the project.

If you have any further comments or questions, please call Joe Krueger at 243-7745.

Very truly yours,

  
LLOYD LEE  
Engineering Division Chief

LL/WOA:c(ED96-709)  
RESP-LTR.DEA

xc: Gary Gill, OEQC  
Rodney Funakoshi, WOA



# OFFICE OF STATE PLANNING

Office of the Governor

MAILING ADDRESS: P.O. BOX 3540, HONOLULU, HAWAII 96811-3540  
STREET ADDRESS: 250 SOUTH HOTEL STREET, 4TH FLOOR  
TELEPHONE: (808) 587-2846, 587-2800

BENJAMIN J. CAYETANO, Governor

FAX: Director's Office 587-2848  
Planning Division 587-2824

Ref. No. Z-0113

May 22, 1996

The Honorable Charles Jencks  
Director  
Department of Public Works and  
Waste Management  
County of Maui  
200 South High Street  
Wailuku, Hawaii 96793

RECEIVED  
MAY 28 1996

Attention: Mr. Joe Kruger

WILSON OKAMOTO & ASSOCIATES

Dear Mr. Jencks:

We have the following comment on the draft environmental assessment for the Lower Honoapiilani Road Improvements, Phase III, project.

The discussion on page 4-5 relative to the Coastal Zone Management (CZM) program is incomplete. It references only seven CZM objectives. Please note that there are ten CZM objectives with supporting policies and that all should be included in the assessment.

If you have any questions, please call Charles Carole at 587-2804.

Sincerely,

Gregory G.Y. Pai, Ph.D.  
Director

cc: OEQC  
✓ Wilson Okamoto & Associates, Inc.

LINDA CROCKETT LINGLE  
Mayor

CHARLES JENCKS  
Director

DAVID C. GOODE  
Deputy Director

AARON SHINMOTO, P.E.  
Chief Staff Engineer



COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS  
AND WASTE MANAGEMENT  
200 SOUTH HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.  
Land Use and Codes Administration

EASSIE MILLER, P.E.  
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.  
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.  
Highways Division

June 24, 1996

Mr. Gregory G.Y. Pai  
Office of State Planning  
State of Hawaii  
415 S. Beretania Street, Room 409  
Honolulu, Hawaii 96813

SUBJECT: LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE III  
DRAFT ENVIRONMENTAL ASSESSMENT  
TMK: 4-3-06: POR. 41, 4-3-08: POR. 83 & 84, 4-3-10: POR. 5 & 6  
LAHAINA, MAUI, HAWAII

Dear Mr. Pai:

Thank you for your comments on the Draft Environmental Assessment for the subject project. For the Final Environmental Assessment, we will revise the discussion to include all ten Coastal Zone Management objectives and policies.

If you have any further comments or questions, please call Joe Krueger at 243-7745.

Very truly yours,

A handwritten signature in black ink, appearing to read "Lloyd Lee", is written over the typed name.

LLOYD LEE  
Engineering Division Chief

LL/WOA:c(ED96-711)  
RESP-LTR.DEA

xc: Gary Gill, OEQC  
Rodney Funakoshi, WOA

BENJAMIN J. CAYETANO  
GOVERNOR



GARY GILL  
DIRECTOR

STATE OF HAWAII  
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

220 SOUTH KING STREET  
FOURTH FLOOR  
HONOLULU, HAWAII 96813  
TELEPHONE (808) 586-4186  
FACSIMILE (808) 586-4186

RECEIVED  
JUN 10 1996

WILSON OKAMOTO & ASSOC., INC.

June 6, 1996

Mr. Charles Jencks, Director  
Department of Public Works and Waste Management  
County of Maui  
200 South High Street  
Wailuku, Hawaii 96793

Dear Mr. Jencks:

Subject: Draft Environmental Assessment for Lower Honoapiilani  
Road Improvements, Phase III, Lahaina, Maui

Thank you for the opportunity to review the subject document. We have the following comments.

Shoreline Hardening

The Department of Public Works and Waste Management proposes to construct a new concrete box culvert within the shoreline area. It is the policy of the State of Hawaii under HRS Chapter 205A to discourage all shoreline hardening that may affect access to, or the configuration of, our island beaches.

Any EA prepared in conjunction with a proposal to construct a shoreline hardening structure should be accompanied by appropriate justification and detailed studies including, but not limited to, the following:

1. A Historical Shoreline Analysis of coastal erosion and accretion rates. This should include a description of all movements of the neighboring shoreline over at least the past 30 years. This analysis should be based, at least in part, on aerial photographs available through government agencies and private vendors. The analysis should provide a detailed history of erosion and accretion patterns using all available evidence.
2. A description of the nature of the affected shoreline, whether sandy, rocky, mud flats or any other configuration. The history and characteristics of adjoining sand dunes and reefs should be included.

Mr. Jencks  
June 6, 1996  
Page 2

3. Site maps that clearly show the current certified shoreline, previous certified shorelines, the private property line and the location of the proposed structure. Any nearby public access right-of-way should also be depicted.
4. Beach profiles that extend off shore at appropriate intervals along the beach indicating the width and slope of both the submerged and dry portions of the beach.
5. An analysis of any existing nearby structures, walls or revetments and their cumulative impacts on the shoreline.
6. A description of structures and improvements adjacent to the project and how they may be affected by the construction of the proposed hardening project.
7. A wave and storm frequency analysis for the area in question. This should include any relevant coastal processes such as longshore currents and seasonal wave patterns.
8. An analysis that predicts the location of future shorelines with and without the proposed structure at least 30 years into the future or over the expected life of the hardening project.
9. Photos of the site that illustrate past and present conditions and locate the proposed structure.
10. All alternatives to shoreline hardening should be thoroughly researched and analyzed. These alternatives should include onsite drainage system, retreat from the shoreline by moving structures inland, and a no action alternative.

The inclusion of this information will help make an Environmental Assessment complete and meet the requirements of Chapter 343, HRS. Only after thorough study and analysis should any permit for shoreline hardening be considered.

#### Cumulative Impact

The new concrete box culvert will be constructed to convey stormwater runoff from the parcel owned by Maui Land and Pineapple Company. The Company proposes to develop a housing project on the subject parcel. Since the box culvert is a necessary precedent for the residential development, impacts of the housing development must also be disclosed in the environmental assessment.

#### Concrete Channel

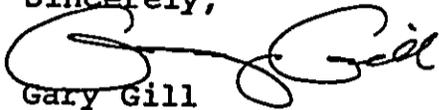
Water flows faster in concrete channels and therefore more suspended sediments and other polluted runoff are carried to the nearshore waters. Please describe the water quality impacts of the concrete channel on nearshore waters. Also, please consider

Mr. Jencks  
June 6, 1996  
Page 3

alternatives such as an onsite drainage system, a grassed lined channel or other similar system.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185. Mahalo.

Sincerely,



Gary Gill  
Director

c: Wilson Okamoto and Associates

LINDA CROCKETT LINGLE  
Mayor

CHARLES JENCKS  
Director

DAVID C. GOODE  
Deputy Director

AARON SHINMOTO, P.E.  
Chief Staff Engineer



COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS  
AND WASTE MANAGEMENT  
200 SOUTH HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.  
Land Use and Codes Administration

EASSIE MILLER, P.E.  
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.  
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.  
Highways Division

June 24, 1996

Mr. Gary Gill, Director  
State of Hawaii  
Office of Environmental Quality Control  
220 South King Street, 4th Floor  
Honolulu, Hawaii 96813

SUBJECT: LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE III  
DRAFT ENVIRONMENTAL ASSESSMENT  
TMK: 4-3-06: POR. 41, 4-3-08: POR. 83 & 84, 4-3-10: POR. 5 & 6  
LAHAINA, MAUI, HAWAII

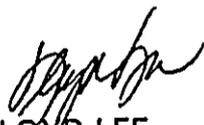
Dear Mr. Gill:

Thank you for comments on the Draft Environmental Assessment for the subject project.

The area in which the box culvert outlets to the ocean is along a rocky area of the coastline which is not subject to erosion. Furthermore, the project will not result in any increased flows. As such, the requested analysis are not warranted given the location and scope of the drainage outlet improvements.

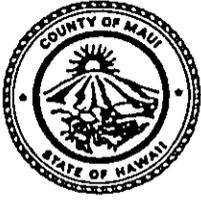
If you have any further comments or questions, please call Joe Krueger at 243-7745.

Very truly yours,

  
LLOYD LEE  
Engineering Division Chief

LL/WOA:c(ED96-713)  
Resp.Ltr-DEA

xc: Rodney Funakoshi, WOA



DEPARTMENT OF  
**PARKS AND RECREATION**  
COUNTY OF MAUI

1580-C Kaahumanu Avenue, Wailuku, Hawaii 96793

LINDA CROCKETT LINGLE  
Mayor  
HENRY OLIVA  
Director  
ALLEN SHISHIDO  
Deputy Director

(808) 243-7230  
FAX (808) 243-7934

April 22, 1996

Mr. Charles Jencks, Director  
Department of Public Works and Waste Management  
County of Maui  
Engineering Division  
200 South High Street  
Wailuku, Hawaii 96793

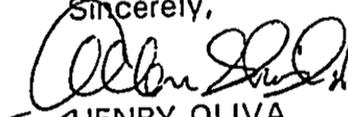
Attention: Joe Kruger, Civil Engineer

Dear Mr. Jencks:

SUBJECT: Lower Honoapiilani Road Improvements, Phase III  
Draft Environmental Assessment (Negative Declaration Anticipated)  
Tax Map Keys: 4-3-06: por. 41, 4-3-08: por. 83 & 84,  
4-3-10: por. 5 & 6  
Lahaina, Maui, Hawaii

We have reviewed the Draft Environmental Assessment (Negative Declaration Anticipated) for the above-referenced project and have no comments on this.

If you require additional information, please contact Patrick Matsui at 243-7387.

Sincerely,  
  
HENRY OLIVA  
Director

PTM

c: Patrick Matsui, Chief of Parks Planning and Development  
Gary Gill, Director, Office of Environmental Quality Control  
Rodney Funakoshi, Project Planner, Wilson Okamoto & Associates, Inc.

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APR 24 1996

WILSON OKAMOTO & ASSOCIATES, INC.

LINDA CROCKETT LINGLE  
Mayor

CHARLES JENCKS  
Director

DAVID C. GOODE  
Deputy Director

AARON SHINMOTO, P.E.  
Chief Staff Engineer



COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS  
AND WASTE MANAGEMENT  
200 SOUTH HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.  
Land Use and Codes Administration

EASSIE MILLER, P.E.  
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.  
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.  
Highways Division

June 24, 1996

Mr. Henry Oliva, Director  
County of Maui  
Department of Parks and Recreation  
1580-C Kaahumanu Avenue  
Wailuku, Hawaii 96793

SUBJECT: LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE III  
DRAFT ENVIRONMENTAL ASSESSMENT  
TMK: 4-3-06: POR. 41, 4-3-08: POR. 83 & 84, 4-3-10: POR. 5 & 6  
LAHAINA, MAUI, HAWAII

Dear Mr. <sup>Henry</sup> Oliva:

Thank you for your review of the Draft Environmental Assessment for the subject project. This is to acknowledge your indication of no comments on the proposed road improvements.

If you have any questions please call Joe Krueger at 243-7745.

Very truly yours,

  
LLOYD LEE  
Engineering Division Chief

LL/WOA:c(ED96-708)  
RESP.LTR.DEA

xc: Gary Gill, OEQC  
Rodney Funakoshi, WOA

LINDA CROCKETT LINGLE  
Mayor



*C. Jones, DPWW*  
DAVID W. BLANE  
Director

GWEN OHASHI HIRAGA  
Deputy Director

RECEIVED  
COUNTY OF MAUI

'96 JUN -4 P3:45

COUNTY OF MAUI  
PLANNING DEPARTMENT  
230 S. HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

May 30, 1996

ENGINEERING  
DEPT. OF PUBLIC WORKS  
COUNTY OF MAUI  
PUBLIC WORKS

RUSH

DEPT. OF PUBLIC WORKS	INFO	ACTION	SEE ME	COMMENTS	CCPY	FILE
DIRECTOR						
DEP. DIR						
PERS.						
STAFF CE						
LUCA						
VW RECL.						
SOLID W.						
ENGR.						
PLANS.						
DATA						

Return to \_\_\_\_\_ Date \_\_\_\_\_

Ref. No. \_\_\_\_\_

Mr. Gary Gill, Director  
Office of Environmental Quality Control  
220 South King Street, 4th Floor  
Honolulu, Hawaii 96813

Dear Mr. Gill:

RE: Lower Honoapiilani Road Improvements, Phase III Draft Environmental Assessment,  
TMK: 4-3-06:por. 41, 4-3-08:por. 83 and .84, 4-3-10:por. 5 and 6 Honokowale  
Lahaina, Island of Maui, Hawaii

The Maui Planning Department has reviewed the Draft Environmental Assessment for the subject project and offers the following comments:

1. The proposed project will require Special Management Area and Shoreline Setback Variance permits. A timely application will aid in preventing possible delays.
2. Potential Impacts and Proposed Mitigation Measures, Section 5, suggests that consideration be made that the physical construction occur during a period of normally low visitor counts.

Should you need additional information on this subject, please contact Staff Planner, Mr. Don Schneider, of this office at 243-7735.

Very truly yours,

*Gwen Ohashi Hiraga*  
DAVID W. BLANE  
Director of Planning

DWB:DAS:osy

xc: Colleen Suyama, Planning Program Manager, Land Use Management  
Don A. Schneider, Staff Planner  
Project File (G:\planning\atltds.pii)

LINDA CROCKETT LINGLE  
Mayor

CHARLES JENCKS  
Director

DAVID C. GOODE  
Deputy Director

AARON SHINMOTO, P.E.  
Chief Staff Engineer



COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS  
AND WASTE MANAGEMENT  
200 SOUTH HIGH STREET  
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.  
Land Use and Codes Administration

EASSIE MILLER, P.E.  
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.  
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.  
Highways Division

June 10, 1996

Mr. David W. Blane  
Director  
Planning Department  
County of Maui  
250 South High Street  
Wailuku, HI 96793

SUBJECT: LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE III  
JOB NO. 94-79

Dear Mr. Blane:

Thank you for your comments on the draft environmental assessment for the subject project. The special management area and shoreline setback variance permits are being prepared for a timely application. Also, consideration will be made for construction to occur during a period of normally low visitor counts.

If you have any questions, please call Joe Krueger at Extension 7745.

Sincerely,

A handwritten signature in black ink, appearing to read "Lloyd P.C.W. Lee".

Lloyd P.C.W. Lee  
Engineering Division Chief

JK:mik(ED96-623)  
G:\ENGVALL\94-79.PLN

cc: Richard Harada, Wilson Okamoto & Associates, Inc.

**APPENDIX B**

Drainage Report for  
Lower Honoapiilani Road  
Improvements, Phase 3

DRAINAGE REPORT  
FOR  
LOWER HONOAPIILANI ROAD IMPROVEMENTS  
PHASE 3

LAHAINA, MAUI, HAWAII

TMK: 4-3-05  
4-3-06  
4-3-08  
4-3-09  
4-3-10

PREPARED FOR:  
COUNTY OF MAUI  
DEPARTMENT OF PUBLIC WORKS

PREPARED BY:  
WILSON OKAMOTO & ASSOCIATES

APRIL 1996

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APPENDIX A - HYDROLOGIC CALCULATIONS

APPENDIX B - HYDRAULIC CALCULATIONS:

PIPE FLOW ANALYSIS: EXISTING CONDITIONS

PIPE FLOW ANALYSIS: PROPOSED CONDITIONS

SWALE ANALYSIS

CULVERT HYDRAULICS

## I. INTRODUCTION

Location. The project is located along the northwest coast of the island in the Lahaina District between Kaanapali and Kapalua. (See Exhibit A, "Location Map".) The project area extends from Mahinahina Stream to Hoohui Road along Lower Honoapiilani Road. (See Exhibit B, "Vicinity Map".) The project is largely limited to the roadway right-of-way.

Project Description. The proposed project consists of road improvements and the construction of a new box culvert. Road improvements shall extend over an approximately 1 mile length of road and consist of road widening, concrete curb and gutters, on-street parking and drainage improvements. The new box culvert will convey existing runoff from the open lot (TMK: 4-3-9:52), discharge from Honoapiilani Highway culvert, and pipe flows from Mahinahina Ventures subdivision under Lower Honoapiilani Road to the ocean.

## II. EXISTING CONDITIONS

Topography. The topography of the project site is generally flat on the northern portion of the project site. The southern portion of the site is somewhat steeper. Slopes are less than 10 percent. Elevations range between 5 and 40 feet.

Soil Conditions. The U.S. Department of Agriculture Soil Conservation Service's Soil Survey of the Island of Kauai, Oahu, Maui, Molokai and Lanai, classifies the soils within the project site as Ewa Silty Clay (EaA), Lahaina Silty Clay (LaB and LaC), and Rough Broken and Stony Land (rRS). See Exhibit C for the soil classification map.

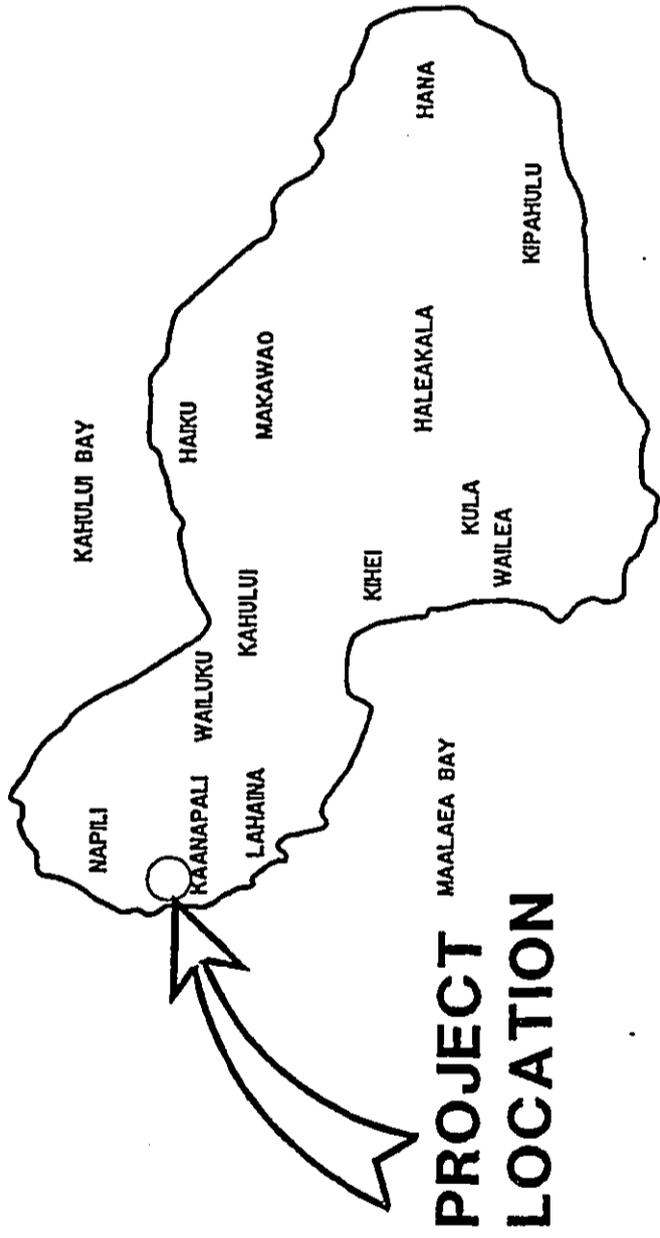
Ewa Silty Clay Loam (EaA) consists of well-drained soils. Runoff is very slow and the erosion hazard is no more than slight. Slopes range from 0 to 3 percent.

Lahaina Silty Clay (LaB) has moderate permeability. Runoff is slow and erosion hazard is slight. Slopes range from 3 to 7 percent.

Lahaina Silty Clay (LaC) consists of well-drained soils. Runoff is medium and erosion hazard is moderate. Slopes range from 7 to 15 percent.

Rough Broken and Stony Land (rRS) is found in gulches. Runoff is rapid and geologic erosion is active.

On-site Drainage. The existing Lower Honoapiilani Road extends across several watersheds that extend to the ocean. The drainage pattern of these watersheds has been altered with the construction of Honoapiilani Highway (mauka and roughly parallel to the Lower



**PROJECT  
LOCATION**



**MAUI**  
NTS

**EXHIBIT A**  
**LOCATION MAP**



**WILSON OKAMOTO  
& ASSOCIATES, INC.**

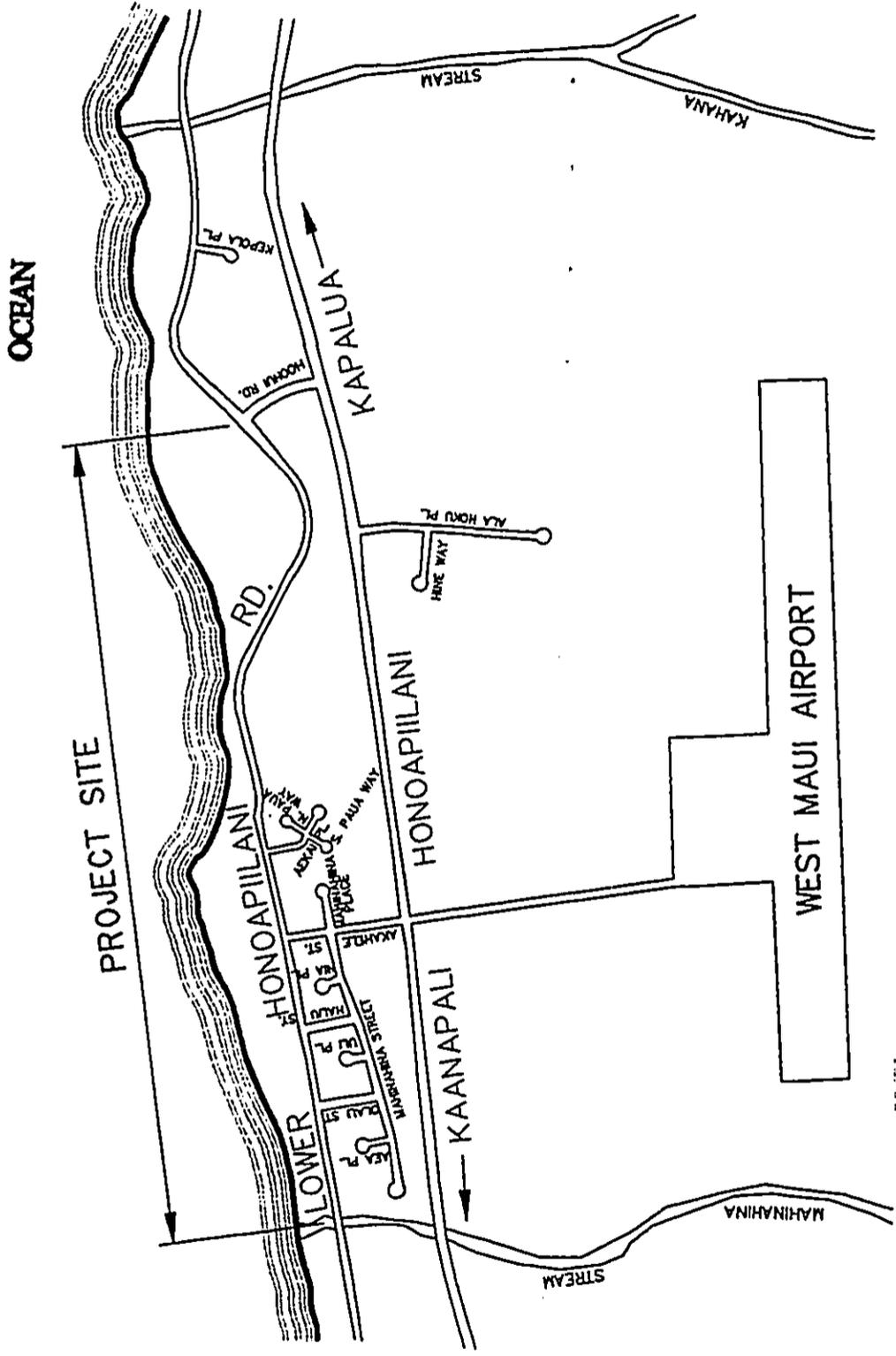
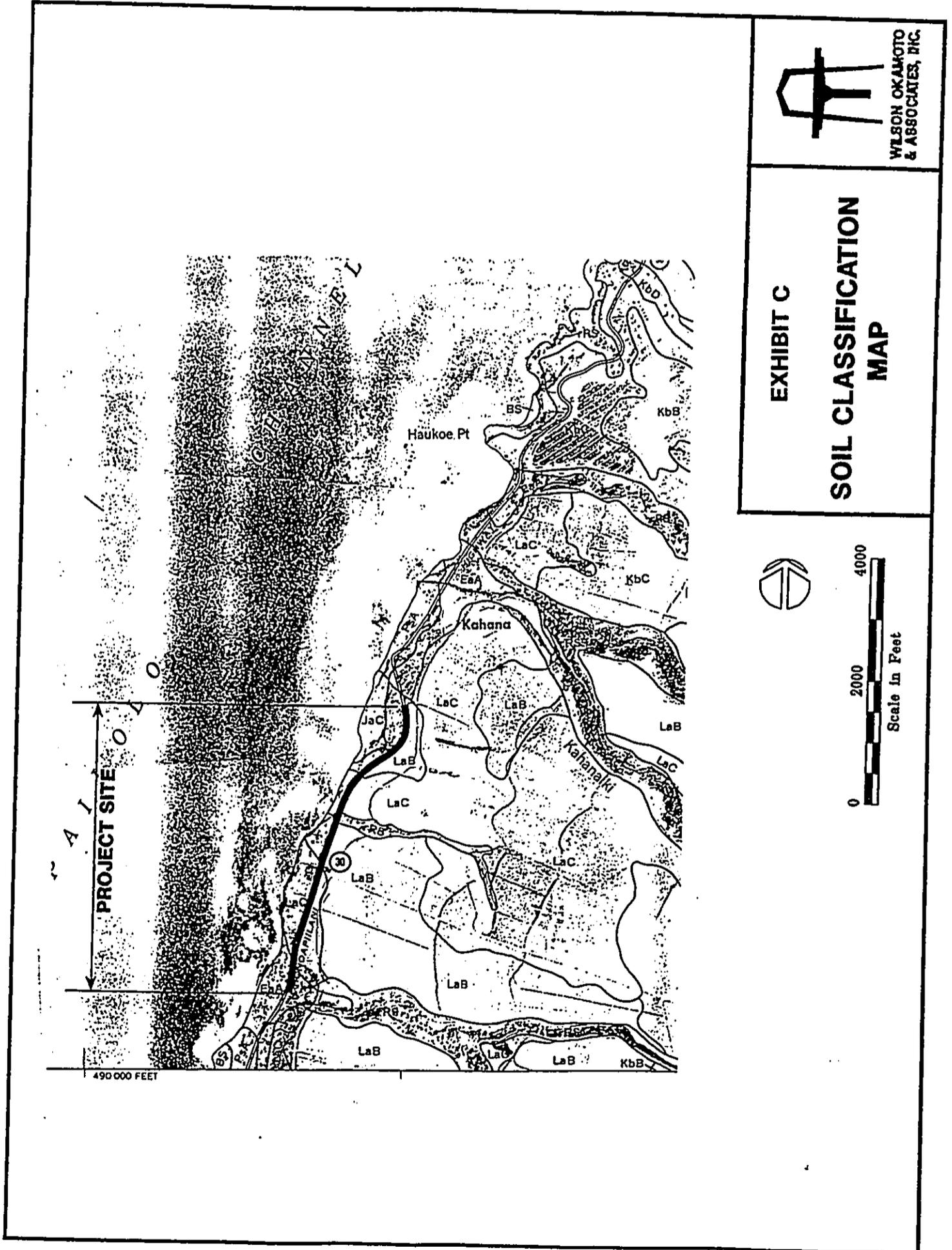


EXHIBIT B

VICINITY MAP



WILSON OKAMOTO  
& ASSOCIATES, INC.



WILSON OKAMOTO  
& ASSOCIATES, INC.

EXHIBIT C

SOIL CLASSIFICATION  
MAP



490 000 FEET

Honoapiilani Road). The drainage pattern was again altered with the construction of developments between Honoapiilani Highway and Lower Honoapiilani Road. As this area was developed, each development constructed drainage improvements to carry the runoff through their project. The existing drainage system along Lower Honoapiilani Road consists of these individual drainage systems constructed for these developments. Currently, the runoff from areas between Lower Honoapiilani Road and the ocean drain toward the ocean. Exhibits D, E, F and G contain the existing and proposed drainage systems.

The Mahinahina Ventures Subdivision system conveys runoff from above the Highway as well as local drainage to a system along Lower Honoapiilani Road. This system has two outlets. The south side of this system consists of 24- and 36-inch drain lines along Lower Honoapiilani Road. This portion of the system outlets to the Mahinahina Stream channel. The north side of this system consists of 24-inch drain lines and 72"x44" arch pipes connecting to a box culvert that outlets at the park. Exhibits D and E show the layout of the north and south systems for Mahinahina Ventures subdivision.

A single catch basin fronts the Hale Mahina Beach Resort (4-3-06:41) to provide local road drainage. (See Exhibit D.) This catch basin connects to the system running through that development.

A second major system extends through Kahana Falls and Kahana Villas (4-3-10:13 and 32) and runs roughly parallel to Lower Honoapiilani Road. This system conveys runoff from above the Highway as well as local drainage. The system parallel to Lower Honoapiilani Road consists of 60- and double 60-inch drain lines. These lines also connect to the box culvert at the park. See Exhibit F for the location of this system.

A smaller system also runs through the Kahana Falls development. This system collects local drainage and conveys it across Lower Honoapiilani Road. Catch basins on either side of the road provide road drainage at this crossing. The drain line crossing Lower Honoapiilani Road is an 18-inch line. (See Exhibit G.)

A third major system runs through Kahana Manor (4-3-10:11). This system conveys runoff from across the Highway as well as local drainage. This system has a 60-inch drain line that crosses Lower Honoapiilani Road to run along the north boundary of the Sands of Kahana. A catch basin to the south of this line is connected by an 18-inch drain line. A 36-inch system that runs along Lower Honoapiilani Road to the north also connects to the 60-inch line. This sub-system drains Hoohui Road and the parcels north of Hoohui Road. Exhibit G shows the Kahana Manor systems.

The hydraulic analyses of the pipe systems under existing flow conditions can be found in Appendix B, "Pipe Flow Analysis: Existing Conditions". The structure names and flow quantities

listed are based on the drainage reports for various developments along Lower Honoapiilani Road.

#### Off-site Drainage

Above the project area is Pohakukaanapali Gulch. According to a previous State Department of Transportation drainage plan (F.A. Project No. RF-030-1(7)), approximately 625 cfs will be generated in the Pohakukaanapali Gulch Watershed during a 100-year storm. Three smaller drainage areas also contribute to overall flow totalling 663 cfs. The flow crosses Honoapiilani Highway through a 120-inch culvert and discharges to a lot on the west side of the Highway. This lot (TMK: 4-3-09:52) is undeveloped except for a sewer pump station located along Lower Honoapiilani Road. This area has been identified as a flood prone area in the Honolua Watershed Work Plan and as Zone A4 (area of 100-year flood) on the Flood Insurance Rate Map (FIRM). A desilting basin above the Highway reduces the sediment load but does not eliminate flooding.

### III. PROPOSED CONDITIONS

#### On-site Drainage

As part of the roadway improvements, the roadway will be widened to 11-foot wide travelways. On the east side of the travelway, there will be a buffer of variable width. In unimproved areas, new curbs, gutters, and sidewalks will be constructed. On the west side of the travelway, an asphaltic concrete (A.C.) swale/buffer, with widths ranging from 4- to 8-feet, will be constructed. This area can also be used as on-street parking. The travelway and buffer areas will have a minimum of 2-inches A.C. overlay except in areas with cross-slopes of less than 1%. In these areas, a 3-inch overlay will be used at the crown, tapering down to 2-inches at the edge of the travelway.

On-site areas were divided into drainage areas for each inlet structure. The corresponding runoff for a 10-year storm was calculated using the Rational Method and based on the "Revised Interim Drainage Standards for County of Maui - January 1994." Based on Table I of the Standards, the roadway improvements do not change the runoff coefficients. Thus, the on-site increase in runoff is negligible. Runoff that previously drained via sheet flow on the west side of the roadway will be intercepted by the proposed swale. New drain inlets will be installed at low points of the swale to intercept the flow. Low areas along the gutter for unimproved sections on the east side of the road will have new catch basins. Appendix A lists the drainage areas and flows for the new structures.

According to the Standards, flooding widths for minor roads cannot exceed 8 feet of travelway. Analysis of the swale at critical areas show that the flow is either contained in the swale or within the maximum flood width for all sections. Table 1 lists

TABLE 1

LOWER HONOAPIILANI ROAD - PHASE 3  
NAPILI, MAUI

OCTOBER 17, 1995  
3371-01/SWCAP

CAPACITY OF SWALE ALONG MAKAI SIDE OF TRAVELWAY

STA. TO STA.	TOTAL FLOW INTO INLET cfs	SWALE WIDTH ft	CRITICAL SECTION			* COMMENTS
			FLOW cfs	SLOPE ft/ft	TOP WIDTH OF FLOW ft	
38+00 - 38+77	0.28	7.0	0.28	0.0030	4.82	CONTAINED IN SWALE
38+77 - 41+50	1.14	7.0	0.41	0.0086	4.57	CONTAINED IN SWALE
41+50 - 46+50	0.82	7.0	0.82	0.0050	6.56	CONTAINED IN SWALE
46+50 - 50+37	0.98	7.0	0.98	0.0096	6.20	CONTAINED IN SWALE
50+37 - 52+69	0.62	7.0	0.62	0.0056	5.78	CONTAINED IN SWALE
52+69 - 55+20	0.67	7.0	0.27	0.0020	8.77	CONTAINED WITHIN MAX. FLOOD WIDTH
55+20 - 59+15	0.68	5.0	0.68	0.0050	5.89	CONTAINED WITHIN MAX. FLOOD WIDTH
76+50 - 80+17	0.27	8.0	0.27	0.0020	5.13	CONTAINED IN SWALE
80+17 - 82+87	1.57	8.0	1.22	0.0042	7.86	CONTAINED IN SWALE
82+87 - 84+73	0.90	8.0	0.90	0.0070	6.37	CONTAINED IN SWALE
84+73 - 86+28	0.84	8.0	0.84	0.0037	7.00	CONTAINED IN SWALE

NOTES:

1. LEFT SIDE SLOPE: 20.00H:1V (5%)
2. RIGHT SIDE SLOPE: 16.67H:1V (6%)
3. MANNING'S "n"=0.015 FOR AC
4. MINIMUM SLOPE = 0.2%
5. FROM STA. 59+15 TO 65+37, ROADWAY IS SUPERELEVATED TOWARDS EAST SIDE OF ROAD. THUS, FLOW IN SWALE IS NEGLIGIBLE AND ROADWAY RUNOFF FLOWS TO EXISTING CATCH BASINS.
6. FROM STA 65+37 TO 76+50, RUNOFF SHEETFLOWS TO SHORELINE.

\* MAXIMUM FLOOD WIDTHS FOR MINOR ROADS = 8 FT.

the inlets, flows and top widths of flows for critical sections of the swale.

Nine drain inlets, 2 catch basins and 1 storm drain manhole comprise the new structures connected to the existing drain lines via 18-inch reinforced concrete pipes. Two new catch basins will replace existing grated inlets and 1 catch basin will replace an existing manhole. The location of these drainage structures and their corresponding drainage areas are shown, by drainage system, on Exhibits D, E, F and G. Eight new structures are proposed for the Mahinahina Ventures Subdivision system. A catch basin and three drain inlets will be added to the south system, carrying an additional 2.19 cfs flow to the Mahinahina Stream outlet. The north system will have 3 new drain inlets and a manhole. Flows in the 72"x44" arch pipe will increase 2.20 cfs.

One new catch basin ties into the Kahana Falls and Kahana Villas drainage system. This structure connects to the 60-inch pipe via an 18-inch pipe, adding 0.36 cfs to the total flow. Two existing grated inlets will be converted to catch basins. Their drainage areas do not change so there is no additional flow. The hydraulic analysis performed for this system shows no overtopping of drainage structures or flooding of the roadway will occur due to the additional flows.

Two new drain inlets connect to the existing catch basin on the west side of the road fronting the Kahana Falls development. Approximately 1.57 cfs drains through 18-inch pipes to the catch basin, then continues downstream with the existing flows through an existing 18-inch pipe. The analysis using a 10-year storm indicates the flows will be contained and structures will not overtop.

The Kahana Manor system will have a new drain inlet at the southern end of its current line. A flow of 0.90 cfs will enter the existing system via an 18-inch pipe. An existing manhole, located about 100 feet from the Hoohei Road intersection, will be converted into a new catch basin. This structure will intercept 0.55 cfs of runoff from the roadway. Calculations show the increase of 1.45 cfs will not cause the inlets to be overtopped during a 10-year storm.

The new swale will taper to the existing ground at the end of the project limits. Runoff generated beyond the last drain inlet on the west side will follow the existing drainage path. The hydraulic analyses in Appendix B, "Pipe Flow Analysis: Proposed Conditions" list the flows per inlet structure in each of the systems, as well as the conditions under the proposed increase in runoff. The new structures are shown as shaded entries. The Mahinahina Ventures Subdivision north system connecting to the new triple barrel culvert and the Kahana Falls system connecting to the existing 3'x5' box culvert are shown as a single system in the analysis.

### Off-site Drainage

Approximately 663 cfs will flow down to Lower Honoapiilani Road from the Honoapiilani Highway culvert during a 100-year storm. In order to prevent flooding of both the roadway and sewer pump station, the runoff will be channelized into a 30-ft. wide channel. This channel includes a concrete 2:1 sloped spillway, SAF stilling basin, and CRM channel upstream of a triple barrel 9'x3' box culvert. The box culvert will extend from the open lot's property line under Lower Honoapiilani Road, outletting through the existing rock wall. See Exhibit F for the location and alignment of the inlet structure and new box culvert. The outlet will be constructed inland of the certified shoreline, so a Department of the Army Corps of Engineers permit is not required.

The box culvert will also carry runoff generated on-site from the open lot. Approximately 11.36 acres of the open lot will drain to the new box culvert. This area is currently undeveloped, without existing drainage improvements. During a 100-year storm, 23.48 cfs will be generated. Additional runoff from Mahinahina Ventures Subdivision increases the flow sheetflowing over the open lot to 28.68 cfs. See calculations in Appendix A.

The Mahinahina Ventures Subdivision 72"x44" arch pipe drain will be intercepted by the new box culvert. The arch pipe will connect to one barrel of the new culvert, adding 81.3 cfs to the system. This will decrease flows in the existing 4'x6' box culvert. However, the existing arch pipe on the Kapalua side (downstream) of the new box culvert will be retained as an overflow connection to the existing 4'x6' box culvert. Any overflow into the existing section of arch pipe will not be considered in this analysis, since the culvert is sized for the entire design flow.

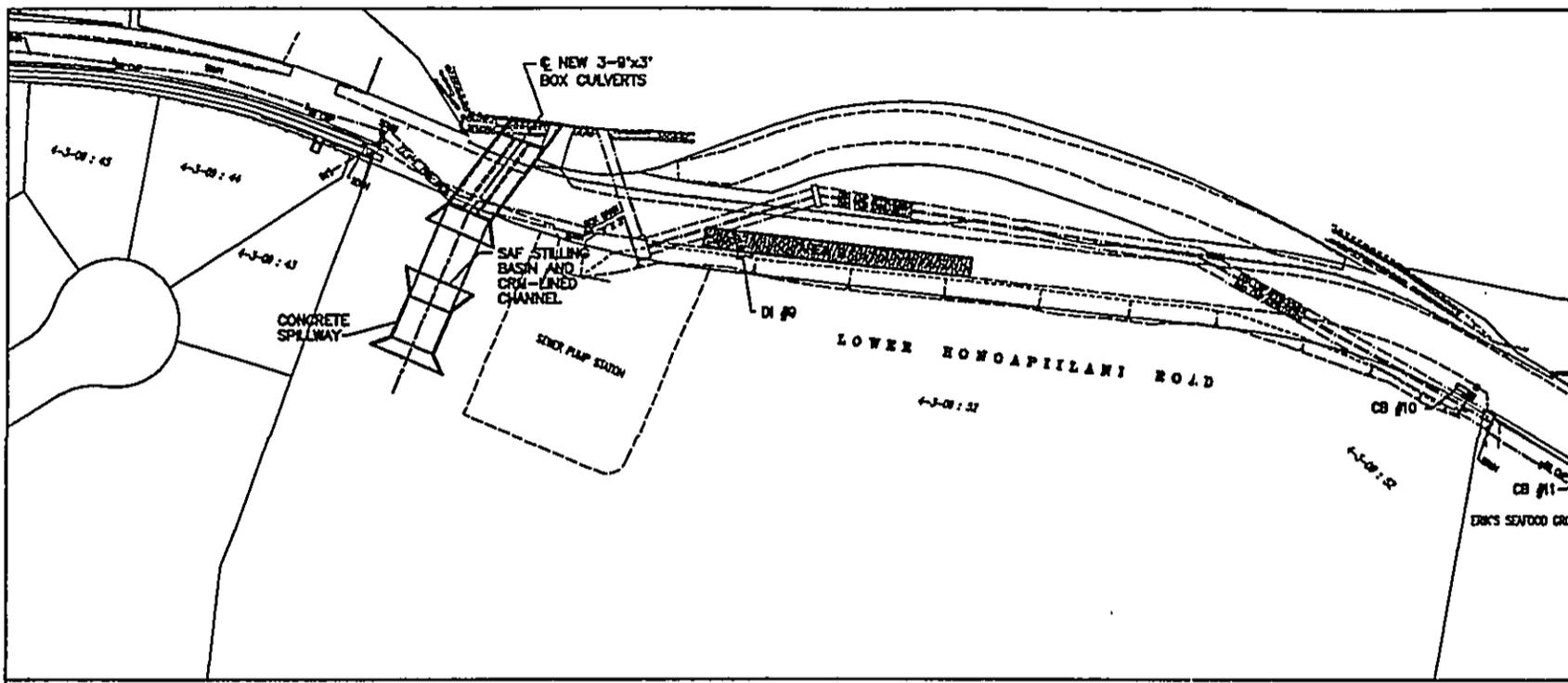
Total runoff through the new culvert will be 773 cfs. Analysis shows the culvert will operate with inlet control and normal depth of 2.56 ft. Outlet velocities will be 11.20 fps for 773 cfs. The hydraulic grade line elevation and the elevation at the outlet shown in the calculations are based on the culvert hydraulics for the triple barrel culvert. See "Pipe Flow Analysis: Proposed Conditions" in Appendix B. The pipe system analysis for the Mahinahina Ventures Subdivision north system shows the inlets will not be overtopped during a 10-year storm.

#### IV. CONCLUSIONS

The proposed roadway improvements to the Lower Honoapiilani Road will widen the travelway and provide additional drainage in the area between Mahinahina Stream and Hoohui Road. The roadway improvements do not significantly increase the runoff coefficient, time of concentration, or flows of the areas now draining to the existing systems. However, new inlets to drain additional areas slightly increase the flows in the drainage system. The proposed swale will intercept the majority of runoff from the roadway and channel the flow into new drainage structures. Analysis shows that the swale can accommodate the on-site runoff during a 10-year storm.

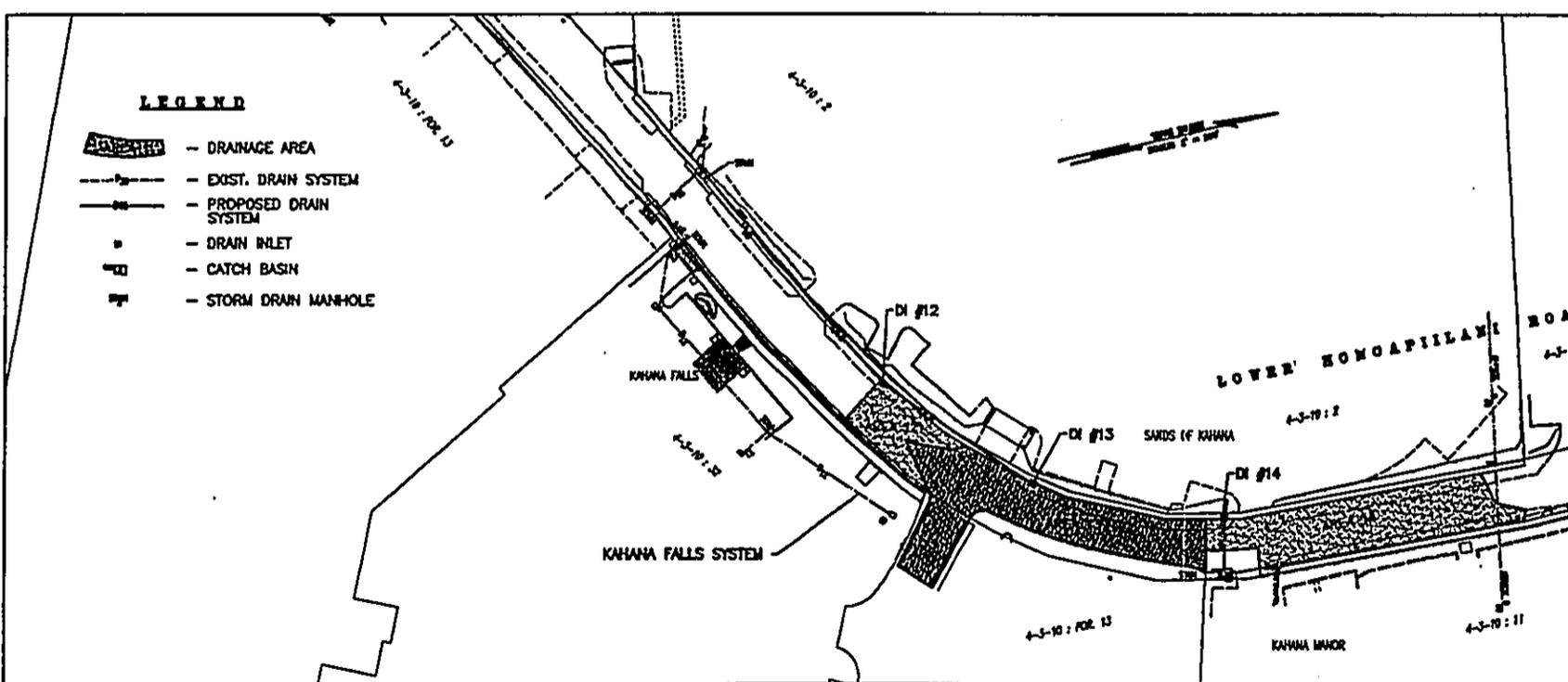
A total of 7.22 cfs will be added to the overall roadway drainage system. The Mahinahina Ventures system has a flow increase of 4.39 cfs. The Kahana Villas system flow increases by 0.36 cfs. The Kahana Falls and Kahana Manor system flows increase by 1.57 cfs and 0.90 cfs, respectively. Hydraulic analysis for each system indicates the existing drain lines are sufficient to contain the additional flows without overflowing.

The offsite runoff will be channeled through a triple barrel 9'x3' box culvert below Lower Honoapiilani Road. Approximately 773 cfs will be generated during a 100-year storm. The culvert will operate under inlet control, with depth at the inlet of 5.1'. Since the roadway grades are higher than the proposed headwater elevation, the roadway will not be flooded.



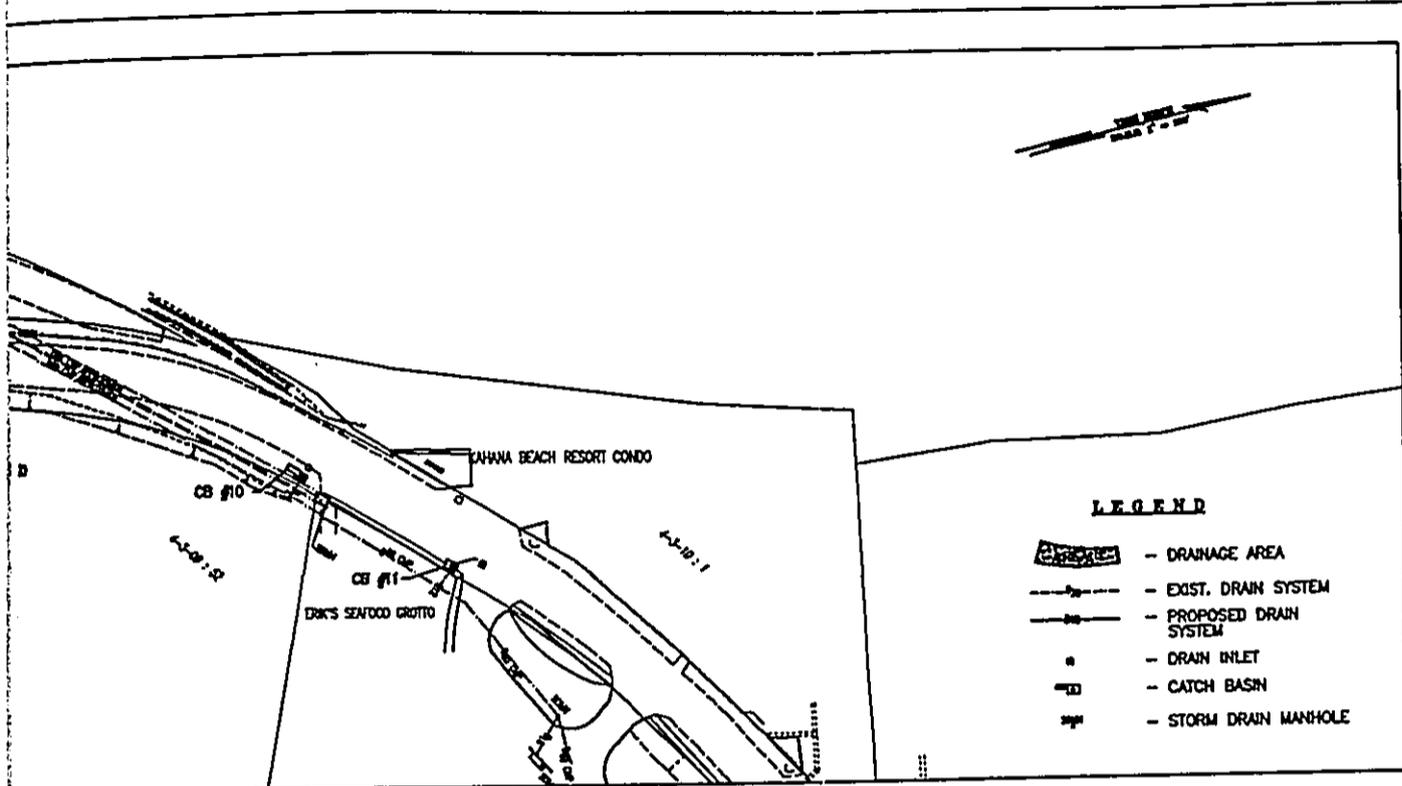

**WILSON OKAMOTO & ASSOCIATES, INC.**  
 ENGINEERS-ARCHITECTS  
 1000 S. WILSON ST., SUITE 200  
 HONOLULU, HAWAII 96813

**KAHANA VILLA/KAHANA FALLS SYSTEM**  
 LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE - 3  
 LAHAINA, MAUI, HAWAII



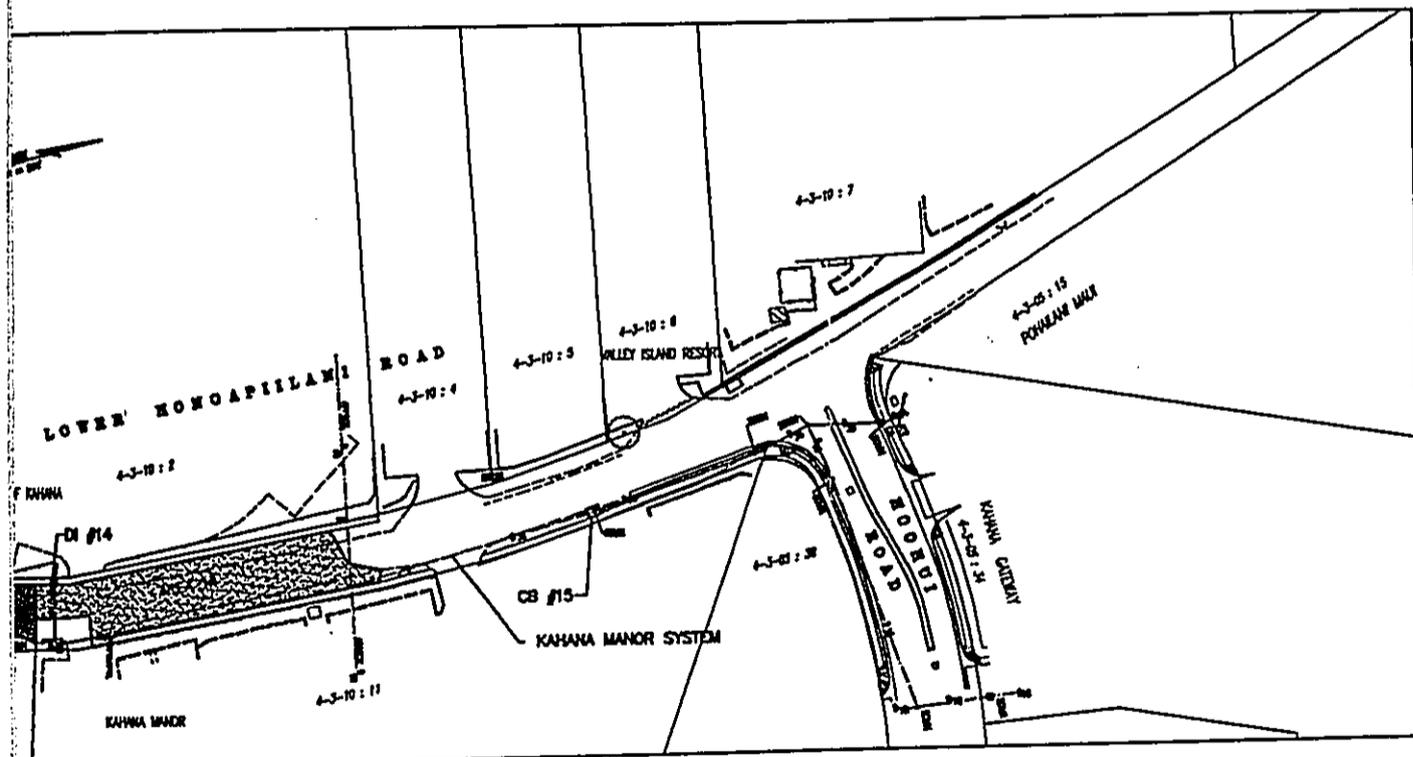

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 HONOLULU, HAWAII 96813

**KAHANA FALLS & KAHANA MANOR SYSTEMS**  
 LOWER HONOAPIILANI ROAD IMPROVEMENTS, PHASE - 3  
 LAHAINA, MAUI, HAWAII



**KAHANA FALLS SYSTEM**  
ROAD IMPROVEMENTS, PHASE - 3  
MA, MAUI, HAWAII

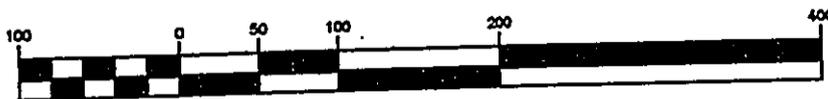
**EXHIBIT F**



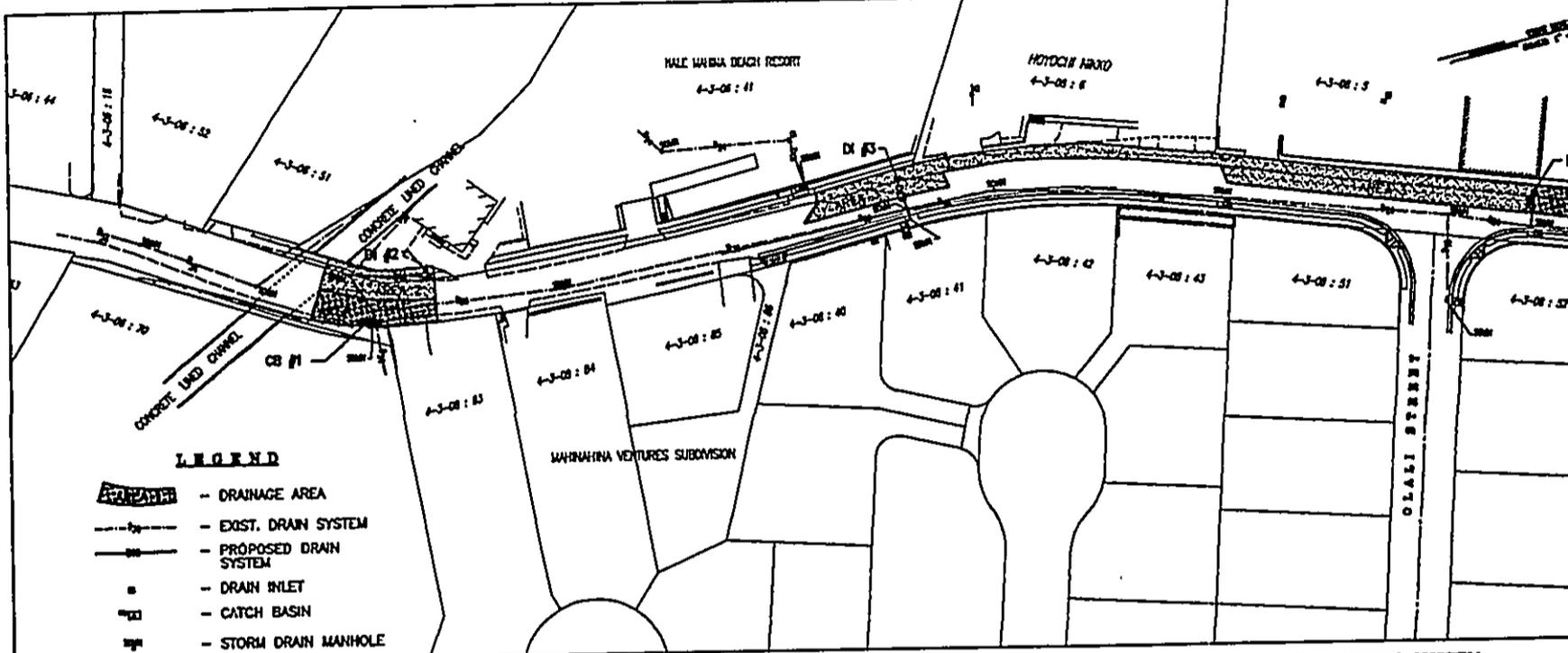
**KAHANA MANOR SYSTEMS**  
ROAD IMPROVEMENTS, PHASE - 3  
MA, MAUI, HAWAII

**EXHIBIT G**

**GRAPHIC SCALE**



( IN FEET )  
1 inch = 100 ft.

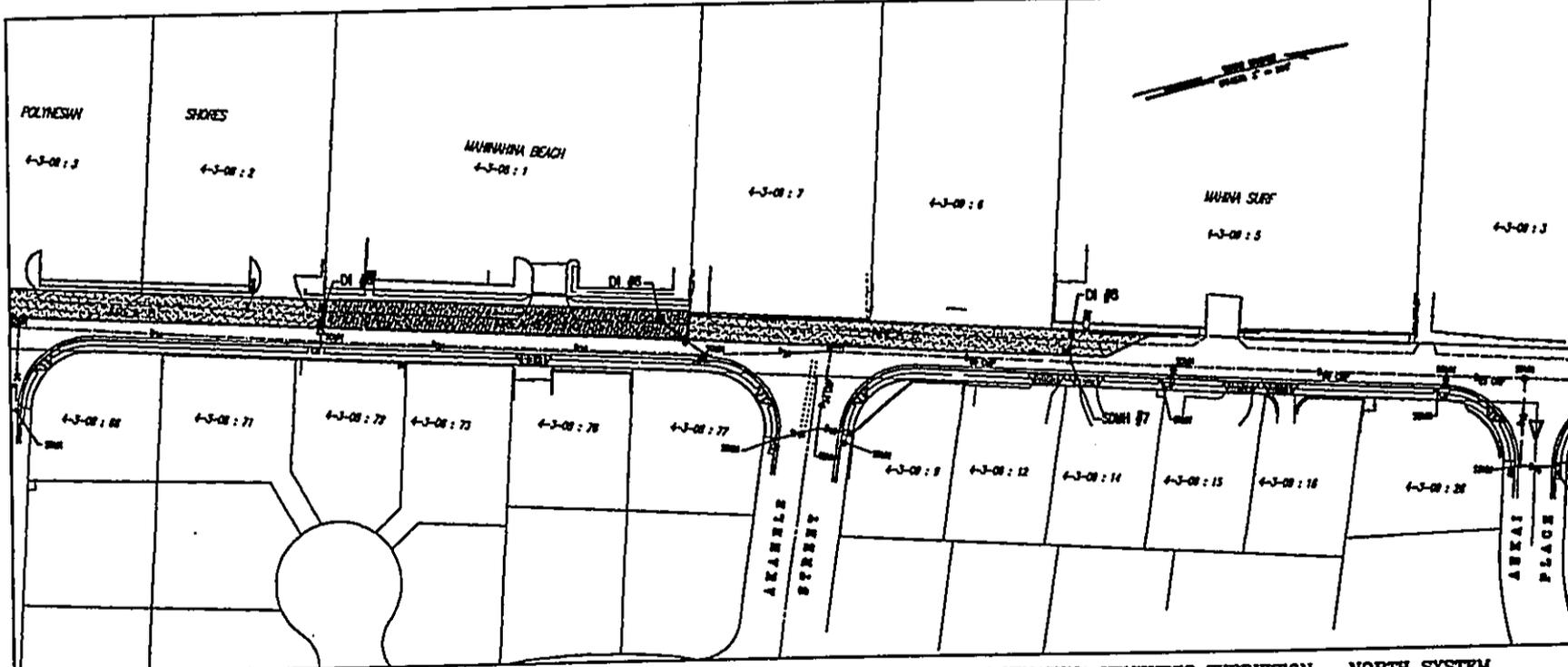


**LEGEND**

- DRAINAGE AREA
- EXIST. DRAIN SYSTEM
- PROPOSED DRAIN SYSTEM
- DRAIN INLET
- CATCH BASIN
- STORM DRAIN MANHOLE

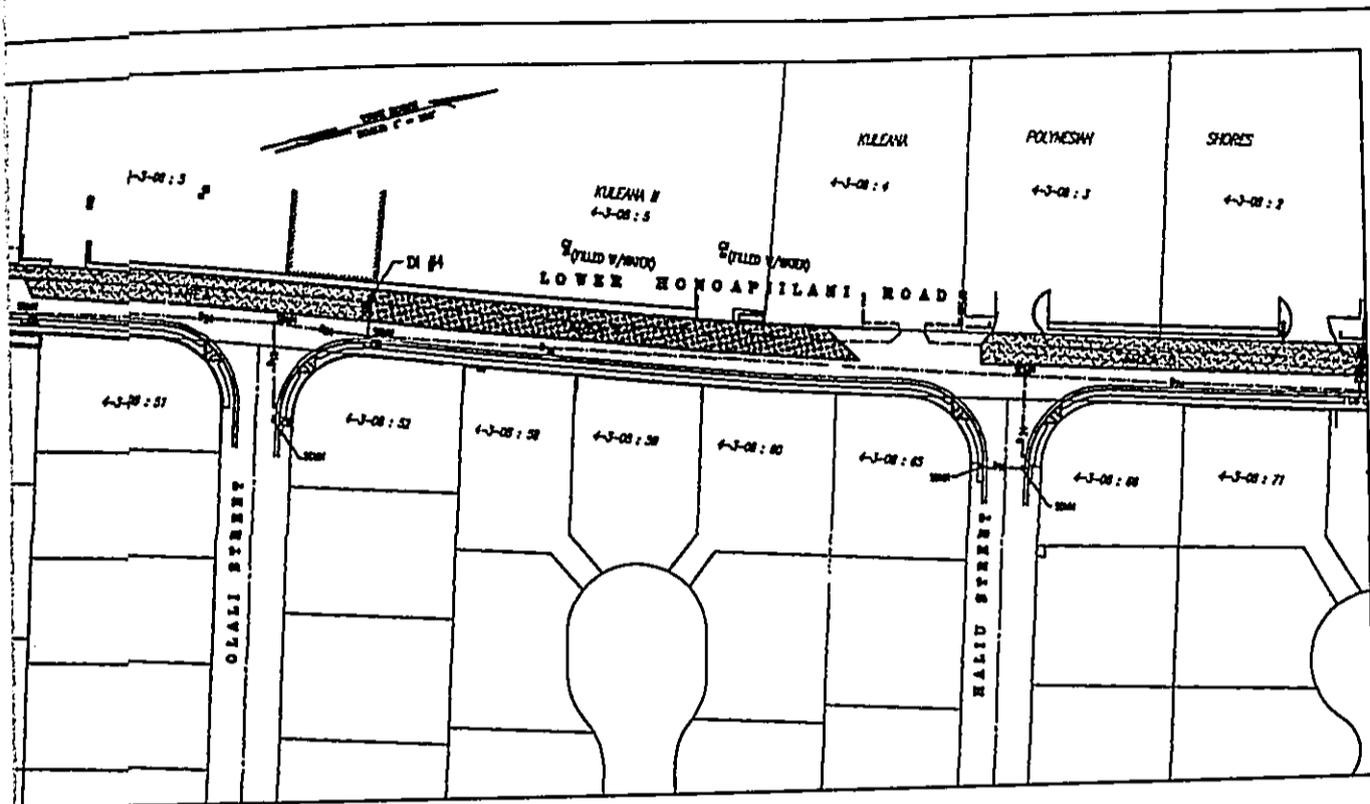
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 1000 KALANANAKU AVE., SUITE 200  
 HONOLULU, HAWAII 96813

**MAHINAHINA VENTURES SUBDIVISION - SOUTH SYSTEM**  
 LOWER HONOAPILANI ROAD IMPROVEMENTS, PHASE - 3  
 LAHAINA, MAUI, HAWAII



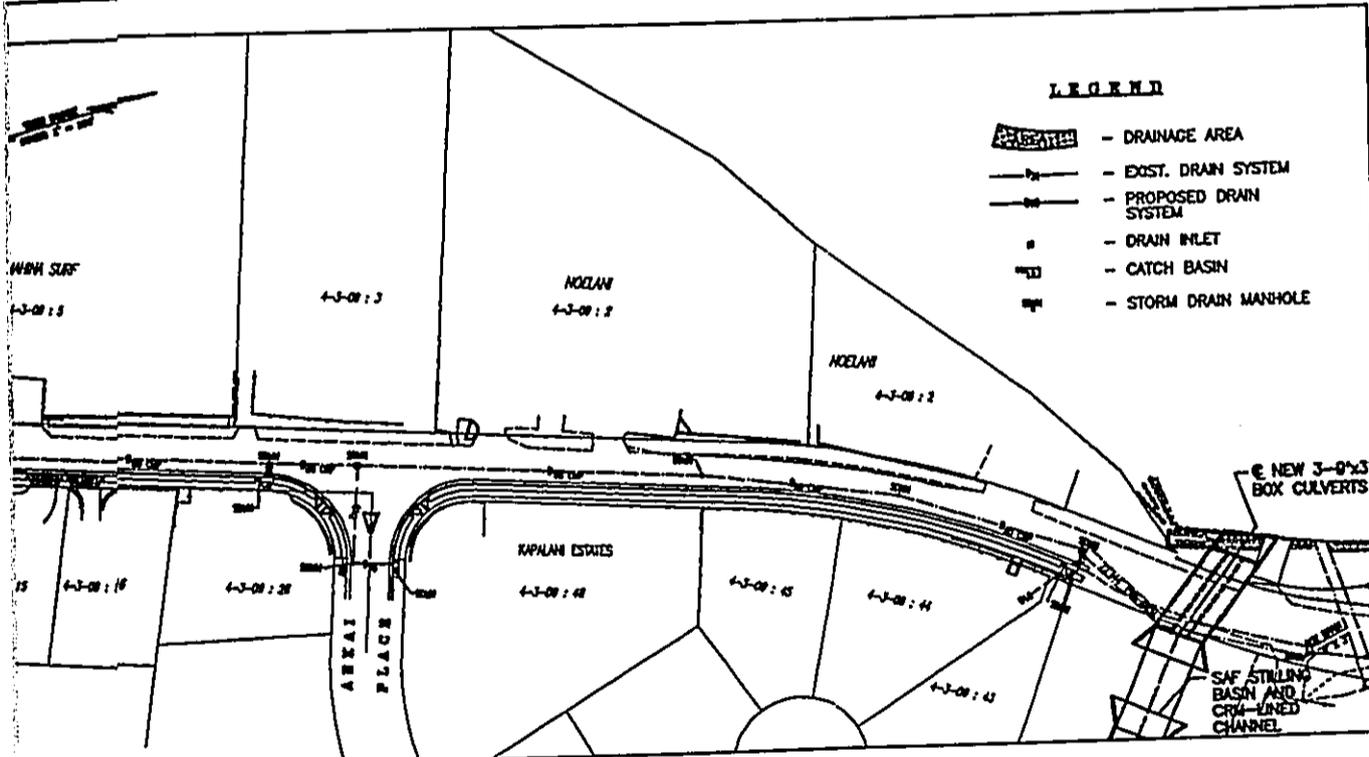
WILSON OKAMOTO & ASSOCIATES, INC.  
 ENGINEERS-ARCHITECTS  
 1000 KALANANAKU AVE., SUITE 200  
 HONOLULU, HAWAII 96813

**MAHINAHINA VENTURES SUBDIVISION - NORTH SYSTEM**  
 LOWER HONOAPILANI ROAD IMPROVEMENTS, PHASE - 3  
 LAHAINA, MAUI, HAWAII



SUBDIVISION - SOUTH SYSTEM  
DRAINAGE IMPROVEMENTS, PHASE - 3  
MAUI, HAWAII

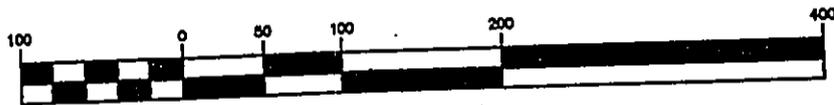
EXHIBIT D



SUBDIVISION - NORTH SYSTEM  
DRAINAGE IMPROVEMENTS, PHASE - 3  
MAUI, HAWAII

EXHIBIT E

GRAPHIC SCALE



( IN FEET )  
1 inch = 100 ft.

V. REFERENCES

1. Drainage and Erosion Control Study for the Falls of Kahana, Richard M. Sato & Associates, September 1990.
2. Drainage Study and Supporting Computations for Development of Kahana Villa, Warren S. Unemori Engineering, Inc., March 9, 1979.
3. Honolua Watershed Work Plan, West Maui Soil and Water Conservation District and County of Maui, March 1976.
4. Hydraulic and Hydrologic Report for Kahana Villa - Increment III, Warren S. Unemori Engineering, Inc., June 1980.
5. Hydraulic and Hydrologic Report for Mahinahina Ventures Subdivision, Warren S. Unemori Engineering, Inc., March 1981.
6. Interim Drainage Standards for County of Maui, Department of Public Works and Waste Management, County of Maui, January 1994.
7. Revised Drainage & Erosion Calculations for Kahana Manor, Norman Saito Engineering Consultants, Inc., May 1979.
8. Sands of Kahana drainage calculations, Norman Saito Engineering Consultants, Inc., February 1981.
9. Soil Survey of the Island of Kauai, Oahu, Maui, Molokai and Lanai, U.S. Department of Agriculture Soil Conservation Service, August 1972.

APPENDIX A  
HYDROLOGY CALCULATIONS

LOWER HONOAPIILANI ROAD - PHASE 3  
 NAPILI, MAUI

OCTOBER 17, 1995  
 3371-01/3371AK

HYDROLOGIC CALCULATIONS - NEW INLET STRUCTURES

INLET STRUCTURE	DRAINAGE AREA NAME	AREA A (acres)	LENGTH OF FLOW, L (feet)	SLOPE S (ft/ft)	TIME OF CONCENTRATION (min)	CORRECTION FACTOR	INTENSITY I (in/hr)	RUNOFF Q (cfs)
CB #1	AREA 1	0.05	77	0.013	5.0	4.65	8.37	0.28
DI #2	AREA 2	0.05	102	0.028	5.0	4.65	8.37	0.33
DI #3	AREA 3	0.14	442	0.036	5.0	4.65	8.37	0.82
DI #4	AREA 4	0.13	303	0.026	6.0	4.45	8.01	0.76
DI #5	AREA 5	0.14	330	0.007	6.0	4.45	8.01	0.85
DI #6	AREA 6	0.11	234	0.012	5.0	4.65	8.37	0.67
DI #8	AREA 8	0.06	265	0.020	8.5	4.00	7.20	0.68
CB #9	AREA 9	0.06	155	0.024	5.0	4.65	8.37	0.36
DI #12	AREA 12	0.01	225	0.027	5.0	4.65	8.37	0.35
DI #13	AREA 13	0.19	130	0.027	5.0	4.65	8.37	1.22
DI #14	AREA 14	0.15	200	0.009	6.0	4.45	8.01	0.90

NOTES:

1. AREAS LESS THAN 100 ACRES, USE RATIONAL METHOD,  $Q = C I A$
2. TIME OF CONCENTRATION = 5 MINUTES (MINIMUM)
3. RECURRENCE INTERVAL = 10 YEARS ;  $i = 1.8 \text{ IN/HR}$
4. RUNOFF COEFFICIENT,  $C = 0.20 + 0.03 + 0.07 + 0.45 = 0.75$   
 (FROM TABLE 1, "REVISED INTERIM DRAINAGE STANDARDS FOR COUNTY OF MAUI",  
 JANUARY 1994).
5. SDMH #7 INSTALLED OVER EXISTING 60" DRAINLINE
6. CB#10 AND CB#11 REPLACE EXISTING INLET STRUCTURES  
 AND ARE NOT ANALYZED.

DOCUMENT CAPTURED AS RECEIVED

- ARCHITECTURAL
- STRUCTURAL
- CIVIL
- PLANNING

WILSON OKAMOTO & ASSOCIATES, INC.  
ENGINEERS, ARCHITECTS AND PLANNERS

COMPUTED BY AK  
CHECKED BY RH  
DATE JANUARY 2 1996

FLOW INTO NEW CULVERT

PROJECT 3371-01

SHEET NO.      OF      SHEETS

MAHINAHUA VENTURES

$T_m = 50$  yrs  
1-HR RAINFALL = 2.5 in.

REF: "MAHINAHUA VENTURES" - RECEIVED  
DRAWINGS BY: WATSON & UNEMOTO

DRAINAGE AREA "A" :  $Q = 3.2$  cfs

DRAINAGE AREA "B" :  $Q = 2.0$  cfs

(AREA = 2.9 AC)

$Q = 5.2$  cfs

HONOLULU HIGHWAY - DRAINAGE MAP

$T_m = 50$  yrs (EXCEPT AS NOTED)

REF: "DRAINAGE MAP", HONOLULU  
HIGHWAY - HONOLULU TO KAHANA  
BY STATE DOT (DEC. 1977)

DRAINAGE AREA "K" :  $Q = 0$  cfs

DRAINAGE AREA "L" :  $Q = 6.45$  cfs ( $T_m = 100$  yrs)

DRAINAGE AREA "M" :  $Q = 3$  cfs

DRAINAGE AREA "N" :  $Q = 7$  cfs

(AREA = 251.6 AC)

$Q = 66.3$  cfs

OPISU LOT (EXCLUDING PUMP STATION LOT)

$T_m = 100$  yrs

(SEE ATTACHED SHT)  $Q = 23.48$  cfs

(AREA = 10.9 AC)

TOTAL NEW  $Q$  INTO NEW CULVERT =  $5.2 + 66.3 + 23.48 = 95.08$

MAHINAHUA VENTURES SUBDIVISION - NORTH SYSTEM

$Q$  (INTO EXIST. BOX CULVERT) = 81.3 cfs

TOTAL  $Q$  INTO NEW CULVERT =  $95.08 + 81.3 = 176.38 \approx 176$  cfs

- ARCHITECTURAL
- STRUCTURAL
- CIVIL
- PLANNING

**WILSON OKAMOTO & ASSOCIATES, INC.**  
ENGINEERS, ARCHITECTS AND PLANNERS

COMPUTED BY AK  
CHECKED BY \_\_\_\_\_  
DATE JANUARY 2 1996

RUNOFF FROM OPEN LOT

PROJECT 3371-01  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_ SHEETS

$A = 11.30 \text{ ac} - \frac{12,050}{43560} = 10.94 \text{ ac}$  (FROM TAX MAPS)

$C = 0.53$  (MODERATE CHARACTERISTICS)

$i_{10} = 2.0 \text{ in/hr}$

$i_{50} = 2.5 \text{ in/hr}$

$i_{100} = 2.75 \text{ in/hr}$

$L = 950 \text{ ft}$

$H = 60 - 11.5 = 48.5 \text{ ft}$  (ASSUMED)

$S = \frac{1}{4} = 48.5 / 950 = 5.11 \%$

ASSUME AVG. GRASS SURFACE

FROM PLATE 1 :  $T_c = 27 \text{ MINUTES}$

FROM PLATE 2 :  $I_{10} = 3.25 \text{ in/hr}$

$I_{50} = 3.70 \text{ in/hr}$

$I_{100} = 4.05 \text{ in/hr}$

RATIONAL FORMULA  $Q = CIA$

$Q_{10} = C I_{10} A = (0.53)(3.25 \text{ in/hr})(10.94 \text{ ac}) = 18.84 \text{ cfs}$

$Q_{50} = C I_{50} A = (0.53)(3.70 \text{ in/hr})(10.94) = 21.45 \text{ cfs}$

$Q_{100} = C I_{100} A = (0.53)(4.05 \text{ in/hr})(10.94) = 23.48 \text{ cfs}$

REFERENCE : "REVISED INTERIM DRAINAGE STANDARDS FOR COUNTY OF MAUI -  
JANUARY 1994"

APPENDIX B  
HYDRAULIC CALCULATIONS

PIPE FLOW ANALYSIS:  
EXISTING CONDITIONS

Note: Calculations are based on the referenced drainage reports. The structure names have been adapted from these previous reports.





MAHINAHINA VENTURES SUBDIVISION - NORTH SYSTEM & KAHANA VILLA/KAHANA FALLS SYSTEM															FILE: DRAIN23.WK1				
Inlet	Runoff	dn	VF	Size of Pipe	n	Length	Sf	S	Inv. Elev.	Hf	Manhole Losses			Ent. Cont.		Hydraulic Grade Elev.		Fin. Grade Elev.	
											A	B	C	D	Cont.	Up	Down		
	7.3	0.98	2.32	24	0.024	266	0.0035	0.0101		0.94									
CB14									32.65		0.02	0.07	0.01	0.00	1.41			34.07	36.40
DMH11	1.9	0.61	0.60	24	0.024	208	0.0002	0.0076		0.05							34.84		
									34.23		0.00	0.00	0.01	0.00	0.67			34.91	38.70



KAHANA MANOR SYSTEM													FILE: DRAIN4.WK1						
Inlet	Runoff	dn	VF	Size of Pipe	n	Length	Sf	S	Inv. Elev.	HF	Manhole Losses			Ent. Cont.	Hydraulic Grade Elev.		Fin. Grade Elev.		
											A	B	C		D	Down		Up	
OUTLET																			
	262.2	5.00	13.35	60	0.013	259	0.0101	0.0050	2.50	2.63						7.50	7.50		
615									3.80		0.00	0.09	0.40	0.10	0.00		10.13		
	257.9	5.00	13.13	60	0.013	23	0.0098	0.0043	3.90	0.23							10.94	11.90	
592									3.90		0.00	0.00	0.39	0.00	0.00			11.33	11.90
	257.9	2.59	13.13	60	0.013	250	0.0098	0.0204	9.00	2.45							13.78		
342									9.00		0.00	0.00	0.39	0.00	0.00			14.17	18.00
	257.9	2.49	13.13	60	0.013	40	0.0098	0.0250	10.00	0.39							14.56		
302									10.00		0.57	0.72	0.39	0.32	0.00			16.56	21.00
	220.5	3.88	11.23	60	0.013	16	0.0072	0.0250	10.40	0.11							16.68		
285									10.40		0.39	2.00	0.26	0.00	8.73			19.39	22.00
302									11.00										
	35.7	3.00	5.05	36	0.024	155	0.0098	0.0033	11.00	1.51							18.08		21.00
MH									11.51		0.06	0.39	0.04	0.00	3.02			18.57	19.50
302									11.75										
	1.7	0.50	0.96	18	0.024	191	0.0009	0.0215	11.75	0.17							16.73		21.00
CBC1									15.86		0.00	0.02	0.00	0.00	0.66			16.75	20.20
615									5.55										
	2.1	0.52	1.19	18	0.024	93	0.0014	0.0280	5.55	0.13							10.84		11.90
F1									8.15		0.00	0.01	0.01	0.00	0.76			10.86	12.40
	0.6	0.44	0.76	12	0.024	109	0.0010	0.0061	8.15	0.11							10.97		
TC									8.81		0.00	0.00	0.00	0.00	0.40			10.97	11.00

PIPE FLOW ANALYSIS:

PROPOSED CONDITIONS

Note: Calculations are based on the referenced drainage reports. The structure names have been adapted from these previous reports. New structures are indicated by shading.

FILE: DRAIN1A.WK1

MAHINAHINA VENTURES SUBDIVISION - SOUTH SYSTEM

Inlet	Runoff	dn	VF	Size of Pipe	n	Length	Sf	S	Inv. Elev.	HI	Manhole Losses			Ent. Cont.	Hydraulic Grade Elev.		Fin. Grade Elev.
											A	B	C		D	Down	
OUTLET																	
	27.6	3.00	3.90	36	0.024	81	0.0058	0.0025	6.43	0.47					11.40	17.00	
DMH3A									6.63		0.03	0.00	0.06	2.39	11.87		20.20
DMH3	27.3	3.00	3.86	36	0.024	30	0.0057	0.0010	6.66	0.17	0.03	0.13	0.06	2.39	12.13		20.20
DMH10	16.7	1.47	2.36	36	0.024	130	0.0021	0.0063	7.48	0.28	0.01	0.00	0.01	1.77	12.64		16.10
DMH9	16.7	1.47	2.36	36	0.024	240	0.0021	0.0064	9.01	0.51	0.02	0.00	0.05	1.77	13.17		14.20
DMH8	11.2	0.96	3.57	24	0.024	61	0.0084	0.0280	10.72	1.30	0.05	0.00	0.02	1.75	13.79		14.70
CB8	11.2	0.94	3.57	24	0.024	156	0.0084	0.0356	16.27	0.76	0.05	0.07	0.02	1.75	17.21		21.00
DMH6	8.7	0.84	2.77	24	0.024	150	0.0050	0.0479	23.46	0.75	0.05	0.00	0.05	1.48	24.30		27.60
CB6	6.6	0.73	3.73	18	0.024	56	0.0135	0.0434	25.89	0.23	0.05	0.14	0.02	1.42	26.62		30.10
DMH5	1.9	0.47	1.08	18	0.024	202	0.0011	0.0327	32.50		0.00	0.00	0.01	0.71	32.97		37.40
DMH3A	0.3	0.06	0.17	18	0.013	55	0.0000	0.0196	11.92	0.00	0.00	0.00	0.00	0.00	11.96		20.20
D12									13.00		0.00	0.00	0.00	0.30	13.06		17.50
DMH3	0	0.07	0.00	18	0.013	8	0.0000	0.0200	9.84	0.00	0.00	0.00	0.00	0.00	12.36		20.20
CB1									10.00		0.00	0.00	0.00	0.31	12.36		20.40

FILE: DRAIN1A.WK1

MAHINAHINA VENTURES SUBDIVISION - SOUTH SYSTEM

Inlet	Runoff	dn	VF	Size of Pipe	n	Length	Sf	S	Inv. Elev.	Hf	Manhole Losses			Ent. Cont.	Hydraulic Grade Elev.		Fin. Grade Elev.
											A	B	C		D	Down	
DMH9																	
	0.8	0.18	0.45	18	0.013	29	0.0001	0.0159	9.91	0.00	0.00	0.00	0.00	0.00	13.28	14.20	
D13									10.37						13.29	14.20	
CB6																	
	0.8	0.20	0.45	18	0.013	24	0.0001	0.0129	25.89	0.00	0.00	0.00	0.00	0.00	27.33	27.60	
D14									26.20						27.33	29.90	

MAHNAHINA VENTURES SUBDIVISION - NORTH SYSTEM & KAHANA VILLA/KAHANA FALLS SYSTEM															FILE: DRAIN23B.WK1		
Inlet	Runoff	dn	VF	Size of Pipe	n	Length	Sf	S	Inv. Elev.	Hf	Manhole Losses			Ent. Cont.	Hydraulic Grade Elev.		Fin. Grade Elev.
											A	B	C		D	Down	
OUTLET									3.00							3.00	8.00
DMH1	203.7	2.92	5.18	4x6	0.013	89	0.0023	0.0072		0.20					6.56		
DMH2	203.4	2.85	5.18	2-60	0.013	125	0.0015	0.0024	3.64	0.19	0.13	0.40	0.26	0.00		10.34	10.80
DMH4	203.4	3.65	5.18	2-60	0.013	265	0.0015	0.0017	3.94	0.40	0.06	0.00	0.04	0.00		10.63	14.80
DMH5	203.4	2.43	5.18	2-60	0.013	230	0.0015	0.0048	4.38	0.35	0.06	0.00	0.04	0.00		11.13	13.50
OUTLET									5.48		0.06	0.00	0.04	0.00		11.47	
3x9CON	257.7	2.56	11.20	3x9	0.013	54	0.0050	0.0052		0.27							
DMHA	81.3	0.91	4.15	72x44	0.024	64	0.0045	0.0683	4.37	0.29	0.02	0.00	0.02	0.00		6.93	9.12
DMH23	81.3	1.73	4.14	60	0.024	111	0.0033	0.0689	8.74	0.37	0.04	0.00	0.07	0.00		9.65	12.24
DMH22	81.3	2.11	4.14	60	0.024	125	0.0033	0.0307	16.39	0.42	0.04	0.00	0.02	0.00		18.12	15.70
DMH20	81.3	2.26	4.14	60	0.024	212	0.0033	0.0200	20.23	0.70	0.04	0.00	0.02	0.00		22.34	23.30
DMH19	74.6	2.44	3.80	60	0.024	53	0.0028	0.0085	24.47	0.15	0.04	0.04	0.07	0.03		26.73	27.90
DMH18	70.4	2.42	3.59	60	0.024	190	0.0025	0.0081	24.92	0.47	0.03	0.02	0.06	0.01		28.51	34.20
DMH7A	67.2	2.39	3.42	60	0.024	70	0.0023	0.0286	26.46	0.16	0.03	0.02	0.06	0.01		29.10	35.70
DMH17	66.5	2.38	3.39	60	0.024	164	0.0022	0.0177	27.06	0.36	0.03	0.00	0.02	0.01		30.85	35.90
									28.46		0.03	0.00	0.02	0.08		32.34	36.00
																31.92	

MAHNAHINA VENTURES SUBDIVISION - NORTH SYSTEM & KAHANA VILLA/KAHANA FALLS SYSTEM															FILE: DRAIN23B.WK1				
Inlet	Runoff	dn	VF	Size of Pipe	n	Length	Sf	S	Inv. Elev.	Hf	Manhole Losses				Ent. Cont.	Hydraulic Grade Elev.		Fin. Grade Elev.	
											A	B	C	D		Down	Up		
CB15	11.5	1.03	3.66	24	0.024	81	0.0088	0.0185		0.71							32.63		
CB14	8.1	1.02	2.58	24	0.024	266	0.0044	0.0101	29.96	1.16	0.07	0.10	0.02	1.88				32.84	35.80
DMH11	1.9	0.61	0.60	24	0.024	208	0.0002	0.0076	32.65	0.05	0.03	0.09	0.01	1.50				34.01	36.40
DMH1									34.23		0.00	0.01	0.01	0.00	0.67			34.84	38.70
CB9	0.4	0.08	0.23	18	0.013	22	0.0015	0.0618	7.75	0.03	0.00	0.00	0.00	0.00				10.34	10.80
DMH7A									9.11		0.00	0.00	0.00	0.32				10.37	12.90
D18	0.7	0.08	0.40	18	0.013	18	0.0000	0.2189	27.06	0.00	0.00	0.00	0.00	0.00				30.91	35.70
CB15									31.00		0.00	0.00	0.00	0.41				31.41	35.50
D16	0.7	0.17	0.40	18	0.013	45	0.0000	0.0151	29.96	0.00	0.00	0.00	0.00	0.00				32.85	35.90
CB14									30.64		0.00	0.00	0.00	0.41				32.85	35.90
D15	0.9	0.23	0.51	18	0.013	23	0.0001	0.0122	32.65	0.00	0.00	0.00	0.00	0.00				34.16	36.40
									32.93		0.00	0.00	0.00	0.45				34.16	36.20

KAHANA FALLS SYSTEM															FILE: DRAIN5A.WK1				
Inlet	Runoff	dn	VF	Size of Pipe	n	Length	Sf	S	Inv. Elev.	Hf	Manhole Losses			Ent. Cont.	Hydraulic Grade Elev.		Fin. Grade Elev.		
											A	B	C		D	Down		Up	
OUTLET									6.50							8.00	9.00		
DMH F1	7.8	1.50	4.41	18	0.024	60.71	0.0188	0.0092	7.06	1.14	0.09	0.11	0.00	0.03	1.76	9.14	9.37	10.00	
FI-1	6.0	1.50	3.40	18	0.024	59.31	0.0111	0.0091	7.60	0.66	0.04	0.02	0.00	0.00	1.45	10.03		10.10	
CB#2	5.5	1.50	3.11	18	0.024	78.27	0.0093	0.0036	7.88	0.73	0.04	0.06	0.04	0.00	1.36	10.82	10.96	11.40	
CB#1	3.2	0.68	1.82	22x13	0.024	37	0.0032	0.0184	8.56	0.12	0.01	0.02	0.02	0.00	0.97	11.08	11.13	11.60	
DMH A1	2.5	0.72	1.41	18	0.024	30	0.0019	0.0020	8.62	0.06	0.00	0.00	0.01	0.00	0.84	11.19	11.20	11.60	
DI A2	2.5	0.50	1.41	18	0.024	15	0.0019	0.0133	8.82	0.03	0.00	0.01	0.01	0.00	0.84	11.23	11.25	12.50	
DI A3	2.2	0.25	1.24	18	0.024	35	0.0015	0.0649		0.05	0.01	0.03	0.01	0.00		11.34			
DMH A4	1.5	0.32	1.91	12	0.010	113	0.0010	0.0276	11.09	0.12	0.01	0.00	0.02	0.00	0.76	14.53	11.13	14.80	
DI A5	0.9	0.30	1.15	12	0.010	102	0.0004	0.0110	14.21	0.04	0.01	0.03	0.01	0.00	0.73	15.63	14.95	18.40	
DMH F1	1.8	0.71	1.02	18	0.024	76.28	0.0010	0.0041	15.33	0.08	0.00	0.02	0.00	0.00	0.52		11.25	18.70	
FI C1									7.06		0.00	0.00	0.00	0.00	0.00		9.45	9.37	10.00
CB#2	1.6	0.36	0.91	18	0.013	183	0.0002	0.0132	7.88	0.04	0.00	0.00	0.00	0.00	0.00			10.96	11.10
DI12	1.2	0.33	0.68	18	0.013	125	0.0001	0.0100	10.29	0.02	0.00	0.00	0.00	0.00	0.63	11.00	11.00	14.90	
DI13									11.54		0.00	0.00	0.00	0.00	0.55	11.87	12.09	15.60	

KAHANA MANOR SYSTEM

FILE: DRAIN4A.WK1																			
Inlet	Runoff	dn	VF	Size of Pipe	n	Length	Sf	S	Inv. Elev.	Hf	Manhole Losses				Eht. Cont.	Hydraulic Grade Elev.		Fin. Grade Elev.	
											A	B	C	D		Down	Up		
OUTLET																			
615	263.9	5.00	13.44	60	0.013	259	0.0103	0.0050	2.50	2.66							7.50	7.50	
592	259.6	5.00	13.22	60	0.013	23	0.0099	0.0043	3.80	0.23	0.00	0.09	0.40	0.10	0.00		10.16	10.75	11.90
342	259.6	2.60	13.22	60	0.013	250	0.0099	0.0204	3.90	2.48	0.00	0.00	0.39	0.00	0.00		10.98	11.37	11.90
302	259.6	2.50	13.22	60	0.013	40	0.0099	0.0250	9.00	0.40	0.00	0.00	0.39	0.00	0.00		13.85	14.24	18.00
285	220.5	3.88	11.23	60	0.013	16	0.0072	0.0250	10.00	0.11	0.57	0.72	0.39	0.32	0.00		14.64	16.64	21.00
302									10.40		0.39	2.00	0.26	0.00	8.73		16.75	19.40	22.00
CB15	36.5	3.00	5.16	36	0.024	155	0.0102	0.0033	11.00	1.58	0.00	0.00	0.00	0.00	0.00		18.22	16.64	21.00
302									11.51		0.06	0.39	0.04	0.00	3.02		18.71	18.71	19.50
CBC1	2.6	0.62	1.47	18	0.024	191	0.0021	0.0215	11.75	0.40	0.00	0.00	0.00	0.00	0.00		17.04	16.64	21.00
DI14	0.9	0.34	0.51	18	0.013	34	0.0001	0.0053	15.86	0.00	0.00	0.02	0.00	0.00	0.66		17.06	17.06	20.20
									16.04		0.00	0.00	0.00	0.00	0.47		17.06	17.06	18.40

KAHANA MANOR SYSTEM													FILE: DRAIN4A.WK1					
Inlet	Runoff	dn	VF	Size of Pipe	n	Length	Sf	S	Inv. Elev.	HI	Manhole Losses				Ent. Cont.	Hydraulic Grade Elev.		Fin. Grade Elev.
											A	B	C	D		Down	Up	
615									5.55		0.00	0.00	0.00	0.00	0.00		10.75	11.90
F1	2.1	0.52	1.19	18	0.024	93	0.0014	0.0280	8.15	0.13	0.00	0.01	0.00	0.76	10.88		10.90	12.40
TC	0.6	0.44	0.76	12	0.024	109	0.0010	0.0061	8.81	0.11	0.00	0.00	0.00	0.40	11.00		11.00	11.00

SWALE ANALYSIS

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA. 38+00-38+77

Comment: CAPACITY OF 7' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope..	16.67:1 (H:V)
Right Side Slope.	20.00:1 (H:V)
Manning's n.....	0.015
Channel Slope....	0.0030 ft/ft
Discharge.....	0.28 cfs

Computed Results:

Depth.....	0.13 ft
Velocity.....	0.88 fps
Flow Area.....	0.32 sf
Flow Top Width...	4.82 ft < 7' ∴ OKAY
Wetted Perimeter.	4.83 ft
Critical Depth...	0.11 ft
Critical Slope...	0.0087 ft/ft
Froude Number....	0.61 (flow is Subcritical)

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA 38+77-41+50

Comment: CAPACITY OF 7' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope..	16.67:1 (H:V)
Right Side Slope.	20.00:1 (H:V)
Manning's n.....	0.015
Channel Slope....	0.0086 ft/ft
Discharge.....	0.41 cfs

Computed Results:

Depth.....	0.12 ft
Velocity.....	1.44 fps
Flow Area.....	0.28 sf
Flow Top Width...	4.57 ft < 7' ∴ OKAY
Wetted Perimeter.	4.57 ft
Critical Depth...	0.13 ft
Critical Slope...	0.0083 ft/ft
Froude Number....	1.02 (flow is Supercritical)

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA. 41+50-46+50

Comment: CAPACITY OF 7' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope.. 16.67:1 (H:V)  
Right Side Slope. 20.00:1 (H:V)  
Manning's n..... 0.015  
Channel Slope.... 0.0050 ft/ft  
Discharge..... 0.82 cfs

Computed Results:

Depth..... 0.18 ft  
Velocity..... 1.40 fps  
Flow Area..... 0.59 sf  
Flow Top Width... 6.56 ft < 7' ∴ okay  
Wetted Perimeter. 6.57 ft  
Critical Depth... 0.17 ft  
Critical Slope... 0.0075 ft/ft  
Froude Number.... 0.82 (flow is Subcritical)

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA. 46+50-50+37

Comment: CAPACITY OF 7' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope..	16.67:1 (H:V)
Right Side Slope.	20.00:1 (H:V)
Manning's n.....	0.015
Channel Slope....	0.0096 ft/ft
Discharge.....	0.98 cfs

Computed Results:

Depth.....	0.17 ft
Velocity.....	1.87 fps
Flow Area.....	0.52 sf
Flow Top Width...	6.20 ft < 7' ∴ okay
Wetted Perimeter.	6.21 ft
Critical Depth...	0.18 ft
Critical Slope...	0.0074 ft/ft
Froude Number....	1.13 (flow is Supercritical)

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA. 50+37-52+69

Comment: CAPACITY OF 7' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope..	16.67:1 (H:V)
Right Side Slope.	20.00:1 (H:V)
Manning's n.....	0.015
Channel Slope....	0.0056 ft/ft
Discharge.....	0.62 cfs

Computed Results:

Depth.....	0.16 ft
Velocity.....	1.36 fps
Flow Area.....	0.46 sf
Flow Top Width...	5.78 ft < 7' ∴ okay
Wetted Perimeter.	5.79 ft
Critical Depth...	0.15 ft
Critical Slope...	0.0078 ft/ft
Froude Number....	0.85 (flow is Subcritical)

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA. 52+69-55+20

Comment: CAPACITY OF 7' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope..	16.67:1 (H:V)
Right Side Slope.	20.00:1 (H:V)
Manning's n.....	0.015
Channel Slope....	0.0020 ft/ft
Discharge.....	0.67 cfs

Computed Results:

Depth.....	0.20 ft	
Velocity.....	0.94 fps	
Flow Area.....	0.71 sf	
Flow Top Width...	7.22 ft	> 7' ∴ CHECK FLOODING WIDTH
Wetted Perimeter.	7.23 ft	@ STA 53+63
Critical Depth...	0.15 ft	
Critical Slope...	0.0077 ft/ft	
Froude Number....	0.53 (flow is Subcritical)	

SOLUTION FOR A COMPOSITE CHANNEL  
USA UNITS

top width of flow @ sta 53+63

Discharge	0.67	Velocity Head	0.01
Velocity	0.87	HGL	36.58
Normal Depth	0.20	EGL	36.60
Bottom Slope	0.00200	Froude Number	0.52
Manning's n (eqv)	0.0150	Ycr	0.50

Area 0.77

Top Width 8.77 ← WIDTH OF FLOODING IN SWALE + TRAVELWAY

Wetted Perimeter 8.78

CHECK IF WITHIN 8' WIDE FLOOD WIDTH IN  
TRAVELWAY :

Hit RETURN to continue

8.77' < 7' SWALE + 8' FLOODING  
8.77' < 15' ✓ .OKAY

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA. 55+20-59+15

Comment: CAPACITY OF 5' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope.. 16.67:1 (H:V)  
Right Side Slope. 20.00:1 (H:V)  
Manning's n..... 0.015  
Channel Slope.... 0.0050 ft/ft  
Discharge..... 0.68 cfs

Computed Results:

Depth..... 0.17 ft  
Velocity..... 1.34 fps  
Flow Area..... 0.51 sf  
Flow Top Width... 6.11 ft > 5' ∴ CHECK FLOODING WIDTH  
Wetted Perimeter. 6.12 ft @ STA 57+94  
Critical Depth... 0.15 ft  
Critical Slope... 0.0077 ft/ft  
Froude Number.... 0.82 (flow is Subcritical)

SOLUTION FOR A COMPOSITE CHANNEL  
USA UNITS

TOP WIDTH OF FLOW @ STA 57+94

Discharge	0.68	Velocity Head	0.03
Velocity	1.37	HGL	35.93
Normal Depth	0.17	EGL	35.96
Bottom Slope	0.00500	Froude Number	0.84
Manning's n (eqv)	0.0150	Ycr	0.50

Area 0.50

Top Width 5.89

Wetted Perimeter 5.92

Hit RETURN to continue

← WIDTH OF FLOODING IN SWALE + TRAVELWAY

CHECK IF WITHIN 8' WIDE FLOOD WIDTH IN  
TRAVELWAY :

$$5.89' < 5' \text{ SWALE} + 8' \text{ FLOODING}$$

$$5.89' < 13' \quad \checkmark \quad \therefore \text{OKAY}$$

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA. 76+50-80+17

Comment: CAPACITY OF 8' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope..	16.67:1 (H:V)
Right Side Slope.	20.00:1 (H:V)
Manning's n.....	0.015
Channel Slope....	0.0020 ft/ft
Discharge.....	0.27 cfs

Computed Results:

Depth.....	0.14 ft
Velocity.....	0.75 fps
Flow Area.....	0.36 sf
Flow Top Width...	5.13 ft < 8' ∴ okay
Wetted Perimeter.	5.14 ft
Critical Depth...	0.11 ft
Critical Slope...	0.0087 ft/ft
Froude Number....	0.50 (flow is Subcritical)

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA. 80+17-82+87

Comment: CAPACITY OF 8' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope..	16.67:1 (H:V)
Right Side Slope.	20.00:1 (H:V)
Manning's n.....	0.015
Channel Slope....	0.0042 ft/ft
Discharge.....	1.22 cfs

Computed Results:

Depth.....	0.21 ft
Velocity.....	1.45 fps
Flow Area.....	0.84 sf
Flow Top Width...	7.86 ft < 8' ∴ okay
Wetted Perimeter.	7.87 ft
Critical Depth...	0.19 ft
Critical Slope...	0.0072 ft/ft
Froude Number....	0.78 (flow is Subcritical)

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA. 82+87-84+73

Comment: CAPACITY OF 8' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope..	16.67:1 (H:V)
Right Side Slope.	20.00:1 (H:V)
Manning's n.....	0.015
Channel Slope....	0.0070 ft/ft
Discharge.....	0.90 cfs

Computed Results:

Depth.....	0.17 ft
Velocity.....	1.62 fps
Flow Area.....	0.55 sf
Flow Top Width...	6.37 ft < 8' ∴ okay
Wetted Perimeter.	6.38 ft
Critical Depth...	0.17 ft
Critical Slope...	0.0075 ft/ft
Froude Number....	0.97 (flow is Subcritical)

Triangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name: STA. 84+73-86+28

Comment: CAPACITY OF 8' WIDE SWALE

Solve For Depth

Given Input Data:

Left Side Slope..	16.67:1 (H:V)
Right Side Slope.	20.00:1 (H:V)
Manning's n.....	0.015
Channel Slope....	0.0037 ft/ft
Discharge.....	0.84 cfs

Computed Results:

Depth.....	0.19 ft
Velocity.....	1.26 fps
Flow Area.....	0.67 sf
Flow Top Width...	7.00 ft < 8' ∴ okay
Wetted Perimeter.	7.01 ft
Critical Depth...	0.17 ft
Critical Slope...	0.0075 ft/ft
Froude Number....	0.72 (flow is Subcritical)

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CULVERT HYDRAULICS

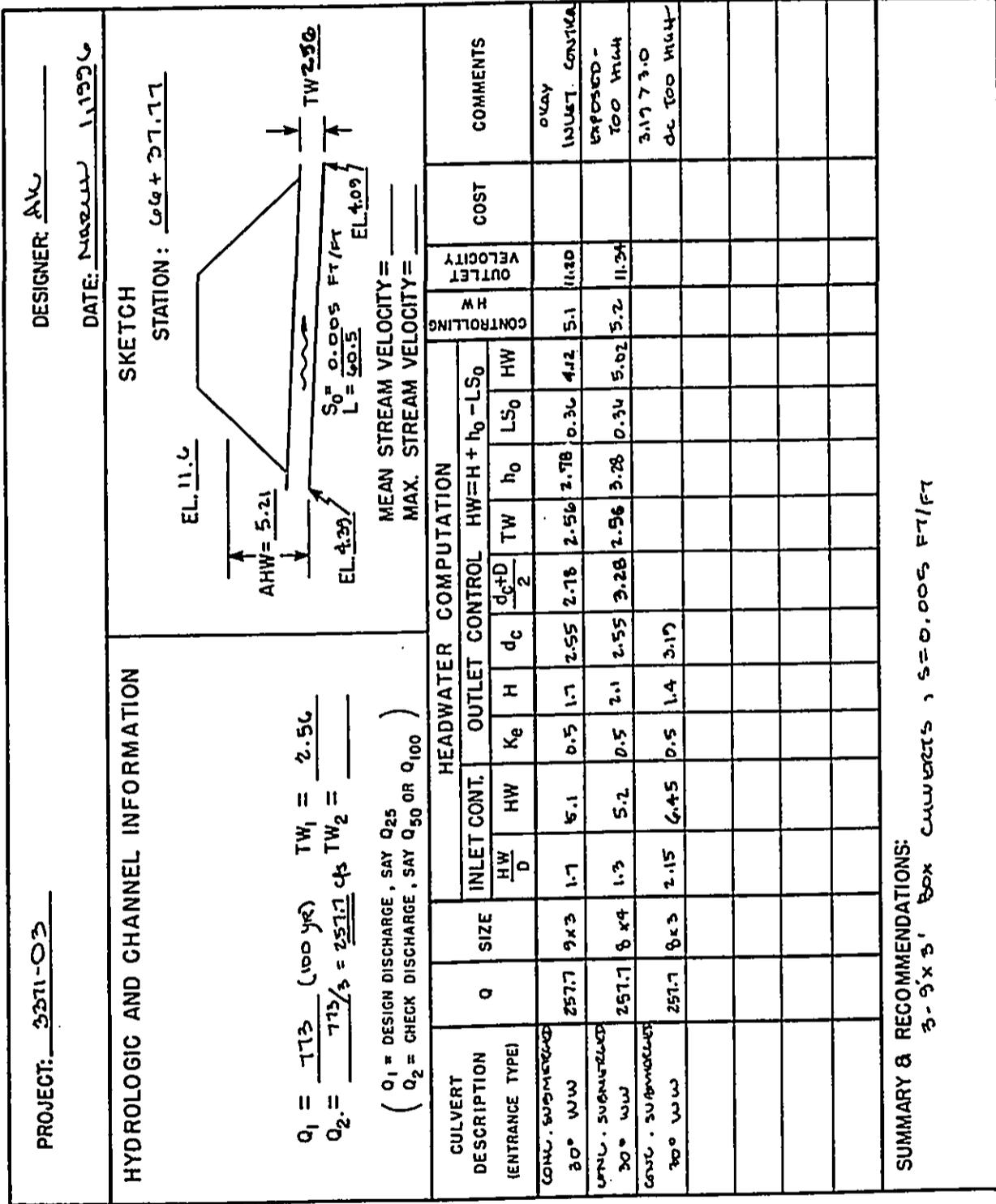


Figure 7

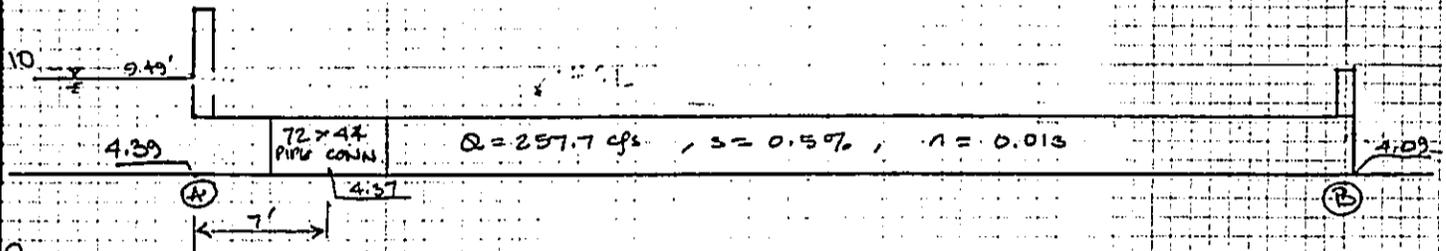
- ARCHITECTURAL
- STRUCTURAL
- CIVIL
- PLANNING

**WILSON OKAMOTO & ASSOCIATES, INC.**  
ENGINEERS, ARCHITECTS AND PLANNERS

COMPUTED BY AL  
CHECKED BY \_\_\_\_\_  
DATE 3/29 1996

HGL @ 72x44" PIPE CONDUIT

PROJECT 3371-03  
SHEET NO. 1 OF 2 SHEETS



INLET CONTROL

$$\begin{aligned} \text{EGL @ A} &= \text{HW} + \text{E} && (\text{HEC-5, PG. 5-3}) \\ &= 5.1' + 4.39' \\ \text{EGL}_A &= 9.49' \end{aligned}$$

BERNOULLI'S CON. FROM (A) TO (B)

$$\text{EGL}_A = d_n + \frac{V_A^2}{2g} + z_B + H_L$$

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2} \Rightarrow \text{BY TRIAL & ERROR } T_w = 2.56$$

$$V = \frac{Q}{A} = \frac{257.7}{(2.56)(9)} = 11.20 \text{ ft/sec}$$

$$H_L = H_c + H_f$$

$$H_c = 0.5 \left( \frac{V^2}{2g} \right)$$

$$H_f = \left( \frac{29 n^2 L}{R^{1.33}} \right) \frac{V^2}{2g}$$

$$H = \frac{V^2}{2g} + H_L$$

$$H = \left( 1 + 0.5 + \frac{29 n^2 L}{R^{1.33}} \right) \frac{V^2}{2g}$$

$$\text{EGL}_A = d_n + H + z_B$$

$$d_n = \text{EGL}_A - H - z_B$$

$$= 9.49 - \left[ \left( 1 + 0.5 + \frac{29 (0.013)^2 (60.5)}{\left( \frac{3 \times 9}{2 \times 3 + 9} \right)^{1.33}} \right) \frac{(11.20)^2}{2 (32.2)} \right] - 4.09$$

$$= 9.49 - (14.5 + .136)(1.95) - 4.09$$

$$= 9.49 - 3.19 - 4.09$$

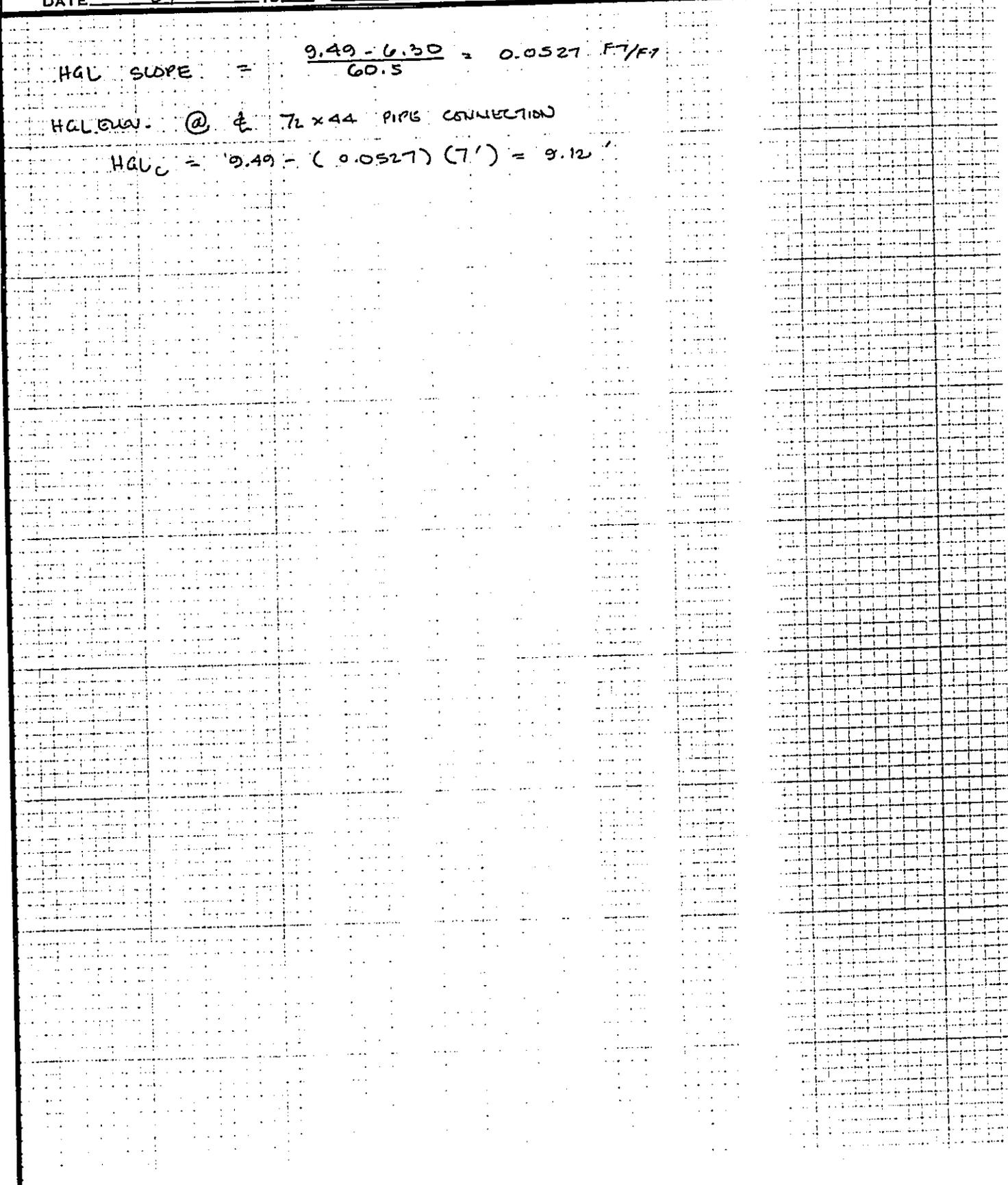
$$d_n = 2.21$$

- ARCHITECTURAL
- STRUCTURAL
- CIVIL
- PLANNING

**WILSON OKAMOTO & ASSOCIATES, INC.**  
**ENGINEERS, ARCHITECTS AND PLANNERS**

COMPUTED BY NC  
CHECKED BY \_\_\_\_\_  
DATE 3/29 1996


PROJECT \_\_\_\_\_  
SHEET NO. 2 OF 2 SHEETS



Rectangular Channel Analysis & Design  
Open Channel - Uniform flow

Worksheet Name:

Comment:

Solve For Depth

Given Input Data:

Bottom Width.....	9.00 ft
Manning's n.....	0.013
Channel Slope....	0.0050 ft/ft
Discharge.....	257.70 cfs

Computed Results:

Depth.....	2.56 ft
Velocity.....	11.20 fps
Flow Area.....	23.01 sf
Flow Top Width...	9.00 ft
Wetted Perimeter.	14.11 ft
Critical Depth...	2.94 ft
Critical Slope...	0.0034 ft/ft
Froude Number....	1.23 (flow is Supercritical)