

JAN 10 '97 04:42PM WILSON OKAMOTO & ASSOC 9462253

P.277

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

RECEIVED
EASSIE MILLER, P.E.
Wastewater Reclamation Division

'97 JAN 10 P5:03
LLOYD P.C.W. LEE, P.E.
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Division

January 2, 1997

Mr. Gary Gill
Director
STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 South Beretania Street, Room 702
Honolulu, HI 96813

SUBJECT: PEAHI ROAD, BRIDGE REPLACEMENT AT KAUPAKULUA STREAM
FEDERAL AID PROJECT NO. BR-0900(48)
FINAL ENVIRONMENTAL ASSESSMENT
NEGATIVE DECLARATION
TMK: 2-1-13:8
HAIKU, HAWAII

Dear Mr. Gill:

We are pleased to submit herewith four (4) copies of the subject Final Environmental Assessment and Negative Declaration in compliance with Chapter 343 of the Hawaii Revised Statutes. The document includes a determination of no significant impact based upon the significance criteria set forth in Title 11 Chapter 200 of the Department of Health Hawaii Administrative Rules. Also enclosed is a completed OEQC Document Publication form. We ask that notice of this filing be published in the January 23, 1997 issue of your Environmental Notice.

Sincerely,

Charles Jencks
Director of Public Works and Waste Management

CY:mku(ED97-01)
G:\ENGL\LIBR0900-48.OEQ

Enclosures

cc: Mr. Myron Okubo, Wilson Okamoto & Associates, Inc.

2

1997-01-23-MA-FEA-Kaupakulua

JAN 23 1997

Bridge Replacement

FILE COPY

**Kaupakulua Bridge Replacement
Final Environmental Assessment**

Prepared for:

County of Maui Department of Public Works
and Waste Management

Prepared by:

Wilson Okamoto & Associates, Inc.

December 1996

Kaupakulua Bridge Replacement

Final
Environmental Assessment
(Negative Declaration)

Prepared for:
County of Maui
Department of Public Works and Waste Management
200 South High Street
Wailuku, Maui, 96793

Prepared by:
Wilson Okamoto & Associates, Inc.
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

September 1996

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I. INTRODUCTION

The County of Maui, Department of Public Works and Waste Management (DPWWM), administers a program to modify or replace functionally or structurally deficient bridges to achieve current standards for roadway widths and load capacities as specified by the American Association of State Highway and Transportation Officials (AASHTO) for Rural Collector Roads. The Kaupakulua Bridge was among the bridges which were prioritized for improvement by the DPWWM for the current fiscal year.

This Environmental Assessment was prepared to satisfy the requirements of Chapter 343, Hawaii Revised Statutes relative to the use of County funds for the replacement of Kaupakulua Bridge. The proposed action is not anticipated to generate significant adverse impacts on the environment.

II. DESCRIPTION OF THE PROPOSED ACTION

A. Project Location

The Kaupakulua Bridge carries Peahi Road over Kaupakulua Stream in the Makawao District of Maui. The bridge is located within Tax Map Key 2-7-13: 8, which is owned by the East Maui Irrigation Company, Ltd. (EMI) (See Figure 1). The immediate surrounding area is largely undeveloped.

As the primary roadway in the project vicinity, Peahi Road provides vehicular access from Hana Highway, which is located approximately three-fourths of a mile north of the project, to agricultural farm lots located about one-fourth mile upland from the bridge. Peahi Road is a lightly traveled, narrow and winding roadway varying in width from two lanes at Hana Highway to a single lane carrying two-way traffic approximately 250 yards from the existing bridge. The bridge consists of a single lane which carries traffic in both directions, as is the

case with a portion of Peahi Road heading upland. The roadway approaches to the bridge are about 17 feet wide with an asphalt concrete surface.

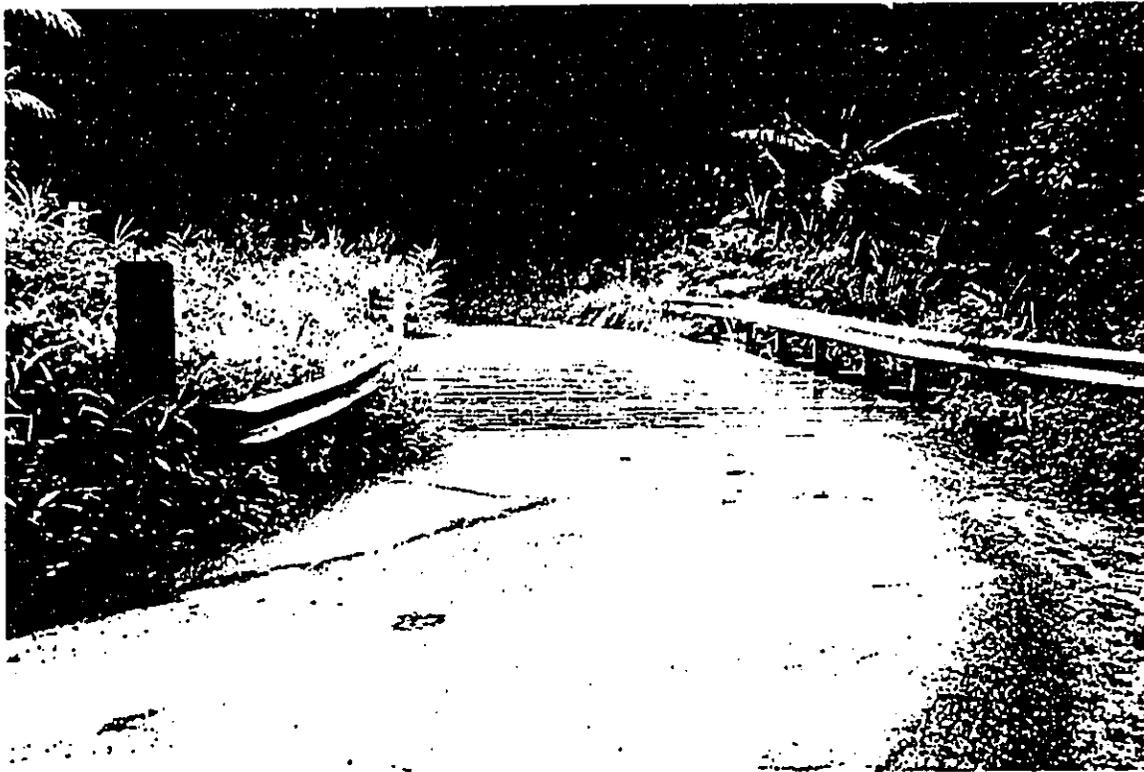
The original structure was constructed in 1911, although various components have been replaced since then. With a posted weight limit of six tons, the existing bridge structure measures 15 feet wide by 34-1/2 feet long. Therefore, the bridge currently does not meet minimum strength requirements to accommodate standard highway truck loads, or two lanes of traffic. The bridge has a timber deck, metal guardrails on either side, concrete rubble masonry (CRM) abutments, and a wooden center brace system supported by a concrete foundation within the streambed (See Photographs 1 through 5).

Periodic bridge inspections are conducted by the DPWWM to assess the structural integrity of all county bridges. The latest inspection report for the Kaupakulua Bridge was prepared in July 1995 (See Appendix A). The following summary is excerpted from the report.

"This bridge is in structurally fair condition. Although county crews have done a very good job replacing the deck, stringers, guardrails, etc., this bridge, due to its location and weather conditions, will require ongoing repairs on a yearly basis. The location is in a rainy area and is usually shaded for the better part of the day, this is conducive to rot and prolific decay to a wooden structure. A replacement structure of concrete construction, would be most desirable."

B. Project Description

Measuring approximately 35 feet wide by 44 feet long, the proposed replacement bridge will cross Kaupakulua Stream approximately 150 feet downstream of the existing bridge (See Figure 2). The new bridge will be constructed of a cast-in-place concrete deck supported by five pre-cast, prestressed concrete girders, cast-in-place concrete abutments and spread footings. Approximately 3-foot high



Photograph 1. Peahi Road at Kaupakulua Bridge facing east.



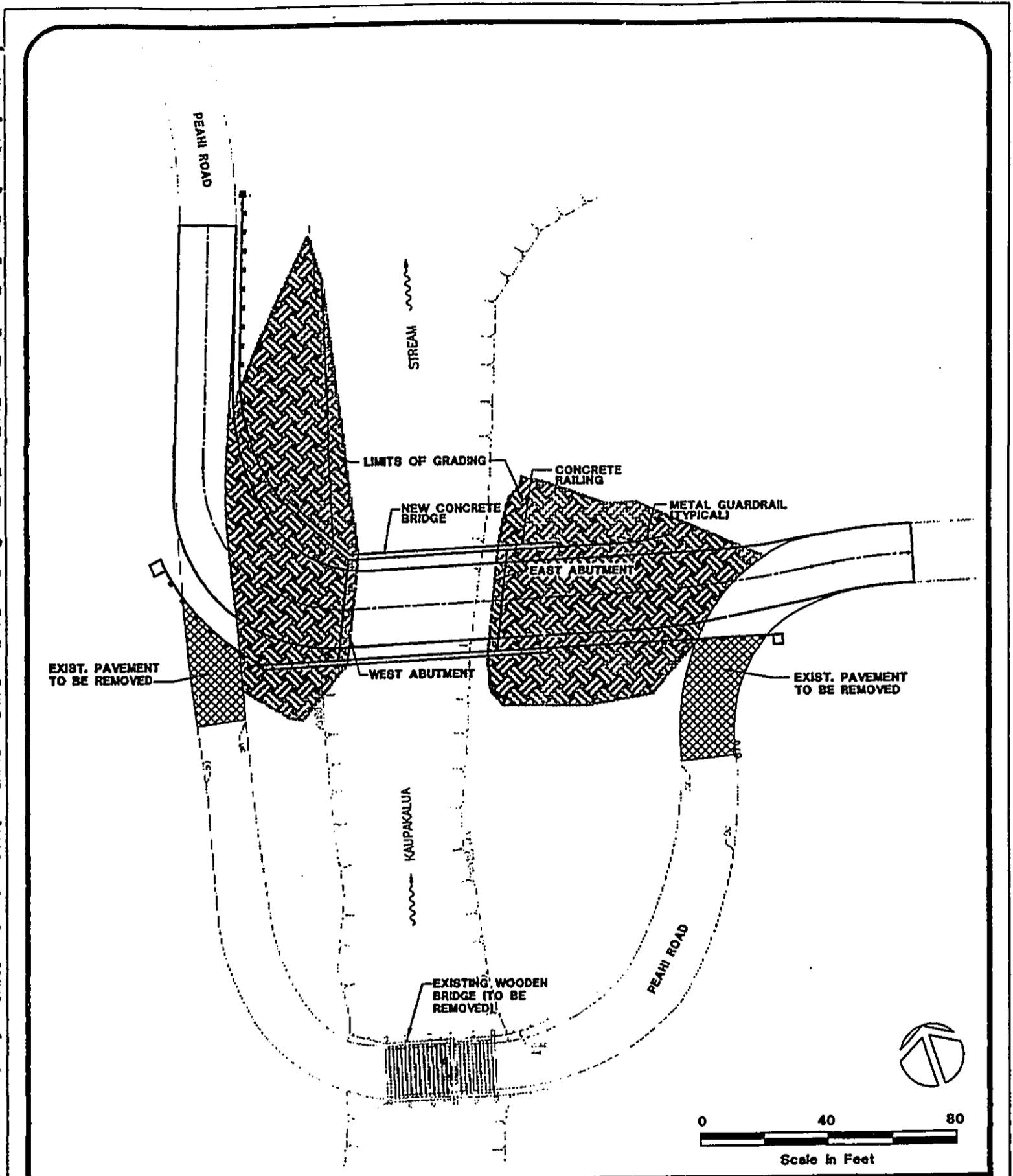
Photograph 3. Makai side of Kaupakulua Bridge facing downstream.



Photograph 4. Kaupakulua Bridge mauka elevation facing downstream (north).



Photograph 5. Kaupakulua Bridge makai elevation facing upstream (south).



Kaupakalua Bridge Replacement

**Fig. 2
Existing &
Proposed Site Plan**

Prepared by :

**Wilson Okamoto
& Associates, Inc**



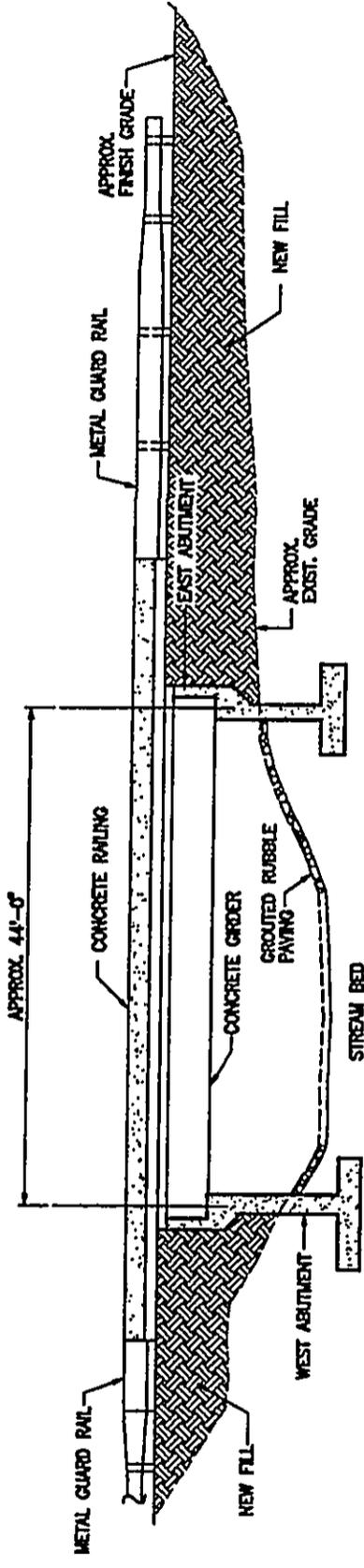
concrete railings will flank either side of the bridge, while 3-foot metal guardrails will flank the approaches to the bridge. As a scour protection measure, a grouted rubble pavement (GRP) will be installed beneath the bridge along both stream embankments down to the edge of the stream bed (See Figure 3).

During the construction period, the existing bridge will remain open to accommodate vehicular access. When the new bridge is completed, the existing bridge, including its center support, will be dismantled and removed, although the bridge abutments will be abandoned in-place. The present approaches of Peahi Road to the old bridge will also be abandoned and a segment of the existing pavement adjacent to the road that will be preserved will be removed to allow vegetation to reestablish and restore the natural setting of the area.

Structural design of the bridge is based on the "Standard Specifications for Highway Bridges" 15th Edition, 1992, prepared by the American Association of State Highway and Transportation Officials (AASHTO) and State Department of Transportation (DOT) design criteria. Civil design specifications are in compliance with DOT Highways guidelines including 1986 Standard Plans and Hawaii Statewide Uniform Design Manual for Streets and Highways, 1980 Edition.

The preliminary cost estimate for this project is \$850,000. The construction period is anticipated to span approximately nine months. Acquisition of a new roadway right-of-way easement will be required for the replacement bridge and roadway approaches.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32



Kaupakalua Bridge Replacement

Figure 3
Proposed Longitudinal Section

Prepared by :
Wilson Okamoto & Associates, Inc 

III. EXISTING ENVIRONMENT AND ANTICIPATED IMPACTS

A. Soils and Topography

In December 1995, a Subsurface Investigation Report was prepared by Fewell Geotechnical Engineering, Ltd. (FGE) for the bridge replacement project. Excerpts from the survey report are included herein, while the report in its entirety is reproduced as Appendix B.

The surface layer of soil is comprised of brown clayey silt which extends to depth of about 7.5 to 9 feet. Below this surface layer, the alluvial soils varies in thickness and composition. Subsurface conditions are generally underlain by alluvial silt, cobbles and boulders, over either residual silts or soft weathered basalt which extends to a depth of about 49 to 52.5 feet.

Soil excavation along the banks of the stream will be required to accommodate the bridge abutments and footings. Grouted rubble pavement (GRP) will be installed beneath the bridge along both stream embankments down to the edge of the stream bed to protect scouring of the abutments.

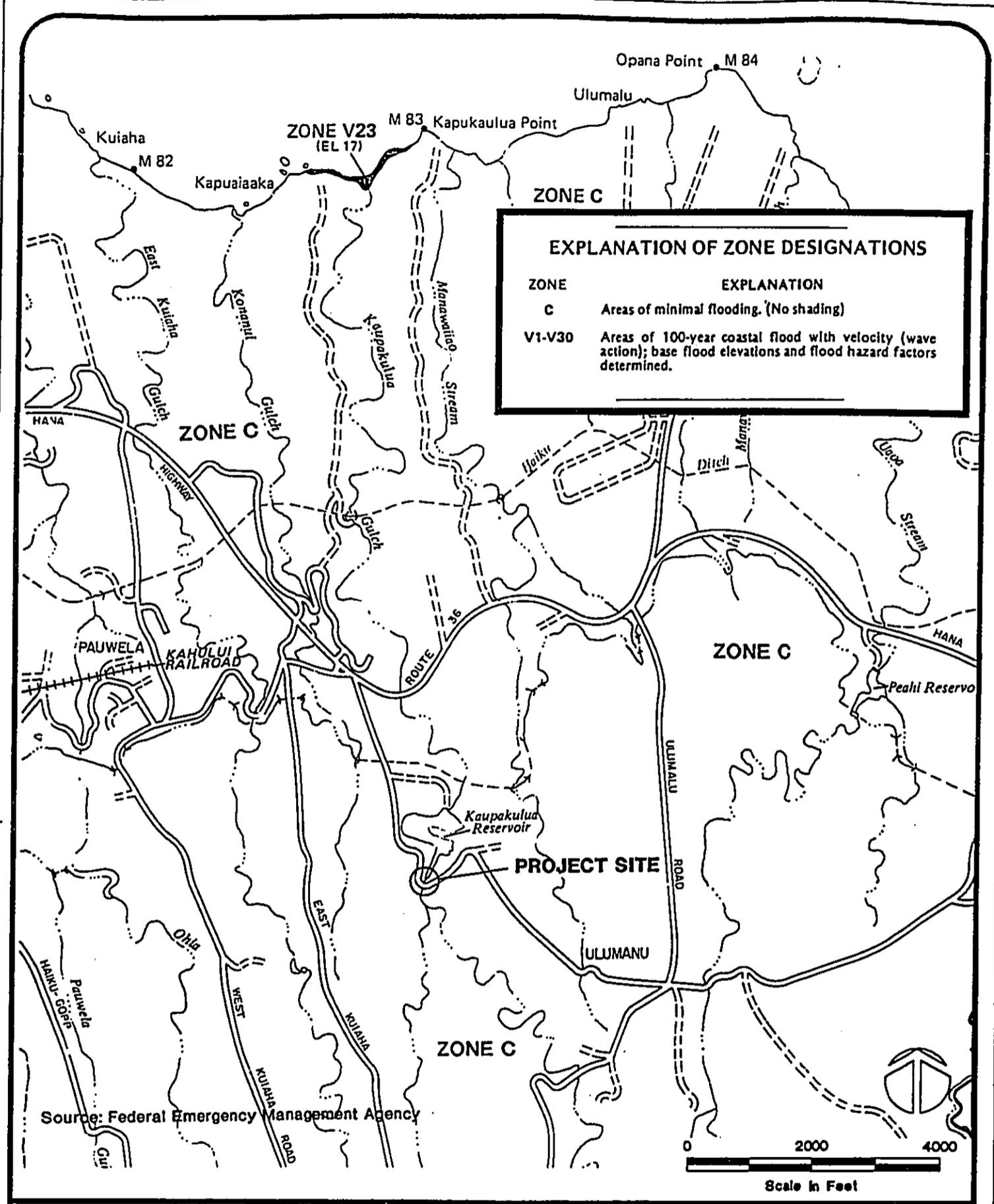
B. Hydrology and Water Quality

Surface water bodies in proximity to the project site include the Kaupakulua Reservoir and Kaupakulua Stream. Within the immediate vicinity of the proposed new bridge is the uppermost reach of Kaupakulua Reservoir. The reservoir is used exclusively by the East Maui Irrigation Company for agricultural irrigation. Water levels in the reservoir can vary greatly over short periods of time, depending on the stage of crop production and amount of rainfall in a given period. During higher stands, the reservoir would extend under the new bridge, while lower stands expose deposited mud which is eroded through by the stream.

In conjunction with the Environmental Reconnaissance Survey, water quality samples were taken by AECOS, Inc. at three locations in proximity to the project area for the purpose of characterizing stream water quality. At the time of the survey, water was flowing in the stream bed, but the flow was divided into a series of isolated segments and pools with flow traveling under the loose bed material between these pools and short riffle areas. Station 1 was located at an unnamed gulch prior to its confluence with Kaupakulua Stream, Station 2 was located in Kaupakulua Stream approximately 50 meters upstream of the existing bridge, and Station 3 was located in downstream of the project site, near the upper end of Kaupakulua Reservoir. Results of these samples showed no significant evidence of water quality problems.

It is anticipated that water quality impacts during the short-term, construction-period will be minimal. Increases in turbidity will be localized near the construction area, and will tend to settle in the nearby reservoir. A Best Management Practices Plan and water quality monitoring plan were prepared to mitigate water quality impacts. The plans were approved by the Department of Health in conjunction with an application for Water Quality Certification pursuant to Section 401 of the Water Quality Act. During construction in and around the gulch, local grading and berming will be used to direct offsite runoff away from any exposed areas of the gulch and bank. A system of silt fences comprised of geotextile fabric will be placed along and near the bottom of slopes to minimize movement of sediment into the gulch. Where possible, sitework will be scheduled during months when the probability of rainfall is very low. Subsequent to completion of the project, all excess material will be removed from the road and the stream areas will be restored to their original physical configuration. Cleared or graded slopes will be stabilized with hydromulch or otherwise revegetated.

Unlike the existing bridge structure, the proposed bridge structure does not require a center support system and footing. As such, construction will be



Kaupakalua Bridge Replacement

**Figure 4
FLOOD INSURANCE RATE
MAP**

Prepared by:
Wilson Okamoto & Associates, Inc

confined to the stream bank area, and will not be required within the stream bed, therefore, the potential for impacts to water quality is minimized. Furthermore, flows in the stream occur rarely and construction could be completed during dry stream conditions. Once construction is completed, the new bridge will have no impact on water quality in Kaupakulua Stream.

According to the Flood Insurance Rate Map prepared by the Federal Emergency Management Agency, the project lies within Zone C which is defined as an area of minimal flooding (see Figure 4). The new bridge is design to accommodate up to a 100-year storm event.

C. Flora and Aquatic Fauna

The aforementioned Environmental Reconnaissance Survey conducted by AECOS, Inc. also included a study of flora and aquatic faunal species which inhabit Kaupakulua Stream near the vicinity of the bridge, and the Kaupakulua Reservoir. Excerpts from the survey report are included herein, while the report in its entirety is reproduced as Appendix C.

Within the stream and embankment areas, vegetation is comprised of rose apple (*Syzygium jambos*), banana (*Musa x paradisiaca*), coffee (*Coffea arabica*), elephant grass (*Pennisetum purpureum*), and job's tears (*Cois lachryma-job*).

Vegetation in the forest area surrounding the project site is dominated by albizia (*Paraserianthus falcataria*) and swamp mahogany (*Eucalyptus robusta*). Other trees include: guava (*Psidium guajava*), rose apple, kukui (*Aleurites moluccana*), mango (*Mangifera indica*), gum (*Eucalyptus sp.*), coffee, Christmasberry (*Schinus terebinthifolius*), 'ape (*Alocasia macrorrhiza*), Asteraceae (*Elephantopus mollis*), palmgrass (*Setaria palmifolia*), basketgrass (*Oplismenus hirtellus*), vervain (*Stachytarpheta jamaicensis*). Some wetland areas dominated by rushes occur within the general area downstream of the proposed bridge crossing.

Aquatic faunal species are very limited within Kaupakulua Stream in the vicinity of the project, as well as within the Kaupakulua Reservoir. A small number of juvenile poecilids or top-minnows were observed in pools in the vicinity of the existing bridge. No snails, or aquatic insects other than mosquito larvae, and no other fish were observed in the vicinity of the proposed bridge crossing.

Aquatic faunal resources which were observed in the reservoir included only a few adult toads (*Bufo marinus*), large numbers of bullfrog tadpoles (*Rana catesbeiana*) and crayfish (*Procambarus clarki*). No fishes of any kind were seen in this area. Observations were made at both the upper end of the reservoir as well as around the dam at the lower end of the reservoir. A few large, lavender dragonflies (*Family Libellulidae*) were observed in the vicinity of the dam.

Complete lists of plant and aquatic animal species identified from the survey area are provided in Tables 2 and 3, respectively, of the report. No State or Federal proposed or listed, threatened or endangered species of plant or animal were found in the project area. Soil tests were not conducted to determine the wetland status of the area since the hydrology and wetland vegetation indicators were not apparent.

No adverse impacts on aquatic resources are anticipated as a result of the proposed project. The subject stream does not support native aquatic fauna in the project area, and the proposed new bridge structure will not impair migratory (amphidromous) habits of native aquatic biota in the event that any such populations exist in more pristine areas upstream of the project site.

D. Air Quality

The absence of any existing development in the vicinity of the bridge, and exposure to trade winds promote good air quality. The only identifiable source of pollution is the light volume of traffic using the bridge.

During the short-term construction period, occasional and minor emissions of fugitive dust, and exhaust emissions from construction equipment will insignificantly degrade air quality in the project vicinity. In the long-term, traffic volumes and associated exhaust emissions along the roadway will not increase as a result of the project. Moreover, by removing the sharp bend in the road, vehicles moving more freely over the bridge may produce less exhaust emissions in the area.

E. Noise

In the rural setting of the project site, ambient noise levels are relatively low. The primary source of noise is from light vehicular traffic along Peahi Road. During the short-term construction period, noise levels at the project site will temporarily increase as a result of construction equipment and activities. There are no noise-sensitive land uses such as residences or schools in the immediate vicinity which could be adversely affected. All equipment, however, shall be fitted with muffling devices to mitigate noise impacts. No long-term adverse noise impacts are anticipated.

F. Scenic and Visual Resources

The area is highly vegetated with large canopy trees and under stories which obscure views of the low-profile existing bridge, except along the Peahi Road approaches. The scenic quality of the area will not be significantly affected by the new bridge as it also is designed with a low profile.

G. Historical and Archaeological Resources

According to an archaeological assessment was prepared by Cultural Resources Hawaii in December 1995, no archaeological sites were encountered in the area of or surrounding the existing bridge. This report was subsequently revised based

on comments received by the State Historic Preservation Division (SHPD). The SHPD concurred with the findings and conclusion contained in the report dated April 1996 (See Appendix D), and determined that the project will have "no effect" on historic sites. However, if, in the unlikely event, any archaeological remains are encountered during construction, work will cease in that area and the State Historic Preservation Division (SHPD) contacted.

IV. RELATIONSHIP TO PLANS, POLICIES AND CONTROLS

A. Existing State and County Designations

The Kaupakulua Bridge is within the State Agricultural District. On the County of Maui's Paia-Haiku Community Plan Land Use Map, the bridge is located within lands designated as Agriculture, which is governed by the requirements of Chapter 205, HRS. The project is consistent with these requirements. There is no county zoning in the area. The project is not located within the Special Management Area, as illustrated in Figure 5 (Consultation with County of Maui, Planning Department, July 26, 1995).

B. Required Permits and Approvals

1. Federal

A Department of the Army Nationwide Permit for Road Crossings is required under Section 404 of the Clean Water Act (Consultation with Corps of Engineers [COE] August 8, 1995), as construction of the replacement bridge will require dredge and fill activities below the high water mark as defined by the COE. A nationwide permit was approved by the Corps of Engineers on October 7, 1996 by the COE.

According to the Federal Highway Administration, a Federal Environmental Assessment, administered under the National Environmental Policy Act, is not required as the project qualifies for a Categorical Exclusion under Code of Federal Regulation 23 Chapter 1 Part 771.117(d)(3).

2. State of Hawaii

A Stream Channel Alteration Permit (SCAP) was required for the project according to the Department of Land and Natural Resources Commission on Water Resource Management (Consultation with DLNR, July 27, 1995). Although no structure will be constructed within the stream bed, the SCAP is required as the concrete footings and abutments, as well as the GRP, of the replacement bridge will alter the condition of the stream banks.

Pursuant to Section 401 of the Clean Water Act, a Water Quality Certification from the Department of Health is required in conjunction with the Department of the Army Nationwide Permit. The certification was approved by the Department of Health, Clean Water Branch on October 7, 1996.

V. ALTERNATIVES TO THE PROPOSED ACTION

A. No Action Alternative

Under the no action alternative, no new bridge replacement or repair would be pursued. Environmental impacts would be avoided, construction costs spared, and the need for permits avoided. However, the bridge would continue to degrade, and in time, may need to be closed should it no longer provide safe vehicular support. The existing condition of a substandard, one-lane bridge carrying two-way traffic would continue. Access to areas beyond the bridge by vehicles with heavy loads would be limited to the existing six-ton load limit. The bridge would continue to degrade and, in time, may need to be closed should the bridge no longer provide safe vehicular support. Resources will continue to be required for the inspection and regular maintenance of the bridge to maximize its useful life.

B. Alternative Project Location

Replacement of the existing bridge adjacent (downstream) to its location was considered. Two bridge configurations were evaluated including one that was similar in size and dimension to the proposed bridge, and a second of narrower width. Both alternatives were not selected due to safety considerations since the sharp curvature of the existing roadway on either side of the bridge requires vehicles to decelerate when approaching and crossing the bridge. Although this deceleration would be necessary for the proposed project, this alternative would have required a "U"-turn instead of a 90-degree turn. This alternative would also require a longer travel distance to the other side of Peahi Road.

VI. DETERMINATION

Based on this Environmental Assessment, it is anticipated that the project will not have a significant effect on the environment, as defined by Section 11-200-12, Hawaii Administrative Rules, Department of Health. An environmental impact statement is not anticipated to be prepared for this project.

The proposed project will not have any significant, long-term adverse impacts on the environment, since grubbing, grading, and construction for the road and bridge widening will be limited to the immediate project site. A replacement bridge built to current FHWA standards is needed to assure the safe movement of vehicles along Peahi Road.

This environmental assessment indicates that the proposed project will not:

- Impact any natural or cultural resources such as historic or archaeological sites;
- Affect any rare or endangered species of flora or fauna;
- Result in significant impacts to the environment;
- Negatively affect the economic or social welfare of the community;
- Have detrimental effects on the public's health; and

Curtail beneficial uses of the environment.

Based on the preceding it has been determined that the proposed project will not have any significant, adverse effects on the environment and, accordingly, an Environmental Impact Statement is not anticipated.

VII. PREPARERS OF THE ENVIRONMENTAL ASSESSMENT

Wilson Okamoto and Associates, Inc.

| | |
|----------------------|------------------------------------|
| Myron Okubo, P.E. | Project Manager/Engineer of Record |
| Earl Matsukawa, AICP | Senior Planner |
| Sarie Uechi, P.E. | Structural Engineer |
| Laura Mau | Planner |

AECOS, Inc.

| | |
|---------------|---|
| Eric Guinther | Water Quality and Environmental Consultant |
|---------------|---|

Cultural Surveys Hawaii

| | |
|---------------------------|---------------|
| Hallett H. Hammatt, Ph.D. | Archaeologist |
| Brian Colin | Archaeologist |
| William Folk | Archaeologist |

Fewell Geotechnical Engineering, Ltd.

| | |
|----------------------|--------------------------------|
| Alan Shimamoto, P.E. | Project Manager/Soils Engineer |
| Butch Gorsha, P.E. | Soils Engineer |

R. T. Tanaka Engineers, Inc.

| | |
|-----------------------|---------------------|
| Kirk Tanaka, P.E. | Principal In Charge |
| Rodelio Hidalgo, P.E. | Project Engineer |

VIII. REFERENCES

County of Maui Planning Department, *Paia-Haiku Community Plan of the County of Maui*, July 1982.

Federal Emergency Management Agency, *Flood Insurance Rate Map, Maui County, Hawaii, Community-Panel Number 150003 0225 B*, June 1, 1981.

State of Hawaii Department of Business, Economic Development & Tourism Land Use Commission, *Land Use District Boundary Maps - Haiku Quadrangle*, 1983.

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

U.S. National Parks Service Western Region Natural Resources and Research Division Hawaii Cooperative Park Service Unit, *Hawaii Stream Assessment - A Preliminary Appraisal of Hawaii's Stream Resources Report R84*, Prepared for the State of Hawaii Department of Land and Natural Resources Commission on Water Resource Management, December 1990.

**IX. LIST OF AGENCIES AND PARTIES CONSULTED DURING THE
PREPARATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT**

The following agencies were consulted during the pre-assessment phase of the Environmental Assessment:

Federal

Army Corps of Engineers

State of Hawaii

Department of Business, Economic Development and Tourism, Land Use Commission

Department of Health, Clean Water Branch

Department of Land and Natural Resources, Historic Preservation Division

Department of Land and Natural Resources, Water Resources Management Division

County of Maui

Department of Public Works and Waste Management

Planning Department

**X. LIST OF AGENCIES AND PARTIES COMMENTING ON THE
DRAFT ENVIRONMENTAL ASSESSMENT**

The agencies, organizations, and individuals listed below were sent copies of the Draft EA with a request for their comments on the project. Of those who formally replied, some had no comments while others provided substantive comments as indicated by the ✓ and ✓✓, respectively. All written comments and responses are reproduced herein.

Federal

- ✓✓ U.S. Army Corps of Engineers
- ✓ U.S. Department of Agriculture - Soil Conservation Service
- ✓✓ U.S. Department of the Interior - Fish and Wildlife Service
- U.S. Department of Transportation - Federal Highways Administration

State

- ✓ Department of Accounting and General Services
- Department of Agriculture
- ✓✓ Department of Business, Economic Development and Tourism - Land Use Commission
- ✓ Department of Hawaiian Home Lands - Planning Office
- Department of Land and Natural Resources - Commission on Water Resource Management
- ✓✓ Department of Land and Natural Resources - State Historic Preservation Division
- ✓✓ Department of Health - Environmental Management Branch
- ✓ Department of Transportation
- ✓✓ Office of Environmental Quality Control
- Office of State Planning
- ✓ Office of Hawaiian Affairs

State (cont.)

- ✓ University of Hawaii - Water Resources Research Center
University of Hawaii - Environmental Center

Maui County

- ✓✓ Board of Water Supply
- ✓ Department of Parks and Recreation
- ✓ Planning Department
Economic Development Agency

Other

- ✓ Maui Electric Company, Ltd.
Haiku Community Association
- ✓✓ East Maui Irrigation Company



United States
Department of
Agriculture

Natural
Resources
Conservation
Service

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

February 6, 1996

Mr. Cary Yamashita, Assistant Division Chief
Department of Public Works and Waste Management
Engineering Division
County of Maui
200 South High Street
Wailuku, Hawaii 96793

RECEIVED
FEB 08 1996

WILSON OKAMOTO & ASSOC. INC.

Dear Mr. Yamashita:

Subject: Draft Environmental Assessment (DEA) - Kaupakalua Bridge Replacement,
Haiku, Maui, HI

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,

 ACTING

KENNETH M. KANESHIRO
State Conservationist

cc:

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

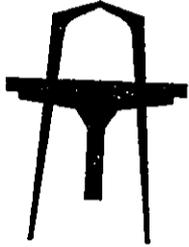
Mr. Earl Matsukawa, Project Planner, Wilson Okamoto & Associates, Inc., 1907 South
Beretania Street, Suite 400, Honolulu, Hawaii 96826

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

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3357-01
June 5, 1996

**WILSON
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A ASSOCIATES, INC.



ENGINEERS
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1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

Mr. Kenneth M. Kaneshiro
State Conservationist
U.S. Department of Agriculture
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850-0001

Dear Mr. Kaneshiro:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 6, 1996 indicating that you have no comments regarding the project. We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script that reads "Myron Okubo".

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

Dobinchick
lufm/7006

Young
CEPOD-ET-PPA

February 7, 1996

Hihars-Endo
Actg
CEPOD-CO

Planning and Operations Division

Mizuc
Actg
CEPOD-ET-P

Mr. Cary Yamashita
Assistant Division Chief
County of Maui
Department of Public Works
and Waste Management
200 South High Street
Wailuku, Hawaii 96793

~~Polowski~~
~~Actg~~
~~CEPOD-ET-Z~~

Dear Mr. Yamashita:

Thank you for the opportunity to review and comment on the ~~Jyd~~ CEPOD-ET Draft Environmental Assessment (DEA) for the Kaupakalua Bridge Replacement Project, Haiku, Maui (TMK 2-7-13: 8). The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control M&R Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act:

a. Based on a consultation meeting held on August 8, 1995, CEPOD-ET-P DA permit will be required for the project. Please contact our files Regulatory Section at 438-9258 for further information.

b. The flood hazard information provided on page 12 of the ~~CF: ET-PO-R~~ (no # provided) DEA is correct.

CEPOD-ET-PPA
(dobinchick)

Sincerely,

o:edp/phstuff
knupakalua.doc

Paul Mizue, P.E.
Acting Chief, Planning
and Operations Division

7095-151
950010151

OPTIONAL FORM 99 (7-90)

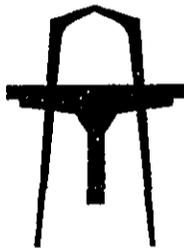
FAX TRANSMITTAL # of pages **1**

| | |
|-------------------------|----------------------------|
| To <i>Laura Mau</i> | From <i>Lolly Silva</i> |
| Dept/Agency | Phone # |
| Fax # <i>9462253</i> | Fax # <i>4384060</i> |

NSN 7540-01-317-7300 5092-101 GENERAL SERVICES ADMINISTRATION

3357-01
June 5, 1996

WILSON
OKAMOTO
& ASSOCIATES, INC.



ENGINEERS
PLANNERS

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. B o x 3 5 3 0
Honolulu, Hawaii 96811

Mr. Paul Mizue, P.E., Acting Chief
Planning and Operation Division
Department of the Army
Pacific Ocean Division, Corps of Engineers
Ft. Shafter, HI 96858-5440

Dear Mr. Mizue:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 7, 1996 commenting on the project. An application for Nationwide Permit for Roadway Crossings (Paragraph 14) was filed for review by your Regulatory Section on March 29, 1996. We appreciate your verification that the flood hazard information provided in the Draft EA is correct.

Your time and effort in reviewing the subject Draft EA are also appreciated.

Very truly yours,

A handwritten signature in cursive script that reads "Myron Okubo".

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management



United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS ECOREGION
300 ALA MOANA BOULEVARD, ROOM 3108
BOX 50088
HONOLULU, HAWAII 96850
PHONE: (808) 541-3441 FAX: (808) 541-3470

RECEIVED
FEB 20 1996

WILSON G. GARDNER, ASST. DIR.

In Reply Refer To: MRL

Ms. Cary Yamashita
Assistant Division Chief
County of Maui
Department of Public Works and Waste Management
Engineering Division
200 South High Street
Wailuku, HI 96793

FEB 15 1996

Re: Kaupakalua Bridge Replacement, Draft Environmental Assessment.

Dear Ms. Yamashita:

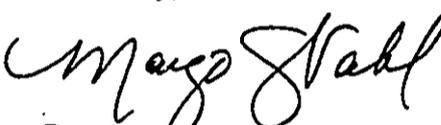
The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Environmental Assessment for bridge replacement at Kaupakalua Stream. The project sponsor is the County of Maui Department of Public Works and Waste Management. The purpose of the project is to replace the existing bridge that carries Peahi Road over Kaupakalua Stream. The new bridge will be constructed approximately 150 feet downstream of the existing bridge. The new bridge will consist of a cast-in-place concrete deck supported by five precast concrete girders and cast-in-place concrete abutments and spread footings. A grouted rubble pavement will be installed beneath the bridge along both stream embankments down to the edge of the stream bed as a scour protection measure. Once the new bridge is complete, the old bridge will be dismantled and removed, with only a portion of its abutments remaining in place.

Based on the information provided in the Draft Environmental Assessment for the project, we do not anticipate significant adverse impacts to fish and wildlife resources to result from the proposed project. However, the Service recommends that areas not in the immediate vicinity of the existing and new bridge remain in their natural states. The Service also recommends that areas where vegetation will be removed during construction be revegetated upon completion of the project and that the applicant contact the Natural Resources Conservation Service on Maui at 808/244-3729 for assistance in identifying suitable plants for erosion control. Finally, the Service is concerned that the proposed project may cause indirect adverse impacts to the water quality of Kaupakalua Stream and associated fish and wildlife resources and habitats. Therefore, the Service recommends that the following measures to minimize the degradation of water quality be incorporated into the permit conditions:

- a. No construction materials should be stockpiled in the aquatic environment;
- b. All construction-related materials should be placed or stored in ways to avoid or minimize disturbance to the aquatic environment;
- c. All construction-related materials should be free of pollutants;
- d. No contamination of the aquatic environment (from trash, debris disposal, etc.) should result from construction activities;
- e. Dewatering of excavated materials should be done in a manner that will minimize the reintroduction of silt into the aquatic environment.

The Service appreciates the opportunity to comment. We look forward to seeing the final environmental assessment. If you have questions regarding these comments, please contact Fish and Wildlife Biologist Michael Lusk at 808/541-3441.

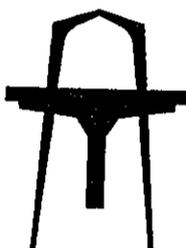
Sincerely,

for 
Brooks Harper
Field Supervisor
Ecological Services

cc: DAR, Maui
DAR, Honolulu
DLNR, Honolulu
CZMP, Honolulu
OEQC, Honolulu
Wilson Okamoto & Associates, Honolulu

3357-01
June 5, 1996

**WILSON
OKAMOTO**
& ASSOCIATES, INC.



ENGINEERS
PLANNERS

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

Mr. Brooks Harper, Field Supervisor
Ecological Services
U.S. Department of the Interior
Fish and Wildlife Service
Pacific Islands Ecoregion
300 Ala Moana Boulevard, Room 3108
Honolulu, Hawaii 96813

Dear Mr. Harper:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 15, 1996 (Ref. MRL) indicating that you do not anticipate significant adverse impacts to fish and wildlife resources as a result of the project. Please be assured that areas not in the immediate proximity of the proposed bridge construction site will remain undisturbed. Areas which are disturbed during construction will be revegetated as soon as possible to mitigate erosion. We have forwarded a copy of your recommended permit conditions to the U.S. Army Corps of Engineers for their consideration in processing the Nationwide Permit which is required for the project.

We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script, appearing to read "Myron Okubo". The signature is written in black ink and is positioned above the typed name.

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
U.S. Army Corps of Engineers
County of Maui, Department of Public Works and Waste Management



University of Hawaii at Manoa

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

24 January 1996

RECEIVED
JAN 29 1996

WILSON OKAMOTO & ASSOCIATES

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

Attn: Cary Yamashita, Asst. Division Chief

Gentlemen:

**SUBJECT: Kaupakalua Bridge Replacement
Draft Environmental Assessment**

We have reviewed the subject Draft Environmental Assessment and have no comments to offer at this time.

Thank you for the opportunity to testify.

Sincerely,

Roger S. Fujioka
Roger S. Fujioka,
Director, WRRRC

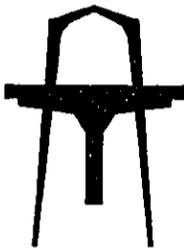
RSF:jmn

cc: Office of Environmental Quality Control
Wilson Okamoto & Assoc., Inc.

AN EQUAL OPPORTUNITY EMPLOYER

3357-01
June 5, 1996

**WILSON
OKAMOTO**
& ASSOCIATES, INC.



**ENGINEERS
PLANNERS**

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

Mr. Roger S. Fujioka, Ph.D., Director
Water Resources Research Center
University of Hawaii
2540 Dole Street
Holmes Hall, Room 283
Honolulu, HI 96822

Dear Dr. Fujioka:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of January 24, 1996 indicating that you have no comments regarding the project. We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script, appearing to read "Myron Okubo".

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

BENJAMIN J. CAYETANO
GOVERNOR



ESTHER UEDA
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813
Telephone: 587-3822

January 26, 1996

RECEIVED
JAN 30 1996

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

WILSON OKAMOTO & ASSOC., INC.

Attn.: Cary Yamashita, Asst. Division Chief

Dear Mr. Jencks:

Subject: Kaupakalua Bridge Replacement - Draft
Environmental Assessment

The Department of Business, Economic Development & Tourism has referred the subject Draft Environmental Assessment (DEA) to our office for review.

We have reviewed the subject DEA and confirm that the project site, identified as TMK: 2-7-13: por. 8, is within the State Land Use Agricultural District.

We have no further comments to offer at this time.

If you have any questions in regards to this matter, please feel free to contact me or Leo Asuncion of my staff at 587-3822.

Sincerely,

A handwritten signature in cursive script, appearing to read "Esther Ueda".

ESTHER UEDA
Executive Officer

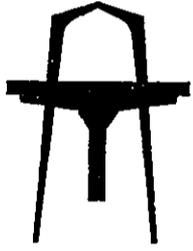
EU:th

cc: OEQC
Mr. Earl Matsukawa
DBEDT (Dir. Ref. No. 96-212-J)

3357-01
June 5, 1996

**WILSON
OKAMOTO**

& ASSOCIATES, INC.



**ENGINEERS
PLANNERS**

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

Ms. Esther Ueda, Executive Officer
Land Use Commission
Department of Business, Economic Development and Tourism
P.O. Box 2359
Honolulu, HI 96804-2359

Dear Ms. Ueda:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of January 26, 1996 (Dir. Ref. No. 96-212-J) commenting on the project. We appreciate your verification of the State Land Use Agricultural District designation for TMK parcel 2-7-13:8 within which the project is located. We have determined that a portion of the project will also be located within TMK parcel 2-7-13:31, which is similarly designated Agricultural according to Mr. Leo Asuncion of your office (Telephone communication, April 8, 1996). The Final EA will include a reference to the additional TMK parcel.

Very truly yours,

A handwritten signature in cursive script that reads "Myron Okubo".

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

BENJAMIN J. CAYETANO
GOVERNOR
STATE OF HAWAII



STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

KALI WATSON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

JOHIE M. K. M. YAMAGUCHI
DEPUTY TO THE CHAIRMAN

February 9, 1996

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

RECEIVED
FEB 12 1996

WILSON OKAMOTO & ASSOC. INC.

Attention: Cary Yamashita, Assistant Chief Engineer

Dear Mr. Jencks:

Subject: Kaupakalua Bridge Replacement
Draft Environmental Assessment
(Negative Declaration Anticipated)
Tax Map Key: 2-7-13:08 (por)
Haiku, Maui, Hawaii

The proposed bridge replacement will have no adverse impacts upon the programs or projects of the Department of Hawaiian Home Lands.

Based upon information provided in the subject report, we have no objections to a Negative Declaration for the project.

If you have any questions, please call Joe Chu of our Planning Office at 586-3838.

Warmest aloha,

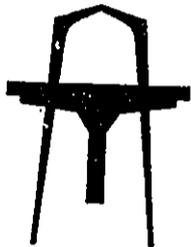
A handwritten signature in cursive script that reads "Kali Watson".

Kali Watson, Chairman
Hawaiian Homes Commission

c: ✓ DEQC
Wilson Okamoto & Associates, Inc.

3906L14

WILSON
OKAMOTO
& ASSOCIATES, INC.



ENGINEERS
PLANNERS
1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253
Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

3357-01
June 5, 1996

Mr. Kali Watson, Chairman
Hawaiian Homes Commission
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, HI 96805

Dear Mr. Watson:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 9, 1996 (Ref. 3906L14) commenting that the project will not impact DHHL programs or projects, and that you have no objections to a Negative Declaration being filed for the subject project. We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script that reads "Myron Okubo".

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

BENJAMIN J. CAYETANO
GOVERNOR



STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097
FEB 16 1996

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO:

HWY-PS
2.9071

County of Maui
Department of Public Works &
Waste Management
Engineering Division
200 South High Street
Wailuku, Hawaii 96793

RECEIVED
FEB 22 1996

WILSON OKAMOTO & ASSOC., INC.

Attention: Cary Yamashita, Assistant Chief

Gentlemen:

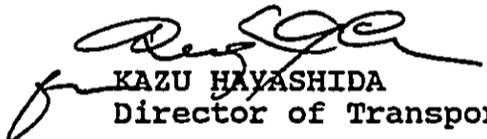
Subject: Draft Environmental Assessment (EA) for the
Kaupakalua Bridge Replacement
Haiku, Maui, Hawaii, TMK: 2-7-13: 8 (por.)

Thank you for requesting our review of the Draft EA.

The proposed replacement of the Kaupakalua Bridge and its associated construction activities will not impact our State highway facilities.

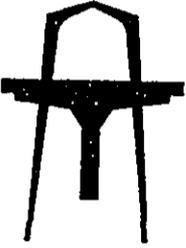
We concur with the proposal to keep the existing Kaupakalua Bridge open to accommodate vehicular access during the construction of the new bridge.

Very truly yours,


KAZU HAYASHIDA
Director of Transportation

cc: Wilson Okamoto & Assoc. (Earl Matsukawa, Project Planner)

WILSON
OKAMOTO
& ASSOCIATES, INC.



ENGINEERS
PLANNERS

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

3357-01
June 5, 1996

Mr. Kazu Hayashida, Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Dear Mr. Hayashida:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 16, 1996 (Ref. HWY-PS 2.9071) commenting that the project will not impact State highway facilities. We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script that reads "Myron Okubo".

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII



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

LAWRENCE MIKE
DIRECTOR OF HEALTH

In reply, please refer to: ✓

February 16, 1996

96-016/epo

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

ATTENTION: Gary Yamashita
Assistant Division Chief

Dear Mr. Yamashita:

Subject: Draft Environmental Assessment
Kaupakalua Bridge Replacement
Haiku, Maui, Hawaii
TMK: 2-7-13:8 (por.)

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

Water Pollution

A National Pollutant Discharge Elimination System (NPDES) permit is required for any discharge to waters of the State including the following:

1. Storm water discharges relating to construction activities for projects equal to or greater than five acres;
2. Storm water discharges from industrial activities;
3. Construction dewatering activities;
4. Cooling water discharges less than one million gallons;
5. Ground water remediation activities; and
6. Hydrotesting water.

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FEB 26 1996

WILSON OKAMOTO & ASSOC., INC.

County of Maui
February 16, 1996
Page 2

Any person wishing to be covered by the NPDES general permit for any of the above activities should file a Notice of Intent with the Department's Clean Water Branch at least 90 days prior to commencement of any discharge to waters of the State.

Any questions regarding this matter should be directed to Mr. Denis Lau of the Clean Water Branch at 586-4309.

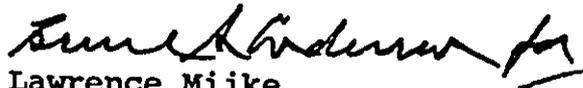
Polluted Runoff Control

Proper planning, design, and use of erosion control measures and management practices will substantially reduce the total volume of runoff and limit the potential impact to the coastal waters from nonpoint source pollution. The following measures are suggested steps that can be taken to minimize erosion during construction:

1. Conduct grubbing and grading activities during the low rainfall months.
2. Replant or cover bare areas as soon as grading or construction is completed. New plantings will require soil amendments, fertilizers, and temporary irrigation to become established. Use high planting and/or seeding rates to ensure rapid stand establishment.
3. Properly dispose of sediment and debris from construction activities.
4. Minimize amount of construction time spent in the stream beds.

If you should have any questions on this matter, please contact Mr. Randall Rush of the Environmental Planning Office at 586-7550.

Sincerely,



Lawrence Miike
Director of Health

c: OEQC
Wilson Okamoto & Associates ✓

WILSON
OKAMOTO
& ASSOCIATES, INC.



**ENGINEERS
PLANNERS**

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3830
Honolulu, Hawaii 96811

3357-01
June 5, 1996

Mr. Lawrence Miike, Director
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, HI 96801

Dear Mr. Miike:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 16, 1996 (Ref. 96-016/epo) commenting on the subject project. We appreciate the information you provided regarding the National Pollutant Discharge Elimination System (NPDES) permit requirements. Based on our discussion with Mr. Alec Wong of your office, the project is not subject to this permit (Telephone Communication, February 7, 1996). However, your recommended runoff control measures will be implemented to the extent practicable during project construction. For your information, a Best Management Practices Plan and water quality monitoring plan were submitted to your office for review in conjunction with an application for Water Quality Certification.

We appreciate your time and effort in reviewing the Draft EA.

Very truly yours, --

Myron Okubo
Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

465

RECEIVED
COUNTY OF MAUI

'96 FEB 21 P2:55



STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
711 KAPIOLANI BOULEVARD, SUITE 500
HONOLULU, HAWAII 96813-5249
PHONE (808) 594-1888
FAX (808) 594-1865

ENGINEERING DIVISION
DEPT. OF PUBLIC WORKS

February 17, 1996

County of Maui
Attn: Gary Yamashita
Dept. of Public Works and Waste Management
Engineering Division
200 South High Street
Wailuku, HI 96793

Dear Mr. Yamashita:

Thank you for the opportunity to review the Draft Environmental Assessment (DEA) for the Kaupakalua Bridge Replacement, Maui County, Hawaii. The Kaupakalua bridge carries Peahi road over Kaupakalua stream in the Makawao District. The bridge is located within lands owned by the East Maui Irrigation Company, Ltd. The immediate surrounding area is largely underdeveloped.

After a careful review of the DEA and supporting documentation, the Office of Hawaiian Affairs has no objections to the proposed bridge replacement. Based on the information contained in the DEA, the proposed replacement apparently bears no significant long-term adverse impacts on the surrounding ecosystem. Furthermore, no known archaeological remains exist and the new bridge will not significantly alter the scenic view. Please contact me, or Linda K. Delaney, the Land and Natural Resources Division Officer (594-1938), or Luis A. Manrique (594-1935), should you have any questions on this matter.

Sincerely yours,

Linda M. Colburn
Linda M. Colburn
Administrator

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APR 02 1996

LM:lm

WILSON OKAMOTO & ASSOCIATES

**WILSON
OKAMOTO**
& ASSOCIATES, INC.



**ENGINEERS
PLANNERS**

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

3357-01
June 5, 1996

Ms. Linda M. Colburn, Administrator
State of Hawaii
Office Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, HI 96813-5249

Dear Ms. Colburn:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 17, 1996 indicating that you have no objections to the subject project. We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script that reads "Myron Okubo".

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

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

February 22, 1996

Mr. Cary Yamashita, Assistant Division Chief
Department of Public Works and Waste Management
County of Maui
200 South High Street
Wailuku, Hawaii 96793

RECEIVED
FEB 25 1996

WILSON OKAMOTO & ASSOC. INC.

Dear Mr. Yamashita:

Subject: Draft Environmental Assessment for the Kaupakalua Bridge Replacement

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

1. Please consider other alternatives to the proposed action that would not affect the stream banks. Is it possible to increase the span of the bridge to completely avoid the stream banks?
2. We understand that some streams in the area contribute to ditch systems. Please indicate whether this portion of Kaupakalua Stream was a perennial stream at one time and whether its waters presently contribute to any ditch system. If in the future, water is restored to the Kaupakalua Stream, please indicate what effects such restoration may have on the proposed bridge.
3. Please describe all the available details of the Best Management Practices Plan and the water quality monitoring plan.

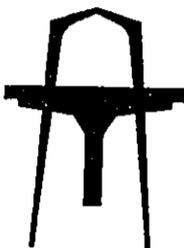
If you have any questions, please call Jeyan Thirugnanam at 586-4185. Thank you.

Sincerely,

A handwritten signature in cursive script, appearing to read "Gary Gill".

Gary Gill
Director

WILSON
OKAMOTO
& ASSOCIATES, INC.



ENGINEERS
PLANNERS

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

3357-01
June 5, 1996

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

Dear Mr. Gill:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 22, 1996 commenting on the subject project. The following responses are offered in the respective order of your comments:

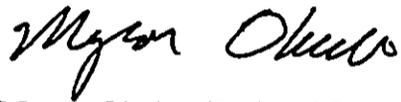
1. An alternate bridge design which would avoid the stream banks entirely would require a significant increase in the length of the bridge from 44 feet to approximately 120 feet. To accommodate such an extended span, larger support girders and abutments, complex geometric bridge constraints (due to the road curvature and bridge alignment), and a grade change on the roadway approaches to access a higher bridge deck would be required. These additional requirements would make the bridge prohibitively expensive to construct. The current bridge design offers a cost-effective structure which addresses hydrology and safety requirements.
2. As noted in the Environmental Reconnaissance Survey prepared by AECOS, Inc. (Appendix C of the Draft EA), Kaupakulua Stream and its branches are presently part of the East Maui Irrigation Company (EMI) system which diverts water from numerous east Maui streams to the residential and agricultural areas of central Maui. In the event that these diversions are discontinued, the portions of Kaupakulua Stream flowing perennially would probably extend to a lower elevation than is presently the case, but its lower reaches would remain intermittent. Therefore, the Kaupakulua Stream in the vicinity of the bridge would continue to be interrupted. This would have no impact on the proposed bridge, nor would the bridge have any impact on the stream flow.
3. A Best Management Practices Plan and water quality monitoring plan are currently under review by the Department of Health in conjunction with an application for Water Quality Certification. The Final EA will include a description of key features of the plans. If this is an area of particular concern to your agency, please contact the DOH Clean Water Branch.

WILSON
OKAMOTO
& ASSOCIATES, INC.

3357-01
Letter to Mr. Gary Gill
Page 2
June 5, 1996

We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,



Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

(P) 1129.6

FEB 22 1996

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

RECEIVED
FEB 26 1996

WILSON OKAMOTO & ASSOC., INC.

Attention: Mr. Cary Yamashita
Assistant Division Chief

Gentlemen:

Subject: Kaupakalua Bridge Replacement
Makawao, Maui, Hawaii
Draft Environmental Assessment

Thank you for the opportunity to review the subject document. We have no comments to offer.

If there are any questions, please have your staff contact Mr. Ralph Yukumoto of the Planning Branch at 586-0488.

Very truly yours,



GORDON MATSUOKA
State Public Works Engineer

RY:jk

cc: OEQC

Wilson Okamoto & Associates, Inc.

**WILSON
OKAMOTO**
A ASSOCIATES, INC.



**ENGINEERS
PLANNERS**

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

3357-01
June 5, 1996

Mr. Gordon Matsuoka
State Public Works Engineer
State of Hawaii
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Matsuoka:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 22, 1996 (Ref. (P)1129.6) indicating that you have no comments regarding the project. We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script, appearing to read "Myron Okubo". The signature is fluid and somewhat stylized.

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

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

RECEIVED
MAR 18 1996

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

March 13, 1996

WILSON OKAMOTO & ASSOC., II.

Mr. Cary Yamashita, Assistant Chief
Department of Public Works and Waste Management
Engineering Division
200 South High Street
Wailuku, Hawaii 96793

LOG NO: 16387
DOC NO: 9602KD37

Dear Mr. Yamashita:

**SUBJECT: County of Maui, Historic Preservation Review of a Draft
Environmental Assessment -- Kaupakalua Bridge Replacement
Project, Kaupakalua, Makawao District, Island of Maui
TMK: 2-7-13: 8 (por.)**

Thank you for submitting for review the draft Environmental Assessment of the proposed Kaupakalua Bridge replacement project. The project is located along Peahi Road, less than one mile south from Hana Highway. The existing bridge over Kaupakalua Stream is to be removed, and a new concrete structure is to be built c. 120f north of the present stream crossing.

The draft Environmental Assessment includes as Appendix D a draft report entitled *Archaeological Assessment of the Proposed Bridge Replacement Site at Kaupakalua, Hamakualoa District, Island of Maui* (B.L. Colin and H.H. Hammatt, 1995). This report presents the findings of a surface survey that was conducted of the project area. We have not previously reviewed this survey document, and we have some questions at this time.

According to the draft EA (Fig. 2), new construction will extend a minimum of c. 80 m (240 f) north of the existing bridge. Based on the information provided in the archaeological survey, we are not certain that the entire project area was included within the inventory survey (see attached comments). Likewise, we cannot be certain that all historic sites within the project area have been identified.

The project will involve cutting into the existing stream banks for construction of abutments on both sides of the bridge. It also appears that an area of stream side bottom lands will be impacted by the project. We would like to see a statement in the inventory survey report concerning the likelihood of buried cultural deposits or features within the project area, based on observed soil deposits along the stream bed and on the geomorphology of the area.

Ms. Cary Yamashita
Page 2

We will conclude our review of this project after the draft inventory survey report has been acceptably revised.

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

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

KD:jen

cc: Gary Gill, Director, OEQC
Earl Matsikawa, Wilson Okamoto & Associates
(1907 S. Beretania Street, Suite 400 Honolulu 96826)

ATTACHMENT

Items for Clarification or Revision - Inventory Survey of the Kaupakalua Bridge Replacement Project Area

Introduction

- 1) There appears to be some confusion in the report as to how large an area was examined. On page 1 of the report, it is stated that an area 50 m (164 ft) was examined in all directions from the existing bridge. In the following paragraph, it is stated that an area 30 m (98.4 ft) in diameter was examined.
- 2) According to maps provided in the draft EA, the proposed construction area will extend beyond the maximum limits of the area surveyed (assuming it was either 30 or 50 m radius from the existing bridge).

Historic Background

- 3) The lengthy quotation from Kelly is not cited in the list of references and no date is provided in the text for this reference.
- 4) The McKinzie reference on page five is dated 1986. The date given for the McKinzie source in the list of references on page 11 is 1983. Which is the correct date?

Previous Archaeological Research

- 5) The site number for Site 50-50-06-1221 is incomplete on Figure 4.
- 6) Site 50-50-06-1221 is not the only archaeological site recorded for Kaupakalua, as stated on page 6. The Kaupakalua Winery (Site 50-50-06-1569) is a known archaeological site within the ahupua'a. This site is located at the junction of East Kuiaha Road and Kaupakalua Road.
- 7) Is the Sinoto 1992 reference on page 8 the same as the Pantaleo and Sinoto 1992 source given in the list of references? Which is correct?
- 8) The last sentence in the previous archaeological section on page 8 is incomplete.
- 9) There is no statement in the background sections which summarizes settlement patterns in the area of the project, and there are no statements as what types of sites, if any, would be likely to occur in the project area.
- 10) The citation for Kame'eleihiwa 1992 in the list of references could not be located in the text. Is this book cited in the report?

Attachments
Page 2

Findings

- 11) It is stated in the report that the banks of the streambed were examined during the survey. There is no discussion of the observed soil stratigraphy or deposition along the bank that would help us to determine the likelihood of subsurface deposits along the sides of the stream. In some cases, the nature of the stream bed and exposed deposits can aid in predicting buried sites.
- 12) An area of piled boulders was observed by SHPD staff in the vicinity of the bridge, within what appears to be the proposed project area. Was this area examined during the survey? Is it natural or cultural?

CULTURAL SURVEYS HAWAII

Archaeological Studies
Hallett H. Hammatt, Ph.D.
733 N. Kalaheo Avenue
Kailua, Hawaii 96734
FAX: (808) 262-4950, Bus: 262-9972

COVER SHEET FOR TRANSMITTAL

TO: Theresa Donham
State Historic Preservation Division
130 Mahalani St.
Wailuku, Maui 96793

PROJECT: East Maui Bridge--Kaupakalua.

DATE/TIME SENT: April 15, 1996

FROM: Brian Colin

REMARK: Enclosed for your review is a copy of the revised report (and three additional pages concerning these revisions). When these changes are finalized, we will submit a final copy to the Honolulu SHPD. Please contact me with any further questions.

CC Laura Mau 946 2253

MAHALO!

COMMENTS

The following is an itemized list addressing the "Items for Clarification or Revision"

1. and 2. Both of these comments have been addressed in the Abstract (page i) and Methods (page 2).
3. The date for the Kelly report is 1983, it has also been included in the References (See page 5 and References (page 14)).
4. The date for the McKinzie report was a typo on page 5 it is 1983 (see page 6).
5. See Fig. 4 (page 8) for addition of full site number.
6. The Kaupakalua Winery (Site -1576) and the Kaupakalua Village (Site -1569) have both been added to the report (see pages 7 and 9).
7. The quote should have been Pantaleo and Sinoto 1992 not Sinoto 1992 (page 9).
8. The last sentence has been rewritten (see page 10).
9. See Settlement Pattern Summary and Expected Findings (page 9).
10. The Kame'eleihiwa 1992 reference has been removed.
- 11., 12. Both of these comments have been addressed on page 10.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
23 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT COLOMA-ADARAM

AQUACULTURE DEVELOPMENT
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CONSERVATION AND

RESOURCES ENFORCEMENT

CONVEYANCES

FORESTRY AND WILDLIFE
HISTORIC PRESERVATION

DIVISION

LAND MANAGEMENT

STATE PARKS

WATER AND LAND DEVELOPMENT

April 25, 1996

Mr. Cary Yamashita, Assistant Chief
Department of Public Works and Waste Management
Engineering Division
200 South High Street
Wailuku, Hawaii 96793

LOG NO: 17003 ✓
DOC NO: 9604KD18

Dear Mr. Yamashita:

**SUBJECT: County of Maui, Historic Preservation Review of a Draft Environmental Assessment
- Kaupakulua Bridge Replacement Project
Kaupakulua, Makawao District, Island of Maui
TMK: 2-7-13: 8 (por.)**

This is a follow up of our letter dated March 13, 1996 regarding the archaeological survey report attached to the draft Environmental Assessment for the subject bridge replacement project. In our previous letter, we requested some revisions and additional information in order to make an informed assessment of project impacts to historic sites.

We have received a revised draft of the report entitled *Archaeological Assessment of the Proposed Bridge Replacement Site at Kaupakulua, Hamakualoa District, Island of Maui* (B. Colin and H.H. Hammatt 1996). The revised report addresses our questions regarding the area surveyed, and provides the additional information requested. It is now acceptable as a final report.

The report indicates that no evidence of historic sites was identified within the project area, and that the proposed project will have no impact on historic sites. Based on the additional information provided, we are now able to concur with the report findings and conclusion. We believe that this project will have "no effect" on historic sites.

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

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

KD:jen

cc: Brian Colin, Cultural Surveys Hawaii (733 N. Kalaheo Avenue, Kailua, 96734)
Ms. Linda M. Hihara-Endo, U.S. Army Engineer District (Ft. Shafter, 96858)
(File No. NW 950010151)

RECEIVED

MAY 03 1996

WILSON OKAMOTO & ASSOCIATES

LINDA CROCKETT LINGLE
Mayor



DAVID W. BLANE
Director
GWEN OHASHI HIRAGA
Deputy Director

COPY

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

February 2, 1996

Mr. Cary Yamashita, Assistant Division Chief
Department of Public Works and
Waste Management
200 South High Street
Wailuku, Hawaii 96793

RECEIVED
FEB 02 1996

Dear Mr. Yamashita:

WILSON DRAGOTIC & ASSOC., INC.

RE: Kaupakalua Bridge Replacement

Thank you for the opportunity to comment on the *Kaupakalua Bridge Replacement Draft Environmental Assessment*.

The proposed action is in keeping with the County of Maui's program to modify or replace functionally or structurally deficient bridges to achieve current standards for roadway widths and load capacities as specified by the American Association of State Highway and Transportation Officials (AASHTO) for Rural Collector Roads.

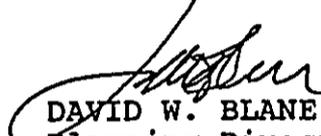
The Kaupakalua Bridge was among the bridges which were prioritized for improvement by the Department of Public Works and Waste Management for the current fiscal year. The bridge is scheduled for complete replacement by a cast-in-place concrete bridge situated approximately 150 feet downstream of the existing bridge.

The review of the Draft Environmental Assessment for the proposed bridge replacement has not identified any significantly adverse impacts based on the significance criteria listed in §11-200-12 of the Environmental Impact Statement Rules. Therefore, the Planning Department has no further comments on this project.

Mr. Cary Yamashita, Assistant Division Chief
February 2, 1996
Page 2

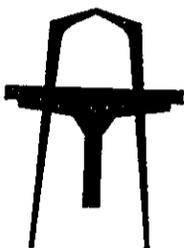
If additional clarification is required, please contact Don
Schneider of this office at 243-7735.

Very truly yours,


DAVID W. BLANE
Planning Director

DWB:ds
cc: Colleen Suyama
OEQC
Wilson Okamoto & Associates, Inc
Don Schneider
dlm:hsj/psd

WILSON
OKAMOTO
& ASSOCIATES, INC.



ENGINEERS
PLANNERS

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

3357-01
June 5, 1996

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

Dear Mr. Blane:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 2, 1996 indicating that you have no comments regarding the subject project. We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script that reads "Myron Okubo". The signature is fluid and appears to be written in dark ink.

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management



**BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1108
WAILUKU, MAUI, HAWAII 96783-7108**

6
FEB 23 1996
WILSON OKAMOTO & ASSOCIATES, INC.

February 21, 1996

County of Maui
Department of Public Works & Waste Management
Engineering Division
200 South High Street
Wailuku, HI 96793
Attn: Cary Yamashita, Assistant Division Chief

RE: Kaupakalua Bridge Replacement; Draft Environmental Assessment
& anticipated Negative Declaration; TMK 2-7-13: por. 8; Haiku

Dear Mr. Yamashita,

Thank you for the opportunity to comment on the proposed project.

We forward for your information a map indicating approximate alignment of our planned well development in the area. We would appreciate if this bridge could be constructed with adequate structural strength and pipe supports for a possible future pipeline crossing. Please contact Director David Craddick at 243-7816 at your earliest convenience regarding possible coordination.

We request that precautionary measures be taken during construction to prevent petroleum products, construction materials and debris, and eroded soils from entering the stream.

West Maui Watershed Coordinator, Dr. Wendy Wiltse, may also have some insights to offer regarding protection of stream ecosystems during construction. She can be reached at 661-7856.

Sincerely,

David Craddick
David Craddick
Director

cc: Earl Matsukawa, Project Planner, Wilson Okamoto & Associates, Inc.
Honorable Gary Gill, Director, OEQC

"By Water All Things Find Life"

Printed on recycled paper



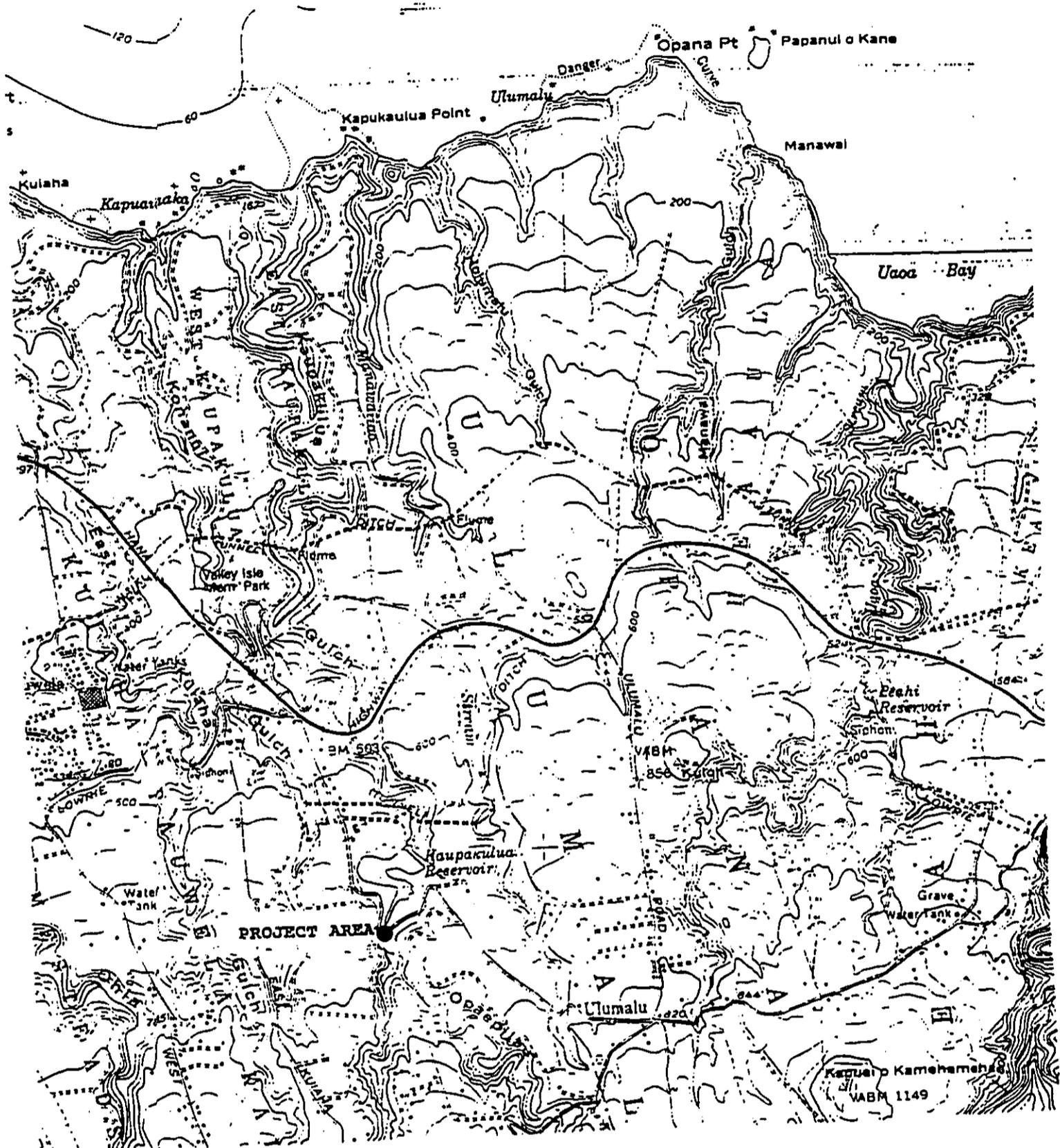
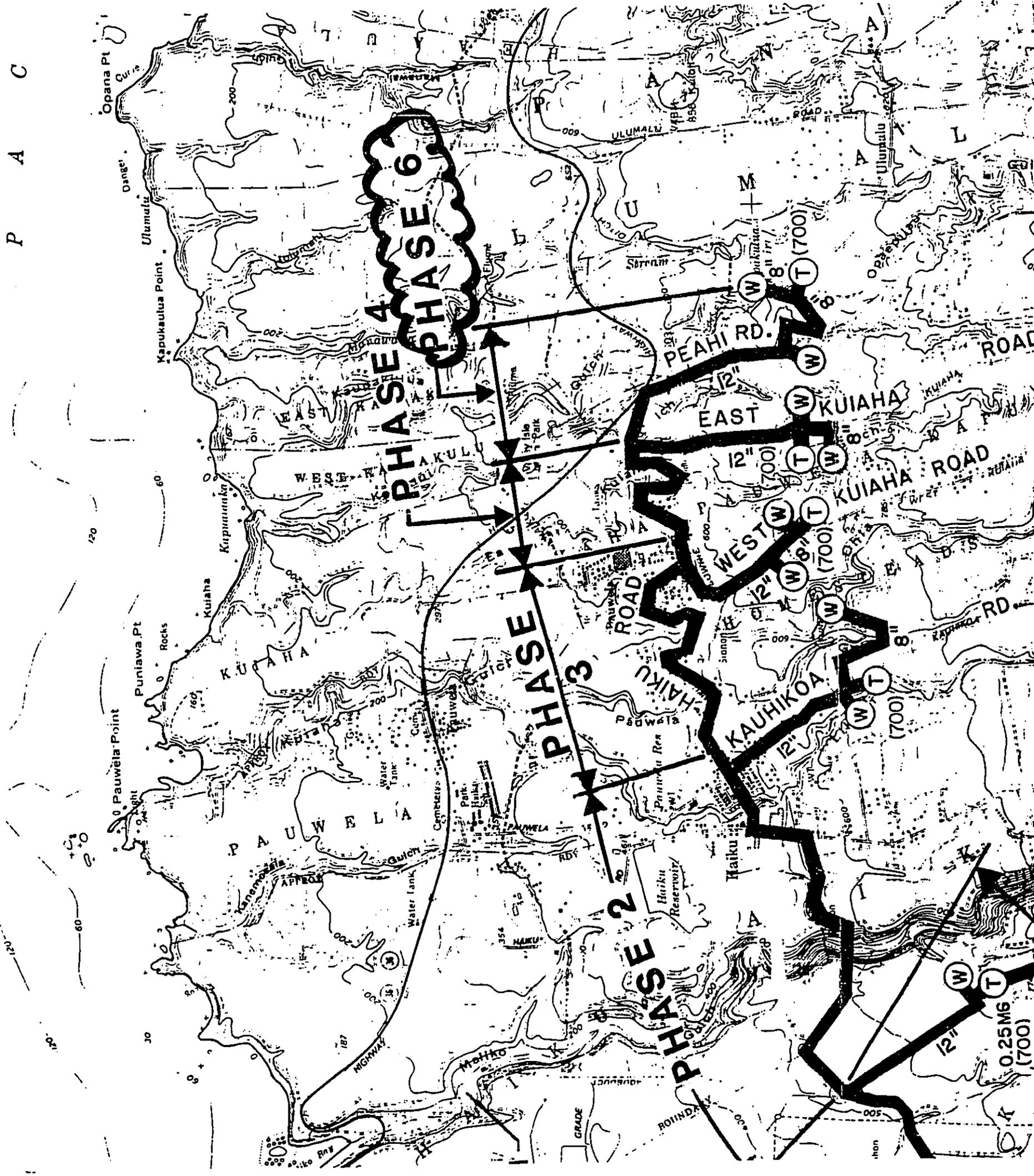
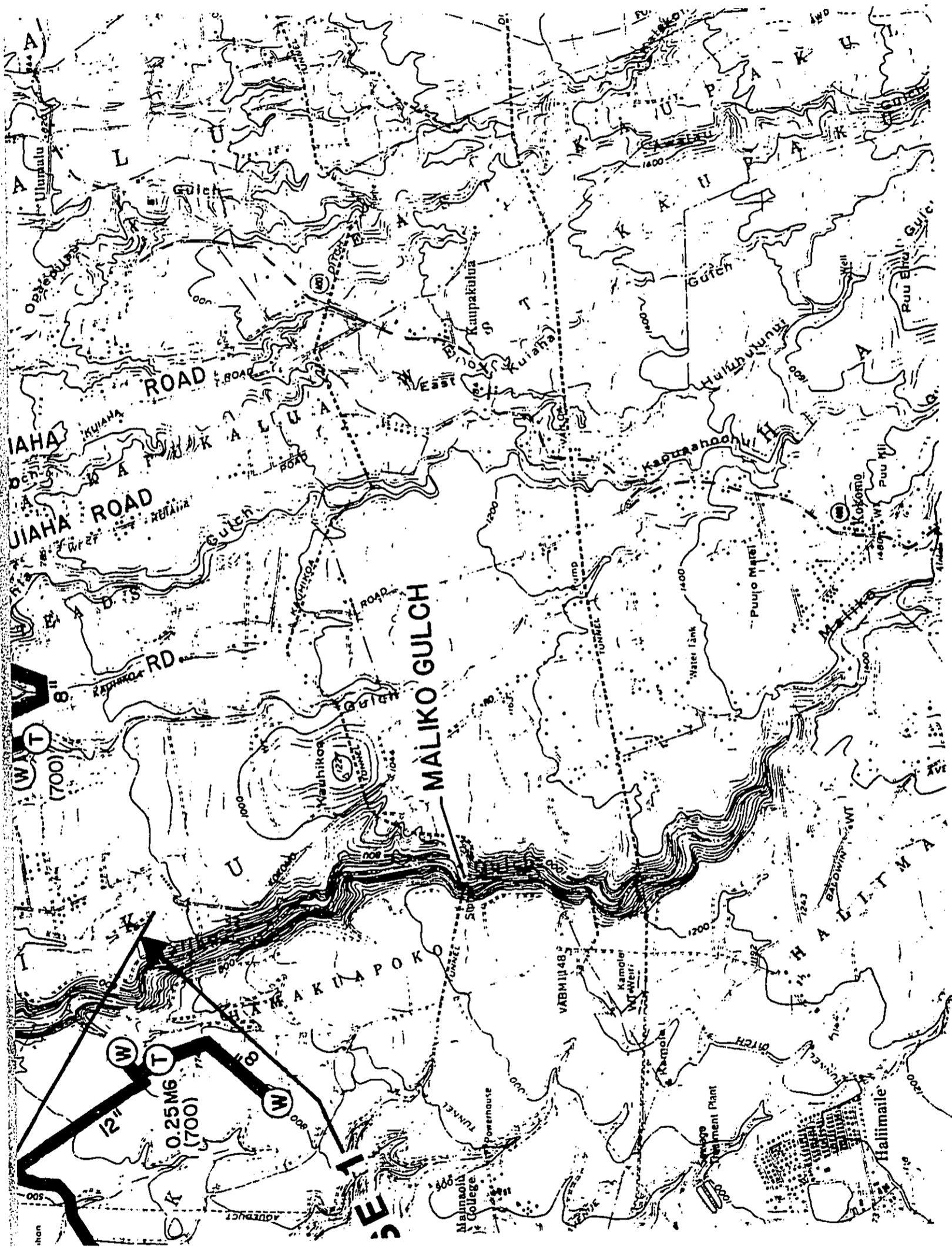


Figure 3 Portion of USGS 7.5 minute series, Haiku Quad, displaying project area

Applicant's Project Site

P A C





**WILSON
OKAMOTO
& ASSOCIATES, INC.**



**ENGINEERS
PLANNERS**

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

3357-01
June 5, 1996

Mr. David Craddick, Director
Board of Water Supply
County of Maui
P.O. Box 1109
Wailuku, HI 96793-7019

Dear Mr. Craddick:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 21, 1996 commenting on the subject project. We appreciate the information you provided regarding BWS planned projects. The bridge can be designed to accommodate the loads for a new 8-inch water line, assuming it will be comprised of ductile iron material. As there are various methods to support the pipe along the bridge, please furnish desired details for the supports and approximate water line alignment and profile. The costs and responsibilities for inspection of the work during construction must be coordinated between BWS and Department of Public Works and Waste Management. During construction, measures will be taken to prevent petroleum products, construction materials and debris, and eroded soils from entering the stream.

We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script that reads "Myron Okubo".

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management



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

January 25, 1996

RECEIVED
JAN 29 1996

MEMO TO: Charles Jencks, Director
Department of Public Works

ATTENTION: Cary Yamashita, Assistant Engineering Division Chief

FROM: *Henry Oliva* Henry Oliva, Director

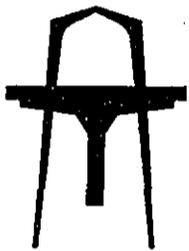
SUBJECT: Draft Environmental Assessment For Kaupakalua Bridge
Replacement

WILSON OKAMOTO & ASSOCIATES

We have reviewed the draft environmental assessment for the subject project and have no comments. Thank you for the opportunity to review and comment on this.

c: OEQC
Wilson Okamoto & Associates, Inc.

**WILSON
OKAMOTO
& ASSOCIATES, INC.**



**ENGINEERS
PLANNERS**

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. B o x 3 5 3 0
Honolulu, Hawaii 96811

3357-01
June 5, 1996

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

Dear Mr. Oliva:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of January 25, 1996 indicating that you have no comments regarding the subject project. We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management



February 14, 1996

Mr. Cary Yamashita
Assistant Division Chief
County of Maui
Department of Public Works and Waste Management
Engineering Division
200 So. High Street
Wailuku, HI 96793

Dear Mr. Yamashita:

Subject: Kaupakalua Bridge Replacement Draft Environmental Assessment
(Negative Declaration Anticipated)
TMK: 2-7-13:8(por.)
Haiku, Maui, Hawaii

Thank you for allowing us to comment on the above subject.

In reviewing the information transmitted and our records, Maui Electric Company at this time has no objections to the subject project.

If you have any questions or concerns, please call Fred Oshiro at 872-3202.

Sincerely,

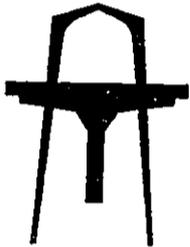
Edward Reinhardt
Manager, Engineering

FO:rt

cc: Mr. Gary Gill (SOH - Office of Environmental Quality Control)
Mr. Earl Matsukawa (Wilson Okamoto & Associates, Inc.)



WILSON
OKAMOTO
& ASSOCIATES, INC.



**ENGINEERS
PLANNERS**

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. B o x 3 5 3 0
Honolulu, Hawaii 96811

3357-01
June 5, 1996

Mr. Edward Reinhardt, Manager
Engineering Department
Maui Electric Company, Ltd.
P.O. Box 398
Kahului, HI 96732-0398

Dear Mr. Reinhardt:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 14, 1996 indicating that you have no objections to the subject project. We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script that reads "Myron Okubo".

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

A&B-HAWAII, INC.
HONOLULU

TELEPHONE: (808) 579-9516
FACSIMILE: (808) 579-9517

EAST MAUI IRRIGATION COMPANY, LIMITED

P.O. BOX 48, PAIA, MAUI, HAWAII 96779

February 22, 1996

County of Maui
Department of Public Works
200 South High St.
Wailuku, HI 96793

RECEIVED
FEB 23 1996

Attention: Mr. Cary Yamashita, Assistant Division Chief

WILSON OKAMOTO & ASSOCIATES, INC.

Dear Mr. Yamashita:

We have reviewed the Kaupakalua Bridge Replacement Draft Environmental Assessment prepared for your department by Wilson Okamoto & Associates, Inc. dated January 1996. Our only comment is that the contractor for this project coordinates all work with East Maui Irrigation Co., Ltd.

Should you have questions, please contact me at 579-9516.

Very truly yours,



Garret Hew
Gen. Supt. Admin. &
Business Management

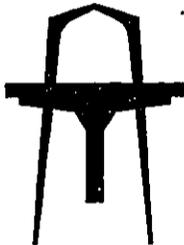
Alexander & Baldwin

GH:juh

125 Years Strong

cc: Office of Environmental Quality Control
Wilson Okamoto & Associates, Inc.

WILSON
OKAMOTO
& ASSOCIATES, INC.



**ENGINEERS
PLANNERS**

1907 S. BERETANIA STREET
HONOLULU, HAWAII 96826
PH: (808) 946-2277
FAX: (808) 946-2253

Mailing address:
P. O. Box 3530
Honolulu, Hawaii 96811

3357-01
June 5, 1996

Mr. Garret Hew
Gen. Supt. Admin. and Business Management
East Maui Irrigation Company, Limited
P.O. Box 48
Paia, Hawaii 96779

Dear Mr. Hew:

Subject: Draft Environmental Assessment (EA)
Kaupakulua Bridge Replacement

Thank you for your letter of February 22, 1996 commenting on the subject project. Please be assured that all construction activity will be coordinated between the contractor and East Maui Irrigation Co., Ltd. We appreciate your time and effort in reviewing the Draft EA.

Very truly yours,

A handwritten signature in cursive script that reads "Myron Okubo". The signature is written in dark ink and is positioned above the typed name.

Myron Okubo, Project Manager

cc: Office of Environmental Quality Control
County of Maui, Department of Public Works and Waste Management

APPENDIX A

*Bridge Inspection Report for
Kaupakulua Bridge*

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

July 1995

CORRECTION

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

APPENDIX A

*Bridge Inspection Report for
Kaupakulua Bridge*

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

July 1995

***** IDENTIFICATION *****

1 State : Hawaii 159
8 STRUCTURE NUMBER: 009335001100001
Inventory Route : on 152000003
Highway Dist. : 20
County Code: 009 4 Place code:
6 Features Intrsct: KAUPAKALUA STRM
7 Facility Carried: PEAHI RD.
9 Location : .8 MI.S.OF HAIKU RD/PEAHZ6
11 Milepoint : 000.000
16 Lat: 20deg 54.8' 17 Long: 156deg 18.0'
98 Border Br State :
99 Border Br Stru #:

***** STRUCTURE TYPE & MATERIAL *****

43 Stru Main Material- Timber
Type- Stringer/Multibeam/Girder 702
44 Stru App Material- Other
Type- Other 000
45 # of Main Spans : 002
46 # of App Spans : 0000
107 Deck Stru - 8
108 Wearing Surf/Protective Sys type
A Wearing Surface - Timber 7
B Membrane - None 0
C Deck Protection - None 0

***** AGE & SERVICE *****

27 Year Built : 1911
106 Year Reconstructed : 1985
42 Type of Service on -Highway
under: Waterway 15
Lanes On Stru: 01 Under Stru: 00
ADT : 000510
30 Yr of ADT : 84 109 Truck ADT : %
19 Bypass, Detour Length (miles) 03

***** GEOMETRIC DATA *****

48 Length of Max Span (ft) : 0016
49 Structure Length (ft) : 000039
50 Curb/Sidewalk Width L: 00.0 R: 00.0
51 Bridge Width, curb-to-curb : 016.3ft
52 Deck Width, out-to-out : 019.5ft
32 Approach Rdwy Width : 017ft
33 Bridge median - No median 0
34 Skew : 00 deg 35 Stru Flared: 0
10 Inventory Rt Min Vert Clrn : 99'99"
47 Inv. Rt Total Horz Clrn : 14.0ft
53 Min Vert Clrn over Rdwy : 9999
54 Min Vert Underclearance : N0000ft
55 Min Lateral R Underclrn : N000ft
56 Min Lateral L Underclrn : 000ft

***** NAVIGATION DATA *****

38 Navigation Control : N
111 Pier Protection-functioning:
39 Navigation Vert Clrn : 000ft
116 Vert Lift Br Min Clrn : ft
40 Navigation Horz Clrn : 0000ft
a Recorded 11/16/93

NBI SI&A sheet

11/16/93

Sufficiency Rating = 046.0
Status = Functional obsolete

***** CLASSIFICATION *****

112 NBIS Bridge Length : Y
104 Hwy System of Inventory Rt: 8
26 Functional Classification : 08
100 Defense Hwy Designation : 0
101 Parallel Stru Designation : N
102 Direction of Traffic : 3
103 Temporary Stru Designation:
110 Designated Natl Network : 0
20 Toll : 3
21 Main - :County highway : 02
22 Owner- County highway : 02
37 Historical Significance : 4

***** CONDITIONS *****

58 Deck : 5
59 Superstructure : 6
60 Substructure : 7
61 Channel Protection : 7
62 Culverts : N

***** LOAD RATING & POSTING *****

31 Design Load - H 10 : 1
64 Operating Rating : 107
66 Inventory Rating : 105
70 Posting - Unknown : 1
41 Stru Open/Posted/Closed: F
- Posted for load

***** APPRAISAL *****

67 Structure Evaluation : 5
68 Deck Geometry : 3
69 Underclearance Vert/Horz : 8
71 Waterway Adequacy : 7
72 Approach Roadway Alignmen : 4
36 Traffic Safty Features : 0000
113 Scour Critical Bridges : 8

***** PROPOSED IMPROVEMENTS *****

75 Type of Work : 000
76 Length of Stru Imprvmt : 000000
94 Bridge Improvement Cost: 000000
95 Roadway Imprvmt Cost : 000000
96 Total Project Cost (K) : 000000
97 Year of Imprvmt Cost Est. :
114 Future ADT : 000000
115 Year of Future ADT :

***** INSPECTIONS *****

90 Insp Date: 07/95 91 Freq: 24mo
92 Critical Feature Insp 93 Date:
A Frac. Crit Detail :N /
B Underwater Insp :N /
C Other Special Insp:N /
Upload to Mainframe / /

County of Maui
Department of Public Works
Engineering Division

BRIDGE INSPECTION REPORT

Date of Inspection 7/17/95 Bridge Name KAUPAKALUA #35
 Bridge Number 0933500100001 Number of Spans 2
 Location: Island MAUI Route No. _____ Highway PEAHI RD.
 Feature Intersected KAUPAKALUA STREAM
 Bridge Material: Superstructure TIMBER Substructure MASONRY

| 36 | TRAFFIC SAFETY FEATURES | Indicate if feature meets currently acceptable standards. 0-No 1-Yes 2-Not Applicable |
|----|----------------------------|---|
| | 1. Bridge Railings | 1 <i>RECENTLY INSTALLED</i> |
| | 2. Transitions | 0 |
| | 3. Approach Guardrail | 0 |
| | 4. Approach Guardrail Ends | 0 |

CONDITION RATING REMARKS

| 58 | DECK | REMARKS |
|----|---------------------------------|---------|
| | 1. Wearing Surface | 9 |
| | 2. Deck - Structural Condition | 9 |
| | 3. Curbs | N |
| | 4. Median | |
| | 5. Sidewalks | |
| | 6. Parapet | ↓ |
| | 7. Railing | 9 |
| | 8. Paint | N |
| | 9. Drains | |
| | 10. Lighting Standards | |
| | 11. Utilities | |
| | 12. Joint Leakage | |
| | 13. Expansion Joints or Devices | ↓ |
| | INSPECTION RATING | |
| | | 9 |

NEW DECK TIMBER

| 59 | SUPERSTRUCTURE | REMARKS |
|----|--|---------|
| | 1. Bearing Devices | N |
| | 2. Stringers | 9 |
| | 3. Girders, Beams, or Arches | 6 |
| | 4. Floor Beams and Diaphragms | N |
| | 5. Trusses - General | |
| | - Portals | |
| | - Bracing | |
| | 6. Paint | |
| | 7. Machinery (Movable Spans) | |
| | 8. Rivets and /or Bolts | |
| | 9. Welds - Cracks | |
| | 10. Rust | ↓ |
| | 11. Timber Decay | 9 |
| | 12. Concrete Cracking and /or Spalling | N |
| | 13. Collision Damage | 9 |
| | 14. Deflection Under Load | 9 |
| | 15. Alignment of Members | 9 |
| | 16. Vibrations Under Load | 9 |
| | 17. Flat Slab | N |

Date of Inspection 7/17/95
 Bridge Number 0093350011 00001 Bridge Name KAUPAKALUA # 35

| | | CONDITION RATING | REMARKS |
|----|------------------------------------|------------------|---------|
| 60 | SUBSTRUCTURE | | |
| 1. | Abutment - Wings | 7 | |
| | - Backwall | 7 | |
| | - Footing | 6 | |
| | - Piles | N | |
| | - Erosion | 7 | |
| | - Settlement | 7 | |
| 2. | Piers or Bents - Caps | 7 | |
| | - Column | 7 | |
| | - Footing | 6 | |
| | - Piles | N | |
| | - Scour | 7 | |
| | - Settlement | 7 | |
| 3. | Pile Bents | N | |
| 4. | Concrete Cracking and /or Spalling | 7 | |
| 5. | Steel Corrosion | N | |
| 6. | Timber Decay, etc. | 7 | |
| 7. | Debris on Seats | 7 | |
| 8. | Paint | N | |
| 9. | Collision Damage | 7 | |
| | Inspectors Condition Rating | 7 | |

| | | | |
|----|---|-------------------|--------------------------|
| 61 | CHANNEL & CHANNEL PROTECTION | DRY STREAM | |
| 1. | Channel Scour | 7 | |
| 2. | Embankment Erosion | 7 | |
| 3. | Drift | 7 | |
| 4. | Vegetation | 6 | BANKS: HEAVILY VEGETATED |
| 5. | Channel Change | 7 | |
| 6. | Fender System | N | |
| 7. | Spur Dikes & Jetties | N | |
| 8. | Rip Rap | N | |
| 9. | Adequacy of Opening | 7 | |
| | Inspectors Condition Rating | 7 | |

| | | | |
|----|--------------------------------------|---|--|
| 62 | CULVERT & RETAINING WALLS | | |
| 1. | Barrel: | | |
| | Concrete | N | |
| | Steel | | |
| | Timber | | |
| 2. | Headwall | | |
| 3. | Cutoff Wall | | |
| 4. | Adequacy | | |

Date of Inspection 7/17/95
Bridge Number 009235001120001 Bridge Name KAUPAKALUA # 38

93 CRITICAL FEATURE INSPECTION DATE

- 1. Fracture Critical Details N
- 2. Underwater Inspection N
- 3. Other Special Inspection N

CONDITION RATING

REMARKS

RESTRICTIONS:

- 1. Posted Loading
- 2. Legibility
- 3. Visibility

| |
|---|
| 5 |
| 7 |
| 7 |

6 TON POSTED KAH SIDE

REPAIRS AND IMPROVEMENTS:

- 1. List all work done to this bridge since the last inspection including cost.
- 2. Indicate proposed and /or recommended improvements including estimated cost.
- 3. List any existing temporary conditions.

REMARKS AND RECOMMENDATIONS:

- 1. Does this bridge require inspection by Bridge Design Section? Yes No
- 2. Remarks: Describe defects. Use sketches, diagrams, and /or photographs where possible.

Inspected by: Signature _____
Title _____

Supervised by: Signature _____
Title _____

BRIDGE SCOUR SCREENING

Bridge Name: KAUPAKALUA
 Bridge No.: 009335001100001
 District: MAKAWAO

Photo: roll: _____
 frame: _____
 Date: 7/17/95

| | | | |
|--|--|--|--|
| A. Structure Data: Year Built <u>1911</u> No. of Spans <u>2</u> As-builts available? _____ | | Bridge Length: <u>39 ft.</u> No. of piers: <u>1</u> | |
| B. Is bridge constructed over water? If yes, is it _____ a. <u>Intermittant</u> b. Small stream w/ continuous flow c. River (large) d. Tidal Is underwater inspection required? _____ | | <input checked="" type="radio"/> yes <input type="radio"/> no | <input type="radio"/> yes <input checked="" type="radio"/> no |
| C. Abutment 1. Type of Abutment | | LEFT <input checked="" type="radio"/> Vertical <input type="radio"/> Stub Other _____ | RIGHT <input checked="" type="radio"/> Vertical <input type="radio"/> Stub Other _____ |
| 2. Any signs of scour? | | <input checked="" type="radio"/> None <input type="radio"/> Minor <input type="radio"/> Severe | <input checked="" type="radio"/> None <input type="radio"/> Minor <input type="radio"/> Severe |
| 3. Scour protection in place? If so, what type? _____ | | <input type="radio"/> yes <input checked="" type="radio"/> no | <input type="radio"/> yes <input checked="" type="radio"/> no |
| 4. Abutment in streambed? | | <input checked="" type="radio"/> yes <input type="radio"/> no | <input checked="" type="radio"/> yes <input type="radio"/> no |
| 5. Abutment inundated by high flow? | | <input type="radio"/> yes <input checked="" type="radio"/> no | <input type="radio"/> yes <input checked="" type="radio"/> no |
| 6. Overall Condition | | <input checked="" type="radio"/> Good <input type="radio"/> Requires Repair | <input checked="" type="radio"/> Good <input type="radio"/> Requires Repair |
| 7. Comments _____ | | | |
| D. Piers | | | |
| 1. Any signs of scour? | | <input type="radio"/> yes <input checked="" type="radio"/> no | <input type="radio"/> yes <input checked="" type="radio"/> no |
| 2. Scour protection in place? If so, what type? _____ | | <input type="radio"/> yes <input checked="" type="radio"/> no | <input type="radio"/> yes <input checked="" type="radio"/> no |
| 3. Is it on piles? If so, length of piles = _____ | | <input type="radio"/> yes <input checked="" type="radio"/> no | <input type="radio"/> yes <input checked="" type="radio"/> no |
| 4. Overall Condition | | <input checked="" type="radio"/> Good <input type="radio"/> Requires Repair | <input type="radio"/> Good <input checked="" type="radio"/> Requires Repair |
| 5. Comments _____ | | | |

BRIDGE SCOUR SCREENING (page 2)

| | | |
|--|---------------------------------------|----------------------|
| E. Channel Bottom | | |
| 1. Shifting | <u>yes</u> | no |
| 2. Aggradation | yes | <u>no</u> |
| 3. Degradation | yes | <u>no</u> |
| 4. Type material of channel bottom | Solid Rock Rocky Concrete Lined | Sand <u>Earth</u> |
| F. Overall Comments <u>Channel shifts minimally year to year depending on amount of silt + rock build up</u> | | |
| | | |
| G. Analysis | | |
| Is analysis required? | yes | <u>no</u> |
| If yes, who will do analysis? | In-House | Consultant |
| Is topo required? | yes | no |
| If no, provide sketch and take measurements | | |
| H. Scour Analysis Code _____ | | |
| I. SI&A, Item 113 Code <u>B</u> | | |

County of Maui
Department of Public Works
Engineering Division

KAUPAKALUA #35
REPAIRS & IMPROVEMENTS

1. Work completed since last inspection.
 - a. County crews replaced deck planks, stringers, and railings.

2. Proposed or recommended improvements.
 - a. All wooden members should be painted and sealed.
 - b. Remove all debris from upstream channel.
 - c. Clean and remove all moss and vegetative growth from underside of deck.

Inspected by: Steven P. Johnson
Title: SUPV CONSTR INSP
Reviewed by: Chris Johnston
Title: Asst. Engr. Proj. Mgr.

County of Maui
Dept. of Public Works
Engineering Division

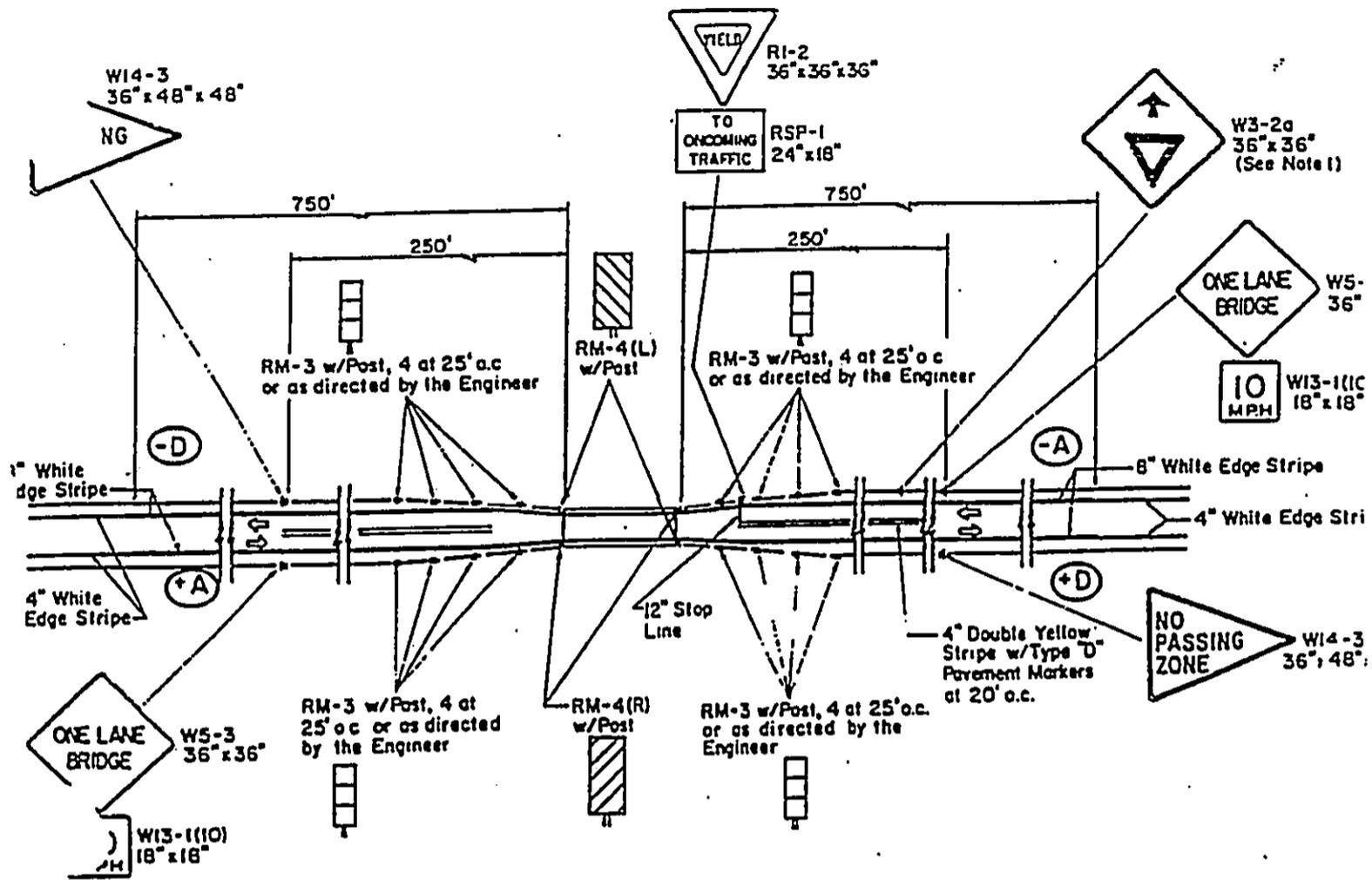
KAUPAKALUA #35

SUMMARY OF RECOMMENDATIONS

This bridge is in structurally fair condition. Although county crews have done a very good job replacing the deck, stringers, guardrails, etc., this bridge due to it's location, and weather conditions, will require ongoing repairs on a yearly basis. The location is in a rainy area and is usually shaded for the better part on the day, this is condusive to rot and prolific decay to a wooden structure. A replacement structure of concrete construction, would be most desireable.

BRIDGE INVENTORY
DEFECTS CODING GUIDE

| <u>Material</u> | <u>Code No.</u> | <u>Description of Defect</u> |
|-----------------|-----------------|---|
| Concrete | 1 | Hairline Cracks in Concrete |
| Concrete | 2 | Cracks in Concrete |
| Concrete | 3 | Spalled Concrete |
| Concrete | 4 | Spalled Concrete with reinforcing exposed |
| Concrete | 5 | Scaling |
| Concrete | 6 | Honeycomb Voids |
| Concrete | 7 | Efflorescence |
| Concrete | 8 | Rust Stains |
| Concrete | 9 | Weathered/Waterstained |
| Timber | 10 | Split Timber |
| Timber | 11 | Decayed Timber |
| Timber | 12 | Crushed Timber |
| Timber | 13 | Splintered Timber |
| Timber | 14 | Weathered/Worn Timber |
| Timber | 15 | Insufficient Nailing or Bolting |
| Steel | 16 | Rusted Steel |
| Steel | 17 | Corroded Steel |
| Other | 18 | Erosion |
| Other | 19 | Undermining |
| Other | 20 | Footing exposed |
| Other | 21 | Settlement of Pavement |
| Other | 22 | Vegetation Growth |
| Other | 23 | Debris |
| Other | 24 | Scour |
| Other | 25 | Cracks on Pavement |



TYPICAL ONE LANE BRIDGE DELINEATION

NOTES:

1. YIELD AHEAD sign (W3-2a) shall be installed only on approaches to a YIELD sign (RI-2) that is not visible for a sufficient distance to permit a driver to bring his vehicle to a stop at the YIELD sign. Final location will be determined in the field by the Engineer.
2. Stop line and YIELD signs shall be installed on the approach that has the longer or better sight distance. Final location will be determined in the field by the Engineer.
3. Signs shall be spaced a minimum of 125 feet apart in the same direction of traffic.

er treatment

| | | |
|--|------------------------|-------|
| STATE OF HAWAII DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION | | |
| STANDARD PLAN TE-67 | | |
| DELINEATION AND PAVEMENT MARKINGS AT BRIDGES | | |
| <i>Erichi Tanaka</i> APPROVED | <i>2/28/61</i> DATE | |
| DATE | REVISION | APP'D |

KAPPKALUA #. 35

LOCATION: 0.500 M. S. 1000 M. HAIKU RIVER

PLAN NO.

TYPE - TRUSS

YEAR BUILT -

LANES ON STRUCTURE - 1

NO. OF SPANS - 2

MAX. SPAN LENGTH - 16.0

APPROX. RIVER WIDTH -

APPROX. CURVE RADIUS -

WEAR AND SURFACE - TRACED

DATE OF INSPECTION

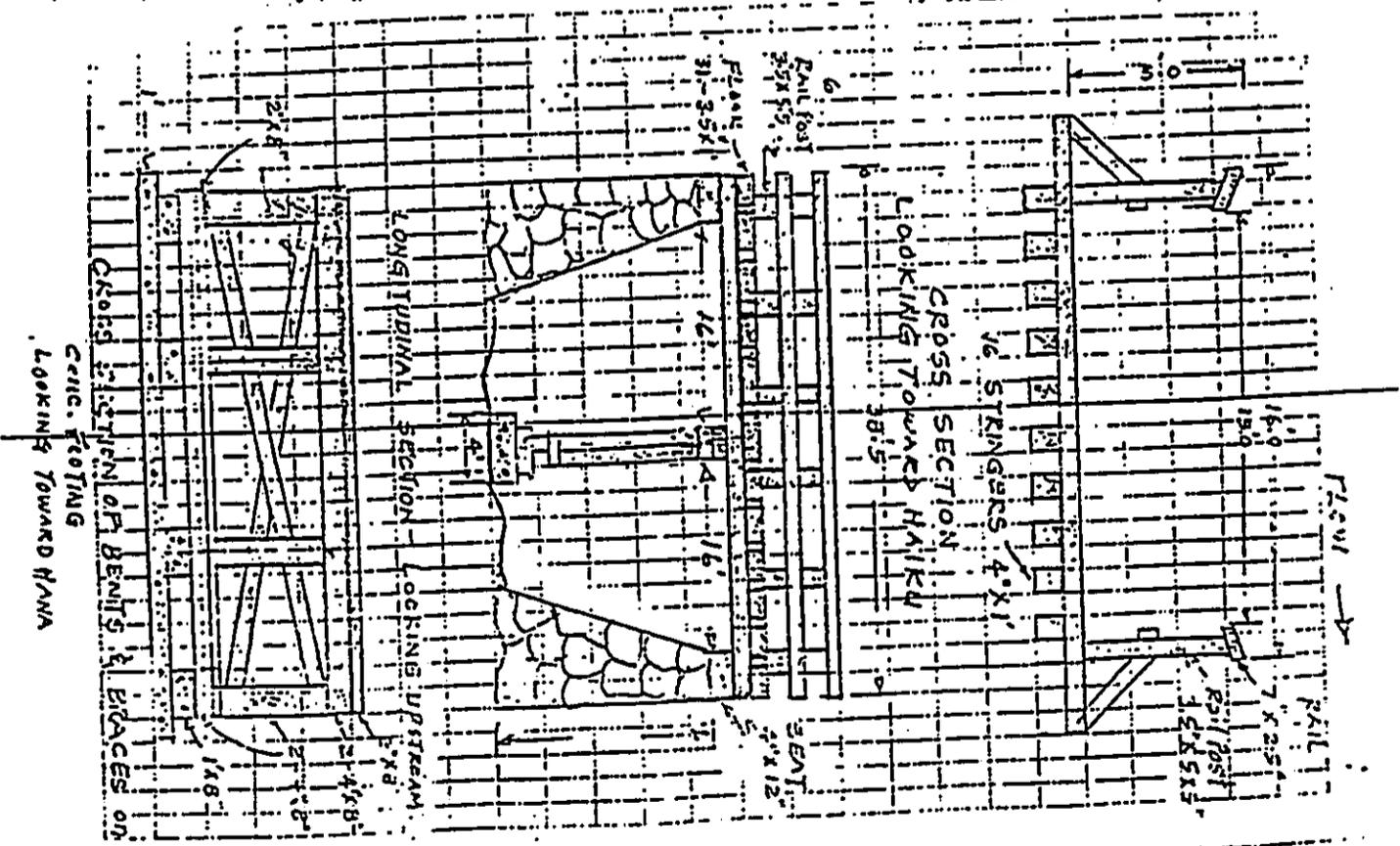
SUNNY AND CLEAR

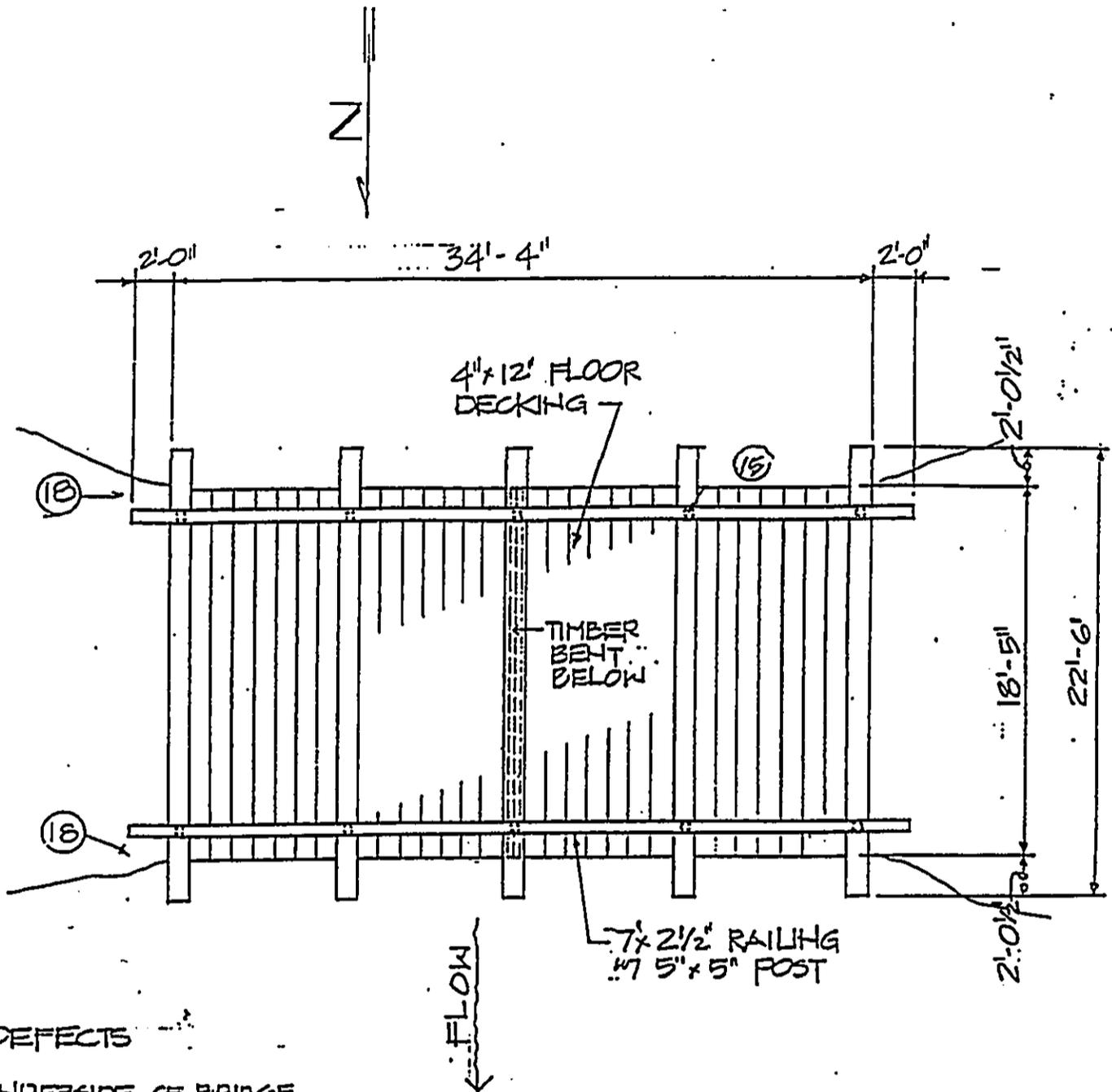
G. MASLIZAKI

B. MUSATA

H. TINUNAGA

D. J. [Signature]



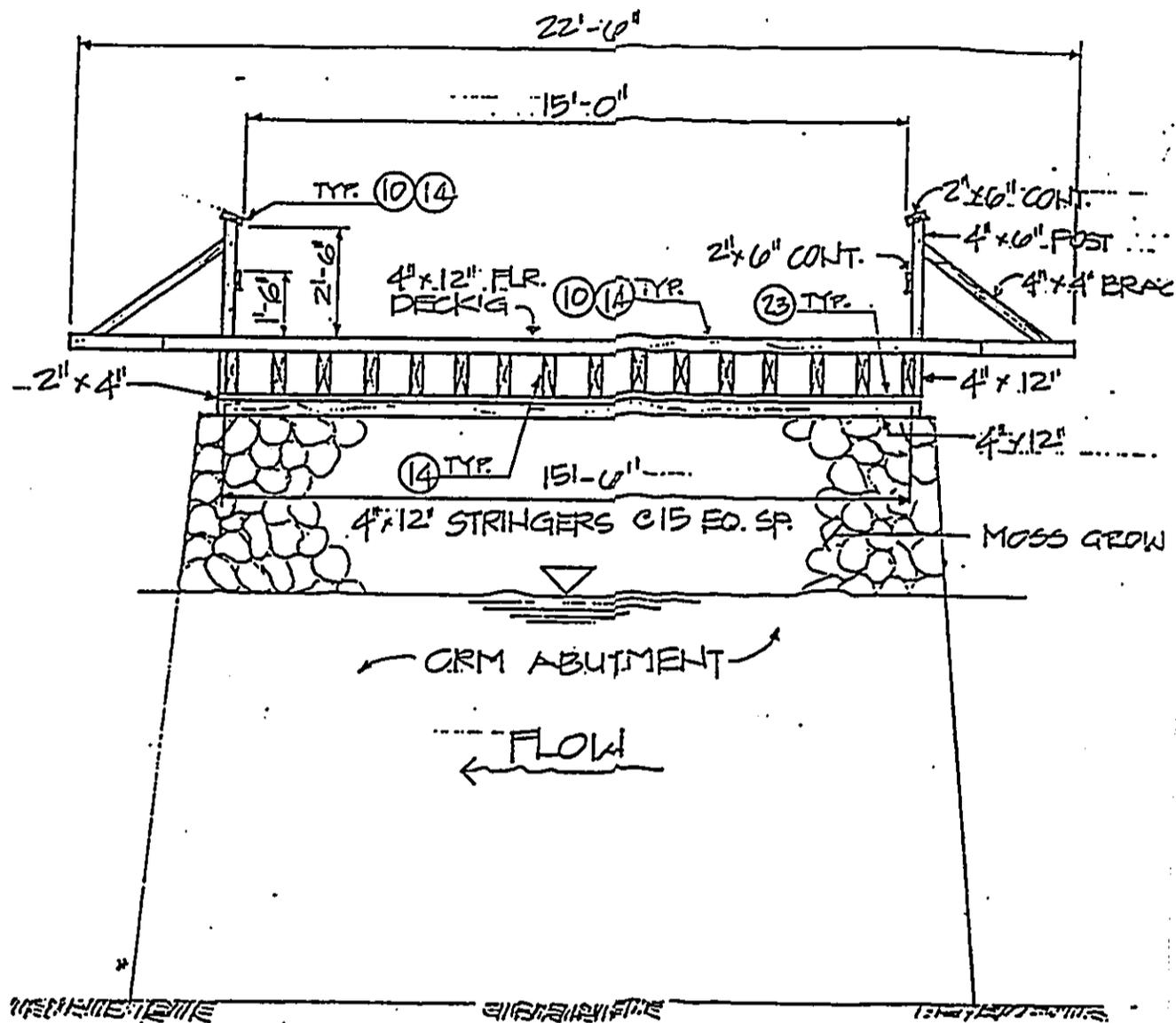


- DEFECTS
- * UNDERSIDE OF BRIDGE

PLAN
SCALE 1/16" = 1'-0"

KAUPAKALUA BRIDGE

| | | |
|----------------------|--|--|
| STRUCTURE NO: 35 | FEATURES INTERSECTED: KAUPAKALUA STREAM | COUNTY of MAUI DEPT. of PUBLIC WOR INVENTORY OF BRIDGE |
| DISTRICT: MAKAWAO | | |
| LOCATION (T.M.K.): | | |

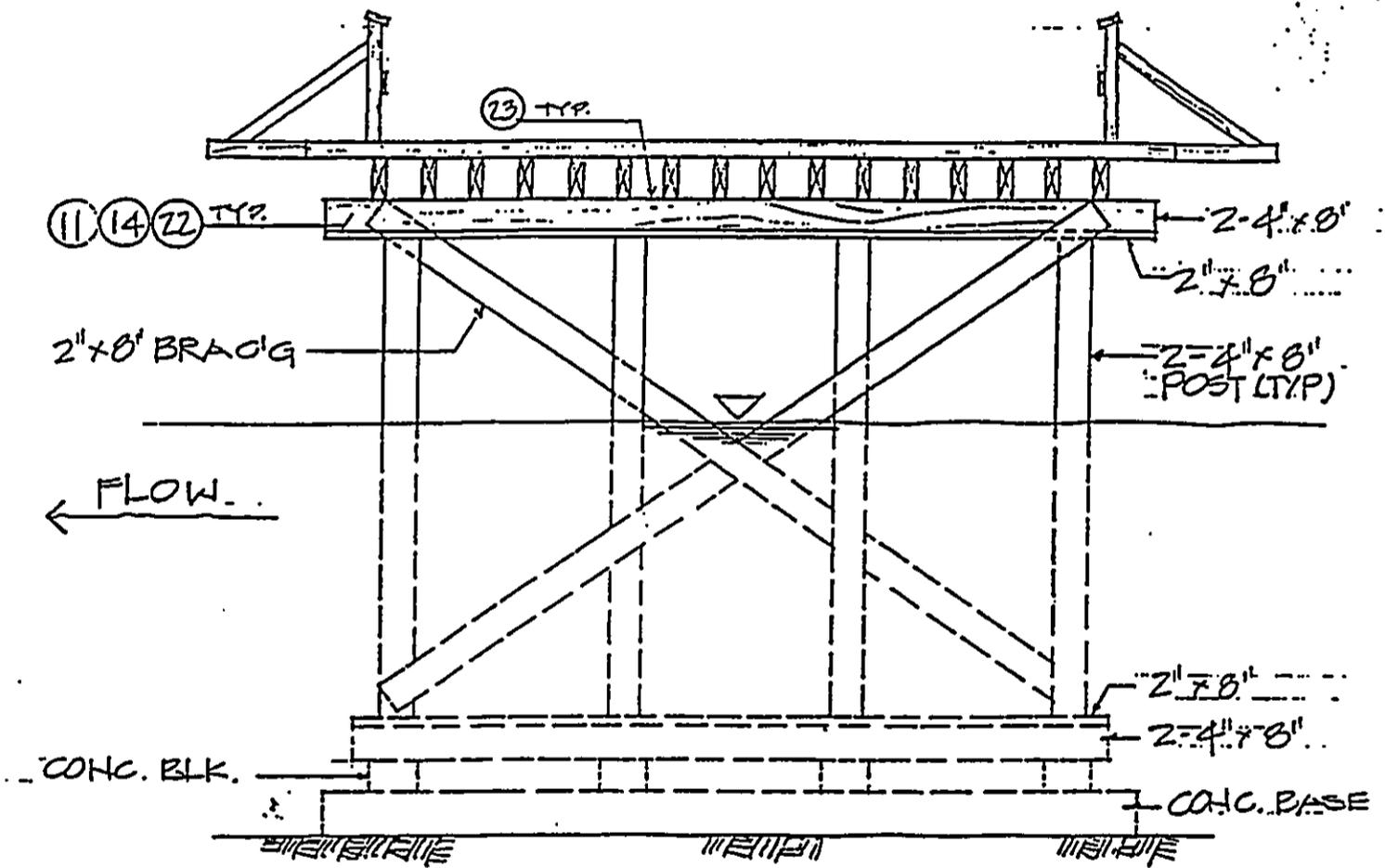


ABUTMENT ELEVATION. LOOKING EAST.

SCALE 1/4" = 1'-0"

KAUPAKALUA BRIDGE

| | | |
|------------------------------|--|---------------------------------------|
| STRUCTURE NO.: 35 | FEATURES INTERSECTED: KAUPAKALUA STREAM | COUNTY of MAUI DEPT. of PUBLIC WOR |
| DISTRICT: MAKAWAO | | INVENTORY OF BRIDG |
| LOCATION (T.M.K.): 2-7-13 | | |

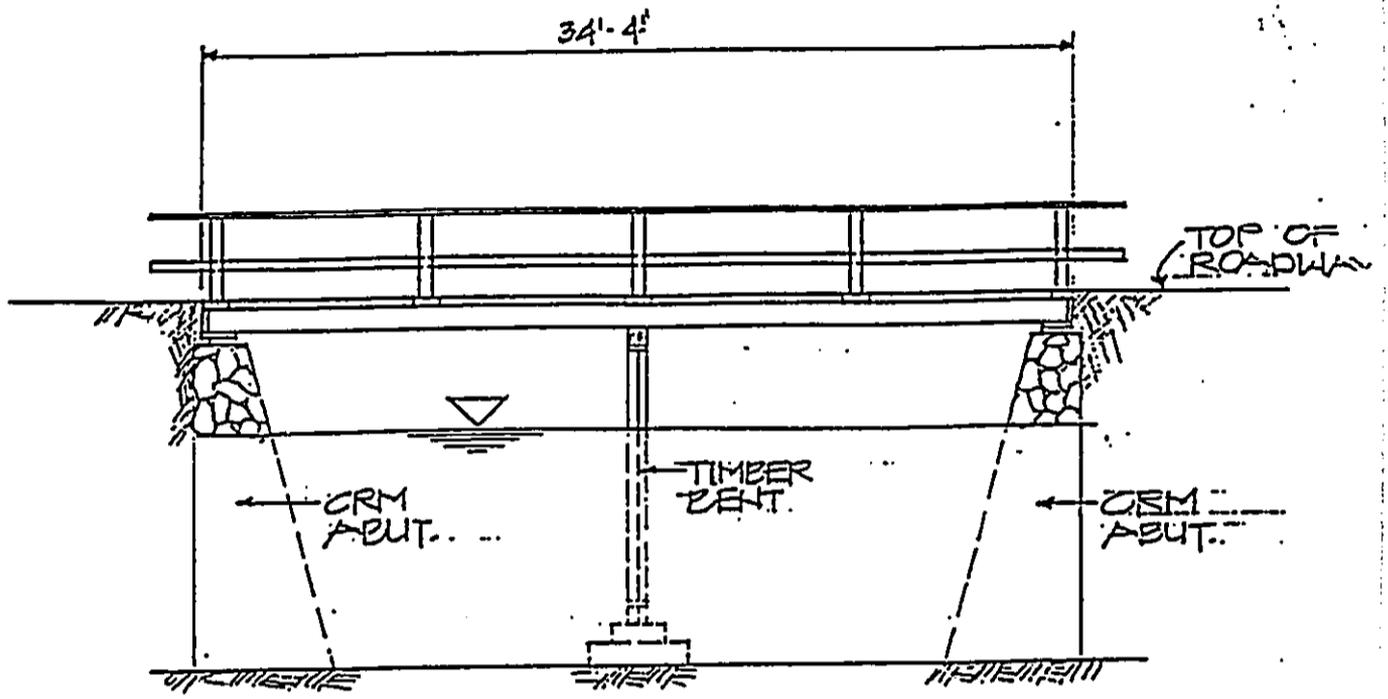


ELEVATION AT TIMBER BENT LOOKING EAST

SCALE 1/4" = 1'-0"

KAUPAKALUA BRIDGE

| | | |
|------------------------------|--|--|
| STRUCTURE NO.: 35 | FEATURES INTERSECTED: KAUPAKALUA STREAM | COUNTY of MAUI DEPT. of PUBLIC WOR INVENTORY OF BRIDGE |
| DISTRICT: MAKAWAO | | |
| LOCATION (T.M.K.): 2-7-13 | | |



ELEVATION LOOKING NORTH
 SCALE: 1/8" = 1'-0"

KAIPAKALUA BRIDGE

| | | |
|------------------------------|--|---|
| STRUCTURE NO.: 35 | FEATURES INTERSECTED: KAIPAKALUA STREAM | COUNTY of MAUI DEPT. of PUBLIC WORKS |
| DISTRICT: MAKAWAO | | INVENTORY OF BRIDGES |
| LOCATION (T.M.K.): 2-7-13 | | |

- ARCHITECTURAL
- STRUCTURAL
- CIVIL
- PLANNING

WILSON OKAMOTO & ASSOCIATES
ENGINEERS, ARCHITECTS AND PLANNERS

COMPUTED BY S.Y.
CHECKED BY _____
DATE AUG. 25, 1982

KAUPAKALUA BRIDGE
No. 35

PROJECT 65363-01
SHEET NO. 1 OF 2 SHEETS

2 SPAN TIMBER BRIDGE, MAX. SPAN = 16'

STRINGERS: 4x12 @ 1'-0" o.c.

DECK'G. DOES NOT GOVERN
CHECK STRINGERS:

$$M_{cap} = 1.5 \left(\frac{4 \times 12^2}{6} \right) \times \frac{1}{12} = 12^k'$$

$$M_{DL} = \frac{0.025(16)^2}{8} = 0.8, \quad M_{LL} = 11.2^k'$$

$$M_{H20} = \frac{16(16)}{4} \times \frac{1}{6} = 10.7^k'$$

$$\text{INVENTORY RATING} = \frac{11.2}{10.7} \times 20 = H21.0$$

$$\text{OPERATING RATING} = \frac{14.8}{10.7} \times 20 = H27.7$$

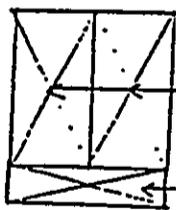
$$V_{cap} = 0.095 \left(\frac{2}{3} \right) 4(12) = 3.04^k$$

$$V_{DL} = \frac{0.025(16)}{2} = 0.20, \quad V_{LL} = 2.84^k'$$

$$V_{H20} = 16 \left(\frac{1}{6} \right) = 2.67^k'$$

$$\text{INVENTORY RATING} = \frac{2.34}{2.67} \times 20 = H21.3 \text{ (FLEXURE GOVERNS)}$$

CHECK BENT CAP BEAM:



$$M_{cap} = 1.5 \left(2 \times \frac{4 \times 8^2}{6} \right) = 32^k'$$

$$M_{DL} = \frac{[16(0.025) + (0.016)] 4.67^2}{8} = 1.13^k'$$

$$M_{LL} = 30.9^k'$$

$$M_{H20} = \frac{16(4.67)}{4} = 18.7^k'$$

$$V_{cap} = 0.095 \left(\frac{2}{3} \right) 8(8) = 4.05^k \text{ (ASSUMING 4x8'S ACT TOGETHER)}$$

$$V_{DL} = \frac{0.42(4.0)}{2} = 0.33, \quad V_{LL} = 3.22^k'$$

$$V_{H20} = 16^k$$

$$\text{INVENTORY RATING} = \frac{3.22}{16} \times 20 = H4.02$$

$$\text{OPERATING RATING} = \frac{4.05(1.3) - 0.33}{16} \times 20 = H5.54$$

- ARCHITECTURAL
- STRUCTURAL
- CIVIL
- PLANNING

WILSON OKAMOTO & ASSOCIATES
ENGINEERS, ARCHITECTS AND PLANNERS

COMPUTED BY S.Y.
 CHECKED BY _____
 DATE Aug. 25, 1980

| |
|-------------------|
| KAUPAKALUA BRIDGE |
| No. 35 |

PROJECT 52363-01
 SHEET NO. 2 OF 2 SHEETS

ASSUMING 4x8's & 2x8 ARE ADEQUATELY CONNECTED

$$V_{cap} = 0.095 \left(\frac{2}{3}\right) (8 \times 10) = 5.07^k$$

$$V_{DL} = 0.83, \quad V_{LL} = 4.24$$

| | | | |
|---|---|---------|-----|
| INVENTORY RATING = $\frac{424}{16} \times 20 = 45.30$ | } | GOVERNS | 105 |
| OPERATING RATING = $\frac{5.76}{16} \times 20 = 47.2$ | | | 107 |

$$POST GVW = \frac{7.2}{1.05} \times 0.85 = \underline{6 \text{ TONS}}$$

THIS POSTING ASSUMES THAT THE ELEMENTS ARE ADEQUATELY CONNECTED, THAT IS, THE 4x8'S ARE THRU-BOLTED & THE 2x8 IS LAG SCREWED TO THE 4x8'S.

County of Maui
Department of Public Works
Engineering Division

Photo's and Description
Kaupakalua #35



5. Heavy moss growth underside of girders.



6. Upstream, mid channel, debris.

Prepared by: Curtis T. Nagata

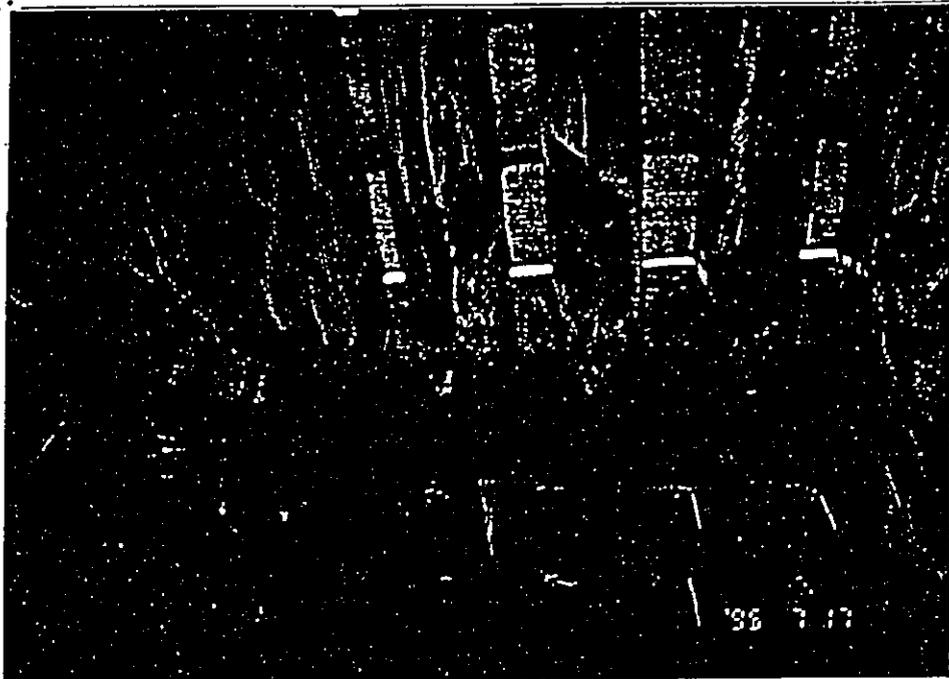
Title: Summer Intern

CORRECTION

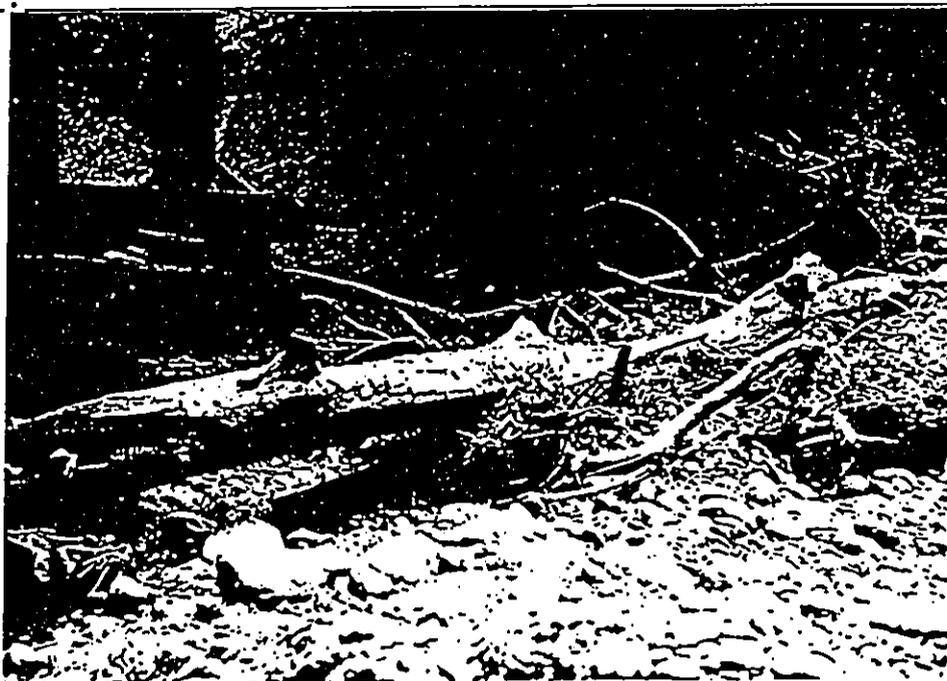
THE PRECEDING DOCUMENT(S) HAS
BEEN REPHOTOGRAPHED TO ASSURE
LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

County of Maui
Department of Public Works
Engineering Division

Photo's and Description
Kaupakalua #35



5. Heavy moss growth underside of girders.



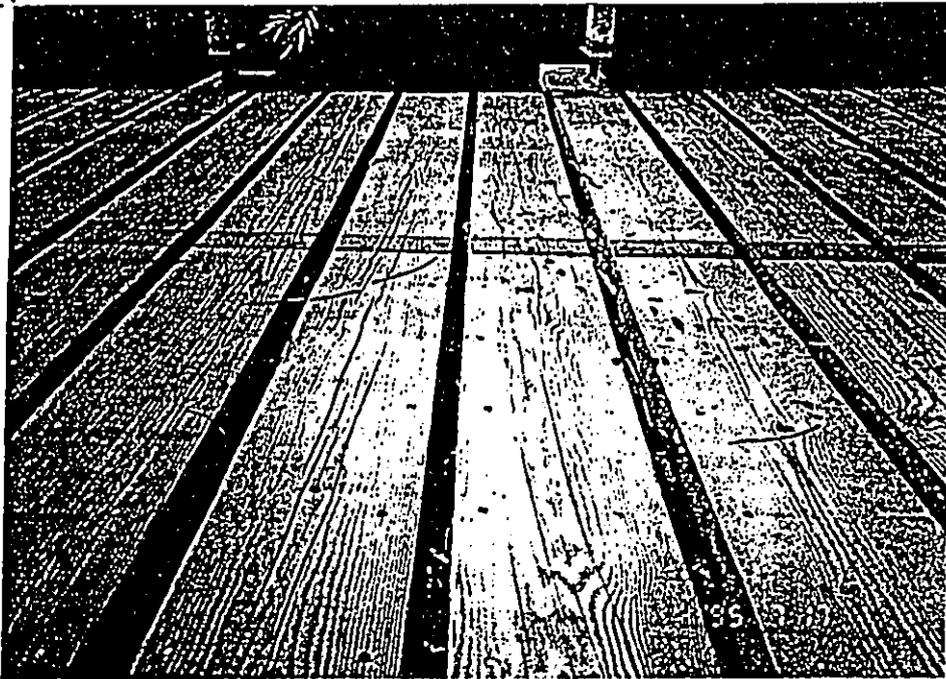
6. Upstream, mid channel, debris.

Prepared by: Curtis T. Nagata

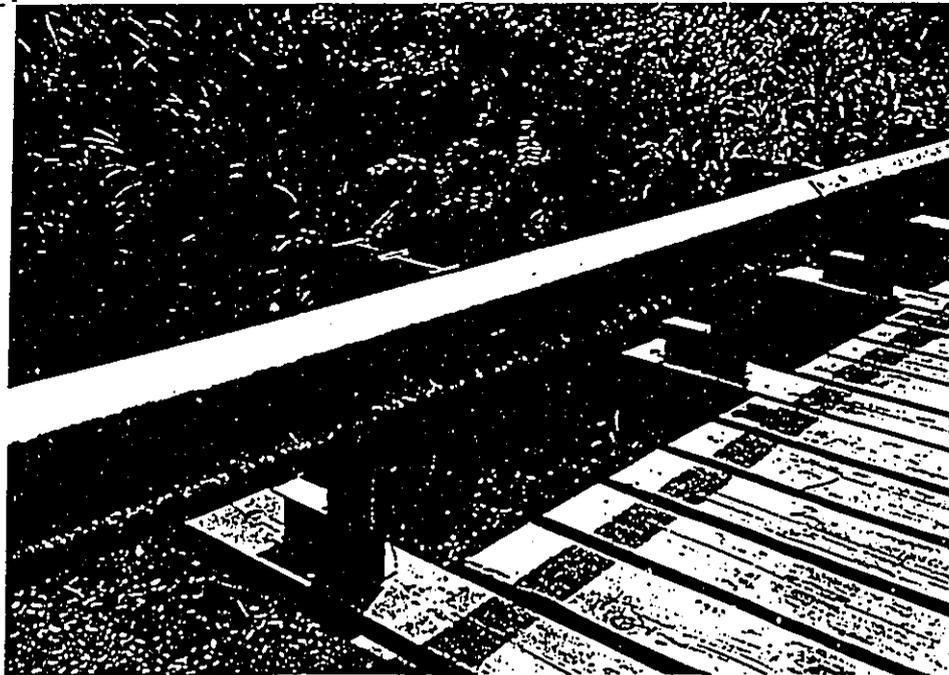
Title: Summer Intern

County of Maui
Department of Public Works
Engineering Division

Photo's and Description
Kaupakalua #35



3. New deck planks.



4. New guardrails.

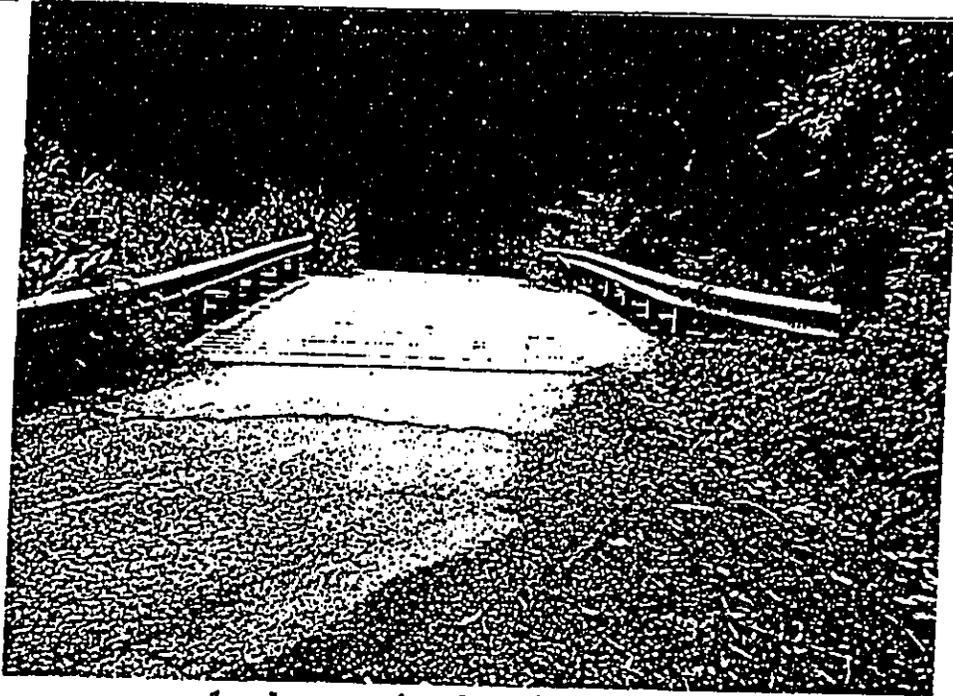
Prepared by: Curtis T. Nagata

Title: Summer Intern

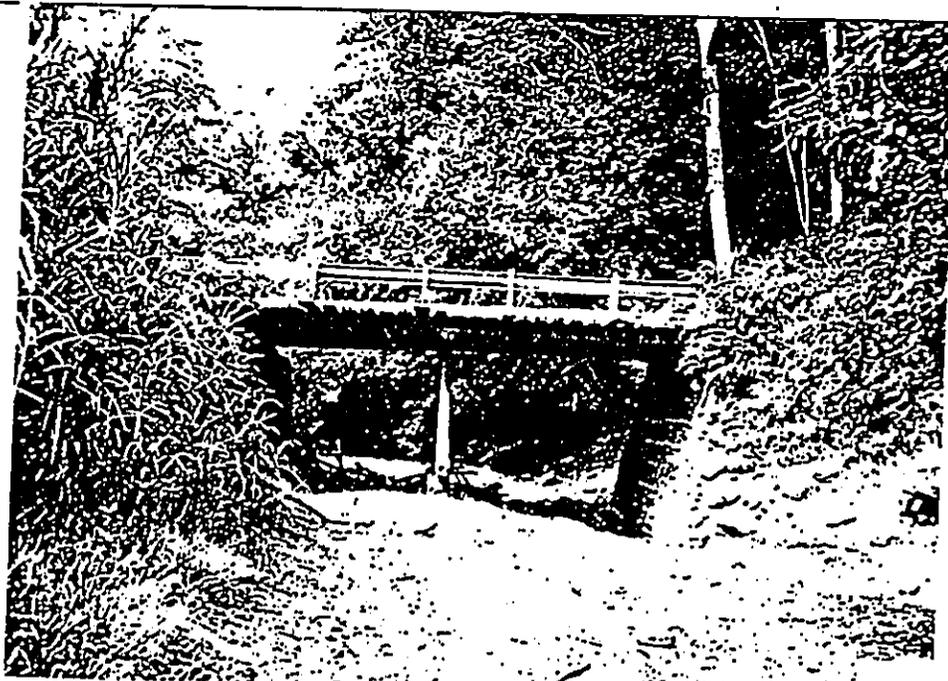
DOCUMENT CAPTURED AS RECEIVED

County of Maui
Department of Public Works
Engineering Division

Photo's and Description
Kaupakalua #35



1. Approach, looking towards Hana.



2. Elevation, looking upstream.

Prepared by: Curtis T. Nagata

Title: Summer Intern

APPENDIX B

*Subsurface Investigation Report for
Kaupakulua Bridge*

Fewell Geotechnical Engineering, Inc.

December 1995



**FEWELL
GEOTECHNICAL
ENGINEERING, LTD.**

Oahu Office
96-1416 Waihana Place
Pearl City, Hawaii 96782-1973
(808) 455-6569
FAX (808) 456-7062

Maui Office
251 Lalo Place, Unit G-2
Kahului, Maui 96732
(808) 873-0110
FAX (808) 873-0906

Kauai Office
4180 Rice Street, #106B
Lihue, Kauai 96766
(808) 245-8982
FAX (808) 245-8982

File 1433.01
December 6, 1995

Wilson Okamoto & Associates, Inc.
1907 South Beretania Street, 4th Floor
Honolulu, Hawaii 96826

Attention: Mr. Myron Okubo, P.E.
Senior Project Engineer

Subject: **Subsurface Investigation Report**
Kaupakalua Bridge Replacement
Haiku, Maui, Hawaii

We have completed a subsurface investigation for the proposed Kaupakalua Bridge Replacement, in Haiku, Maui, Hawaii. This letter summarizes our findings and conclusions and present geotechnical recommendations for the design and construction of the bridge and its related retaining walls and approach embankments. This work was completed in general accordance with our October 4, 1994 Proposal and our February 16, 1995 Subconsultants Agreement for Services with Wilson Okamoto & Associates, Inc.

The scope-of-work of this investigation originally included two 35-foot deep borings for the bridge abutments to determine the subsurface conditions beneath each abutment and a shallow boring at the edge of the existing Peahi Road embankment to determine the pavement design characteristic of the soils beneath the existing roads. Due to the unanticipated and adverse soil conditions encountered, the abutment borings were extended to depths of 49 feet and 54 feet, and the shallow boring was deleted. A surface sample of the embankment soils was obtained from the edge of the existing road to determine the pavement support properties.

The borings were not completed until September 1995 due to the ponding conditions resulting from the filling of the adjacent Kaupakalua Reservoir by East Maui Irrigation Company during the summer months. The evaluation of the subsurface conditions and the completion of this report were delayed pending pertinent design information and the design traffic for the bridge and its approach embankments.

Project Considerations - We understand that the existing bridge crossing Kaupakalua Stream along Peahi Road will be replaced with a new structure downstream from the existing bridge. The general area is approximately 1 mile south of the intersection of Peahi Road and Haiku Road and is shown on the attached Project Location Map, Figure 1.

The September, 1995 preliminary plans by Wilson Okamoto & Associates, Inc. (WOA) indicate that the new bridge will be a two-lane concrete bridge, which will be approximately 110 feet downstream of the existing bridge and immediately upstream of the existing Kaupakalua Reservoir. Kaupakalua Stream in this area is a shallow, intermittent stream flowing in a general north-south direction.

At the proposed bridge crossing, the stream is about 45 feet wide and increases to about 50 feet wide on the downstream side of the bridge toward Kaupakalua Reservoir. The bottom of the stream is at approximately Elev. 655. The banks on either side of the stream form relatively level terraces, which drop down to the bottom of the stream at a slope of about 2 Horizontal to 1 Vertical (2H:1V). The top of the western bank of the stream is at about Elev. 663 and the top of the eastern bank is at approximately Elev. 661.

The portion of the existing Peahi Road approaching the new bridge crossing is at approximately Elev. 671 on both sides of the stream. It appears to be constructed on a fill embankment which is approximately 8 to 10 feet in height and slopes down towards the streambed at slopes ranging from about 1-1/2H:1V to 2H:1V. The area is overgrown with underbrush and Eucalyptus and Koa trees.

The new bridge will be a single-span concrete bridge approximately 35 feet wide by 50 feet long. It will be constructed with concrete girders and decking, and reinforced concrete abutments will be used to elevate the bridge above the stream. The top of the bridge deck is planned at approximately Elev. 670, with the bottom of the deck girders at about 10 feet above the bottom of the stream. The abutment loads are estimated at 12 kips per foot.

The existing topography and the planned finish grades for the bridge will necessitate the construction of 8- to 10-foot high approach embankments to re-route the road to the new bridge. Retaining walls are currently proposed to support the grade differences along the majority of the embankments, with graded slopes used where possible. We understand that the bottom of the stream beneath and immediately adjacent to the bridge will be armored with rip-rap such that stream scour should not be a significant consideration in the abutment design.

The preliminary information indicates that the new bridge and its related appurtenances will be constructed as a Federal Aid Project and its design must comply with the general requirements and design guidelines of the State of Hawaii Department of Transportation (HDOT). Although no design traffic information is available for Peahi Road in this area, we understand that the bridge must be designed to accommodate H-20 truck loads.

For the pavement design analysis, we have assumed that the road is classified as a rural street with a 15-year design life, no traffic growth, and an average daily traffic (ADT) of 1,000 vehicles per day (VPD) with 0.5 percent truck traffic. We have assumed that the truck traffic will consist of 60 percent 2-axle trucks, 35 percent 3-axle trucks, 5 percent 4-axle trucks and no 5-axle or 6-axle trucks, which results in a traffic index of 5.5.

Subsurface Investigation - Two test borings were drilled during the period of September 25 through October 4, 1995 at the approximate locations shown on the attached Site and Boring Location Plan, Figure 2. Boring 1 was drilled in the vicinity of the western abutment, while Boring 2 was drilled at the eastern abutment.

The borings were drilled with a Concore A-1 Special portable drilling rig advancing 4-inch diameter augers and wash-boring tools. The borings were originally scheduled for a depth of 35 feet below the existing ground surface, but were extended to depths of 49 and 54 feet at the eastern and western abutment, respectively, due to the unanticipated and adverse soil conditions encountered.

Relatively undisturbed samples of the subsurface soils were obtained with 2-inch or 3-inch O.D. split- spoon samplers or 3-inch diameter Shelby Tubes, driven by a 140-pound hammer falling 30 inches. A bulk sample of the near-surface soils in the existing embankment was obtained from the location shown on Figure 2.

Selected samples of the subsurface soils were tested in the laboratory to determine their pertinent engineering properties, including moisture content, density, shear strength and consolidation characteristics. Atterberg Limits tests were also performed to aid in the classification of the soils. The bulk sample of the near-surface soils of the existing embankment was tested to determine its pavement support characteristics.

The materials encountered in the borings are shown on the attached Boring Logs, Figures 3 and 4. A Boring Log Legend has been included as Figure 5. The results of the laboratory tests are shown on the Boring Logs, where appropriate, and are graphically illustrated in Figures 6 through 12. Table I summarizes the results of the laboratory tests.

General Subsurface Conditions - The test borings revealed that the site of the new bridge is generally underlain by alluvial (water-deposited) silts, cobbles and boulders, over either residual (soils weathered-in-place from parent rock) silts or soft highly to completely weathered basalt, which extended to a depth of about 52.5 feet in Boring 1 and to the bottom of Boring 2 at a depth of 49.0 feet. Hard moderately weathered basalt was found below the saprolite in Boring 1 and extended to the bottom of the boring at 54.0 feet.

In general, the surface layer of alluvial soils consisted of a brown clayey silt which extends to depths of 7.5 to 9.0 feet in both of the test borings, or to between about Elev. 655 and Elev. 652. Below this surface layer, the alluvial soils vary significantly in composition and thickness between Borings 1 and 2, which were drilled at the western and eastern abutments, respectively. The alluvium extends to a depth of 37.5 feet in Boring 1, but only to a depth of 16.0 feet in Boring 2.

Beneath the surface layer of alluvial silts, the alluvium in Boring 1 generally consists of very stiff to hard clayey silts with subrounded gravel which extends to a depth of 25.0 feet below the existing ground surface, or to approximately Elev. 638, where an approximately 8-foot thick layer of dense gravel and cobbles, with thin seams of medium stiff organic silts are encountered. A 2.5-foot thick layer of medium stiff to stiff organic alluvial silts underlies the gravel and cobble layer at a depth of 32.5 feet, followed by a 2.5-foot thick layer of dense alluvial silty sand. Highly to completely weathered basalt was encountered below the alluvial sand at a depth of 42.5 feet and extend to a depth of 52.5 feet where the hard, moderately weathered basalt was encountered.

The surface alluvial clayey silts in Boring 2 extend to a depth of about 9.0 feet below the existing ground surface or to about Elev. 652, where it is underlain by a 7-foot thick layer of dense alluvial boulders and gravel. The alluvial boulder layer is underlain by stiff to hard residual soils which extend to a depth of 40.0 feet. Highly to completely weathered

soft basalt was encountered at this depth and extended to the bottom of the boring at 49.0 feet.

The near-surface layer of alluvium encountered in both borings generally consists of high plasticity clayey silts which are designated as MH under the Unified Soil Classification System (USC). The surface 1.5 feet of the layer is loose, while the deeper soils within the layer exhibit consistencies ranging from very stiff to hard. A 2-foot thick layer of medium stiff silts was encountered between 3.5 feet and 5.5 feet in Boring 1, while a 3.5-foot thick layer of medium stiff silts was found between 5.5 feet and 9 feet in Boring 2.

Except for the loose surface soils and the above-described medium stiff materials, the alluvial silts are generally very stiff to hard and exhibit moderate densities, high shear strengths and low compressibility. The interbedded layers of medium stiff silts exhibit moderate shear strengths and moderate compressibility. The deeper silts found in Boring 1, between 7.5 feet and 25.0 feet, are very stiff to hard with high shear strengths and low compressibility.

Laboratory tests on the near-surface alluvial soils indicate that they possess relatively high moisture contents. The samples of these soils showed moisture contents ranging from 7 to 28 percent above their estimated optimum moisture contents, with the majority of the samples showing moisture contents of at least 13 percent above optimum.

The layer of clayey weathered cobbles and gravel found in Boring 1 at a depth of 25.0 feet and the boulder layer found in Boring 2 at a depth of 9.0 feet are dense with high shear strengths and low compressibility, although occasional thin seams of organic silt were found within the layer encountered in Boring 1. The materials are generally classified as GC and GP under the USC.

The 2-foot thick layer of organic silts found beneath the boulder layer in Boring 1 is classified as an OH soil under the USC and is medium stiff to stiff with low shear strengths and moderate to high compressibility. The dense alluvial sand found beneath the organic silts in Boring 1 is dense and exhibits high shear strengths and low compressibility.

The residual soils encountered below the boulder layer in Boring 2 consist of multicolored clayey silts which are designated as MH under the USC with consistencies ranging from stiff to hard with occasional seams of medium stiff soils. The residual silts exhibit low to moderate compressibility and relatively high shear strengths.

Highly to completely weathered basalt was encountered below the alluvium in Boring 1 at a depth of 37.5 feet, and beneath the residual soils in Boring 2 at a depth of 40.0 feet. The weathered rock generally breaks down to a silty sand or gravel when remolded and is considered a soft rock which is equivalent to hard soils. It exhibits high shear strengths and low compressibility.

Groundwater was initially encountered at depths of 6.0 to 13.0 feet below the ground surface, i.e., Elev. 655 and Elev. 650, respectively, at the start of the investigation and appeared to fluctuate with the rainfall and stream flow in the area. The groundwater levels within the borings dropped to depths of between about 18.0 feet and 19.0 feet, or between Elev. 644 and Elev. 643, during the drier periods when the stream ceased to flow. Additionally, observations prior to the actual field work indicated that the combination of heavy rains and the closing of the Kaupakalua Reservoir immediately downstream of the

site can result in inundation of the area with water levels at least up to the top of the eastern bank at about Elev. 661.

Discussion - We believe that the proposed site can be adequately developed to satisfactorily support the new bridge and its related improvements provided the recommendations of this report are followed. The subsurface investigation revealed that the alignment of the bridge and its approach embankments is generally underlain by competent alluvial soils, although the near-surface seams of medium stiff to stiff alluvial silts, the varying water levels and the high in-situ moisture contents of the on-site soils will necessitate some special precaution in the construction and may result in higher than normal construction costs.

The most significant geotechnical concerns associated with the bridge and embankment construction are varying groundwater levels, the high in-situ moisture contents of the on-site soils and the moderately to highly compressible layers of near-surface alluvial silts encountered between approximately Elev. 659.5 and Elev. 657.5 in Boring 1 at the western abutment, and between Elev. 655.5 and Elev. 652.0 in Boring 2 at the eastern abutment. The 2.5-foot thick layer of medium stiff organic silts found in Boring 1 at a depth of 32.5 feet is weak and highly compressible, but is sufficiently deep that it should not significantly impact the proposed construction.

We believe that the problems posed by these conditions can be minimized by the judicious scheduling of the construction, using imported rather than the on-site soils for the embankment construction, deepening the foundations for the abutments and their associated retaining walls and allowing the approach embankments to settle prior to the construction of utilities and other settlement-sensitive items on or within the embankments.

The 2.0 to 3.5 thick layers of compressible near-surface alluvial soils encountered between about Elev. 659.5 and Elev. 657.5 in Boring 1 and between Elev. 655.5 and Elev. 652.0 in Boring 2 will not provide adequate support for the new abutments and their associated retaining walls without excessive settlements and possibly a bearing capacity failure. The foundations for these structures should be deepened such that they bear below these soils and within either the hard alluvial silt layer encountered at about Elev. 657 in Boring 1 or the boulder layer found at Elev. 652 in Boring 2. The abutment and retaining wall settlements should be limited to no more than about 1/2 inch provided their foundations bear on these materials.

The boulders anticipated at the foundation bearing level of the eastern abutment can result in point loads to the bottom of the abutment and retaining wall foundations, and should be removed from beneath the wall foundations. The foundations should be undercut a minimum of 12 inches and backfilled with imported granular fill compacted in accordance with the recommendations of this report. Alternatively, the foundations may bear on a 12-inch thick layer of granular fill placed directly on the boulder layer to minimize excavation of the boulders.

The compressibility of the near-surface alluvial soils will result in significant settlements of up to 1-1/4 inch for the approach embankment due to the weight of the 8- to 10-foot thickness of fill placed over these soils. Our analysis indicates that 90 percent of the settlement will likely occur during construction of the embankments and within the 2 weeks following its completion. The construction of utilities and other settlement-sensitive structures should be delayed until the settlements have occurred.

Laboratory tests on the near-surface on-site silts indicate that they possess in-situ moisture contents ranging from 7 to 28 percent above their estimated optimum moisture contents, with the majority of the material exhibiting moisture contents at least 13 percent above their optimums. The use of the on-site soils for fill would require extensive drying to attain adequate compaction of the material which is probably not practical in the Haiku area where there is significant rainfall most of the year. The use of imported fill for the construction of the embankments would facilitate and expedite the site grading and minimize construction delays.

Due to the high moisture contents, compaction of the existing ground to receive fill can result in shear failure and "soil pumping" under the weight of heavy equipment during the site grading and foundation construction. Construction equipment should be limited to light to moderate equipment. Compaction of the existing ground prior to fill placement or foundation construction is not recommended. The loose surface soils and any loosened materials within the foundation excavations should be carefully removed such that the then exposed surface consists of the undisturbed natural soils.

The groundwater levels varied significantly during the period of the investigation and appear to depend on the regional rainfall. Additionally, the combination of heavy rains and the closing of the adjacent Kaupakalua Reservoir downstream of the site generally results in inundation of the site with water levels observed up to the top of the eastern bank of the stream at Elev. 661. Higher water levels may occur during other times of the year. The maximum water level can likely best be determined through consultations with East Maui Irrigation Company.

Construction during the rainy periods of the year may not allow the construction of the approach embankments and may necessitate the use of cofferdams and extensive dewatering of the foundation excavations to construct the abutments and retaining walls. Judicious scheduling of the construction during the drier periods of the year can minimize dewatering and expedite the construction of the foundations and approach embankments under relatively dry conditions. The high water levels resulting from the closing of the reservoir downstream must also be considered in the design of any structures subjected to uplift pressures and in the lateral pressure design of the abutments and retaining walls.

Recommendations

General - The varying groundwater and surface water levels should be considered in the proposed bridge construction to minimize the necessity of cofferdams and dewatering. The construction should be scheduled during the drier periods of the year such that sheeting and dewatering can be avoided or minimized in the foundation construction and to allow the construction of the approach embankments. Structures sensitive to hydrostatic uplift should be designed to accommodate water levels up to at least Elev. 661 and to the level anticipated during the closing of the adjacent reservoir, whichever is higher.

The use of the on-site soils as fill will require significant drying of the soils to attain adequate compaction. In view of the high rainfall prevalent in the Haiku area, the use of the on-site soils is not practical, and imported fill should be used for the site grading.

Site Preparation - Prior to the start of the site grading the site should be cleared and grubbed in general accordance with Section 201 of the 1994 Hawaii Standard Specifications for Road, Bridge and Public Works Construction (Standard Specifications). The existing trees and roots should be removed and the resulting depressions cleaned out to very stiff to hard natural ground or compacted fill and backfilled in accordance with the grading recommendations.

Where the ground surface to receive fill is steeper than 5H:1V, the existing ground should be benched with a series of horizontal terraces prior to fill placement. The benches should extend through any loose surface soils, uncompacted fills and slopewash into the very stiff to hard natural ground or compacted fill. Filling should commence at the lowest point and progress upward with the compaction equipment traversing perpendicular to the fall-line of the slope.

Any soft spots encountered during the site preparation should be removed and the resulting depression or excavation backfilled in accordance with the grading recommendations.

Grading - Once the site preparation has been completed, site grading may commence to generate the finish design grades. The excavated on-site soils are too wet to compact and should not be re-used as fill. Imported fill should be used to complete the site grading.

In general, the imported fill should consist of low-expansion soil, free of organics and rocks or soil clods greater than 3 inches in diameter. It should have a plasticity index (PI) of less than 20 and a Sand Equivalency (SE) greater than 10 when tested in general accordance with Laboratory Tests AASHTO T-90 and AASHTO T-176.

The initial 18 inches of fill or backfill placed on the existing ground should consist of Aggregate Subbase conforming to Section 703.17 of the Standard Specifications. Fill and backfill placed within 3 feet of the pavement subgrades (bottom of pavement section) should have a CBR of 12 or more when tested in accordance with Laboratory Bearing Ratio Test ASTM D1883.

Areas to receive fill or new construction should be carefully excavated and cleaned out to very stiff to hard natural ground to remove the 18-inch thick surface layer of loose soils or any soils loosened during the excavation. Compaction of these areas is not recommended. Where the new fill embankments will tie-in to the existing Peahi Road, or other areas which are within 2 feet of the pavement subgrades, they should be overexcavated to a depth of 2 feet and backfilled in accordance with these recommendations. Any soft spots or uncompacted fills encountered should be removed, and the resulting depression similarly backfilled.

Fill and backfill should be placed in level lifts of no more than 8 inches in loose thickness, moisture-conditioned to within 3 percent of its optimum moisture content and uniformly compacted to at least 90 percent relative compaction as determined by Laboratory Compaction Test AASHTO T-180. Fill and backfill placed within 3 feet of the pavement subgrades should be compacted to at least 95 percent relative compaction. Construction and compaction equipment should be limited to small- to moderate-sized equipment to minimize the potential for soil pumping until the fill has attained a thickness of at least 2 feet above the existing ground.

The weight of the fill embankments will result in up to 1-1/4 inches of settlement due to the near-surface compressible soils. The installation and construction of utilities and settlement-sensitive items should be delayed for a period of at least 2 weeks to allow the settlements to subside to tolerable levels.

Cut and fill slopes should be limited to no steeper than 2H:1V for slope heights of up to 10 feet. Slopes exceeding this height are not anticipated on this project and should be individually evaluated should they occur. Fill slopes should be over-constructed during the mass grading and subsequently cut back to their planned lines and grades such that the slope face is a tight, well compacted surface.

Portions of the graded slopes exposed to stream flow should be protected by armoring such as rip-rap to minimize erosion. The top of the graded slopes, in their final configuration, should extend a lateral distance of at least 2 feet beyond the curbs and pavements of the new roadway.

Abutments and Retaining Walls - The current plans indicate that the abutment and its adjacent retaining walls will be used to support the 8- to 10-foot high grade differences along the portions of the approach embankments immediately adjacent to the new bridge. This will result in wall design heights of up to 18 feet.

The western abutment and retaining wall foundations should bear in the hard alluvial silts below approximately Elev. 657, while the eastern abutment and walls should bear on the dense boulder layer anticipated at about Elev. 652 or on a 12-inch thick layer of compacted Aggregate Subbase placed directly on the boulder layer. Foundations bearing in these materials may be designed for an allowable bearing capacity of 3,000 pounds per square foot (p.s.f.). This value may be increased by one-third for short-term transient loads.

The abutment and wall footings should have a minimum base width of 4 feet. The abutment footings and any wall footing within a lateral distance of 10 feet of the bottom of the stream banks should be embedded at least 24 inches below the adjacent bottom of the stream. The remaining retaining wall foundations should be embedded at least 24 inches below the lowest adjacent compacted subgrade on level ground. Footings on slopes or within 6 feet of the top of slopes should be embedded such that there is a minimum of 8 feet of horizontal set-back between the lower, outside edge of the foundation and the compacted slope face.

The foundation excavations should be cleaned out of any loose materials to the hard undisturbed natural ground prior to the placement of the steel and concrete. Compaction of the supportive silts anticipated at the bearing level of the western abutment is not recommended due to their high moisture contents.

The foundations for the eastern abutment will be founded on a boulder layer and should be overexcavated to allow the placement of at least 12 inches of Aggregate Subbase compacted to 95 percent relative compaction between the bottom of the foundation and the boulders. Should it be desirable to place the Aggregate Subbase directly on the boulder layer and minimize the excavation of the boulders, the subbase layer should extend a lateral distance of at least 18 inches beyond the edges of the footings, or a distance equivalent to the thickness of the Aggregate Subbase layer, whichever is greater.

Any soft spots encountered in the foundation excavations should be removed down to the hard natural ground and the resulting depressions backfilled in accordance with the grading recommendations. The overexcavation should extend a lateral distance on each side of the foundation equivalent to the depth of the overexcavation below the footing.

Backfill within the active wedge behind the abutment and retaining walls should consist of a granular material conforming to the requirements of Structure Backfill A under Section 703.20 of the Standard Specifications. The active wedge is defined as the soil prism delineated by the back of the wall, the ground surface and an imaginary line extending from the heel of the wall to the ground surface at an angle of 45 degrees.

The unyielding abutments should be designed for an at-rest lateral earth pressure of 55 pounds per cubic foot (p.c.f.), while yielding retaining walls may be designed for an active lateral earth pressure of 40 p.c.f. for Structural Backfill A. These pressures are given in terms of equivalent fluid pressure for level backfill and do not include traffic surcharge, foundation, or hydrostatic pressures, which must be added where appropriate.

Due to potential inundation of the abutment area, the walls should be designed to withstand short-term hydrostatic pressures which can occur when the water level rises in the area of the bridge. Although weepholes or transverse drains should allow the water to drain, it is anticipated that the drainage of the water behind the wall will be relatively slow in comparison to the water in the stream, which can result in hydrostatic pressures against the back of the walls during this period.

Adequate drainage, in the form of weepholes or transverse drains, should be provided behind the walls to minimize the buildup of hydrostatic pressures. Transverse drains should consist of perforated pipe surrounded by 6 inches of filter gravel, or ASTM D448 No. 6 Gravel (3B Fine) wrapped in non-woven filter fabric. Should weepholes be used, a continuous line of filter gravel, or 3B Fine wrapped in filter fabric, at least 12 inches in cross-sectional area, should be placed behind each line of weepholes. The filter gravel should conform to Section 703.18, and the filter fabric should conform to the requirements of Section 716.03 of the Standard Specifications.

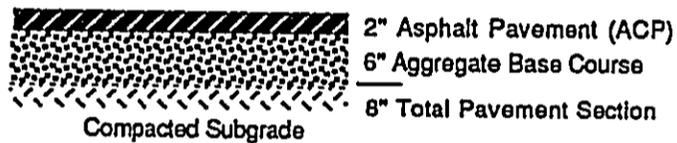
A friction factor of 0.40 and an adhesion of 150 p.s.f. may be used between the bottom of the western abutment and wall footings and the supportive alluvial silts to resist sliding. A friction factor of 0.55 may be used between the bottom of the eastern abutment and wall footings and the supportive Aggregate Subbase. No adhesion should be used for the walls founded on the Aggregate Subbase.

Keyways cut into the on-site soils may be designed for a passive resistance of 125 p.c.f. equivalent fluid pressure based on submerged conditions. Passive resistance should be disregarded for walls founded on slopes steeper than 3H:1V, or within 5 feet of the top of the slopes, and in the top 24 inches of embedment for walls founded on level ground.

The wall backfill should be placed and compacted in accordance with the grading recommendations using small, light compactors. Below a depth of 3 feet of the pavement subgrades, compaction of the backfill should not exceed 95 percent relative compaction in order to minimize the lateral earth pressures against the walls.

Total and differential settlements exceeding 1/2-inch are not anticipated provided the design height of the wall does not exceed 18 feet. Should the design height exceed 18 feet, FGE, Ltd. should be notified so that these recommendations can be re-evaluated and revised, if necessary. Steel reinforcement of the abutments, retaining walls and their foundations should be provided as recommended by the Project Structural Engineer.

Pavements - A laboratory California Bearing Ratio Test performed on a sample of the predominant surface soils indicated a CBR of 12 and 2.8 percent swell when tested in accordance with Laboratory Bearing Ratio Test ASTM D1883. Based on these test results, a minimum CBR of 12, and the pavement design procedures of HDOT, we believe that a pavement section consisting of 2 inches of Asphaltic Concrete, over 6 inches of Aggregate Base Course, placed on the compacted subgrade should be sufficient for the anticipated light passenger car and rural traffic assumed for Peahi Road. The recommended pavement section is shown below.



The Aggregate Base Course should conform to Section 703.06 of the Standard Specifications and should be compacted to at least 95 percent relative compaction. The subgrade should be shaped to drain and should similarly be compacted to at least 95 percent relative compaction for a minimum depth of 6 inches prior to the placement of the Aggregate Base Course in accordance with Section 203 (C) of the Standard Specifications.

The above pavement section is based on a modified pavement design procedure of the HDOT which does not include the required drainage course of permeable subbase and the following design traffic assumptions:

1. An Average Daily Traffic (ADT) of 1,000 vehicles per day with no traffic growth.
2. A 15-year design period.
3. A 24-hour truck traffic (T_{24}) of 0.5 percent with 60 percent 2-axle trucks, 35 percent 3-axle trucks, 5 percent 4-axle trucks and no 5- or 6-axle trucks, which results in a Traffic Index (TI) of 5.5.

Should the actual design traffic differ from the above assumptions, FGE, Ltd. should be notified so that the recommended pavements section can be re-evaluated and revised, if necessary.

Miscellaneous - Utilities should be installed in accordance with Section 206 or the appropriate section of the Standard Specifications pertaining to each particular utility once the fill settlements have subsided. Utility backfills should be placed and compacted in accordance with Section 206 and the grading recommendations, using the appropriate mechanical compactors above and around the pipes. Jetting and ponding of the backfills should not be allowed as a method of compaction.

Adequate shoring and bracing should be provided by the contractor in accordance with the applicable DOSH and other governmental regulations for all foundation excavations, utility trenches and other similar deep site excavations. Should the construction of the walls and abutments proceed during the wetter periods of the year, dewatering and use of cofferdams should be anticipated for the foundation excavations. The design of the cofferdam and dewatering system should be the responsibility of the contractor.

Adequate drainage should be incorporated into the design of the project to direct water away from the roadway and to preclude the ponding of water adjacent to or beneath the planned embankments, pavements and walls.

The Island of Maui is designated as Seismic Zone 2A under the Uniform Building Code and the site conditions correspond to a Site Coefficient of S_1 .

Quality Control - The site preparation and grading operations should be monitored by FGE, Ltd. with intermittent density tests taken to determine whether the specified levels of compaction are consistently obtained in the fills and backfills. Samples of the proposed fill materials should be submitted to FGE, Ltd. no less than 7 working days prior to their intended job-site delivery to allow adequate time for testing, evaluation and approval.

The foundation excavations for the abutment and retaining walls should be monitored by FGE, Ltd. to determine whether the anticipated foundation soils are encountered. The recommendations given herein are contingent upon adequate construction monitoring of the geotechnical phases of the construction by FGE, Ltd.

Limitations - This report has been prepared for the exclusive use of Wilson Okamoto & Associates, Inc. for the Kaupakalua Stream Bridge Replacement in Haiku, Maui, Hawaii. No warranty, expressed or implied, is made.

The analysis, conclusions and recommendations of this report are based in part upon the data obtained in the test borings and upon the assumption that the soil conditions do not deviate from those observed. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that planned at the present time, FGE, Ltd. should be notified so that supplemental recommendations can be given. The conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing.

Unanticipated soil conditions are commonly encountered and cannot be fully determined by soil samples, test borings or test pits. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. Some contingency funds are recommended to accommodate such potential extra costs.

The scope-of-work for this investigation was limited to conventional geotechnical services and did not include any environmental evaluations or assessments. Silence in the report regarding any environmental aspects of the site does not indicate the absence of potential environmental problems.

The boring locations were approximately determined by tape measurements from existing physical features. Elevations were estimated from the available topographic plans. The locations and elevations of the borings should be considered accurate only to the degree implied by the methods used.

Groundwater was encountered at the depths and times indicated on the Boring Logs. It must be noted, however, that fluctuations in the level of the groundwater may occur due to variations in rainfall, tides, temperature and other factors not present at the time the measurements were made.

FGE, Ltd. should be provided the opportunity for general review of the final design drawings and specifications in order to verify that the earthwork and foundation recommendations have been properly interpreted and implemented in the design and specifications. If FGE, Ltd. is not accorded the privilege of making this recommended review, it can assume no responsibility for misinterpretations of the recommendations.

FGE, Ltd. should also be retained to provide periodic soil engineering services during construction. This is to observe compliance of the design concepts, specifications and recommendations and to allow design changes in the event the subsurface conditions differ from that anticipated prior to construction. The recommendations given herein are contingent upon adequate construction monitoring by FGE, Ltd.

Should you have any questions regarding this report or if we can be of further assistance to you, please do not hesitate to contact us.

Respectfully submitted,

FEWELL GEOTECHNICAL ENGINEERING, LTD.

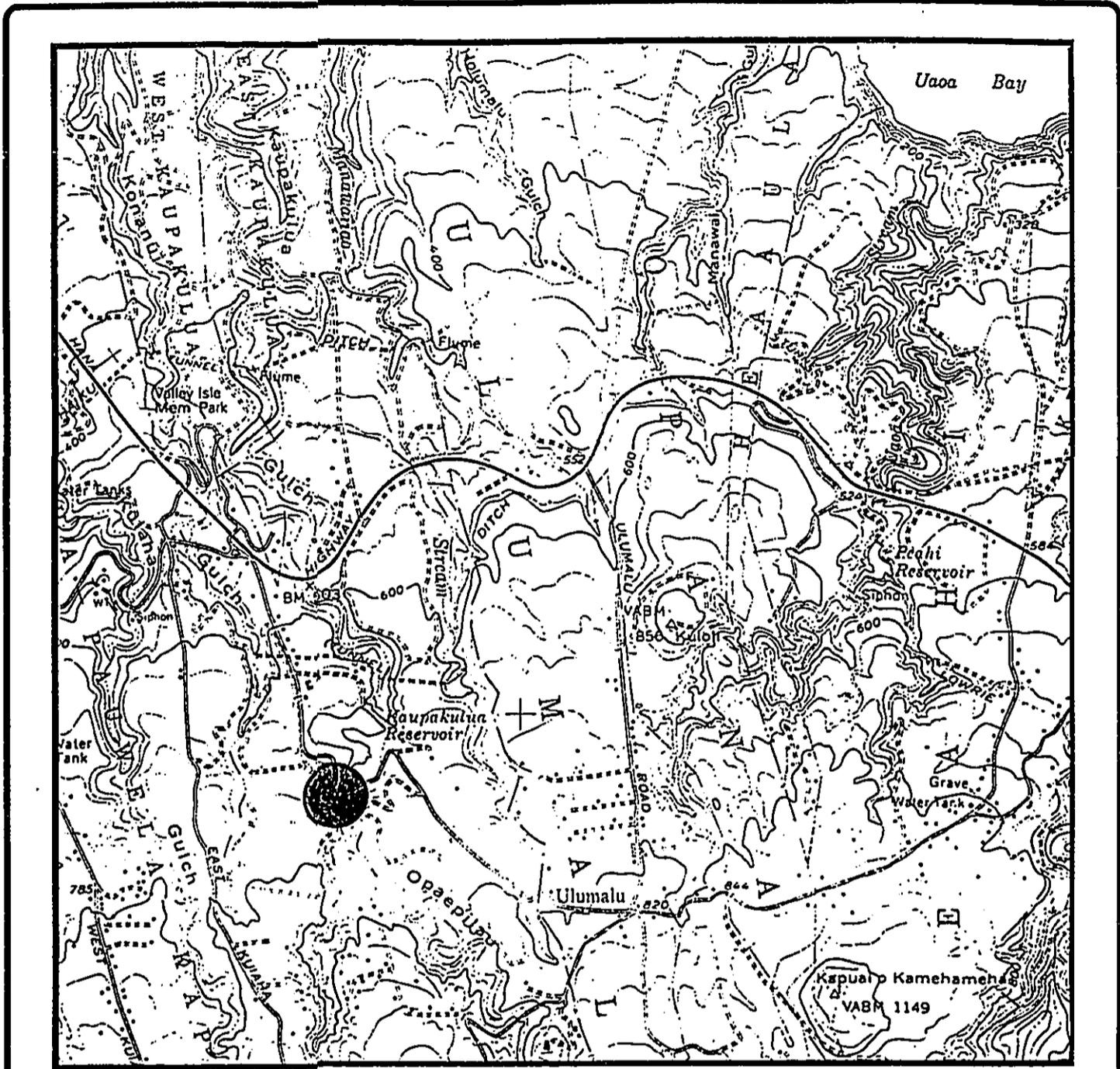

By Alan J. Shimamoto, P.E.

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Attachments



Copy to: FGE, Ltd. - Maui (Attention: Mr. Butch Gorsha)



LEGEND:

● PROJECT LOCATION

SCALE: 1"=2000'

GENERAL AREA:

HAIKU, MAUI, HAWAII

REFERENCE:

HAIKU QUADRANGLE
U.S.G.S. TOPOGRAPHIC MAP



F.G.E. Ltd.

PROJECT LOCATION MAP

Kaupakalua Bridge Replacement
Haiku, Maui, Hawaii

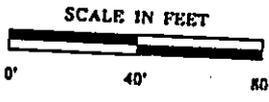
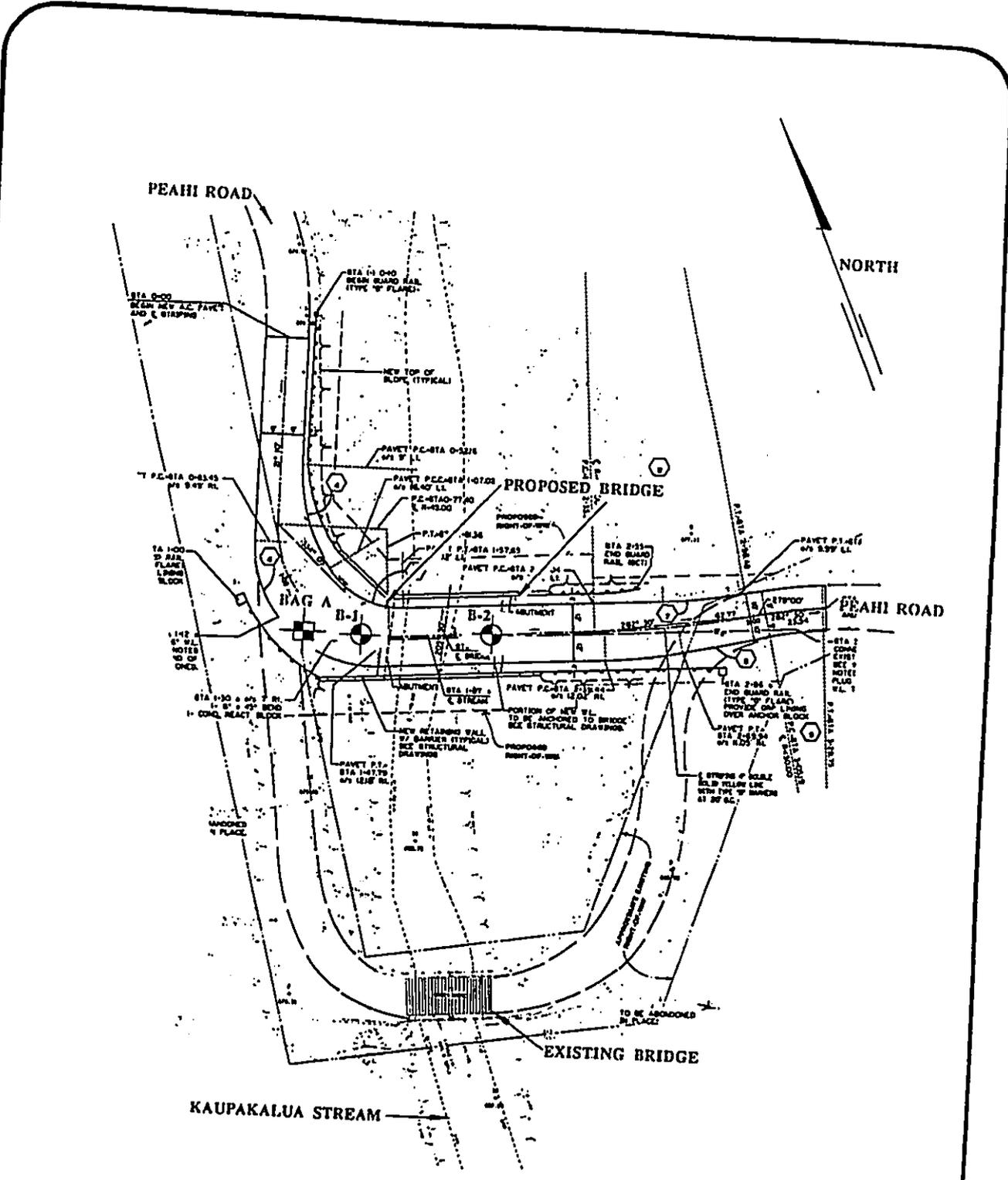
File:

1433.01

Date:

December 1995

Figure 1



- LEGEND**
- FGE BORING LOCATION
 - FGE BULK SAMPLE LOCATION

REFERENCE: UNDATED PRELIMINARY SITE PLAN PROVIDED BY WILSON OKAMOTO & ASSOCIATES ON SEPTEMBER 15, 1995

| | | |
|---|--|---------------|
|  FGE <small>66.5111 WAINIWA PLACE PEARL CITY HAWAII 96771</small> | FEWELL GEOTECHNICAL ENGINEERING, LTD. | |
| | SITE AND BORING LOCATION PLAN | |
| | KAUPAKALUA BRIDGE REPLACEMENT HAIKU, MAUI, HAWAII | |
| | FILE 1433.01 | DECEMBER 1995 |

FIGURE 2



F.G.E. Ltd.
96-1416 Waihona Place
Pearl City, Hawaii

Boring: 1
Project: Kaupakalua Bridge Replacement
Location: Haiku, Maui, Hawaii
Surface Elevation: 663.0' ±
Depth to Water: 19.0' (10-4-95 @ 11:00 am)
Date Completed: 9-27-95

File: 1433.01
Project Engineer: AS
Field Engineer: ES
Drafted by: LB
Date of Drawing: December 1995

| LAB TEST RESULTS | MOIST CONT. % | DRY DEN. PCF | BLOWS PER FT. | SAMPLE | DEPTH | CLASSIFICATION |
|--|---------------|--------------|---------------|--------|--------------|--|
| Swell = 1.6% Swell Index = 0.23 LL = 59, PI = 21 LL = 76, PI = 28 Direct Shear: c = 560 p.s.f. φ = 42° No Swell | 39 | 87 | 20 | 1 | 0 - 1.5' | Brown Clayey SILT (MH), <u>loose</u> , damp (SLOPEWASH) |
| | 33 | 86 | 6 | 2 | 1.5 - 3.0' | Brown Clayey SILT (MH), <u>hard</u> , damp At 3.5' grades to <u>medium stiff</u> |
| | | | 55 | 3 | 3.0 - 4.5' | At 5.5' grades to <u>hard</u> (ALLUVIUM) |
| | | | 55 | 4 | 4.5 - 10.0' | Dark Brown SILT (MH) with fine sand and gravel, <u>hard</u> , damp (ALLUVIUM) |
| | 49 | 75 | 38 | 5 | 10.0 - 15.0' | Reddish Brown and Gray Clayey SILT (MH) with subrounded gravel, <u>hard</u> , wet At 16.0' grades to <u>very stiff to hard</u> |
| | 53 | 72 | 24 | 6 | 15.0 - 20.0' | Gray SILT (ML) with subrounded gravel, <u>hard</u> , damp (ALLUVIUM) |
| | 42 | 84 | 100/8" | 7 | 20.0 - 25.0' | Gray SILT (ML) with subrounded gravel, <u>hard</u> , damp (ALLUVIUM) |
| | 30 | 95 | 100/5" R | 8 | 25.0 - 30.0' | Gray Clayey Highly Weathered COBBLES and GRAVEL (GC) with seams of medium stiff silt, <u>dense</u> , damp At 29.0' to 32.5' encountered a weathered boulder |
| | | | 53 | 9 | 30.0 - 35.0' | Gray Organic SILT (OL), <u>medium stiff to stiff</u> , wet (ALLUVIUM) |

Figure 3 a



F.G.E. Ltd.
96-1416 Waihona Place
Pearl City, Hawaii

Boring: 1
Project: Kaupakalua Bridge Replacement
Location: Haiku, Maui, Hawaii
Surface Elevation: 663.0' ±
Depth to Water: 19.0' (10-4-95 @ 11:00 am)
Date Completed: 9-27-95

File: 1433.01
Project Engineer: AS
Field Engineer: ES
Drafted by: LB
Date of Drawing: December 1995

| LAB TEST RESULTS | MOIST CONT. % | DRY DEN. PCF | BLOWS PER FT. | SAMPLE | DEPTH | CLASSIFICATION |
|---|---------------|--------------|---------------|--------|-------|--|
| Gradation: 36% Gravel 42% Sand 22% Silt/Clay | | | 30 | 10 | 0 | Dark Gray Silty SAND (SM), trace gravel, dense, wet (ALLUVIUM) |
| | 41 | 74 | 55 | 11 | 40 | Dark Gray/Black Highly to Completely Weathered BASALT (WH-WC), soft, wet |
| | | | 48 | 12 | 45 | |
| | 46 | 77 | 90 | 13 | 50 | |
| | | | R | 14 | 55 | Gray Moderately Weathered BASALT (WM), hard BOH @ 54.0' |
| | | | | | 60 | |
| | | | | | 65 | |
| | | | | | 70 | |

Figure 3 b



F.G.E. Ltd.
96-1416 Waihona Place
Pearl City, Hawaii

Boring: 2
Project: Kaupakalua Bridge Replacement
Location: Haiku, Maui, Hawaii
Surface Elevation: 661.0' ±
Depth to Water: 18.0' (10-4-95 @ 10:50 am)
Date Completed: 10-4-95

File: 1433.01
Project Engineer: AS
Field Engineer: ES
Drafted by: LB
Date of Drawing: December 1995

| LAB TEST RESULTS | MOIST CONT. % | DRY DEN. PCF | BLOWS PER FT. | SAMPLE | DEPTH | CLASSIFICATION | |
|------------------|--|--------------|---------------------------------------|--------|-------|---|---|
| Consol. | 53 | 65 | 18 | 1 | 0-1 | Brown Clayey SILT (MH), <u>loose</u> , damp (SLOPEWASH) | |
| | | | 18 | 2 | 1-5 | Brown Clayey SILT (MH), <u>very stiff</u> , damp At 5.0' grades to <u>stiff</u> (ALLUVIUM) | |
| | 54 | 70 | 7 | 3 | 5-10 | Brown Clayey SILT (MH) with gravel, <u>medium stiff to stiff</u> , wet (ALLUVIUM) | |
| | | | R | 4 | 10-15 | Gray Fresh Basalt BOULDERS (GP) with seams of clayey sandy gravel <u>dense</u> , moist (ALLUVIUM) | |
| | 15 | 109 | 50/5" R | 5 | 15-20 | Brown Clayey SILT (ML) with gravel-sized rock fragments, <u>very stiff to hard</u> , moist (RESIDUAL) | |
| | | | 100%REC 77%RQD 18 49/9" R | 6 | 20-25 | | |
| | LL=43, PI=5 Gradation: 0% Gravel 4% Sand 96% Silt/Clay | 53 | 70 | 31 | 8 | 25-30 | Grayish Brown SILT (ML) with completely weathered gravel-sized rock fragments, <u>stiff to hard</u> , saturated At 28.5' encountered highly weathered sections (RESIDUAL) |
| | | | | 14 | 9 | 30-35 | Brown SILT (ML) with completely weathered gravel-sized rock fragments, <u>medium stiff to</u> |
| | | | | 23 | 10 | 35-38 | |
| | | 53 | 70 | 19 | 11 | 38-40 | |

Figure 4 a



F.G.E. Ltd.
96-1416 Waihona Place
Pearl City, Hawaii

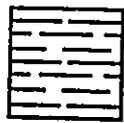
Boring: 2
Project: Kaupakalua Bridge Replacement
Location: Haiku, Maui, Hawaii
Surface Elevation: 661.0' ±
Depth to Water: 18.0' (10-4-95 @ 10:50 am)
Date Completed: 10-4-95

File: 1433.01
Project Engineer: AS
Field Engineer: ES
Drafted by: LB
Date of Drawing: December 1995

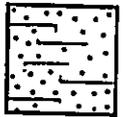
| LAB TEST RESULTS | MOIST CONT. % | DRY DEN. PCF | BLOWS PER FT. | SAMPLE | DEPTH | CLASSIFICATION |
|--|---------------|--------------|---------------|--------|-------|--|
| Consol. | 54 | 71 | 13 | 12 | 38-40 | stiff, saturated Brown SILT (ML) with completely weathered gravel-sized rock fragments, <u>medium stiff to stiff, saturated</u> (RESIDUAL) |
| Gradation: 66% Gravel 26% Sand 8% Silt/Clay | 46 | 67 | 37 | 13 | 40-45 | Gray/Brown Highly to Completely Weathered BASALT (WH-WC) with seams of saprolite, <u>soft, saturated</u> |
| | 54 | 69 | 19 | 15 | 45-50 | |
| | | | | | 50-70 | BOH @ 49.0' |

Figure 4 b

MAJOR ROCK TYPES



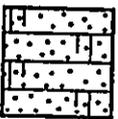
BASALT



TUFF



DECOMPOSED ROCK

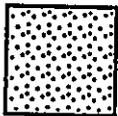


CORAL

MAJOR SOIL TYPES



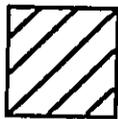
GRAVEL



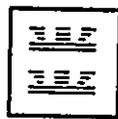
SAND



SILT

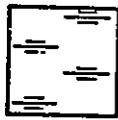


CLAY

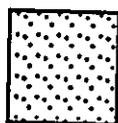


PEAT/ORGANICS

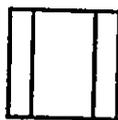
SECONDARY CLASSIFICATION



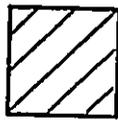
GRAVELLY



SANDY



SILTY



CLAYEY

SAMPLING SYMBOLS



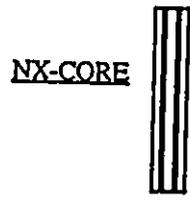
3" O.D. UNDISTURBED SAMPLE

3" O.D. DISTURBED SAMPLE

2" O.D. STANDARD PENETRATION SAMPLE

NO RECOVERY SHELBY TUBE

BAG SAMPLE



NX-CORE



WATER LEVEL



F.G.E. Ltd.

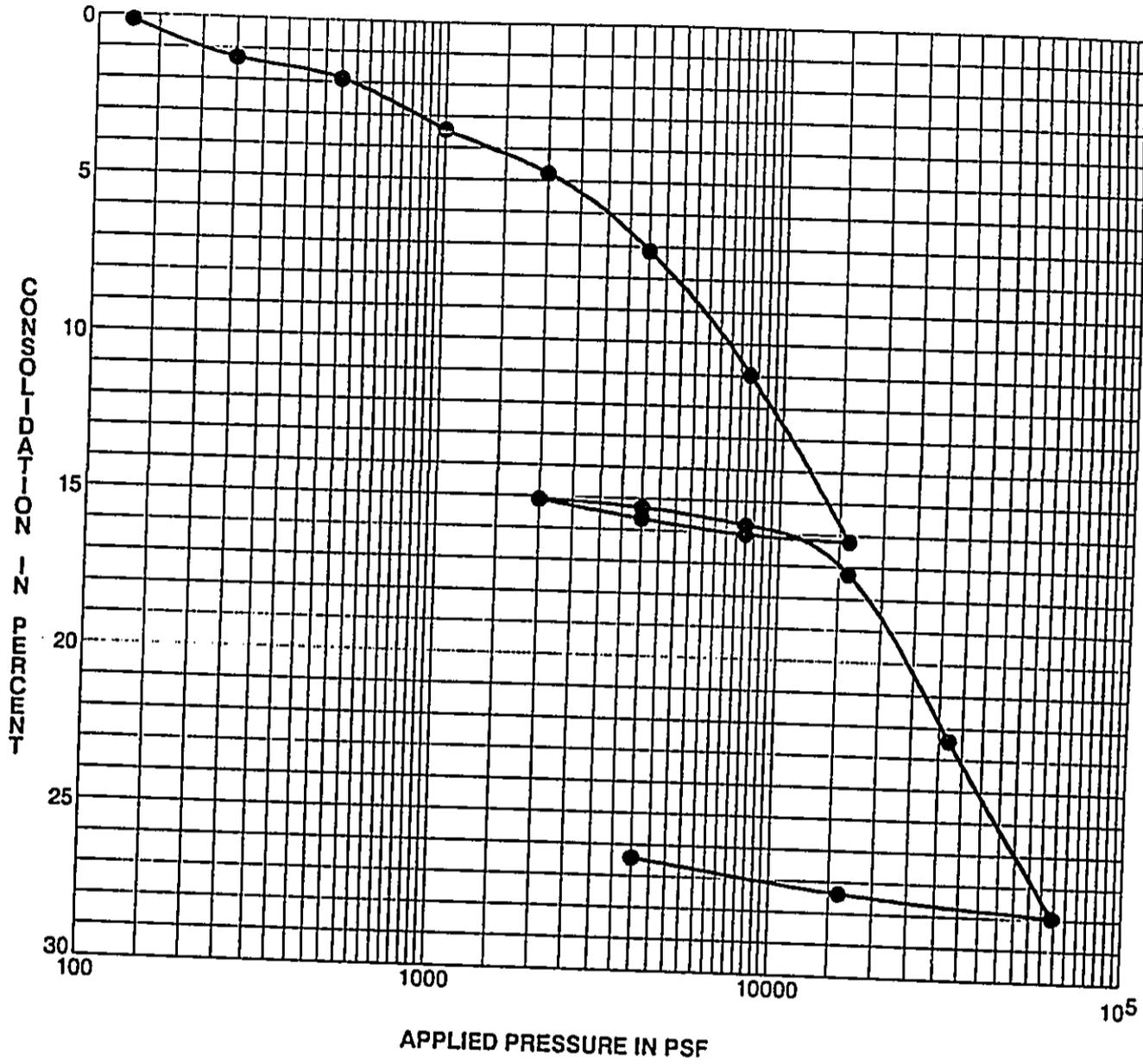
BORING LOG LEGEND

Kaupakalua Bridge Replacement
Haiku, Maui, Hawaii

File:
1433.01

Date:
December 1995

Figure 5



| Sample Identification | Depth (feet) | Classification | LL | PI |
|-----------------------|--------------|------------------------|----|----|
| 2-3 | 6.0 | Brown Clayey SILT (MH) | | |



F.G.E. Ltd.

CONSOLIDATION CURVE

Kaupakalua Bridge Replacement

Haiku, Maui, Hawaii

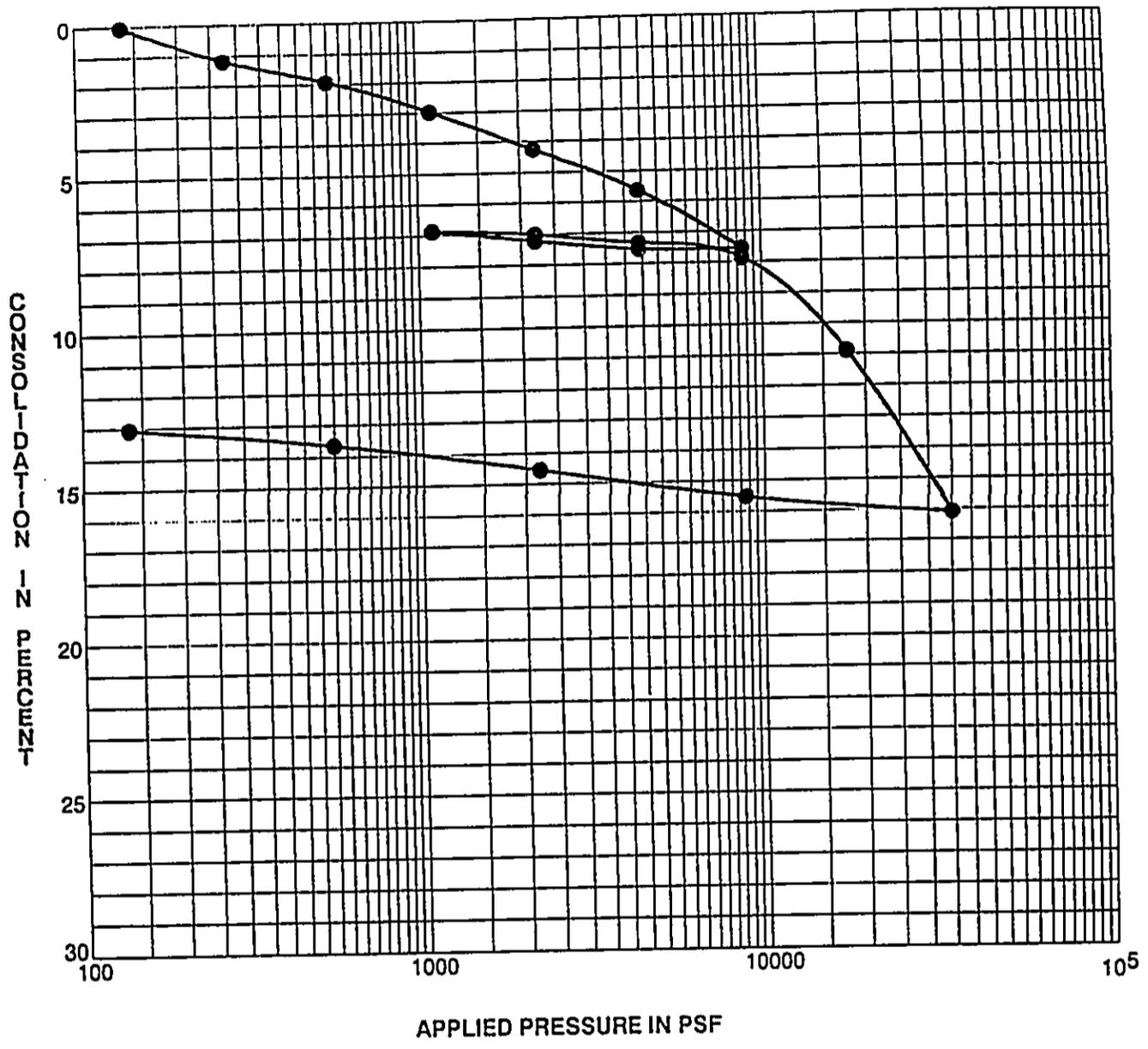
File:

1433.01

Date:

December 95

Figure 6



| Sample Identification | Depth (feet) | Classification | LL | PI |
|-----------------------|--------------|--------------------------------|----|----|
| 2 - 12 | 37.0 | Brownish Gray Clayey SILT (MH) | | |



F.G.E. Ltd.

CONSOLIDATION CURVE

Kaupakalua Bridge Replacement
Haiku, Maui, Hawaii

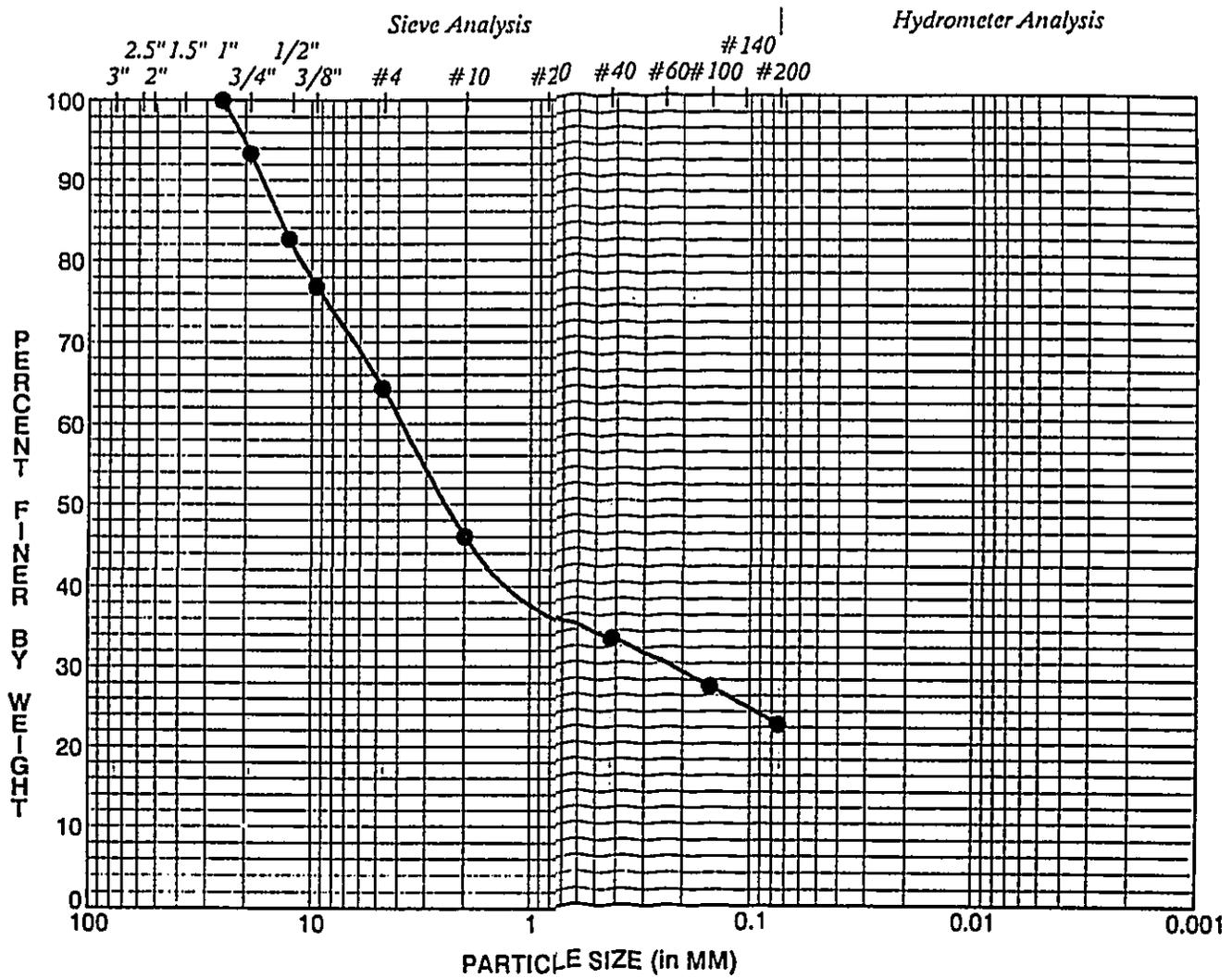
File:

1433.01

Date:

December 95

Figure 7



| Gravel | | Sand | | | Silt and Clay |
|--------|------|--------|--------|------|---------------|
| coarse | fine | coarse | medium | fine | |

| Sample ID | Depth | Classification | MC% | LL | PL | PI | Gc | Cu |
|-----------|-------|--------------------------|-----|----|----|----|----|----|
| ● 1-12 | 43.5 | Brown SAND & GRAVEL (SM) | | | | | | |

| Sample ID | Depth | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt & Clay |
|-----------|-------|------|-----|------|-----|---------|-------|--------------|
| ● 1-12 | 43.5 | 25.4 | 3.9 | 0.25 | | 35.7 | 41.9 | 22.4 |



F.G.E. Ltd.

GRAIN SIZE DISTRIBUTION

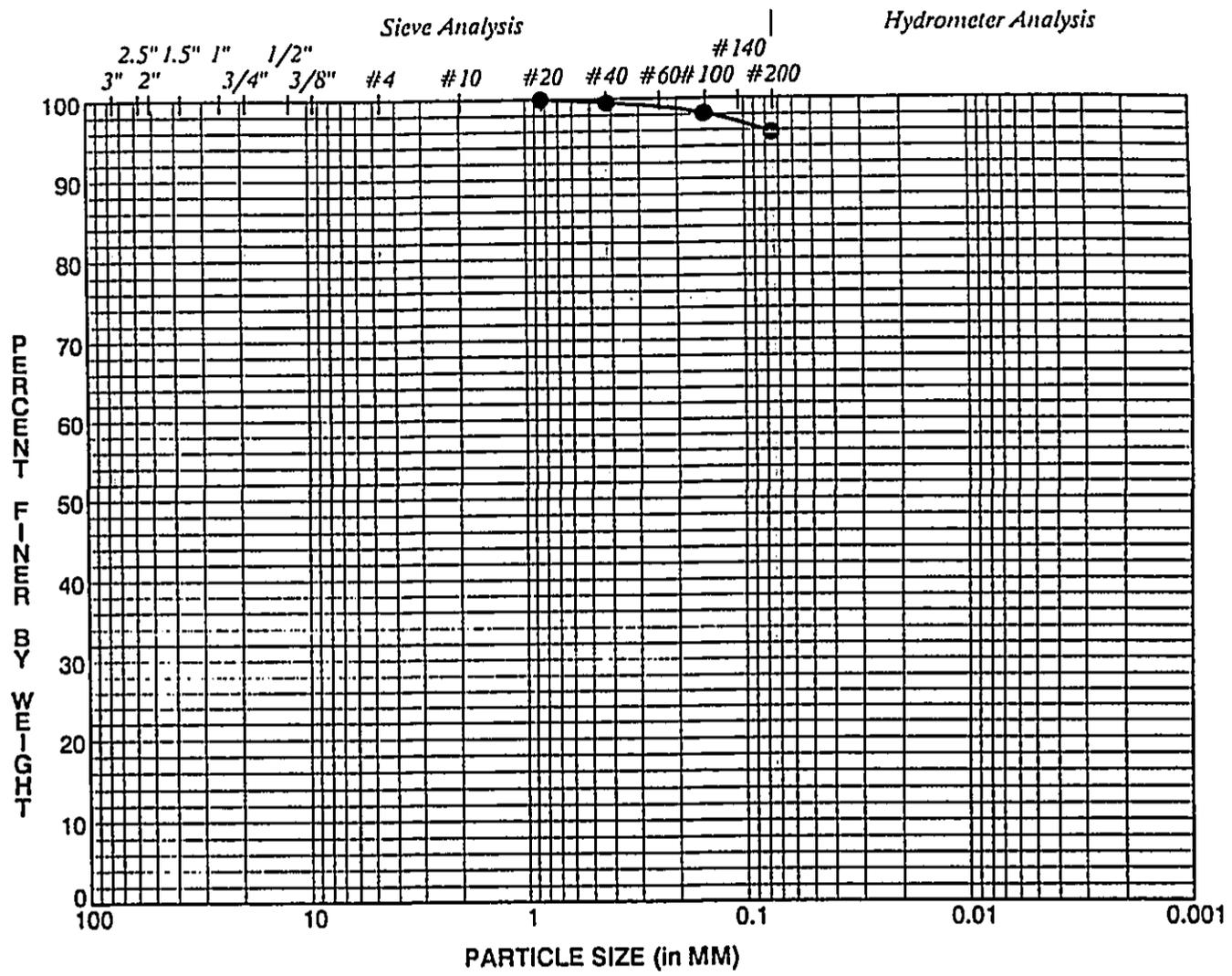
Kaupakalua Bridge Replacement

Haiku, Maui, Hawaii

File:
1433.01

Date:
December 95

Figure 8



| | | | | | |
|--------|------|--------|--------|------|---------------|
| Gravel | | Sand | | | Silt and Clay |
| coarse | fine | coarse | medium | fine | |

| Sample ID | Depth | Classification | MC% | LL | PL | PI | Gc | Cu |
|-----------|-------|-----------------|-----|----|----|----|----|----|
| ● 2-9 | 25.0 | Brown SILT (ML) | | 43 | 38 | 5 | | |

| Sample ID | Depth | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt & Clay |
|-----------|-------|------|-----|-----|-----|---------|-------|--------------|
| ● 2-9 | 25.0 | 0.8 | | | | 0.0 | 4.3 | 95.7 |



F.G.E. Ltd.

GRAIN SIZE DISTRIBUTION

Kaupakalua Bridge Replacement

Haiku, Maui, Hawaii

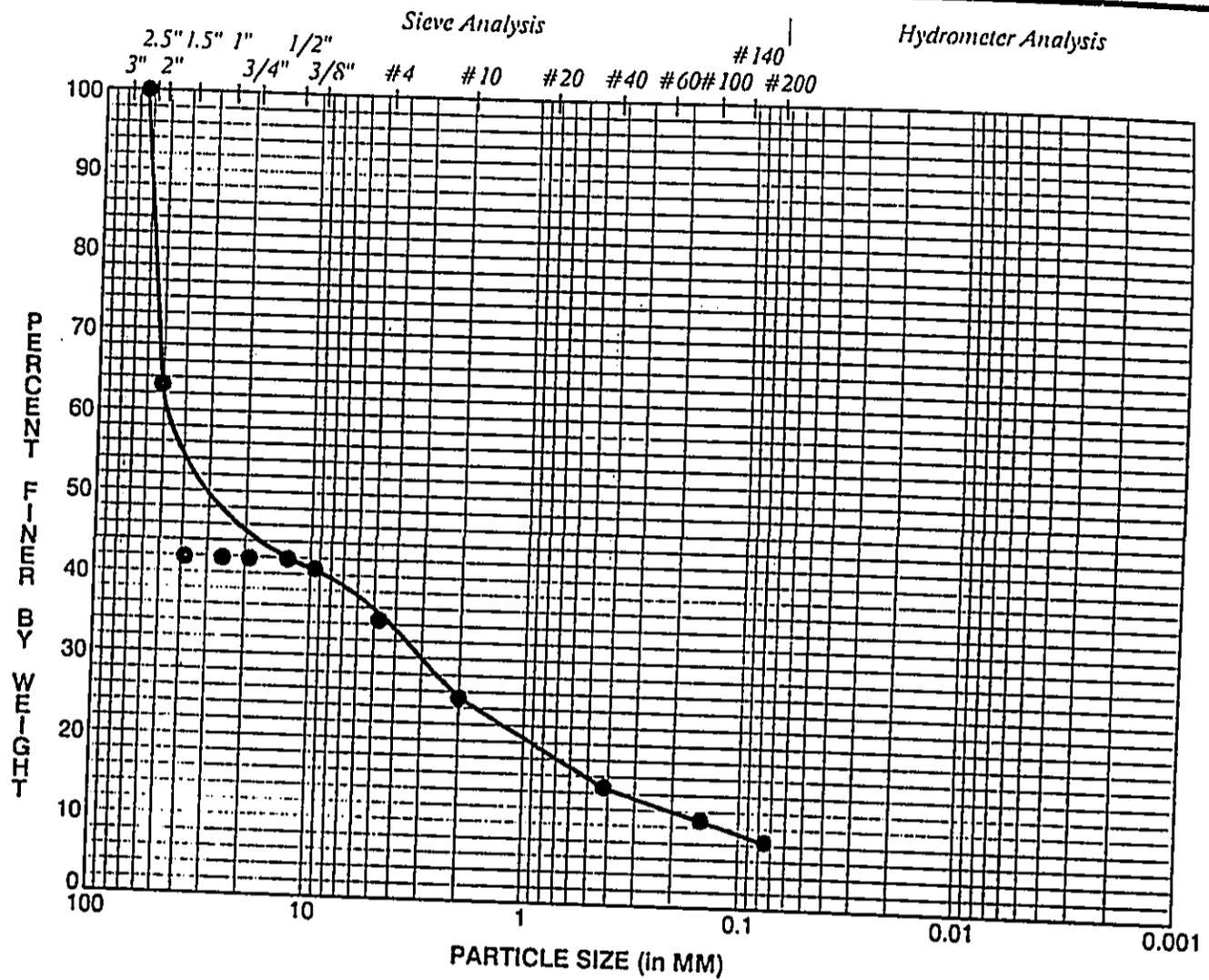
File:

1433.01

Date:

December 95

Figure 9



| | | | | | |
|--------|------|--------|--------|------|---------------|
| Gravel | | Sand | | | Silt and Clay |
| coarse | fine | coarse | medium | fine | |

| Sample ID | Depth | Classification | MC% | LL | PL | PI | Cc | Cu |
|-----------|-------|----------------------------------|-----|----|----|----|------|-------|
| ● 2-13 | 42.0 | Brown Weathered BASALT FRAGMENTS | 46 | | | | 1.72 | 416.8 |

| Sample ID | Depth | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt & Clay |
|-----------|-------|------|------|------|-------|---------|-------|--------------|
| ● 2-13 | 42.0 | 63.5 | 48.7 | 3.13 | 0.117 | 65.5 | 26.1 | 8.4 |

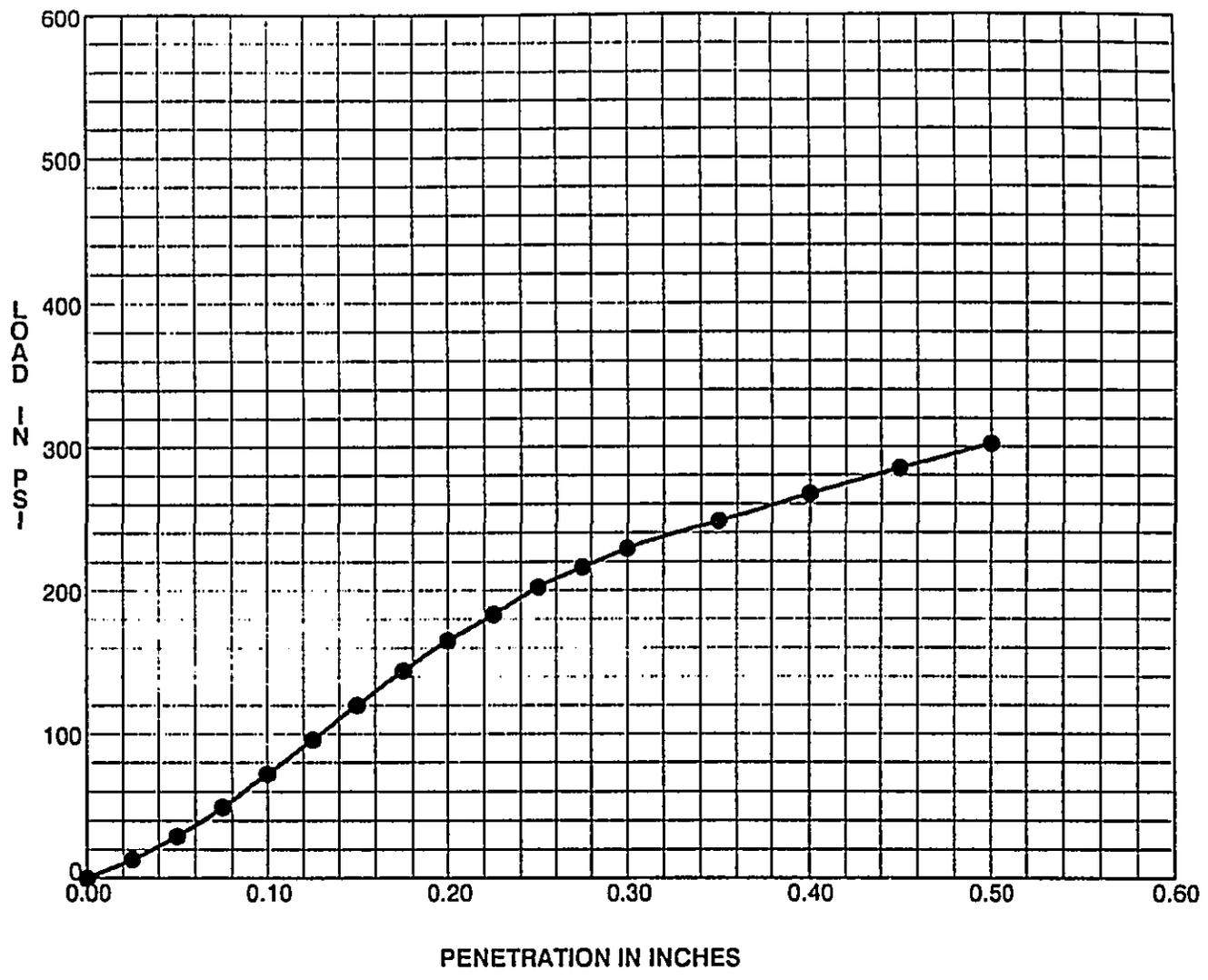


F.G.E. Ltd.

GRAIN SIZE DISTRIBUTION
 Kaupakalua Bridge Replacement
 Haiku, Maui, Hawaii

File:
1433.01
 Date:
December 95

Figure 10



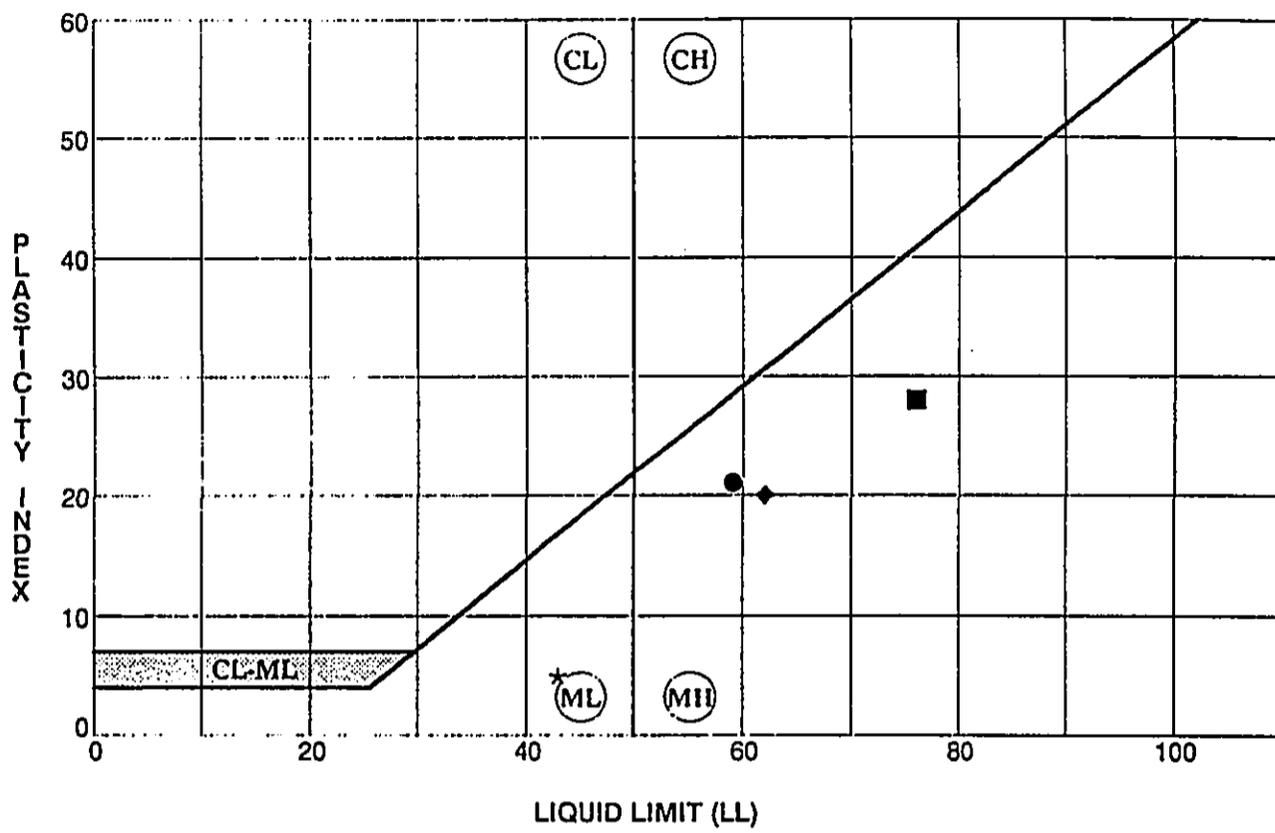
| Sample Identification | Classification | CBR | % Comp. | Max. Den. | Opt. % MC | % Swell | LL | PI |
|-----------------------|------------------------|------|---------|-----------|-----------|---------|----|----|
| ● BAG A | Brown Clayey SILT (MH) | 12.0 | 93 | 100 | 26 | 2.8 | 62 | 20 |
| | | | | | | | | |
| | | | | | | | | |



CALIFORNIA BEARING RATIO
 Kaupakalua Bridge Replacement
 Haiku, Maui, Hawaii

File:
 1433.01
 Date:
 December 95

Figure 11



| Sample Identification | Depth in Feet | LL | PL | PI | Classification |
|-----------------------|---------------|----|----|----|------------------------|
| ● 1-3 | 6.0 | 59 | 38 | 21 | Brown Clayey SILT (MH) |
| ■ 1-6 | 18.5 | 76 | 48 | 28 | Brown Clayey SILT (MH) |
| * 2-9 | 25.0 | 43 | 38 | 5 | Brown SILT (ML) |
| ◆ BAG A | 0.0 | 62 | 42 | 20 | Brown Clayey SILT (MH) |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |



F.G.E. Ltd.

PLASTICITY INDEX CHART

Kaupakalua Bridge Replacement

Haiku, Maui, Hawaii

File:
1433.01

Date:
December 95

Figure 12

TABLE I

Summary of Laboratory Test Results

| Sample No. | Depth (ft.) | Moisture Content (%) | Dry Density (p.c.f.) | Direct Shear | | Atterberg Limits | | Gradation | | | Swell (%) | Swell Index |
|------------|-------------|----------------------|----------------------|--------------|----------|------------------|----------------------|------------|----------|---------------|-----------|-------------|
| | | | | C (p.s.f.) | Ø (deg.) | Liquid Limit (%) | Plasticity Index (%) | Gravel (%) | Sand (%) | Silt/Clay (%) | | |
| 1-1 | 1.0 | 39 | 87 | | | | | | | | | |
| 1-2 | 3.5 | 33 | 86 | | | | | | | 1.6 | 0.23 | |
| 1-3 | 6.0 | --- | --- | | | 59 | 21 | | | | | |
| 1-5 | 13.5 | 49 | 75 | | | | | | | | | |
| 1-6 | 19.0 | 53 | 72 | 560 | 42 | 76 | 28 | | | 0.0 | 0.0 | |
| 1-7 | 24.0 | 42 | 84 | | | | | | | | | |
| 1-8 | 28.5 | 30 | 95 | | | | | | | | | |
| 1-11 | 38.5 | 41 | 74 | | | | | | | | | |
| 1-12 | 43.5 | --- | --- | | | | | 36 | 42 | 22 | | |
| 1-13 | 48.5 | 46 | 77 | | | | | | | | | |
| 2-1 | 1.0 | 53 | 65 | | | | | | | | | |
| 2-3 | 6.0 | 54 | 70 | | | | | | | | | |
| 2-5 | 13.5 | 15 | 109 | | | | | | | | | |
| 2-9 | 25.0 | --- | --- | | | 43 | 5 | 0 | 4 | 96 | | |
| 2-11 | 34.0 | 53 | 70 | | | | | | | | | |
| 2-12 | 37.0 | 54 | 71 | | | | | | | | | |
| 2-13 | 42.0 | 46 | 67 | | | | | 66 | 26 | 8 | | |
| 2-15 | 47.0 | 54 | 69 | | | | | | | | | |
| Bag A | 0.0 | 26 (Opt.) | 100 (Max. Dens.) | | | 62 | 20 | | | 3.6 | | |

APPENDIX C

*Environmental Reconnaissance Survey for
Kaupakulua Bridge*

AECOS, Inc.

December 1995

AECOS No. 805A

**Environmental Reconnaissance Survey
for the Kaupakalua Bridge
on Peahi Road, Ha'iku, Maui**

Prepared for:

Wilson Okamoto & Associates, Inc.
1907 So. Beretania St., Suite 400
Honolulu, Hawaii 96826

Prepared by:

AECOS, Inc.
970 N. Kalaheo Ave., Suite C300
Kailua, Hawaii 96734

December 1995

Table of Contents

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KAUPAKULUA STREAM

INTRODUCTION

The following report details the results of a site survey conducted on October 4, 1995 at the location of a proposed new road bridge in Kaupakulua Gulch (Makawao District, Maui). The proposed bridge would replace the existing Kaupakulua Bridge on Peahi Road at a location approximately 100 ft (30 m) downstream from the existing bridge and would be built by the County of Maui. The correct name for the stream and gulch appears to be Kaupakulua (Pukui, Elbert, & Mookini, 1974; Hawaii Cooperative Park Service Unit, 1990; Geographic Decision Systems International, 1994) as appears on the USGS 7.5-minute series topographic sheet (Haiku Quadrangle, 1983) but the name Kaupakulua is used in County records for the bridge.). Kaupakulua will be used here for the stream and gulch and Kaupakulua in reference to the old bridge in order to maintain consistency with existing County records.

The field reconnaissance survey encompassed Kaupakulua Gulch from Kaupakulua Reservoir upstream to the confluence of an unnamed gulch and Opaepilau Gulch, with particular focus on the area around the proposed new bridge site. During the field visit aquatic resources were surveyed, a list of riparian vegetation made, stream/wetland boundaries at the proposed bridge crossing point assessed, and water samples collected. Permission to enter areas off the County roadway was granted by the property owner, East Maui Irrigation Co. (EMI).

STREAM DESCRIPTION

Kaupakulua Stream is located in the Makawao District of Maui near Pauwela and Ha'iku, (Figure 1) entering the sea just west of Kapukaulua Point. The lower reach of the stream combines flows from a small, unnamed gulch (perhaps could be considered the upper end of Kaupakulua) and Opaepilau Gulch, the latter which results from the confluence of Kalakohi and Awalau gulches. However, the drainage basin for this system extends no higher than an elevation of about 2800 ft (850 m) where the head of Awalau Gulch lies on the narrow interfluvium between flows that drain west to Maliko Gulch and east to Opana Gulch. Both Maliko and Opana are significant drainages of the northwest slope of Haleakala. Opaepilau Gulch joins Kaupakulua a short distance upstream (around 200 ft or 60 to 70 meters) of the Peahi Road bridge and the EMI Kaupakulua Reservoir.

Kaupakulua Stream is assigned the code number 6-3-03 in the Hawaii Stream Assessment. It is described as an interrupted stream. That is, flow in the upper reaches may be continuous year-round, but flow in the lower reach is intermittent. At the time of

the survey, no flow was observed at Hana Highway (stream bed elevation of 150 m or 500 ft), flow was present under Peahi Road bridge (elevation 180 m or 600 ft), but was absent a short distance upstream. Water was present in a large pool in Opaepilau Gulch below State Highway 400 (elevation 240 m or 780 ft), but appeared to be stagnant and the stream bed was dry on the upstream side of the culvert. Moderate flow was present in Kaupakulua Stream at State Highway 400 (elevation 310 m or 1020 ft). Kaupakulua Stream is part of the EMI water system, with water diverted at several points upstream of the Kaupakulua Reservoir, and ditch water added at other points (e.g. the New Hamakua Ditch terminates on Kalakohi Gulch and the water transferred to the Kauhikoa Ditch further downstream).

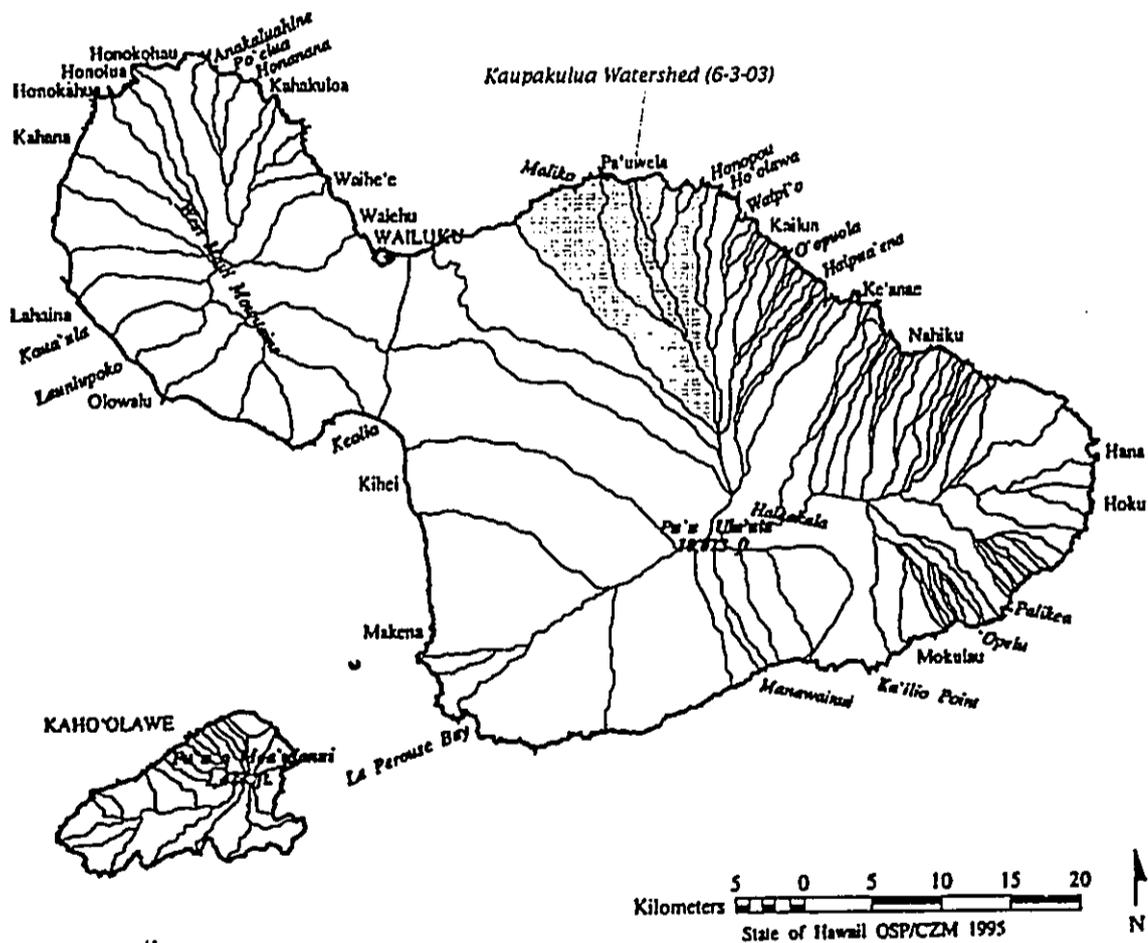


Figure 1. The islands of Maui and Kaho'olawe showing drainage basins as delimited by OSP (1994). The area described in Table 1 is shaded on this map. The Kaupakulua drainage is shown in darker shading.

A continuous-record stream gage (No. 602400) was maintained on Awalau Gulch, a branch of Kaupakulua, at Kailili between 1965 and 1971. Flow averaged 3.56 cfs (median flow = 2.7 cfs) from the drainage area of 0.23 sq. mile (147 acres or 59 hectares) above the gage (Hawaii Cooperative Park Service Unit, 1990). This area is the very uppermost end of the watershed contributing flow to Kaupakulua Stream. The total area of the Kaupakulua watershed is 2,420 acres (979 hectares) (OSP, 1994).

Table 1 presents a summary of information concerning the bridge project stream and all other streams in the same general area. A similar table was prepared in a report on a stream along the Hamakua Coast of the Big Island (AECOS, 1994) with further refinements to the form introduced here. The table represents an attempt to develop a systematic approach to listing streams and gulches in an area: essentially a conversion of map information into a table, allowing the map information to be combined with other written information.

Streams and/or dry gulches are listed in order as they appear along the coast for the island segment defined as the wedge-shaped land area between two major drainages which contains the Kaupakulua drainage (see Figure 1). The listing starts with Maliko Gulch in the Paia (west) direction and extends towards Hana (eastward) to Kakipi Gulch. Every stream and gulch that can be readily recognized as such *at the coastline* on the 7.5-minute series, topographic map (mostly the USGS Haiku Quadrangle) is listed, some as unnamed features. In the first column, streams appear in italics and gulches are given in regular type (a style adapted from USGS topographic maps). Although gulches are generally considered dry much of the time and streams flowing much or all of the time, the distinction here is simply one established by USGS in mapping and not meant to imply a particular class (see column 4). The listing of features from west to east is continued in the arrangement of tributaries given for each outlet. However, not all unnamed, upstream tributaries are given. In some cases multiple tributaries are simply indicated by a number in parentheses: "unnamed (3)" meaning three unnamed branches.

Column 2 provides vertical and horizontal bars which show the relationships between tributaries that do not empty at the shore. A vertical dashed line identifies the root stream (discharging to the sea) of a complex stream system. Thus Kaupakulua Gulch is so marked. Tributaries are then joined by a solid or dotted vertical line (unnamed and Opaepilau, in this case). The jog in the vertical line at Opaepilau Gulch indicates that Awalau and Kalakoi (joined by a vertical line) are tributaries of Opaepilau. The maximum elevation of Opaepilau Gulch (column 5) indicated is in parentheses because Opaepilau Gulch above this point changes name (i.e., this is the point of confluence of Awalau and Kalakoi gulches). Bold type identifies this system as the subject of the report. The jog at Kaupakulua to the shifted vertical opposite "unnamed" says that this unnamed gulch is a

Table 1. Summary of stream relationships, characteristics, and other pertinent information for East Maui streams and gulches near Kaupakulua Stream.

| Stream / Gulch | Code | Class ¹ | "Headwaters" Elevation ² | Aquatic Resources ³ | Survey Data |
|----------------|--------|--------------------|--|-----------------------------------|----------------|
| Pa'ia ↑ | | | | | |
| Maliko | 6-3-01 | Pi | (~) | | |
| unnamed (3) | | I | ~3800 | | |
| Kahakapao | | I | ~6000 | | |
| unnamed (2) | | I | ~5400 | | |
| Waiohiwi | | I | ~5200 | | |
| unnamed | -- | I | 200 | | |
| Kanemoeala | -- | I | 450 | | |
| Kuiaha | 6-3-02 | Pi | (310) | | |
| Lilikoi | | I | 1450 | | |
| Pauwela | | Pi | 1200 | | |
| Ohia | | Pi | (1080) | | |
| Kapua'aho'ohui | | Pi | 2100 | | |
| Huluhulunui | | Pi | 2500 | | |
| East Kuiaha | -- | Id | 2140 | | |
| Konanui | -- | I | 850 | | |
| Kaupakulua | 6-3-03 | Pi | (610) | | |
| unnamed | | I | 1420 | | |
| Opaepilau | | I | (880) | | |
| Awalau | | Id | 2750 | | |
| Kalakohi | | I | 2280 | | |
| Manawai'iao | 6-3-04 | Pi (I) | 960 | | |
| Holumalu | -- | I | 550 | | |
| unnamed | -- | I | 280 | | |
| unnamed | -- | I | 420 | | |
| Manawai | -- | I | 700 | | |
| Uaoa | 6-3-05 | Pi (I) | 1350 | | |
| unnamed | -- | I | 300 | | |
| Keali'i | 6-3-06 | I | 650 | | |
| Peahi | -- | | 440 | | |
| Kakipi | 6-3-07 | Pc | (550) | | |
| Opana | | P | 6000 | | |
| Halehaku | | P | 3000 | | |
| Palama | | I | 1850 | | |
| Koale | | I | 2280 | | |

Table 1. (continued)

| Stream / Gulch | Code | Class ¹ | "Headwaters" Elevation ² | Aquatic Resources ³ | Survey Data |
|---------------------|------|--------------------|--|-----------------------------------|----------------|
| Kakipi (continued) | | | | | |
| <i>Waihe'e</i> | | <i>I</i> | (990) | | |
| <i>Maka'a</i> | | <i>I</i> | 1600 | | |
| <i>Kaulu</i> | | <i>I</i> | 1530 | | |
| <i>Papalua</i> | | <i>I</i> | (580) | | |
| <i>Pi'iloi</i> | | <i>I</i> | 2020 | | |
| <i>Kapala'alaea</i> | | <i>I</i> | 570 | | |
| unnamed | | <i>I</i> | 780 | | |
| Hana ↓ | | | | | |

NOTES:

- 1 - P = perennial; I = intermittent; c = continuous; i = interrupted. Where given in *italics*, the class is inferred from topographic sheet by solid, dash-dotted, or no blue line. * = from present study.
- 2 - In feet, estimated (from topographic sheets) upper elevation of drainage basin; generally somewhat higher than headwaters. Blank indicates name change to tributary listed in next row; elevation in () indicates name change to tributary in next row at indicated elevation. d = diversion of water for use (domestic or agriculture).
- 3 - Summary from Hawaii Stream Assessment (Hawaii Cooperative Park Service Unit, 1990); U = Unknown (aquatic ranking).

tributary of Kaupakulua with the confluence at 610 feet elevation (where Kaupakulua loses its name, becoming "unnamed" gulch and Opaepilau Gulch).

Column 3 (Code) lists the State code number for perennial streams. Codes have been assigned by DLNR only to perennial streams and not intermittent streams, which most of the features in this area appear to be. The same basic coding system is presented by OSP (1994) for delineating watersheds based upon the USGS system. Thus the Kaupakulua watershed would be designated 20020000:3-03. However, because the Hawaii Stream Assessment considered only selected streams and assigned consecutive numbers, many smaller watersheds are left without a code. In this area, these are all small watersheds with upper elevations under 1000 feet (indicated by "--" in column 3).

Column 4 (Class) presents type of stream feature: "P" for perennial stream and "I" for intermittent stream. A lower case "i" indicates an interrupted stream, usually one which is perennial at higher elevations but intermittent at lower elevations. However, because some of these streams extend above 5000 feet, many may also be dry in the uppermost reach above the cloud layer. A "c" indicates continuous flowing to the sea. A code given in *italics* is one determined from the topographic sheet only. Where given in parentheses,

this determination from USGS disagrees with either field observation or the Hawaii Stream Assessment class designation.

Column 5 gives the elevation of the "headwaters" in feet above sea level. The value is estimated by examination of the 7.5 minute series topographic map, and represents an attempt to determine the highest elevation at which a distinct channel for the stream is probably present. Usually, this is higher than the upper end of the quad sheet blue line, but lower than the highest point in the particular drainage basin. Where this value was particularly difficult to determine because of numerous small tributaries or a lack of channel down-cutting to an extent that would be evident from a 40-foot contour interval, the value is preceded by a "~". An elevation in parentheses indicates that no headwater exists for the stream or gulch name.

Column 6 summarizes the aquatic resources rankings from the Hawaii Stream Assessment. None of these streams are ranked in that document (Hawaii Cooperative Park Service Unit, 1990). Column 7 gives references to previous studies on streams in the area. No other surveys are known from these gulches and streams.

PREVIOUS SURVEYS

No East Maui streams were included in the statewide survey of modified-channel streams by Timbol and Maciolek (1978). Very little information about Kaupakulua Stream, or any of the other streams in this part of Maui, is presented in the Hawaii Stream Assessment (Hawaii Cooperative Park Service Unit, 1990). The stream is flagged as having a "special area" wetland, apparently a reference to small palustrine wetlands identified by USFWS. Although several such features are identified on USFWS maps, the only one of interest here is Kaupakulua Reservoir, which is coded "PUS3Ch" on the USFWS map. This code references a palustrine (pond, swamp, or marsh) wetland type: an unconsolidated shore, mud bottom, seasonally flooded impoundment (USFWS, 1995).

No native forest occurs along this stream. Unspecified archaeological information of moderate sensitivity is associated with this watershed, which is somehow translated to a "substantial" cultural resource in the Resource Assessment Summary. It may be worth noting that the summary of all surveyed streams in Hawaii under cultural resources failed to assign a single "moderate" and assigned very few "limited" ranks for any stream from the four point scale, suggesting that rankings in this category should be used with discretion. Recreational resources were deemed "moderate" with only swimming listed as an opportunity, and the stream was given a "moderate" ranking under Recreation in the Resource Assessment Summary (Hawaii Cooperative Park Service Unit, 1990).

FIELD SURVEY

RIPARIAN VEGETATION

Within the survey area, Kaupakulua Stream flows through a gulch which is heavily forested in secondary growth. A list of plant species identified from the survey area is given in Table 2. The forest in the project area is dominated by albizia (*Paraserianthus*) and swamp mahogany (*Eucalyptus robusta*). Other large trees in the area include guava (*Psidium guajava*), rose apple (*Syzygium jambos*), kukui (*Aleurites moluccana*), mango (*Mangifera indica*), and gum (*Eucalyptus* sp.). The understory is dominated by coffee (*Coffea arabica*) in localized areas, or fairly devoid of shrubs, with the exception of scattered Christmasberry (*Schinus terebinthifolius*) near the stream, young guava, and new growth seeded from the mature forest trees. The high canopy and generally sparse shrub growth allow for a dense herb layer of 'ape (*Alocasia macrorrhiza*), a Compositae (*Elephantopus mollis*), and palmgrass (*Setaria palmifolia*) to develop in some areas, and basketgrass (*Oplismenus hirtellus*), vervain (*Stachytarpheta*), and ferns (*Nephrolepis exaltata*) in others.

The stream channel above the Peahi Road bridge is a well-defined boulder and 'li'ili (rounded stones) bed, with the forest vegetation growing down to the margin: mostly rose apple on the steep left bank, and banana (*Musa*), coffee, and grasses above the right bank in an area that may have once been used for cultivation of food crops. At the time of the survey, water was flowing in the stream bed, but flow was divided into a series of isolated segments and pools with flow under the loose bed material between these pools and short riffle areas.

Starting at about 10 meters upstream of the bridge is an area influenced by Kaupakulua Reservoir, which backs up to this point when full. The stream bed and banks to the high water mark are comprised of dark mud (wet soil and mud deposits) and mostly devoid of vegetation. Through the middle of this area, the stream flows over a bed of 'li'ili in a channel about 2 m across which appears to have been eroded through a previous mud deposit. At the time, impounded water reached to just downstream of the proposed bridge site. When the reservoir is full, water backs up under the existing road bridge (see Figure 2). Within this area, the high water mark coincides closely with a vegetation line which is mostly dominated by elephant grass (*Pennisetum purpureum*) and job's tears (*Coix lachryma-jobi*) on the right bank, and non-wetland plants of the gulch forest (mostly basket grass and *Elephantopus* as ground cover) on the left.

Downstream from the proposed bridge location the reservoir widens out appreciably. Some areas of broad mud flat that appear to be inundated only by the highest water level support a growth of rushes (*Schoenoplectus*), which were devoid of flowers at the time of the survey. All around the reservoir, the upper limit of impounded water is evident by a

Table 2. Plant species listing for Kaupakulua Stream
(Upper end of Kaupakulua Reservoir to 100 m upstream of Peahi Road)

| Species | Common name | Status | Abundance |
|--|--------------------|------------|------------|
| ┌FERNS┐ | | | |
| BLECHNACEAE | | | |
| <i>Blechnum occidentale</i> L. | | nat. UP | Uncommon |
| ADIANTACEAE | | | |
| <i>Adiantum raddianum</i> | common maidenhair | nat. FACU | Occasional |
| LINDSAEACEAE | | | |
| <i>Sphenomeris chinensis</i> (L.) Bedd. | lace fern | ind. FAC | Uncommon |
| NEPHROLEPIDACEAE | | | |
| <i>Nephrolepis exaltata</i> (L.) Schott | common sword fern | ind. FAC* | Uncommon |
| POLYPODIACEAE | | | |
| <i>Phlebodium aureum</i> (L.) J. Sm. | hare's foot fern | nat. UP | Common |
| <i>Phymatosorus scolopendria</i> (Burm.) Pic.-Ser. | <i>laua'e</i> | nat. FACU | Uncommon |
| <i>Pleopeltis thunbergianus</i> | <i>pakahakaha</i> | ind. UP | Uncommon |
| THELYPTERIDACEAE | | | |
| <i>Christella ?dentata</i> | wood fern | nat. UP | Occasional |
| ┌DICOTYLEDONES┐ | | | |
| ANACARDIACEAE | | | |
| <i>Mangifera indica</i> L. | mango | nat. FACU | Occasional |
| <i>Schinus terebinthifolius</i> Raddi | Christmas berry | nat. FACU- | Occasional |
| APIACEAE | | | |
| <i>Centella asiatica</i> (L.) Urb. | Asiatic pennywort | nat. FAC | Uncommon |
| ASTERACEAE (COMPOSITAE) | | | |
| ? <i>Crassocephalum crepidioides</i> (Benth.) S. Moore | | nat. UP | Uncommon |
| <i>Elephantopus mollis</i> Kunth | | nat. FACU- | Abundant |
| <i>Emilia fosbergi</i> Nicolson | flora's paintbrush | nat. UP | Uncommon |
| <i>Erechtites valerianifolia</i> (Wolf) DC | | nat. FAC | Uncommon |
| uniden. | | nat. -- | Occasional |
| uniden. | | -- | Uncommon |
| BEGONIACEAE | | | |
| <i>Begonia hirtella</i> Link | begonia | nat. UP | Uncommon |
| BIGNONIACEAE | | | |
| <i>Spathodea companulata</i> P. Beauv. | African tulip tree | nat. UP | Uncommon |
| EUPHORBIACEAE | | | |
| <i>Aleurites moluccana</i> (L.) Wild. | <i>kukui</i> | pol. UP | Occasional |

Table 2 (continued).

| Species | Common name | Status | | Abundance |
|--|----------------------|--------|------|------------|
| FABACEAE | | | | |
| <i>Desmodium incanum</i> DC | Spanish clover | nat. | UP | Occasional |
| <i>Leucaena leucocephala</i> (Lam.) de Wit | <i>koa haole</i> | nat. | UP | Uncommon |
| <i>Paraserianthus falcataria</i> (L.) I. Nielsen | albizia | nat. | UP | Abundant |
| MALVACEAE | | | | |
| <i>Hibiscus tiliaceus</i> L. | <i>hau</i> | ?ind. | FACW | Occasional |
| <i>Sida rhombifolia</i> L. | | nat. | FACU | Occasional |
| uniden. | | | - | Uncommon |
| MORACEAE | | | | |
| <i>Ficus microcarpa</i> L. fil. | Chinese banyan | nat. | UP | Uncommon |
| MYRTACEAE | | | | |
| <i>Eucalyptus robusta</i> Sm. | swamp mahogany | nat. | FACU | Abundant |
| <i>Eucalyptus</i> sp. | gum | nat. | UP | Uncommon |
| <i>Psidium guajava</i> L. | common guava (s) | nat. | FACU | Common |
| <i>Syzygium cumini</i> (L.) Skeels | Java plum | nat. | FACU | Uncommon |
| <i>Syzygium jambos</i> (L.) Alston | rose apple | nat. | FAC | Common |
| PASSIFLORACEAE | | | | |
| <i>Passiflora subpeltata</i> Ort. | white passion flower | nat. | UP | Occasional |
| PROTEACEAE | | | | |
| <i>Grevillea robusta</i> A. Cunn. ex R.Br. | silk oak | nat. | UP | Uncommon |
| ROSACEAE | | | | |
| <i>Rubus rosifolius</i> Sm. | thimbleberry | nat. | FAC- | Occasional |
| RUBIACEAE | | | | |
| <i>Coffea arabica</i> L. | Arabian coffee | nat. | UP | Common |
| SOLANACEAE | | | | |
| <i>Solanum americanum</i> Mill. | <i>popolo</i> | ?ind. | FACU | Occasional |
| URTICACEAE | | | | |
| <i>Pilea microphylla</i> (L.) Liebm. | artillery plant | nat. | UP | Occasional |
| VERBINACEAE | | | | |
| <i>Stachytarpheta urticifolia</i> (L.) Vahl | vervain | nat. | FAC* | Common |
| —MONOCOTYLEDONES— | | | | |
| AGAVACEAE | | | | |
| <i>Cordyline fruticosa</i> (L.) A. Chev. | <i>ti</i> | pol. | UP | Uncommon |
| ARACEAE | | | | |
| <i>Alocasia macrorrhiza</i> (L.) Schott | elephant's ear, 'ape | pol. | FAC- | Abundant |
| ARECACEAE | | | | |
| <i>Cocos nucifera</i> L. | coconut palm | pol. | FACU | Uncommon |

Table 2 (continued).

| Species | Common name | Status | Abundance |
|--|-------------------------|------------|---------------|
| CANNACEAE | | | |
| <i>Canna indica</i> L. | Indian-shot | nat. FACU | Uncommon |
| COMMELINACEAE | | | |
| <i>Commelina diffusa</i> N. L. Burm. | honohono | nat. FACW | Common |
| CYPERACEAE | | | |
| <i>Cyperus</i> sp. | | | FACW Uncommon |
| <i>Schoenoplectus ?juncoides</i> (Roxb.) Palla. | kaluha | ?ind. OBL | Common |
| DIOSCOREACEAE | | | |
| <i>Dioscorea bulbifera</i> L. | hoi, bitter yam | pol. UP | Uncommon |
| MUSACEAE | | | |
| <i>Musa x paradisiaca</i> L. | banana | pol. FACU | Occasional |
| PANDANACEAE | | | |
| <i>Pandanus tectorius</i> S. Parkinson ex Z. | hala | ?ind. FAC | Uncommon |
| POACEAE (GRAMINEAE) | | | |
| <i>Brachiaria mutica</i> (Forssk.) Stapf | California grass | nat. FACW | Occasional |
| <i>Coix lachryma-jobi</i> L. | Job's tears, pu'ohe'ohe | nat. FACW+ | Common |
| <i>Echinochloa crus-galli</i> (L.) P. Beauv. | barnyard grass | nat. FACW | Occasional |
| <i>Oplismenus hirtellus</i> (L.) P. Beauv. | basketgrass | nat. FACU | Abundant |
| <i>Paspalum conjugatum</i> Bergius | Hilo grass | nat. FAC+ | Uncommon |
| <i>Pennisetum purpureum</i> Schumach. | elephant grass | nat. FACU | Common |
| <i>Schizostachyum glaucifolium</i> (Rupr.) Munro | bamboo, 'ohe | pol. FACW | Occasional |
| <i>Setaria palmifolia</i> (J. König) Stepf | palm grass | nat. FACU | Abundant |
| <i>Sporobolus</i> sp. | smut grass | nat. | Uncommon |
| ZINGIBERACEAE | | | |
| <i>Hedychium flavescens</i> N. Carey | yellow ginger | nat. FAC- | Common |

KEY:

Status = distributional status

end. = endemic; native to Hawaii and found naturally nowhere else.

ind. = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.

nat. = naturalized, exotic plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778 and well established outside of cultivation.

orn. = exotic, ornamental; plant not naturalized (not well-established outside of cultivation).

pol. = Polynesian introduction before 1778.

Status = USFWS wetland indicator status (1988)

OBL = obligate wetland species; usually found only in a wetland; (>99% probability) indicative of wetlands.

FAC = facultative; equally likely to occur in wetlands (34% - 64%) or nonwetlands.

FACW = facultative wetland species; grows in wetlands (67% - 99%) and non-wetland situations, may be indicative of wetlands.

FACU = upland species; not usually indicative of wetlands (1% - 33%).

NI = Insufficient information available to determine indicator status.

Table 2 (continued).

UP = Species not included in USFWS (1988) presumably because species does not occur in wetlands in Hawaii.

+ / - = indicates frequency is (+) more towards wetland occurrence or less towards wetland occurrence in facultative species.

* = status considered tentative.

Abundance = abundance ratings are for this site only.

Uncommon - a plant found less than five times;

Occasional - a plant that was found between five and ten times;

Common - a plant considered an important part of the vegetation and observed numerous times.

Abundant - plants found in large numbers, dominant or locally dominant.

sharp line between the vegetation and bare mud, indicating a fluctuating water level. Where the ground slope is not steep, the marginal vegetation is California grass (*Brachiaria mutica*) in one area, and palm grass with 'ape in another. Tufts of healthy looking *Schoenoplectus* occur right at the vegetation margin.

STREAM BIOTA

Within the general area downstream of the proposed bridge crossing occur some wetland areas dominated by rushes. Within the reservoir itself only a few adult toads (*Bufo marinus*) and large numbers of bullfrog tadpoles (*Rana catesbeiana*) and crayfish (*Procambarus clarki*) were observed. No fishes of any kind were seen. Observations were made at both the upper end of the reservoir and around the dam. A few large, lavender dragonflies (Family Libellulidae) were seen in the vicinity of the dam.

A small number of juvenile poecilids or top-minnows (perhaps guppies) were observed in pools in the vicinity of the existing bridge. No snails, no aquatic insects other than mosquito larvae, and no other fishes were observed in the vicinity of the proposed bridge crossing. Indeed, the paucity of aquatic fauna was somewhat surprising, but perhaps indicative of the ephemeral nature of the water supply. In particular, the reservoir may change considerably in volume over short periods of time, even to the point of completely drying up. It is interesting to note that pools isolated on the mud flats by the most recent drop harbored mosquito larvae and no minnows (the two normally would not be found together), again suggesting that the reservoir is not habitat to top minnows, an unusual circumstance for a lowland stream.

Walking on the reservoir bottom, although mud, was not a problem in this area, because the mud, although flooded at the time, had been recently dry for a long enough period to form a supportive crust (the center channel of the stream at the upper end of the reservoir was not firm under foot). Burrows of crayfish are numerous in the mud of the reservoir.

Figure 2. Photographs of the stream from the Kaupakalua Bridge on Peahi Road looking downstream towards Kaupakulua Reservoir and showing stream conditions at high water (July 25, 1995) and low water (October 4, 1995 -- level lower than elevation at proposed new bridge site). New bridge would be constructed approximately in area indicated by horizontal white lines.



July 25, 1995 (photo by Laura Mau)



October 4, 1995 (photo by Rodger Douglas).

Table 3. Checklist of aquatic animals observed or reported from Kaupakulua Stream.

| Species | Common name | Status | Abundance |
|------------------------------------|--------------------------------|--------|------------|
| ┌—INVERTEBRATES—┐ | | | |
| ARTHROPODA, INSECTA | | | |
| ODONATA, LIBELLULIDAE | | | |
| uniden. | dragonfly | nat. | Uncommon |
| ARTHROPODA, CRUSTACEA | | | |
| DECAPODA - CAMBARIDAE | | | |
| <i>Procambarus clarki</i> (Girard) | American swamp crayfish | nat. | Abundant |
| ┌—VERTEBRATES—┐ | | | |
| FISHES - POECILIIDAE | | | |
| uniden | top-minnow | nat. | Uncommon |
| AMPHIBIANS - BUFONIDAE | | | |
| <i>Bufo marinus</i> L. | giant neotropical toad (adult) | nat. | Occasional |
| AMPHIBIANS - RANIDAE | | | |
| <i>Rana catesbeiana</i> Shaw | American bullfrog (tadpole) | nat. | Common |

KEY

STATUS:

nat. = naturalized; adventive or introduced (exotic) species, now established in stream or reservoir.

WATER QUALITY

Three samples of water were collected from the Kaupakulua Stream system (Figure 3) for measurements of several common water quality parameters (see Table 4). Station 1 was located on the unnamed gulch where the stream passes under Kaupakulua Road (State Highway 400). Station 2 was located on Kaupakulua Stream about 50 m upstream of the Peahi Road bridge (i.e., just above the project area). Station 3 was located in Kaupakulua Reservoir near the upper end but downstream of the proposed bridge crossing point.

The results of the water quality analyses are given in Table 5. The pH values are within the normal range for streams. Conductivity values defy the usual circumstance of gradually increasing downstream as salts are picked up by the flow. The pattern observed here may indicate that the waters are from different sources. As observed in the field, the upstream water was turbid. It is not known where this water originated, nor why the clarity was low. The relatively high nitrate + nitrite would require more sampling to explain. However, the low value downstream (i.e., in the reservoir) may be the result of nitrate uptake by plants (particularly microscopic algae) within this body of water. The

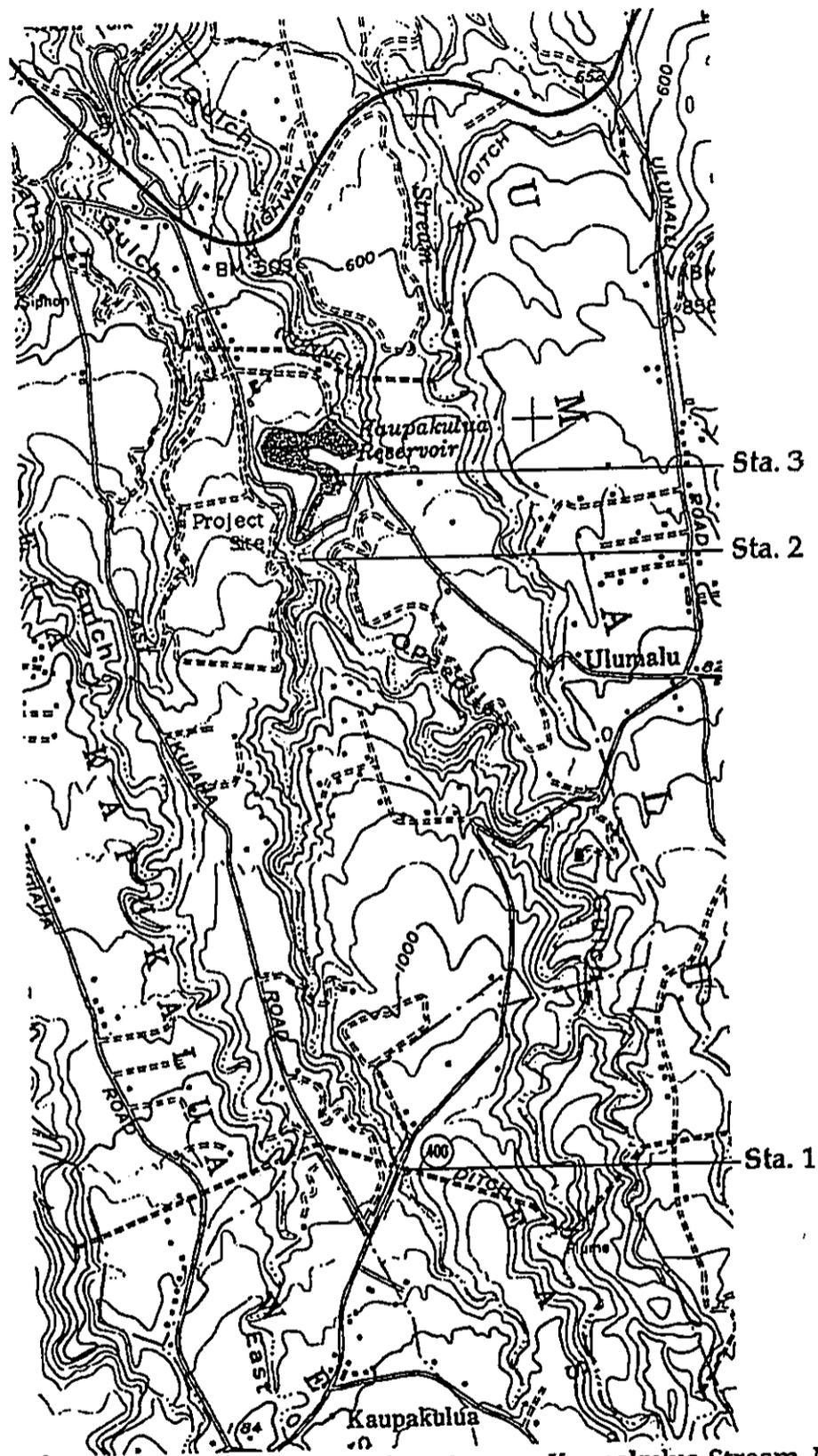


FIGURE 3. Water quality station locations on Kaupakulua Stream, Maui.

fact that total nitrogen (total N) shows a different pattern than nitrate + nitrite supports this conclusion: nitrate entering the reservoir is converted to organic matter and is measured by the total N value. A value of 70 $\mu\text{g N/l}$ nitrate + nitrite is not exceptionally elevated and of little or no concern. The comparatively low total N and total P at Station 2 (but high nitrate) follows from the fact that this water is coming from underground flow, which results in particulates being filtered out (thus the low turbidity and TSS), including organic particulates, but highly soluble nitrates being unaffected or even added to the water.

Table 4. Analytical methods and instruments used in the survey of Kaupakulua Stream.

| Analysis List | Method | Reference | Instrument |
|-------------------|---------------------------------|--|---|
| Ammonia | alkaline phenol | Koroleff in Grasshoff et al. (1986) | Technicon AutoAnalyzer II |
| Conductivity | Method 2510B (EPA 120.1) | Standard Methods 18th Edition (1992); EPA (1979) | Hydach pH/conductivity meter |
| Nitrate + Nitrite | EPA 353.2 | EPA (1993) | Technicon AutoAnalyzer II |
| pH | EPA 150.1 | EPA (1979) | Orion SA 250 pH meter w/ Ross combination electrode |
| Total Nitrogen | persulfate digestion /EPA 353.2 | D'Elia et al. (1977) / EPA (1993) | Technicon AutoAnalyzer II |
| Total Phosphorus | persulfate digestion /EPA 365.1 | Koroleff in Grasshoff et al. (1986) / EPA (1993) | Technicon AutoAnalyzer II |
| Suspended Solids | Method 2540D (EPA 160.2) | Standard Methods 18th Edition (1992); EPA (1979) | Mettler H31 balance |
| Turbidity | Method 2130B (EPA 180.1) | Standard Methods 18th Edition (1992); EPA (1993) | Hach 2100P Turbidimeter |

D'Elia, C.F., P.A. Stendler, & N. Corwin. 1977. *Limnol. Oceanogr.* 22(4): 760-764.

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Table 5. Basic water quality characteristics of Kaupakulua Stream (May 1995).

| STATION | pH (pH units) | Cond. ($\mu\text{mhos/cm}$) | Turbidity (ntu) | TSS (mg/l) | Nitrate + nitrite ($\mu\text{g N/l}$) | Total nitrogen ($\mu\text{g N/l}$) | Total phosphorus ($\mu\text{g P/l}$) |
|---------|------------------|----------------------------------|--------------------|---------------|---|--|--|
| Sta. 1 | 6.93 | 99.4 | 39.4 | 16 | 1 | 189 | 77 |
| Sta. 2 | 6.21 | 85.0 | 0.95 | 0.4 | 70 | 109 | 27 |
| Sta. 3 | 6.58 | 43.5 | 9.64 | 5.8 | 1 | 397 | 54 |

THREATENED OR ENDANGERED SPECIES

No State of Hawaii or Federally proposed or listed threatened or endangered species of plant or animal (USFWS, 1994a,b) were found in the project area.

DISCUSSION

The immediate area of the proposed new bridge is the uppermost part of Kaupakulua Reservoir and the stream here is seen to be eroding through a mud deposit at times of low water in the reservoir, or a narrow slough at times of high water in the reservoir (Figure 2). As around most reservoirs with highly variable water levels, the high water mark is well defined by exposed mud banks and the absence of vegetation below this level. In some parts of the Kaupakulua Reservoir, a narrow band of rushes, barnyard grass, and/or California grass is found at or just above this high water mark. Within the channel at the bridge location, some of the vegetation (particularly the elephant grass on the right bank) hangs down into the water, obscuring the actual high water mark. However, in the vicinity of the proposed bridge, this line is the ordinary high water mark (OWHM) and generally coincides with a change in slope (i.e., top of bank) to a narrow (1 to 2 meters wide) ledge characterized by non-wetland indicator species and lacking hydrological indicators. Soil tests to determine wetland status were not conducted in the field because it was clear from the lack of vegetation and hydrology indicators that support of wetland designation did not exist above the reservoir high water mark. Downstream of the bridge site, some small areas supporting wetland plants would benefit from a more careful delineation of the wetland boundary but these areas are not impinged on by the bridge project. The top of the bank is marked on the preliminary survey maps (and labeled "top of gulch") for the bridge as occurring at an elevation of 662 to 663 feet above MLLW where the new bridge would be placed. This line is the best estimate of U.S. Army Corps jurisdiction over navigable waters under Section 404 of the Clean Water Act (See CFR 33 §328.3(e) and §329.11(a)(1)).

The proposed bridge project will have no adverse impacts on aquatic resources of East Maui. The subject stream appears not to support native aquatic fauna in the project area, and the proposed new bridge structure will not impair migratory (amphidromous) habits of native aquatic biota in the event that any such populations exist in more pristine areas upstream of the project site. A Stream Channel Alteration Permit (SCAP) will be applied for from DLNR.

Lower Kaupakulua Stream is intermittent. Water quality impacts generated by the construction should be minimal. Locally generated turbidity will tend to settle in the nearby reservoir. A Best Management Practices (BMP) plan and water quality monitoring

plan will be prepared in order to comply with Section 401 of the Clean Water Act. After construction, the new structure will have no impact on water quality in Kaupakulua Gulch.

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APPENDIX D

*Archaeological Assessment of the Proposed Bridge
Replacement Site at Kaupakulua, Hamakuoloa District,*

Cultural Surveys Hawaii

*December 1995
Revised April 1996
Revised June 1996*

**Archaeological Assessment of the Proposed Bridge
Replacement Site at
Kaupakalua, Hamakualoa District, Island of Maui**

by

Brian L. Colin, B.A.

and

Hallett H. Hammatt, Ph.D.

Prepared for

Wilson Okamoto & Associates

Cultural Surveys Hawaii
Revised April 1996
Revised June 1996

ABSTRACT

At the request of Wilson Okamoto and Associates, Cultural Surveys Hawaii Inc. conducted an archaeological assessment of the site for a proposed bridge replacement in Kaupakalua, Maui. An archaeological survey was conducted of the area surrounding the existing Kaupakalua Bridge on Peahi Road and an area extending from the existing bridge to approximately 90.9 m. (300 ft.) to the north and 30.0 m. to the east and west of the existing bridge (the proposed limit of the construction area for the bridge replacement). The bridge is located on Peahi Road where it crosses the Kaupakalua stream just south (*mauka*) of the Kaupakalua Reservoir. The present bridge is a timber structure that is planned for immediate replacement through the Department of Public Works and Waste Management, County of Maui. The new bridge's proposed placement is approximately 36.4 m. (120.0 ft.) to the north of the existing bridge.

A complete survey of the area underneath and surrounding the existing Kaupakalua bridge was conducted on a single day and an area extending approximately 90.9 m. to the north and 30.0 m. to either side of the streambed was conducted on foot during the second day of survey. The survey was conducted to determine the presence or absence of cultural remains that would be impacted by the replacement of the bridge. Research was also conducted to determine if the bridge qualified for placement on the historic register.

No archaeological sites were observed within the project area. The bridge itself, built in 1911 and was not considered a historic bridge in the Maui Inventory of Bridges because of its lack of integrity and its relatively recent reconstruction, in 1941 and again in 1985.

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INTRODUCTION

Project Area Description

The project area is located in the Makawao Judicial District of east Maui within Hamakualoa, in the *ahupua'a* of Kaupakalua along the northern slopes of Haleakala (Figures 1-3). The *ahupua'a* of Kaupakalua is divided into a east and west *ahupua'a* subdivisions. The project area is situated within the eastern division. The bridge is located along Peahi Road where it crosses Kaupakalua Stream just south of the main body of the Kaupakalua Reservoir.

At the time of the first survey (March 1995) the stream bed was completely dry but it was relatively clear of brush and weeds therefore implying that the stream flow is intermittent (see Figures 7 and 8). On the second day of the survey (April 1996) the stream and reservoir both contained substantial standing water (approximately 8-10 ft. below the bridge) (see Figures 9 and 10). The location of the reservoir adjacent to the project area presumably has affected the project area through bulldozing to create the reservoir and subsequent siltation produced by the reservoir.

The vegetation surrounding the bridge and along the stream bed embankments consisted of various grasses and weeds, banana (*Musa paradisiaca*), guava (*Psidium guajava*), bamboo (*Schizostachyum glaucifolium*), christmas berry (*Schinus terebinthifolius*), and mango (*Mangifera indica*).

Scope of Work

The scope of work called for; 1) A complete ground survey of the entire project area for the purpose of site inventory. All archaeological sites, if any, were located, described, and mapped with evaluation of function, interrelationship, and significance. Documentation included photographs and scale drawings of all sites and complexes. 2) Historical background research on the project area identified previously reported sites and areas of historical interest, 3) An evaluation of the historical significance of the existing bridge structure if it is identified in the historical inventory of Maui Bridges, 4) A report detailing the results of the first three items which will include an evaluation of potential archaeological impact of bridge replacement in the study area as well as mitigation if appropriate.

Methods

Field work was conducted in two days by a qualified archaeologist. Field work consisted of a 100% ground survey, on foot, of the area underneath the bridge and the surrounding area within a 30 meter radius of the existing bridge structure, including the road, stream bed, and the stream embankments. The second day of survey consisted of a complete (100%) ground survey, on foot, of the area extending 90.9 m. north of the existing bridge and 30.0 m. to the east and west of the base of the stream bed. Photographic documentation of the bridge and surrounding area was also conducted during the surveys.

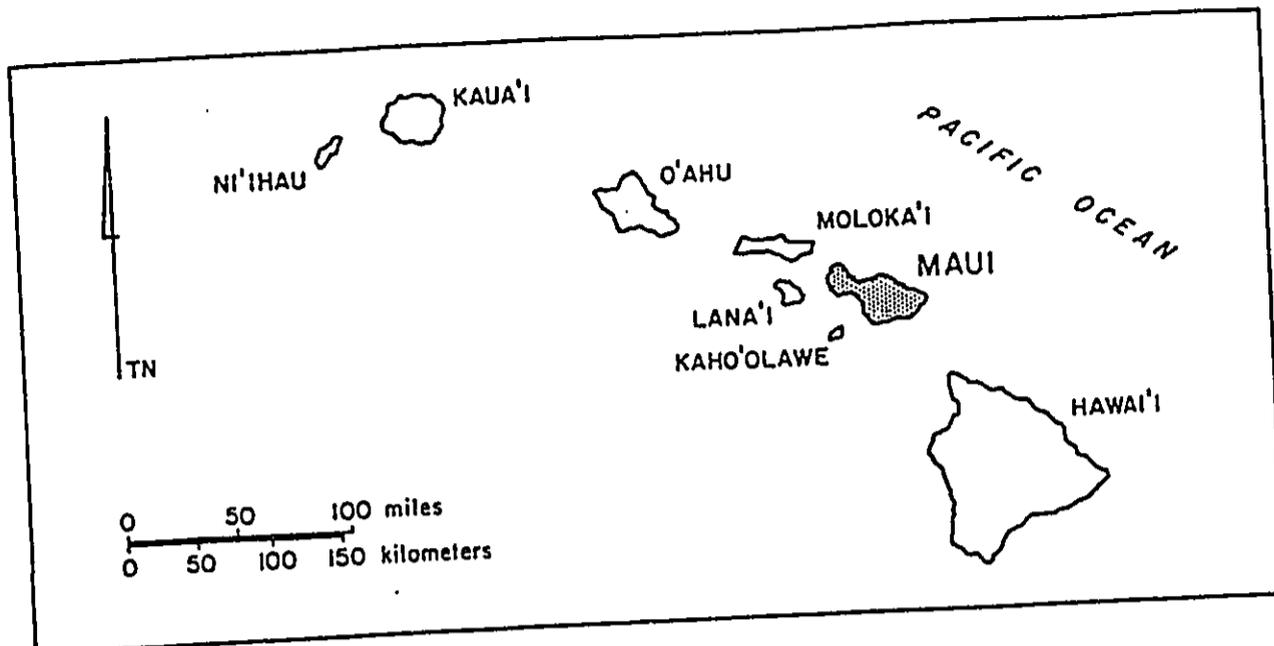


Figure 1 State of Hawai'i

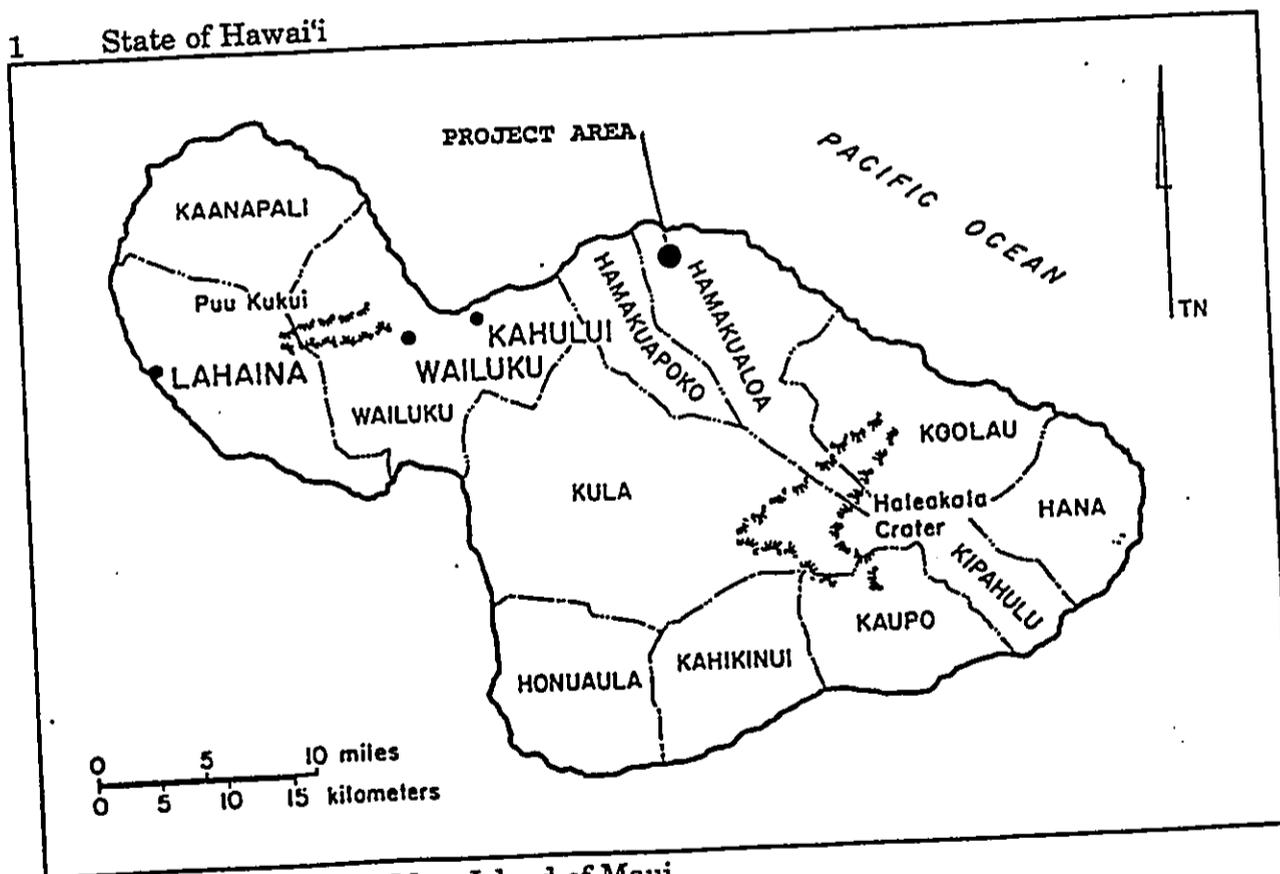


Figure 2 General Location Map, Island of Maui

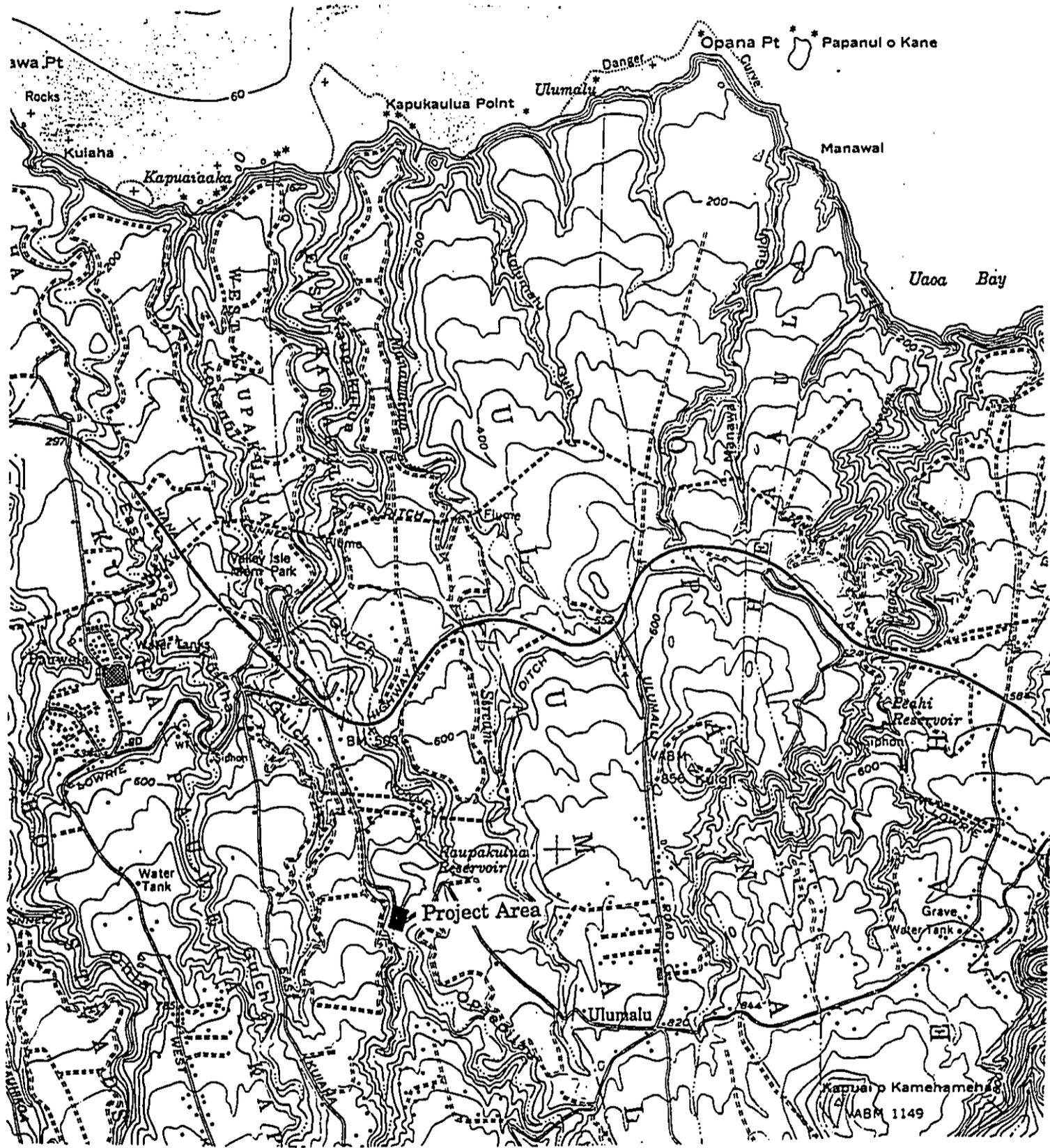


Figure 3 Portion of USGS 7.5 minute series, Haiku Quad, displaying project area

HISTORIC BACKGROUND

The present study parcel is situated in Kaupakalua, an *ahupua'a* in the Hamakualoa district of Maui. Historical documentation by E.F. Craighill Handy and Elizabeth Handy outline likely general patterns in the several *ahupua'a* of Hamakualoa:

Hamakua Poko (Short Hamakua) and Hamakua Loa (Long Hamakua) are two coastal regions where gently sloping *kula* lands intersected by small gulches come down to the sea along the northern coast line of East Maui....Stream taro was probably planted along the watercourses well up into the higher *kula* land and forest taro throughout the lower forest zone. The number of narrow *ahupua'a* thus utilized along the whole of the Hamakua coast indicates that there must have been a very considerable population. This would be despite the fact that it is an area of only moderate precipitation because of being too low to draw rain out of trade winds flowing down the coast from the rugged and wet northeast Ko'olau area that lies beyond. It was probably a favorable region for breadfruit, banana, sugar cane, arrowroot; and for yams and 'awa in the interior. The slopes between the gulches were covered with good soil, excellent for sweet-potato planting (Handy and Handy 1972:498).

The Handys' observations suggest that the lands of and surrounding the present study parcel would have offered area amenable to plantings of several crops by the Hawaiian population; sweet potato being specific to the subject area along with gathering of non-cultivated plants (i.e. *olona* and medicinal plants). This area would also likely have contained habitation sites -both permanent and temporary- associated with the agriculture along the coast. The Kaupakalua Complex (State site 50-50-06-1221), consisting of irrigated terraces and associated features, *makai* (north), approximately one mile, of the present study area, supports their discussion.

The entire *ahupua'a* of West Kaupakalua was awarded to Nueku Namau'u, Land Commission Award #10474 and Royal Patent No. 4490 (Boundary Commission, Maui, Vol. 3: page 496-528). In Marion Kelly's "Gardens of Kona" (1983:26) she relates the following on Namau'u:

Through his father, Manena, Nueku Namau'u was a distant cousin of Mataio Kekuannao'a, father of Kamehameha IV and V and Governor of Oahu in the 1840s (Pukui, Elbert, and Mookini 1974:106). Manena worked for Kamehameha I, serving perhaps as an assistant to John Young on Oahu in 1812 (Reynolds 1938:110-111). Namau'u was a brother-in-law of Manuia, who was

nephew of Ke'eaumoku and was one of several *kahu* (guardians) of Liholiho (Kamakau 1961:220); he accompanied Liholiho to England in 1823 (Ibid.:256). On his return, Manuia was placed in charge of "Fort Ke-kua-nohu, of the fortified hill of Punchbowl, and the harbor of Kou [Honolulu] and made...Chief Marshall" (Kamakau 1961:273). Having such politically powerful relatives encouraged Namau'u to be active in government affairs. He served the Kamehameha family and was a *konohiki* of lands on Oahu (Native Testimony 3:25 ff).. Before Manuia left Hawaii to accompany Boki to the New Hebrides in 1829, he gave his property to Liliha, Boki's wife, and she in turn gave it to Kapoli, the wife of Namau'u, according to testimony by M. Kekuanao'a (Probate 885, First Circuit Court).

Namau'u was given control of the *ahupua'a* of Ho'ae'ae in 'Ewa by Manuia, who had received it from Liholiho (Native Testimony 3:65). Manuia had given permission to Lewis Rees to raise goats on Ualena, an *'ili* within Ho'ae'ae. The arrangement was that Rees would care for the goats and would receive as his compensation half interest in any new kids born there. Rees was awarded 3,453 acres (LCA 193), the whole seaward portion of Ho'ae'ae, after many pages of testimony had been taken by the Commissioners (Award Bk. 1:523-531); the award to Namau'u was reduced by the acreage awarded Rees (Award Bk. 10:624-625).

In the Mahele of 1848, Namau'u received eleven lands. Some of his land came in recognition of his and his father's services, and some because he and his sister, Kaupena, had inherited them from her husband Manuia (Native Testimony 3:25-30, 54-56, 64-66).

On August 18, 1847, N. Namau'u was appointed to the Board of Commissioners to Quiet Land Titles in place of John Young Kanehoa, eldest son of John Young, Sr., who resigned (Kuydendall 1938:280, note 37). Upon his death in 1848, Namau'u was replaced on the Board by S.M. Kamakau (Ibid.).

Kekuanao'a inherited the Namau'u lands, including to in Kona, Moeauoa, and Awake'e. Kekuanao'a surrendered Moeauoa, along with four other lands of Namau'u, to the government in lieu of commutation (*Indices...*1929:80).

Two Grants are displayed on a Haiku Plantation map near the project area these are: Grant 383 to R. Armstrong and Grant 771 to Hikiau. R. Armstrong (Reverend Richard) was stationed at Wailuku, Maui and "by the request of the King" was persuading people to plant sugar (Speakman 1978:117). Grant 383 is located along the western side of the Kaupakalua Gulch.

The second grant (Grant 771) was awarded to Hikiau, who was the daughter of Kapele, who is a sister of Hewahewa (the Kahuna of Kamehameha I) (McKinzie 1983:86). The grant is located along the eastern side of the Kaupakalua Gulch.

Both of the grants and the LCA to Namau'u were incorporated into the Haiku Sugar Company which was established after the mid-nineteenth century by Samuel T.

Alexander and Henry Perrine Baldwin (Speakman 1978:120). Haiku Sugar Company was subsumed in the larger Maui Agricultural Company in 1904.

Currently there is a reservoir situated *makai* (north) of the existing bridge. There are a number of privately owned lots surrounding the gulch and existing bridge.

PREVIOUS ARCHAEOLOGICAL RESEARCH

No archaeological studies have been conducted within the project area or the immediate vicinity. Apparently there is only three previously recorded archaeological sites within the entire *ahupua'a*. The Kaupakalua agriculture complex (State site 50-50-06-1221) is situated within the Kaupakalua gulch along the *makai* (north) side of the Hana Highway. The Kaupakalua Winery (State site 50-50-06-1576) is located at the junction of East Kuiuaha Road and Kaupakalua Road approximately 1.33 miles to the south of the project area. The third site, the Kaupakalua Village (State site 50-50-06-1569) is located mid-way between Makawao and Pauwela approximately 0.758 miles to the west of the project area. In the neighboring bays and gulches within surrounding *ahupua'a* a number of sites have been recorded. The closest of these sites is approximately one mile away. The following is a short synopsis of these sites (Figure 4):

- Site 50-50-06-2928, An unmarked grave site, this site is briefly reported on by Xamanek Researchers. It is situated to the southwest of the present study area on the eastern edge of East Kuiuaha.
- Site 50-50-06-1221, Kaupakalua Complex, this site consists of an agricultural complex comprised of irrigated terraces and associated features. It is located approximately one mile from the coast and is situated approximately one mile to the north of the present study area. It was recorded during the 1973 Statewide Inventory.
- Site 50-50-06-61, *Heiau* Kapuai O Mene, this site was reported destroyed by the Statewide Inventory Survey. It was situated inland at Kuloli in the *ahupua'a* of Opana.
- Site 50-50-06-62, Paho *Heiau*, this site was also reported destroyed by the Statewide Inventory Survey. It was situated along the coastal point in the

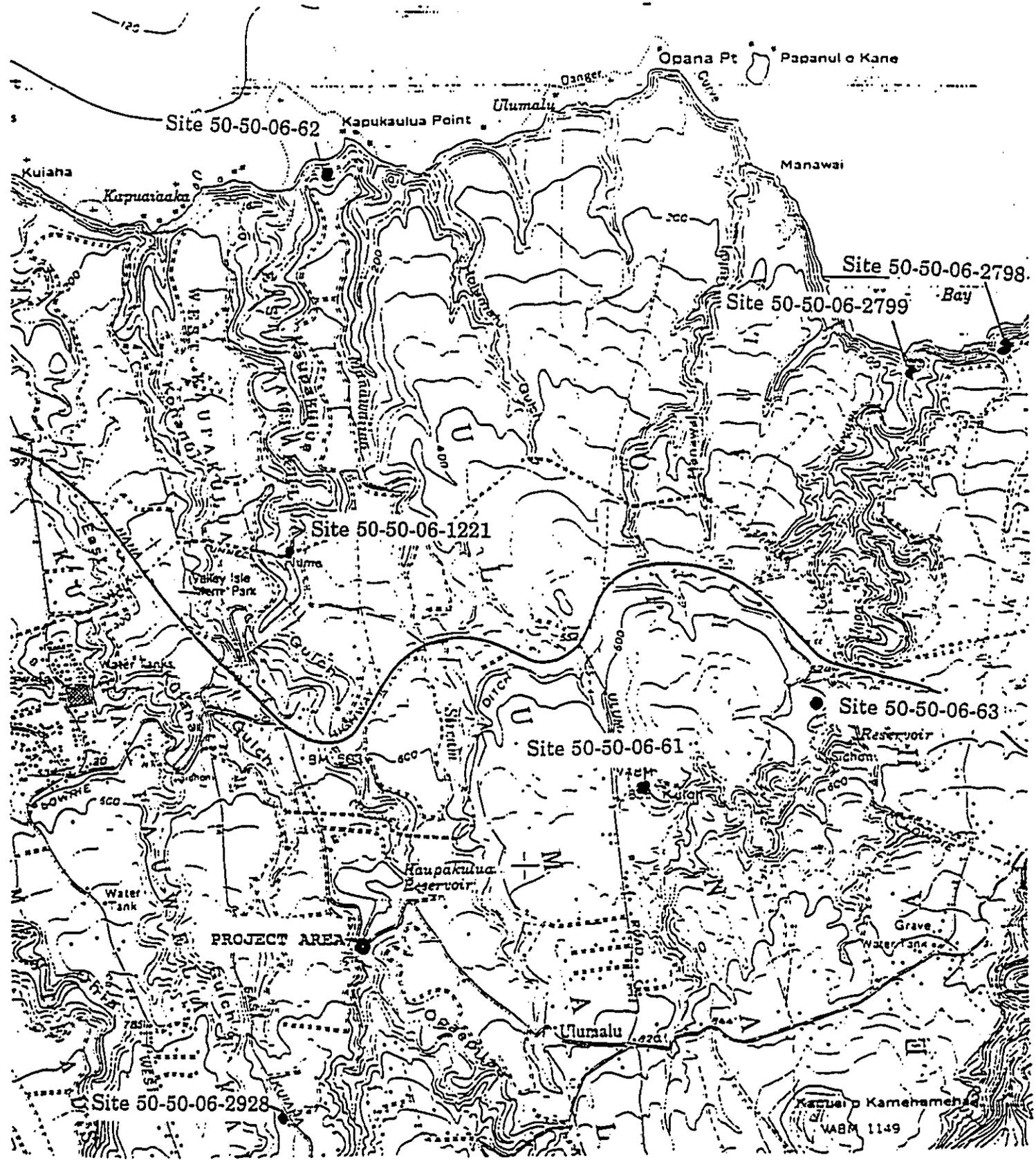


Figure 4 Portion of USGS 7.5 minute series, Haiku Quad, showing archaeological sites in the vicinity

ahupua'a of Opana.

-Site 50-50-06-63, Pu'uokaniau *Heiau*, this site was also reported destroyed by the Statewide Inventory Survey. It was situated inland near the Peahi Reservoir.

-Site 50-50-06-2798, Possible shrine, this site "consists of a badly deteriorated segment of a retaining wall, a scatter of rocks and boulders, and one prominent boulder in a central area on a 30% slope (Pantaleo and Sinoto 1992:7). It is situated in Keali'i iki Gulch within the *ahupua'a* of Peahi. This site was recorded in 1992 by Aki Sinoto and Jeffrey Pantaleo in "Archaeological Inventory Survey of the Proposed Pili Hale Agricultural Subdivision, Peahi, Makawao, Maui, TMK 2-8-04:15 and :30."

-50-50-06-2799, a historic roadway, situated in the *ahupua'a* of Peahi, also recorded in the aforementioned study (Pantaleo and Sinoto 1992:9-10).

-50-50-06-1576, the Kaupakalua Winery, is a historic winery, situated in the *ahupua'a* of Kaupakalua. It was recorded by J.C. Wright in March of 1974 and the only evidence left of the site consists of two cisterns and a small waterhole. The site is listed as being of reserved value.

-50-50-06-1569, the Kaupakalua Village, situated mid-way between Makawao and Pauwela, was noted by J.C. Wright in March 1974 and is listed as being of marginal value.

SETTLEMENT PATTERN SUMMARY AND EXPECTED FINDINGS

The settlement pattern for the area surrounding the project would have probably been typical for the Hamakua District of Maui. It would be expected that habitation would have been concentrated along the coast and within the larger valley systems with permanent stream flow. Within these valleys intensive agricultural pursuits (i.e. taro *loi*) would have been taking place in association with habitation activities. For areas without constant stream flow (i.e. the project area) agricultural activities would not have been as intensive but rather more opportunistic with sweet potato being the main crop although the gathering of non-cultivated agricultural crops (i.e. *olona* and possibly medicinal plants) would also be expected. Habitation within areas without constant stream flow would still be expected to be concentrated along the coast. Therefore, within the project area, site density would be relatively low, habitation activities would be expected further *makai* along the coast and agricultural activities would be expected to be non-intensive. Although agricultural activities most likely took place within the project area the probability for evidence of this activity remaining is extremely low due to the non-intensive nature of the agriculture. This coupled with the construction activities of the

Kaupakalua Reservoir in all probability have obliterated all cultural remains, if any, within the project area.

FINDINGS AND RECOMMENDATION

No archaeological sites were encountered during the present study. The existing bridge structure was built in 1911 as a timber bridge and rebuilt in 1941 and subsequently 1985. It is mentioned in the 1990 Maui County Bridge Inventory (Hawaii Heritage Center 1990) but was not rated as a historic bridge because of its lack of integrity and relatively recent date of rebuilding. The Maui County Bridge Inspection report for 1993 mentions reconstruction of the bridge in 1985.

During the survey the banks of the stream were examined for possible exposed cultural layers or sites. The banks appear to be composed of different episodes of siltation associated with the adjacent Kaupakalua Reservoir. The possibility of cultural remains below the silt layers is not considered probable due to the fact that if there were any cultural remains they were probably obliterated during the construction of the reservoir.

A pile of rocks was observed along the eastern bank of the stream/reservoir at the proposed new bridge location. Upon examination of this pile it is believed to be associated with the construction of the reservoir (i.e. bulldozing).

The present plans for the bridge replacement include a new bridge to be constructed approximately 150 ft. *makai* of the present bridge. This archaeological survey included the realignment of the road and construction of a new bridge. The project area was surveyed in two days. The first day of survey, concentrated around the existing bridge, covered an area of approximately 30.0 by 30.0 m. The second day of survey covered an area of approximately 90.0 m. to the north of the existing bridge and approximately 30.0 m. to either side of the stream bed.

For the reasons stated above, the replacement of the bridge and its associated activities will have no impact on any archaeological/historic sites. If, in the unlikely event, any archaeological remains are encountered during construction, work should be halted in that area and State Historic Preservation Division (SHPD) should be contacted at 587-0047 to determine appropriate treatment of any findings.

PHOTOGRAPHIC APPENDIX

DOCUMENT CAPTURED AS RECEIVED

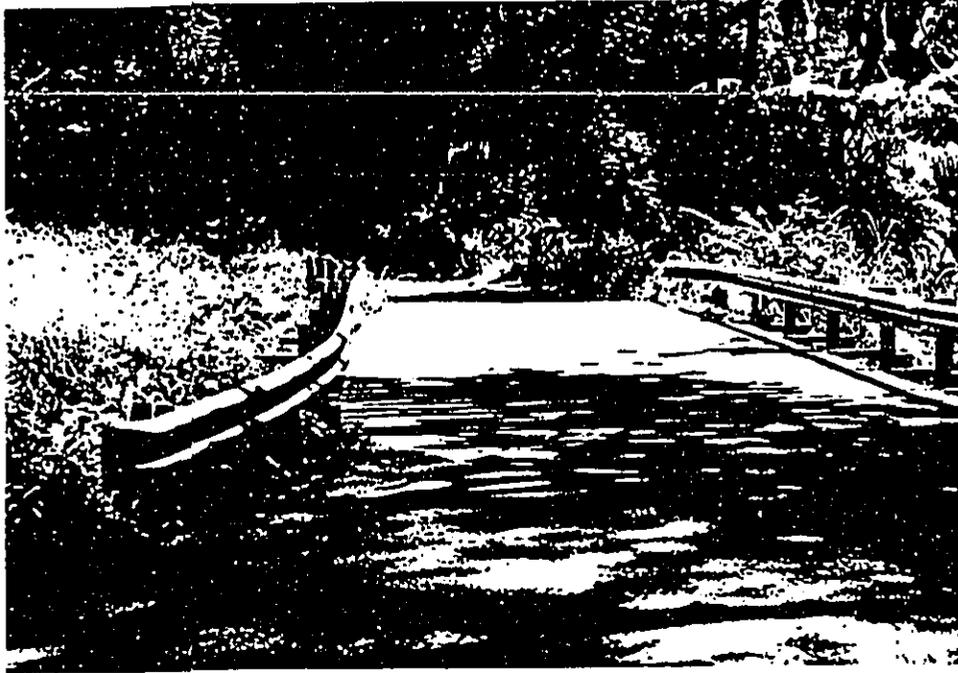


Figure 5 Kaupakalua Bridge, view to east from Peahi Road



Figure 6 Kaupakalua Bridge, view to west from Peahi Road



Figure 7 Kaupakalua Bridge, view to south from streambed

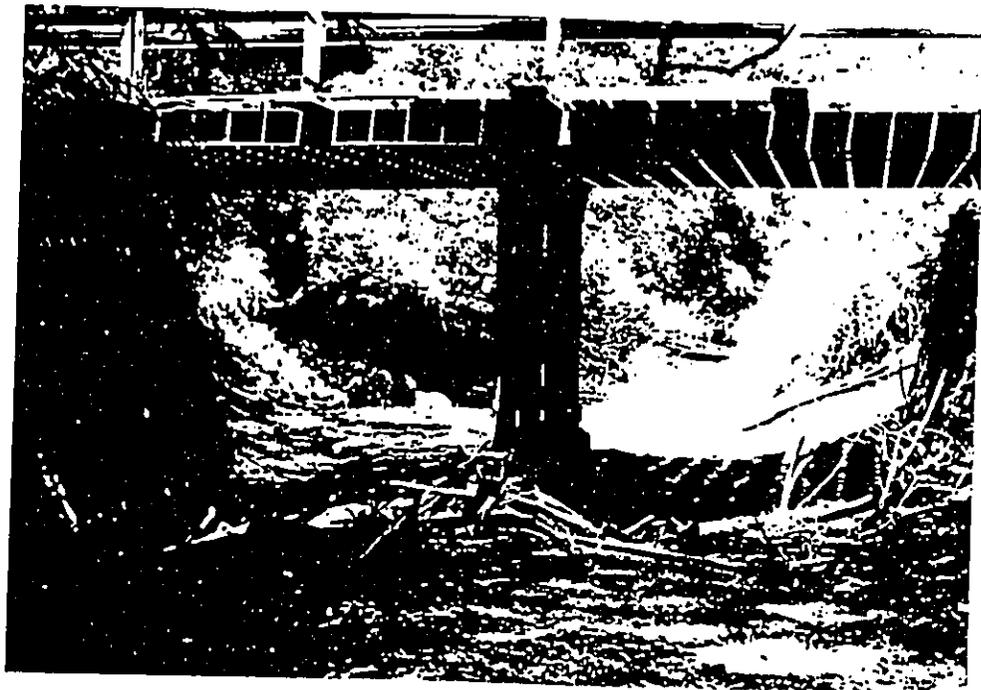


Figure 8 Kaupakalua Bridge, view to north from streambed



Figure 9 Kaupakalua Bridge with reservoir full, view to south



Figure 10 Kaupakalua Bridge, view to north with reservoir full

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