LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director
AARON SHINMOTO, P.E.
Chief Staff Engineer

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration
EASSIE MILLER, P.E.
Wastewater Reclamation Division
LLOYD P.C.W. LEE, P.E.
Engineering Division
DAVID WISSMAR, P.E.
Solid Waste Division
BRIAN HASHIRO, P.E.
Highways Division

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

March 14, 1995

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

SUBJECT: NEGATIVE DECLARATION FOR KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS, FINAL ENVIRONMENTAL ASSESSMENT
TAX MAP KEY: 5-3-01,02,09, VARIOUS 5-4-07, 08 VARIOUS
KAUNAKAKAI, MOLOKAI, HAWAII

The County of Maui, Department of Public Works has reviewed the comments received during the 30-day public comment period which began on September 23, 1994. Our agency has determined that this project will not have a significant environmental effect and has issued a negative declaration. Please publish this notice in the April 8, 1995 OEQC Bulletin.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the Final EA. If you have any questions, please contact Joe Krueger of the County of Maui, Department of Public Works, Engineering Division at 243-7745 or Barry Toyota of Wilson Okamoto & Associates, the EA consultant at 946-2277.

Thank you for your attention to this matter.

Very truly yours,

CHARLES JENCKS
Director of Public Works
and Waste Management

Enclosures
LL/JK:c(ED95-369)
k:\kakai.EQC

26

1995-04-08-MO - Kaunakakai Town Drainage Improvement

APR - 8 1995

FINAL ENVIRONMENTAL ASSESSMENT
NEGATIVE DECLARATION
for the
KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
KAUNAKAKAI, MOLOKAI

Prepared for:

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

Prepared by:

WILSON OKAMOTO & ASSOCIATES, INC.

MARCH 1995

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Prepared by:

WILSON OKAMOTO & ASSOCIATES, INC.
1907 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96826
WOA: 2931-02

MARCH 1995

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PREFACE

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

This Environmental Assessment (EA) has been prepared to meet the requirements of Chapter 343 HRS and Title 11, Chapter 200 by documenting the environmental effects from the implementation of the Kaunakakai drainage improvements. The proposed project is an agency action by the County of Maui Department of Public Works.

SUMMARY
KAUNAKAKAI DRAINAGE IMPROVEMENTS, MOLOKAI
FINAL ENVIRONMENTAL ASSESSMENT
NEGATIVE DECLARATION

Proposing Agency:	County of Maui Department of Water Supply Engineering Division 200 South High Street Wailuku, Hawaii 96793 Contact: Joe Kruger
EA Preparer:	Wilson Okamoto and Associates, Inc. 1907 South Beretania Street, Suite 400 Honolulu, Hawaii 96826 Contact: Barry Toyota, Project Manager
Tax Map Key:	Zone 5; Section 3; Plats 01, 02, 03, 06, 07, 09 Section 4; Plats 07, 08
Location:	Kaunakakai, Molokai, Maui County
Area:	The study area which would be served by the proposed drainage improvements encompasses about 431 acres.
Ownership:	County of Maui and various private landowners
Proposed Action:	Drainage system improvements
Impacts:	Short-term impacts include dust emissions, noise, and occasional roadway obstruction. The long-term impact is improved drainage conditions within the town of Kaunakakai.
Agencies Consulted In Pre-Assessment Process:	State of Hawaii Department of Land and Natural Resources, State Historic Preservation Division County of Maui Department of Public Works

Agencies Consulted Prior to Preparation of Final Environmental Assessment:

Federal Agencies
US Dept. of Agriculture Soil Conservation Service
US Army Corps of Engineers Pacific Ocean Division
US Dept of the Interior Fish and Wildlife Services
US Dept of Commerce National Marine Fisheries Svc.

State Agencies
Department of Accounting and General Services
Department of Agriculture
Dept. of Business, Economic Development and Tourism
DBED & T - State Energy Office
DBED & T - Molokai Office
Department of Defense
Department of Education
Department of Hawaiian Home Lands
Department of Land and Natural Resources - SHPD
Department of Land and Natural Resources - WRC
Department of Land and Natural Resources
Department of Health
Department of Health - Environmental Mgmt. Division
Department of Transportation
Office of State Planning
Office of Hawaiian Affairs
University of Hawaii Water Resources Research Center
University of Hawaii Environmental Center

County Agencies
Department of Water Supply
Planning Department
Department of Parks and Recreation
County of Maui Economic Development Agency
Councilmember Pat Kawano

Molokai Organizations
Molokai Planning Commission - Walter Ragsdale
Molokai Task Force - Harry Chung
Molokai Economic Opportunity - Fred Bicoy
Molokai Ranch - Ian Hurst
Bank of Hawaii - Kip Dunbar
Hawaiian Electric Company, Ltd.

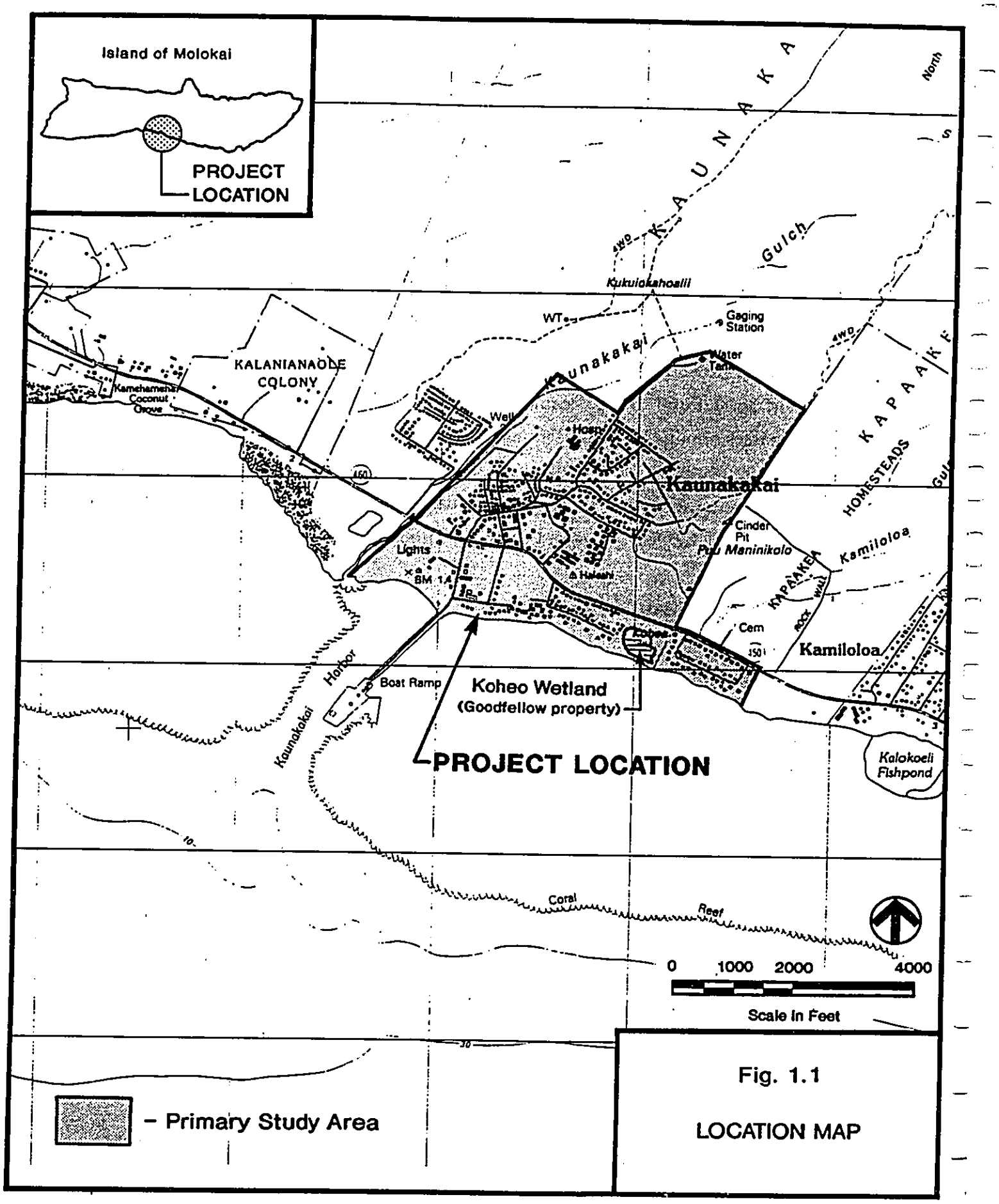
1. INTRODUCTION

1.1 Project Location

Kaunakakai is located on the south-central coast of the island of Molokai. It is the center of population, government, commerce, and water transportation activities for the island. The areal limits of the proposed drainage improvements encompass Kaunakakai Town and its residential areas, Kapaakea Homestead Subdivision, and adjacent agricultural and pastoral lands (see Figure 1.1). The primary study area encompasses about 431 acres. Drainage areas which extend into the upper portions of the East Molokai Mountains above Kaunakakai consist of an additional 7,144 acres. Although not part of the primary study area, runoff from these upper areas will be collected by the proposed drainage improvements.

1.2 Drainage Master Plan

A Drainage Master Plan for Kaunakakai, Molokai, Hawaii was prepared in August 1992 for the County of Maui Department of Public Works to provide the County of Maui with a comprehensive drainage master plan for systematic and orderly development of drainage improvements in Kaunakakai. The report also provided recommendations for relieving the existing flooding problems. Proposed drainage improvements in the report consisted of a combination of drainlines, grated inlets, catch basins, box culverts, and shallow open channels sized for a 10-year storm. Proposed roadway culvert crossings were sized for a 50-year storm. Hydrology calculations in the report were made by using the U.S. Department of Agriculture Soil Conservation Service (SCS) Tabular Method, and by following standards in the 1971 report, "Drainage Master Plan for Maui County".


Island of Molokai
PROJECT LOCATION
KAUNAKA
North
Gulch
4wd
Kukuiokahoalii
WT
Gaging Station
Kaunakakai
Water Tank
KALANIANAOLE COLONY
Kamehameha Coconut Grove
Well
Hosp
Kaunakakai
KAPAAKEA HOMESTEADS
Cinder Pit
Puu Maninikolo
Kamiloloa
Lights
BM 1A
Huleahi
Cem
Kamiloloa
Harbor
Boat Ramp
Koheo Wetland
(Goodfellow property)
PROJECT LOCATION
Kaunakakai
Kalokoeli Fishpond
Coral
Reef
0 1000 2000 4000
Scale in Feet
– Primary Study Area
Fig. 1.1
LOCATION MAP

1.3 Project Implementation

This Environmental Assessment (EA) has been prepared to document potential environmental effects of the implementation of the improvements set forth in the County of Maui Drainage Master Plan for Kaunakakai, Molokai. Although this EA examines the environmental effects of implementation of all of the improvements identified in the Master Plan, at this time, the County of Maui intends to construct only System A as described in Chapter 2.

This EA will also serve as the required environmental documentation for implementation of the subsequent improvements described in Chapter 2. The County of Maui intends to construct these subsequent improvements as funds become available. At this time, no schedule has been established for these subsequent improvements.

2. DESCRIPTION OF THE PROPOSED PROJECT

2.1 Project Need

Drainage problems resulting in flood conditions from runoff during periodic rains and storms have plagued the Kaunakakai area for years. These floods have caused damage to homes and businesses, created inconvenience to residents and visitors, caused hazardous driving conditions, and have limited the availability of emergency services to certain portions of the island.

The flooding is caused by a combination of natural and man-made factors. These include inadequate or nonexistent drainage systems in the business areas of Kaunakakai town, inadequate drainageways to convey the runoff from existing systems in the upper portion of the town to the ocean, poorly maintained drainage systems, poorly drained soils in low-lying areas, and relatively flat topographic conditions.

2.2 Existing Drainage System

The existing drainage system consists of ditches, levees, grassed swales, berms, roadway culverts, catch basins, and drainlines. These systems were designed to convey, divert, or retain runoff generated within the primary study area. However, many of these systems are badly in need of maintenance, and many of the downstream systems (ditches and roadway culverts) are incapable of accommodating the runoff generated from developed conditions upstream. In addition, several of the roadway culvert crossings were noted to have outlet inverts lower than the invert of the outlet drainageway, thus resulting in ponding during periods of low flow.

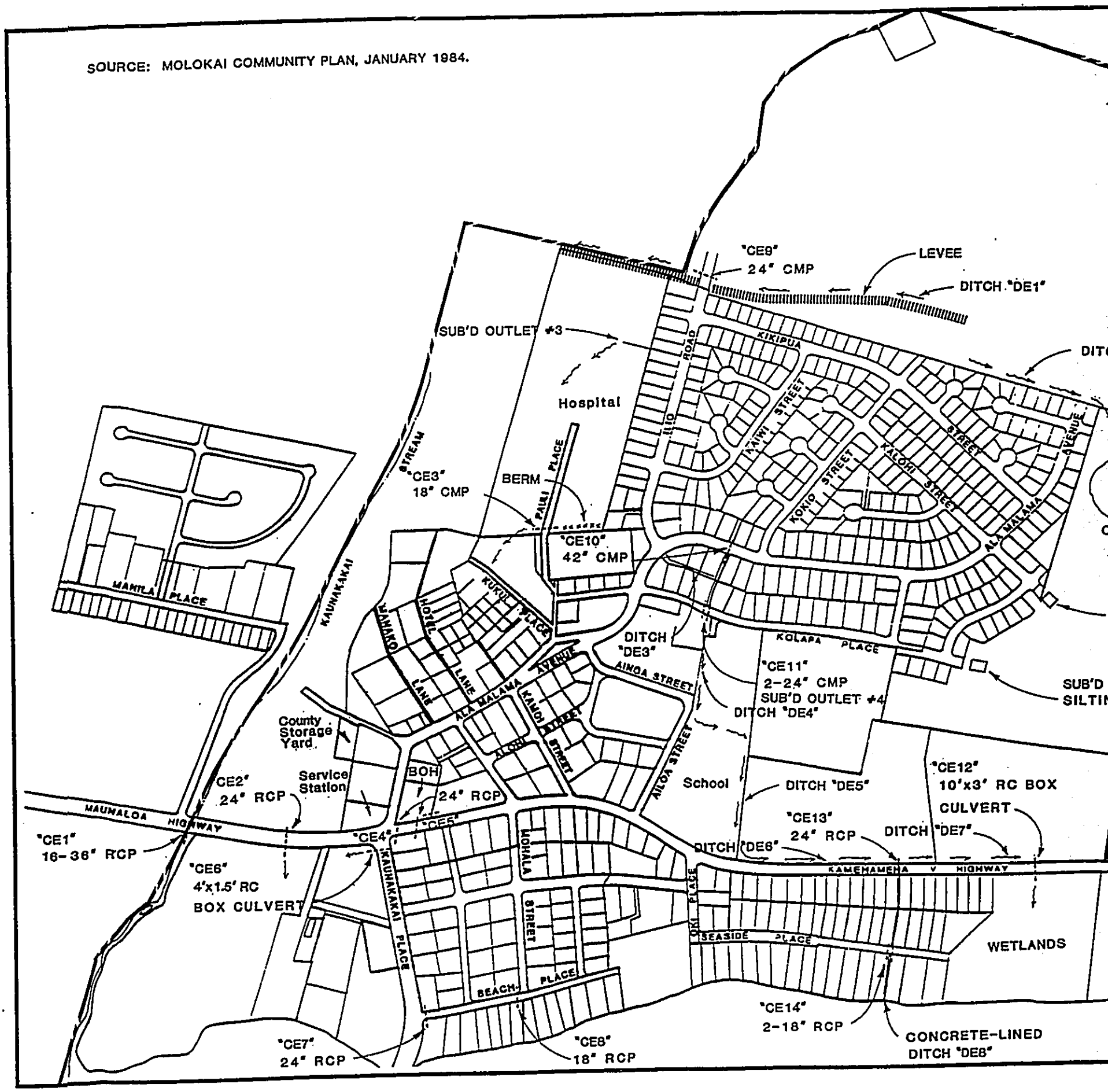
The Kaunakakai Drainage Master Plan divided the existing drainage system into five sub-areas for analysis. These five sub-areas were as follows: 1) Kaunakakai Stream, 2) the Kaunakakai Town area along Ala Malama Avenue down to Beach Place, 3) the upper Kaunakakai subdivision area, 4) Kaunakakai School down to Seaside Place, and 5) the Kapaakea Loop subdivision. The following discussion of these existing sub-areas is based on drainage conditions at the time the Kaunakakai Drainage Master Plan was being prepared (1991-92). Figure 2.1 provides an overview of the existing culverts and ditches in the study area.

2.2.1 Kaunakakai Stream

The portion of Maunaloa Highway which crosses Kaunakakai Stream is designed as a ford. Currently, sixteen 36-inch Reinforced Concrete Pipe (RCP) culverts (designated "CE1") pass flow under the roadway during periods of low flow and light rain conditions. Figure 2.2 shows photographs of the ford crossing during low flow, and of Kaunakakai Stream the day after heavy rains. During periods of heavy rainfall, storm flows will overtop the ford crossing. It is estimated by Maui County public works personnel that this occurs about two to three times per year, on average. Three-foot concrete posts alongside the highway are painted red at the level indicating the depth of the flow considered dangerous for vehicles to cross the ford.

Although Kaunakakai Stream overflows Maunaloa Highway during periods of heavy rainfall, a levee constructed by the Corps of Engineers prevents the stream from further flooding the town area. The main problem with the stream overflowing the ford is the inability of vehicles to get from one side of the stream to the other. Thus, access to emergency services such as Molokai General Hospital, police, and fire protection is severely hampered.

SOURCE: MOLOKAI COMMUNITY PLAN, JANUARY 1984.



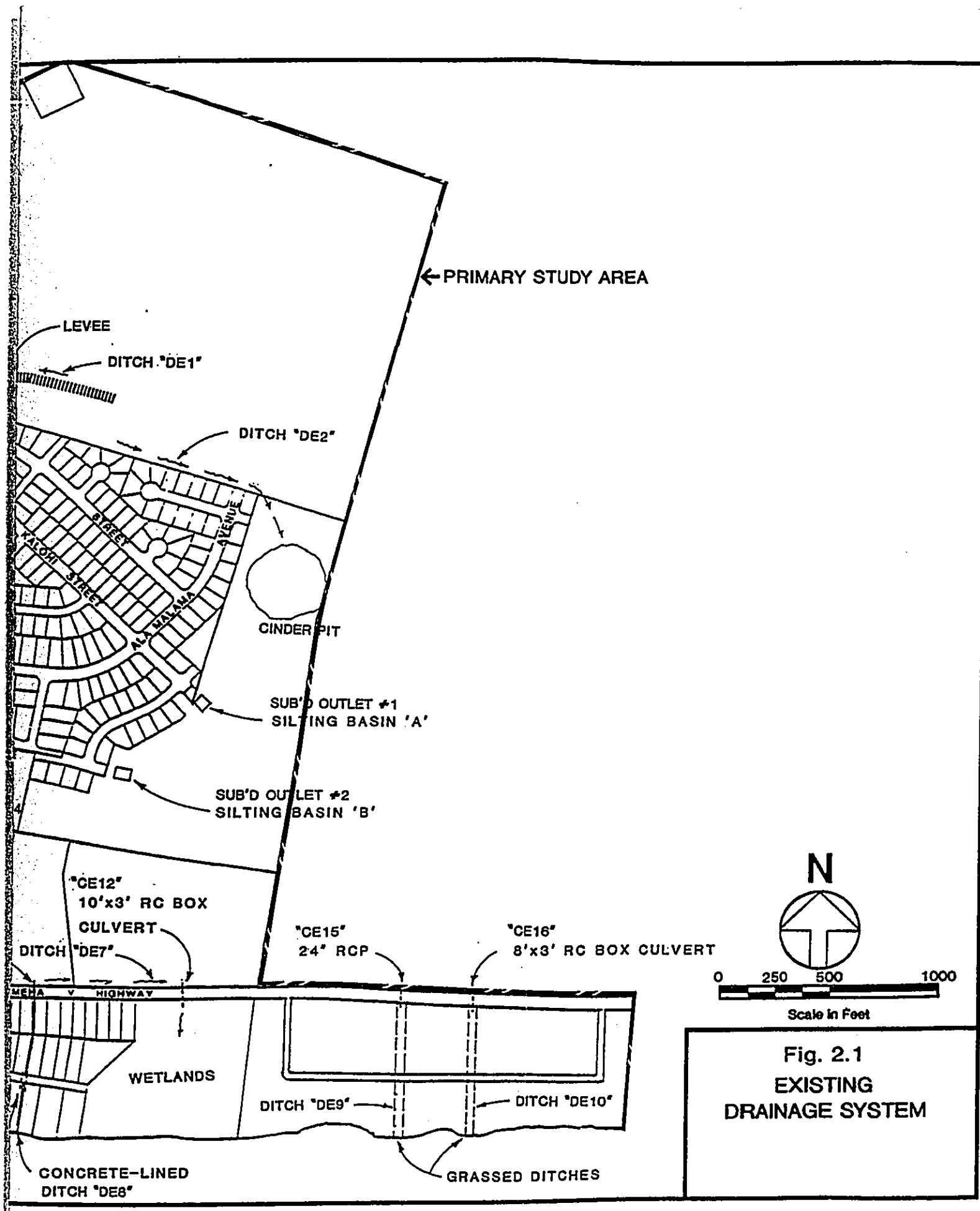
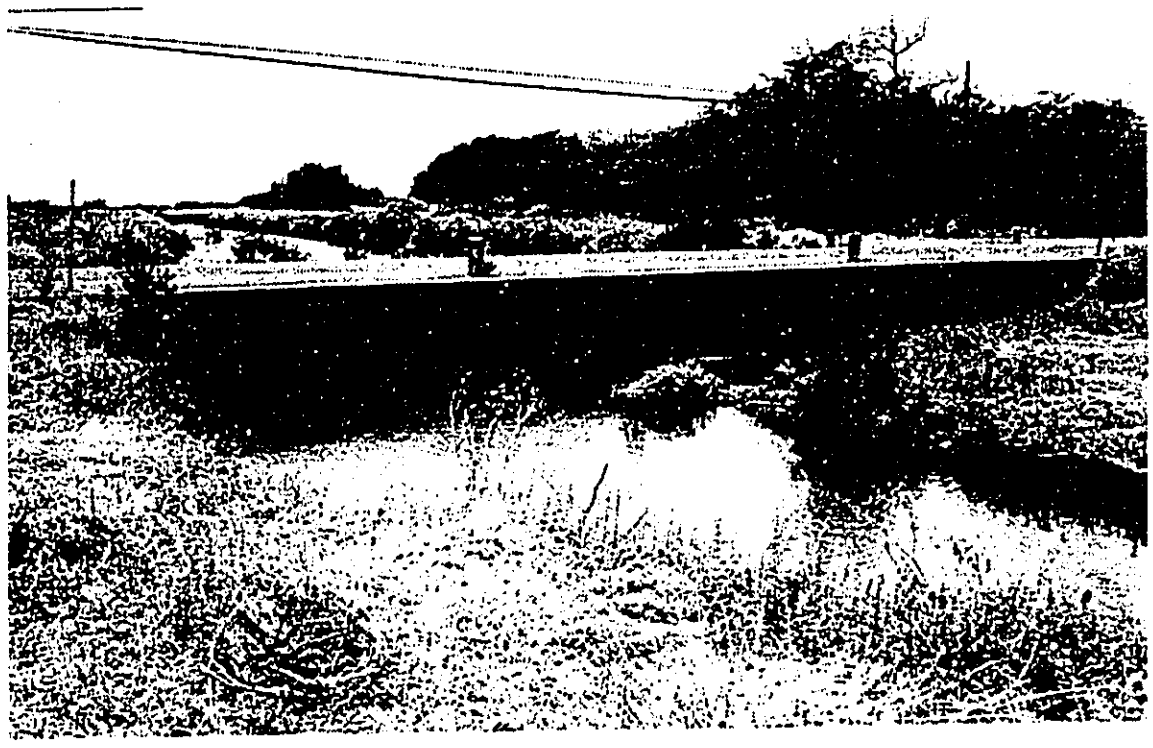


Fig. 2.1
EXISTING
DRAINAGE SYSTEM



Ford crossing at Maunaloa Highway and Kaunakakai Stream during low flow conditions

Downstream view of Kaunakakai Stream the day after heavy rains.

Fig. 2.2

2.2.2 Kaunakakai Town to Beach Place

Above the town's business district, along the southwestern boundary of Molokai General Hospital, a 3 to 4-foot high earthen berm diverts sheet flow generated above the Armory. The berm passes the flow under Pauli Place through an 18-inch Corrugated Metal Pipe (CMP) culvert, "CE3". The water then sheet flows to the house lots located north of Ala Malama Avenue and collects in low points.

Within the town's business district, there are no existing drainage systems. All surface flows are currently carried along the streets. During periods of heavy rainfall, flooding occurs along Ala Malama Avenue, Alohi Street, and Mohala Street. The flooding problem is compounded by the reduced carrying capacity of the concrete gutters along Ala Malama Avenue. The reduced capacity of the gutters is the result of road resurfacing without sufficiently planing the previous road surface. Figures 2.3 and 2.4 show photographs of flooding on Ala Malama Avenue, Mohala Street, and Kamehameha V Highway during a heavy rainfall in May 1992.

On Kamehameha V Highway, there is a 24-inch RCP culvert, "CE2", which is intended to drain water from the County storage yard to the area south of the highway. However, because the invert of the pipe is about 12 inches above the existing ground, and because the ground is not graded to drain towards the culvert's inlet, water tends to accumulate in low points within the County yard.

Within the town, an inlet/catch basin system is located at the intersection of Kamehameha V Highway and Ala Malama Avenue. Water is conveyed from this system under the highway through a 24-inch RCP culvert, "CE4", into a grassed ditch running along the south side of the highway (see bottom photo on Figure 2.4).

Ala Malama Avenue after a heavy rain

Mohala Street after a heavy rain.

Fig. 2.3

Flooded lot on Mohala Street, just south of Kamehameha V Highway.

Roadside ditch on the south side of Maunaloa Highway.

Fig. 2.4

This ditch also receives flow from two drop inlets located along the north side of the highway and routes it south through a 24-inch culvert, "CE5". The roadside ditch conveys the flow west under Kaunakakai Place just south of the highway through a 4-foot x 1.5-foot Reinforced Concrete (RC) box culvert, "CE6".

From "CE6", a second roadside ditch on the south side of the highway should convey the flow to the west and around the wastewater pumping station and then south towards the ocean. However, since the ditch lacks sufficient slope to drain into the ocean, most of the runoff ponds in the ditch alongside of the highway.

The runoff generated within the area bounded by Kaunakakai Place, Mohala Street, Kamehameha V Highway, and Beach Place was designed to drain to the ocean through two culverts. The first culvert is a 24-inch CMP, "CE7", at the intersection of Beach Place and Kaunakakai Place, and the second an 18-inch CMP, "CE8", located at the intersection of Beach Place and Mohala Street. However, as the result of poor grading, most of the runoff in this area ends up ponding within low points in the area north of Beach Place.

2.2.3 Upper Kaunakakai Subdivision

Ditch "DE1" and the associated 8 to 10-foot high levee are located just north of the upper boundary of the town's existing subdivision developments, and serves as the primary diversion for runoff generated on the hill slopes above the town. The ditch is sufficient to convey the flow generated from a 50-year storm. However, a 24-inch CMP culvert, "CE9", which passes flow under the town's water tank access road cannot accommodate this occurrence. Thus, during times of heavy rainfall the ditch/levee system essentially acts as a detention basin.

A grassed swale, "DE2", directly above the subdivision lots conveys additional runoff east towards the Puu Maninikolo cinder pit. At the time of the survey, a heavy growth of grass within the swale had reduced the capacity of this swale by about half.

The subdivisions below or south of the diversion ditch/levee are served by several drainline and catch basin systems. These drainage systems empty into two silting basins and two natural drainageways. Silting basin "A" (subdivision outlet #1), located at the end of Kalohi Street, was badly overgrown with tall grass and koa trees at the time of the survey, and had a large build-up of silt material which reduced the capacity of the basin by as much as 75%. Overflow from this basin is conveyed by a CRM spillway south into a natural drainageway which outlets onto the cultivated fields adjacent to Kamehameha V Highway.

Silting basin "B" (subdivision outlet #2), located at the end of Kolapa Place, was also overgrown with tall grass and some koa trees, but the accumulation of silt was much less pronounced than basin "A". As with basin "A", basin "B" has a CRM spillway which drains overflow south onto the cultivated fields. In spite of the heavy growth in both basins, they appeared to be structurally stable.

One of the two natural subdivision drainageways, subdivision outlet #3, begins about 300 feet north of Molokai General Hospital and eventually drains towards flatter terrain just above Kukui Place. From this point, the water sheet flows down to Ala Malama Avenue and accumulates alongside the road.

The second natural drainageway (subdivision outlet #4) is a well-defined channel which begins 150 feet above Ala Malama Avenue between Ilio and Kokio Roads. It receives runoff from subdivision drainlines and passes through two roadway

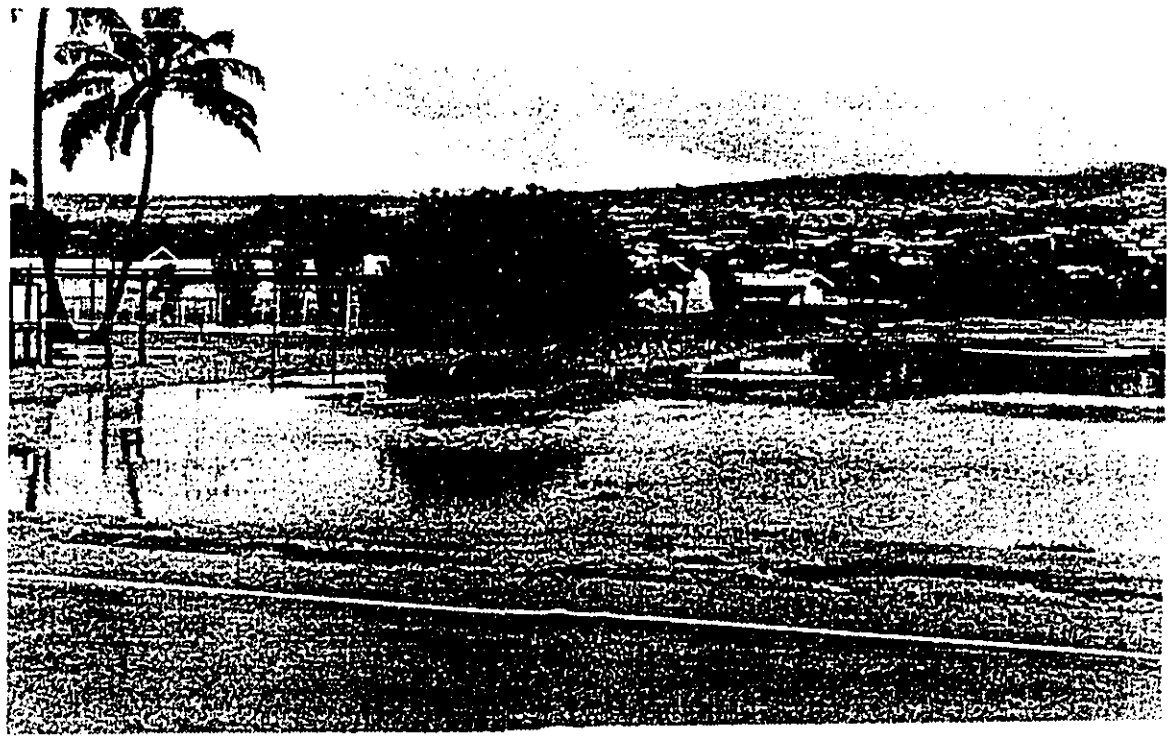
culvert systems: a 42-inch CMP, "CE10" which crosses Ala Malama Avenue, and two 24-inch CMP lines, "CE11", which cross Kolapa Place. Downstream or south of the 24-inch culverts, the gully transitions to a grassed trapezoidal ditch, "DE4".

2.2.4 Kaunakakai School to Seaside Place

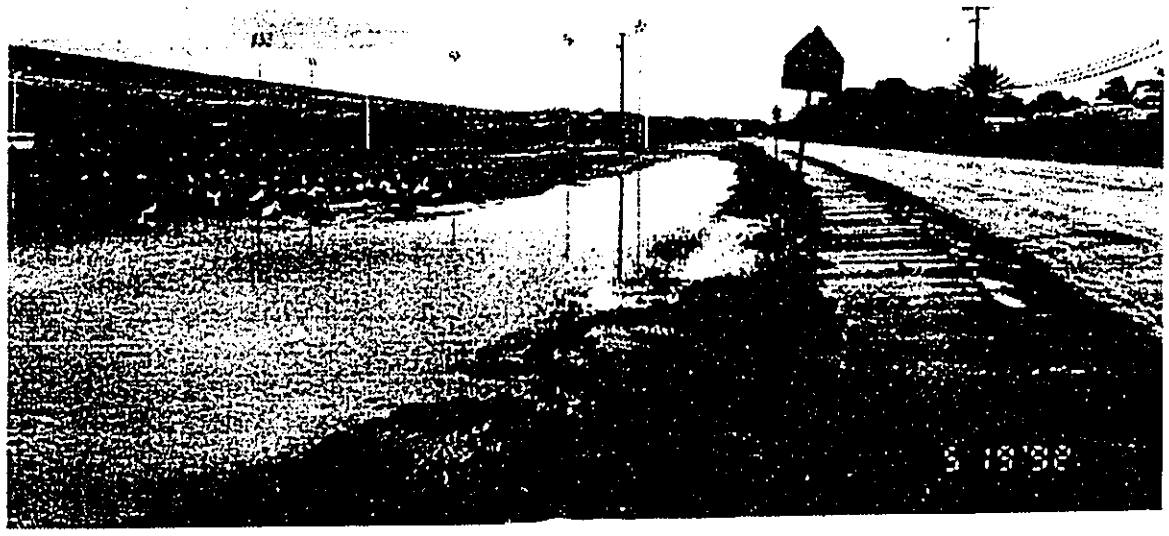
Ditch "DE4" continues to the south and conveys flow through a 48-inch RCP culvert (used as a walkway crossing) located about 200 feet downstream of Kolapa Place where it transitions to a grassed swale, "DE5". This swale runs adjacent to the north and east boundaries of Kaunakakai Elementary School towards the highway, where it then turns 90 degrees and runs alongside the highway to the east. As can be seen in the top photo on Figure 2.5, the swale overflows into the adjacent field during heavy rainfall.

After the 90 degree turn to the east, the swale transitions to "DE6", which is 4-foot wide and 6 inches deep and lined with concrete. This lined swale runs for approximately 850 feet before becoming a grassed trapezoidal ditch, "DE7", with a top width of 16 feet and depth of 3 feet. At the time of the survey, a heavy growth of grass in the ditch had reduced the capacity by about half. The photograph on the bottom of Figure 2.5 shows storm runoff overtopping the ditch after a heavy rain in May 1992.

Ditch "DE7" drains to a 10-foot wide x 3-foot high RC box culvert, "CE12", which conveys flow to the south side of the highway. However, when surveyed in May 1992, the midpoint of this culvert was partially clogged with a thick layer of silt and dead vegetation. A 24-inch RCP culvert, "CE13", serves as a second highway crossing for the swale, but because the inlet invert of the pipe is approximately 1 foot above the invert of the swale, the culvert serves as a ditch relief line.



East boundary of Kaunakakai Elementary School with flooded area on adjacent playing field.



Swale and ditch along Kamehameha V Highway.

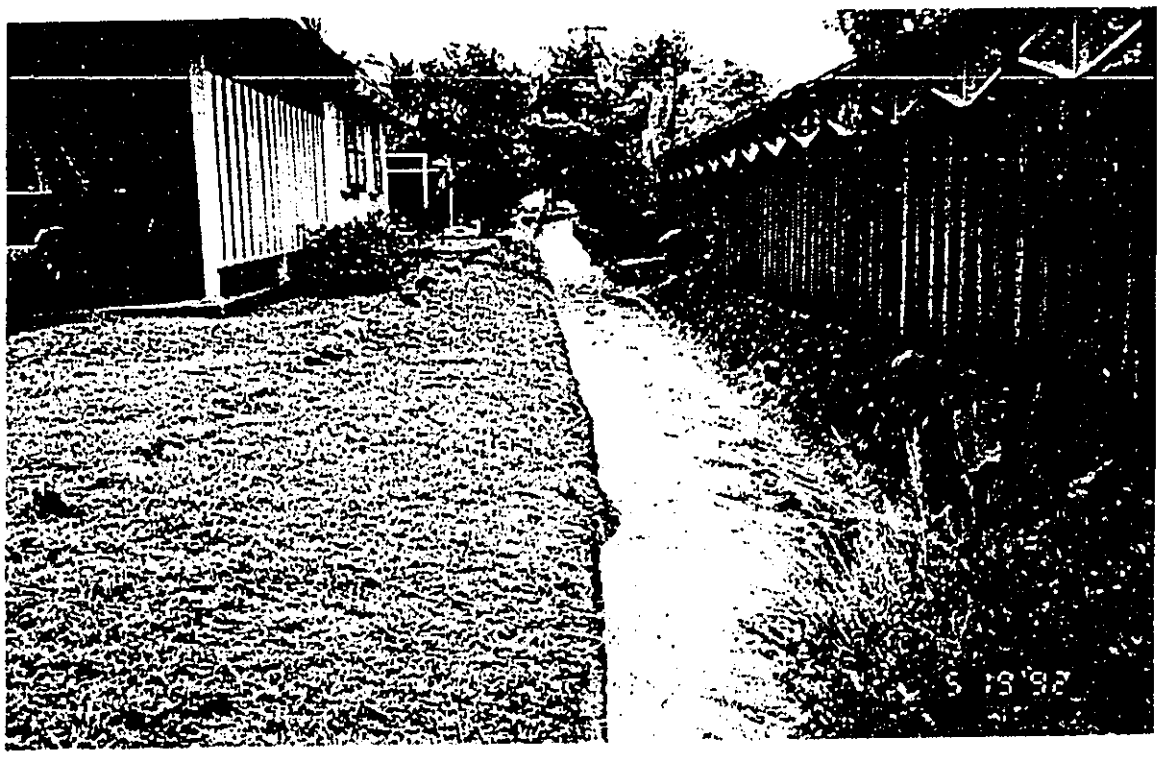
Fig. 2.5

The outlet for the 24-inch culvert, "CE13", consists of a concrete-lined trapezoidal channel, "DE8", which runs approximately 600 feet to the ocean. This ditch is 2 feet wide on the bottom and 4 feet wide at the top, with a depth of 1 foot. Before outletting to the ocean, the ditch passes under Seaside Place through two 18-inch RCP culverts, "CE14". The capacity of this channel had been previously reduced due to debris build-up in the channel. Figure 2.6 shows photographs of the ditch flowing strongly after a heavy rain. It appears in the bottom photograph that the resident adjacent to the ditch had cleared the ditch of vegetation just prior to the rainfall.

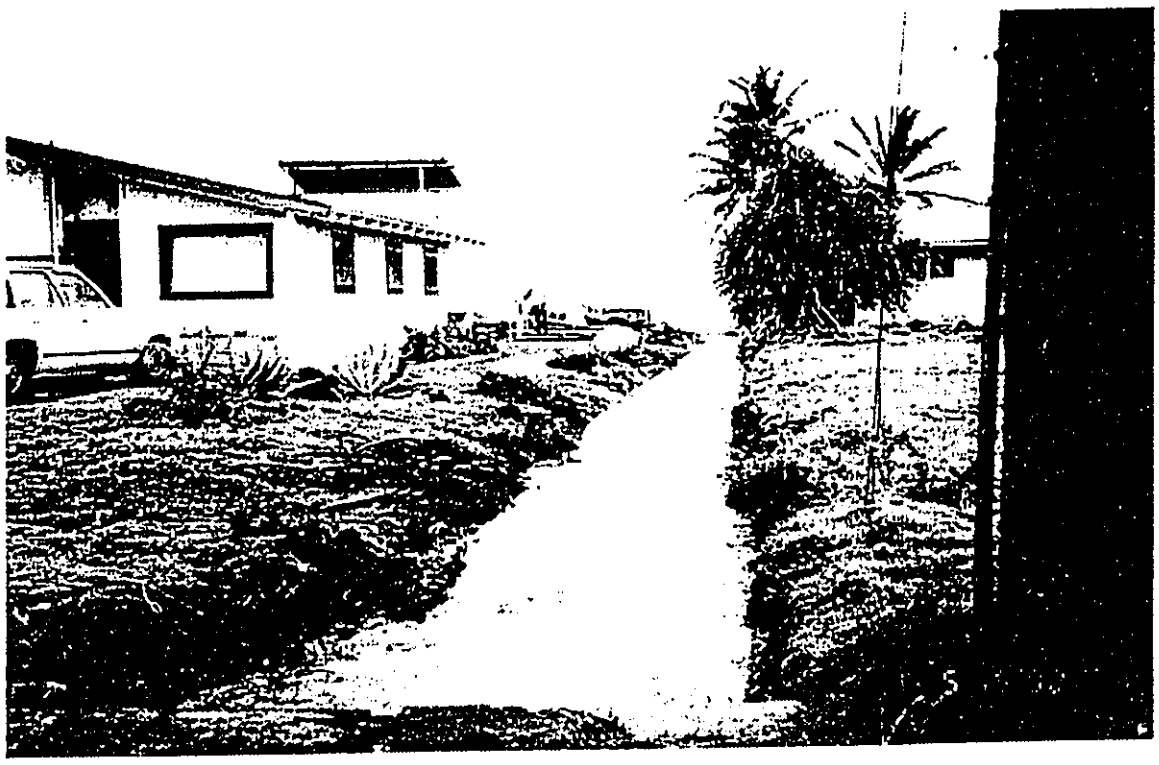
The 10-foot x 3-foot box culvert, "CE12", does not outlet into a defined drainageway after crossing the highway. Once the flow is on the south side of the highway, the water ponds in a small marshy area adjacent to the highway known as the Goodfellow property. Originally identified as Koheo Wetland, the property has been filled in, thus preventing any water to outlet into either the marsh or the ocean.

2.2.5 Kapaakea Subdivision

The drainage system for the Kapaakea Loop area consists of a 24-inch RCP culvert, "CE15", and an 8-foot x 3-foot RC box culvert, "CE16", crossing the highway. During surveys in May 1992, both of these culverts were in need of maintenance, as silt and dead vegetation had accumulated within the culverts. Also, both culvert outlet inverts are lower than the existing drainage ditches, thus resulting in ponding at the outlets. Figure 2.7 shows photographs of the debris and vegetation build-up on the north and south sides of the box culvert "CE16".

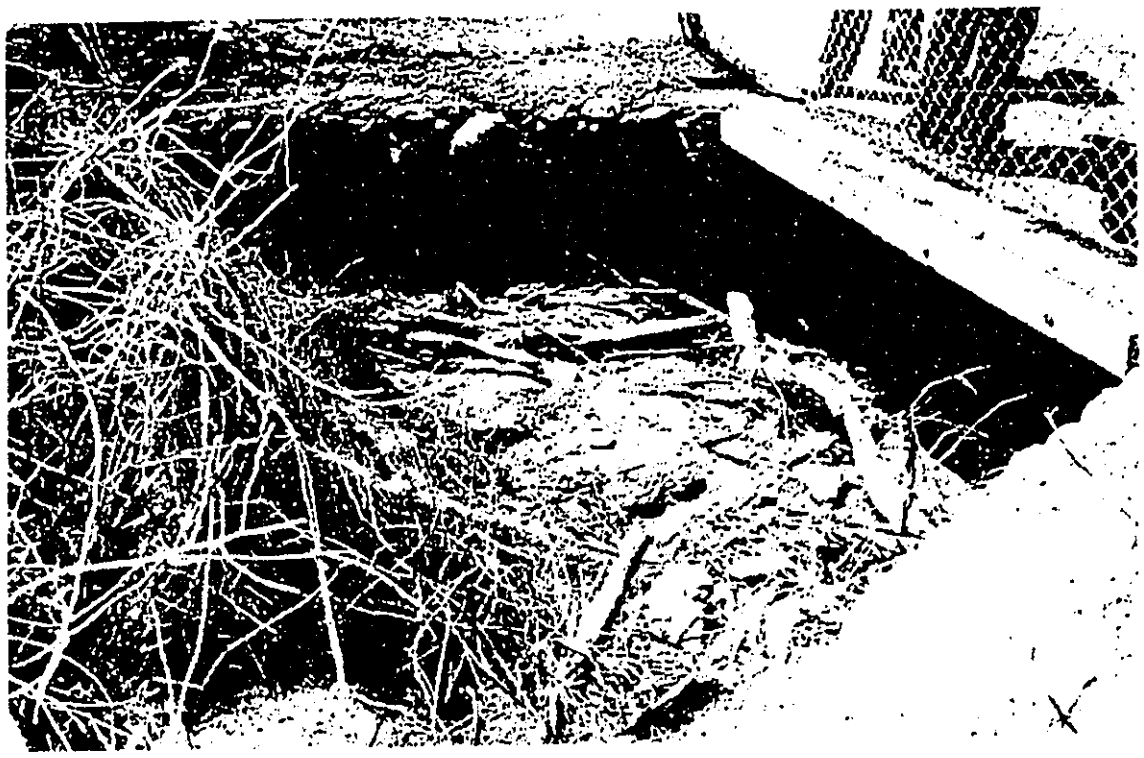


Concrete channel "DE8" near Kamehameha V Highway.



Channel DE8 where it outlets to the ocean.

Fig. 2.6



Dead vegetation in box culvert "CE16" on the north side of Kamehameha V Highway.

A heavy overgrowth of grass in ditch "DE10" on the south side of the highway.

Fig. 2.7

The outlet for the 24-inch culvert consists of a graded ditch, "DE9", 3 feet wide with stone-lined walls and a depth of 1.5 feet. Although much of this ditch is in good condition, several locations along this ditch were completely blocked with soil and planted vegetation at the time of the survey. Thus, these obstructions have caused water to build up at the outlet end of the culvert.

The grassed ditch, "DE10", draining the 8-foot x 3-foot box culvert is trapezoidal in shape with a top width of 12 feet and a depth of 2 feet. As observed in May 1992, a heavy overgrowth of grass had reduced the capacity of the ditch by more than 50 percent. Both ditches "DE9" and "DE10" do not have culvert crossings to pass water through the Kapaakea Loop before outletting into the ocean. Thus, during times of heavy rainfall, runoff flows over the roadways to the ocean.

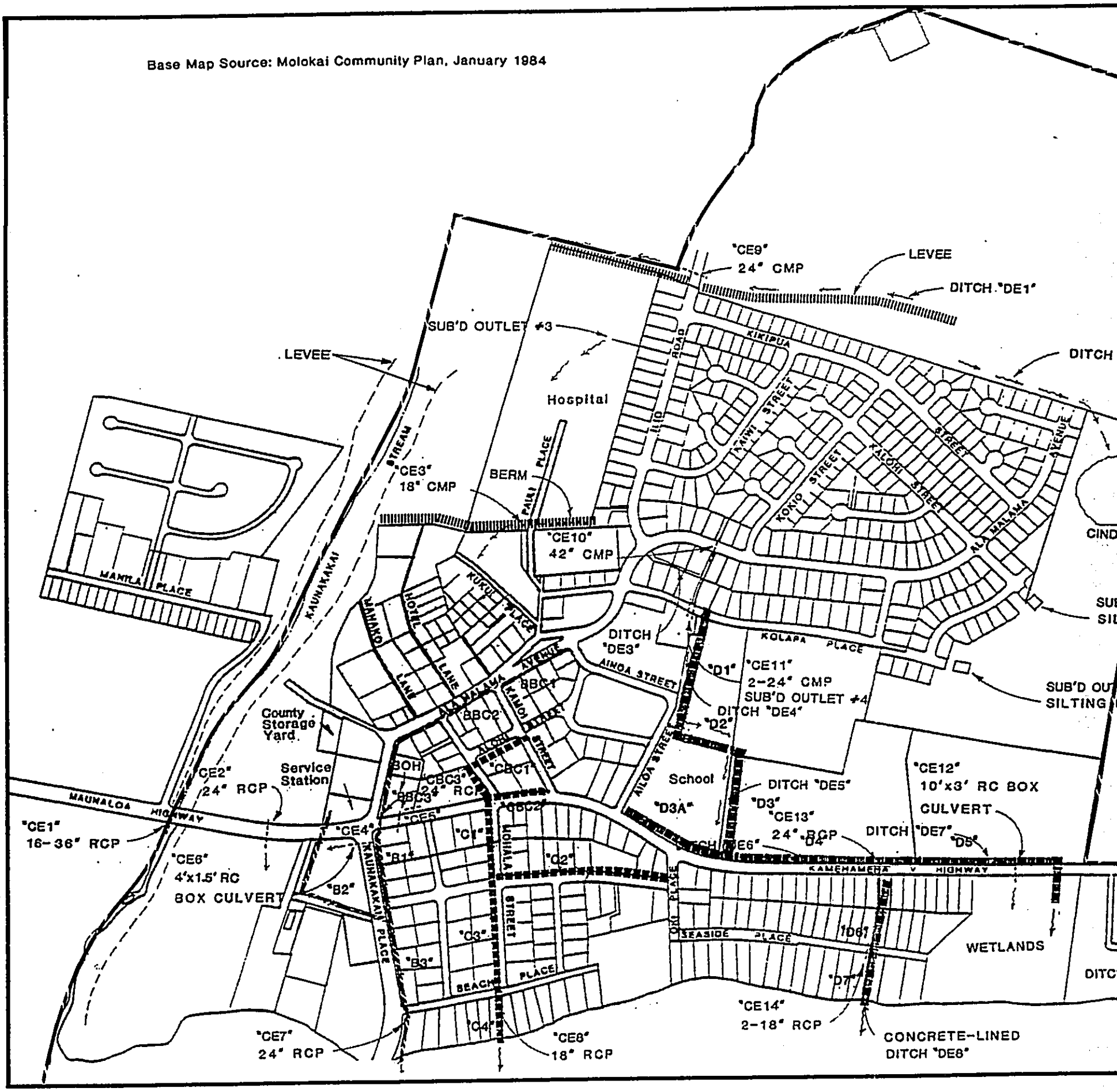
Previously, the U.S. Army Corps of Engineers planned a second flood control project within the town which would have consisted of a concrete-lined channel along with levees above Kapaakea. However, the proposed project was canceled in 1978 because of insufficient funds.

2.3 Proposed Drainage Improvements

The proposed system has been designed to address the inadequacies in the existing system, and has been sized to accommodate future development. The system consists of a combination of drainlines, grated inlets, catch basins, box culverts, and shallow open channels designed for a 10-year storm. Proposed roadway culvert crossings were designed for a 50-year storm.

The system was divided up into five separate sub-systems, designated A through E, each addressing individual problem areas. Figure 2.8 presents a schematic overview

Base Map Source: Molokai Community Plan, January 1984



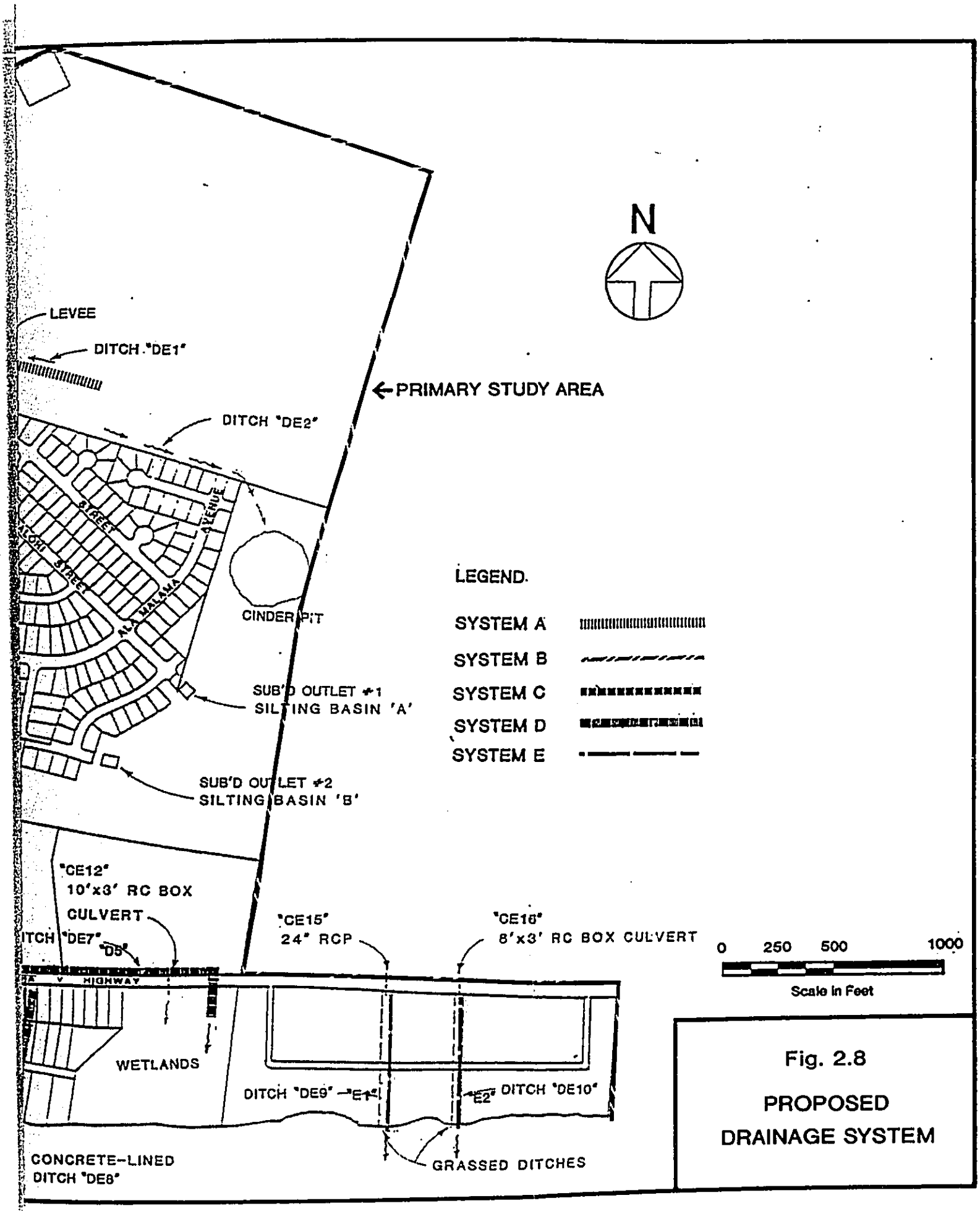


Fig. 2.8

PROPOSED
DRAINAGE SYSTEM

of the proposed system overlaid on the existing system. Table 2.1 is a summary of the proposed sub-systems and individual design features.

TABLE 2.1
Proposed Drainage System Characteristics

System	Design Characteristics
A	Earthen levee/grassed ditch
B	Concrete box culverts w/ grate inlets/concrete open channels
C	Concrete box culverts w/ grate inlets/concrete open channels
D	Concrete open channels/concrete box culverts
E	Concrete open channels/concrete box culverts

The shallow open channels of the systems were selected because of two significant study area constraints: 1) the low elevation of the study area, and 2) the flat topography of the study area in locations below the residential subdivisions.

2.3.1 System "A"

System "A" is located just above the business district of Kaunakakai generally following the southern boundary of Molokai General Hospital and consists of a berm/grassed ditch combination approximately 1,100 feet in length, along with a new 24-inch RCP culvert #1. The berm/grassed ditch would tie into the existing Corps of Engineers levee along the Kaunakakai Stream bank and serve as a diversion for runoff generated on approximately 28.8 acres above the town's center. This berm/grassed ditch would divert runoff discharged from the subdivision drainline and from the berm located above the Armory.

2.3.2 System "B"

System "B" consists of a combination box culvert/grate inlet and open channel system. This system would serve to drain the center of the business district, the County storage yard, and land directly east of Kaunakakai Place. The drainline portion would consist of concrete box culverts which would run under Ala Malama Avenue. After passing under Kamehameha V Highway through a new 5-foot x 2-foot RC box culvert #2 (replacing culverts "CE4" and "CE5"), the drainline would drain to a 970 feet long concrete open channel that outlets to the ocean. The first 470 feet of this channel (designated as "B1") would be 6 feet wide and 3 feet deep. A new 24-inch RCP culvert #3 would replace the existing 24-inch culvert, "CE2", and drain runoff from the County storage yard into channel "B2". This channel would then discharge approximately 24 cubic feet per second (cfs) through a new 5-foot x 2-foot RC box culvert #4. This box culvert would discharge into channel "B1", at which point a transition to a 9-foot wide channel, "B3", would occur. Channel "B3" would then pass the flow under Beach Place through a new 9-foot x 3-foot box culvert #5 (replacing culvert "CE7") before emptying into the ocean.

2.3.3 System "C"

System "C" also consists of a combination box culvert/grate inlet and open channel system. This system would drain the town's business district portion southeast of Ala Malama Avenue, and areas south of Kamehameha V Highway, which would include land straddling Mohala Street down to Beach Place. The box culvert/grate inlet portion would start along Alohi Street and run under Mohala Street to Kamehameha V Highway. After crossing under the highway through a new 7-foot x 2-foot box culvert #6, the system would empty into a concrete-lined channel, "C1", 7-foot x 2-foot. A second cut-off channel "C2" would empty through a new 4-foot

x 2-foot RC box culvert (#7) into "C1", which would then transition to a 10-foot wide x 2-foot deep channel, "C3". After crossing under Beach Place with two new 6-foot x 2-foot box culverts #8 (replacing culvert "CE8"), channel "C3" would continue for another 200 feet to the ocean.

2.3.4 System "D"

System "D" follows the existing ditches "DE4" through "DE7" and consists of concrete-lined channels which would drain runoff generated from portions of the town's subdivisions. The channel would also serve as a collection channel for runoff generated from the grassed recreational field and cultivated lands adjacent to Kamehameha V Highway. This rectangular channel would cross Kamehameha V Highway through an existing 10-foot wide x 3-foot high box culvert, "CE12", and a new twin 24-inch RCP crossing #9 located at the existing 24-inch RCP culvert, "CE13". The two 24-inch pipes would divert flow under the highway and out to the ocean through a 4-foot x 2-foot channel "D6". This channel would cross Seaside Place as a new 6-foot x 2-foot RC box culvert #10 (which replaces culvert "CE14"), which would then become a 6-foot x 2-foot channel "D7". Both channels would replace the existing channel "DE8" which flows into the ocean.

The existing 10-foot x 3-foot culvert would outlet into the Goodfellow property. Although it is classified as a wetlands area by the Corps of Engineers, the area has been filled. The Corps of Engineers has ordered the lot owners to remove the fill material and to restore the wetlands area. Thus, this area can be used as a natural stormwater detention basin as the original wetlands was used. This detention basin would serve to settle out solid materials before discharging into the ocean.

2.3.5 System "E"

System "E" consists of two concrete-lined channels which would run 600 feet from Kamehameha V Highway to the ocean. A 6-foot wide x 3-foot high channel "E1" would replace the existing ditch "DE9". A new 8-foot x 3-foot box culvert #11 would replace culvert "CE15" and convey flow across Kamehameha V Highway, while another new 6-foot x 3-foot box culvert #12 would cross Kapaakea Loop.

A second channel "E2", which would be 20 feet wide and 4 feet deep, would drain flow from Kamiloloa Stream. This channel would replace the existing ditch "DE10". Two new 10-foot x 4-foot box culverts #13 would convey flow under the highway, replacing culvert "CE16". A second pair of new 10-foot x 4-foot box culverts #14 would allow flow to pass under Kapaakea Loop.

2.4 Land Ownership

Portions of 38 Tax Map Key (TMK) parcels will be affected by the proposed improvements. Table 2.2 lists the TMK's on which the proposed drainage improvements will occur. Included in the table is the total acreage of each parcel and the approximate easement area required in order to construct the improvements. The TMK parcels are grouped by drainage "system". In addition to the easements in the table, there are drainage easements which cross Seaside Place, Kaunakakai Place, Beach Place, Mohala Street, and Kamehameha V Highway, and which will be installed within Ala Malama Street, Alohi Street, and Mohala Street. These County and State roads are owned by the County of Maui and/or the State of Hawaii and do not have Tax Map Key numbers.

TABLE 2.2
Kaunakakai Drainage Improvements Tax Map Key Areas

System	Tax Map Key	Landowner	Parcel Acreage	Approx. Easement Area (sq. ft.)
A	5-3-09:22	private	1.19	6,000
	5-3-09:18	County of Maui	0.47	800
	5-3-09:17	private	9.99	4,400
	5-3-03:01	private	3,580.32	12,000
B	5-3-01:03	County of Maui	3.79	3,750
	5-3-01:08	private	2.62	6,750
	5-3-01:64	private	0.43	1,500
	5-3-01:77	private	0.43	1,500
	5-3-01:76	private	0.31	1,500
	5-3-01:75	private	1.28	1,500
	5-3-01:01	private	7.13	5,700
	5-3-01:65	private	0.67	3,300
	5-3-01:09	private	0.63	3,750
C	5-3-01:82	private	0.47	3,000
	5-3-01:83	private	0.31	1,500
	5-3-01:84	private	0.29	1,500
	5-3-01:01	private	7.13	9,300
	5-3-01:16	private	0.29	3,000
	5-3-01:30	private	6.84	8,250
D	5-3-06:33	private	1.02	4,800
	5-3-02:167	private	5.41	16,500
	5-3-02:52	County of Maui	6.01	8,000
	5-3-03:01	private	3,580.32	44,000
	5-3-07:39	private	3.00	130,680
	5-3-07:15	County of Maui	0.09	4,000
	5-3-07:06	County of Maui	0.04	1,850
E	5-4-07:20	private	0.49	2,200
	5-4-07:19	private	0.49	2,200
	5-4-07:15	private	0.40	1,800
	5-4-07:16	private	0.41	1,800
	5-4-07:04	private	0.38	1,700
	5-4-07:03	private	0.42	1,700
	5-4-08:22	private	0.48	3,150
	5-4-08:21	private	0.46	3,150
	5-4-08:09	private	0.41	2,700
	5-4-08:10	private	0.40	2,700
	5-4-08:08	private	0.42	2,700
	5-4-08:07	private	0.41	2,700

2.5 Cost Estimate

A cost estimate for each of the five proposed systems was developed for budgetary purposes. The cost estimate consisted of three components: 1) land acquisition, 2) engineering, and 3) construction. A summary of these figures is shown in Table 2.3. The table summarizes costs of an open channel system and an underground system. The only structural difference between the two schemes is a structural slab over the open channel which converts it into a box culvert. The underground system is only applicable and feasible to Systems B, C, and D.

TABLE 2.3
Cost Estimate Summary for
Open Channel System and for Underground System

	System	Engineering	Acquisition	Construction	Total Cost
OPEN	A	$81,000	$22,600	$70,800	$174,400
	B	$156,000	$168,100	$1,300,100	$1,624,200
	C	$80,100	$183,900	$667,800	$931,800
	D	$103,100	$187,100	$858,800	$1,149,000
	E	$79,200	$55,800	$660,000	$795,000
	Total Open System (rounded up to the nearest 1,000)				**$4,674,000**
UNDERGROUND	A	$81,000	$22,600	$70,800	$174,400
	B	$175,600	$168,100	$1,463,700	$1,807,400
	C	$137,100	$183,900	$1,142,500	$1,463,500
	D	$275,100	$187,100	$2,292,700	$2,754,900
	E	$79,200	$55,800	$660,000	$795,000
	Total Underground System (rounded up to the nearest 1,000)				**$6,995,000**

2.5.1 Land Acquisition

Land acquisition costs were developed through the use of the "Real Estate Handbook, Second Tax Division, Counties of Maui and Kalawao, Zones 1 through 6, 1991". For each parcel in which a system traversed, the following methodology was used:

1. Determine the total land value of each parcel traversed by a particular system.
2. Determine the amount of easement area required on each of these parcels.
3. Proportion the acquisition cost according to the area of the easement in relation to the entire parcel.

A two percent escalation factor per year was used to project the 1991 land values to 1993.

On-site structures such as buildings and homes were avoided when laying out the proposed systems in an attempt to prevent condemnation of existing buildings when implementing the systems.

2.5.2 Engineering

Engineering costs were taken as approximately 10 percent of the construction cost. The engineering cost includes design fees, subconsultant (soil, structural, etc.) fees, and miscellaneous costs such as travel and printing costs. In addition, the engineering cost of system 'A' also included consultant's fees for an environmental assessment and marine biology study for all five proposed systems.

2.5.3 Construction

Construction costs consisted of the cost to construct in place, each individual system, along with appropriate traffic control. Construction costs do not include cost of relocation of any existing utility lines. Among the construction cost components for the ditch systems were excavation and disposal, base course, concrete formwork and materials. Component costs for roadway culverts included pipe/box culverts and headwalls.

Because the type of construction for system 'A' (earthen berm) remained the same for both schemes, the construction cost remained the same. Likewise, the construction cost for system "E" remained the same for both schemes due to the inability to place the system completely underground.

Most of the channels were allowed maximum depths of only 2 feet to utilize the entire length of the open channel for intercepting runoff. The depth of the channel is limited by both the low elevation in the area and the fact that a channel wall placed above existing grade would not allow runoff from the surrounding area to flow into the channel.

In addition, all open channels where designed to be lined with concrete. Although concrete channels would create higher flow velocities and thus have a higher potential for sediment transport, grassed channels were rejected because of the larger widths that would be required. In addition, the amount of sediment generated in the study area is considered minimal when compared to the upper reaches of the drainage basin and adjacent ranch lands.

2.6 Project Schedule and Implementation

As previously discussed, the County of Maui only intends to construct System A in the near future, as identified in the Kaunakakai Drainage Master Plan. The County of Maui will program and construct the other improvements as funding becomes available. At this time, no schedule has been established for these subsequent improvements.

3. AFFECTED ENVIRONMENT

3.1 Geology and Hydrology

Three volcanoes created the island of Molokai. The western one, known as West Molokai, is 1,381 feet high and about 12 miles across. The eastern one, East Molokai Mountain, is 4,970 feet high, 27 miles long from north to south, and 8 miles wide from east to west. A smaller and much later volcano forms the Kalaupapa Peninsula on the north coast of the eastern volcano.

The rising and receding of the ocean has caused a narrow fringing reef to form along part of the south shore of East Molokai. Inland of the fringing reef, a nearly continuous apron of alluvium lies along this south shore. In part, this alluvium represents an encroachment of terrestrial sediment due to accelerated erosion of the southern slopes. Most of Kaunakakai is located on these alluvium deposits.

Kaunakakai Stream originates in the East Molokai mountains and flows past the town to the west. According to records maintained by the U.S. Department of the Interior Geological Survey, Kaunakakai Stream is an intermittent stream with an average discharge of 1.90 cubic feet per second (cfs). During heavy rains, runoff from Kaunakakai Stream deposits silt into Kaunakakai Harbor.

3.2 Topography and Drainage

Topography in the study area ranges from a flat coastal plain to steep slopes and gulches in the mountains behind Kaunakakai town. Within the watershed, the average elevation is about 5 feet mean sea level along the coastal plain, and rises to about 4,200 feet on the upper slopes of the East Molokai Mountains. Well-defined

gulches mark the upper elevations, while delineation in coastal areas varies and is much less pronounced. As some watercourses approach the coast, they become poorly defined and end before reaching the ocean. The median annual rainfall over the Kaunakakai watershed area varies with elevation from about 10 inches along the coast to about 75 inches at the upper reaches of the watershed. Appendix B contains figures showing the rainfall for storms of different frequency and duration.

Within Kaunakakai town, the existing drainage system consists of ditches, levees, grassed swales, berms, roadway culverts, catch basins, and drainlines. These systems were designed to convey, divert, or retain runoff generated within the primary study area. However, many of these systems are badly in need of maintenance, and many of the downstream systems (ditches and roadway culverts) are incapable of accommodating the runoff generated from developed conditions upstream. In addition, several of the roadway culvert crossings were noted to have outlet inverts lower than the invert of the outlet drainageway, thus resulting in ponding during periods of flow.

3.3 Soils

The general soil associations in the area above Kaunakakai are Very stony land-Rock land and Rough broken land-Oli. The Very stony land-Rock land association has gently sloping to very steep, rocky and stony land types on uplands and in gulches and valleys. The Rough broken land-Oli association has shallow to deep, very steep to precipitous soils in gulches and moderately deep to deep, gently sloping to steep, well-drained soils that have a medium-textured and moderately fine textured subsoil.

The general soil association along the coastal plain on alluvial fans and drainageways is Jaucas-Mala-Pulehu. This soil association has deep, nearly level and gently sloping, excessively drained and well-drained soils that have coarse-textured to fine-textured underlying material. Kealia silt loam (KMW) makes up a significant portion of soil found makai or south of Kaunakakai Town. This soil is poorly drained and ponding occurs in low areas after a heavy rain.

Extensive soil erosion has occurred and continues to occur in the Kamiloloa drainage basin east of Kaunakakai Town. This erosion has deposited silt and other debris which has affected the water quality and the depth of the ocean in the nearshore waters east of Kaunakakai Harbor. The lack of ground cover and the occurrence of short periods of intense rainfall result in flash flood conditions which have contributed to the heavy silting of ocean water inside the reef.

3.4 Flora and Fauna

Low, marshy land covered with grass and brush characterizes the coastal plain of the study area. Kiawe trees and brush cover the areas above the coastal plain while thicker tropical growth covers the uppermost, wet regions.

The shoreline vegetation in the Kaunakakai area consists mainly of kiawe, haole koa, finger grass and pili grass. Along the shoreline west of the harbor, very dense growths of mangrove have developed.

The major terrestrial animal populations of Molokai include introduced feral mammals (deer, goat, mongoose, wild pig), and approximately nine species of native birds, of which five are listed as endangered by the U.S. Department of the Interior Fish and Wildlife Service and the State of Hawaii. These species are the Hawaiian

Coot, Hawaiian common Moorhen, Hawaiian Stilt, Molokai Creeper and Molokai Thrush. The coot, moorhen, and stilt are waterbirds which make their home in fishponds along the south coast of Molokai. The Kaunakakai Sewage Treatment Pond approximately 1,200 feet west of Kaunakakai town also serves as foraging ground for these species.

Two of these endangered species, the Molokai Creeper and the Molokai Thrush, are endemic to the island of Molokai. The habitat of these species is above the 2,000 foot elevation. These elevations do not occur until about 5 miles northwest of the study area.

3.5 Wetlands

There is a drainage ditch along Kamehameha V Highway which directs runoff into a wetland makai of the highway at the end of Seaside Place. This wetland, identified as "Koheo", has been tentatively identified by the U.S. Department of the Interior, Fish and Wildlife Service. It currently consists of a vacant lot at the edge of a residential area. At one time, the area served as a detention site for storm runoff.

When it was first surveyed in 1977, according to the report, the area near the road was characterized by dry, disturbed soil, weedy vegetation and only a few patches of surface water. Towards the beach, the wetland consisted of extremely muddy and mucky soils with larger areas of open water and salt evaporates. At that time, vegetation found in the wetland included both obligate and facultative species, including makai (*Scirpus paludosus*), pickleweed (*Batis maritima*), Bermuda grass (*Cynodon dactylon*), Indian pluchea (*Pluchea indica*), cocklebur (*Xanthium*

saccharatum), and kiawe (*Prosopis pallida*). When the site was first surveyed in 1977, no rare or unusual wildlife was observed in the wetland.

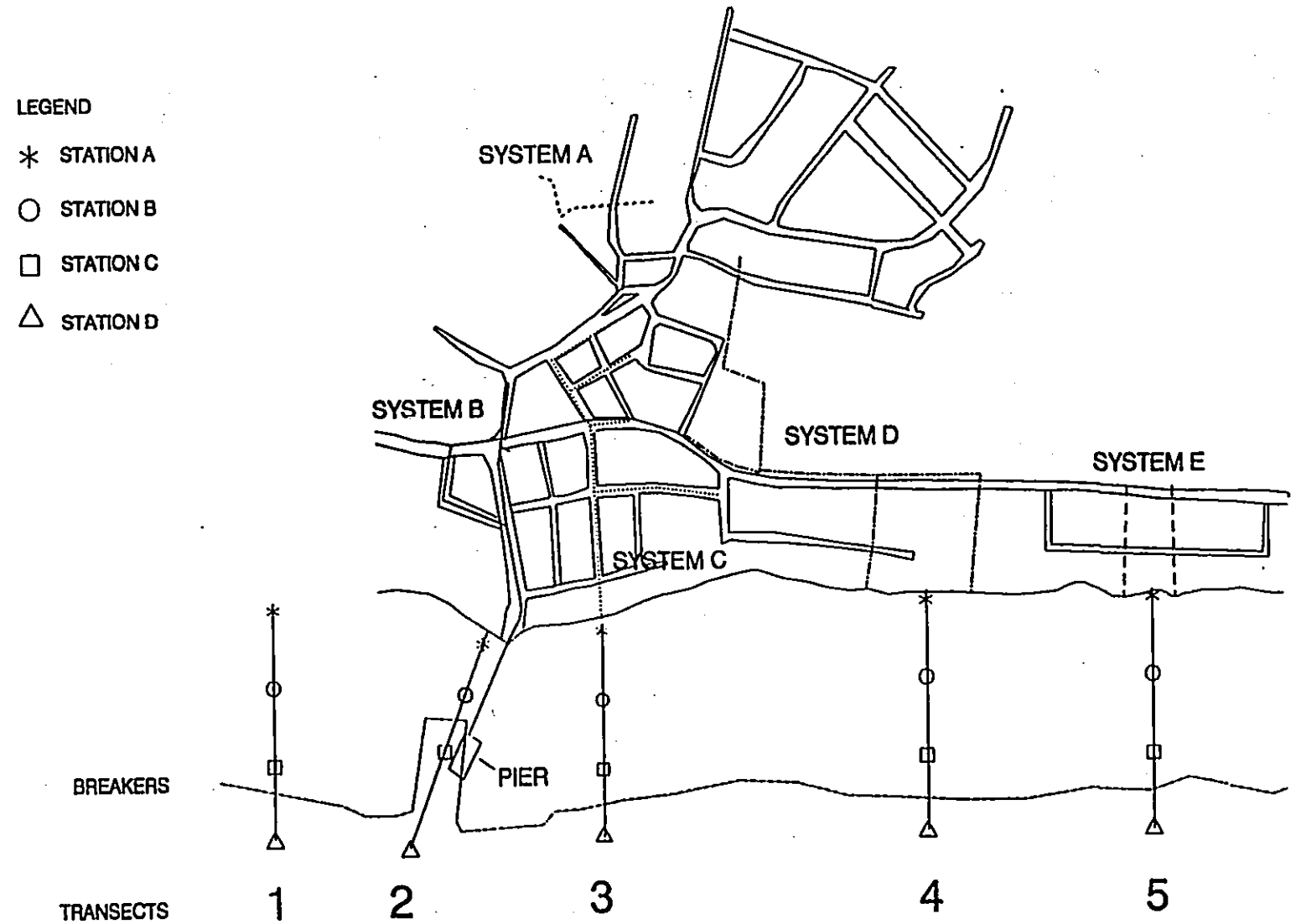
Sometime after 1977, the area was filled by the lot owners. The U.S. Army Corps of Engineers has since ordered the lot owners to remove the fill and restore the wetlands area. When this is accomplished, the area can once again be used as a natural stormwater detention basin, as it once was. The detention basin would serve to settle out solid materials before discharging into the ocean.

3.6 Marine Environment

3.6.1 Water Quality Conditions

A water quality analysis was conducted to determine existing water quality in the marine environment around Kaunakakai and to assess the potential for changes in these conditions due to the proposed drainage improvements (see Appendix C for the complete report).

Data were collected on two days; one day under "normal" dry conditions (April 28, 1992) and the other day after a rainstorm (May 20, 1992). Data collection was performed from 20 stations aligned in 5 transects running perpendicular to the shoreline which corresponded to the proposed discharge points (see Figure 3.1). At each station, samples were taken at three depths; 0.5 meter below the surface, midway between the surface and bottom, and 0.5 meter from the bottom. Water quality parameters measured in each sample included temperature, salinity, turbidity, suspended solids, total nitrogen, nitrate-nitrite (NO_3/NO_2), ammonia (NH_4), total phosphate, orthophosphate (PO_4), reactive silicate (SiO_4), chlorophyll, dissolved oxygen (DO) and PH.



Prepared By: OI Consultants, Inc.

Fig. 3.1

Sampling Stations for Water Quality Assessment

On Molokai, like other islands, offshore water quality is affected by groundwater and surface water discharges. This simultaneous discharge makes it difficult to make definitive statements regarding the impacts of runoff alone. Moderate levels of suspended solids were observed near shore even during dry weather, probably as a result of turbulent mixing in shallow water. The correlation between total suspended solids (TSS) and chlorophyll suggests that the suspended material was predominantly derived from some algal biomass. In contrast, rain runoff might be expected to introduce primarily non-living material. However, little if any of the suspended material could be traced to terrestrial sources. The correlations between chlorophyll, pheopigment, and total phosphorus were similar on both sampling days. Thus, the composition of the suspended material probably did not change very much between the two days. Turbidity changes were closely coupled with TSS changes on the second sampling day, and therefore both TSS and turbidity probably resulted from the presence of resuspended material.

The effects of surface runoff were only locally observable on the second sampling day (e.g. as a slight reduction in the silicate concentration along transect 5). At all other transects persistent freshwater effects were coupled with a strong groundwater influence, and a general increase in reactive silicate concentrations was noted.

3.6.2 Benthic and Fish Communities

A biological survey of the reef environment off Kaunakakai was also conducted to inventory the composition or abundance of possibly sensitive marine organisms, and to provide an estimate of the potential impact of the revised drainage system on the Kaunakakai reef environment (see Appendix B).

Fifteen locations were surveyed on the Kaunakakai reef on May 19 and 20, 1992. Stations were aligned on five sites along the shoreline corresponding to the locations of proposed principal drainage points for the proposed project. For each alignment, a nearshore (NS), mid-reef (MR), and offshore (OS) station was established. (see Figure 3.2). At each station, a 50 meter line was deployed parallel to the shoreline which was used to establish the location and direction of benthic quadrants and fish transects.

The findings of the present study are similar to those of a previous study of the benthic environment along the west side of Kaunakakai Harbor prepared for the U.S. Army Corps of Engineers in 1978. The earlier study found three coral colonies and a diverse invertebrate community at their most shoreward station, which was approximately 300 meters west of Station 1MR. The present results and the 1978 study indicate that effects of turbidity and sedimentation from shore runoff and the harbor on the benthos have been mostly restricted to those areas directly shoreward of the harbor.

Substratum and Benthos

On the nearshore and mid-reef zones of the reef flat the bottom types and dominant biota are substantially unchanged throughout the sampling sites along the study area. The four nearshore transects from 2NS to 5NS were essentially devoid of invertebrates other than the blue clawed swimming crab, *Thalamita crenata*. At Station 1NS, in addition to this crab species, alpheid shrimps (*Alpheus rapax*?) and tubes of vermetid molluscs were observed.

At the mid-reef station 1MR, small colonies of two species of corals (*Porites lobata* and *Pocillopora damicornis*) occurred on or near the transect, and a yellow

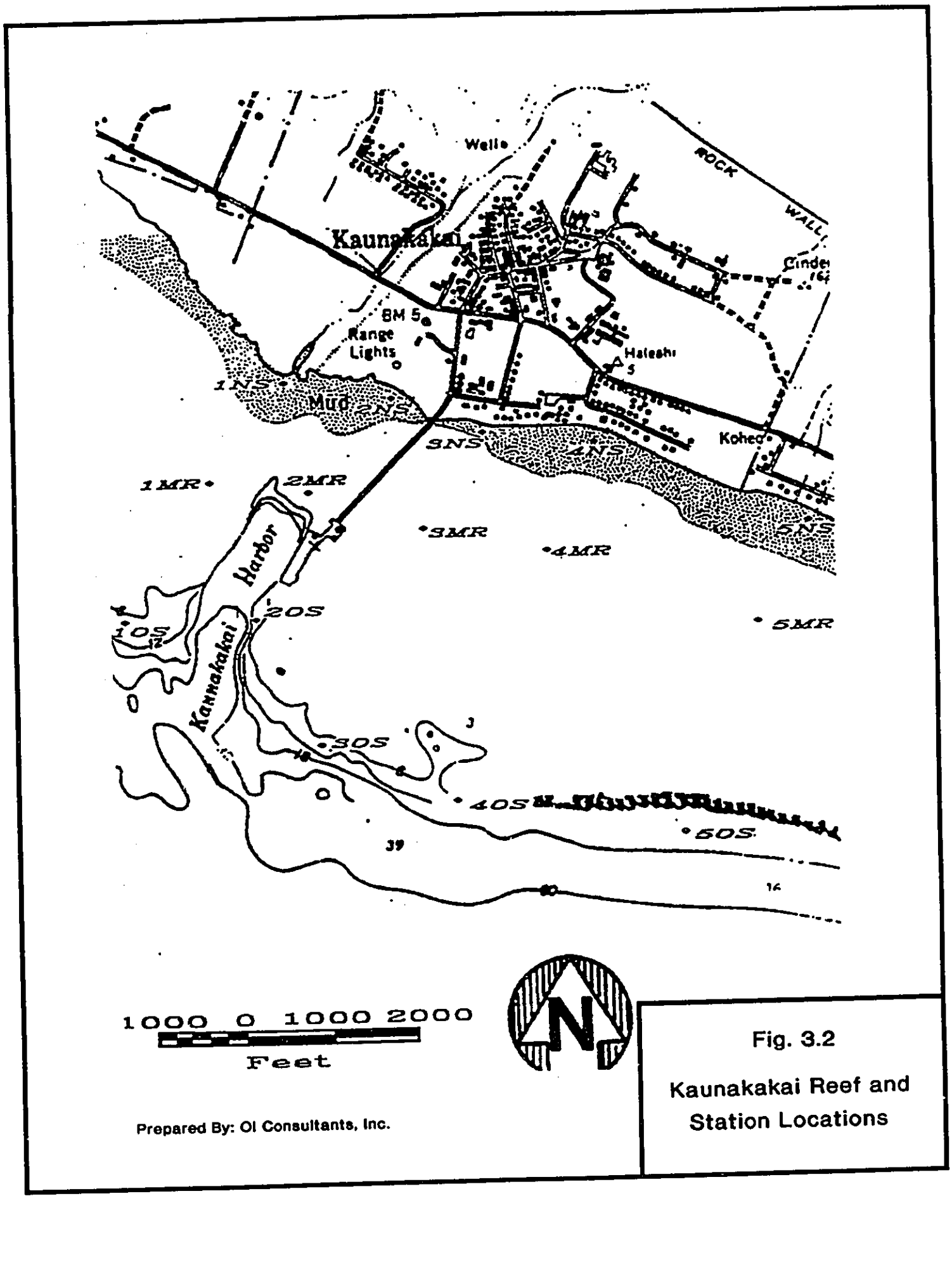


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Fig. 3.2

Kaunakakai Reef and Station Locations

nudibranch, a bristleworm (*Phrecardia striata*) and some boring sea urchins (*Echinometra mathaei*) were found on the coral rubble. Station 2MR had no indications of benthic organisms other than burrow openings. The rest of the mid-reef environment east of the harbor jetty was relatively unchanged. The bottom consisted of exposed muddy sand and a complex association of *Halophila ovalis* with a variety of macroalgae, including *Acanthophora spicifera*, *Hypnea* sp., *Padina japonica*, *Spyridia filamentosa*, *Dictyota* sp., *Lyngbya* sp., *Neomeris annulata*, *Halimeda discoidea* and *Turbanaria ornata*.

The offshore stations show a clear gradient of decreasing reef coral abundance going from the westernmost station (1OS) to Station 5OS at the eastern limit of the study area. The coral community at Station 1OS most closely typified a normal assemblage for a leeward Hawaiian reef, being dominated by *Porites lobata* (37%), followed by *Montipora verrucosa* (6%) and *Montipora patula* (5%), with a few small *Pocillopora meandrina* colonies totaling about 2 percent coverage. Further east at Station 3OS the moderate coral coverage on the transect was dominated by *Montipora patula* at 10%, *Pocillopora meandrina* at 6%, followed by about 4% for *Montipora verrucosa* and 2% for *Porites lobata* and trace amounts of *Porites compressa*, *Pavona varians*, *Pavona duerdeni* and the zoanthid *Palythoa tuberculosa*.

Even further east, total coral coverage decreased dramatically to 7% at Station 4OS, and to only 1.5% at Station 5OS. It was not clear why good coral growth and coverage do not apparently extend much further eastward than Station 3OS on the outer Kaunakakai reef. The only obvious physical variable related to the decreasing coral coverage was increased sand cover, which may restrict coral settlement, development and growth through resuspension scouring and scouring of reef surfaces.

Fish Assemblages

The nearshore and mid-reef sites showed low richness of fishes (only one to four species) but also the highest numbers of individuals per species. These four species were gobies, with two species, *Psilogobius mainlandi* and an unidentified goby, occurring in high numbers. Small schools of an unidentified mullet were seen in the area of transects 2, 4, and 5.

The offshore sites had a greater diversity of fishes than the nearshore and mid-reef sites. Offshore stations 1OS and 3OS had the highest diversity of species. Several species appeared consistently at most of the offshore sites. These included the hawkfish (*Paracirrhites arcatus*), goatfish (*Parupeneus multifasciatus*), damselfish (*Plectoglyphidodon johnstonianus*), wrasses (*Thalassoma duperrey* and *Coris gaimard*), surgeonfish (*Acanthurus nigrofuscus*), triggerfish (*Rhinecanthus rectangulus*), and toby (*Canthigaster jactator*).

3.7 Climate and Air Quality

The climate on Molokai is typical for the Hawaiian Islands, characterized by a two-season year (winter and summer), mild and uniform temperatures, generally humid conditions, and a dominance of northeasterly tradewinds. Mean average temperature ranges from 69°F in January to 76°F in August.

The town of Kaunakakai is generally very dry, receiving an average annual rainfall of about 14 inches. Recorded temperatures closest to Kaunakakai town are at Molokai Airport which showed 70.2°F in the coolest month and 77.6°F in the warmest month. The winds off Kaunakakai are predominantly northeasterly

tradewinds. However, as these winds round the eastern tip of the island and veer westerly along the southern coast, they produce easterly prevailing winds.

The low level of residential and commercial development in the Kaunakakai area, the lack of major stationary sources of air pollution, and the trade wind conditions would indicate air quality is good for this area of Molokai. The only sources of pollution would be from vehicles traveling in the area. However, these mobile sources would not be expected to significantly degrade air quality.

3.8 Noise

Automobile traffic noise is by far the most prominent source of noise in Kaunakakai. Other intrusive noise sources are generated in the light industrial district south of town. The town may be characterized as having a quiet, almost rural setting.

3.9 Traffic

Within the project area, a single State Highway (Kamehameha V Highway) runs east to west through Kaunakakai. This highway serves as the only roadway to connect the Kaunakakai town area with other parts of the island. As such, it must remain open to traffic at all times.

County roads run through residential, commercial, light industrial and public facility areas in the rest of Kaunakakai. Due to the rural character of the town, traffic is light and never reaches congested conditions, except for short periods.

3.10 Existing and Surrounding Land Uses

Existing land use on the listed parcels of System A range from residential to hospital use; System B parcels range from canoe club, office space, warehouse, and petroleum company uses; System C lands are primarily vacant; System D parcels encompass County facility land uses, including the fire station, Kaunakakai Elementary School, and library. System E easements are all located on the borders of residential parcels.

Because the proposed project spans throughout the entire town of Kaunakakai, land uses surrounding the proposed drainage alignments essentially consist of all uses within the town itself. These uses include business/commercial areas in the center of town, single and multi-family residential areas to the northeast, east, and southeast of the town center, and park space, hospital, school, library, and light industrial uses.

3.11 Archaeological/Historic Resources

The State Historic Preservation Division (SHPD) was consulted for this project to determine if the project site or vicinity contains any archaeological or historic resources (see Appendix A). Based on their records, there are two known significant historic sites in the vicinity of the proposed drainage systems. Both sites are located on a property (TMK 5-3-01:2 & 3) at the corner of Kaunakakai Place and Hio Place. One is Site 50-60-03-630, which consists of a historic and prehistoric subsurface deposit. It is not known whether this deposit extends into System B. Previous archaeological testing conducted at the corner of Kaunakakai Place and Kamehameha V Highway found no evidence of historic sites, so it appears that the deposit may not extend toward the highway.

The other site is the Malama House Site (Site 50-60-03-1030), a rectangular platform which is believed to be the foundation of Kamehameha V's residence. However, this site is located away from the proposed drainage system.

A third potential archaeological site not previously identified by SHPD was found near System A during a topographic survey of the area in April 1992. This site was subsequently surveyed in March 1993 (see Appendix D). The surface survey resulted in the location and description of two sites, Site 50-60-03-895 and Site 50-60-03-896. Site 895 consists of a 4 meter by 5 meter stacked boulder enclosure and associated paved area believed to represent early 1900's period construction, possibly a work shed. There is a large tree growing out of the interior of the enclosure which has affected the interior floor area, uprooting and destroying about 60 percent of the interior space and destabilizing the makai enclosure wall.

Site 896 consists of a stacked boulder wall also believed to be historic construction of the late 1800s to early 1900s period, which may have functioned to exclude cattle from Kaunakakai Town. The wall is approximately 250 feet in length and runs along an approximate northwest-southeast axis.

During the survey it was apparent that the majority of the project site has been bulldozed and further modified in modern times. Limited subsurface testing was conducted at Site 895 involving the excavation of two test units. There were very sparse faunal remains and only a few historic-era artifacts observed and recovered. Though recovered material (midden and artifacts) was sparse, Site 895 represents a considerable expenditure of time and energy, and may have been regularly utilized from the early to mid 1900s as a permanent storage shed for agricultural tools.

3.12 Infrastructure

3.12.1 Water

Water service in Kaunakakai is provided to users by the County of Maui Department of Water Supply through a system of transmission and distribution lines of various sizes.

3.12.2 Wastewater

Kaunakakai is served by a single wastewater treatment plant which discharges treated effluent into the ocean offshore of Kaunakakai.

3.12.3 Electrical and Telephone Service

Electrical and telephone service in Kaunakakai is provided by Maui Electric Company and GTE Hawaiian Telephone Company, respectively.

3.13 Socio-Economic Environment

3.13.1 Economic Trends

Historically, agricultural production has been the major source of economic development on Molokai. Until the mid-1970's when it ceased, commercial production of pineapples was the island's major economic activity. Today, many former Molokai pineapple production workers travel to Maui to reduce the labor shortage there. This trend will probably continue into the year 2000 and beyond.

Recently, production of coffee has started on Molokai. In the future this may be a source of additional agricultural production. Other agricultural crops such as watermelon, corn and other types of vegetables will continue to be produced. Molokai can also expect to see re-establishment of the cattle industry. In addition, sheep production may become economically feasible. Agricultural activities will continue primarily on the eastern portion of the island.

Some growth in businesses is anticipated in the Kaunakakai area to serve an increase in population. Tourism related business is receiving a growing share of overall economic activity on the island. Beyond this, major increases in businesses in other areas of Molokai are not anticipated.

3.13.2 Population

According to the 1990 census, the population of Molokai in 1990 was 6,717 persons; an increase of 668 persons or 11 percent from the 1980 figure of 6,049 persons. In comparison, population in the State of Hawaii increased 14.9 percent between 1980 and 1990. In Kaunakakai, the resident population in 1990 was 2,658 persons.

4. RELATIONSHIP TO LAND USE PLANS AND CONTROLS

4.1 Land Use Controls

4.1.1 State Land Use Districts

The majority of the proposed project is located within areas of Kaunakakai town designated "Urban", according to the State of Hawaii Land Use Commission (see Figure 4.1). A portion of System D on the mauka side of Kamehameha V Highway is in the "Agricultural" district. Chapter 205, Hawaii Revised Statutes, Land Use Commission determines the boundaries of the Urban District by including,"those lands that are now in urban use and a sufficient reserve area for foreseeable urban growth. . ." In the establishment of the agricultural districts, the Land Use Commission observes, "the greatest possible protection shall be given to those lands with a high capacity for intensive cultivation."

Construction of any of the drainage improvements would improve drainage conditions in adjacent areas. Since most of the areas affected by the drainage improvements are already of an urban character, construction of the project would not change these patterns of development. For the area of System D in the agricultural district, this area is in park space and is not likely to be placed under intensive cultivation in the foreseeable future. Thus, the improvements would be consistent with the Urban and Agricultural District designations.

4.1.2 Molokai Community Plan

The Molokai Community Plan was adopted in January 1984 to guide development of the island. One of the major features of the Community Plan is the land use map

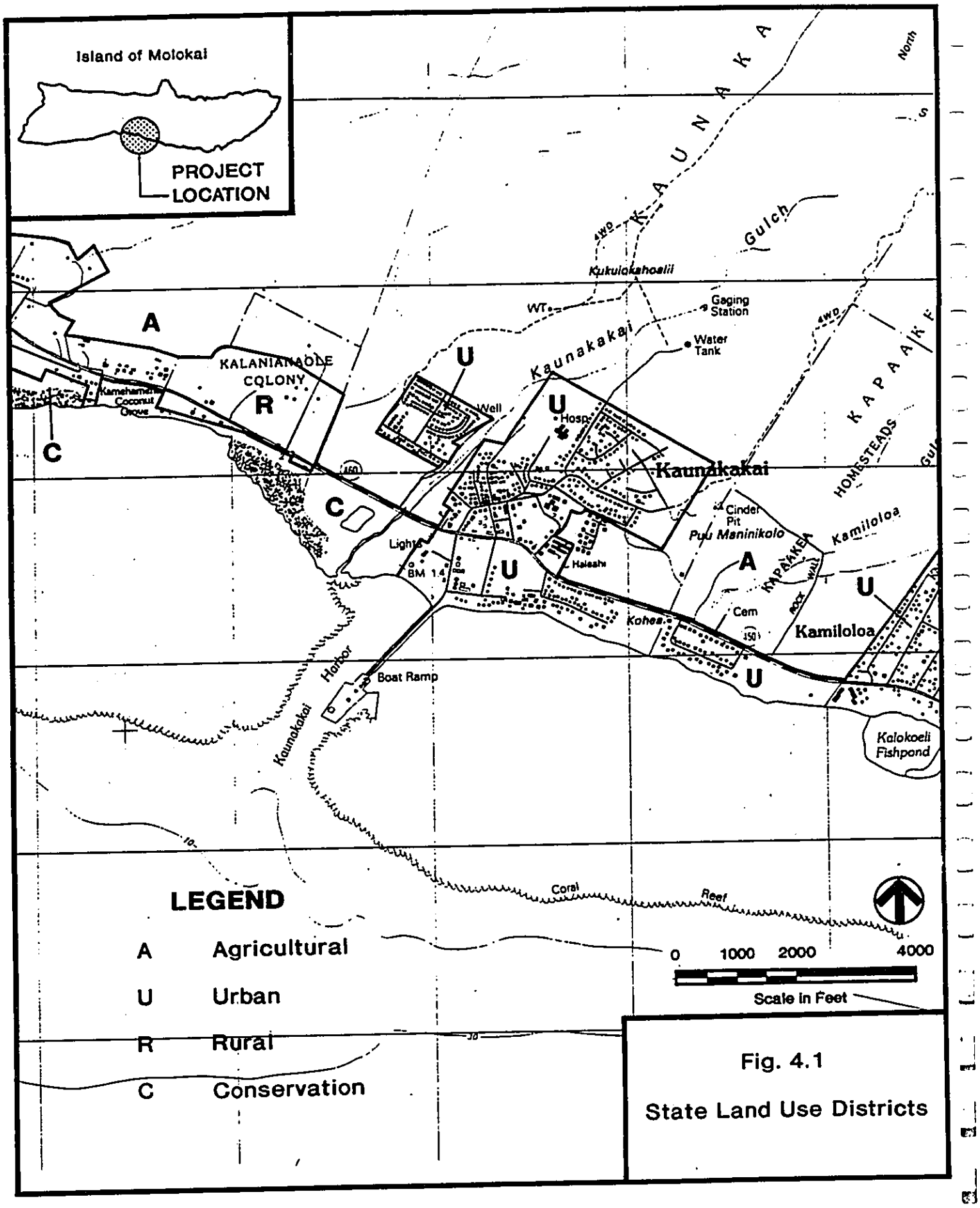


Fig. 4.1

State Land Use Districts

which identifies specific uses for various areas of the island. According to the Molokai Community Plan land use map (see Figure 4.2), System A improvements occur on Public/Quasi-Public and Single Family Residential designations; System B improvements are located within and bordering Business/Commercial, Light Industrial, and Public/Quasi-Public designations; System C improvements border Business/Commercial and Light Industrial designations; System D improvements occur in Public/Quasi-Public, Park, and Single Family Residential designations; and System E improvements are all located on Single Family Residential designations.

The drainage improvements would not be contrary to these existing Community Plan land use designations. Thus, the improvements would be consistent with the Molokai Community Plan.

4.1.3 Special Management Area

The Hawaii CZM Law (Chpater 205A, HRS) charges the Counties with designating and administering special management areas along the State's coasts. Any "development" within the Special Management Area (SMA) boundary requires an SMA Use permit administered by the County of Maui Planning Department. Approval of an SMA Use permit is by the County of Maui Planning Commission. The SMA boundary in the project vicinity encompasses all of Kaunakakai Town (see Figure 4.3). Therefore, all proposed drainage improvements are located within the SMA and will require an SMA permit.

4.2 Permits and Approvals

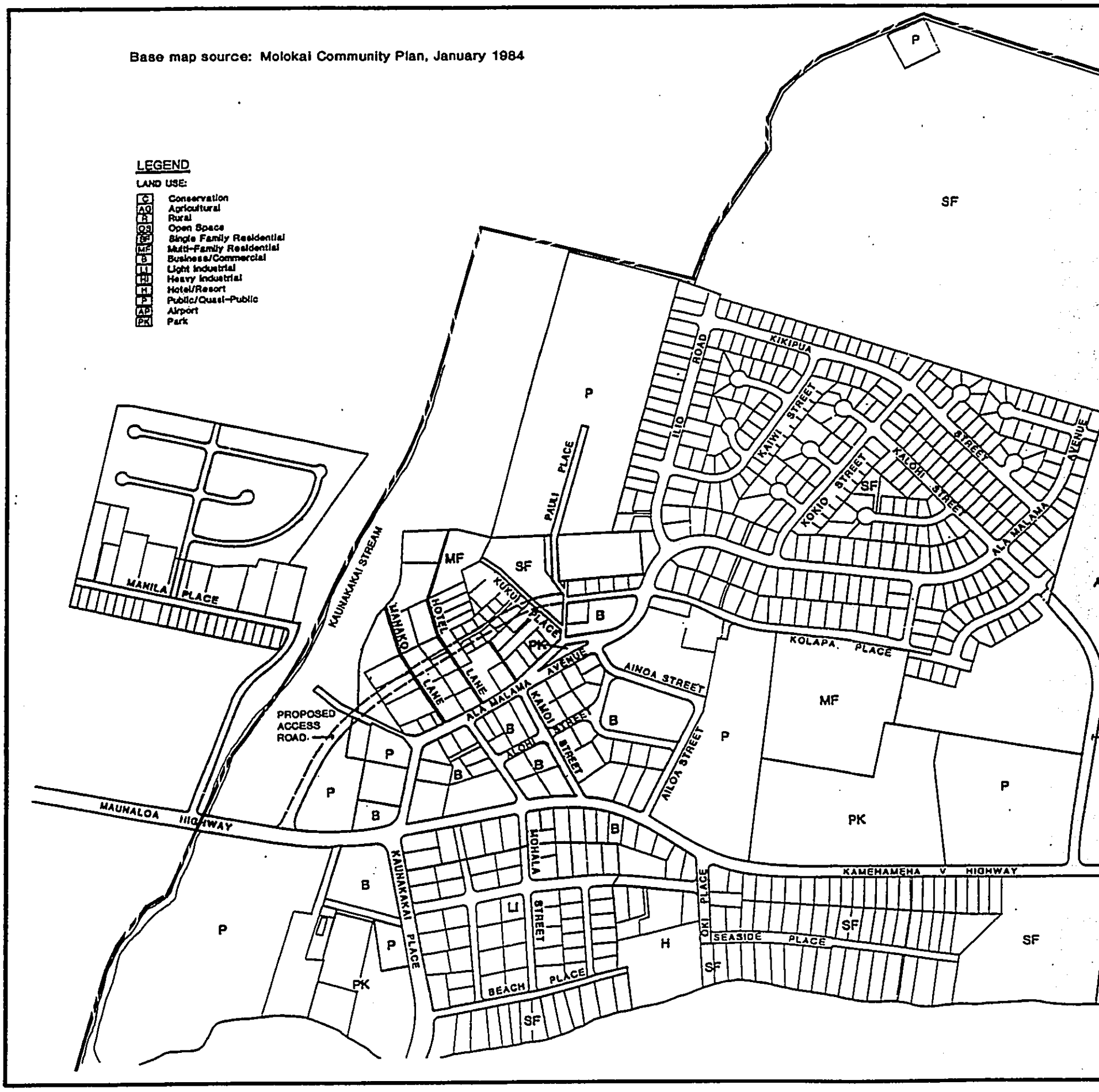
The proposed systems will require improvements to existing outlets along the coast, some of which may require work below the Mean High Water Line. These improvements will require approvals and permits from various Federal, State of Hawaii and County of Maui agencies. The specific permit requirements will depend upon the extent and location of the improvements for each system. The permits most likely required are listed in Table 4.1 below.

TABLE 4.1
Permits/Approvals Required for
Proposed Kaunakakai Drainage System Improvements

System	Permit	Agency
A	Special Management Area (SMA) Permit	County of Maui
B,C,D,E	Special Management Area (SMA) Permit	County of Maui
	Shoreline Setback Variance	County of Maui
	General Permit (1)	Department of the Army Corps of Engineers
	Nationwide Permit (2)	Department of the Army Corps of Engineers
	Coastal Zone Management (CZM) Consistency Determination	State of Hawaii Office of State Planning
	Section 401 Water Quality Certification	State of Hawaii Department of Health
	National Pollution Discharge Elimination System (NPDES) Permit	State of Hawaii Department of Health
	Permit for Work in Shorewaters	State of Hawaii Dept. of Transportation

(1) Section 401 certification not required.
(2) Section 401 certification required.

Base map source: Molokai Community Plan, January 1984



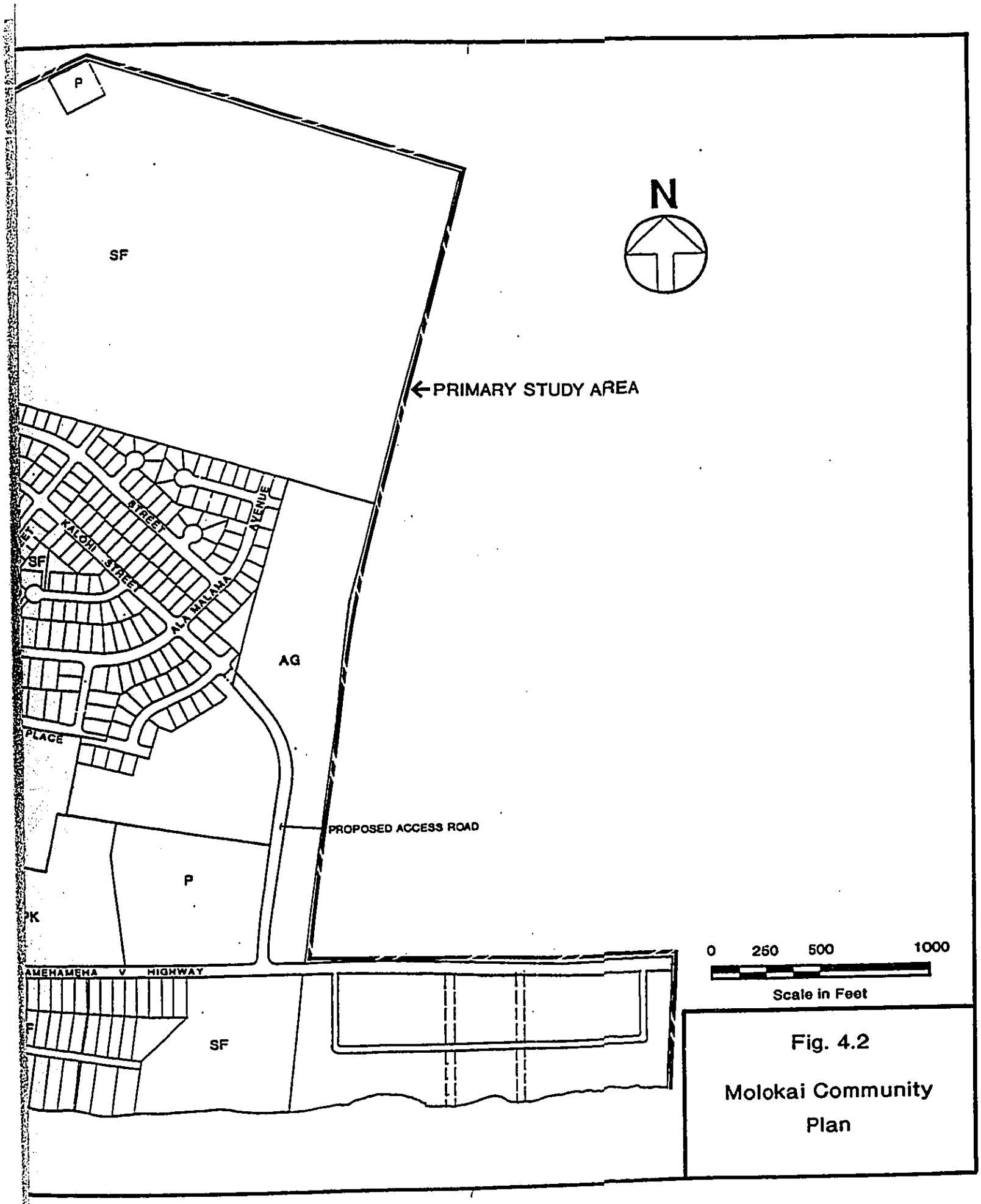


Fig. 4.2

Molokai Community Plan

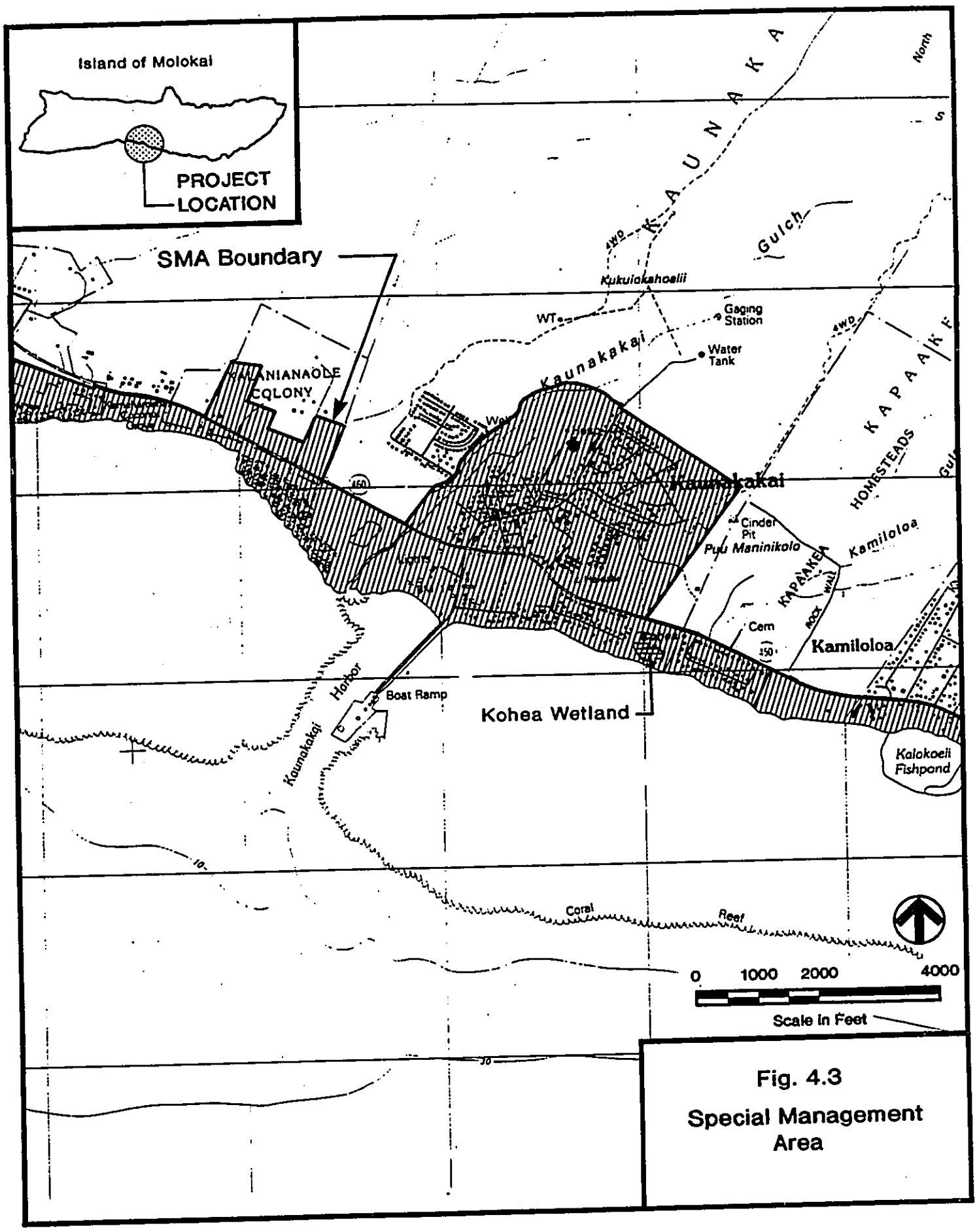


Fig. 4.3

Special Management Area

For projects located within the Special Management Area (SMA), which includes the entire project area, a County of Maui permit will be required. The preparation of this environmental assessment fulfills one of the criteria necessary for approval of this permit. The County of Maui also requires a shoreline Setback Variance for projects located within the shoreline setback area, normally within 40 feet from the shoreline.

The Department of the Army Corps of Engineers requires a permit when a project is being proposed in the waters of the U.S. Waters of the U.S. include ocean waters; coastal, inland and tidal waters; rivers and streams. A permit is required for a number of activities including the construction of pipes under the water, dredging, and excavation.

A Coastal Zone Management (CZM) consistency determination is required when a Federal agency issues a permit or approval for a project located within the coastal zone. An environmental assessment is generally required for a CZM consistency determination.

The Section 401 Water Quality certification applies to projects that require Federal approvals. The requirement is that any applicant for a Federal permit with a proposed project which may result in discharge into navigable waters shall provide certification from the State that the activity will be conducted in a manner that will not violate water quality criteria.

A National Pollution Discharge Elimination System (NPDES) permit is required for construction activity requiring grading of 5 acres or more or construction dewatering.

This permit, administered by the State of Hawaii Department of Health, requires consideration of best management practices and preparation of an erosion control plan.

A permit for Work in Shorewaters is required for any construction within the shorewaters of the State inlcuding shores, shorewaters, and navigable streams. The State of Hawaii Department of Transportation (DOT) Harbors Division administers this permit.

5. POTENTIAL IMPACTS AND MITIGATIVE MEASURES

5.1 Geology and Hydrology

Construction of the proposed drainage improvements will involve constructing an above ground diversion structure for System A, creating new drainageways in Systems B and C, and widening and deepening existing drainageways in Systems D and E. Depths and widths of the new drainageways will vary from between 2 and 12 feet wide, and 2 and 3 feet deep, respectively. Existing drainageways will be widened to between 3 and 20 feet wide, and to between 2 and 5 feet deep. Once excavated, concrete-lined channels will be constructed to convey the surface runoff. These excavations and improvements will not create a significant impact on the geology of the area. In addition, because water supply on Molokai is obtained from deep well sources at high elevation, the improvements will not create adverse impacts to the groundwater geology of this area of Molokai.

System A will consist of above surface improvements only. The intent of System A is to divert runoff from certain areas above Kaunakakai town and direct it to Kaunakakai Stream. Under 10-year storm conditions, System A will divert approximately 46 cubic feet per second (cfs) of surface flow to Kaunakakai Stream, which has a capacity of 900 cfs before overtopping the ford on Kamehameha V Highway. This additional flow into Kaunakakai Stream should not be significant when compared to its capacity. However, if during storm conditions the Kaunakakai Stream and Kamehameha V Highway ford were to be overtopped, the diverted flow from System A could increase the duration of these high flows. This could increase the time Kaunakakai Town would be isolated from the western end of Molokai. Notwithstanding this higher flow in Kaunakakai Stream, construction of System A

would prevent significant flooding to Kaunakakai Town which currently occurs under heavy rainfall conditions.

5.2 Topography

The construction of the proposed drainage improvements will require some trenching and filling to create a new berm (System A) and new drainageways, as well as minor widening and deepening of existing drainageways. Construction activities will be required only in the immediate vicinity of the improvements. Construction of the improvements will not significantly affect the topography of the Kaunakakai area.

5.3 Soils

As previously discussed, drainage from storms has long been a problem to the town of Kaunakakai and surrounding areas. These problems are a result of the relatively flat terrain of the town and steep areas behind it. During storm conditions, flat terrain does not provide sufficient slope to convey the runoff to the ocean. In addition, many of the drainage improvements within the town and makai of Kamehameha V Highway have not been improved to accommodate new developments above the town.

The primary source of soil erosion which has affected coastal water quality occurs in the Kamiloloa drainage basin east of Kaunakakai Town. This erosion is caused by the lack of ground cover and the occurrence of short periods of intense rainfall resulting in flash flood conditions. While this is the primary cause of erosion in Kaunakakai, some soil erosion may occur during excavation and construction of the proposed drainage improvements.

System A will require construction of a berm/grassed ditch which will require trenching and filling. Provided that erosion control measures are practiced during construction, the impacts to soils should not be significantly adverse. The other proposed improvements would construct new drainageways and would widen and deepen existing drainage systems, thereby increasing their ability to convey runoff. Potential soil erosion from construction of the systems can be mitigated by applying best management practices as specified in the NPDES permit application and as performed by the contractor.

5.4 Flora and Fauna

As previously discussed, no Federal or State listed or candidate threatened or endangered species of plants currently inhabit the area or vicinity of the proposed drainage improvements. Principal plant species in the vicinity of the improvements and throughout the areas of town which are not landscaped include kiawe, koa-haole, California grass, pili grass, finger grass, and mangrove along the shoreline. The obligate and facultative wetland vegetation found in Koheo Wetland (makai, pickleweed, Bermuda grass, cocklebur, Indian pluchea, kiawe) is considered common. Construction of the proposed drainage improvements will require removal of vegetation and other surface disturbance. The improvements for all of the systems will occur in areas which appear to have been previously disturbed and lack extensive vegetative cover. Once construction has been completed, vegetation should be re-established in areas immediately adjacent to the improvements and nearby area. Therefore, there should be no adverse impact from the project on the flora of this region of Molokai.

Similarly, there are no Federal or State listed or candidate threatened or endangered species of wildlife which inhabit the region in and around Kaunakakai. Construction

may disturb some of the habitat of various species of wildlife. However, these species would be those found in the various types of vegetation near the improvements. Construction of the drainage improvements should not create adverse impact to the wildlife in the area.

5.5 Wetlands

Upon construction of System D drainage improvements, an existing 10 foot by 3 foot culvert would outlet about 143 cfs into the Koheo Wetland. Presently, much of the wetland has been filled in, and water ponds in a marshy area close to the highway. The increase in runoff into the area should not have any adverse impact on the wetland, since it was previously used as a natural stormwater detention basin before landfill compromised its detention capacity. The restoration and use of this wetland for drainage purposes will be contingent upon the restoration of the wetland (i.e. removal of fill) by the owner.

5.6 Marine Environment

5.6.1 Water Quality

The data on water quality shows that under dry weather conditions, water quality in the nearshore zone is controlled primarily be three processes: 1) nearshore groundwater discharges, which introduce dissolved nutrients into the ocean, 2) waves and currents, which resuspend settled sediments and transport them along shore, and 3) biological processes, particularly production by marine macrophytes and phytoplankton, which may reduce nutrient levels and pH, and increase levels of dissolved oxygen. Measurements taken after a rainstorm show that these processes appear to change only slightly during periods of increased runoff.

Thus, the proposed drainage improvements will have no significant negative impacts on the water quality of the nearshore and offshore marine environments at Kaunakakai. The proposed improvements will direct surface runoff during storm conditions into channels and culverts for disposal into nearby ocean waters. Since the drainage improvements collect runoff more efficiently than the existing systems, there will be an increase in the total flow reaching the ocean waters. However, the quality of the flows should not be significantly different from the existing flows.

5.6.2 Marine Biology

The marine biological analysis suggest that development of a storm runoff drainage system for Kaunakakai is unlikely to have any effect on the Kaunakakai reef or on the reef coral population in the area. The reef flat is over 1 km wide and nearshore areas are covered with a thick layer of fine sediment. Muddy areas near shore are virtually devoid of surface fauna; further offshore the mud/silt bottom is covered with a dense seagrass-macroalgal biotype. Neither environment would be susceptible to negative impacts from storm runoff. The extensive sediment coverage suggests that this area has been under the influence of sedimentation from runoff for a very long time. The only potentially sensitive benthic communities are in the offshore area surrounding the Kaunakakai Harbor and channel. These communities have flourished despite the construction and use of the harbor, and the presence of the Kaunakakai Stream mouth near the harbor. Changes to the drainage system feeding into the Kaunakakai Stream will be minor, and should cause no significant changes in either the volume or quality of the stream discharge.

5.7 Air Quality

Construction of the drainage improvements will involve surface clearing and subsurface excavation activities and will require the use of machinery and equipment. The subsurface activities could create dust and other air pollutants which will create short-term adverse impacts to air quality.

Use of machinery during construction of the improvements will produce emissions which will also create short-term adverse impacts to air quality in the area. However, since these construction activities will be relatively short-term, the impacts should not be significant. Once constructed, no long-term adverse impacts on air quality will result from the proposed improvements.

5.8 Noise

Noise levels in the immediate vicinity of the project site will increase as a result of operating heavy vehicles and other power equipment during construction. Noise sensitive land uses include the Molokai General Hospital near System A and Kaunakakai Elementary School in the vicinity of System D. Noise will affect occupants of these buildings during the construction period.

To mitigate the adverse impact, occupants will have to shut doors and windows and rely on air-conditioning for the duration of construction. In addition, it shall be the contractor's responsibility to minimize noise by properly maintaining mufflers and other noise attenuating equipment.

Although not a noise sensitive land use, commercial establishments near the improvements will also be affected by noise from construction activities. Merchants

and their customers will be subjected to noise from equipment during the short-term period of construction. Once construction has been completed, there should be no adverse impacts from operation of the drainage improvements.

5.9 Traffic

During the construction period, traffic within Kaunakakai town will be affected by the movement of construction vehicles and equipment and by the location of the improvements. Vehicle travel lanes and accessibility to residences and business will be affected depending upon the system. Although relatively short-term, construction activities may disrupt access to residences and businesses, especially for Systems C and D which are located within developed areas of Kaunakakai.

To mitigate adverse impacts from construction activities, a traffic control plan will be prepared during the design phase. This traffic control plan would ensure access is maintained to residences and businesses during construction and would provide for smooth traffic flow. Use of an off-site baseyard to precast items, when possible, would also decrease the time of construction and reduce adverse impacts to traffic flow.

5.10 Archaeological/Historic Resources

Based on consultation with the State Historic Preservation Division (SHPD), the likelihood of encountering any archaeological or historic resources during the construction of Systems B through E is small. In System B, the proposed improvements could have an adverse effect on the deposits of Site 630 which may extend to Hio Place and Kaunakakai Place. In order to mitigate any possible adverse effect, archaeological monitoring shall be performed during excavation of

the portion of System B makai of Kamehameha V Highway. Systems C through E are in developed areas which have been previously disturbed, and these systems should have no effect on significant historic sites. However, during construction, there is always the remote possibility that previously unknown or unexpected subsurface cultural features or deposits might be encountered. If such a situation occurs, construction will be halted and immediate archaeological consultation shall be sought from the SHPD.

Within System A, based on the presumed historic-era construction and use and apparent limited excavation potential, it is recommended that Site 895 be assessed solely under Criterion D, "Site is likely to yield information important to history or pre-history." It is recommended that data recovery take place at Site 895 prior to any construction. This should include further excavations, interviews with local informants, and further background research.

Site 896 is also recommended to be assessed under Criterion D. Data recovery work should include excavations placed to ascertain the stratigraphic sequence of wall construction, and oral interviews with questions specifically addressing wall construction chronology. A light surface scatter of midden and artifacts abutting the wall should also be tested. It is also recommended that the wall be preserved "as is", since it appears to have been constructed to provide a clear separation of residential and agricultural activities, thus helping to define the limits of Kaunakakai Town. This should be possible since only the southeast end of the wall abuts the proposed drainage corridor.

5.11 Infrastructure

Water. During construction, relocation of water lines may be necessary to accommodate the proposed drainage improvements. The relocation will not entail major interruptions to surrounding users.

Wastewater. Existing sewer lines in Kaunakakai will be avoided during installation and construction of drainage improvements. However, if this is not possible, the sewer lines may have to be relocated. It is not anticipated that sewer service will be interrupted to any users within Kaunakakai.

5.12 Socio-Economic Impacts

Some short-term beneficial economic impacts will occur as a result of increased employment and related spending in Kaunakakai during the construction period. In the long-term, construction of the drainage improvements should improve business conditions in Kaunakakai by reducing the threat of flooding to store owners. As a result, more commercial enterprises and customers should be attracted to the town center.

6. ALTERNATIVES TO THE PROPOSED PROJECT

6.1 No Action

Under the No Action alternative, no new drainage improvements would be constructed. The No Action alternative would not implement the Kaunakakai Drainage Master Plan projects determined to be necessary to mitigate flooding currently experienced in Kaunakakai town. As a result, businesses and residences in Kaunakakai would continue to be inundated during heavy rains, with resulting damage to property and disruption to the community. Depending on the magnitude of the storm, these losses and disruptions can be significant over the years.

Under the No Action alternative, these significant adverse impacts to the residents and business owners in Kaunakakai would persist. Therefore, the No Action alternative is not considered a feasible option.

6.2 Delayed Action

If construction of the proposed drainage facilities is delayed, Kaunakakai will continue to experience local flooding during heavy rains. Delay of the project will serve no purpose except to defer the expense of improvements which will eventually be needed. Delayed action will also continue the economic losses suffered by residents and business owners from flooding in Kaunakakai. The Delayed Action alternative is also not considered a feasible option.

6.3 Alternate Plans

Several alternative plans were considered during the planning analysis for the proposed improvements. Use of an underground drainage system to convey flows was initially considered. An underground system would not require use of surface areas for drainage improvements and would retain the areas for other purposes. However, the relatively flat terrain of the Kaunakakai area does not provide sufficient slope to accommodate an underground system. Secondly, an underground system would cost significantly more to construct and maintain.

A system designed to dispose surface flows into Kaunakakai Stream was also considered. This system would have required a pump station to pump the runoff into Kaunakakai Stream. After analysis, it was found this pump system would be difficult to maintain and operate. Moreover, a surface collection system similar to the proposed improvements would be required to collect the runoff prior to pumping into Kaunakakai Stream.

7. DETERMINATION

A draft environmental assessment was prepared and distributed for review in accordance with the consultation process of Chapter 343, Hawaii Revised Statutes. Based on the significance criteria set forth in Section 11-200-12 of Title 11, Chapter 200, this assessment has determined that the proposed Kaunakakai drainage improvements project will not have significant adverse impacts on the environment, and that an environmental impact statement is not required.

Findings and Reasons Supporting the Determination

The effect of the proposed improvements on the environment is determined to be insignificant. Construction and use of the drainage system improvements will not:

- Involve an irrevocable commitment to loss or destruction of any natural or cultural resources;
- Curtail the range of beneficial uses of the environment;
- Conflict with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, etc;
- Substantially affect the economic or social welfare of the community or state;
- Substantially affect public health;
- Involve substantial secondary impacts, such as population changes or effects on public facilities;
- Involve a substantial degradation of environmentally quality;
- Be individually limited, but cumulatively have considerable effect upon the environment or involve a commitment for larger actions;
- Substantially affect a rare, threatened or endangered species or its habitat;
- Detrimentally affect air or water quality or ambient noise levels; or
- Affect an environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, freshwater area, or coastal waters.

8. AGENCIES CONSULTED IN THE PREPARATION OF THE FINAL EA

The following is a list of agencies and organizations which were consulted in preparation of the Final Environmental Assessment. Those consulted parties who responded to consultation letters are noted with an asterisk. A double asterisk indicates those who provided substantive comments. Letters received and responses to those with substantive comments are shown in the following pages.

Federal Agencies

** U.S. Department of Agriculture Soil Conservation Service
** U.S. Army Corps of Engineers Pacific Ocean Division
** U.S. Department of the Interior Fish and Wildlife Services
U.S. Department of Commerce National Marine Fisheries Service

State Agencies

* Department of Accounting and General Services
Department of Agriculture
** Department of Business, Economic Development and Tourism
* DBED & T - State Energy Office
DBED & T - Molokai Office
** Department of Defense
Department of Education
Department of Hawaiian Home Lands
** Department of Land and Natural Resources
** Department of Land and Natural Resources - State Historic Pres. Division
* Department of Land and Natural Resources - Water Resource Mgmt.
** Department of Health
Department of Health - Environmental Mgmt. Division
** Department of Transportation
** Office of State Planning
Office of Hawaiian Affairs
University of Hawaii Water Resources Research Center
** University of Hawaii Environmental Center

County Agencies

** Planning Department
* Department of Water Supply
* Department of Parks and Recreation

County of Maui Economic Development Agency
Councilmember Pat Kawano

Molokai Organizations

Molokai Planning Commission - Commissioner Walter Ragsdale
Molokai Task Force - Harry Chung
Molokai Economic Opportunity - Fred Bicoy
Molokai Ranch - Ian Hurst
Bank of Hawaii - Kip Dunbar
* Hawaiian Electric Company, Ltd.

2431-02 BTV HB RG RH

United States Department of Agriculture

Soil Conservation Service

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

October 20, 1994

RECEIVED
OCT 25 1994

COUNTY OF MAUI
Engineering Division
Department of Public Works
200 South High Street
Wailuku, Maui, Hawaii 96793
ATTN: Lloyd Lee

Dear Mr. Lee:

Subject: DRAFT ENVIRONMENTAL ASSESSMENT - Kaunakakai Town Drainage Improvements
Kaunakakai, Molokai

We have completed our review of the proposed drainage improvements for the community of Kaunakakai, Molokai. We are concerned about the proposed use of the wetland area as a sediment basin in proposed System "D". There is no clear determination of the sediment volume expected from the drainage area. It would be more prudent to prevent or reduce the sediment load entering drainage system "D" and reduce maintenance requirements. Therefore, erosion and sediment control measures must be installed in the drainage area before and during construction. Furthermore, there is no data regarding the capacity of the wetland to assimilate the sediment load.

It is also unclear on the size of drainage area and discharge System "A" will be controlling. Because the location of System "A" ' to residential and commercial areas, higher levels of protection may be necessary. Lastly, the draft environmental assessment does not adequately address the concern or need to control soil movement caused by wind or surface runoff from the construction areas. There is no mention of the development or installation of best management measures during construction.

We realize that this flood prevention project is important to the citizens of Kaunakakai. However, there are serious technical omissions and flaws in the environmental assessment that must be adequately addressed if a negative declaration is contemplated.

Thank you for the opportunity to provide comments on this project. Should you have any questions, please contact Michael C. Tulang at (808) 541-2608.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

cc: Pamela Mills Packo, District Conservationist, Molokai Field Office.
Bruce Anderson, Director, State of Hawaii, Office of Environmental Quality Control
Barry Toyota, Wilson Okamoto & Associates, Inc.

"To lead the way in helping our customers conserve, sustain, and enhance Hawaii's natural resources through efficient service of the highest quality."

LINDA CROCKETT LINGLE
Mayor
GEORGE N. KAYA
Director
CHARLES JENCKS
Deputy Director
AARON SHINMOTO, P.E.
Chief Staff Engineer

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

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration
EASSIE MILLER, P.E.
Wastewater Reclamation Division
LLOYD P.C.W. LEE, P.E.
Engineering Division
DAVID WISSMAR, P.E.
Solid Waste Division
BRIAN HASHIRO, P.E.
Highways Division

November 21, 1994

Mr. Kenneth M. Kaneshiro
State Conservationist
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P.O. Box 50004
Honolulu, HI 96850-0001

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Mr. Kaneshiro:

Thank you for your October 20, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA). Initially, it should be noted a Drainage Master Plan for Kaunakakai was accepted by the County in August 1992. Much of the detail hydrologic analysis related to determining the appropriate drainage improvements were set forth in the Master Plan and were not repeated in the EA.

The improvements for System D have been designed to follow the existing drainage system which currently drains nearby areas. Thus, it will re-establish the existing system that was in place prior to filling the wetland area and has deteriorated over the years. A sediment basin was not included in the planning for System D. Although the re-established wetlands will provide a natural and incidental filtering function, it was not contemplated nor intended that sediment be collected in the wetlands. Erosion and sedimentation is always a County concern. We would welcome any suggestions or Soil Conservation Service programs that would assist in stabilizing erosion areas and reducing sedimentation.

The Master Plan analysis shows the drainage area for System A covered an area of 28.8 acres. The improvements in the Master Plan for the various systems, including System A, were designed for a 10-year storm event, the County's standard design storm. Although any of the systems, including System A, could have been designed for a more severe storm event, a 10-year storm is compatible with the existing drainage system design for the remainder of Kaunakakai Town.

The need to control soil movement caused by wind or surface runoff from construction areas will be included in the erosion control plan which is an integral part of the construction design.

If you have any questions, please call Joe Krueger, our Staff Engineer at 243-7745 or Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Sincerely,

George N. Kaya
Director of Public Works & Waste Management

JK:mlk(ED94-1390)
G:\ENG\ALL\KKAIDEA.DCS

xc: Barry Toyota, Wilson Okamoto & Associates

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF

October 5, 1994

Planning Division

RECEIVED
OCT 0 7 1994
WILSON OKAMOTO & ASSOC., INC

Mr. Joe Krueger
County of Maui
Department of Public Works
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Krueger:

Thank you for the opportunity to review and comment on the Draft Environmental Assessment for the Kaunakakai Town Drainage Improvements, Kaunakakai, Molokai. The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. The permit information provided on page 4-8 of the environmental assessment is correct. Further information may be obtained from our Operations Division at 438-9258.

b. According to the enclosed Federal Emergency Management Agency's Flood Insurance Rate Maps, panel numbers 150003 0040C (dated September 6, 1989), 150003 0045C (dated September 6, 1989), 150003 0080B (dated June 1, 1981), and 150003 0085C (dated September 6, 1989), the project site is located in the following flood hazard zones:

-Zone C. Areas of minimal flooding.

-Zone A. Areas of the 100-year flood where base flood elevations and flood hazard factors are not determined.

-Zone AH. Areas inundated by the 100-year flood with a base flood elevation of 6 feet above mean sea level.

-Zones A2, A3, A4, and A8. Areas inundated by the 100-year flood with base flood elevations ranging from 3 to 21 feet above mean sea level.

-Zone B. Areas between the limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. Should you require additional

information regarding the flood hazard evaluation, please contact Ms. Jessie Dobinchick of my planning staff at 438-2883.

c. We have a concern about System "A" which proposes to divert drainage areas from above Kaunakakai Town into the federally-constructed Kaunakakai Flood Control project which is designed for the Standard Project Flood under existing conditions. However, if drainage from these additional areas is diverted into the channel, the Kaunakakai Flood Control project may experience overtopping during the design flood or provide less flood protection than authorized. Even though System "A" is designed for a 10-year event, please provide a hydraulic design analysis to us which shows water surface profiles along the entire levee system for the 50-, 100-, and Standard Project Floods with the proposed System "A" diversion in place. Please contact Mr. James Pennaz at 438-8599 for further information regarding the hydraulic analysis.

Sincerely,

/s/ J. Pelowski

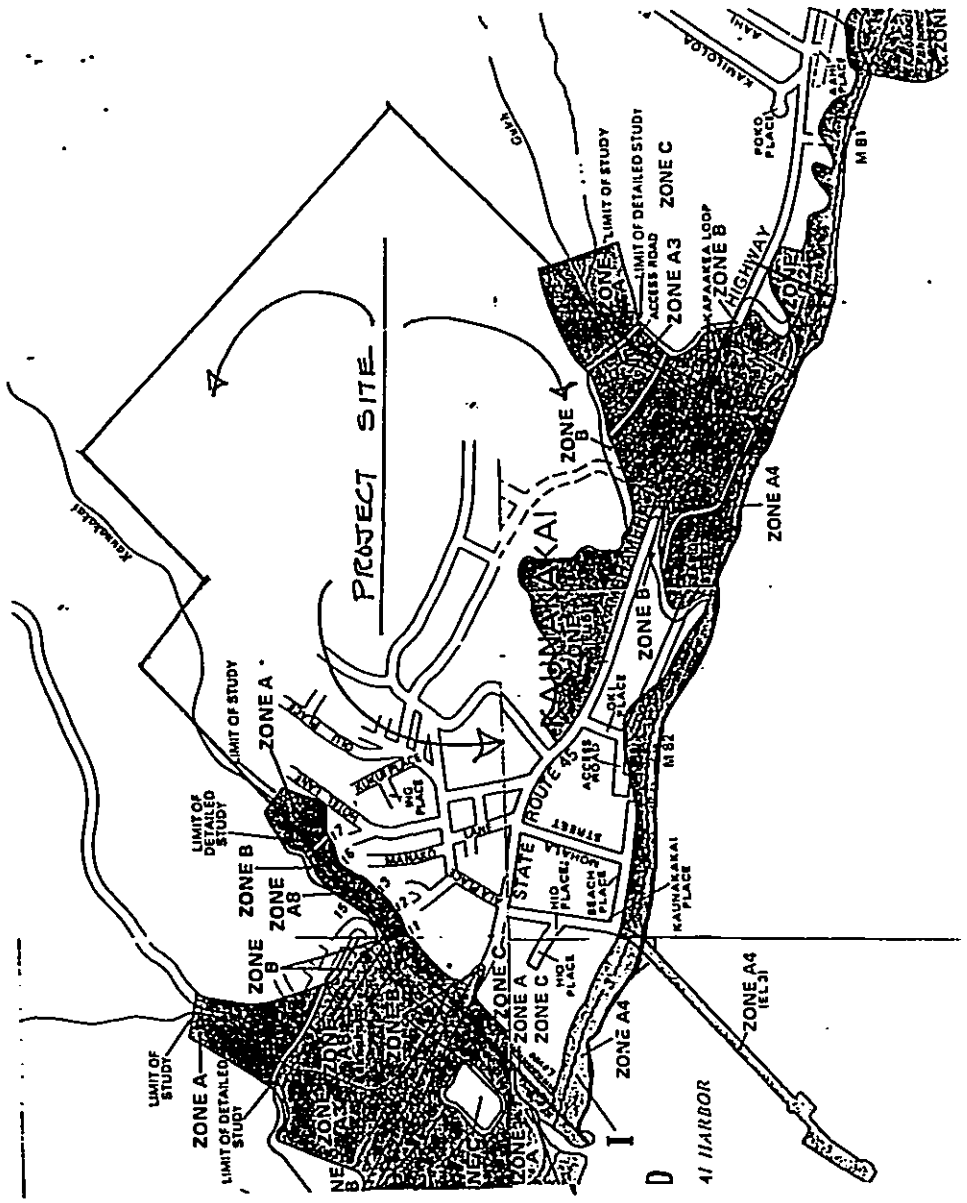
Ray H. Jyo, P.E.
Director of Engineering

Enclosures

Copies Furnished:

Mr. Barry Toyota, Project Manager
Wilson Okamoto and Associates, Inc.
P.O. Box 3530
Honolulu, Hawaii 96811

Mr. Bruce Anderson
State of Hawaii
Office of Environmental Quality Control
220 South King Street, 4th Floor
Honolulu, Hawaii 96813



CUSTOMER COPY

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

November 21, 1994

Mr. Ray H. Jyo, P.E.
Director of Engineering
DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
Fort Shafter, HI 96858-5440

Attention: Planning Division

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Mr. Jyo:

Thank you for your October 5, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA).

We have noted the information you provided regarding the Federal Emergency Management Flood Insurance Rate Maps flood hazard areas.

Our consultant engineers reviewed the available information regarding Kaunakakai Stream prior to proposing the System A improvements. This information was contained in the Flood Insurance Study for County of Maui dated September 6, 1989 which included the various flows expected in Kaunakakai Stream from 10-year, 50-year, 100-year, and 500-year flood events. This source shows a flow of 5,630 cubic feet per second (cfs) for a 10-year flood event; 11,400 cfs for a 50-year flood event; 15,000 cfs for a 100-year flood event and 28,390 cfs for a 500-year flood event. Pertinent portions of the Flood Insurance Study are attached.

We understand from our consultant that the report which accompanied the design of the Kaunakakai Flood Control project was not available. However, review of the as-built drawing for the Flood Control project shows a maximum flow of 15,000 cfs. (A profile from the design drawing is attached.) This maximum flow corresponds to the 100-year flood event in the Flood Insurance Study. based on this review, the calculated design flow for System A from a 10-year storm, approximately 46 cfs, would add less than 0.5 percent to the flow in Kaunakakai Stream for a 100-year flood. Although we share the concern of over-topping, the analysis does not seem to support the idea that System A will cause over-topping the Flood Control project.

If you have any questions, please call Joe Krueger, our Staff Engineer at 243-7745 or Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Sincerely,

George N. Kaya
Director of Public Works & Waste Management

JK:mlk(ED94-1388)
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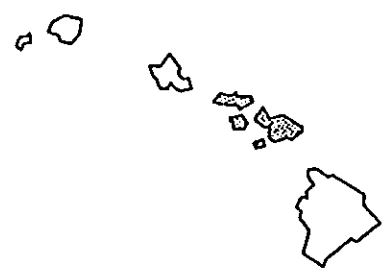
Attachment

xc: Barry Toyota, Wilson Okamoto & Associates

FLOOD INSURANCE STUDY

MAUI COUNTY, HAWAII

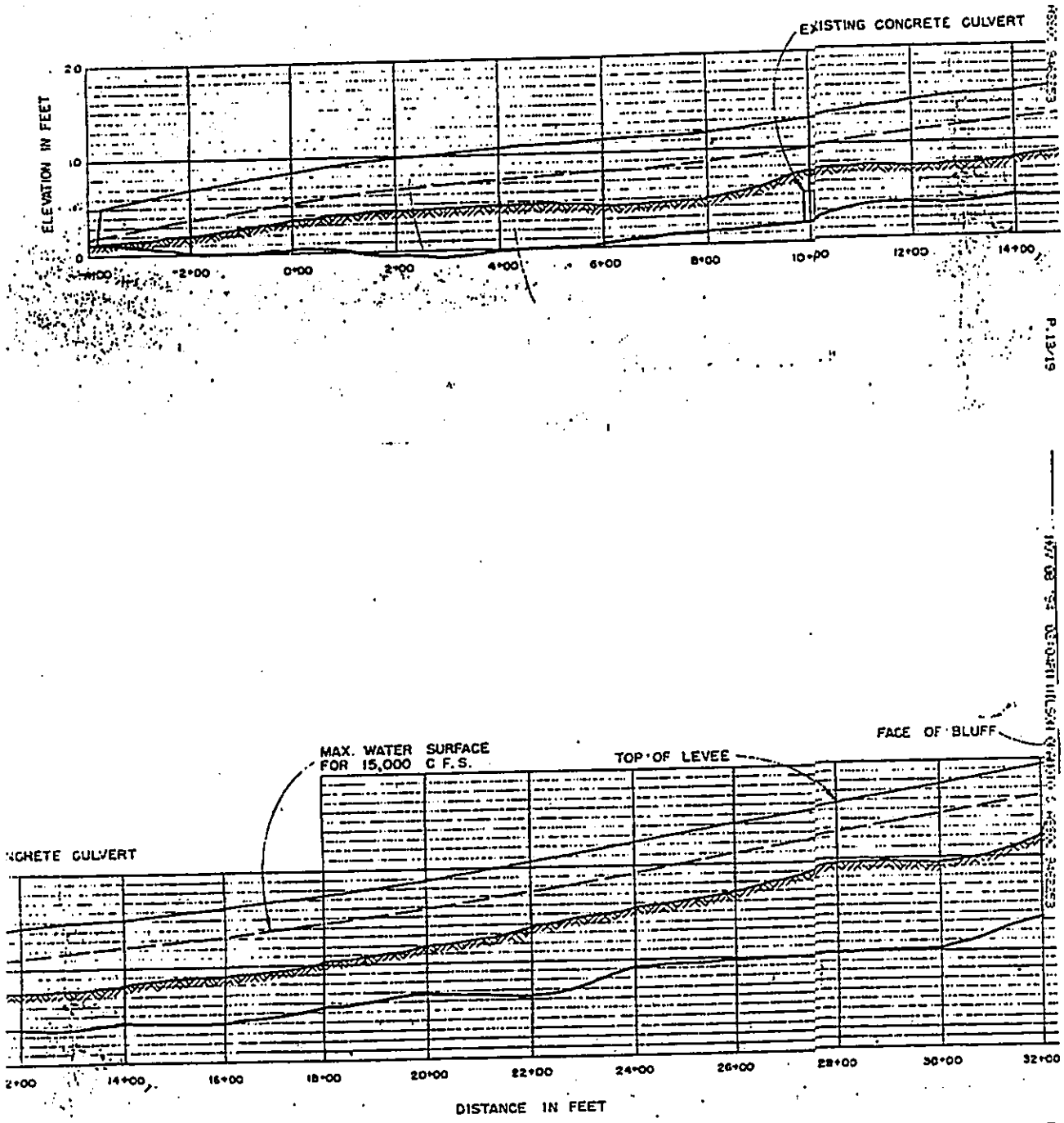


REVISED SEPTEMBER 6, 1989

Federal Emergency Management Agency

Table 1. Summary of Discharges (Cont'd)

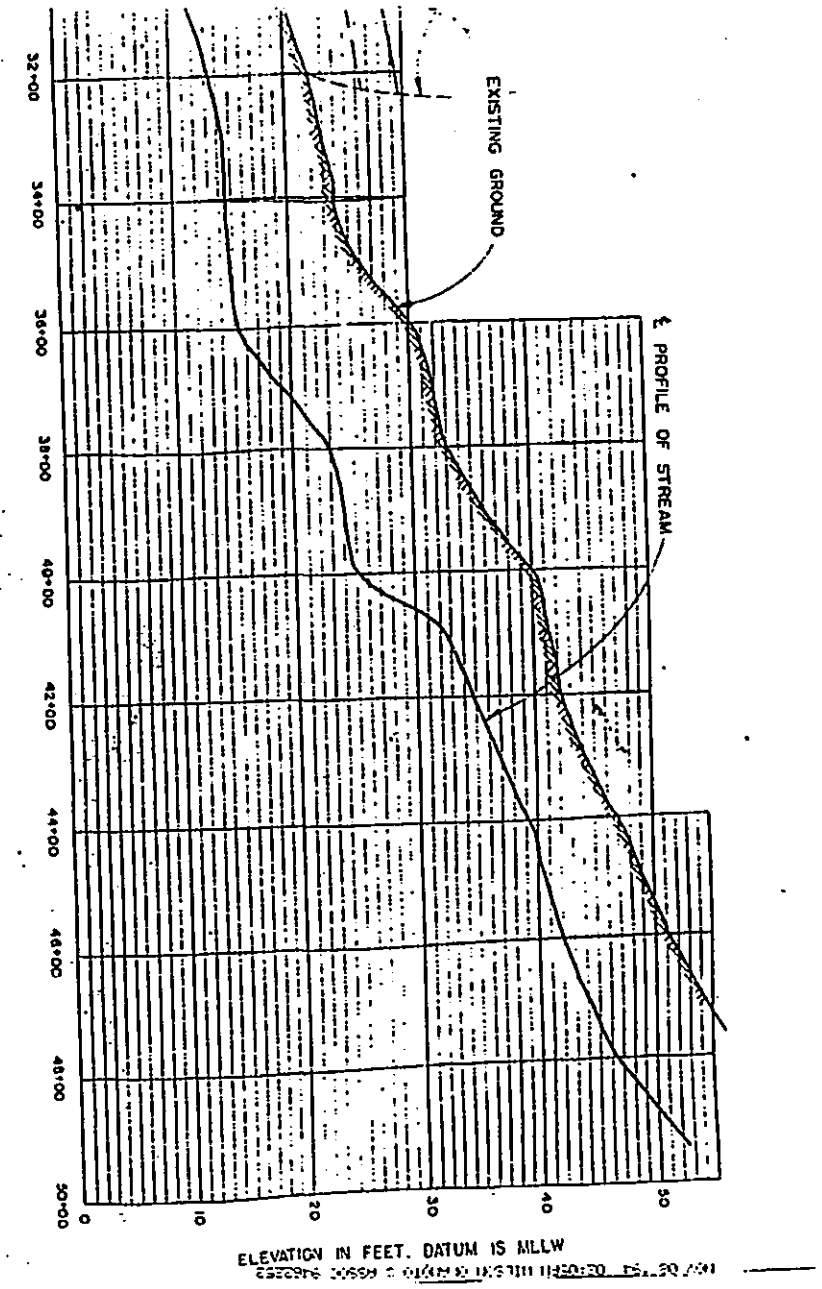
Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharge (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
ISLAND OF MOLOKAI (Cont'd)					
Kaunakakai Stream At Mouth	6.0	5,636	11,400	15,000	28,390
Mile 84 Stream At Mouth	3.7	2,525	6,000	8,200	15,655



PROFILE OF CHANNEL

SCALES : HORIZONTAL : 1"=200'
VERTICAL : 1"=10'

RECEIVED AS FOLLOWS



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Ecoregion
300 Ala Moana Blvd, Room 6307
P.O. Box 50167
Honolulu, Hawaii 96850

NOV 20 1994

In Reply Refer To: CAW

Mr. Joe Krueger
County of Maui
Engineering Division
Department of Public Works
200 South High Street
Wailuku, Maui, Hawaii 96793

Re: Environmental Assessment for Kaunakakai Town Drainage Improvements, Kaunakakai, Molokai, Hawaii

Dear Mr. Krueger:

The U.S. Fish and Wildlife Service (Service) has reviewed the Environmental Assessment (EA) for the Kaunakakai Town Drainage improvements. The proposing agency is the County of Maui, Department of Public Works. The purpose of the proposed project is to relieve the existing flooding problems in the town of Kaunakakai. The Service offers the following comments for your consideration.

The proposed drainage improvements consist of a combination of drainlines, grated inlets, catch basins, box culverts, and shallow, open channels sized to accommodate a 10-year storm. The proposed roadway culvert crossings will be sized to accommodate a 50-year storm. The proposed improvements are broken down into five systems labeled A-E. The following is a brief description of each system:

A. System "A" is located just north of the business district of Kaunakakai, generally follows the southern boundary of Molokai General Hospital, and consists of a berm/grassed ditch approximately 1,100 feet long, which would drain into Kaunakakai Stream.
B. System "B" is located along Ala Malama Avenue and Kaunakakai Place and consists of a combination of a box culvert/grate inlet and an open channel, which would empty into the ocean.
C. System "C" is located along the southeast side of Ala Malama Avenue and runs along the eastern side of Mohala Street down to Beach Place and consists of a combination of a box culvert/grate inlet and an open channel system, which would eventually empty into the ocean.
D. System "D" follows the existing ditches and would drain runoff generated from portions of the town's subdivisions, grassed recreational field and cultivated lands adjacent to Kamehameha V Highway. The runoff collected by this system would follow two paths; one that empties directly into the ocean, and another that empties into the Kohea wetlands.
E. System "E" consists of two concrete-lined channels that would extend 600 feet from the Kamehameha V Highway to the ocean.

The EA examines the environmental effects of implementing each of the five improvements, although the County of Maui currently intends to construct only System A. No schedule has been proposed for constructing Systems B-E.

The EA is well organized and adequately describes the existing environmental conditions at the project site with the exception of the area identified as the Kohea Wetlands. Since this area has been identified for wetland restoration, the Service recommends that the proposed drainage improvements for System D be postponed until after the restoration is completed. Without restoration of the Kohea wetlands, the Service cannot fully determine the extent to which increased runoff may impact the wetlands or the nearshore environment.

The Service has not identified any significant, direct impacts to fish and wildlife resources that will result from implementation of Systems A-C and E. Therefore, the Service concurs with the EA that no endangered species of flora and fauna will be affected by Systems A-C and E. Finally, the Service recommends that implementation of System D be held in abeyance until restoration and revised environmental surveys are completed and reviewed.

The Service appreciates the opportunity to provide these comments. If you have questions regarding these comments, please contact Fish and Wildlife Biologist Christine Willis at 808/541/3441.

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

cc: OEQC, Hawaii
Wilson Okamoto & Ass.
DAR, Hawaii
CZMP, Hawaii
CWB, Hawaii

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director
AARON SHINMOTO, P.E.
Chief Staff Engineer

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

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration
EASSIE MILLER, P.E.
Wastewater Reclamation Division
LLOYD P.C.W. LEE, P.E.
Engineering Division
DAVID WISSMAR, P.E.
Solid Waste Division
BRIAN HASHIRO, P.E.
Highways Division

March 14, 1995

Mr. Brooks Harper, Field Supervisor
U.S. Department of the Interior
Fish and Wildlife Service
P. O. Box 50167
Honolulu, Hawaii 96850

SUBJECT: ENVIRONMENTAL ASSESSMENT FOR KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
KAUNAKAKAI, MOLOKAI

Dear Mr. Harper:

Thank you for your November 20, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA).

Regarding your concerns for System D, the proposed improvements for System D have been designed to follow the existing drainage system which currently drains nearby areas. Thus, it will re-establish the existing system which was in place prior to filling the wetland area and which has deteriorated over the years. Although the improvements to System D have not been programmed, we understand the need to postpone the proposed improvements until restoration of the Kohea wetlands is complete, and we will need to be informed of your schedule for completing this project. During the design phase, the County will complete the necessary environmental surveys and submit the plans for System D for review and approval by your office.

If you have any questions, please call Joe Krueger, our staff engineer at 243-7745 or Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Very truly yours,

CHARLES JENCKS
Director of Public Works
and Waste Management

LL/JK:c(ED95-370)

xc: Wilson Okamoto & Associates

BT/
GS
BG
10/3/94

(P)1842.4

SEP 26 1994

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

Attention: Mr. Joe Krueger

Gentlemen:

Subject: Kaunakakai Town Drainage Improvements
Kaunakakai, Molokai
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: Wilson Okamoto and Associates, Inc.
OEQC

2431-02

JOHN WAIHEE
GOVERNOR

JEANNE K. SCHULTZ
DIRECTOR

RICK EGGED
DEPUTY DIRECTOR

TAKESHI YOSHIHARA
DEPUTY DIRECTOR

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

Central Pacific Plaza, 220 South King Street, 11th Floor, Honolulu, Hawaii
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804 Telephone: (808) 586-2423 Fax: (808) 586-2377

29 September 1994

RECEIVED
OCT 19 1994
WILSON OKAMOTO & ASSOC.

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

Attn: Joe Krueger

Subject: Kaunakakai Town Drainage Improvements

Dear Mr. Krueger:

The Department of Business, Economic Development, and Tourism has been actively involved in building a cultural park near your proposed "B2" drainage improvements.

We testified at your public meetings regarding the planned cultural park and the safety concerns of an open channel system next to the park. In addition, we also testified regarding the open system being unsightly and non-conducive to a cultural park atmosphere.

We again would like to request an underground system of your proposed B2 drainage improvements to minimize negative effects on the proposed cultural park.

Thank you for the opportunity to render comments on the Kaunakakai Town Drainage Improvements Draft EA.

Sincerely,

Jeanne Schultz
Director

c: Bruce Anderson
Office of Environmental Quality Control

Barry Toyota
Wilson Okamoto & Associates, Inc.

Molokai DBEDT Office

LINDA CROCKETT LINGLE
Mayor

GEORGE N. KAYA
Director

CHARLES JENCKS
Deputy Director

AARON SHINMOTO, P.E.
Chief Staff Engineer

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

EASSIE MILLER, P.E.
Wastewater Reclamation Division

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

DAVID WISSMAR, P.E.
Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Division

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

November 21, 1994

Ms. Jeanne Schultz
Director
STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
Central Pacific Plaza
220 South King Street, 11th Floor
Honolulu, HI 96813

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Ms. Schultz:

Thank you for your September 29, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA). We are aware of the State's plans regarding the cultural park which is to be located near the proposed System B improvements.

We have proposed an open channel for System B for several reasons. First, the relatively flat topographic conditions of the entire Kaunakakai area and the need for an ocean outlet would limit the depth an underground system could be buried. The second reason involves cost considerations for both initial construction and on-going maintenance. The design aspects and the cost considerations both weighed in the decision to implement an open channel system.

When the design for System B is undertaken, at that time, there may be measures to mitigate your concerns which can be considered for System B. We will contact you at that time.

If you have any questions, please call Joe Krueger, our Staff Engineer at 243-7745 or Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Sincerely,

George N. Kaya
Director of Public Works & Waste Management

JK:mlk(ED94-1387)
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xc: Barry Toyota, Wilson Okamoto & Associates

2431.02 BT

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

JOHN WAIHEE, Governor
JEANNE K. SCHULTZ, Director
RICK EGGED, Deputy Director
TAKESHI YOSHIHARA, Deputy Director

ENERGY DIVISION, 335 MERCHANT ST., RM. 110, HONOLULU, HAWAII 96813 PHONE: (808) 587-3800 FAX: (808) 587-3820

September 29, 1994

RECEIVED
OCT 3 1994
WILSON OKAMOTO & ASSOC. INC.

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

ATTN: Joe Krueger

Gentlemen:

Subject: Kauanakakai Town Drainage Improvements, Draft Environmental Assessment (Draft EA)
Tax Map Key Numbers: 5-3-01, 02, 09, various
5-4-07, 08 various; Kaunakakai, Molokai, Hawaii

This is to inform you that we have no comments on the subject Draft Environmental Assessment (Draft EA).

Thank you for the opportunity to comment on the subject Draft EA.

Sincerely,

for Maurice H. Kaya
Energy Program Administrator

MHK/hkeis115

cc: OEQC-Mr. Bruce Anderson
Mr. Barry Toyota-Wilson Okamoto & Assoc., Inc.

2431.02 BT JSS BG MY

JOHN WAIHEE
GOVERNOR

EDWARD W. RICHARDSON
ADJUTANT GENERAL

MYLES M. NAKATSU
DEPUTY ADJUTANT GENERAL

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816-4495

October 8, 1994

Engineering Office

RECEIVED
OCT 12 1994
WILSON OKAMOTO & ASSOC. INC.

Mr. Joe Krueger
County of Maui
Engineering Division
Department of Public Works
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Krueger:

Thank you for the opportunity to review the Draft Environmental Assessment for Kaunakakai Town Drainage Improvements. Our comments follow:

We anticipate that the new berm designated as system A will be effective in diverting runoff from the armory and attendant facilities. We asked the engineer/contractor to check with county plans with regard to the new armory entrance from Puali Place. Otherwise, we don't expect to be impacted by the new system except as it provides relief from some of the torrential flooding sometimes experienced by Kaunakakai.

Should you have any questions about these comments, please contact Lieutenant Colonel Richard Young or Ms. Jane Yamamoto on Oahu at 735-4659.

Sincerely,

Jerry M. Matsuda, P.E.
Lieutenant Colonel
Hawaii Air National Guard
Contracting and Engineering Officer

c: OEQC
Wilson Okamoto and Assoc., Inc.

NATIONAL GUARD
Americans At Their Best.

31

LINDA CROCKETT LINGLE
Mayor
GEORGE N. KAYA
Director
CHARLES JENCKS
Deputy Director
AARON SHINMOTO, P.E.
Chief Staff Engineer

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

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration
EASSIE MILLER, P.E.
Wastewater Reclamation Division
LLOYD P.C.W. LEE, P.E.
Engineering Division
DAVID WISSMAR, P.E.
Solid Waste Division
BRIAN HASHIRO, P.E.
Highways Division

November 21, 1994

Lt. Col. Jerry M. Matsuda, P.E.
Contracting and Engineering Officer
Hawaii Air National Guard
STATE OF HAWAII
DEPARTMENT OF DEFENSE
3949 Diamond Head Road
Honolulu, HI 96816-4495

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Colonel Matsuda:

Thank you for your October 28, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA). According to our Master Plan, improvements for System A would not affect Puali Place, except for the culvert. However, our design engineer for System A will check to ensure the new design will be compatible with the new entry to the armory.

If you have any questions, please call Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Sincerely,

George N. Kaya
Director of Public Works & Waste Management

JK:mlk(ED94-1392)
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xc: Barry Toyota, Wilson Okamoto & Associates

JOHN WAIHEE
GOVERNOR

HERMAN M. AIZAWA, Ph.D.
SUPERINTENDENT

RECEIVED
COUNTY OF MAUI

'94 OCT -6 P2:51

ENGINEERING DIVISION
DEPT. OF PUBLIC WORKS

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

September 30, 1994

Mr. Joe Krueger
County of Maui, Engineering Division
Department of Public Works
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Krueger:

SUBJECT: Kaunakakai Town Drainage Improvements, Draft Environmental Assessments
TMK: 5-3-01, 02, 09, various 5-4-07, 08 various

We have reviewed the subject draft environmental assessment and have the following comments. The proposed drainage improvements will have an impact on Kaunakakai Elementary School during the period of construction.

The Department of Education (DOE) requests that the contractor be required to provide mitigating measures to address the noise, dust, and traffic affecting the elementary school. If noise and dust levels exceed Department of Health standards, we will require the developer to provide and install air-conditioning at no cost to the DOE for the classrooms being impacted by this construction project. At a minimum, large noise barriers should be provided.

Furthermore, since the plan is to install shallow open concrete channels on three sides of Kaunakakai Elementary School, the DOE will require that chain-link fences be constructed on the school's perimeter at no cost to the DOE to prevent students from entering the culverts or the open channels.

Traffic to the school during school hours should not be disrupted so parents, students, and staff can ingress and egress the school without traffic delays or hazards. The developer should inform the school's administration of the construction schedule to enable the school to take the necessary steps to minimize any disruption to the delivery of educational services.

Should there be any questions, please call the Facilities Branch at 733-4862.

Sincerely,

Herman M. Aizawa, Ph.D.
Superintendent

HMA:hy

cc: A. Suga, OBS
R. Murakami, MDO

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

November 28, 1994

Mr. Herman M. Aizawa, Ph.D.
Superintendent
State of Hawaii
Department of Education
P. O. Box 96804
Honolulu, Hawaii 96804

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Dr. Aizawa:

Thank you for your September 30, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA).

The contractor will be required by the project's plans and specifications to provide mitigating measures to address the noise, dust, and traffic affecting the elementary school.

The open concrete channels on three sides of Kaunakakai Elementary School will have chain-link fences constructed on the school's perimeter at no cost to the Department of Education.

Traffic to the school during morning and afternoon peak hours will not be disrupted. Traffic control devices will be installed to mitigate ingress and egress traffic delays to the school.

We will conduct a preconstruction meeting with the selected contractor. At that time, we will require a contractor work schedule which will be submitted to you for your review and comments.

Please note that the County will try to minimize impacts to the school during the construction period.

If you have any questions, please contact Stanley Kunitake or Lloyd Lee of our Engineering Division at 243-7745.

Very truly your,

GEORGE N. KAYA
Director of Public Works
and Waste Management

LL/JK:c(Ed94-1395)
KKaDra.ltr

xc: Barry Toyota

JOHN WAIHEE
GOVERNOR OF HAWAII

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

KEITH W. AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JOHN P. KEPPELER II
DONA L. HANAIKE

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

REF:OCEA:DKP

FILE NO.: 95-141
DOC. ID.: 5050

OCT 25 1994

The Honorable George Kaya, Director
Department of Public Works
County of Maui
200 South High Street
Wailuku, Hawaii 96793

OCT 26 1994

Attn: Mr. Joe Krueger

Dear Mr. Kaya:

SUBJECT: Draft Environmental Assessment (DEA): Kaunakakai Town Drainage Improvements, Kaunakakai, Molokai; TMKs: 5-3-01, 02, 09: various; and 5-5-07, 08: various

We have reviewed the DEA information for the subject project transmitted by your letter dated September 13, 1994, and have the following comments:

Division of Aquatic Resources

The Division of Aquatic Resources (DAR) comments that their Molokai biologist reported that the drainage improvements to prevent excessive flooding are long overdue and will definitely benefit the community. No significant long-term impact to aquatic resources is expected, although some temporary disturbance to the environment may occur during construction.

DAR suggests that: Site work be conducted, as much as possible during periods of minimal rainfall; all areas denuded of vegetation should be quickly stabilized to control erosion; and precautions be take to prevent construction materials, debris, petroleum products and other potential contaminants from enter Kaunakakai Stream, Harbor or coastal waters.

Historic Preservation Division

We reiterate the comments of our Historic Preservation Division which were previously forwarded to you directly by their letter of September 28, 1994 (enclosed).

We have no other comments to offer at this time. Thank you for the opportunity to comment on this matter.

Please feel free to call Steve Tagawa at our Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Very truly yours,

KEITH W. AHUE

Enclosure

c: Barry Toyota, Wilson Okamoto & Assoc. w/o encl.
OEQC

57

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

November 21, 1994

Mr. Keith W. Ahue
Director
STATE OF HAWAII
DEPARTMENT OF LAND & NATURAL RESOURCES
P.O. Box 621
Honolulu, HI 96809

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Mr. Ahue:

Thank you for your October 25, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA).

Your comments will be noted that the Division of Aquatic Resources (DAR) does not expect significant long-term impact to aquatic resources from the proposed improvements.

The DAR mitigation measures related to construction activities have been noted. However, it should be noted, none of the systems will involve clearing of large areas. The need to control construction materials, debris, petroleum products and other potential contaminants are covered in the specifications for the construction contractor.

The comments from the Historic Preservation Division will be addressed under a separate letter.

If you have any questions, please call Joe Krueger, our Staff Engineer at 243-7745 or Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Sincerely,

George N. Kaya
Director of Public Works & Waste Management

JK:mlk(ED94-1391)
G:\ENG\ALL\KKADEA.ltr

xc: Barry Toyota, Wilson Okamoto & Associates

JOHN WAIHEE
GOVERNOR OF HAWAII

RECEIVED
OCT 0 6 1994
WILSON OKAMOTO & ASSOC. INC

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

2931-02 DT
10/6/94

KEITH AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JOHN P. KEPPELER II
DONA L. HANAIKE

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

September 28, 1994

Department of Public Works
Attn: Joe Krueger
County of Maui
Engineering Division
200 South High Street
Wailuku, Hawaii 96793

LOG NO: 12720
DOC NO: 9409SC11

Dear Mr. Krueger:

SUBJECT: Review of an Archaeological Inventory Survey Report of a Portion of the Kaunakakai Town Drainage Improvements, Draft Environmental Assessment
Kaunakakai, Moloka'i (TMK: 5-3-1, 2, 6 & 7)

Thank you for the opportunity to comment on the archaeological inventory survey report which forms part of the draft environmental assessment for the proposed Kaunakakai Town Drainage Improvements (*Archaeological Inventory Survey of a Portion of Drainage System A, Kaunakakai, Moloka'i [TMK 5-3-1, 2, 6 & 7]*. By D.F. Borthwick and H.H. Hammatt, 1993).

We believe that the survey has adequately covered the project area, finding a total of two historic sites. Before we can conclude that the report is final and acceptable, however, there are a number of revisions to be made; Attachment 1 itemizes these revisions. In brief, we believe that the description of Site 50-60-03-895 should be modified so as to include a third feature, the filled soil areas on the bluff's edge. In addition, we would like to see additional information provided on the two sites immediately adjacent to the project area: the possible cemetery and the discontinuous wall section. Most of the recommended revisions are minor and we believe they can be easily accomplished. We anticipate accepting the revised report.

cc: H HAMMATT VIA FAX

If there is disagreement over these comments, please let us know, and a consultation meeting can occur between our staff and your archaeological consultant, Cultural Surveys Hawai'i, Inc., in order to resolve the problems.

Please feel free to contact our Moloka'i archaeologist, Sara Collins, at 587-0013, if you have any questions.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

cc: Mr. Roger Evans, OCEA
Wilson Okamoto & Associates, ATTN: Mr. Barry Toyota

ATTACHMENT I

COMMENTS ON ARCHAEOLOGICAL INVENTORY SURVEY
CONDUCTED AT KAUNAKAKAI, MOLOKAI (TMK: 5-3-1, 2, 6 & 7)

BACKGROUND

Substantive Remarks

Cover Page and Page 1: The location for the project area seems to be incorrect, as stated here. The accompanying maps (Figures 3 and 4) indicate that System A lies within TMKs 5-3-02 and 5-3-09, in or along various parcels. Please correct the text and cover page so as include the true location of the project area.

Page 18, Historic Background: Page 18 is missing.

Page 20, Paragraph 1: This discussion of Site -895 with respect to Kamalae Heiau is somewhat confusing. The site plotted on Figures 7 and 8 is labelled -895, not Kamalae Heiau; your textual discussion implies that the location of Kamalae Heiau is illustrated in Figures 7 and 8.

Figures

Page 7, Figure 5: Where are the "possible cemetery" and the "roughly stacked, discontinuous wall" sites described in the text (p. 6)? They should be added to Figure 5 since they were described and surveyed. Also, please add a scale and north arrow to Figure 5.

Other Comments

Pages 10 - 17, Background: There are a number of incorrect, incomplete, or missing references in the sections on Previous Archaeology and Historic Background. Please rectify these omissions. Also, please provide the full citation for references that have been obtained from another source -- e.g., Cooke 1949, IN Silva 1983.

Page 25, Paragraph 1: Did the informants provide any information on Sites -895 and -896?

Spelling and Typos

Page 17, Paragraph 2: In the second sentence, "Kuykendahl" should be spelled "Kuykendall."

Page 20, Paragraph 2: In the second sentence, the word "till" should be "still."

Page 24, Paragraph 1: In the fourth sentence, the word "islands" should be singular.

Page 25, Paragraph 3: In the second sentence, the date "1776" should probably be "1778."

METHODS

Substantive Remarks

Page 6, Methods: Who were the two archaeologists from CSH who performed the fieldwork portion of the inventory survey?

Page 6, Paragraph 2: How were Sites -895 and -896 mapped (i.e., Figure 10)? Please add the method to this discussion (e.g., compass and tape).

DESCRIPTIONS

Spelling and Typos

Page 27, Paragraph 2: The second sentence lacks an article and its auxiliary verb; the sentence should probably read: "The edge of the bluff to the east of the site was modified . . .".

DESCRIPTIONS

Substantive Remarks

Page 27, Paragraph 3: The filled-in bluff edges on the east side of the site, or probable planting areas, should be considered a third feature (C) of Site -895. Any data recovery plan developed for Site -895 should include testing of one of these modified soil areas so as to ascertain its construction and probable function(s).

Page 27, Survey Results: Please provide photographs of the two sites in the project area: -895 and -896. These photographs should include views of the multiple features at Site -895. Also, please provide photographs of the "possible cemetery area" and "roughly stacked, discontinuous wall" described on page 6.

ET

LINDA CROCKETT LINGLE
Mayor
GEORGE N. KAYA
Director
CHARLES JENCKS
Deputy Director
AARON SHINMOTO, P.E.
Chief Staff Engineer

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

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration
EASSIE MILLER, P.E.
Wastewater Reclamation Division
LLOYD P.C.W. LEE, P.E.
Engineering Division
DAVID WISSMAR, P.E.
Solid Waste Division
BRIAN HASHIRO, P.E.
Highways Division

November 21, 1994

Mr. Don Hibbard
Administrator
State Historic Preservation Division
STATE OF HAWAII
DEPARTMENT OF LAND & NATURAL RESOURCES
33 South King Street
Honolulu, HI 96813

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Mr. Hibbard:

Thank you for your September 28, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA) and the Archaeological Inventory Survey Report. We have sent your comments to our archaeological consultant, Cultural Surveys Hawaii, for incorporation into their final report.

Cultural Surveys Hawaii has indicated the information regarding the cemetery was obtained from alocal informant during their field work. Cultural Surveys will locate this feature on their report graphics and maps to provide a record of its location. Similarly, a new graphic and map will be incorporated into the report to locate the discontinous wall feature.

If you have any questions, please call Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Sincerely,

George N. Kaya
Director of Public Works & Waste Management

JK:mlk(ED94-1394)
G:\ENGALL\KKAIDEA.ltr

xc: Barry Toyota, Wilson Okamoto & Associates

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

RECEIVED
JAN 0 6 1995

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

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
DEPUTY
GILBERT COLOMA-AGARAN
AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

January 3, 1995

Mr. Bruce Gorst
Wilson Okamoto & Associates
P.O. Box 3530
Honolulu, Hawaii 96813

LOG NO: 13258
DOC NO: 9411SC08

Dear Mr. Gorst:

SUBJECT: Historic Preservation Review of a Revised Report on the Archaeological Inventory Survey of a Portion of Drainage System A Kaunakakai, Moloka'i
TMK 5-3-02: po. 72; 5-3-03: por. 01; 5-3-09: por. 17

Thank you for the submission of the revised archaeological inventory survey report for Kaunakakai Drainage Improvement System A (Archaeological Inventory Survey of a Portion of Drainage System A, Kaunakakai, Moloka'i [TMK 5-3-02: por. 72; 5-3-03: por. 01; 5-3-09: por. 17. 1994. D.F. Borthwick and H. H. Hammatt). The revisions were made in response to our letter of September 18, 1994.

The revisions have been acceptably made. We can now verify that the inventory survey of the subject parcels has been successfully executed. On October 4, 1994, Sara Collins of our staff, conducted a field inspection of the project area.

We concur with the significance assessments provided for sites -895 and 896; both sites are significant for their information content.

We also concur with the mitigation commitment to conduct data recovery work at both sites (including additional background research, oral history, excavations, and analysis of materials). We are, however, uncertain about the function(s) attributed to Site -895, but believe that data recovery work may result in clear findings on site function(s). Prior to conducting such fieldwork, a data recovery plan must be submitted to and accepted by the State Historic Preservation Division. Successful execution of the data recovery work will result in "no adverse effect" to these sites.

Please feel free to call our Moloka'i Archaeologist, Sara Collins, at 587-0013, if you have any questions.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

SC:ab

cc: Mr. Douglas Borthwick, Cultural Surveys Hawai'i, Inc.
Mr. Joe Krueger, County of Maui Dept. of Public Works

JOHN WAIHEE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

OCT 27 1994

ENGINEERING DIVISION
DEPT. OF PUBLIC WORKS

'94 OCT 28 P4:14
RECEIVED
COUNTY OF MAUI

KEITH W. AHUE
CHAIRMAN

DR. PETER BYRNE, M.D.
ROBERT S. NAKATA
J. DOUGLAS ING, ESQ.
ROBERT G. GRALD
DAVID HORIKOA

RAE M. LOUI, P.E.
DEPUTY

Mr. John L. Sakaguchi, Planner
Wilson Okamoto & Associates, Inc.
P. O. Box 3530
Honolulu, Hawaii 96811

Dear Mr. Sakaguchi:

This is in response to your request for a determination as to whether the watercourses indicated on Figure 10 of the Kaunakakai Drainage Master Plan are considered to be "streams" as defined in Section 13-169-2, HAR, and are subject to stream channel alteration permits.

We have discussed these watercourses with the Division of Aquatic Resources' aquatic biologist on Molokai, and it appears that these watercourses are not considered to be "natural watercourses" and they do not support instream uses, therefore, they are not considered to be "streams" as defined in Section 13-169-2, HAR. Since these watercourses are not considered to be streams, they are not subject to stream channel alteration permits pursuant to Section 13-169-50, HAR.

We appreciate your inquiry and your concern for the Commission's permit requirements. Should you have any questions regarding this letter, please do not hesitate to call David Higa at 587-0249.

Sincerely,

RAE M. LOUI
Deputy Director

DH:ss

c: Mr. Joe Krueger, County of Maui, Dept. of Public Works

BT/
JS

JOHN WAIHEE
GOVERNOR OF HAWAII

PETER A. SYBINSKY, PH.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:

October 27, 1994 94-200/epo

Mr. Barry Toyota
Project Manager
Wilson Okamoto & Associates, Inc.
1907 South Beretania Street
Honolulu, Hawaii 96826

Dear Mr. Toyota:

Subject: Draft Environmental Assessment

Kaunakakai Drainage Improvements
Kaunakakai, Molokai
TMK: 5-3-01, 02, 09 & 5-4-07, 08

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

Nonpoint Source Pollution Concerns

The proposed drainage improvement project is located on the island of Molokai above the South Molokai coastline, one of sixteen Water Quality Limited Segments identified by the Hawaii State Department of Health. Currently, state monitoring of coastal waters show significant violations of water quality standards for suspended solids and nutrients. Proper planning, design, and use of erosion control measures and best management practices will substantially reduce the total volume of runoff, erosion, and potential for nonpoint source pollution.

As part of the proposed drainage improvements, we recommend the following measures to reduce sediment and improve coastal water quality of South Molokai.

1. Replant or cover bare areas from construction activities as soon as grading or grubbing work is completed. New planting will require soil amendments, fertilizers, and temporary irrigation to become established. Use high planting and/or seeding rates to ensure rapid stand establishment.

2. Improve, manage, and maintain the ground cover in the Kamiloloa drainage basin, located east of Kaunakakai town,

If you should have any questions, please contact Ms. Shirley Nakamura of the Environmental Planning Office at 586-4345.

Sincerely,

Peter A. Sybinsky, Ph.D.
Director of Health

c: MDHO (David Nakagawa)
EPO(Shirley)

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director
AARON SHINMOTO, P.E.
Chief Staff Engineer

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

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration
EASSIE MILLER, P.E.
Wastewater Reclamation Division
LLOYD P.C.W. LEE, P.E.
Engineering Division
DAVID WISSMAR, P.E.
Solid Waste Division
BRIAN HASHIRO, P.E.
Highways Division

March 14, 1995

Dr. Peter A. Sybinsky, Director
State of Hawaii
Department of Health
P. O. Box 3378
Honolulu, Hawaii 96801

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Dr. Sybinsky:

Thank you for your October 27, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA).

We acknowledge that monitoring of coastal waters off Molokai show significant violations of water quality standards. In consultation with the Department of Land and Natural Resources, we note that the Division of Aquatic Resources (DAR) does not expect significant long-term impact to aquatic resources from the proposed improvements.

Your recommendations regarding measures to reduce sediment and improve coastal water quality of South Molokai are noted and will be addressed during design. Please be aware that none of the drainage systems will involve clearing of large areas. The need to reduce sediment through immediate new planting will be covered in the specifications for the construction contractor. Maintenance of the groundcover will be the responsibility of the County of Maui within the project limits.

If you have any questions, please call Joe Krueger, our staff engineer, at 243-7745 or Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Very truly yours,

CHARLES JENCKS
Director of Public Works
and Waste Management

LL/JK:c(ED95-371)

xc: Wilson Okamoto & Associates

JOHN WAIHEE
GOVERNOR

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

REX D. JOHNSON
DIRECTOR

DEPUTY DIRECTORS
KANAHELE HOLT
GLENN M. OKIMOTO
JOYCE T. OMINE
CALVIN M. TSUDA

IN REPLY REFER TO:

STP8.6433

October 26, 1994

RECEIVED
NOV 0 2 1994
WILSON OKAMOTO & ASSOC.

Mr. Joe Krueger
Engineering Department
Department of Public Works
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Krueger:

Subject: Draft Environmental Assessment (EA)
Kaunakakai Town Drainage Improvements
TMK: 5-3-01, 02, 09; 5-4-07, 08

We have the following comments on the Kaunakakai Town drainage improvements plan:

1. The Kaunakakai Stream overtops the ford on Maunaloa Highway, not Kamehameha V Highway. An indication on how frequently storm runoff overtops the Maunaloa Highway ford should be included in the final EA.

2. The EA states "System A" will increase the flow of Kaunakakai Stream by about 46 cfs under 10-year storm conditions. This increase flow should be mitigated by installing a storm drain culvert beneath the Maunaloa Highway ford at no cost to the State.

3. Plans for any construction within the State highway right-of-way must be submitted for our review and approval.

We appreciate the opportunity to provide comments.

Sincerely,

Glenn M Okimoto

Rex D. Johnson
Director of Transportation

c: OEQC, Wilson Okamoto & Associates, Inc.

LINDA CROCKETT LINGLE
Mayor

GEORGE N. KAYA
Director

CHARLES JENCKS
Deputy Director

AARON SHINMOTO, P.E.
Chief Staff Engineer

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

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

EASSIE MILLER, P.E.
Wastewater Reclamation Division

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

DAVID WISSMAR, P.E.
Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Division

November 21, 1994

Mr. Rex D. Johnson
Director of Transportation
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 Punchbowl Street
Honolulu, HI 96813-5097

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Mr. Johnson:

Thank you for your October 26, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA).

The correction to the name of the Maunaloa Highway will be incorporated in the Final EA. According to our personnel at the Kaunakakai baseyard, the frequency of overtopping the ford is about two to three times per year. It should be noted, the crossing of Kaunakakai Stream has been designed as a ford by the State. The problem of overtopping is inherent with a crossing designated as a ford.

The analysis of the increased flow to Kaunakakai Stream was included in the Drainage Master Plan for Kaunakakai Town. This analysis was based on the number and size of the culverts under the Maunaloa Highway stream ford and showed the ford will experience overtopping at flows of approximately 900 cubic feet per second (cfs). The Flood Insurance Study which covers the Kaunakakai area indicates flows of 5,636 cfs in Kaunakakai Stream for a 10-year flood. An additional culvert to carry the added flow of about 46 cfs from System A would not prevent overtopping the ford.

If there is any construction within the State highway right-of-way for any of the drainage improvements, the County will submit the plans for review and approval during the design phase.

If you have any questions, please call Joe Krueger, our Staff Engineer at 243-7745 or Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Sincerely,

George N. Kaya
Director of Public Works & Waste Management

JK:mlk(ED94-1386)
G:\ENG\ALL\KKAIDEA DOT

xc: Barry Toyota, Wilson Okamoto & Associates

OFFICE OF STATE PLANNING
Office of the Governor

RECEIVED
OCT 28 1994
WILSON OKAMOTO & ASSOC. INC.

Ref. No. C-858

September 26, 1994

Mr. Joe Krueger
Engineering Division
Department of Public Works
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Krueger:

Subject: Draft Environmental Assessment for the Proposed Kaunakakai Town Drainage Improvements, Kaunakakai, Molokai

We have reviewed the environmental assessment for the proposed Kaunakakai Town drainage improvements. In general, we agree that the proposed improvements are needed. However, we have concerns about the project design relative to our statutory responsibilities.

The proposed drainage construction and improvements will, as expected, increase impermeable surfaces, and along with it, the potential for additional chemical agents in the runoff. The detrimental effects these pollutants will have on the coastal ecosystems and water quality is a significant concern to us.

Water quality, coastal water quality in particular, is a leading environmental issue. In this regard, the State's Coastal Zone Management (CZM) law requires that the following policies be complied with:

* Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs. (Section 205A-2(c)(4)(C))

* Promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate water quality standards. (Section 205A-2(c)(4)(D))

Since drainage systems C, D and E will discharge into class AA marine waters, this matter is critically important. The objective of the class AA water classification is to maintain the waters in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or actions. Therefore, mitigation measures should be considered and incorporated into the design of the project to assure compliance with the State CZM and Department of Health laws and regulations.

If there are any questions, please contact our Coastal Zone Management Program at 587-2876.

Sincerely,

Mary Lou Kobayashi for
Norma Wong
Director

cc: Dr. Bruce Anderson, DOH
Barry Toyota, Wilson Okamoto & Associates

3.

LINDA CROCKETT LINGLE
Mayor
GEORGE N. KAYA
Director
CHARLES JENCKS
Deputy Director
AARON SHINMOTO, P.E.
Chief Staff Engineer

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

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration
EASSIE MILLER, P.E.
Wastewater Reclamation Division
LLOYD P.C.W. LEE, P.E.
Engineering Division
DAVID WISSMAR, P.E.
Solid Waste Division
BRIAN HASHIRO, P.E.
Highways Division

November 21, 1994

Ms. Norma Wong
Director
STATE OF HAWAII
OFFICE OF STATE PLANNING
P.O. Box 3540
Honolulu, HI 96811-3540

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Ms. Wong:

Thank you for your September 26, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA).

The drainage improvements to be constructed will involve open concrete channels, box culverts, and an earthen levee. Major construction of impervious surfaces would not be involved. Thus, although there would be some increases, the increase should not be so significant.

We also share your concern that coastal waters be protected. The water quality analysis conducted as part of the EA addressed the issue of water quality of nearshore and offshore marine environments. (See Appendix B in the EA.) Water quality sampling was conducted in the nearshore waters near the discharge points for the various systems, including Systems C, D, and E. (See Figure 3.1 in the EA.) As can be seen, the sampling program included marine waters classified as Class AA. The results of the analysis showed implementation of the drainage improvements would have no significant negative impacts on the water quality of the nearshore and offshore marine environments.

Notwithstanding these findings, as requested, mitigation measures to further protect these waters will be considered during design of the Systems C, D, and E.

If you have any questions, please call Joe Krueger, our Staff Engineer at 243-7745 or Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Sincerely,

George N. Kaya
Director of Public Works & Waste Management

JK:mlk(ED94-1389)
G:\ENG\ALL\KKAIDEA.osp

xc: Barry Toyota, Wilson Okamoto & Associates

University of Hawai'i at Mānoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

October 20, 1994
EA:0092

Mr. Joe Krueger
County of Maui
Department of Public Works
Engineering Division
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Krueger:

Draft Environmental Assessment (EA)
Kaunakakai Town Drainage Improvements
Kaunakakai, Molokai

The proposed project involves construction of drainage improvements within the town of Kaunakakai to prevent inundation of roads, homes, and businesses during periods of heavy rains. Improvements consist of drainlines, grated inlets, catch basins, box culverts, and shallow open channels.

We have reviewed the Draft EA with the assistance of David Penn, Geography; and Malia Akutagawa of the Environmental Center.

Technical Characteristics

Tables and Figures. A map scale should be estimated in Figures 2.1 and 2.8. A No Scale sign on the various maps is professionally unacceptable. Figure 1.1 should show the boundaries of the upslope secondary study area where runoff is generated. Figure 2.1 should show surrounding land uses and outlines of subareas 1-5. Also the school and levee referenced on page 2-2 were not included in this figure. Figure 2.2 reveals a stream that is heavily affected by sediments and encroaching vegetation directly upstream of existing ford culverts; yet, there is no mention of this encroachment or any plan to remove it. It would be helpful if existing and proposed drainage systems were displayed on Figure 2.8 or as transparent overlays. The tie-in of System A with the existing levee should be clearly depicted in this figure. When System A is constructed, what happens to the old berm and

CE3? While figures show DE9 and DE10 reaching the ocean, the text states that there are no culvert crossings for these ditches to pass under the road. Does this mean that ditch sections are discontinuous and dissected by the road?

On page 3-3 and 5-2, the Draft EA mentions erosion in an adjacent basin without focusing on erosion within the study area! While the amount of sediment generated in the study is indeed minimal when compared to the upper reaches of the drainage basin, this in itself is not a valid argument in support of concrete lined open channels as intimated in the Draft EA. It seems that a detention basin for storm runoff generated upslope might be a better alternative than intended conveyance of this runoff through CE9.

More information needed. Rainfall and runoff statistics for the primary and secondary study areas would be helpful, including diagrams and runoff hydrographs for existing drainage systems. The Draft EA should also include a discussion of the strengths and weaknesses of the SCS Tabular Method employed.

The addition of 46 cfs to Kaunakakai streamflow should be discussed in terms of ford culvert capacity. In storms not only the duration but also the magnitude of flooding would increase, affecting not only the timing but also the degree of isolation from public services. Diversion of additional runoff into the Kaunakakai area would seem to require amendment of interim instream flow standards by the State Commission on Water Resource Management. Man-made factors contributing to the problem should also include poor planning, zoning, permitting, and implementation of construction activities (see p. 2-6).

Reliance on outdated concepts. Although we have not reviewed the referenced 1992 Drainage Master Plan, its application here seems to reflect an over-reliance on outdated concepts of maximum efficiency of stormwater conveyance to the oceans. There should be more reference to and application of state-of-the-art concepts of runoff control through source area management, detention and retention of stormwater runoff, and non-structural runoff management alternatives. Maui County's reliance upon the 1971 Drainage Master Plan Standards is especially disturbing. These standards are largely outdated and should be updated continually to reflect evolving state-of-the-art conceptual understanding and engineering methods.

Potential Environmental Impacts

Marine studies. Marine sampling of pre-project and post-project conditions without reference to the occurrence and deviation from prevailing currents, tides, and other ocean conditions makes results difficult to analyze and incorporate into evaluation. Baseline quantification of pre-project and post-project inputs to the marine environment is a critical step missing from this Draft EA.

Transect data of coral abundance were somewhat misleading. On page 3-10, the Draft EA states:

> "The offshore stations show a clear gradient of decreasing reef coral abundance going from the westernmost station (1OS) to Station 5OS at the eastern limit of the study area ... The only obvious physical variable related to the decreasing coral coverage was increased sand cover, which may restrict coral settlement, development and growth through resuspension scouring and scouring of reef surfaces."

The Draft EA fails to mention the uniqueness of this area, in that the Kaunakakai wharf creates a microhabitat in which reef life to the immediate west is sheltered by this man-made structure from the trade winds. On typical days when the trade winds are blowing, the water to the east of the wharf is choppy, and the currents churn up the muddy substratum making the waters turbid. On the portion west of the wharf, the waters are calm, the sediments are well settled and visibility is good. These conditions are likely more favorable to coral growth, since the stresses of light inhibition and heavy siltation are not factors in this micro-environment. Although Station 3OS is to the west of the wharf, Figure 3.2 reveals that there is some kind of outlet (another reef or possibly one of the rock pilings constructed at the wharf) which also serves to shelter this station from the churning currents. The wording in the Draft EA suggests an illusory view that Stations 1OS and 3OS are the norm and the west stations are aberrants.

The Draft EA fails to note that practically the entire Kaunakakai region from Makakupai'a to Pala'au consists of mudflats. No information was given as to the history of this region, nor any discussion of whether past agricultural and ranch activities promoted erosion and sedimentation, or whether this mudflat habitat always had existed. No mention was made that in the afternoons, when the tradewinds pick up and the currents are stronger, the waters in this entire region are brown, discouraging coral growth. It is no wonder that the nearshore, midreef, and easterly offshore sites exhibit low abundances of coral.

The Draft EA also omits any data on the condition of these corals except in an offhanded manner. In an inventory of benthic species at a mid-reef station the document states, "...a bristleworm and some boring sea urchins were found on the coral rubble" (p. 3-8). Since coral abundances are very low especially in the nearshore and mid-reef stations, and since coral rubble was mentioned, is it fair to assume that most of the reef is dead?

Will the discharge of freshwater into the ocean significantly alter the salinity of nearshore waters and in turn stress or kill existing, live coral as well as change the marine species composition to one mirroring a more estuarine habitat?

Water quality. Assertions that total flows will increase with no changes in water quality should be confirmed by the presentation of baseline data on pre-project discharges

(water quantity and quality) and comparison of these baseline data with estimates of post-project conditions for the same parameters. What are the magnitudes, timing, frequency, duration, and constituents of existing flows in the drainage systems? How would these characteristics change with construction of the proposed projects with improved maintenance of existing systems or with implementation of other drainage alternatives?

Possibility of pesticide and fertilizer input into drainage system and ocean. The Draft EA does not reflect the presence of any agricultural sites next to the town; yet there are two, approximately one-acre cornfields, one makai of Manila Camp overlooking the main highway, and the second between the new baseball field (east of Kaunakakai Elementary School) and Kapa'akea Cemetery. Does runoff from these cornfields contain pesticides and fertilizers? Will this water be integrated into the drainage system and be discharged ultimately into the ocean?

> Under Section 11-200-12(b), a project is deemed significant if it....
>
> (1) involves an irrevocable commitment to loss or destruction of any natural or cultural resource, (7) involves a substantial degradation of environmental quality, [and] (11) affects an environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

Since there is a potential for environmental degradation in that water discharge into the ocean may carry pesticides and fertilizers, and decreased salinity levels may serve to stress reef and other marine life. Our reviewers suggests that an EIS be prepared to better assess the significance of this project.

Wetland Restoration and Integration into Drainage System

The Draft EA should discuss in greater detail the compatibility of drainage inputs with wetland restoration and the management plans for maintaining the restored habitat. For instance, how much sedimentation would be expected and how would deposits be managed? How does the projected input of drainage water to the wetland compare with its previous capacity and historical inputs with regard to both volume and constituents?

Cultural and Archaeological Resources

The Draft EA should address the occurrence of cultural resources which may not be classified as archaeological or historic "sites."

Socio-economic Impacts

Economic feasibility. The Draft EA reveals a major maintenance problem of existing drainage structures, but there is no analysis of the degree to which improved maintenance would improve drainage conveyance. It is important to compare the costs and benefits of improved maintenance with those of new construction of drainage systems. The feasibility of moving currently misplaced culverts into better positions instead of replacing them with new culverts in new locations should be addressed. Trade-offs between upgrades and maintenance of existing systems and acquiring new easements for new construction should be discussed.

Public Input. Is there public support from the Molokai community for the implementation of a new drainage system? Are there concerns about the fact that the proposed project will have an increased capacity to support further development that could potentially change the rural town atmosphere of "Mom and Pop" stores to a more urban atmosphere? Are fishermen and subsistence practitioners concerned about water discharge into the ocean and potentially changing the marine habitat in the wharf area?

Although the proposed drainage system may seem fairly benign as far as physical structures proposed for placement on or in the ground, this project may have more far-reaching, long-term effects. Under Section 11-200-12(b), H.A.R. a project is considered significant if it....

> (4) substantially affects the economic or social welfare of the community or State, (6) involves substantial secondary impacts, such as population changes or effects on public facilities, [and] (8) is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.

Since this project is potentially significant socially as well as environmentally, the drafting of an EIS would seem to be required.

Need for Extended Review

If this project is approved as is, and since only System A is scheduled for implementation, an extended review period for the other systems may be warranted, especially given the deficiencies in the current assessment.

Necessity of Project and Alternatives to Action

While the inadequacy of the present drainage system in conveying stormwater runoff to the ocean is a cause of flooding, it is also a form of runoff detention and retention which

lessens the conveyance of pollutants to the marine environment and enhances groundwater recharge.

The alternatives analysis is limited and should be expanded to include greater discussion of detention and retention structures (possibly including constructed wetlands and other storage of stormwater runoff for future use), improved maintenance, runoff control in source areas, and non-structural alternatives.

Conclusion

We do not agree that the "proposed system [as described in this Draft EA] is designed to address present inadequacies ...." (p. 2-16) The proposed system does not address present inadequacies in maintenance, lack of state-of-the-art structures, and faulty construction/siting of existing structures. The document is lacking in many areas: no cost-benefit analysis is made, no exploration is offered into the possibility of integrating existing with proposed structures to minimize cost and environmental impact; no prediction or estimate is attempted of changes in existing environmental conditions (e.g., water quality, impact on reef life, erosion, etc.), and no reference is made to potential social impacts resulting in the proposed system's increased capacity to support new developments. Because this project may be significant environmentally, economically, and socially, we recommend that an EIS be prepared as required under Section 11-200-12 of the Hawaii Administrative Rules (H.A.R.)

Thank you for the opportunity to review this Draft EA.

Sincerely,

John T. Harrison
Environmental Coordinator

cc: OEQC
Wilson Okamoto and Associates, Inc. ✓
Roger Fujioka
David Penn
Malia Akutagawa

37

LINDA CROCKETT LINGLE
Mayor
GEORGE H. KAYA
Director
CHARLES JENCKS
Deputy Director
AARON SHINMOTO, P.E.
Chief Staff Engineer

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

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration
EASSIE MILLER, P.E.
Wastewater Reclamation Division
LLOYD P.C.W. LEE, P.E.
Engineering Division
DAVID WISSMAR, P.E.
Solid Waste Division
BRIAN HASHIRO, P.E.
Highways Division

November 21, 1994

Mr. John T. Harrison
Environmental Coordinator
UNIVERSITY OF HAWAII AT MĀNOA
Environmental Center, 317 Crawford
2550 Campus Road
Honolulu, HI 96822

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Mr. Harrison:

Thank you for your October 20, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA).

Figures 2.1 and 2.8 have been reduced from a larger scale map for presentation purposes. The scale is approximately 1-inch equals 270 feet. The upper portions of the secondary study area extend into the upper portions of East Molokai above Kaunakakai. This area was not mapped as it was not part of the primary study area. The school and levee will be added to Figure 2.1 and 2.8. The stream in Figure 2.2 is Kaunakakai Stream. There are no plans to remove the vegetation in the area of the photograph at this time. We do not feel the vegetation is affecting the capacity of the stream. It also provides a stabilizing effect to the soil along the stream bank. An additional figure will be included in the Final EA to show the existing and proposed improvements.

The tie-in of System A with the existing topography is a detail of the design phase. The existing levee will not be affected by System A as the improvements are mauka of the end of the levee. As stated in the Draft EA, DE9 and DE10 currently flow across the road. System E has been proposed to alleviate this condition.

While we realize erosion is a serious problem, the Kamiloloa area is outside of the primary study area of the drainage improvements. The concept of detention basins was considered in the Kaunakakai Town Drainage Improvements Master Plan. However, detention basins are somewhat land intensive. With few exceptions, all of the land is privately owned near the shoreline where the detention basins would be effective. The County lacks sufficient funds to purchase such lands or to acquire easements to construct detention basins. Additionally, the County does not have the personnel to maintain such additional facilities. Implementation of the proposed drainage improvements should reduce erosion and sedimentation problems by reducing the larger surface flows over exposed lands.

Rainfall data was included in the Kaunakakai Town Drainage Improvements Master Plan. Appropriate similar data will be added as an appendix to the Final EA. The SCS method was also discussed in the Kaunakakai Town Drainage Master Plan. The Drainage Master Plan for the County of Maui (1971) sets forth the method of analysis of flows and is used uniformly throughout the County to calculate runoff.

The analysis of the increased flow to Kaunakakai Stream was included in the Drainage Master Plan for Kaunakakai Town. This analysis was based on the number and size of the culverts under the Maunaloa Highway stream ford and showed the ford will experience overtopping at flows of approximately 900 cubic feet per second (cfs). The Flood Insurance Study which covers the Kaunakakai Stream for a 10-year flood. An additional culvert to carry the added flow of about 46 cfs from System A would not prevent overtopping the ford. Moreover, it should be noted, the crossing of Kaunakakai Stream has been designed as a ford by the State. The problem of overtopping is inherent with a crossing designated as a ford.

The intent of the drainage improvements are to alleviate flooding in the Kaunakakai area. As previously stated, the Drainage master Plan for the County of Maui sets forth the method of analysis of flows and is used uniformly throughout the County to calculate runoff. The concepts used in the County Drainage Master Plan are not outdated. The Rational Method (to determine peak flows) and the Manning's equation (to determine open channel flows) are incorporated into the drainage standards of all the counties in the State and are widely used throughout the country. For larger drainage basins, more accurate methods of calculating peak flows are available. We recognize this limitation to the Rational Method and have used the SCS TR-55 method of analysis to compute the peak flows.

Appendix B contains the marine biological and water quality studies. The conclusion set forth in Appendix B are consistent with the State of Hawaii Department of Land and Natural Resources Division of Aquatic Resources Division. The State has also concluded they do not expect significant long-term impact to aquatic resources from the drainage improvements.

The Kaunakakai wharf and causeway are under the jurisdiction and control of the State of Hawaii Department of Transportation. The water quality analysis in Appendix B shows under both typical dry and wet conditions (the day after a heavy rainstorm) the turbidity levels were similar and low at the sample stations inshore of the reef edge and off the reef edge. Turbidity was low at stations east of the pier.

The substrate data for the offshore stations clearly shows an increase in sand, not mud, at the eastern stations. The observations made up and down the reef slopes verified that the conditions described for the survey transects typified conditions for the offshore segment of each of the sample sites. The date and conclusion set forth in Appendix B and the Draft EA represent a true description or the nearby marine and water quality environment.

The water quality data taken immediately after heavy rainfall show salinity levels are depressed along the shoreline. However, they remained at typically dry weather levels at the mid-reef and offshore stations. Thus, the existing level of freshwater discharge appears to impact salinity levels for a narrow band along the shoreline where the biological communities are composed primarily of macroalgae and burrowing invertebrates. Increased flows for short periods of time due to drainage improvements would not likely alter these communities or impact communities further from the shore. The overall conclusion of this analysis is that offshore water quality is determined by groundwater flow, wind, waves and currents, and not by runoff.

The potential for fertilizers and pesticides entering offshore waters can be eliminated if these items are no longer used by the farmers. However, the use of fertilizers and pesticides is determined by the farmers of the lands, not by the County. Unless the scope of these agricultural activities is going to increase, there would be no change in the magnitude of discharge after the drainage improvements are completed. Finally, it should be noted, these fields are subject to flooding from flows in upper areas. The intent of the drainage improvements is to direct the flows away from the fields so that flooding no longer occurs.

An archaeological inventory survey was conducted for System A. (See Appendix C.) However, as part of that survey, research was conducted on the location of previous studies in the Kaunakakai area. These findings indicate most of the archaeological field work within the coastal area has been subsurface surveys due to the absence of associated surface features and alluviation. The State Historic Preservation Division has reviewed the inventory survey and submitted comments. Their response indicates they anticipate accepting the report after their comments have been addressed.

Maintenance of existing drainage improvements will alleviate some of the flooding problems which currently occur. However, improved maintenance would not be sufficient to correct the recurring flooding problems. The identified improvements are necessary to correct these problems.

Two (2) public information meetings were conducted as part of the Drainage Master Plan. Although the meetings were not well attended, there were a number of questions about the design of the various systems and the need for improved maintenance. These questions were considered in the final system improvements described in the Draft EA. It should be noted, growth and development of the Kaunakakai area are addressed by the Molokai Community Plan, not by the drainage improvements. Public input is generally included in developing the community plan.

A number of alternatives were considered before the decision was made to implement the improvements shown in the Draft EA. The improvements are considered the most feasible for implementation given existing land uses and environmental impacts.

As the lead agency with responsibility to implement Chapter 343, Hawaii Revised Statutes, and the State of Hawaii Department of Health Administrative Rules, Title 11, Chapter 200, we believe an Environmental Assessment is appropriate for this Kaunakakai Town Drainage Improvements.

If you have any questions, please call Joe Krueger, our Staff Engineer at 243-7745 or Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Sincerely,

George N. Kaya
Director of Public Works & Waste Management

JK:mlk(ED94-1393)
G:\ENG\ALL\KKAIDEA.wh

xc: Barry Toyota, Wilson Okamoto & Associates

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109

November 18, 1994

Mr. Joe Krueger
Department of Public Works, Engineering Division
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Krueger,

RE: Proposed construction of drainage improvements in Kauankakai, Molokai; Request for comments on the Draft Environmental Assessment

Thank you for providing the Board of Water Supply with the opportunity and the materials to review the subject assessment.

We note that the proposal includes the possible relocation of waterlines, as required. Your department expects that the relocations will not entail major interruptions to surrounding users. Our district engineer, Herb Chang and Molokai supervisor, Philip Akiona can assist you with water system design, installation, review process and documentation requirements.

You can find attached a copy of the relevant section of the 1991 Fire Protection System Map No. 40 for your reference.

Sincerely,

David R. Craddick, Director

DDS:rt:\ddc\kaunakka.ddc

"By Water All Things Find Life"

DEPARTMENT OF
PARKS AND RECREATION
COUNTY OF MAUI
1580 KAAHUMANU AVENUE, WAILUKU, HAWAII 96793

LINDA CROCKETT LINGLE
Mayor
CHARMAINE TAVARES
Director
MIKE DAVIS
Deputy Director

(808) 243-7230

October 11, 1994

County of Maui
Engineering Division
Dept. of Public Works
200 South High Street
Wailuku, HI 96793

Subject: Kaunakakai Town Drainage Improvements, Draft Environmental Assessment (Draft Ea)
TMK: 5-3-01, 02, 09, various 5-4-07, 08 various

Gentlemen:

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

Thank you for allowing us to comment on the EA. We are returning the project's documents for your disposition.

Sincerely,

CHARMAINE TAVARES
Director

CT/rt

Enclosure

LINDA CROCKETT LINGLE
Mayor

BRIAN W. MISKAE
Director

GWEN Y. OHASHI
Deputy Director

2431-02 BJ ✓ HB ✓ RH

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

October 18, 1994

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

RECEIVED
OCT 26 1994

Dear Mr. Krueger:

Subject: Kaunakakai Town Drainage Improvements, Draft Environmental Assessment (Draft EA)
Tax Map Key: 5-3-01, 02, 09, various 5-4-07, 08 various; Kaunakakai, Molokai, Hawaii

We have the above mentioned Draft Environmental Assessment (Draft EA) for the proposed Kaunakakai Town Improvements project. We have the following comments:

1. This office has participated in the development of the Kaunakakai Drainage Master Plan since the Molokai workshop in September 1991.

2. An Environment policy in the Molokai Community Plan (1984), page 11, item e states:

   Prepare and adopt a drainage master plan for major settlement areas, particularly Kaunakakai Town, which emphasizes land management techniques, such as the use of natural landscape swales, periodic maintenance of stream channels and avoidance of development in flood-prone areas to minimize the potential of flood damage.

   Therefore, the Kaunakakai Drainage Master Plan is consistent with this policy.

3. The Molokai Planning Commission has granted several SMA permits in Kaunkakai Town within recent years with the condition that the applicant contribute their fair share for drainage improvements as determined by the Kaunakakai Drainage Master Plan.

4. As noted in Chapter 4 of the draft EA, Special Management Area and Shoreline Setback Variance approvals will have to be obtained from the Molokai Planning Commission for "development" within the Special Management Area and "structures" within the Shoreline Setback Area. Please note that the shoreline setback area varies up to a maximum of 150 feet depending on the average lot depth of the shoreline property. We have attached the SMA and Shoreline Setback Variance applications for your reference as well as the Molokai Planning Commission's Rules on these matters.

Thank you for providing us with the opportunity to comment on the Draft EA. Should you have any questions, please contact Clayton Yoshida of this office.

Very truly yours,

Brian Miskae
Planning Director

Encl.

cc: Bruce Anderson, OEQC
Barry Toyota, Wilson Okamoto, and Associates
Gwen Ohashi, Deputy Planning Director
Colleen Suyama
Clayton Yoshida, AICP

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

November 21, 1994

Mr. Brian Miskae
Planning Director
COUNTY OF MAUI
PLANNING DEPARTMENT
250 S. High Street
Wailuku, HI 96793

SUBJECT: KAUNAKAKAI TOWN DRAINAGE IMPROVEMENTS
DRAFT ENVIRONMENTAL ASSESSMENT
KAUNAKAKAI, MOLOKAI

Dear Mr. Miskae:

Thank you for your October 18, 1994 comments on the Kaunakakai Town Drainage Improvements Draft Environmental Assessment (EA).

We concur with the Environmental policy of the Molokai Community Plan that drainage improvements have long been needed to alleviate the periodic flooding which affects the residents and businesses of the Kaunakakai area. As funds become available, our plans are to move forth with the improvements established in the Kaunakakai Town Drainage Master Plan.

We intend to apply for the necessary permits, including the Special Management Area and Shoreline Setback Variance approvals, as designs of specific improvements proceed. We will look forward to working with your office and the Molokai Planning Commission on these approvals.

If you have any questions, please call Joe Krueger, our Staff Engineer at 243-7745 or Barry Toyota, Engineer, of Wilson Okamoto & Associates at 946-2277.

Sincerely,

George N. Kaya
Director of Public Works & Waste Management

JK:mlk(ED94-1385)
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xc: Barry Toyota, Wilson Okamoto & Associates

2131-02 BT/
HSB
10/3/94 BG

OCT 3 1994

September 28, 1994

Mr. Joe Krueger
County of Maui
Engineering Division
Department of Public Works
200 S. High Street
Wailuku, HI 96793

Dear Mr. Krueger:

Subject: Kaunakakai Town Drainage Improvements, Draft EA
TMK: 5-3-01, 02, 09, various 5-4-07,08

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

In reviewing the information transmitted and our records, we have no objection to the subject project. If coordination is necessary for any relocation of our existing facilities, we encourage the developer's consultant to meet with us as soon as practical so that service can be provided on a timely basis.

If you have any questions or concerns, please call Dan Takahata at 871-2385.

Sincerely,

Edward L. Reinhardt

Edward L. Reinhardt
Manager, Engineering

DT:rt

cc: Barry Toyota, Wilson Okamoto & Associates, Inc.
Bruce Anderson, State of Hawaii, Office Of Environmental Quality Control

9. REFERENCES

Aotani & Associates, Inc. *Molokai Community Plan*. Prepared for the County of Maui. October 1984.

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APPENDIX A

Pre-Consultation Letters

JOHN WAIHEE
GOVERNOR OF HAWAII

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

JOHN P. KEPPELER, II
DONA L. HANAIKE

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

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

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

September 4, 1992

LOG NO.: 6256
DOC NO.: 2490a

RECEIVED
SEP 10 1992
WILSON OKAMOTO & ASSOCIATES

Mr. Bruce Gorst, Planner
Wilson Okamoto & Associates, Inc.
1150 South King Street
Honolulu, Hawaii 96814

Dear Mr. Gorst:

SUBJECT: Historic Preservation Review of the Kaunakakai Drainage Improvements
Kaunakakai, Molokai
TMK: 5-3-1, 2, 6 & 7

This is in response to your letter dated August 26, 1992, requesting information about known historic sites in Kaunakakai and also seeking our comments on the County of Maui's proposed drainage improvements. We understand that you need this information for the preparation of an Environmental Assessment for this proposed project.

The map that you attached to the letter has been very useful in locating the extent of the project area and the location of the different drainage systems A through E. We will use the same designations in our comments. Per information that you provided by phone, Systems A through E are new systems which will require excavation into previously undisturbed areas.

In the vicinity of System B in Kaunakakai Place and Hio Place is a significant historic site that is listed in our inventory of historic places. There are two known significant historic sites in the vicinity of the proposed drainage systems. Both sites are located on a property (TMK 5-3-01: 2 & 3) at the corner of Kaunakakai Place and Hio Place. One is site 630 which consists of a historic and prehistoric subsurface deposit. Whether this deposit extends into drainage System B is not known. Archaeological testing conducted in a parcel at the corner of Kaunakakai Place and Kamehameha Highway (TMK 5-3-01: 64) found no evidence of historic sites, so it appears that the deposit may not extend toward the highway.

The other site is the Malama House Site (site 1030), a rectangular platform which is believed to be the foundation of Kamehameha V's residence. However, this site is located away from the drainage system, so the proposed improvement will have "no effect" on this site.

Additional information was also provided by Mr. John Sakaguchi of your office in a letter dated September 3, 1992. The rectangular walled enclosure that was located by the surveyors and shown on the topographic survey map for System A has not been previously identified. This structure was described by Mr. Sakaguchi as measuring 15 ft. by 18 ft. with 3 ft. high walls. At this time, significance of this structure is not known. We need additional information such as its function and age. With the presence of this structure, it is possible that others are also present.

In sum, Systems A and B are of particular concern to our office. For System A, an archaeological inventory survey is necessary to identify all significant historic sites, including the rectangular walled enclosure. If significant historic sites are present, an acceptable mitigation plan should be submitted to our office for approval. In System B, it appears that the proposed improvement will have an adverse effect on the deposits of 630 which may extend to Hio Place and Kaunakakai Place. For this project to have a "no adverse effect", we recommend archaeological monitoring during excavation in the portion of the system makai (south) of Kamehameha Highway. The other systems are on developed areas which have been previously disturbed by road construction and/or residencial development. It is not likely for historic sites to be present, so we believe that Systems C, D, and E will have "no effect" on significant historic sites.

Should you have any questions about these comments, please call Annie Griffin at 587-0013.

Sincerely,

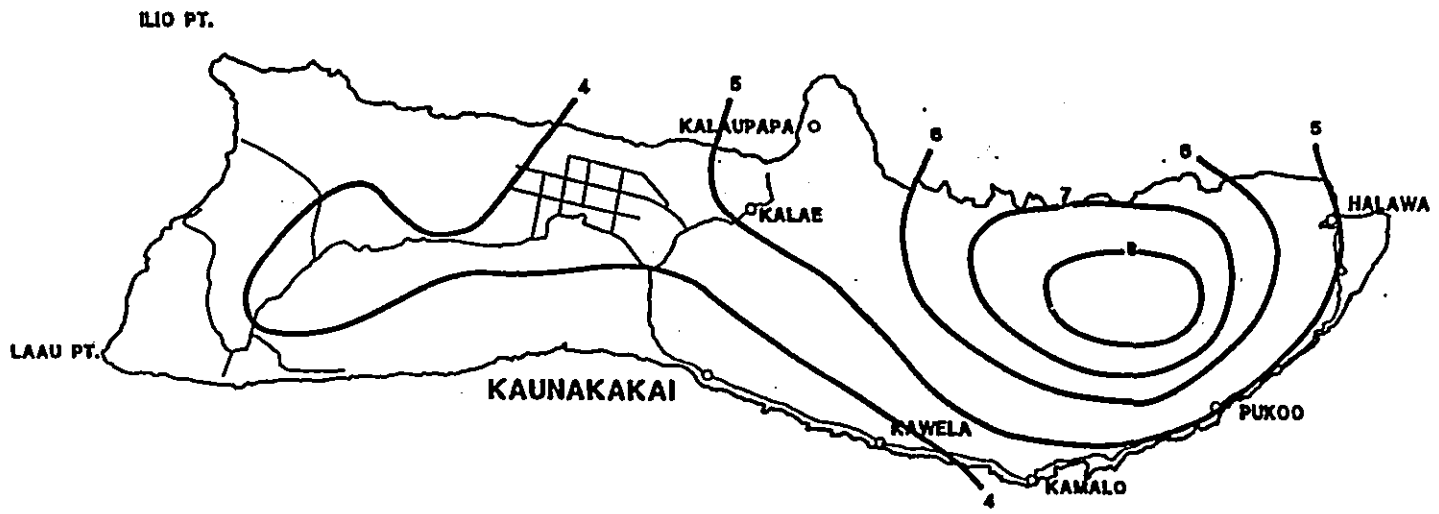
DON HIBBARD, Administrator
State Historic Preservation Division

AG:aal

APPENDIX B

Molokai Rainfall Isohyet Maps for Storms of
Different Frequency and Duration

ISLAND OF MOLOKAI



GRAPHIC SCALE
(IN MILES)

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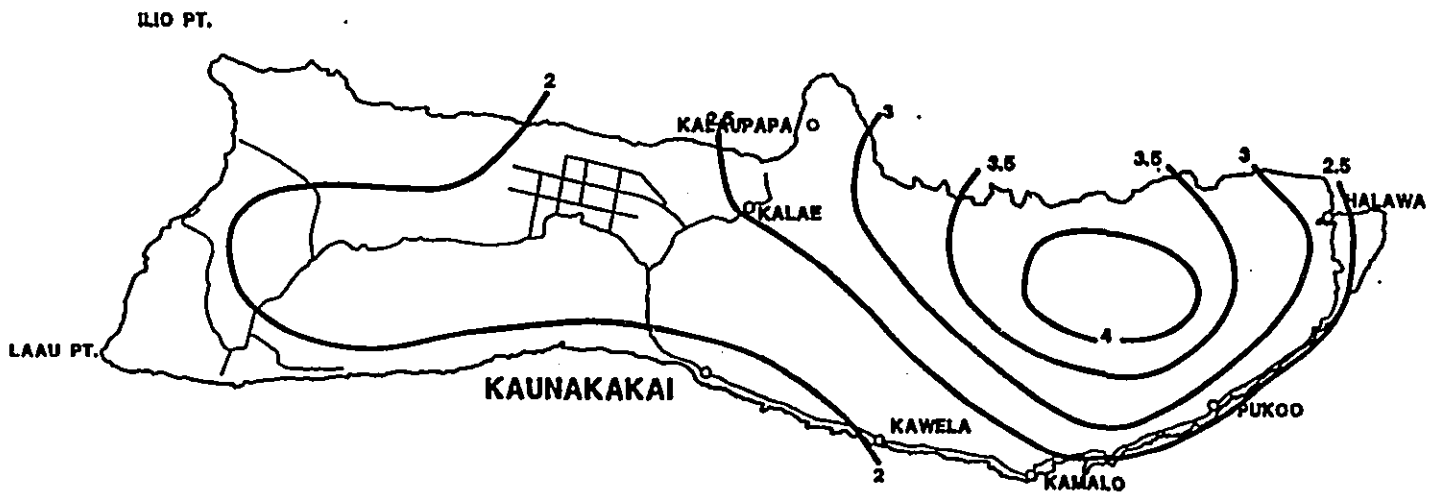
SOURCE: RAINFALL FREQUENCY ATLAS OF THE HAWAIIAN ISLANDS, TECHNICAL PAPER NO. 43, U.S. WEATHER BUREAU, 1962.

KAUNAKAKAI DRAINAGE MASTER PLAN	FIGURE 4 2-YEAR 24-HOUR RAINFALL INCHES	WILSON OKAMOTO & ASSOCIATES, INC. Honolulu, Hawaii

ISLAND OF MOLOKAI



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GRAPHIC SCALE
(IN MILES)

SOURCE: RAINFALL FREQUENCY ATLAS OF THE HAWAIIAN ISLANDS, TECHNICAL PAPER NO. 43, U.S. WEATHER BUREAU, 1962.

KAUNAKAKAI
DRAINAGE MASTER PLAN

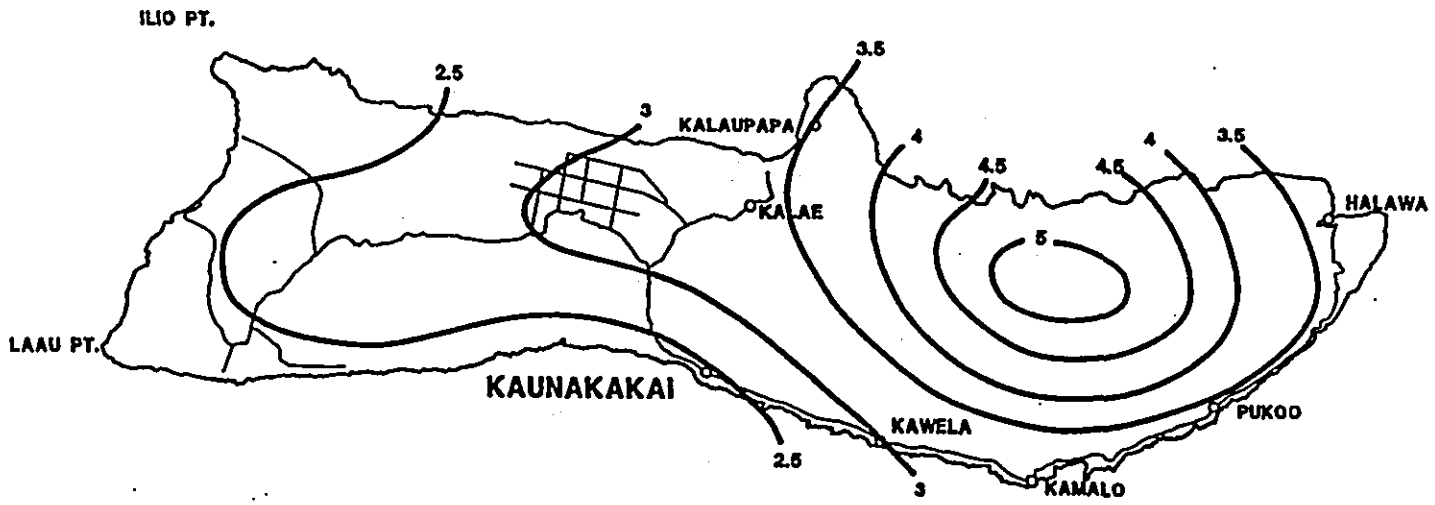
FIGURE 5

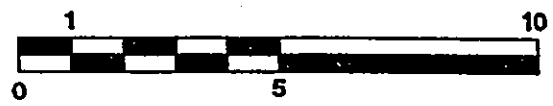
10-YEAR 1-HOUR RAINFALL

INCHES

WILSON OKAMOTO & ASSOCIATES, INC.
Honolulu, Hawaii

ISLAND OF MOLOKAI





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(IN MILES)

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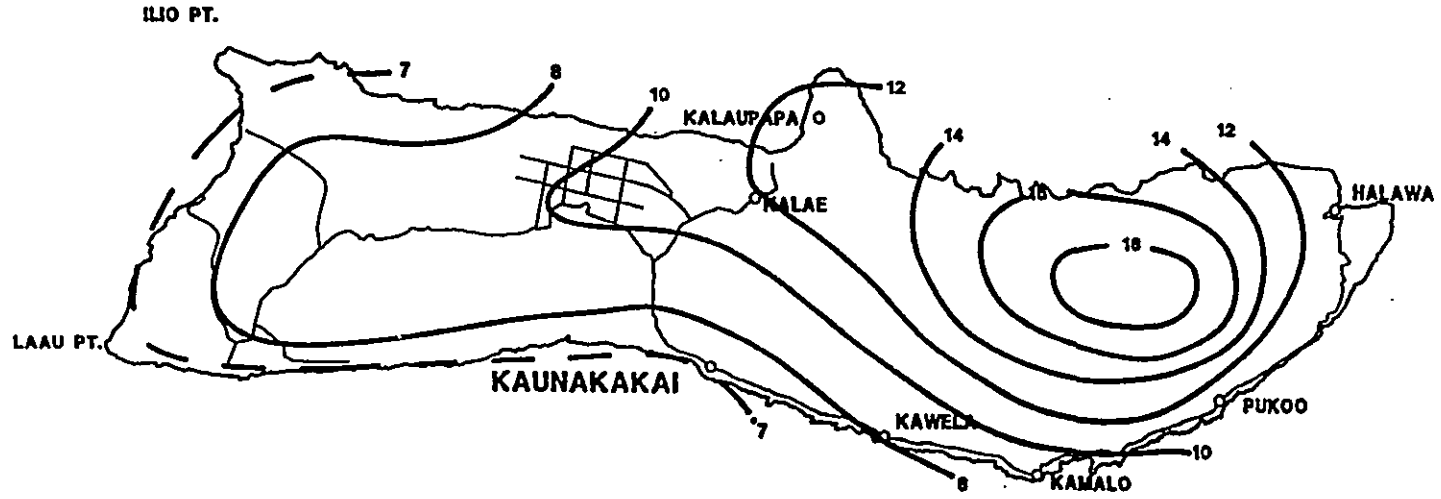
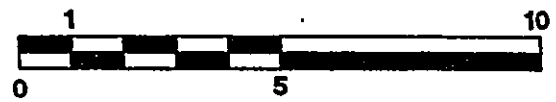
SOURCE: RAINFALL FREQUENCY ATLAS OF THE HAWAIIAN ISLANDS, TECHNICAL PAPER NO. 43, U.S. WEATHER BUREAU, 1962.

KAUNAKAKAI DRAINAGE MASTER PLAN	FIGURE 6 50-YEAR 1-HOUR RAINFALL INCHES	WILSON OKAMOTO & ASSOCIATES, INC. Honolulu, Hawaii

ISLAND OF MOLOKAI





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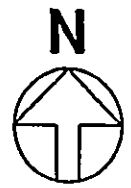
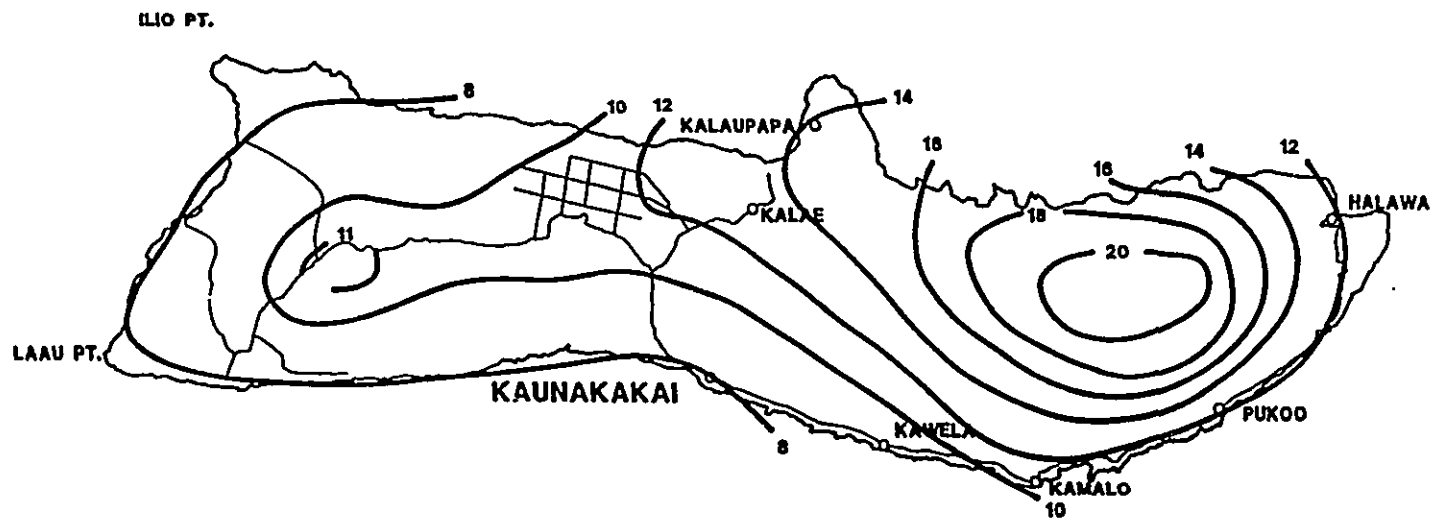
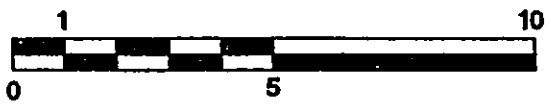


SOURCE: RAINFALL FREQUENCY ATLAS OF THE HAWAIIAN ISLANDS, TECHNICAL PAPER NO. 43, U.S. WEATHER BUREAU, 1962.

KAUNAKAKAI DRAINAGE MASTER PLAN	FIGURE 7 50-YEAR 24-HOUR RAINFALL INCHES	WILSON OKAMOTO & ASSOCIATES, INC. Honolulu, Hawaii

ISLAND OF MOLOKAI





GRAPHIC SCALE
(IN MILES)

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SOURCE: RAINFALL FREQUENCY ATLAS OF THE HAWAIIAN ISLANDS, TECHNICAL PAPER NO. 43, U.S. WEATHER BUREAU, 1962.

KAUNAKAKAI DRAINAGE MASTER PLAN	FIGURE 8 100-YEAR 24-HOUR RAINFALL INCHES	WILSON OKAMOTO & ASSOCIATES, INC. Honolulu, Hawaii

APPENDIX C

Water Quality and Marine Biological Studies;
Impact Analysis, prepared by OI Consultants, Inc.

KAUNAKAKAI DRAINAGE MASTER PLAN
KAUNAKAKAI, MOLOKAI, HAWAII

WATER QUALITY AND MARINE BIOLOGICAL STUDIES; IMPACT ANALYSIS

Prepared for:

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Prepared by:

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June, 1992

Executive Summary

The Kaunakakai Drainage Master Plan has been designed to reduce flooding in the town of Kaunakakai, Molokai. This plan includes a variety of improvements to the town's drainage system, which will direct storm runoff through a series of drainage channels into the ocean. Construction of this system will relocate some existing drainages and change the volumes and perhaps the quality of water discharged through others.

This report describes existing environmental conditions in the marine environment seaward of Kaunakakai, based on the results of water quality surveys, marine biological surveys, and the examination of aerial photographs. These data form the basis for an assessment of the potential impacts of the proposed drainage improvements on the water quality and marine biological communities of the area.

Our analysis indicates that implementation of the drainage improvement plan will have no significant negative impacts on the water quality of the nearshore and offshore marine environments at Kaunakakai. Under dry weather conditions, water quality in the nearshore zone is controlled primarily by three processes: 1) nearshore groundwater discharges, which introduce dissolved nutrients in to the ocean, 2) waves and currents, which resuspend settled sediments and transport them along shore, and 3) biological processes, particularly production by marine macrophytes and phytoplankton, which may reduce nutrient levels and pH, and increase levels of dissolved oxygen. These processes appear to change only slightly during periods of increased runoff.

After implementation of the drainage system improvements, larger volumes of storm runoff may be discharged into the nearshore area. However, the combination of wide offshore mud flats, generally strong currents, and vigorous mixing by waves will combine to rapidly dilute and disperse these inflows so that nutrient and sediment conditions are likely to be similar to those observed under existing conditions.

The marine biological analysis suggests that development of a storm runoff drainage system for Kaunakakai is unlikely to have any effect on the Kaunakakai reef or on the reef coral population in the area. The reef flat is over 1 km wide and nearshore areas are covered with a thick layer of fine sediment. Muddy areas near shore are virtually devoid of surface fauna; further offshore the mud/silt bottom is covered with a dense seagrass-macroalgal biotope. Neither environment would be susceptible to negative impacts from storm runoff. The extensive sediment coverage suggests that this area has been under the influence of sedimentation from runoff for a very long time. The only potentially sensitive benthic communities are in the offshore area surrounding the Kaunakakai Harbor and channel. These communities have flourished despite the construction and use of

the harbor, and the presence of the Kaunakakai Stream mouth near the harbor. Changes to the drainage system feeding into the Kaunakakai Stream will be minor, and should cause no significant changes in either the volume or quality of the stream discharge.

Table of Contents

PART A

WATER QUALITY CONDITIONS OFF KAUNAKAKAI, MOLOKAI

INTRODUCTION

This study is part of an environmental assessment for the Kaunakakai Drainage Master Plan. The proposed improvements to the Kaunakakai drainage system include five independent phases, each of which involves a different subdivision of this small town on the southern shore of Molokai. The improvements will proceed from west to east, eventually affecting about 2 km of the coast.

Implementation of the plan will entail rerouting rainwater discharge flows and changing the volumes of runoff discharged at various locations along the shoreline. Since the redirection of surface runoff could alter the quantity and quality of freshwater discharged into the ocean, a Hawaii Water Quality Certificate has been required for this project. If construction within the marine environment is required, a construction permit must also be obtained from the Army Corps of Engineers. Either permit would require a site-specific assessment of marine impacts.

This study provides information on existing water quality and biotic conditions in the marine environment around Kaunakakai, along with a preliminary assessment of the potential for changes in these conditions due to the proposed drainage improvements. The information presented in this report will also serve as a baseline that can be used to detect any future changes that might result from the drainage project.

METHODS

For the water quality analysis, a grid of 20 stations was established in the coastal waters off Kaunakakai (Figure 1). These stations are aligned along five transects (1-5) running perpendicular to the shoreline. These transect lines lie offshore of the proposed discharge points for each of the five phases of the drainage improvement project (A-E). Transect 1 is located off a natural stream, whose discharge volumes are likely to increase following the first phase of the project. Transect 3 lies midway between the two proposed discharge points to be constructed during phase "D"; transect 4 lies between the two phase "E" discharge points (Fig. 1).

Four sampling stations (A-D) were located along each transect. In general, three of these stations were located along the reef flat, between the shore and the breaker line, and one was located immediately outside the breaker line. At the pier (transect 2), where a dredged channel cuts through the reef, two stations were located on the mud flats and two were located in deeper water. Due to nearly constant mixing and shallow (0.5 m) depths, a single water sample from just below the surface (at approximately 0.5 m depth) was taken to represent the entire water column at stations along the reef flat. Outside the breaker line, samples were taken at three depths: 0.5 m below the surface (S), midway

between surface and bottom (M), and 0.5 m above the bottom (B). Because of irregular bottom contours and difficulty in positioning, sampling depths at each station are not exactly the same for the two sampling dates.

Data were collected on two days, in order to assess the effects of variations in runoff on nearshore water quality. The first set of samples was taken under "normal" dry conditions (4/28/92); the second set was collected the day after a major rainstorm (5/20/92).

A variety of water quality parameters were measured at Kaunakakai, including those regulated by the State of Hawaii for discharges into open coastal waters, and additional parameters used to differentiate local groundwater influx from surface runoff. The following parameters were measured in each sample: temperature, salinity, turbidity, suspended solids, total nitrogen, nitrate-nitrite (NO_3/NO_2), ammonia (NH_4), total phosphate, orthophosphate (PO_4), reactive silicate (SiO_4), chlorophyll, dissolved oxygen (DO) and pH. The general methods used for to measure these parameters are listed in Table 1.

TABLE 1. WATER QUALITY ANALYSES

Water Quality Parameter	Collection and Analysis Method
Temperature	Precision thermometer
Salinity	Laboratory salinometer
Water Samples:	5 liter Niskin bottles
Nutrients	Technicon AutoAnalyzer II;
Total Nitrogen	D'Elia et al., 1977
NH_4	Solorzano, 1969
No_3/NO_2	Technicon Inc., 1977
Total Phosphorus	Grasshoff et al., 1983
PO_4	Murphy and Riley, 1962
SiO_4	Strickland and Parsons, 1972
Chlorophyll	Turner Designs fluorometer; Strickland and Parsons, 1972
Turbidity	Turner Designs nephelometer; APHA, 1986
Suspended Solids	Filtration, Cahn electrobalance; APHA, 1986
Dissolved Oxygen	YSI laboratory oxygen meter;
pH	Orion digital pH meter

RESULTS

Tables 2 and 3 present the results of water quality sampling at Kaunakakai on April 28 and May 20, 1992, respectively.

Nearshore salinity reductions can be used as indicators of freshwater entering the marine environment. Figure 2 shows the distribution of salinity among the five stations over the two sampling days. This figure also shows total suspended solids, turbidity, chlorophyll *a*, total nitrogen, and total phosphorus for the two sampling days. In this and the following figures, only the surface samples are shown for the offshore stations.

Figure 3 shows dissolved nutrient and silicate concentrations at the sampling stations. Groundwater in the Hawaiian islands is typically high in silicate, nitrate, and phosphate, but concentrations of these materials in the open ocean are extremely low. Although nitrate and phosphate concentrations may be affected by nearshore biological activity, silicate typically provides an excellent tracer of groundwater seepage into nearshore marine waters in Hawaii. Several other physical parameters, pH, temperature, and dissolved oxygen, are used to assess water circulation and residence times; these are presented in Figure 4.

The salinity of the open ocean around Hawaii is normally about 35.0 parts per thousand (ppt). During the first sampling day, most stations were relatively close to this salinity. Nearshore salinities at station 2A and several other reef-flat stations were slightly elevated (35.39 ppt), perhaps due to solar heating and evaporation in the waters over the reef flats. In contrast, nearshore Station 5A and some of the offshore stations had lower than "typical" salinity. The depressed salinity at station 5A (28.51 ppt) may reflect the discharge of low-salinity groundwater into the nearshore area. The elevated silicate concentrations along transect 5 also support this possibility. The lowered salinities offshore could be due to offshore submarine springs or transport of low-salinity water by littoral currents.

The influence of storm runoff on nearshore water quality (as measured on the second sampling day) was as might be expected: salinity was considerably reduced in onshore waters (A-stations) but increased in seaward stations. Even the offshore stations showed lower salinities than on the first sampling day. The greatest freshwater impact was observed near the stream mouth (Transect 1), where salinities were reduced to about 2 ppt near shore. The impact was least at transect 5. Among the other nearshore stations, salinities averaged about 20 ppt.

On the dry-weather sampling day (April 28), short-period wind waves of about 0.6 to 1.2 m height were encountered seaward of the reef. Under these conditions, wind- and wave-generated turbulence resuspends a considerable amount of benthic

particulate material over the inner part of the reef flat. Total suspended solids (TSS) levels were highest near shore (esp. at stations 2A through 5A: 15-20 mg/l) and decreased rapidly in a seaward direction. Extensive sea grass beds about 150-300 m offshore (see Part B of this report) may facilitate sedimentation of particulates, limiting their transport to the offshore portions of the reef flat. Station 3C had anomalously high TSS levels (about 13 mg/l), perhaps due to locally enhanced mixing.

On the second sampling day (May 20) the wind and sea were calm, with waves of about half a meter or less. Once again, stations 2A through 5A had the highest TSS levels (25-75 mg/l), presumably reflecting the strong influence of dispersed runoff on nearshore water quality. However, this particulate material appears to have remained near shore, since TSS levels at the offshore stations are generally comparable with (in some cases even lower than) those observed on the first sampling day. There were no correlations between TSS levels and salinity (r^2=0.32, n=32) or between TSS and salinity change from dry to wet conditions (r^2=0.29, n=32).

TSS levels (and changes in TSS between the and second sampling days) were greatest at the central transects, with a maximum at station 3A. Along transect 1, TSS levels were relatively low on both days (<10 mg/l) but did not decline significantly at the seaward stations on the second sampling day. This may reflect the presence of fine particulate material circulating over the reef flat and offshore, with relatively little dilution.

The extensive sandy areas along transect 1 indicate that fine suspended material from the nearby stream discharge does not typically settle out directly seaward of the stream mouth. Instead, this fine material may be transported in an easterly direction, to be deposited in the mud flats or in deeper water near the pier. The stream water discharged at transect 1 may also be preferentially transported in an easterly direction. The elevated TSS levels at station 2B may indicate a seaward-moving plume in the pier area (as observed by divers and noted in section B of this report).

The high silicate content of the water at station 1A (the stream-mouth) on the second sampling day suggests an origin in groundwater rather than direct surface runoff. Since sampling was conducted on the day following a rain event, a large volume of groundwater may have been entering the stream through its banks and discharging into the ocean. This hypothesis is further supported by the observations (Figure 4) that particulate levels were relatively low near the stream mouth, pH was reduced, and levels of dissolved oxygen (DO) and temperature were low. Such conditions are typical for groundwater but not (generally) for surface runoff. As noted in Part B of this report, extensive freshwater seepage was also observed along the shoreline at transects 1 and 2 during the biological survey on 20 May, 1992.

The elevated levels of TSS, turbidity, SiO_4, temperature, and DO along transect 3 suggest the entrapment of groundwater discharge in a littoral circulation cell in this area. Alternatively, water may have been slowly moving westward along the reef flat, passing transects 5, 4, and 3 in that order, then exiting seaward through gap in the reef near the pier. Regional groundwater discharge along the shoreline could yield the gradual decline in salinity and an increase in silicate observed at the nearshore stations. Cooling by the groundwater would be compensated for by solar heating due to reduced mixing.

Turbidity was low (<3 NTU) on the first sampling day and did not correlate well with the distribution of suspended matter (r^2=0.62, n=32). Very high (10-35 NTU) turbidity levels were observed on the second sampling day, but only at the nearshore stations (except for station 2B, where elevated turbidity may indicate a seaward-moving plume). On the second sampling day, there was a strong correlation between turbidity and TSS overall (r^2=0.98, n=32), indicating that much of the turbidity was related to the presence of particulate material.

Chlorophyll *a* concentrations were correlated with TSS levels (r^2=0.77, n=64). If both chlorophyll and pheopigments (the products of chlorophyll breakdown) together are compared with TSS levels, the correlation improves, suggesting that most of the material consisted of resuspended sediment rather than recently introduced terrestrial material. Chlorophyll concentrations were quite high at the nearshore stations (particularly station 5A, at almost 3 μg/l). This may reflect increased production in response to nutrients introduced through groundwater seepage. This conclusion is supported by the correlation between chlorophyll and silicate along transects 3 through 5 (r^2=0.93, n=18). Surprisingly, no silicate was detectable at transect 1, and SiO_4-concentrations along transect 2 were near the lower detection limit.

Unlike silicate, total phosphorus was correlated with chlorophyll at all stations and on both sampling days (r^2=0.75, n=64). Total nitrogen showed no relationship with chlorophyll in dry weather. However, on the second sampling day, a weak correlation was observed (r^2=0.73). Benthic algae, brought into suspension by the surf during the rainstorm, were perhaps more replete in nitrogen than the planktonic forms that predominated during the dry period. This suggests rapid nutrient recycling at the sediment surface.

Concentrations of free inorganic nitrogen species (NO_3/NO_4) were low at all stations on the first sampling day, being at or below the limits of detection (Figure 3). Under these conditions, nitrogen could be a limiting nutrient for algal growth. However, when currents are strong, the standing stock of phytoplankton may be controlled by biomass export, rather than by nutrient limitation.

After the rain, nitrate/nitrite concentrations were elevated at all the nearshore stations except 3A (where a maximum might have been expected based on the transport hypothesis described above). Orthophosphate concentrations were also relatively low at this station. Such low nutrient levels in coupled with low salinities are difficult to explain, but might reflect consumption of nutrients by abundant macrophytes (e.g. sea grasses).

Variations in water temperature (Figure 4) reflected both turbulent mixing and water exchange. Water temperature generally decreased with station depth along transects 3, 4, and 5 on both sampling days. This effect was much more noticeable on the second sampling day, when nearshore temperatures were quite high compared with those offshore (approx. 35 vs 25°C). These higher temperatures probably reflect more stable conditions on the second sampling day, with less horizontal and vertical mixing. There was little difference between water temperatures on the two sampling days at stations 1 and 2.

Generally the same factors influenced both temperature and dissolved oxygen (DO) levels. DO levels on the two sampling days were generally quite similar along transects 1 and 2 (Figure 4). However at stations 3 through 5, DO levels were considerably higher on the second sampling day. Although the highest temperatures were measured at the nearshore ("A") stations, maximum oxygen levels were observed at B-stations (transects 3,4) or the C-station (transect 5) on the second sampling day. The abundant seagrass beds at these stations may have been supplying DO through photosynthesis.

The pH of nearsnore seawater is influenced by the relative concentration of CO_2 (gas) and HCO_3^- and CO_3^{--} anions, and is usually quite constant (buffered) at slightly above 8.0. The pH of fresh water in Hawaii is usually around 7.0 or less. A large influx of groundwater or runoff could thus result in a lowering of pH, as observed at station 1A on the second sampling day. The pH balance may also be influenced by algae, which remove carbon dioxide and/or bicarbonate from the water during photosynthesis. Such photosynthetic activity appears to explain most of the variation in pH encountered at Kaunakakai. On the first sampling day, pH was generally higher at the eastern stations. It rose from 8.3 at station 1A to a maximum at the nearshore stations of transect 4 (8.7). The higher values found at eastern nearshore stations may reflect greater nutrient availability in these areas. At all transects the pH converged towards open ocean values near 8.4.

Ground water apparently had little influence on pH during the first sampling day. pH levels were significantly reduced at the eastern stations on the second sampling day. However, this effect was probably not due to the direct influence of runoff, since the pH reductions were more pronounced further from shore (where runoff effects would be minimal). At transect 2 there was little difference in pH between the first and second sampling

days, and little variation at various distances from shore.

At the offshore stations, pH was persistently lower on the second sampling day. DO levels were also lower on this day, despite higher algal biomass (chlorophyll concentration) and nutrient input (Figure 5). Water temperatures strongly influence oxygen solubility in water (warm waters hold less oxygen). However, water temperatures offshore were similar on both days, so the difference in DO levels was probably not caused by a difference in water temperature.

DISCUSSION

Because of the simultaneous discharge of surface runoff and groundwater discharge, it is difficult to make definitive statements regarding the impacts of runoff alone. Moderate levels of suspended solids were observed near shore even during dry weather, probably as a result of turbulent mixing in shallow water. The correlation between TSS and chlorophyll suggests that the suspended material was predominantly derived from algal biomass. In contrast, rain runoff might be expected to introduce primarily nonliving material. However, little if any of the suspended material could be traced to terrestrial sources. The correlations between chlorophyll, pheopigment, and total phosphorus were similar on both sampling days. Thus, the composition of the suspended material probably did not change very much between the two days. Turbidity changes were closely coupled with TSS changes on the second sampling day, and therefore both TSS and turbidity probably resulted from the presence of resuspended material.

The effects of surface runoff were only locally observable on the second sampling day (e.g. as a slight reduction in the silicate concentration along transect 5). At all other transects persistent freshwater effects were coupled with a strong groundwater influence, and a general increase in reactive silicate concentration was noted.

Groundwater discharges in Hawaiian coastal areas are often traceable through localized increases in nutrient levels in the marine environment. However, the nutrient concentrations measured near shore at Kaunakakai on the second sampling day varied greatly from one transect to the next and showed no relation with silicate levels. These deviations may be due to variations in the proportion of groundwater and runoff at different transects. Alternatively, nutrient concentrations may have been strongly influenced by biological activities such as photosynthesis. At station 3A, in particular, silicate concentrations were high but nutrient levels were low. At station 4A, higher nutrient levels corresponded with elevated silicate concentrations, and the influence of groundwater was obvious on the second sampling day. Both nutrient and silicate levels were relatively low at station 5A, at levels only half as

high as those at station 4A. High algal biomass on the second sampling day and the preservation of influent nutrient loads along transect 5 provide a possible explanation for this observation. In cases where relatively high nutrient loads coincided with reduced silicate concentrations, surface runoff might provide an explanation.

These data suggest that the main source of nutrients to the inshore water at Kaunakakai is groundwater seepage. If this is indeed the case, the proposed drainage improvements will not cause significant changes in the nearshore nutrient levels. The stream discharge at transect 1 appears to represent a relatively undisturbed drainage condition, which has evolved over geological time. The proposed drainage improvement could result in greater discharge volumes at this location, which could lead to reduced nearshore salinities and pH levels during high discharge periods.

Also of concern is the potential increase in the amount of particulate matter imported into the littoral zone near the new discharge points. Fine particulate matter may accumulate around the new discharge points or be transported toward the pier, accumulating in locations of low mixing. Along transects 2 and 3 (on either side of the pier) sedimentation of such materials has occurred in the past. The stream is probably the source of at least some of this material. Relatively small alterations in discharge volumes at these locations are not likely to have a significant influence on the character of the established mud-bottom fauna and flora. At the eastern transect stations, sedimentation effects from the discharge sites are likely to be limited to nearshore areas, where such fine sediments have apparently been collecting for many years.

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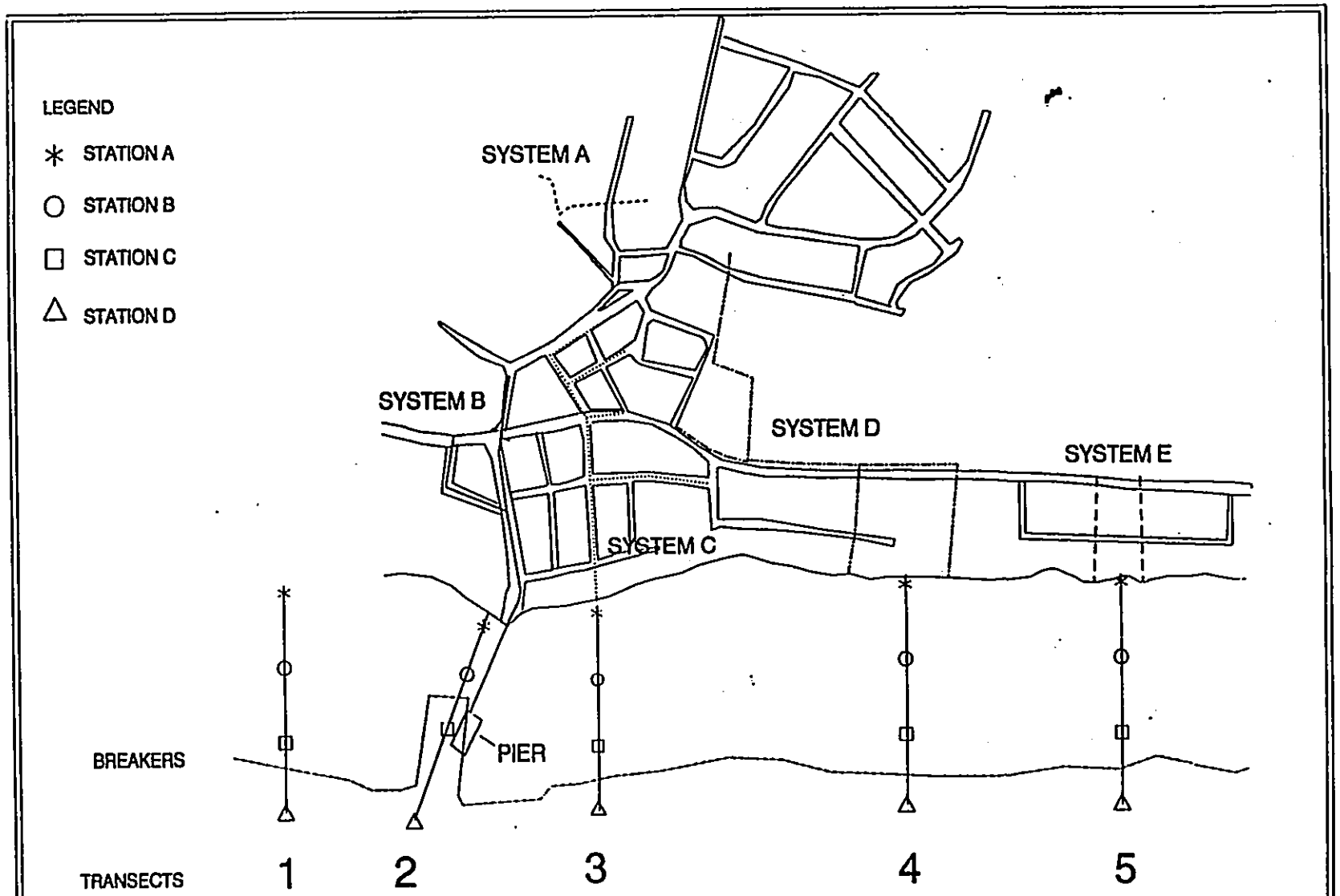
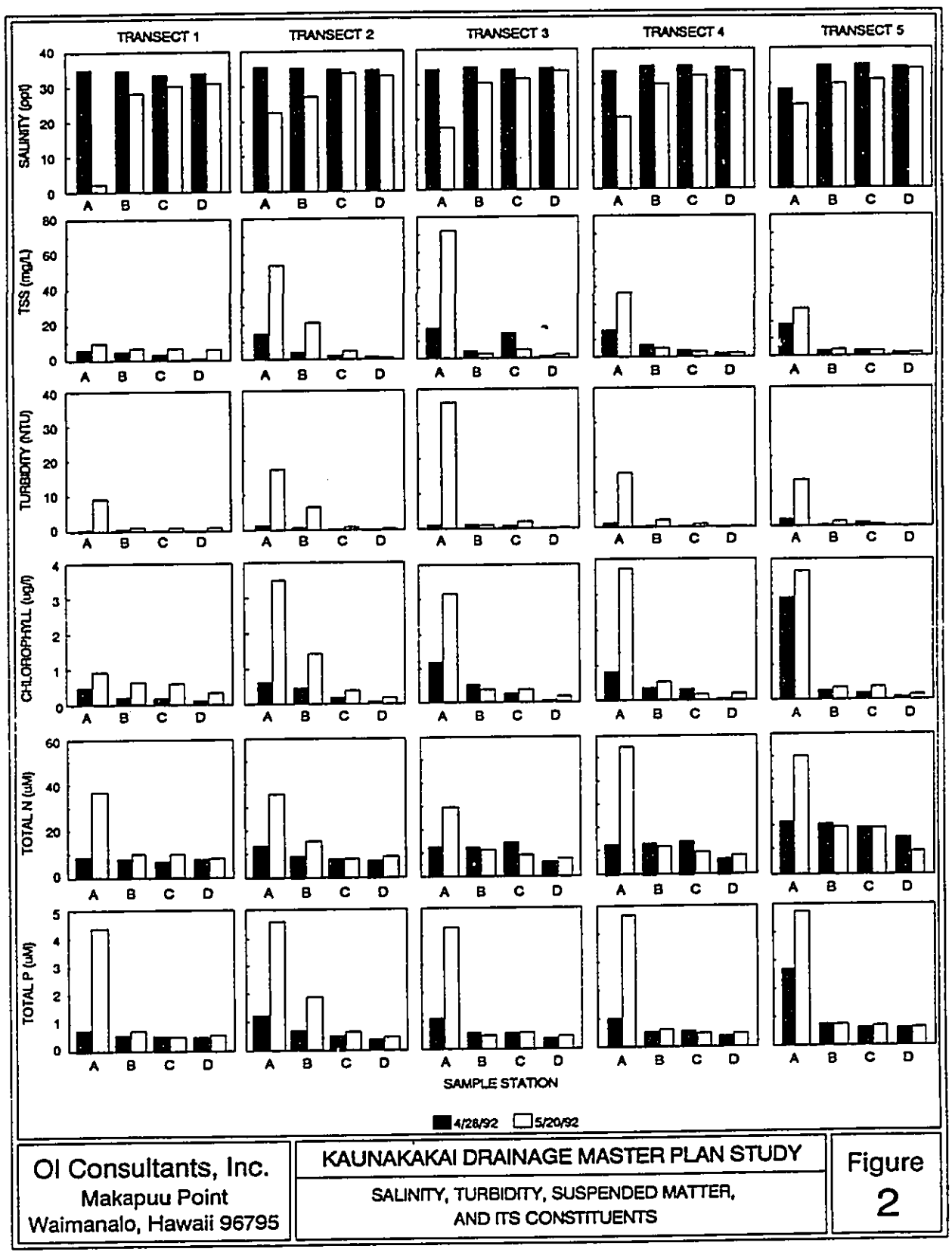
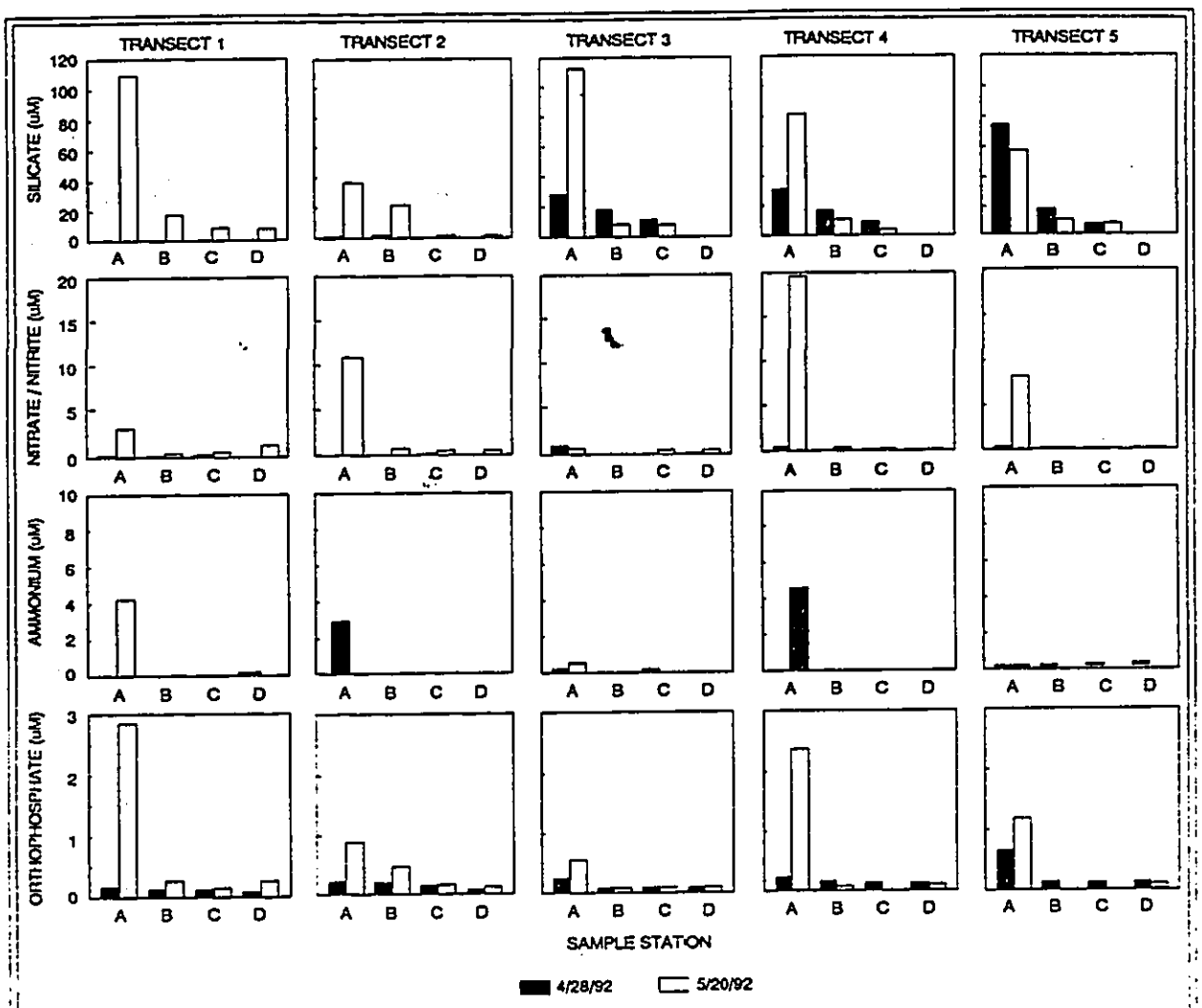


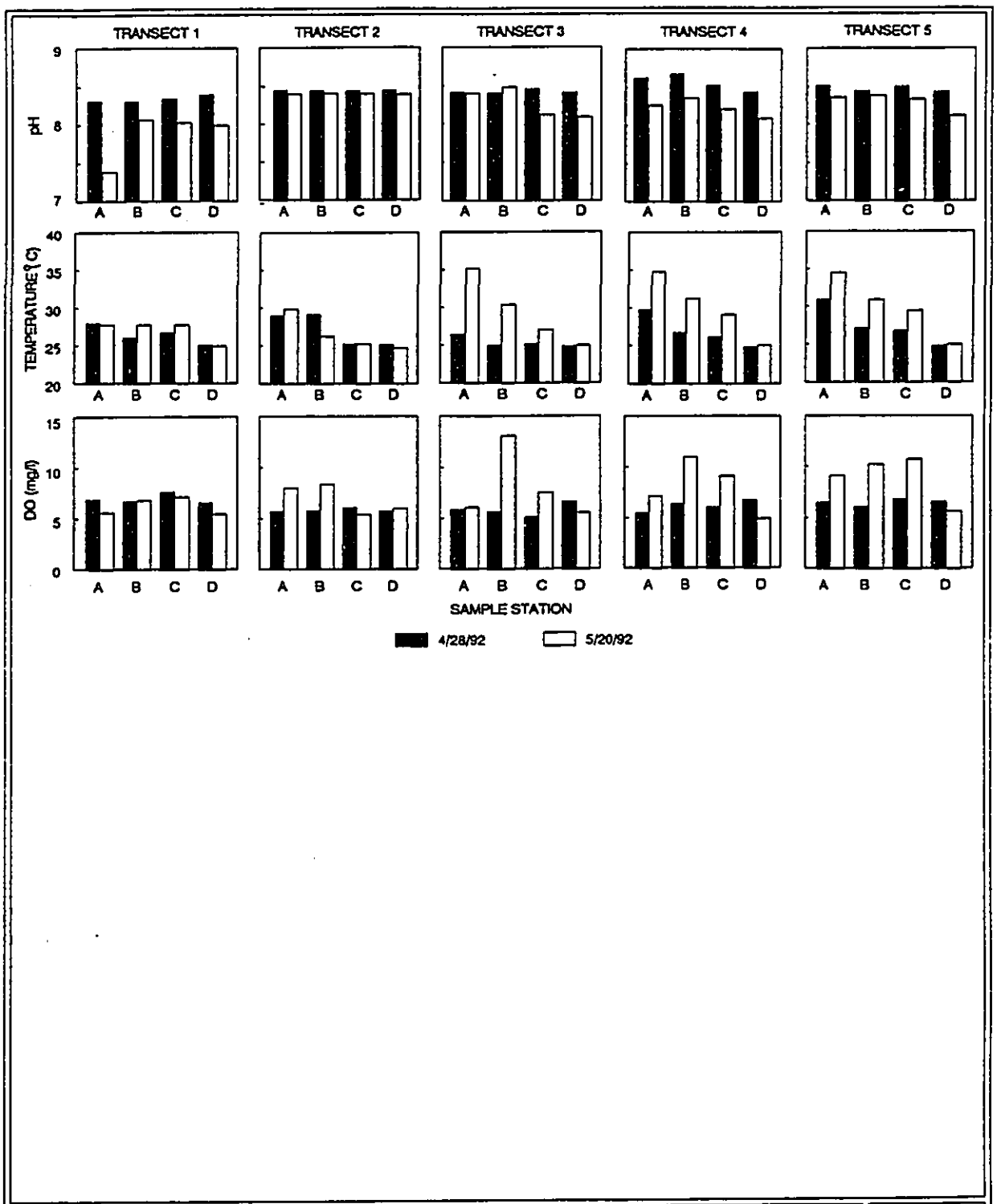
OI Consultants, Inc. Makapuu Point Waimanalo, Hawaii 96795	KAUNAKAKAI DRAINAGE MASTER PLAN STUDY SAMPLING STATIONS FOR WATER QUALITY ASSESSMENT	Figure 1



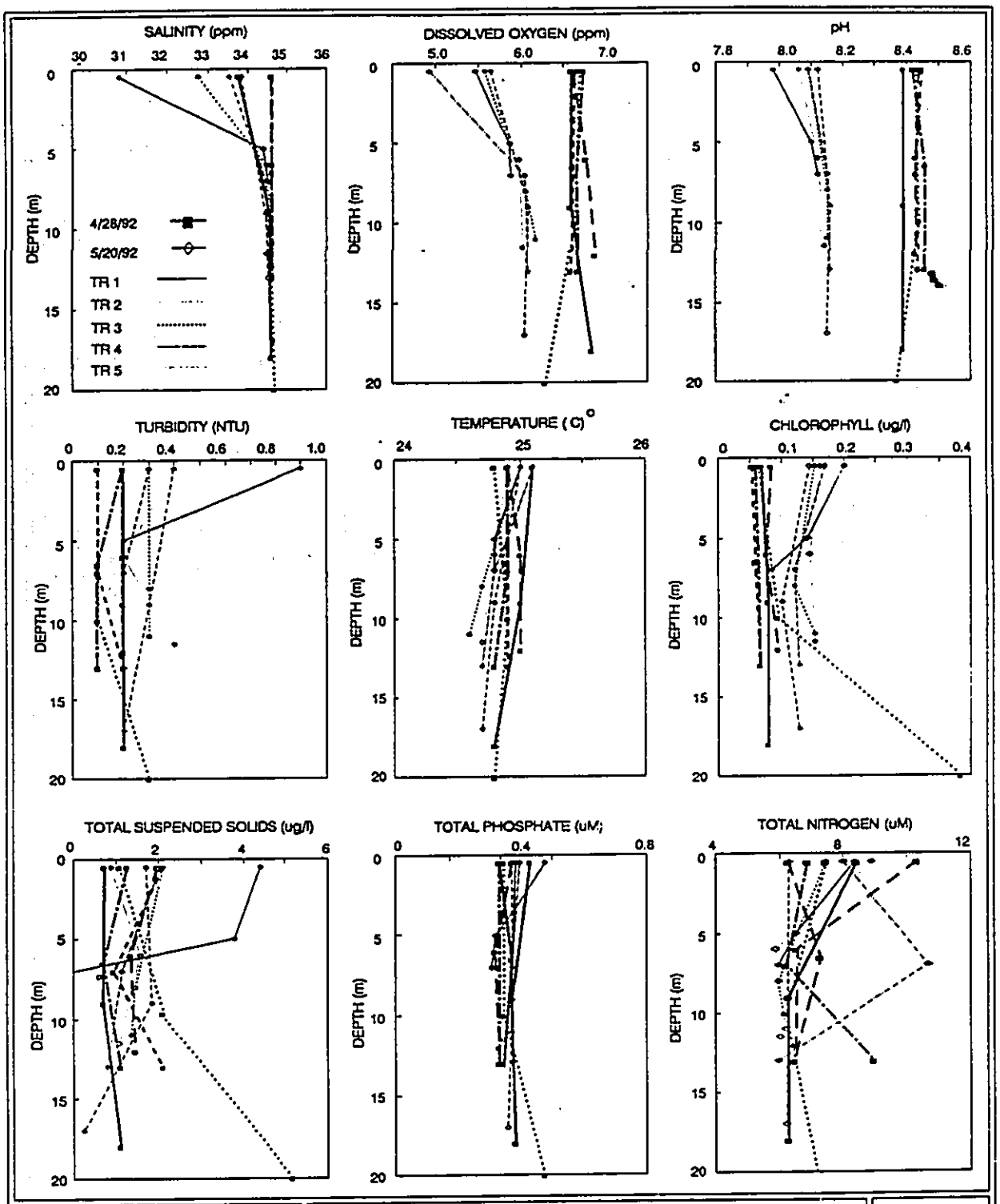
OI Consultants, Inc. Makapuu Point Waimanalo, Hawaii 96795	KAUNAKAKAI DRAINAGE MASTER PLAN STUDY SALINITY, TURBIDITY, SUSPENDED MATTER, AND ITS CONSTITUENTS	Figure 2



OI Consultants, Inc. Makapuu Point Waimanalo, Hawaii 96795	KAUNAKAKAI DRAINAGE MASTER PLAN STUDY REACTIVE SILICATE AND DISSOLVED NUTRIENT IONS	Figure 3



OI Consultants, Inc. Makapuu Point Waimanalo, Hawaii 96795	KAUNAKAKAI DRAINAGE MASTER PLAN STUDY pH, TEMPEARATURE, AND DISSOLVED OXYGEN	Figure 4



OI Consultants, Inc. Makapuu Point Waimanalo, Hawaii 96795	KAUNAKAKAI DRAINAGE MASTER PLAN STUDY DEPTH PROFILES OF SELECTED PARAMETERS AT THE D-STATIONS	Figure 5

Table 2. Water quality for samples collected off Kaunakakai, Molokai, on April 28, 1992. These samples represent typical dry weather conditions. Station locations as shown in Figure 1.

SAMPLE I.D.	DEPTH (m)	TEMP (deg C)	SAL (ppt)	DO (mg/l)	pH (unit)	TURB (NTU)	TSS (mg/l)	SI (uM)	NO3 (uM)	NH4 (uM)	TN (uM)	PO4 (uM)	TP (uM)	CHL (ug/l)	PHEO (ug/l)
1 A	0.30	28.1	34.98	6.93	8.31	0.5	4.33	ND	0.12	ND	9.11	0.17	0.77	0.29	0.28
1 B	0.60	26.1	34.81	6.75	8.30	0.6	3.55	ND	0.08	ND	8.35	0.13	0.57	0.13	0.08
1 C	0.70	26.8	33.63	7.66	8.34	0.3	2.53	ND	0.21	ND	7.13	0.13	0.56	0.11	0.10
1 D S	0.50	25.1	33.92	6.60	8.39	0.2	0.72	ND	ND	0.15	8.53	0.09	0.51	0.07	0.01
1 D M	9.00	25.0	34.65	6.59	8.39	0.2	0.70	ND	ND	ND	6.37	0.10	0.44	0.08	0.01
1 D B	18.00	24.8	34.70	6.85	8.39	0.2	1.11	ND	ND	ND	6.37	0.10	0.45	0.08	0.02
2 A	0.40	29.1	35.39	5.70	8.45	1.2	14.29	1.38	ND	ND	13.72	0.22	1.25	0.62	0.32
2 B	0.80	29.2	35.11	5.74	8.41	0.6	3.91	1.99	ND	ND	9.36	0.20	0.71	0.46	0.20
2 C S	0.50	25.3	34.80	6.08	8.35	0.2	2.20	ND	0.16	ND	8.21	0.15	0.53	0.19	0.09
2 C M	4.25	25.2	34.81	5.75	8.34	0.7	4.20	ND	0.12	ND	6.91	0.16	0.59	0.38	0.12
2 C B	8.00	24.8	34.81	4.81	8.34	1.4	5.22	ND	0.09	ND	7.42	0.16	0.59	0.38	0.15
2 D S	0.50	24.8	34.70	6.70	8.43	0.1	1.09	ND	ND	ND	7.56	0.08	0.41	0.06	0.02
2 D M	10.00	24.9	34.69	6.64	8.44	0.1	2.18	ND	ND	ND	6.30	0.08	0.41	0.09	0.05
2 D B	20.00	24.8	34.78	6.30	8.37	0.3	5.18	0.80	0.08	ND	7.27	0.12	0.57	0.38	0.15
3 A	0.02	26.5	34.35	5.86	8.42	1.1	17.41	29.09	0.46	0.21	12.85	0.25	1.11	1.15	0.35
3 B	0.10	25.0	35.00	5.69	8.41	1.3	4.35	18.53	0.04	ND	12.71	0.08	0.60	0.51	0.23
3 C	0.35	25.2	34.37	5.15	8.46	0.9	14.39	11.37	ND	0.21	14.69	0.09	0.59	0.25	0.23
3 D S	0.50	24.9	34.70	6.64	8.42	0.2	1.26	ND	0.05	ND	6.37	0.09	0.39	0.05	0.02
3 D M	6.50	24.9	34.71	6.62	8.46	0.1	0.70	ND	ND	ND	7.38	0.09	0.44	0.06	0.02
3 D B	13.00	24.9	34.73	6.60	8.46	0.1	1.11	ND	ND	ND	6.55	0.11	0.41	0.07	0.02
4 A	0.02	29.8	33.67	5.51	8.64	1.3	15.14	31.35	0.42	ND	13.21	0.22	1.04	0.72	0.38
4 B	0.10	26.8	35.13	6.45	8.69	0.3	6.78	16.81	0.09	ND	13.64	0.15	0.54	0.32	0.19
4 C	0.35	26.2	35.17	6.04	8.54	0.4	3.61	9.74	0.10	ND	14.47	0.12	0.57	0.29	0.21
4 D S	0.50	24.9	34.72	6.75	8.45	0.1	2.10	ND	0.07	ND	6.98	0.12	0.39	0.06	0.01
4 D M	7.00	24.9	34.67	6.66	8.43	0.1	0.95	ND	0.07	ND	6.30	0.12	0.39	0.06	0.01
4 D B	13.00	24.8	34.73	6.68	8.44	0.2	2.11	ND	0.09	ND	9.07	0.12	0.39	0.07	0.01
5 A	0.10	31.0	28.51	6.53	8.52	2.0	18.15	74.70	0.41	0.12	14.83	0.65	1.89	2.92	0.44
5 B	0.50	27.2	35.07	6.08	8.45	0.5	3.26	17.69	0.14	0.17	14.29	0.13	0.54	0.27	0.14
5 C	0.50	26.9	35.31	6.87	8.51	1.1	3.17	7.14	0.13	0.26	13.10	0.12	0.45	0.19	0.11
5 D S	0.50	24.9	34.70	6.62	8.44	0.2	1.97	ND	0.10	0.39	10.44	0.13	0.44	0.08	0.03
5 D M	6.00	25.0	34.72	6.78	8.43	0.2	1.36	ND	0.11	ND	6.62	0.12	0.38	0.08	0.03
5 D B	12.00	25.0	34.71	6.89	8.43	0.2	1.46	ND	0.12	ND	6.59	0.12	0.39	0.09	0.03

Table 3. Water quality for samples collected off Kaunakakai, Molokai, on May 20, 1992. These samples represent typical wet weather conditions. Station locations as shown in Figure 1.

Station I.D.	DEPTH (m)	TEMP (deg C)	SAL (ppt)	DO (mg/l)	pH (unit)	TURB (NTU)	TSS (mg/l)	SI (uM)	NO3 (uM)	NH4 (uM)	TN (uM)	PO4 (uM)	TP (uM)	CHL (ug/l)	PHEO (ug/l)
1 A	0.1	27.8	2.06	5.64	7.38	9.2	6.59	108.99	2.17	4.24	36.86	2.85	4.29	0.55	0.41
1 B	0.3	27.8	28.32	6.86	8.06	1.2	4.64	16.98	0.26	ND	10.01	0.26	0.69	0.38	0.13
1 C	0.5	27.8	30.43	7.18	8.02	0.9	4.67	8.26	0.35	ND	10.04	0.15	0.51	0.35	0.06
1 D S	0.5	25.0	31.10	5.47	7.98	0.9	4.39	7.66	0.89	ND	8.46	0.26	0.57	0.20	0.07
1 D M	5.0	24.8	34.50	5.86	8.10	0.2	3.77	ND	0.22	ND	6.59	0.12	0.38	0.14	0.09
1 D B	7.0	24.8	34.62	5.87	8.12	0.2	0.00	ND	0.39	ND	6.05	0.12	0.36	0.08	0.06
2 A	0.1	29.9	22.62	8.02	8.08	17.4	53.33	37.93	11.00	2.99	35.42	0.88	4.55	3.51	2.07
2 B	0.5	26.3	27.10	8.40	8.14	6.6	20.65	22.42	0.67	ND	15.70	0.46	1.86	1.42	0.28
2 C S	0.5	25.3	33.73	5.41	8.09	0.8	4.40	1.81	0.43	ND	7.92	0.16	0.65	0.38	0.25
2 C M	0.3	24.8	34.54	6.01	8.13	0.7	5.78	ND	0.21	ND	6.48	0.12	0.57	0.28	0.12
2 C B	5.5	24.6	34.65	6.05	8.13	1.4	6.26	ND	0.20	ND	7.31	0.11	0.65	0.26	0.20
2 D S	0.5	24.9	32.95	5.58	8.06	0.4	0.87	1.61	0.48	ND	9.00	0.12	0.45	0.16	0.11
2 D M	6.0	24.8	34.57	5.97	8.12	0.2	1.57	ND	0.16	ND	5.94	0.09	0.44	0.14	0.07
2 D B	11.5	24.7	34.58	6.01	8.14	0.4	1.07	4.00	0.16	ND	6.08	0.09	0.41	0.15	0.05
3 A	0.1	35.2	17.69	6.12	8.40	36.1	72.26	112.81	0.31	0.54	29.48	0.55	4.29	3.09	1.41
3 B	0.2	30.4	30.60	13.17	8.48	0.9	2.57	8.51	ND	ND	11.30	0.07	0.47	0.35	0.09
3 C	0.5	27.1	31.59	7.57	8.12	2.0	4.88	8.23	0.18	ND	9.18	0.09	0.57	0.35	0.08
3 D S	0.5	25.0	33.87	5.58	8.09	0.3	2.10	ND	0.20	ND	7.52	0.10	0.45	0.15	0.07
3 D M	8.0	24.7	34.64	6.05	8.15	0.3	1.45	ND	0.12	ND	6.05	0.10	0.44	0.12	0.04
3 D B	11.0	24.6	34.68	6.17	8.15	0.3	1.35	5.82	0.20	ND	6.26	0.09	0.44	0.15	0.06
4 A	0.3	34.8	20.57	7.15	8.27	15.5	36.58	81.06	19.59	4.65	55.12	2.35	4.67	3.26	0.53
4 B	0.3	31.3	30.09	11.03	8.36	2.0	5.06	10.84	0.26	ND	11.77	0.07	0.59	0.46	0.18
4 C	0.5	29.2	32.36	9.16	8.22	0.8	2.78	3.76	0.20	ND	9.58	ND	0.47	0.14	0.07
4 D S	0.5	25.1	33.69	4.93	8.09	0.3	2.03	ND	0.17	ND	8.10	0.09	0.47	0.17	0.08
4 D M	7.0	24.8	34.55	6.04	8.15	0.2	1.13	ND	0.10	ND	10.76	0.08	0.44	0.12	0.04
4 D. B	13.0	24.7	34.61	6.08	8.16	0.2	0.79	4.45	0.21	ND	6.05	0.07	0.44	0.13	0.06
5 A	0.1	34.5	23.99	9.20	8.36	13.4	27.11	57.02	8.17	0.11	33.34	1.19	3.30	3.65	0.35
5 B	0.3	31.0	29.80	10.30	8.38	1.3	3.65	9.89	0.13	ND	13.25	ND	0.51	0.33	0.23
5 C	0.5	29.5	30.94	10.80	8.34	0.6	2.75	7.42	0.12	ND	12.92	ND	0.48	0.36	0.28
5 D S	0.5	25.0	33.98	5.65	8.12	0.4	1.70	ND	0.15	ND	6.37	0.09	0.44	0.14	0.09
5 D M	9.0	24.8	34.55	6.08	8.16	0.3	1.85	ND	0.07	ND	6.34	0.09	0.44	0.10	0.05
5 D B	17.0	24.7	34.72	6.04	8.15	0.2	0.24	ND	0.09	ND	6.30	0.08	0.42	0.13	0.06

PART B

BENTHIC AND FISH COMMUNITIES OF THE KAUNAKAKAI REEF ENVIRONMENT IN THE VICINITY OF THE KAUNAKAKAI DRAINAGE SYSTEM

INTRODUCTION

In order to deal with a long occurring problem of poor drainage and flooding in the town of Kaunakakai, an improved drainage system has been planned for the area (Wilson Okamoto and Associates, 1992). The system would integrate and upgrade the drainage culverts and ditches that now deliver runoff from Kaunakakai to the shoreline into six principal runoff locations: 1) into Kaunakakai Harbor just west of the pier, 2) at the end of Mohala Place east of the Harbor pier, 3) two culverts near the end of Seaside Place, and 4) two culverts near the middle of the loop road that comes off of Kamehameha Highway east of Seaside Place. The runoff estimated for this drainage area for 50 year storms has been estimated to be 9924 cu. ft./sec, more than five times the present drainage capacity for the culverts in the area (Wilson Okamoto and Associates, 1992).

All of the runoff for the area is released at the shoreline margin of a coral reef system which has not been studied for its composition or abundance of possibly sensitive marine organisms. Therefore, the present study was undertaken to determine this information and provide an estimate of the potential impact of the revised drainage system on the Kaunakakai reef environment.

STUDY AREA

The coral reef off Kaunakakai is part of an extended system that borders the entire south shore of Molokai. The reef is very broad, ranging up to a mile wide in the center of the study area (Figure 1), and shallow, with maximum depths of only about 0.5 m MLLW (Mean Lower Low Water) across its expanse. Outside of the reef margin, the bottom slopes gradually down to 18 m (60 ft) within about 40 m (130 ft) from the margin, then more steeply to 55 m (180 ft) about 44 m (145 ft) further seaward.

Little information has been available concerning the substratum characteristics, benthic communities or fish fauna of this broad reef. The Molokai Coastal Resource Atlas (Manoa Mapworks, 1984) lists the shoreline as a detrital sand beach, the nearshore reef to be silt, and the reef from about 150 m (495 ft) to be mostly consolidated reef with 25 to 50% sediment bottom. No human uses of this area of the reef are listed. The harbor and nearshore area west of the harbor jetty are described as silt, and the reef west of the harbor as consolidated reef with 25 to 50% sediment.

A comprehensive survey was made of the water quality and biological communities on the reef up to 800 m west of the Kaunakakai Harbor jetty in 1978 as a baseline study for harbor expansion being considered at that time (Harbor Planning Design and Research, 1978). The study found dramatically increasing coral coverage and numbers of fish going seaward from the edge of the reef flat to about 12 m (40 ft) depth on the reef slope west of the harbor. Coral coverage ranged up to 80% of the bottom, and a maximum of 52 species were sighted at the station with the

highest coral coverage. Many species of non-coral invertebrates occurred in the more shoreward areas where coral coverage was low.

The present study area extends from the area covered in the Harbor Planning Design and Research, (1978) to about 1575 m (5200 ft) east of the Kaunakakai Harbor jetty, and from the shoreline to just outside of the margin of the reef flat.

METHODS

Fifteen locations on the Kaunakakai reef were surveyed on May 19 and 20, 1992. Intense rains occurred the day before and on the first day of the survey, making nearshore water very muddy and turbid and conditions difficult for underwater observations, especially at Stations 2NS and 2MR shoreward of Kaunakakai Harbor. However, conditions improved on May 20 to where surveys could be made. Wind and sea conditions during the survey were moderate onshore southwesterly winds producing moderate surf on May 19, subsiding to 1-2 foot waves on May 20.

The stations were aligned on five sites along the shoreline corresponding to the locations of proposed principal drainage points for the proposed project (Harbor Planning Design and Research, 1978). Station locations are shown in Figure 1. For each site a nearshore (NS) station was surveyed within 10 m of the shoreline, a mid-reef (MR) station established with a measuring tape at 450 m offshore, and an offshore (OS) station outside of the reef flat at 4 to 5 m depth. Observers walked the reef from the shoreline station to the mid-reef station at each site, and the general characteristics of the environment along these paths were recorded. Also, dives were made up and down the reef slope at Stations 2OS, 3OS and 5OS and the benthic characteristics noted and compared to the observations made at these stations.

At each station a 50 m line was deployed parallel to the shoreline which was used to establish the location and direction of benthic quadrats and fish transects. An observer used a 1 m^2 quadrat frame which was deployed at 10 randomly selected points along the transect line at each station. The quadrat frame was subdivided into 100 subsections to estimate the portion of the bottom comprised of various substratum types or biota. Each subsection at least half occupied by a given bottom type, seagrass, macroalga or colonial invertebrate was counted and totaled for the quadrat, and their abundances were expressed as percent coverage. Solitary invertebrates occurring within the frame were also counted and totaled, and expressed as number/m^2. All species of macro-invertebrates occurring in the vicinity of the transect but not on the line or within any quadrat were also listed and their relative abundances noted. All organisms noted were larger than approximately 2 mm length or diameter.

Diversities of the coral communities at Station 1OS to 5OS were calculated using the Shannon-Weaver Index (Shannon and Weaver, 1963) by the formula:

$$H' = -P_i \ln P_i$$

where P_i= the percent coverage by the i^{th} species on the quadrat.

Values for percent coverage by species and for total coral were averaged for the ten quadrats on each transect for a mean transect value.

Visual surveys for fishes were done along 50 X 3 m transects. The observer swam along a line parallel to shore playing out a marked transect line. During this initial survey of the entire 3 m strip all large mobile fishes were counted. The observer then resurveyed the transect counting the smaller, less mobile species in a 1.5 m wide strip of bottom on each side of the 50 m transect line. This technique follows Fowler (1987) and combines the advantages of counting fishes that move out of the area as the observer approaches and counting smaller fishes, like juveniles, that are more cryptic and seek shelter temporarily rather than fleeing the area. Species that were observed near the transect were noted as present at a site but number of individuals were not noted. This qualitative sampling was opportunistic and should not be considered as a complete qualitative survey of the areas. Transects at the offshore stations (OS) were done with SCUBA, while the mid-reef stations (MR) and nearshore transects 4NS & 5NS were done while snorkeling. The remaining nearshore (NS) transects were done by walking along the 50 X 3 m transect because of the shallow depth of water at these stations. The number of individuals per species were recorded on underwater paper already labeled with common species names. Shannon's Diversity Index (Shannon and Weaver, 1963) was calculated to compare species richness and evenness differences between the sites by the following formula:

$$H' = \sum_{i=1}^{N} \frac{N_i}{N} \ln \frac{N_i}{N}$$

where N= total number of individuals on the transect and N_i= the number of individuals in the i^{th} species.

This diversity index is most appropriately used for comparisons within a study and should not be used for comparisons between studies using different sampling methods or comparing different communities.

RESULTS

Substratum and Benthos

The characteristics of the bottom types and the dominant biota at each station are shown in Tables 1 to 3. On the nearshore and mid-reef zones of the reef flat the bottom types and dominant biota are substantially unchanged throughout the sampling sites along the study area. Table 1 shows the four nearshore transects from 2NS to 5NS to be essentially devoid of invertebrates other than the blue clawed swimming crab, *Thalamita crenata*, which was occasionally observed moving along the bottom. No animals or macroalgae were observed in any quadrat on any of these nearshore transects. The composition of the bottom is entirely sandy mud with no hard substratum except rare blocks of coral rubble that have washed up near the shore. Small quantities of algae occur on these blocks, primarily *Acanthophora spicifera* and *Hypnea* at Station 2 and *Ulva* at Station 4. The only other indication of benthic life in this nearshore zone were abundant burrow openings at the sediment surface, indicating the subsurface presence of a filter feeding species such as a polychaete worm or the ghost shrimp *Callianassa* sp.

Despite the fact that it was located immediately outside the mouth of Kaunakakai Stream and near the harbor, Station 1NS was the nearshore area least showing the effects of land runoff and sedimentation and with the least turbidity on May 19 of all the NS stations. Sediment at Station 1NS was relatively clean calcareous sand with a small mud component, and intermittent areas of hard bottom occurred which supported a few species of macroalgae (Table 1). In addition to the crab *Thalamita crenata*, alpheid shrimps (*Alpheus rapax*?) were seen at the entrances to their burrows, and tubes of vermetid molluscs were common on the hard bottom areas. It appears that most sediment laden runoff from the stream is moved eastward by the normal prevailing nearshore current, to be deposited on the reef shoreward of the harbor where the heaviest mud deposits were found.

Further offshore at the mid-reef stations (Table 2), the Site 1 Station 1MR was also unique from the stations further west, having relatively high amounts of hard bottom and a variety of macroalgae and invertebrates. Small colonies of two species of corals (*Porites lobata* and *Pocillopora damicornis*) occurred on or near the transect, and a yellow nudibranch, a bristleworm (*Phrecardia striata*) and some boring sea urchins (*Echinometra mathaei*) were found on the coral rubble. These were typical of the conditions throughout most of the reef flat from the 1NS to the 1MR stations, again showing the limited effect runoff induced sedimentation has had on this area of the reef.

Station 2MR, just shoreward of the Kaunakakai Harbor, had no indications of benthic organisms other than burrow openings. Sediment was mostly fine mud at least ankle deep, and turbidity was the highest of any mid-reef station.

The mid-reef environment east of the harbor jetty was relatively unchanged throughout the three sites surveyed. Going from the nearshore to the mid-reef stations the bottom composition changed gradually from the bare sandy mud to sand with a small mud component. This substratum becomes overgrown by the seagrass *Halophila ovalis* from about 150 to 300 m offshore. Hard substratum gradually become more abundant with distance offshore, reaching a maximum at about 350-400 m offshore, then decreasing as sand became more abundant in the vicinity of the MR stations at 450 m offshore.

The mid-reef stations from 3MR to 5MR (Table 2) show roughly equal amounts of the bottom to be exposed muddy sand and a complex association of *Halophila ovalis* with a variety of macroalgae, including *Acanthophora spicifera*, *Hypnea* sp., *Padina japonica*, *Spyridia filamentosa*, *Dictyota* sp. *Lyngbya* sp., *Neomeris annulata*, *Halimeda discoidea* and *Turbanaria ornata*. A few macroinvertebrates were noted, especially *Alpheus rapax* in their burrows, and small blue and lavender sponges. A single colony of *Pocillopora damicornis* was noted near the transect at Station 3MR, and a single *Porites compressa* at Station 5MR.

The offshore stations (Table 3) show a clear gradient of decreasing reef coral abundance going from the westernmost Station (10S) to Station 50S at the eastern limit of the study area. Mean total coral coverage decreased from a high of 50 to 60% at Stations 10S and 20S on either side of the Kaunakakai Harbor channel to only 1.5% of the available bottom at Station 50S. Maximum coral cover on the randomly placed quadrat ranged as high as 97% at Station 10S and 85% at Station 20S, but never exceeded 4.5% at Station 50S.

The coral community at Station 10S most closely typified a normal assemblage for a leeward Hawaiian reef, being dominated by *Porites lobata* (37%), followed by *Montipora verrucosa* (6%) and *Montipora patula* (5%), with a few small *Pocillopora meandrina* colonies totaling about 2% coverage. Mean H' diversity was quite low at 0.73, due to the dominance by *Porites lobata*. At Station 20S, just across the harbor channel, the species dominance was quite different, with high coverages of *Montipora verrucosa* (30%) and *Montipora patula* (19%), followed by about 5% coverage each for *Porites lobata* and *Pocillopora meandrina* and about 1% each for *Porites compressa* and *Pavona varians*. This assemblage of species resulted in a moderately high H' species diversity of 1.02 This station is within a few meters of the dredged harbor channel, and the high abundance of *Montipora* in this area may be related to a higher tolerance by this genus to low to intermediate levels of turbidity and sedimentation of small particles. *Montipora* is the dominant coral in the more turbid areas of Kaneohe Bay and the few areas of Honolulu Harbor where reef coral may be found.

Further east at Station 30S the moderate coral coverage on the

transect was dominated by *Montipora patula* at 10%, *Pocillopora meandrina* at 6%, followed by about 4% for *Montipora verrucosa* and 2% for *Porites lobata* and trace amounts of *Porites compressa*, *Pavona varians*, *Pavona duerdeni* and the zoanthid *Palythoa tuberculosa*. With the three other species found near the transect (*Pocillopora eydouxi*, *Montipora flabbelata* and *Leptastrea purpurea*) the total of eleven species of coral was the highest at any of the stations. The Shannon-Weaver species diversity mean value of 1.59 was highest at this station, due to both the greater number of species and the relatively even distribution of coverage among the species.

Further east, total coral coverage decreased dramatically to 7% at Station 40S, and to only 1.5% at Station 50S. Diversity indices decreased accordingly, reaching a mean value 0.29 at Station 50S, the lowest found at any transect. The limited coral coverage in these areas is primarily scattered small colonies of *Pocillopora meandrina* with a smattering of *Porites lobata*. The reef becomes increasingly affected by sand deposition going eastward, with mean sand coverage climbing from less than 1% at 30S to 10% at 40S and 24% at 50S. Observed turbidity increased accordingly going eastward, with wave resuspension of sand being the primary source. This sand does not appear to be related to runoff from the distant shoreline, since the sand appeared to be all calcareous with no terrigenous component.

The observations made up and down the reef slopes at Station 20S, 30S and 50S verified that the conditions described above typified conditions for the offshore segments of each respective reef site. No substantial coral cover was found from 1 m to 20 m depth in the vicinity of Station 50S. *Pocillopora meandrina* gradually became slightly more abundant going into the shallows at 2 to 3 m, but at 1.5 m depth the bottom became totally sand scoured with no live corals. At Station 30S moderate coral cover extended to 1.5 m where it became dominated by *Porites lobata*, and the calcareous alga *Porolithon gardineri*, was also common. At 1 m depth coral virtually disappeared and the bottom was dominated by the alga *Sargassum echinocarpum* with adventitious growths of *Jania* and by *Liogora*. At Station 20S luxuriant coral growth extended from the reef margin down the reef slope to about 6 m depth, where the channel cut abruptly ends all reef surfaces and heavy deposits of sediment prevent coral survival.

Fish Assemblages

The nearshore and mid-reef sites showed low richness of fishes but also the highest numbers of individuals per species (Table 4). This is evident by the low Shannon's Diversity Index values. Only one to four species were observed on the transect at each nearshore site. These four species were gobies, with two species, *Psilogobius mainlandi* and an unidentified goby, occurring in high numbers. *Psilogobius mainlandi* shares a burrow with an alpheid shrimp, and the other three species of gobies seek shelter under small pieces of rubble when disturbed.

Small schools of an unidentified mullet were seen in the nearshore area of transects 2, 4, & 5 but were only observed within the 3 X 50 survey area at Station 4NS. One fisherman was observed in the area of 1NS and 2MR fishing for mullet from a boat using a cast net. Visibility was very low at sites 2NS and 2MR (<0.2 m) and this probably accounted for the absence of fishes observed on these transects.

The offshore sites (OS) had a greater diversity of fishes than the nearshore and mid-reef sites. The site on the east side of the Harbor (2OS) had the highest species richness of fishes and also the greatest amounts of coral and highest topographic relief. Fish diversity at this site ranked third behind Stations 1OS and 3OS. The diversity index value at Station 2OS was probably lowered by relatively large numbers of three species: *Mulloides flavolineatus*, *Chromis vanderbilti*, and *Thalassoma duperrey*. This was the only site where the obligate coralivorous butterflyfishes *Chaetodon ornatissimus* and *C. unimaculatus* were seen on the transects, although they were observed in the areas of Stations 1OS and 3OS.

Offshore stations 1OS and 3OS had similar species richness and ranked one and two in the Diversity Index. Almost half of the species represented at both sites were surgeonfishes (Acanthuridae) which feed on attached algae.

Stations 4OS and 5OS had fewer species of fishes and had the lowest diversity index values of all the offshore sites. Fishes seen at the eastern end of the study area represented a wide range of fish families and tended to be the small species that could take shelter in colonies of *Pocillopora meandrina* and other small shelter sites.

Several species appeared consistently at most of the offshore sites. The hawkfish *Paracirrhites arcatus*, was counted on all offshore sites and was usually seen perched on top of colonies of *Pocillopora meandrina*. The goatfish *Parupeneus multifasciatus*, was counted at transect 1OS and 2OS but was also seen at Stations 3OS and 4OS. The damselfish *Plectoglyphidodon johnstonianus*, usually associated with living coral, occurred on transects 2OS and 3OS, and also was seen in the area at Stations 4OS and 5OS. The most common wrasse was *Thalassoma duperrey* included in counts at all the offshore sites. Low densities of juveniles *Coris gaimard*, a wrasse, existed at Stations 1OS, 3OS, 4OS, and 5OS but was only seen on the transect at 3OS. Adult *C. gaimard* were also seen in the vicinity of 1OS. The most common surgeonfish was *Acanthurus nigrofuscus*, found at all the offshore stations and included in transect counts at four stations. The triggerfish *Rhinecanthus rectangulus* occurred in low densities at all offshore stations except 2OS, although it was only observed off the transect at 5OS. The toby *Canthigaster jactator* occurred at all offshore stations, and none were observed to be infected with the abdominal cavity parasite *Philometra* sp. (Deardorff and Stanton 1983).

One other study has done fish surveys at sites in the vicinity of our transects (Hawaii Planning Design and Research 1978). Station 10S of the present study was located near the site of their Biological Station 5. Fifteen of the 23 species seen at Stations 10S were listed for Biological Station 5 of the 1978 study.

DISCUSSION

The findings of the present study are similar to those of the previous study at Kaunakakai (Hawaii Planning Design and Research, 1978) of the benthic environment along the west side of the Kaunakakai Harbor. The earlier study found three coral colonies and a diverse invertebrate community at their most shoreward station, which was approximately 300 m west of Station 1MR. This area was not surveyed in the present study, but it is quite likely that such benthic conditions still exist, given the improvement that was observed in environmental conditions and the abundances of benthic organisms from Station 2MR to 1MR. The present results and the 1978 study indicate that effects of turbidity and sedimentation from shore runoff and the harbor on the benthos have been mostly restricted to those areas directly shoreward of the harbor. Despite the location of Stations 1NS and 1MR directly off the Kaunakakai Stream mouth little indication was found of direct impact from the stream on the reef environment, especially compared with all areas on the reef further to the east. This may be due to infrequent intermittent flow from the stream and/or diversion of stream runoff to the east once the flow reaches the shoreline. Also the construction of flood control berms above the shoreline in this area may have directed much of the stream's flow from its original course. During the survey substantial freshwater seepage was noted along the shoreline between Stations 1NS and 2NS. This seepage, along with restricted circulation may be a principal source of the highly turbid water and muddy bottom that occurs from 2NS to 2MR.

Further offshore, the 1978 study found coral coverage along a line about 300 west of the harbor, to an average of 72% at 2 m depth, 48% at 7 m, and 58% at 12-15 m depth, in good agreement with the 50% coverage found at Station 10S in the present study. Species composition was also comparable. Both studies show that the effects of turbidity and sedimentation from either shore runoff or the Kaunakakai Harbor have been restricted and not detrimental to the survival of a flourishing and highly aesthetic coral reef and reef fish community.

It is not clear why good coral growth and coverage do not apparently extend much further eastward than Station 30S on the outer Kaunakakai reef. All physical conditions concerning wave exposure, water movement, reef slope, nutrient, sediment and turbidity levels would be expected to be similar along this broad and open reef front. The only obvious physical variable related to the decreasing coral coverage was increased sand cover, which

may restrict coral settlement, development and growth through resuspension scouring and scouring of reef surfaces.

It is highly unlikely that development of a storm runoff drainage system for Kaunakakai will have any effect on the Kaunakakai reef or on the reef coral population in the area. The reef flat is 1.2 to 1.3 km wide and covered over most of its surface with a thick layer of sediment with a consistency of sandy mud near the shore to muddy sand up to 500 m offshore. Along most of the reef flat the sediment surface is virtually devoid of macrobiotic nearshore and supports a dense seagrass-macroalgal biotope further offshore. Neither environment would be susceptible to negative impacts from storm runoff, and the area has apparently been under the influence of sedimentation from runoff for a very long time. The only potentially sensitive benthic communities are in the offshore area surrounding the Kaunakakai Harbor and channel. These communities have flourished despite the construction and use of the harbor, and the presence of the Kaunakakai Stream mouth directly onshore from the harbor.

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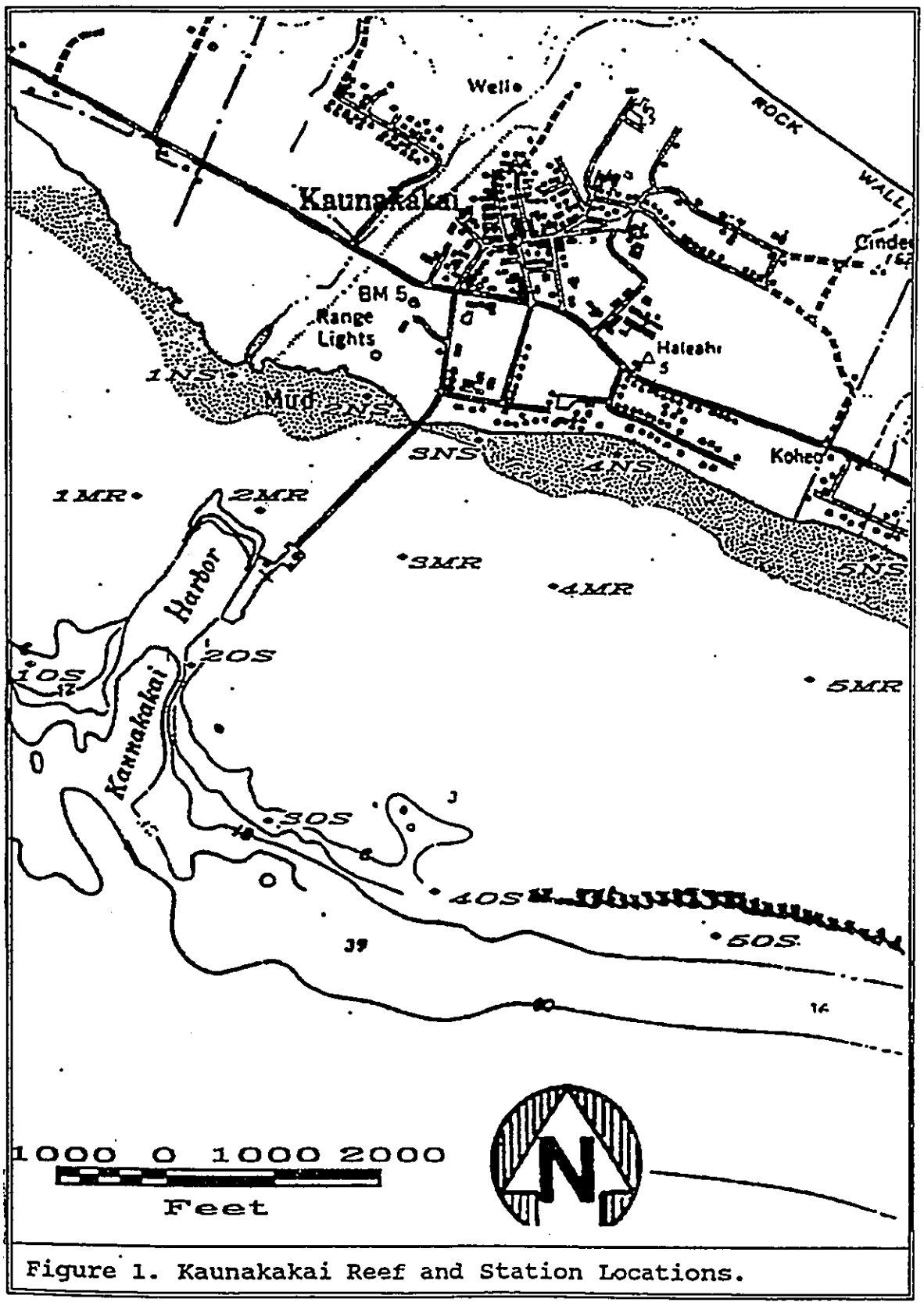

Figure 1. Kaunakakai Reef and Station Locations.

Table 1. Substrata Type and Percent Coverage and Organisms Observed on Nearshore Transects - Kaunakakai, Molokai

			Quadrat Number										
Station	Depth	Substrate	1	2	3	4	5	6	7	8	9	10	Mean
1NS	0.1 m	Sand	100	98	100	100	96	99	100	100	100	100	99.2
		Rubble	0	2	0	0	4	1	0	0	0	0	0.7
		Macroalgae: *Acanthophora spicifera*, *Desmia*, *Valonia*											
		Invertebrates: Portunidae (*Thalamita crenata*), Alpheidae (*Alpheus rapax*?), Vermetidae, abundant burrows											
2NS	0.2 m	Mud/Sand	100	100	100	100	100	100	100	100	100	100	100
		Macroalgae: *Hypnea* and *Acanthophora* moderately abundant on rubble near high water mark.											
		Invertebrates: Abundant burrows											
3NS	0.3 m	Mud/Sand	100	100	100	100	100	100	100	100	100	100	100
		Macroalgae: None observed											
		Invertebrates: *Thalamita crenata*											
4NS	0.3 m	Mud/Sand	100	100	100	100	100	100	100	100	100	100	100
		Macroalgae: *Ulva* on rubble near shore											
		Invertebrates: *Thalamita crenata*, abundant burrows.											
5NS	0.3 m	Mud/Sand	100	100	100	100	100	100	100	100	100	100	100
		Macroalgae: None observed											
		Invertebrates: *Thalamita crenata*, abundant burrows.											

Table 2. Substrata Type and Organisms Observed on Mid Reef Transects - Kaunakakai, Molokai

Sta.	Depth	Substrate	Quadrat Number 1	2	3	4	5	6	7	8	9	10	Mean
1M	0.4 m	Sand	80	72	98	96	94	100	99	99	85	93	82.6
		Rubble	20	28	2	4	6	0	1	1	5	7	7.4
		Macroalgae: *Acanthophora spicifera*, *Dictyota*, *Hypnea*, *Neomeris*, *Gracilaria*, *Spyridia filamentosa*											
		Invertebrates: Yellow Nudibranch (*Plachobranchus?*), Alpheidae (*Alpheus rapax*), Polychaeta (*Pherecardia striata*), *Echinometra mathaei*, *Porites compressa* and *Pocillopora damicornis*											
2MR	1.3 to 0.75 m	Sand/Mud	100	100	100	100	100	100	100	100	100	100	100
		Macroalgae:None observed											
		Invertebrates: None observed											
3MR	0.7 m	Sand/Mud	100	100	47	99	47	66	93	12	24	38	62.6
		Hydrophila /Algae	0	0	53	1	53	36	7	88	76	62	37.6
		Macroalgae: *Acanthophora spicifera*, *Padina*											
		Invertebrates: Alpheidae (*Alpheus rapax*), *Pocillopora damicornis*											
4MR	0.5 m	Sand/Mud	1	5	30	15	5	100	100	100	67	82	51.5
		Hydrophila/ Algae	99	95	70	85	95	0	0	0	23	18	48.5
		Macroalgae: *Acanthophora spicifera*, *Hypnea*, *Padina*, *Spyridia*, *Dictyota*											
		Invertebrates: Alpheidae (*Alpheus rapax*), blue and lavender sponges											
5MR	0.5 m	Sand/Mud	100	100	100	100	90	15	16	24	6	3	55.4
		Rubble	0	0	0	0	0	0	1	2	0	3	0.6
		Hydrophila/ Algae	0	0	0	0	10	85	83	74	94	94	44.0
		Macroalgae: *Acanthophora spicifera*, *Padina*, *Dictyota*, *Lyngbya*, *Neomeris*, *Halimeda*, *Turbinaria*											
		Invertebrates: Alpheidae (*Alpheus rapax*), *Porites compressa*											

Table 3. Coverage and species diversity of reef corals on offshore transects off Kaunakakai, Molokai.

		Quad										Transect		
Station	Species	1	2	3	4	5	6	7	8	9	10	Min	Max	Mean
1OS	*Por. lobata*	7	6	40	80	38	57	28	55	33	26	6	80	37
	P. compressa	0	0.2	0	0	0	0	0	2	1	3	0	3	0.6
	P. meandrina	5	2	0.5	0	0	0.2	12	0	0	0	0	12	1.9
	Mont. patula	2	14	13	4	2	2	7	2	0	0	0	14	4.6
	M. verrucosa	6	11	2	13	2	5	10	6	0	5	0	13	6
	Total Coral Coverag	20	33	55	97	42	64	57	65	34	34	34	97	50
	Species Diversity	1.13	1.24	0.74	0.6	0.38	0.43	1.24	0.58	0.13	0.7	0.13	1.31	0.73
	Sand	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rubble	0	0	0	0	0	0	0	0	0	0	0	0	0
2OS	*Por. lobata*	1	0	0	18	0.5	0.5	14	16	0	3	0	18	5.3
	P. compressa	0	0	0	0	0	0	0	0	0	11	0	11	1.1
	P. meandrina	2	0	1	0	0	7	8	0	15	12	0	15	4.5
	M. patula	20	13	20	40	10	22	15	11	17	22	10	40	19
	M. verrucosa	36	23	40	19	10	34	14	55	35	30	10	55	29.6
	Pav. varians	1	0	0	1	0	5	1	3	0	0	0	5	1.1
	Total Coral Coverag	60	36	61	78	20	68	52	85	67	78	20	85	60.6
	Species Diversity	0.92	0.65	0.71	1.1	0.79	1.17	1.43	0.98	1.02	1.41	0.65	1.43	1.02
	Sand	0	0	5	0	0	0	0	0	0	0	0	5	0.5
	Rubble	0	2	11	0	40	0	0	0	0	0	0	40	5.3
3OS	*Por. lobata*	13	4	0.1	0.5	0.5	0.5	0.2	0.5	0.2	3	0.1	13	2.25
	P. compressa	0	0	0	0	0.5	0	0	0	0	0	0	0.5	0.05
	P. meandrina	4	10	5	7	5	6	1.5	5	9	11	1.5	11	6.25
	Mont. patula	17	18	12	9	5	14	9	5	6	5	5	18	10
	M. verrucosa	5	2	4	2	2	7	4	2	4	5	2	7	3.7
	Pav. duerdeni	0	0	0	0	0	0	0	0.5	0	0	0	0.5	0.05
	P. varians	0	0	0	0	0	0.2	0	0	0	0	0	0.2	0.02
	Paly. tuber.	0	0.1	0	0	0	0	0	0	0	0.2	0	0.2	0.03
	Total Coral Coverag	39	34	21	19	13	27	15	12	18	24	12	39	22.3
	Species Diversity	1.23	1.12	1	1.1	1.27	1.13	0.95	1.28	1.11	1.27	0.95	1.28	1.14
	Sand	0	0	0	6	0	0	0	0	0	0	0	6	0.6
	Rubble	0	0	0	0	0	0	0	0	0	0	0	0	0
4OS	*Por. lobata*	1	2	3	0	0	0.5	0.5	3	4	0.2	0	4	1.42
	Poc. damicor	2	0	0	0	0	0	0	0	0	0	0	2	0.2
	P. meandrina	5	9	6	0.2	0.5	3	7	4	6	3	0.2	9	4.37
	Mont. patula	0	0.1	0.2	0	0	0.5	0.5	1	1	0	0	1	0.33
	M. verrucosa	1	1	1	0	0.1	1	0.5	2	0.1	0.5	0	2	0.72
	Total Coral Coverag	9	12	10	0.2	0.6	5	8.5	10	11	3.7	0.2	12	7.04
	Species Diversity	1.15	0.76	0.98	0	0.45	1.09	0.66	1.28	0.96	0.6	0	1.28	0.79
	Sand	6	4	0	15	30	0	40	0	6	4	0	40	10.5
	Rubble	0	0	0	0	0	0	0	0	0	0	0	0	0
5OS	*Por. lobata*	2	0	1	0.1	0	0	0	0	0.2	0.1	0	2	0.34
	P. meandrina	1	3	3	4	0	0	0	0	0	0.2	0	4	1.12
	M. patula	0.1	0	0.2	0	0	0	0	0	0	0	0	0.2	0.03
	M. verrucosa	0.5	0.1	0.2	0.2	0	0	0	0	0	0	0	0.5	0.1
	Total Coral Coverag	3.6	3.1	4.4	4.3	0	0	0	0	0.2	0.3	0	4.4	1.59
	Species Diversity	1.06	0.14	0.88	0.2	0	0	0	0	0	0.64	0	1.06	0.29
	Sand	2	22	0	0	85	99	10	11	15	0	0	99	24.4
	Rubble	2	0	0	1	0	1	6	1	0	0	0	0	1.1

Gobiidae																			
Acentrogobius nephodes							1												
Asterropteryx semipunctatus							1										1		
Psilogobius mainlandi							>100					>100					14		
Unidentified species											>100			>100					
Blennidae																			
Exallias brevis															1				
Balistidae																			
Melichthys niger										•									
Rhinecanthus rectangulus					1								1		1				
Sufflamen bursa										1									
Ostraciidae																			
Ostracion meleagris				•						•									
Tetradontidae																			
Arothron hispidus														•					
Canthigaster jactator	3								3				2			3			4
Diodontidae																			
Diodon hystrix														•					
Number of Species	0	4	12	0		0	17	1	1	14	2	1	9	0		3	7		
Number of individuals	0	>100	29	0		0	97	>100	>100	38	>100	>100	28	0		16	26		
Shannon's Diversity Index	--	0.16	2.3	--		--	2.03	0	0	2.45	0.3	--	1.76	--		0.46	1.88		

Table 4. Fish survey of coastline near Kaunakakai Harbor, Molokai. One 50 x 3 m visual transect at each site. NS = Near shore; MR = mid-reef flat; OS = offshore, near the reef slope. Numbers = number of fish observed on the transect; * = unquantified presence of species in the area of the transect.

TRANSECT	1			2			3			4			5		
Station	NS	MR	OS	NS	MR	OS	NS	MR	OS	NS	MR	OS	NS	MR	OS
Date (June, 1992)	19	19	20	19	19	20	20	19	20	20	19	20	20	19	20
Duration (minutes)	5	16	13	7	8	15	10	16	12	10	16	12	10	16	11
Depth (m)	0.1	0.4	2	0.2	0.8	2	0.1	0.5	4	0.2	0.5	6	0.2	0.5	4
Visibility (m)	1	4	7	0.1	0.2	5	1	2	5	1	1	4	1	2	4
Synodontidae															
Synodus spp.	*														
Muraenidae															
Gymnothorax undulatus	*					*									
Fistularidae															
Fistularia petimba							*								*
Scorpaenidae															
Sebastapistes coniorta							1		*						2
Mugilidae															
unidentified species		*						10		*					
Carangidae															
Caranx melampygus													*		
Serranidae															
Cephalopholis argus				1											
Apogonidae															
Foa brachygramma													1		
Cirrhitidae															
Cirrhitops fasciatus							*								
Paracirrhites arcuatus	3			3			4			2			4		
Mullidae															
Mulloides flaviolensus				40											
Parupenaeus cyclostomus	1														
P. multifasciatus	2			2			*			*					

Chaetodontidae						
Chaetodon tremblii				•		
C. miliaris					1	
C. lunula	•					
C. ornatissimus	•	2		•		
C. quadrimaculatus				•		
C. unimaculatus	•	2		•		
Forcipiger flavissimus	•	•				
Pomacentridae					5	
Abudefduf abdominalis					1	
Chromis vanderbilti	1	16				•
Dascyllus labisella		3			•	•
Plectoglyphidodon johnstonianus		1		3		
Stegastes fasciolatus		•				
Labridae				•	•	•
Bodianus bilunulatus				1	•	•
Coris gaimard	•					
Gomphosus varius	•	1		•		
Labroides phthirophagus				•		
Stethojulis balteata	1			1		•
Thalassoma ballieui		1				
T. duperrey	4	11		4	12	2
T. trilobatum	•					
Zanclidae						
Zanclus cornutus		•				
Scaridae					2	
Scarus dubius					•	6
S. perspicillatus		1				
S. sordidus	•					
Acanthuridae						
Acanthurus achilles	•			3		
A. blochii	3					
A. dussumieri	1	•				
A. leucopareius	1			5		
A. nigrofuscus	6	6		6	•	4
A. olivaceus	•			1		
A. triostegus	5			4		4
Ctenochaetus strigosus		3		2		

APPENDIX D

Archaeological Inventory Survey
of a Portion of Drainage System A, Kaunakakai, Molokai
prepared by Cultural Surveys Hawaii

Archaeological Inventory Survey
of a Portion of Drainage System A,
Kaunakakai, Moloka'i
(TMK 5-3-02: por. 72; 5-3-03: por. 01; 5-3-09: por. 17)

by

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Cultural Surveys Hawaii
May 1993
Revised November 1994

ABSTRACT

Cultural Surveys Hawaii conducted an archaeological inventory survey at the request of Wilson Okamoto and Associations, Inc. for the proposed Kaunakakai Drainage Improvement System A (TMK 5-3-02: por. 72; 5-3-03: por. 01; and 5-3-09: por. 17). The majority of the project area has been extensively modified during recent times but two sites (State Sites 50-60-03-895 and 50-60-03-896) were located and described and sub-surface testing was conducted at Site -895. The sites consist of an enclosure with associated surface pavements (Site -895) and a stacked boulder wall (Site -896).

The sites appear to be of historic construction and use. This is evident by the construction style and sub-surface testing results at Site -895. However, the literature review indicates that Site -895 is in proximity with a formerly existing *heiau*, Kamalae *Heiau*, which was described in 1909 as having been "entirely destroyed" (J.F.G. Stokes). However, based on the present research (literature review and inventory survey) we do not believe sites, specifically Site -895, represent(s) the remains of a *heiau*.

Cultural Surveys Hawaii recommends further archaeological work at the two sites (-895 and -896) to address specific questions as to chronological and functional interpretations. It is also further recommended that Site -896 be preserved as is.

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INTRODUCTION

A. Project Area Description

The project area is situated within the dry leeward south central Moloka'i area directly *mauka* (east) of Kaunakakai Town (Figures 1 & 2). The area surveyed extends from Homeolu Place in a westerly direction some 950 feet to the drainage channel of Kaunakakai Stream (Figures 3 & 4).

The elevation range is from 10 to 40 feet A.M.S.L. Rainfall averages approximately 15 inches per year with the majority of rainfall occurring in the winter months, October to March (Armstrong Ed. 1973).

Soils in the project include very stony rocky land (rVT2) and Pulehu series alluvial deposits (PsA) (Foote et al. 1972). The soil classified as rVT2 encompasses the eastern portion of the project area with the more normally productive PsA type soil associated with Kaunakakai flood plain.

Vegetation along the proposed drainage is dominated by various grasses and *kiawe* trees, except in an area of the Kaunakakai flood plain which is planted in corn.

Much of the project area has been historically, and in some cases recently, modified. Modifications include bulldozing associated with house construction and an associated cesspool, utility pole emplacement, flood drainage berms, a corn field, and Kaunakakai Stream Flood Control. Essentially, the entire project area has been bulldozed, except for the site areas.

From Pauli Place the proposed drainage corridor passes between an existing home and then through a bulldozed flat. The two site areas, situated on the edge of a bedrock bluff, are located 350 feet from Pauli Place (Figure 4). Beyond the sites the corridor turns more northerly, passing under utility lines and down a short, but steep *kiawe*-covered

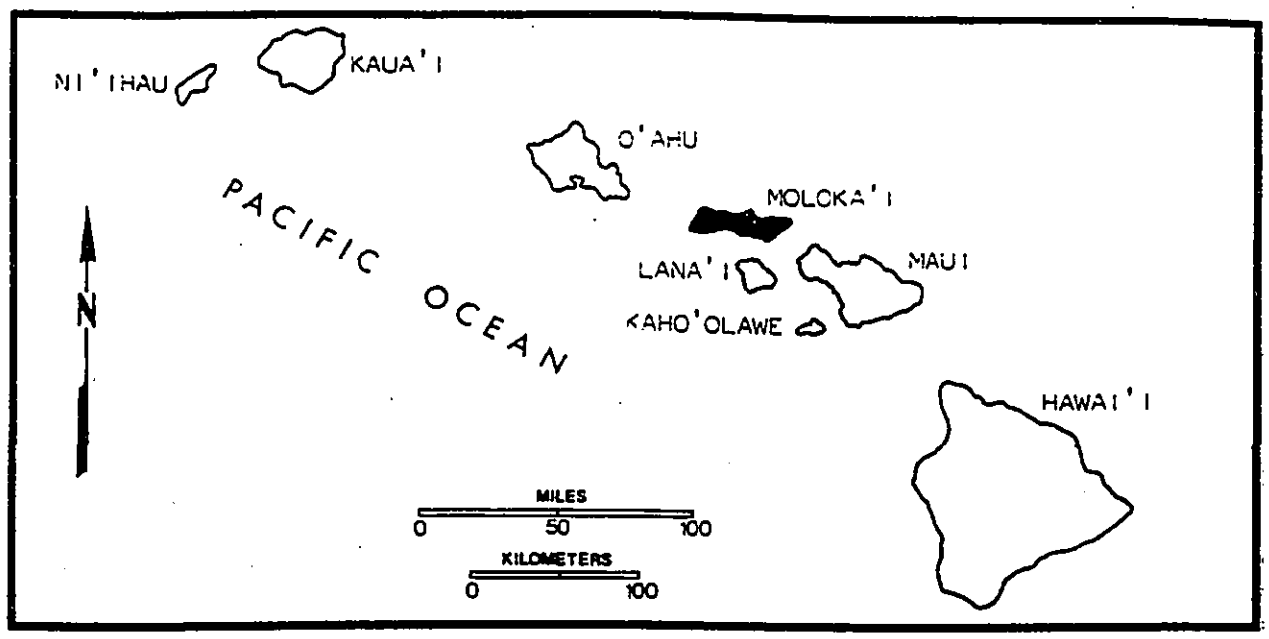


Figure 1 State of Hawai'i

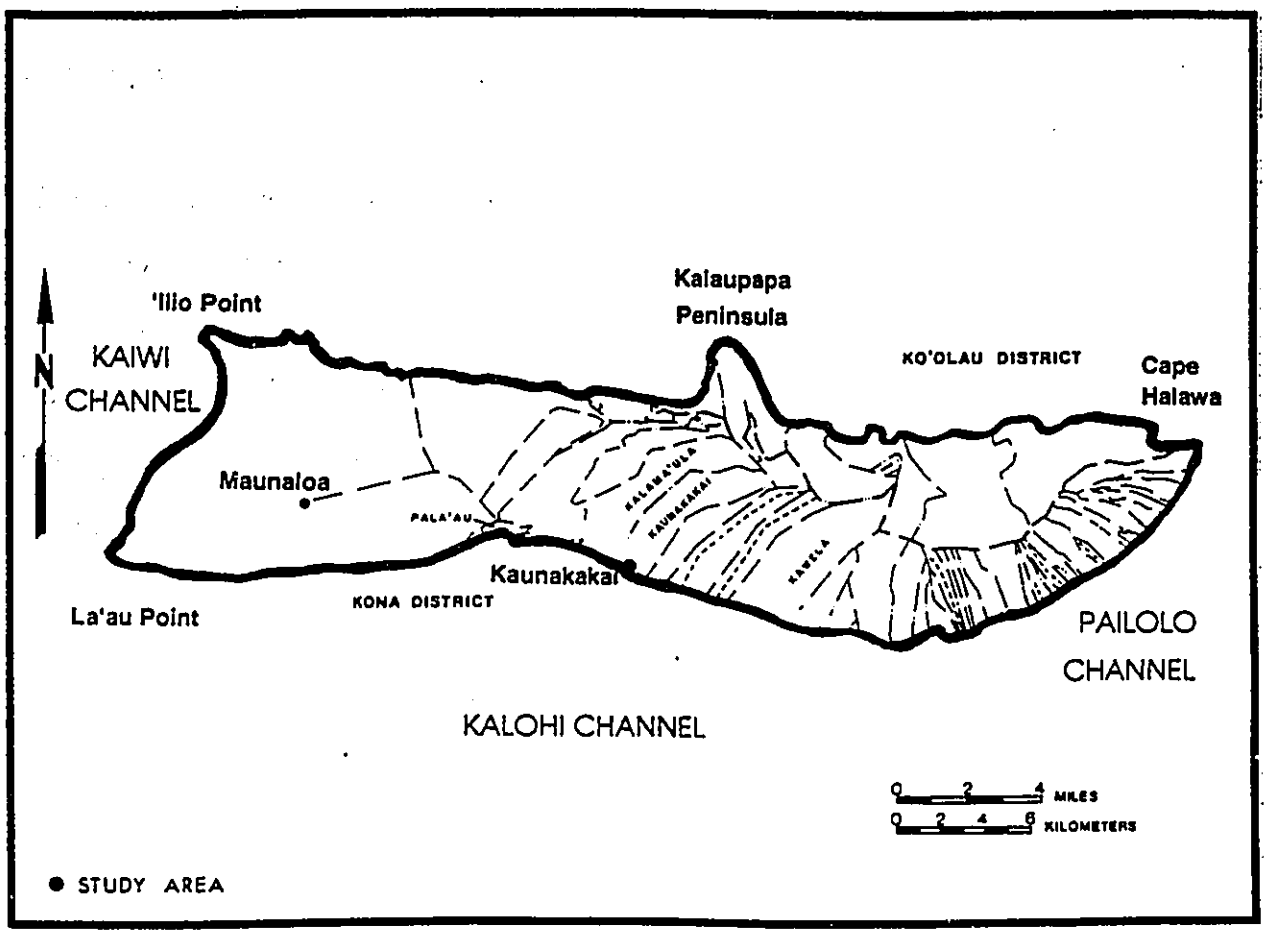


Figure 2 Moloka'i Island Location Map

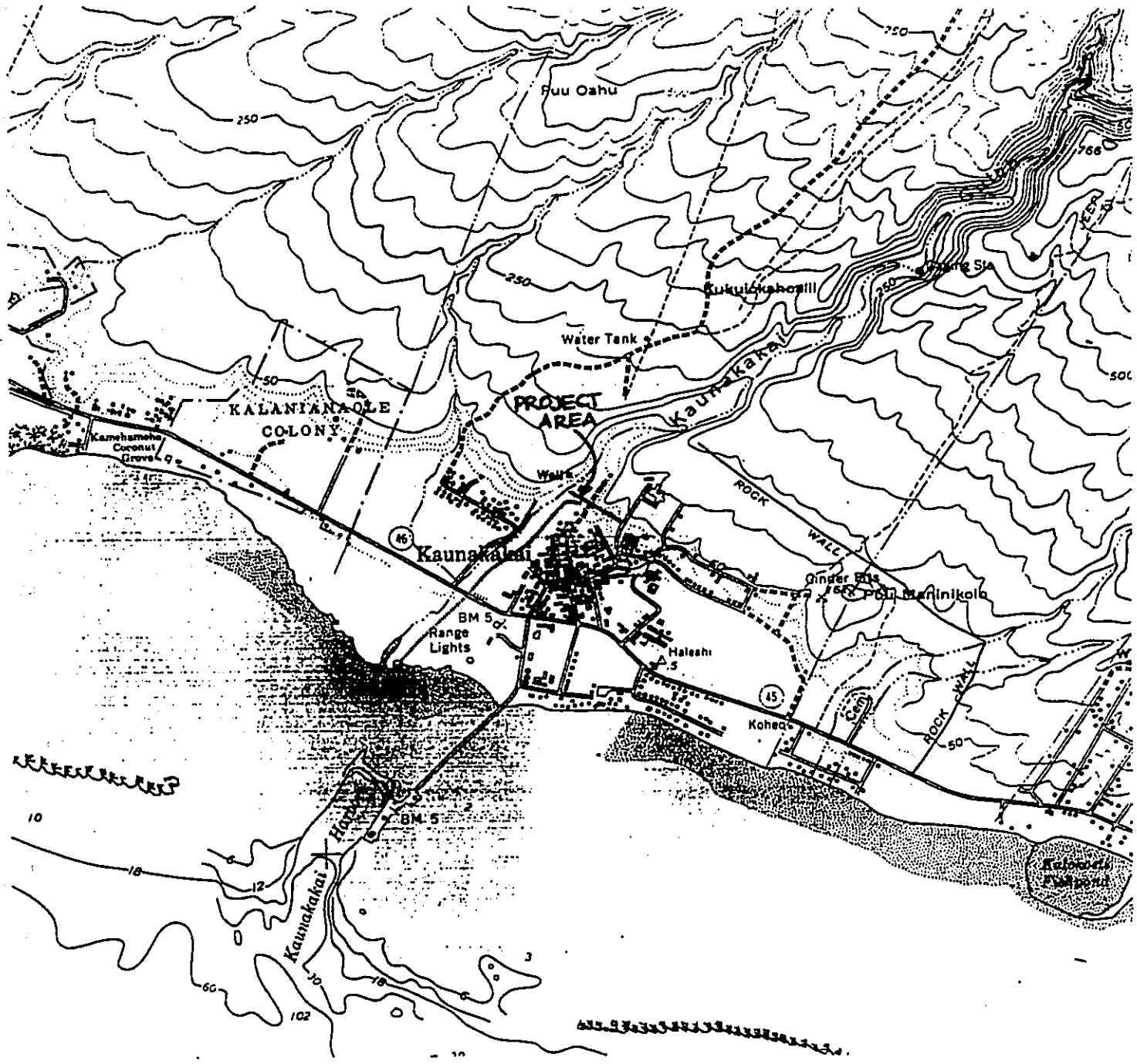


Figure 3 Portion of USGS Kaunakakai Quad Showing Project Location

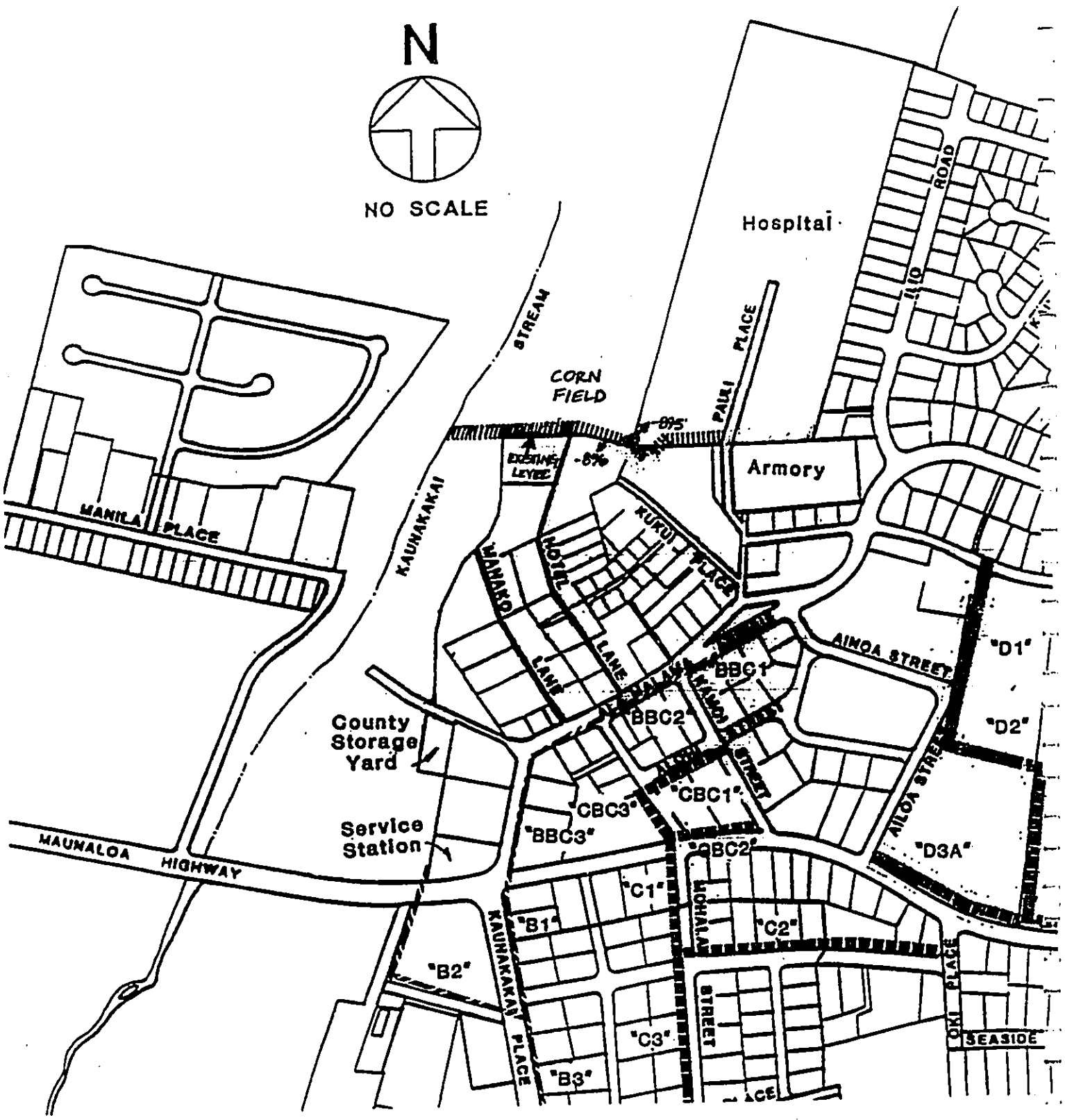


Figure 4 General Project Area and Site Locations: Portion of Map for Kaunakakai Drainage Improvement Project (Wilson Okamoto & Associates)

embankment to a dirt road. The roadway, which is 530 feet from Pauli Place, contains underground water lines. From the roadway to Kaunakakai Stream, the corridor has been intensively modified, including a flood control berm on the southern side of the corridor and cultivated corn within the corridor itself. The portion of Kaunakakai Stream where the corridor is proposed to intersect has already been modified (*i.e.*, channelized) for flood control.

B. Scope of Work and Methods

Scope of Work

Cultural Surveys Hawaii was contracted to provide a complete archaeological inventory survey of the proposed "System A of the Kaunakakai Drainage Master Plan" (Wilson Okamoto & Associates). The scope of work for the inventory survey includes:

1. A complete ground survey of the entire project area for the purpose of site inventory. All sites would be located, described, and mapped with evaluation of function, interrelationships, and significance. Documentation will include photographs and scale drawings of selected sites and complexes. All sites will be assigned State Site numbers.

2. Limited subsurface testing to determine location, boundaries, depth and quantity of cultural materials within archaeological sites and to obtain datable samples for chronological information if none is available for sites in the immediate area from previous studies.

3. Research on historic and archaeological background, including search of historic maps, written records, Land Commission Awards, and Native Testimony. This research will focus on the specific area with general background on the *ahupua'a* and district and will emphasize settlement patterns.

4. Preparation of a survey report which will include the following:

   a. A topographic map of the survey area showing all archaeological sites and site areas;

   b. Description of all archaeological sites with selected photographs, scale drawings, and discussions of function;

c. Historical and archaeological background sections summarizing prehistoric and historic land use as they relate to the archaeological features;

d. A summary of site categories, their significance in an archaeological and historic context;

e. Recommendations based on all information generated which will specify what steps should be taken to mitigate impact of development on archaeological resources - such as data recovery (excavation) and preservation of specific areas. These recommendations will be developed in consultation with the landowner and the client and/or State and County agencies.

This scope also includes full coordination with the State Historic Preservation Division of the Division of Land and Natural Resources (SHPD/DLNR), and Maui County relating to archaeological matters. This coordination takes place after consent of the owner or representatives.

Methods

Two archaeologists, Douglas F. Borthwick and John F. Driscoll, completed the fieldwork portion of the inventory survey on the days of March 3rd and 4th, 1993. The ground survey was accomplished by walking roughly east-west oriented transects from Pauli Place in Kaunakakai Stream to the edge of the corridor and back. The corridor surveyed ranged in width from 30 to a maximum of 170 feet, and as previously mentioned, the length was approximately 950 feet. The ground visibility ranged from excellent (bare ground) to fair in areas with knee-high grass. Plotting of site areas was done on a 1-inch-equals-20-feet scale plan map. The plan map also included detailed contours, and other elevation references, in addition to the two sites, -895 and -896, which were already accurately plotted and shown on the map (Figure 5).

The two sites encountered were mapped to scale, utilizing hand held tape and compass, detailed site descriptions were written and representative photographs taken. Additionally, notes were taken on areas of interest adjacent to the project area.

Two areas of interest were noted. They include "a possible cemetery" (local informant) and a roughly stacked, discontinuous wall which runs along the top

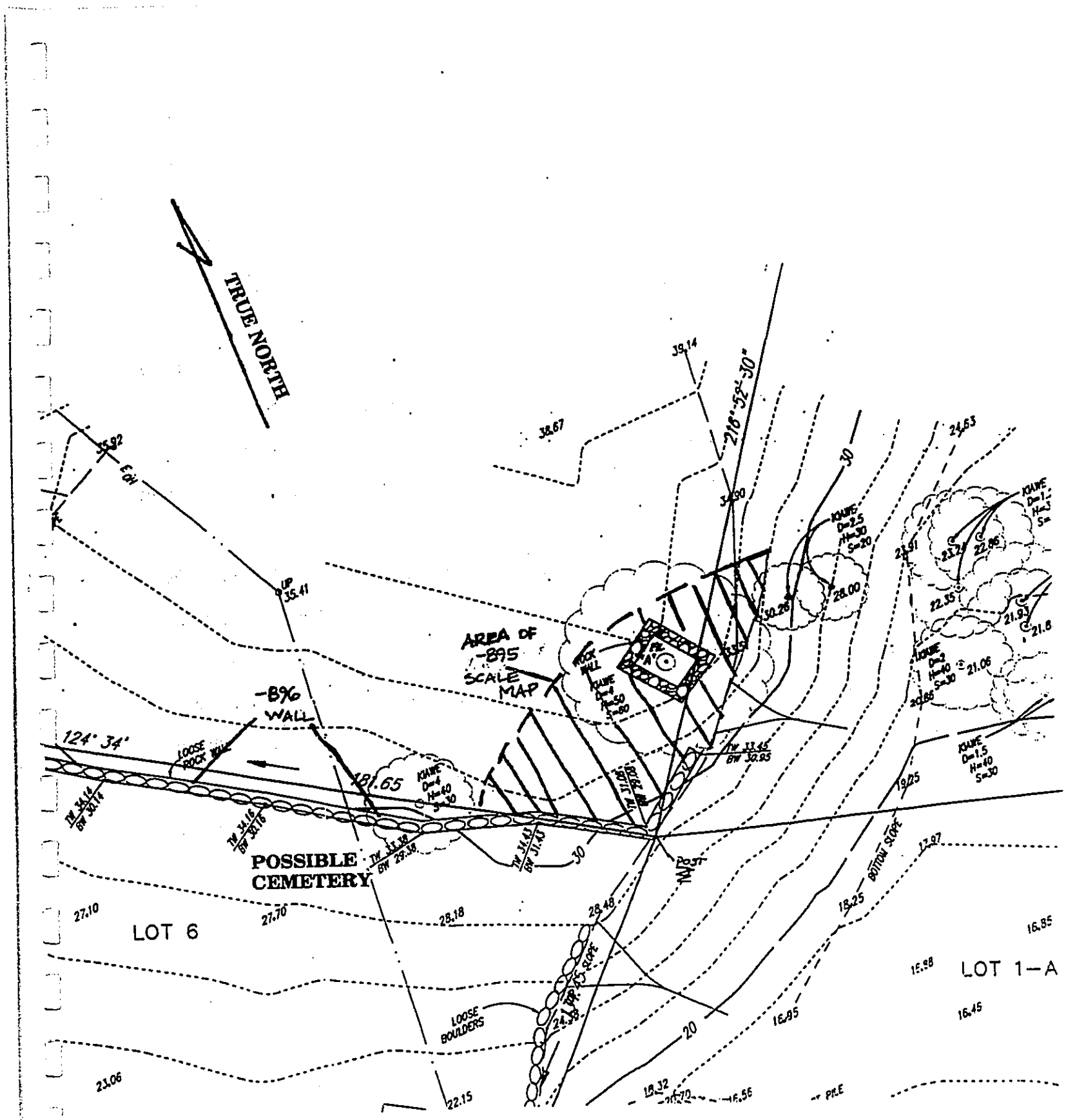


Figure 5 Portion of Kaunakakai Drainage System "A" Plan Showing Sites -895 and -896 (1" = 30')

edge of Kaunakakai Gulch north of the project area. The possible cemetery was pointed out to us by local informants who utilized a bulldozed baseyard at the end of Kukui Place, adjacent to the project area. The "cemetery" is presently just a bulldozed portion of the baseyard which contains a fairly dense surface scatter of midden and artifacts. The midden and artifacts range from recent to indigenous. The reported cemetery is outside of the project area; nevertheless, we inspected the area for indications of a previously existing cemetery (i.e. headstones, alignments, human bone fragments). No clear evidence of a cemetery was observed. The surface scatter of midden and artifacts observed is more consistent with the demolition of residential units. The implications of this reported cemetery to the project will be discussed in the Summary and Recommendations section of this report.

The stacked stone wall along the top edge of Kaunakakai Gulch begins some 100 feet north of the proposed "limits of grading" and 30 feet north of the limits - or outside the surveyed areas. The location and orientation of the wall was noted but no field number or detailed description was given. Previous archaeological research *mauka* of Kaunakakai Town (Weisler 1989) identified and described a stacked stone wall (Site 50-60-03-889) along the eastern edge of Kaunakakai Gulch. Based on Site -889's description and perusal of available maps, it is presumed that the presently observed wall section represents the seaward (*makai*) extent of wall site -889.

Limited sub-surface testing was conducted at Site -895 (CSH1). The testing consisted of two test units, one dug within the enclosure (Feature A), and the other within the paved area (Feature B) on the *makai* side of the enclosure. The test unit locations were plotted on the scale map, pre-and post-excavation photos were taken, and one profile per unit was drawn. Excavated sediments were sifted through 1/8 inch wire mesh screen with all artifacts, midden, and charcoal observed, collected and retained in provenience

labelled sample bags. The test units were subsequently backfilled, reconstructing the specific areas to their previous state.

Laboratory analysis of recovered materials consisted of weighing and describing individual artifacts and separating midden to individual components. Table 1 lists all recovered materials and appears at the end of the Survey Results section of this report.

PREVIOUS ARCHAEOLOGY

There has been a significant amount of archaeological work within Kaunakakai *ahupua'a*. Work done prior to the late 1960s has been summarized in Catherine C. Summers' "Moloka'i: A Site Survey" (Summers 1971). Summers' work describes sites on the island of Moloka'i by individual *ahupua'a* based on previous research, especially John F. G. Stokes' 1909 10-week survey of *heiau* and other major sites on Moloka'i as well as "revisiting" some 100 sites (*Ibid.*:iii). Additionally, Summers describes legendary, traditional, and historical information related to Moloka'i in general, and the reader is referred to her document as the most comprehensive island-wide study to date.

Recent archaeological work in Kaunakakai has been focussed on the seaward portion, between Kamehameha Highway and the ocean, except for a 115-acre survey *mauka* of Kaunakakai Town. Surveys and testing within the immediate coastal zone include Shun (1982), Komori (1983), Athens (1983), Landrum (1984), Kennedy (1988) and most recently, Tuggle (1993). The *mauka* survey, conducted for Moloka'i Ranch, was completed in 1988 (Weisler 1989) (Figure 6).

The majority of the work within coastal Kaunakakai has been sub-surface surveys due to the absence of associated surface features and alluviation. The exceptions are J.S. Athens (1983) and Tuggle (1993) who conducted research associated with the Malama Platform (Site 50-60-03-1030), the former Moloka'i residence of Kamehameha V.

The sub-surface surveys clearly indicated a rapid alluviation and shoreline accretion related to the 19th century introduction of ungulates (i.e., cattle, deer, goats, and sheep). Below the historically induced alluvial deposits and modern fill layers cultural deposits range from historic to pre-historic. The largest deposit so far encountered has been assigned State Site 50-60-03-630. Two features within this

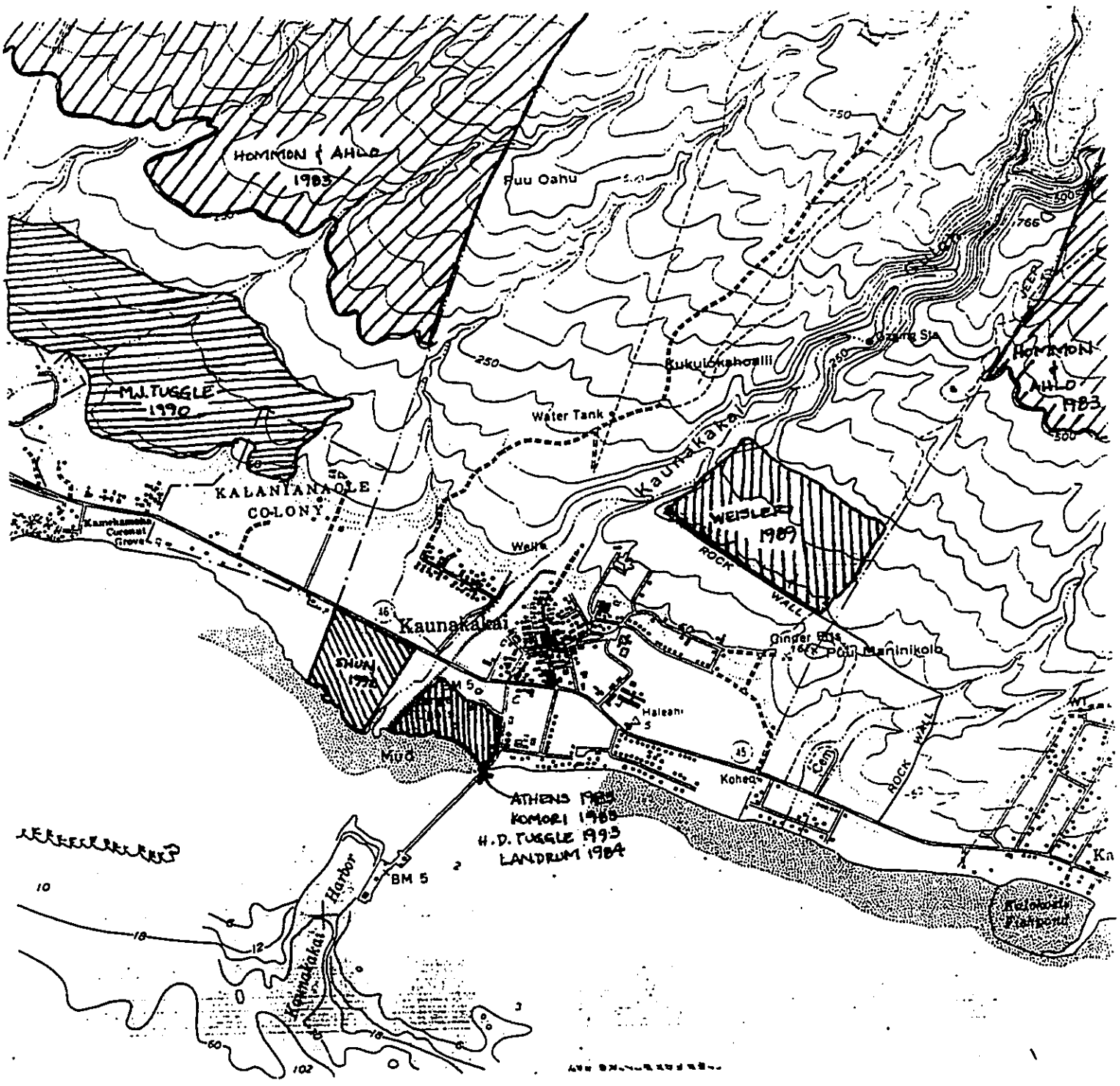


Figure 6 Portion of USGS Kaunakakai Quad Showing Project Locations of Previous Research

sub-surface deposit were dated to A.D. 1230-1340 and A.D. 1435-1665 (Athens 1983:82). Collected historic-era artifacts were generally fragmentary and ranged from the mid 1800s till the present, indicating the highly disturbed nature of much of the Site -630 cultural deposit.

During the survey *mauka* of Kaunakakai Town (Weisler 1989), four sites were assigned State Site numbers 50-60-03-886 to -889. Three of the sites (-886 to -888) represent "the largest dryland agricultural system yet recorded on leeward Moloka'i" (*Ibid.*:iii). Additionally, seven (7) features were subjected to limited sub-surface testing, which resulted in recovery of very sparse faunal samples. However, charcoal collected and analyzed indicated "that the agricultural zone on the east side of Kaunakakai Gulch (Sites -886, -887, and -888) was used as early as the late 13th century (Early Expansion Period) and into the beginning of the Proto-Historic Period (A.D. 1650 - 1795; temporal periods after Kirch 1985)" (*Ibid.*66).

Surveys in the adjacent *ahupua'a* of Kalama'ula (east) (Hommon and Ahlo 1983; Athens 1985; Tomonari-Tuggle 1990) and Kamiloloa (Hommon and Ahlo 1987; Davis 1977; Dye 1977) have identified extensive agricultural complexes with associated temporary habitation features, pre-historic and historic permanent habitation sites and an early historic cemetery (Dye 1977). Moreover, extensive work in the similar environment of Kawela and Makakupa'ia Iki *ahupua'a* was conducted by the Bishop Museum (Weisler and Kirch 1982). This survey resulted in the identification of some 500 features which "includes the majority of archaeological sites within the *ahupua'a* of Kawela and Makakupa'ia Iki" (*Ibid.*:47).

The settlement pattern of south central Moloka'i as indicated by the previous research includes a coastal habitation zone populated by at least the 13th century (Athens 1983) with upland agricultural activity possibly as early (Weisler 1989) but definitely by

the 15th century (Weisler 1989; Tomonari-Tuggle 1990). Permanent habitation appears to have been for the most part within the coastal zone or at the foot of ridges as they meet the coastal flats (Hommon and Ahlo 1983; Tomonari-Tuggle 1990). The upland agricultural zone appears essentially to have temporary shelters as occupation sites though a few exceptions indicative of permanent habitation were noted (Hommon and Ahlo 1983). However, the survey of Kawela and Makakupa'ia indicated a somewhat divergent settlement pattern. Weisler and Kirch (1982) suggest that the "Initial human use of the Kawela area has been dated to ca. A.D. 1500, as evidenced from the culturally stratified basal deposit of the Mound site" (*Ibid.*:52). The "Mound site" refers to a coastal sand dune on the *makai* side of Kamehameha Highway. Additionally, "settlement within the *ahupua'a* of Kawela and Kamakupa'ia was concentrated on the slopes and gulch edges that surround Kawela Gulch and along the ridge flats that traverse the upland below the 120 ft. contour" (*Ibid.*:49).

Variation of the settlement pattern along the south central coast of Moloka'i appears to be related to both temporal and environmental differences. The portion of the coast closest to Kaunakakai was apparently populated considerably earlier than the Kawela area. The broader coastal flats within the Kaunakakai, Kalamaula area were as Tomonari-Tuggle suggests "The probable locus of primary *ahupua'a* settlement". Through excavations at the Malama Platform itself indicated that "The swampy conditions of this area immediately behind the high-tide line discouraged occupation" (Tomonari-Tuggle 1993:54). The area of Kaunakakai Town (still on the coastal flat) and areas adjacent to the "original stream" (on the coastal flat) are posited to have been the main settlement for Kaunakakai *ahupua'a* (Weisler 1989, Tuggle 1993). Thus, it appears that the more favorable environmental conditions in the Kaunakakai area (*i.e.*, broad coastal plain, wide fringing reef with a natural channel, and Kaunakakai Stream) made the area the focus of

environmental conditions in the Kaunakakai area (*i.e.*, broad coastal plain, wide fringing reef with a natural channel, and Kaunakakai Stream) made the area the focus of early settlement along Moloka'i's south shore.

The only previous research directly related to the project area is J.F.G. Stokes' notes on Kamalae (Kumalae?) *heiau*. During Stokes' 1909 survey of *heiau* on Moloka'i, he was shown the location of a previously existing *heiau* "behind Kaunakakai Village". Stokes located, by means of a transit, the location of a "*heiau* entirely destroyed. It is said to have been for human sacrifice, and that the drums were heard at night" (Stokes 1909). The *heiau*, Kamalae or Kumalae, in different notations by Stokes, was located to Pu'u Kakalahale with a bearing and distance of 35° 29' 30", and 12,890 feet. Use of the bearing and distance provided by Stokes places the location of the reported *heiau* in a range of 50 to 200 feet of project Site 50-60-03-895 (CSH1) depending on the variables of what map is used (*i.e.*, 1886, 1924, or present USGS) and accuracy of true north arrows. Review of Stokes' field notes and other material (*i.e.*, maps and photographs) at the Bishop Museum archives failed to divulge any new information other than what is available about the site in Summers (1971). The field notes, however, are indicative of the degree to which Stokes carried out his survey during 1909. After reading through his material on Moloka'i, as well as being aware of his similar survey work in West Hawaii, it is felt that even had there been a remnant of the *heiau* structure, Stokes would have mentioned it. This perceived attention to detail is also suggestive that the features associated with Site -895 (*i.e.*, high walled enclosure and pavements) were not present in 1909 or were actively being utilized for a nondescript purpose. However, this is only speculation, and Site -895's function and probable age will be discussed in detail elsewhere (*i.e.*, Site Description, Summary and Recommendation sections).

The implications of the previous research to this particular project area include in part: (1) No known sites in proximity to a reported "entirely destroyed" *heiau*; (2) Kaunakakai Town area probably having been the focus of *ahupua'a* settlement, but little or no archaeology having taken place within the town proper; and (3) the Kaunakakai area having the earliest dates (*ca.* 13th century) for occupation (Athens 1983; Weisler 1989) so far recorded on the south central coast of Moloka'i.

HISTORIC BACKGROUND

The *ahupua'a* of Kaunakakai encompasses some 5,200 acres and extends from the coast to approximately 3,500 ft. A.M.S.L. The coastal frontage is approximately 6,500 ft. wide narrowing towards *mauka*, in the relatively typical triangular *ahupua'a* configuration. There have been a number of in-depth background studies concerning Kaunakakai, as mentioned in the Previous Research section of this report, and the following discussion will not reiterate, in full, this information. The reader is referred to Summers (1971), Carol Silva's "Historic Document Search" in Athens (1983), and Tuggle (1993) for a more complete review of historic literature concerning Kaunakakai.

Traditional References

The place name "Kaunakakai" has been interpreted in various ways, including: "Kaunakahakai, resting-(on)-the beach" (Mary Kawena Pukui, per comm. cited IN Summers 1971:87); "to go along in company of four" ([Cooke 1949:83] IN Silva 1983:2) and in reference to salt works said to have been initiated by a foreigner who referred to the area as "current of the sea" or "Kauna-Kahakai" ([Harriet Ne 1981:23024] IN Silva 1983:3).

Traditional accounts concerning Kaunakakai generally refer to the area as a favored canoe landing. This is in terms of being a stop-over or victualling locale, not necessarily the actual destination. For example, Kamakau wrote "Kamehameha and his chiefs were quartered at Kaunakakai on Moloka'i, in 1795, on their way to make war upon Ka-Lani-Ku-Pule" (*i.e.*, on O'ahu)(Kamakau 1961:312).

Based on the traditional accounts it is clear that the Kaunakakai area was known throughout the island chain as a safe stop-over. This was due in part to environmental factors like wind direction and the large natural channel through a fringing reef (which

also provided for good fishing and a safe and calm anchorage inside the reef), its central location on Moloka'i, and also the off-shore fresh water springs ([Remy 1893] IN Weisler 1989:11).

Mid 1800s

The *ahupua'a* of Kaunakakai was apparently "omitted" during the land tenure change, *Māhele*, of the mid 1800s. The *Māhele*, here referring to the numerous governmental decrees between 1846 and 1854, changed traditional communal-based land tenure to privatized ownership. The term "omitted" refers to the lack of legal documentation at the time of the *Māhele* to the ownership of Kaunakakai. However, Interior Department documents of 1852 and 1854 by Abner Paki to the Minister of Interior relate that he, Abner Paki, owned Kaunakakai *ahupua'a* (Int. Dept 1/15/1852, 1/24/1854). Additionally, no individual *kuleana* were awarded within the *ahupua'a*.

In 1855 Kamehameha V (Lota Kapu-aiwa) bought or was "conveyed" the *ahupua'a* of Kaunakakai for two hundred dollars (Int. Dept 7/27/1885). Lot Kamehameha eventually had sheep and cattle roaming the countryside as in 1859 his brother, Alexander Liholiho (Kamehameha IV) established a sheep station, which Lot Kamehameha inherited upon A. Liholiho's death (1863) (Kuykendall 1953:11). Lot Kamehameha also actively sought to increase his Moloka'i holding as: "In the desire to have a country estate, he bought up land and cattle from the resident Hawaiians and used Moloka'i as a vacation ground from his cares of State" ([Judd IV, 1936:10] IN Summers 1971:23). In 1868 Lot Kamehameha released deer adding to the free-roaming ungulate population. In response to the foraging animals walls were built in areas where the populace and/or crops needed protection. It was probably during this time (ca. 1850s to 1870s) that the wall surrounding "Kaunakakai Village" was constructed. The

surrounding wall is clearly visible on the two 1880s maps, Jackson 1882, Kaunakakai Harbor and Monsarrat 1886, Government Survey Moloka'i) (Figure 7). Ruth Ke'elikolani inherited the *ahupua'a* upon Lot Kamehameha's death (1872). The 1882 Jackson Harbor notes "Ruth's House." Princess Ruth Ke'elikolani dies in 1883 with the bulk of her estate inherited by Bernice Pauahi Bishop, but apparently Kaunakakai was not an immediate part of that inheritance.

However, after the death of Bernice Pauahi Bishop (1884), her estate, through trustees, petitioned and received the *ahupua'a* of Kaunakakai. Interior Department document of 11/15/1889 indicates that Kaunakakai was owned by Kalani Pueo in 1843, "from whom Mrs. Bishop inherited same," though as mentioned previously in 1852/54 Abner Paki, Bernice Pauahi Bishop's father, indicated he owned Kaunakakai. The relationship of "Kalani Pueo" to Abner Paki and Bernice Pauahi Bishop is not known to us at this time. Confirmation of the ownership of Kaunakakai *ahupua'a* by the Bishop Estate occurred in November 1890 (Indices 1929).

In 1898 the American Sugar Co. (ASCO) was incorporated by a group of men who a year earlier had "formed the Molokai Ranch by purchasing holdings from the Bishop Estate. This property had been ranch land formerly owned by Kamehameha V, and the *ahupua'a* of Kaluakoi, which belonged to Charles R. Bishop" (Summers 1971:24).

Thus the *ahupua'a* of Kaunakakai became the property of Moloka'i Ranch, with Kaunakakai Town, because of the ASCO wharf, becoming the urban center of Moloka'i. The ASCO was short-lived due to the salinity of water pumped from surface wells (Condé and Best 1973:275). However, an alternative explanation put forth by locals was that during the course of constructing rail lines, wharf and other major infrastructure components, the ASCO utilized stones from *heiau*, thus incurring "the wrath of Hawaiian

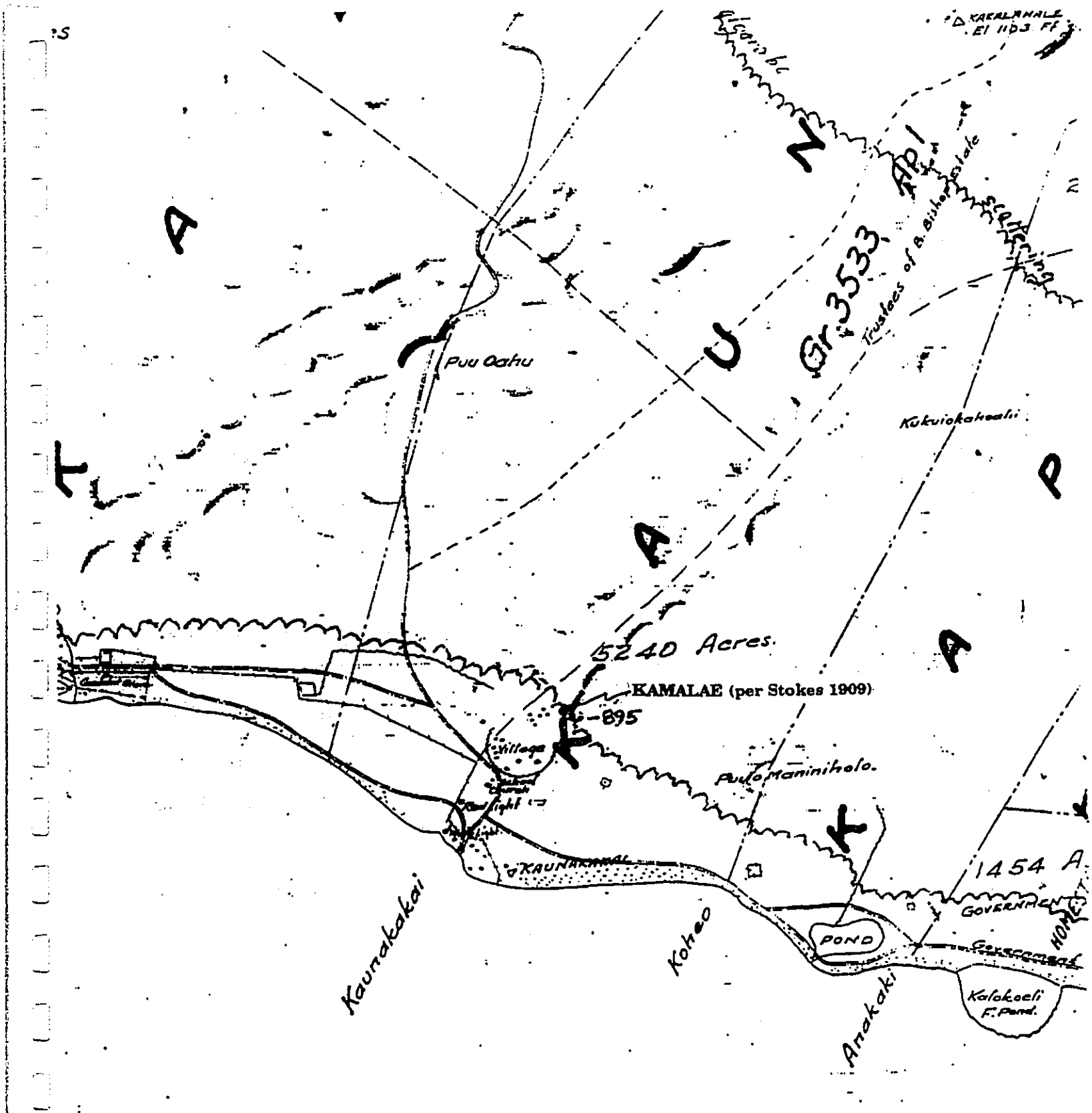


Figure 7 Portion of Monsarrat's 1886 Government Survey of Moloka'i Map, Showing Kaunakakai Village Area With Wall, Location of Site 50-60-03-895 is Approximate; Kamalae *Heiau* Location per J.F.G. Stokes

Gods" (*Ibid.*).

This may have been the time of the destruction of Kamalae Heiau as reported by J.F.G. Stokes. The reported *heiau* location, when plotted on the 1924 Land Court App. 632 map (Figure 8) puts it within the vicinity of Lot 6 which includes walls and a flume not shown on the 1886 Monsarrat map (Figure 7). The construction of the walls and flume may have been the agents of destruction. However the 1886 map, which J.F.G. Stokes utilized during his 1909 survey does not show a structure (stone or wooden framed) in the locus of the *heiau*, possibly indicating the *heiau* was not there at that time, though such structures as *heiau* were not routinely plotted by Monsarrat anyway.

1920s-1980s

Kaunakakai Town expanded in the 1920s as pineapple began to be grown by Libby McNeil and Libby in the Maunaloa area. Kaunakakai Wharf was till the major port though Libby and later the California Packers Corporation developed their own smaller ports. Cattle ranching was the main economic land use for Kaunakakai *ahupua'a* with Molokai Ranch becoming a more organized operation. Molokai Ranch was also the lessor of the most pineapple lands.

The Hawaiian Homestead Act of 1921 had a direct impact on Moloka'i as the very first Homestead developed, Kalanianaole Colony, was in the adjacent *ahupua'a* of Kalamaula (Tomonari-Tuggle 1990:10). Water for "bathing, laundry, and farming" was originally supplied from a spring in Kaunakakai by wooden flume, with a spring in Kalumaula providing drinking water (*Ibid*:11).

Homesteads were also developed in Kaunakakai but they were apparently associated with the Territory of Hawaii and were not part of the Hawaiian Homesteads.

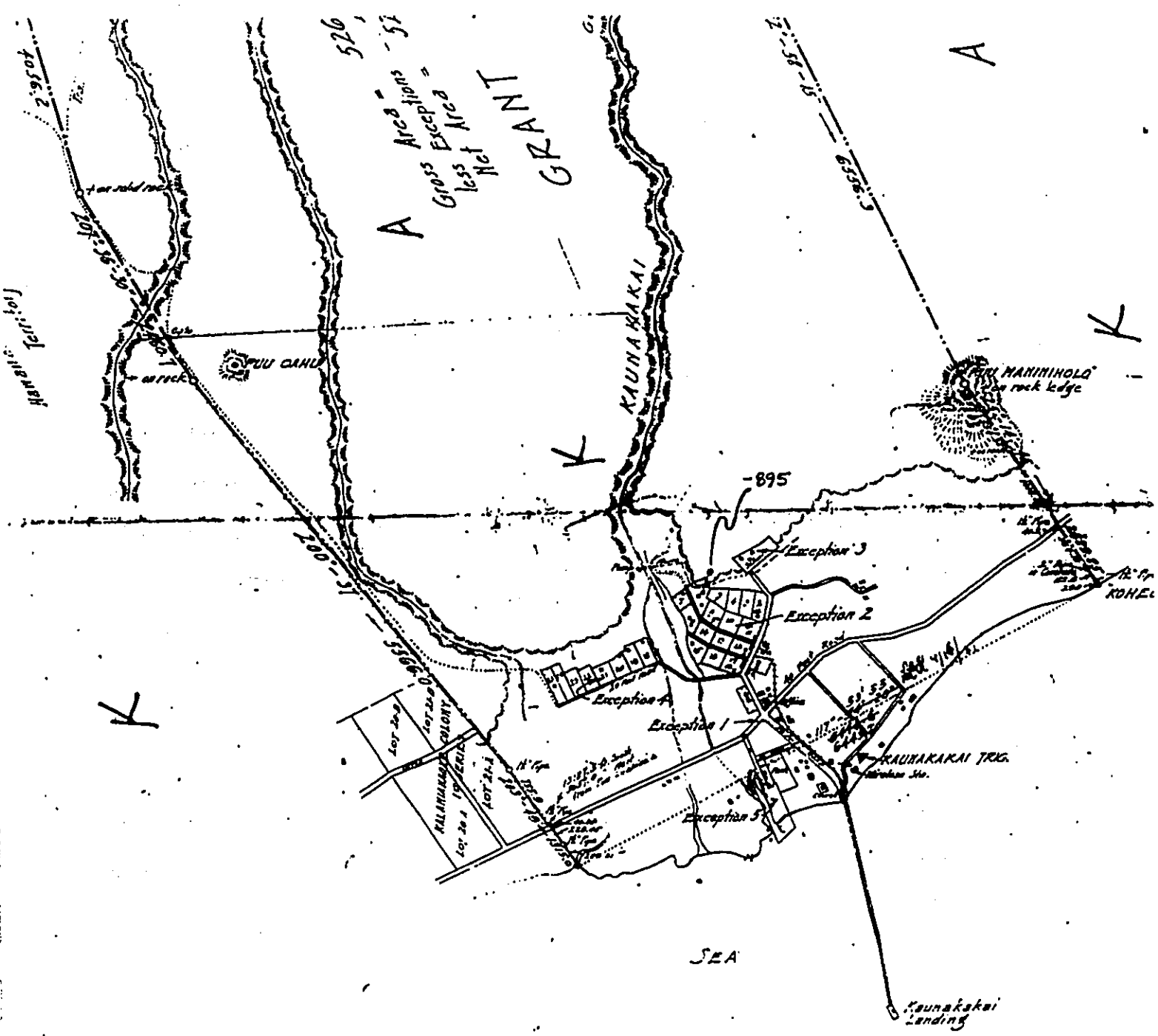


Figure 8 Portion of Land Court Application 632 Map for Grant 3533:1 to the Bishop Estate

Two clusters of lots are shown on the 1924 (Ld Ct App 632) Map (Figure 8). Lots 2 to 17 actually being part of Kaunakakai Town and Lots 18 to 25 west of the Town. It is presumed that the wall configuration as shown on the 1924 map and as seen, in part, today correlates to this time period. Site -896 (stacked boulder wall) is part of this wall complex. Site -895 (enclosure and paving) just *mauka* of the wall is believed to have been associated with the Homesteads of Kaunakakai Town, possibly Homestead Lot 6, the closest to the site area. Lot 6 as shown in various sections of the 1924 map (Figures 8 & 9) contained at least 3 structures plus a section of a flume (mentioned previously).

Water, in terms of supply and flooding, remained problematic. However, water projects initiated in the 1950s have done a lot to alleviate the supply and flooding problems. Kaunakakai Stream which used to have up to four meandering coastal outlets was channelized into one leveed outlet. The channelization of Kaunakakai Stream greatly reduced the flood hazard. In the late 1950s a 5.5 mile water tunnel project affecting the *mauka* portion of Kaunakakai Gulch was begun, with completion in the early 1960s (Summers 1971:25). The water from this project was "then stored in a 1.4 billion gallon reservoir at Kualapu'u" (*Ibid.*).

Post 1950

Kaunakakai Town remained the major urban center on Moloka'i though pineapple plantations towns of Mauna Loa and Kualapu'u supported sizeable populations. However, pineapple production on Moloka'i was phased out during the 1970s with complete abandonment by the early 1980s.

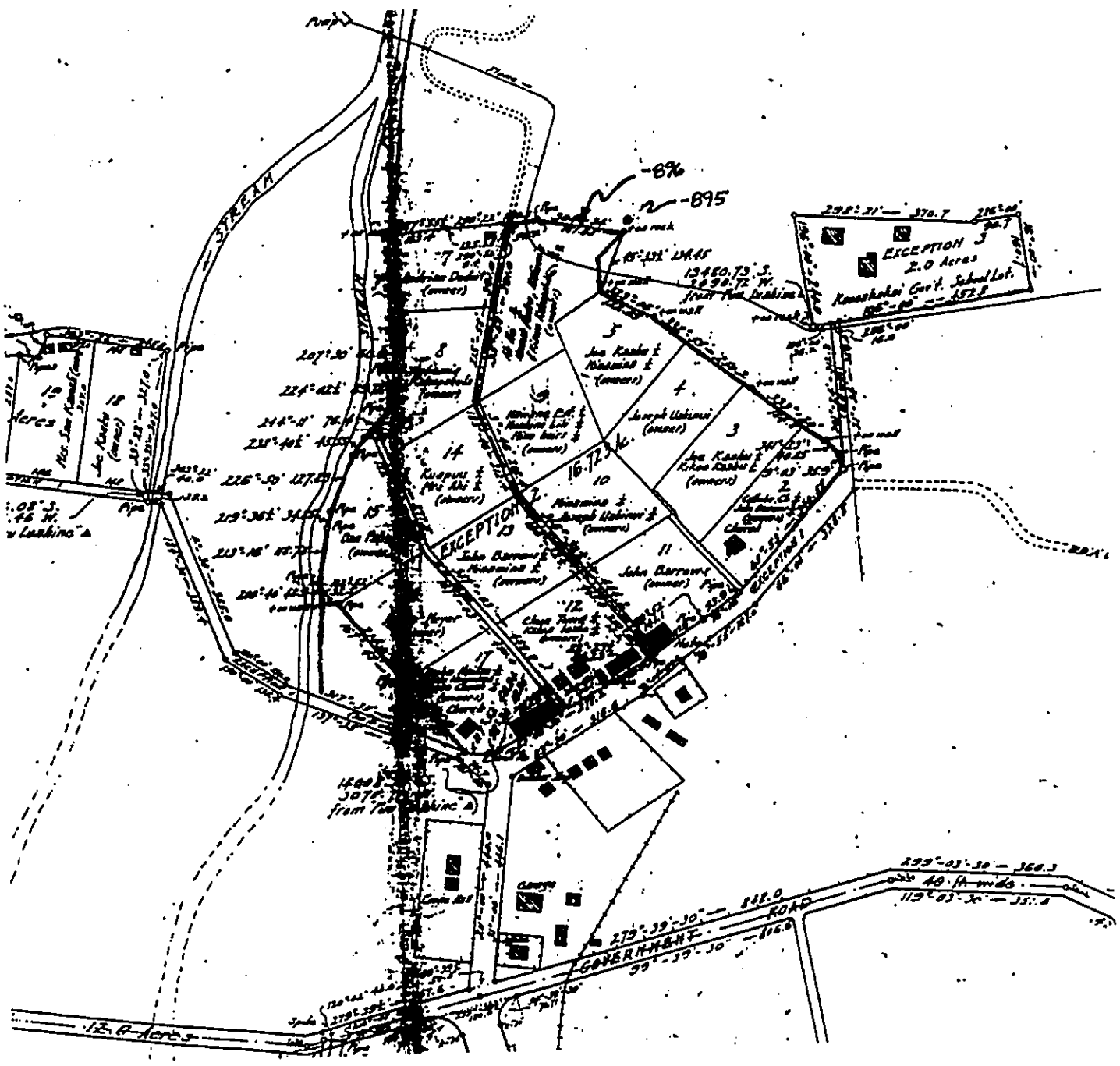


Figure 9 Portion of 1924 Map (Exception 2) Showing Proximity of "Lot 6" to Site Areas

Kaunakakai Town continues to be the urban center of Moloka'i. Subdivisions have expanded upslope of the town proper with possibly more on the way (Weisler 1989 project area). Tourism and service-related industries have replaced commercial agriculture as the economic mainstay. Kaunakakai Harbor is, as was always the case, the main import/export locale for the entire island. The bulk of the *ahupua'a* of Kaunakakai is still utilized by Molokai Ranch for cattle pasturage.

Informal Oral Interviews

Adjacent to the project area, at the *mauka* end of Kukui Place, past the teachers' cottages, is a bulldozed lot, utilized as a construction (trucking) baseyard. The lot corresponds to "Lot 6, Kaunakakai Homesteads" as depicted on the 1924 Lt Ct. App. 632 map (Figure 8). This lot, as mentioned previously, contained at least three structures and a flume section, based on the 1924 map. Ownership of Lot 6 in the 1920s, as per the 1924 map, was "Ah Ho ¾, Hannah Pedro, Nahemia and Kiawe Kalaepahula ¼." The lot, presently designated by TMK 5-3-02:22 is shown (on our TMK maps) as being owned by "Lui Ako." Actual or present ownership is not known to us at this time.

Informal discussions concerning this lot were initiated with individuals utilizing the construction baseyard. We were informed that the *mauka* portion of the lot, adjacent to Site -896 wall, previously contained a small cemetery. Additionally, we were told that the lot, which had been purchased relatively recently, had been bulldozed at least twice. The area pointed out to us as having been the cemetery location contained a relatively dense surface scatter of midden and artifacts. The midden and artifacts included both indigenous and historic-era materials. Indigenous materials included marine shell midden, basalt flakes, and a basalt adz fragment. Historic materials range from early historic (*e.g.*, black glass) to modern (*e.g.*, aluminum cans). No evidence of burials, human

bones, stone or cement alignments were observed during the surface inspection of this area, which as stated previously, is outside the present study area. The surface scatter appears more consistent with the demolition of residential units.

The individuals we talked with wished to remain anonymous but we certainly do appreciate the time and information they cordially gave us.

The bulldozed baseyard lot, like sites -895 and -896 are within the general proximity to J.F.G. Stokes' reported (1909) "entirely destroyed" Kamalae *Heiau*. It is interesting to speculate that the reverence attributed to this locale may have roots deeper than a "possible historic cemetery." The location of this present baseyard behind Kaunakakai Town and "at the foot of a ridge", not on top as is Site -895, may more accurately portray that which Stokes recorded in 1909 for Kamalae *heiau*. Stokes also wrote that Kamalae *Heiau* was formerly for human sacrifice, possibly suggesting a source from which human bones were unearthed in the past. However, this is just speculation at this point, and it seems just as likely that early Kaunakakai Homesteaders had family burial plots that were not well recorded and may have inadvertently been destroyed.

The cemetery and/or *heiau* aside, the overall settlement pattern for Kaunakakai has not changed significantly over time. The locus of settlement remains the Kaunakakai Town area which, based on previous archaeological research and ethnographic literature, was also the traditional or pre- A.D. 1778 pattern. The natural "harbor" of Kaunakakai, though historically enhanced extensively still is a dominate factor, as it appears to have been traditionally in defining Kaunakakai as the port center for all Moloka'i.

The prime agricultural lands of Kaunakakai are the alluvial flats. This is presently evidenced by commercial corn cultivation within the western, or Kaunakakai Gulch, portion of the project area. The sloping uplands, marginal in terms of agricultural productivity, support cattle grazing and wildlife habitat. Recent research within the 40

m. and 75 m. contour range above Kaunakakai Town has revealed an extensive dryland agricultural complex dated to as early as the 13th century (Weisler 1989). The type of habitation associated appears to be exclusively temporary.

The environmental constraints of the marginal agricultural lands were manifested traditionally with seasonal plantings and associated temporary habitation. Historically, low intensive agricultural use of the uplands has been mainly cattle ranching. Though the actual usages (seasonal plantings versus pasturage) are different they both represent a non-intensive agricultural response to the same environment.

The Town of Kaunakakai probably contains a much larger permanent population than in traditional times and continues to grow upslope, with new and proposed subdivisions. Providing for the larger and expanded population is clearly dramatically different than the traditional subsistence-oriented economy. However, in general, where people live and farm is still similar to traditional times though, as the population expands, this is gradually changing.

SURVEY RESULTS

Site Descriptions

State Site # 50-60-03-895 **CSH Site:** 1
Site Type: Complex
Function: Habitation (Temporary)
Total Features: 3
Dimensions: 290 sq. meters
Location: Kaunakakai Town
Elevation: 35 ft. A.M.S.L.

Description: Site 50-60-03-895 (Figure 10) Feature A consists of a well made enclosure with a paved area on the *makai* side. The interior area of the enclosure measures 3 m. NW/SE x 2 m. NE/SW with exterior measurements of 5 m. x 4 m. The walls are of stacked boulders, 6-7 courses high and up to 1.2 m. in height. There is a constructed 1 m.-wide entrance on the NW side although the walls have collapsed somewhat. There is also an exterior buttress-like terrace to help hold up the walls on the eastern and southern sides, which is up to 1 m. wide (avg .7 m.). The buttress-like terrace is built against the lower course of the enclosure walls (east and south) and is built up to a maximum height of .6 m. (avg. .25 m.).

Site 50-60-03-895 (Figure 10) Feature B is the leveled paved area on the *makai* side of the enclosure. The leveling has created three somewhat discrete paved areas. The paved surface closest to the enclosure is boulder paved. Adjacent to its *makai* side is an area predominantly cobble paved. The farthest *makai* area is boulder/cobble paved. The paved areas are delineated by boulder alignments.

The site is situated on a blocky bedrock bluff with the edge of bluff to the east of Feature A, modified probably for agricultural plantings. The modifications, designated Feature C of Site -895, include filling in caps between the very large *in situ* boulders which make up the bluff edge with smaller stones creating trough-like planting areas. The planting areas measure roughly 4 m. long by 1 m. wide. They are narrow, deep elongated pockets with bedrock boulders and boulder stacking delineating both the up slope and down slope sides with rocky soil interiors.

Excavation Results

Testing at Site -895 consisted of the excavation of two units. Test Unit 1 (TU1, .7 m. x .7 m.) was excavated within the interior of Feature A (enclosure) with Unit 2 (TU2, 1 m. x 1 m.) within the cobble paved area on the *makai* side of the enclosure (Figure 10).

TU1 was situated against the southeast wall of the enclosure for two main reasons; one, to ascertain the stratigraphic sequence of the wall construction with any interior cultural deposits; and two, because of the large *kiawe* tree within the enclosure limiting the excavatable area. The excavation exposed two stratigraphic layers (I and II) (Figure 11)

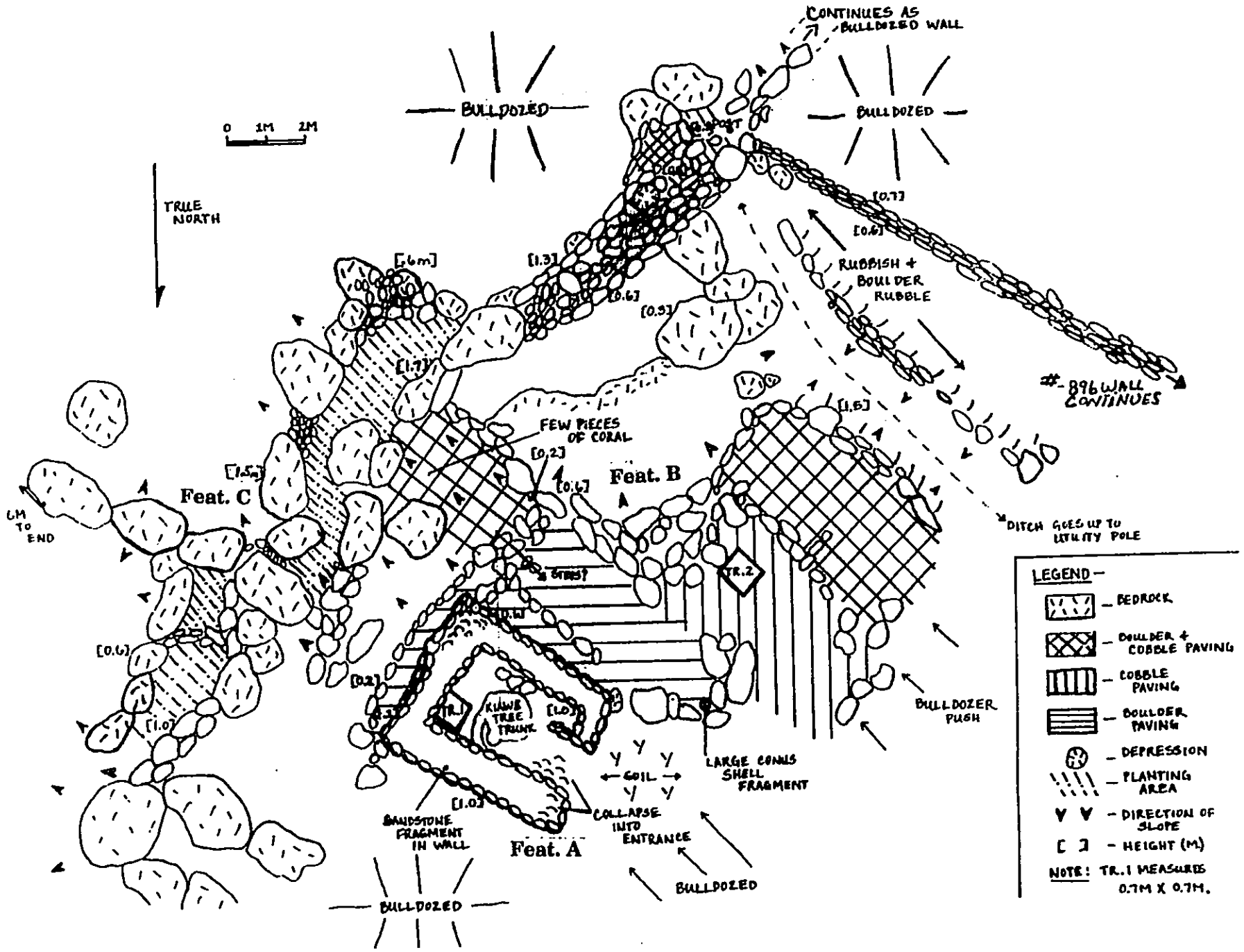


Figure 10 Site 50-60-03-895 Plan View with Section of Site 50-60-03-896 Wall

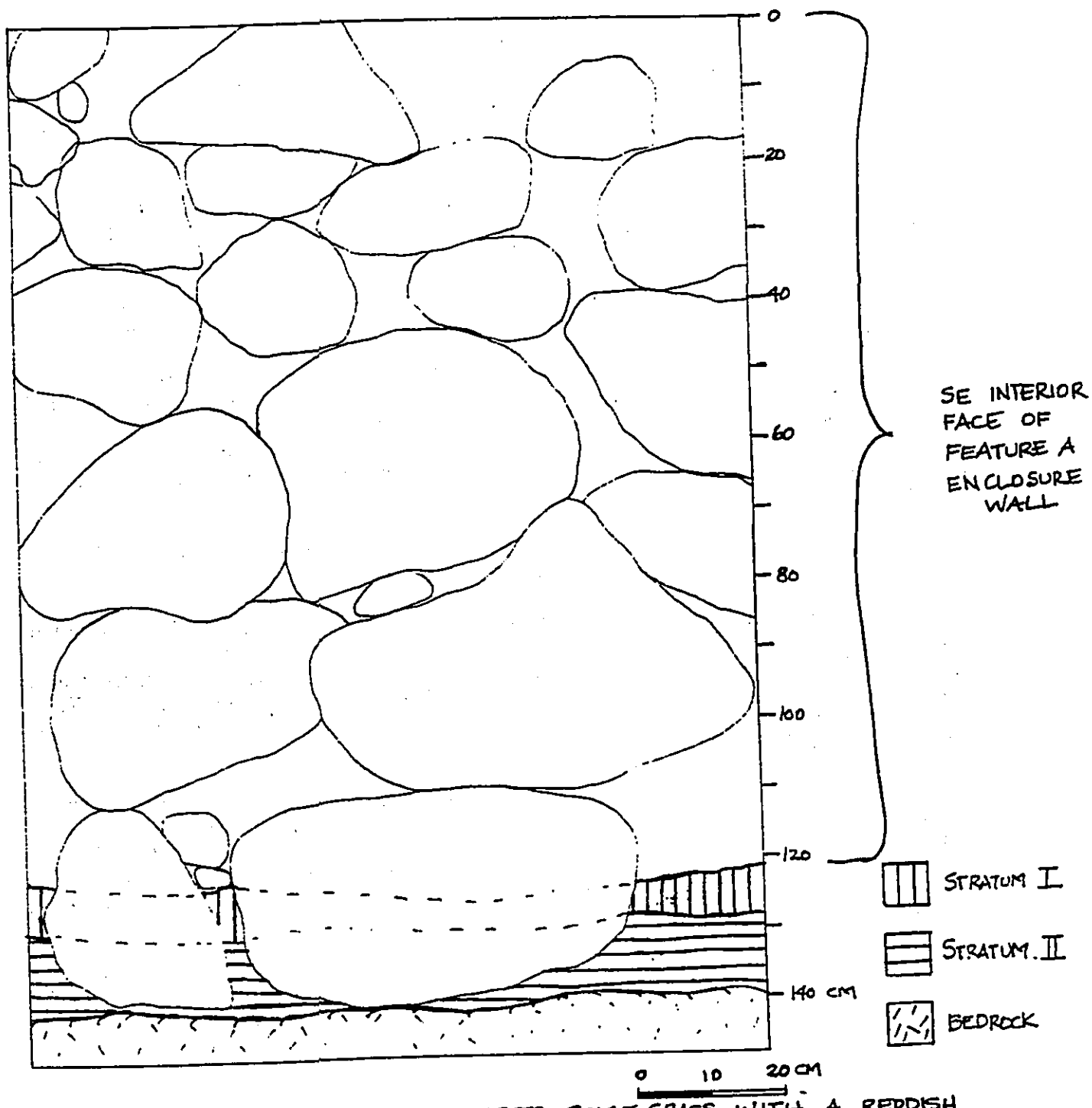


Figure 11 Test Unit 1 (TU1), Southeast Profile, Site 50-60-03-895 Feature A Enclosure Wall

Stratum I consists of a high percentage of organic debris with reddish brown (2.5YR 3/4) silt loam matrix. The organic debris is *kiawe* and grass litter. Artifacts collected consisted of historic-era material only, though water-rounded basalt cobble manuports were noted. Midden recovered was very sparse; totaling 3.4 grams, plus 5.3 grams of coral. The midden components included 1.0 gm. unidentified marine shell, 0.5 gm. kukui nut and 1.9 gms. charcoal.

Stratum II consists of slightly compact dark reddish brown (5YR 3/3) silt loam. There were a few small pieces of midden and artifacts at the interface of Strata I and II which were included with Stratum I.

The excavation of TU1 indicated that Feature A was built virtually on bedrock. The construction sequence of the feature appears to be a minimal manipulation of the *in situ* blocky bedrock bluff for the lower course, including the "buttress-like terrace", the clearing of an interior space and stacking of the cleared rocks and other locally occurring stones to an average height of one meter. A single historic period usage is also indicated by the preponderance of historic material and clear absence of a stratified layer of indigenous cultural material. Essentially, the southeast profile (drawn) had the greatest soil depth, a maximum of 18 cm., with most of TU1 just Stratum I and leaf litter on bedrock.

TU2 was placed in the predominantly cobble-paved portion of Feature B. Two stratigraphic layers, I and II, were designated (Figure 12).

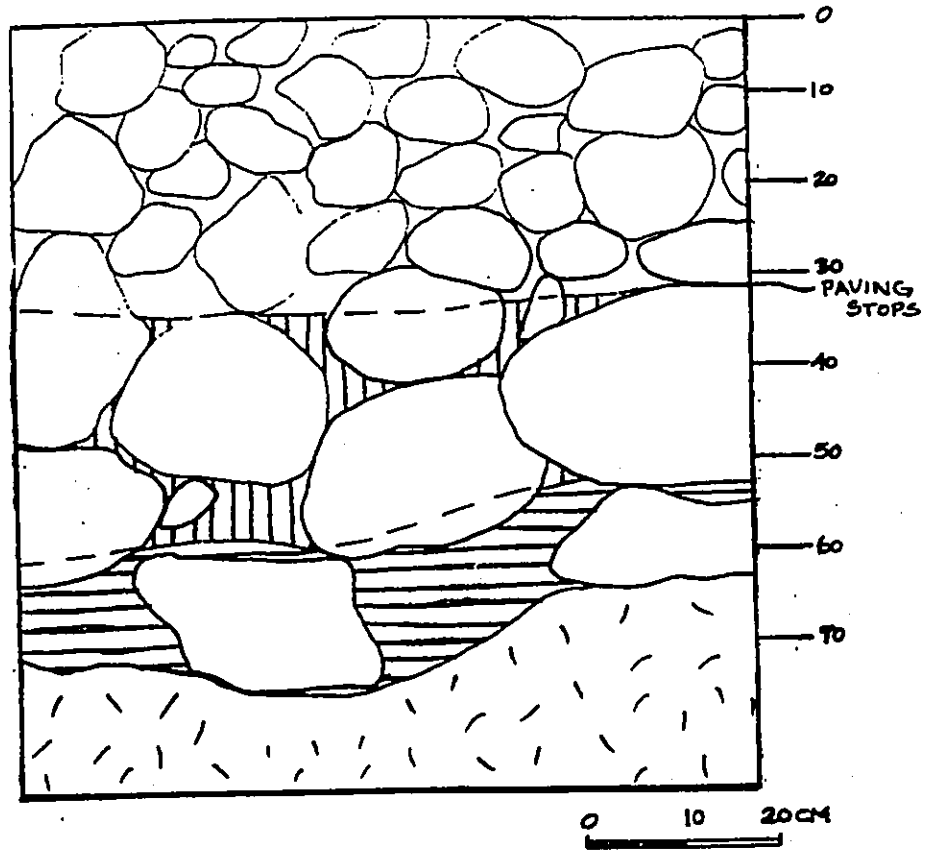
Stratum I consists of the cobble pavement and filtered organic debris and reddish brown (5YR 4/3) silt matrix filling in the interstices between the larger rocks of the pavement base. Recovered with Stratum I provenience were historic-era artifacts, metal and glass fragments, and 89.5 gms. of marine shell midden and 23.0 gms. of coral. The 89.5 gms. marine shell midden actually represents fragments of approximately half of a large *Conus* shell, probably *Conus leopardus*.

Stratum II consists of slightly compact dark reddish brown (5YR 3/4) silt loam with many rootlets, filling in the interstices between the *in situ* blocky bedrock. Recovered material included just 5.4 gms. of midden, consisting of 1.4 gms. unidentified shell, 1.4 gms. kukui nut, and 2.6 gms. of charcoal. This material represents filtered-through pavement material that was collected with Stratum II as larger *in situ* boulders were removed as part of the excavation process.

The excavation of TU2 indicated that the paved area *makai* of the enclosure represents relatively minimal modification to the bedrock bluff top. It appears that *in situ* boulders were roughly arranged, then smaller boulders and cobbles were used to fill in spaces, or interstices, creating a more level surface.

Functional Interpretation

The paucity of faunal material and the recovery of historic-era artifacts only strongly suggests exclusively historic-era usage for Site -895. Though there were indigenous materials present, i.e., coral, shell, and water-rounded basalt stones they were



STRATUM I

STRATUM II

BEDROCK

STRATUM I - 52-60 CM THICK; SMALL BOULDER & LARGE COBBLE PAVING (0-32 CM); LARGE BOULDER FOUNDATION (32-60 CM); ORGANIC LITTER FILTER; SILT LOAM COLLECTION AMONG LARGE BOULDERS

STRATUM II - 14-17 CM THICK; DARK BROWN TO DARK REDDISH-BROWN SILT LOAM, SLIGHTLY COMPACT, ABUNDANT ROOTLETS.

Figure 12 Test Unit 2 (TU2), East Profile, Site 50-60-03-895 Feature B Paved Area

all found in association with predominantly historic materials. No clearly definable cultural layers absent of historic material were present in either test unit. In fact, the excavations indicated a single phase of historic usage, possibly as a work shed (Feature A) and associated work surface (Feature B), the functional interpretation of Site -895.

As mentioned in the previous research section of this report J.F.G. Stokes referenced a *heiau*, Kamalae, in proximity to Site -895. Stokes indicated that the *heiau* was "entirely destroyed." Based on review of Stokes' Moloka'i notes, it is presumed that even if the *heiau* were in remnant condition he would have noted it as he did elsewhere. In Halawa Valley, Stokes wrote of Puupa *heiau* "all that could be found was the remains of a terrace of stone" and in referencing a reported *heiau* on Kaeo Hill, Kaluakoi, he wrote "the fragmented platform pointed out seems to be a natural outcropping of stone, due to erosion." Thus, it is suspected that Stokes would have mentioned Site -895 as the possible remains of Kamalae *Heiau* in terms of remnant terracing and the high walled enclosure.

Additionally, Site -895 appears atypical of a *heiau*. The narrow high-walled enclosure with a well-defined entrance is more typically a historic structure. The construction style of the paved areas *makai* of the enclosure is also atypical of a major *heiau* paving, having very little depth or thickness of construction. Stokes also indicated that Kamalae *Heiau* was at the "foot of the median ridge" with Site -895 being on top of the ridge or bluff.

In conclusion it is felt that Site -895 does not represent the remains of Kamalae *Heiau* "said to have been for human sacrifice" (Stokes 1909). Based on the present level of research Site -895 is functionally interpreted to be an early 20th century constructed work shed area, probably associated with the adjacent housing as seen on the 1924 map (Figure 9).

CSH Site: 2

State Site #	50-60-03-896
Site Type:	Wall
Function:	Cattle Exclusion
Total Features:	1
Dimensions:	250' long
Location:	Kaunakakai Town
Elevation:	30 ft. A.M.S.L.

Description: State Site 50-60-03-896 (CSH 2) is a stacked bi-faced boulder wall. It ranges in height and width from .8 to 1.5 m. The boulders utilized are relatively large subangular basalt rock that naturally occur within the area. It runs roughly parallel to the proposed drainage corridor at approximately 300° TN. This portion of the wall separates a recently bulldozed construction baseyard on the southern side of the wall (outside the project area) from non-bulldozed land (in the project area) on the north side.

The wall section appears to represent a part of a complex of walls around and within Kaunakakai Town that functioned as an exclosure from roaming cattle. The section abutting the project area is presently one of the more intact sections observed behind (*mauka*) of Kaunakakai Town. Historic maps, 1886 and 1924, clearly show a wall

system surrounding Kaunakakai Town. In fact, the walls shown on the 1924 map (Figures 8 and 9) are essentially the same configuration as seen today though some sections have been bulldozed. Based on the map review, it appears that wall -896 as defined in the present survey was built sometime between the 1886 Monsarrat map and the 1924 map.

Table 1: Midden and Artifacts

State Site: 50-60-03-895

Shell/Bone	[illegible]	[illegible]	[illegible]
Trench	[illegible]	[illegible]	[illegible]
Depth/Stratum	[illegible]	[illegible]	[illegible]
Conus sp.		89.5	
Unidentified sp.	1.0		1.4
Kukui nut	0.5		1.4
Coral	5.3	23.0	
Charcoal	1.9		2.6

State Site: 50-60-03-895

Acc #	Site/Feature	Trench	Stratum	Depth (cm)	Area	Length	Width	Thickness	Weight (gms)	Material	Function	Comments
1	895A	1	I	0-10	I	5.7	4.4	3.5	67.7	Basalt	manuport	water-rounded
2	895B	2	I	0-50	I	3.4	3.4	1.9	21.4	Basalt	manuport	water-rounded

State Site: 50-60-03-895

Acc #	Site/Feature	Trench	Stratum	Depth (cm)	Area	Length	Width	Thickness	Weight (gms)	Material	Function	Comments
II-1	895A	1	I	0-10	I	6.4	4.0	0.4	13.5	Glass	bottle	green fragment
II-2	895A	1	I	0-10	I	4.4	3.4	0.5	4.9	Glass	bottle	dk. green fragment
II-3	895A	1	I	0-10	I	1.6	0.7	0.4	0.3	Glass	fragment	lt. green
II-4	895A	1	I	0-10	I	9.7	2.6	0.2	9.2	Metal	strip	
II-5	895A	1	I	0-10	II	0.5/4.6	0.4/3.9	0.1/0.1	5.3	Metal	fragments	
II-6	895A	1	I	Surface	I	11.3	7.8	0.2	53.8	Metal	can	evaporated milk, rusty
II-7	895B	2	I	0-50	I	2.6	1.6	0.5	0.8	Glass	fragment	green
II-8	895B	2	I	0-50	4	1.6/3.9	1.3/3.5	0.3/0.4	6.9	Glass	fragments	lt. brown
II-9	895B	2	I	0-50	4	1.3/2.1	0.9/1.4	0.1/0.1	0.8	Metal	fragments	
II-10	895B	2	II	50-70	I	3.2	2.3	0.3	1.9	Glass	fragment	lt. brown

SUMMARY

The inventory survey of System A - a portion of the proposed Kaunakakai Drainage Improvement Project - included review of previous archaeological and historic literature, surface survey, and limited sub-surface testing. The literature review indicated no recent archaeological research and no numbered Hawaii State archaeological sites within the project area. However, research conducted in 1909 by J.F.G. Stokes relates that within close proximity to the project area was Kamalae *Heiau* which had been "entirely destroyed" (Stokes 1909). Inspection of Stokes' field notes at the Bishop Museum failed to uncover any new information. Historic background research indicated that Kaunakakai was well known as a stop-over locale for canoe travelers among the islands. Additionally, at certain periods large encampments of warriors and their chiefs utilized Kaunakakai as a stop-over in preparation for battle elsewhere. Historically, the harbor of Kaunakakai remained important as the main import and export center for all Moloka'i. The project was not part of any major activity area historically, as it is situated behind (*mauka* of) Kaunakakai and away from major historical alterations specific to Kaunakakai Town and the wharf area.

The surface survey resulted in the location and description of two sites 50-60-03-895 and -896. Site -895, an enclosure and associated paved area, appears to represent historic - early 1900s - period construction, functionally interpreted as a work shed. Site -896, a stacked boulder wall, is also, based on map and other references, presumed to be historic - late 1800s to early 1900s - in construction, functioning to exclude cattle from Kaunakakai Town. During the survey it became apparent that the majority of the project area has been bulldozed and further modified in modern times (post 1950). There is active corn cultivation, as well as flood levees, housing-associated grading, and utility infrastructure associated with power lines and underground water lines within different

portions of the project area.

During the survey, an adjoining bulldozed parcel containing a relatively abundant surface scatter of midden and artifacts (indigenous and historic) was briefly inspected. This was done because informants indicated the possible presence of a small cemetery. No evidence of human burials was observed, in the at-least twice bulldozed lot, which is outside the proposed drainage corridor.

Limited sub-surface testing was conducted at Site -895 involving the excavation of two test units. The test units were placed within the enclosure (TU1) and the adjoining paved area (TU2). There were very sparse faunal remains and only a few historic-era (mainly metal can fragments) artifacts observed and recovered. The excavations also revealed a shallow depth of construction of the paved area as well as a shallow deposit within the enclosure. Though recovered material (midden and artifacts) was sparse, Site -895 represents a considerable expenditure of time and energy. The site may have been regularly utilized from the early to mid 1900s, possibly as a permanent storage shed for agricultural tools. However, the only clearly identifiable can was an opened (2 puncture holes) evaporated milk can that was extremely rusty, suggesting the enclosure probably served multiple purposes as a peripheral feature to the permanent residences just *makai* (*i.e.*, Kaunakakai Homestead Lot 6 and/or Teachers' Cottages). Further evidence for the site not being permanently occupied is the location *mauka* or outside the protective (*i.e.*, cattle exclusion) wall (Site -896) that surrounded Kaunakakai Town, including the Kaunakakai Homestead Lots 2 to 17.

SIGNIFICANCE AND RECOMMENDATIONS

The significance assessments of sites are based on the National Register criteria which, with the inclusion of an additional State Criterion E, have been accepted under the Draft Rules and Regulations of the Historic Sites Section, Department of Land and National Resources (May 1989).

Based on the present information derived from literature review and inventory survey work, we do not think that Site -895 represents the remains of Kamalae *Heiau*. Thus, based on presumed historic-era construction and use and apparent limited excavation potential, we recommend that the site be assessed solely under Criterion D, "Site is likely to yield information important to history or prehistory."

There is a large *kiawe* tree growing out of the interior of the enclosure which has affected the interior floor area, uprooting and destroying some 60% of the approximately 6 square meters of interior space, and destabilizing the *makai* enclosure wall. Clearly, the tree limits the excavation potential and will eventually, if left to grow unchecked, further collapse the walls of the enclosure. Therefore it is recommended that data recovery work take place at Site -895 prior to any construction.

Data Recovery should include further excavations, interviews with local informants, and further background (historical) research. The excavations should be conducted at the enclosure (Feature A), paved areas (Feature B), and planting areas (Feature C). It is further recommended that excavations at the enclosure include a trench through the wall to better ascertain construction sequences and attempt to recover datable material to firmly affix a chronology to the enclosure construction.

Informant interviews for other Moloka'i research (*e.g.*, Tomonari-Tuggle 1990) have been fruitful and a great aide in understanding historic period activities and associated sites. Similar results can be expected concerning the project area. Expanded background

literature research would enhance specifics on such matters as the development of the "Kaunakakai Homesteads," further correlations to regional studies for south central Moloka'i, and Island-wide settlement pattern implications.

Site -896, stacked boulder wall, is also recommended to be assessed solely under Criterion D. Presently, only the section of wall within and adjacent to the project area is described as Site -896. However, it is clear from historic maps that a complex of walls were built surrounding and dividing portions of Kaunakakai Town and that Site -896 represents a remaining part of that complex.

It is further recommended that Data Recovery work also be conducted specific to Site -896. This should include excavations, placed to ascertain stratigraphic sequence of wall construction, as well as associated oral interviews with questions specifically addressing wall construction chronology. Additionally, a light surface scatter of midden and artifacts, abutting the wall and within the project area should also be tested. Though only a modern trash component was observed a few varieties of marine shell fragments were also present, thus warranting further inspection.

Though Data Recovery work specific to Site -896 is deemed warranted, it is also recommended that the wall be preserved "as is". This should be possible as for the most part the wall section only abuts the proposed drainage corridor. The wall was constructed to provide a clear separation of residential and agricultural activities and as such defined the limits of Kaunakakai Town. This same "separation" can still be achieved, with historic character, by retaining the wall.

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PHOTO APPENDIX

Figure 13 Site 50-60-03-895, Feature A Enclosure, Showing Interior with Large Kiawe Tree (View to South)

Figure 14 Site 50-60-03-895, Feature A, Showing Exterior of Southee Wall (View to North)

Figure 15 Site 50-60-03-895, Feature B, Showing Pavements (View to West)

Figure 16 Site 50-60-03-895 Feature B, Showing Close-up of Boulder Pavement (View to West)

Figure 17 Site 50-60-03-895, Feature C, Showing Probable Planting Areas (View to West)

Figure 18 Site 50-60-03-895, Feature C, Showing Boulder Stacking Between Bedrock Boulders (View to West)

Figure 19 Site 50-60-03-896, Showing Intact Portion of Wall (View to NE)

Figure 20 Site 50-60-03-896, Showing Wall under Bulldozed Pushed Debris (View to NW)

Figure 21 Bulldozed Basevard, Area of Possible Cemetery" (View to North) Adjacent to Project Area

Figure 22 Bulldozed Baseyard, Area of "Possible Cemetery" Adjacent to Project Area (View to NW)