# *Final Environmental Impact Statement*

# Lahaina Watershed Flood Control Project

Prepared for:

U.S. Department of Agriculture,
Natural Resources and Conservation Service,
West Maui Soil and Water Conservation District
and the Applicant Agency:
County of Maui, Department of Public
Works and Environmental Management

December 2003

MUNEKIYO & HIRAGA, INC.

<u>FINAL</u>
ENVIRONMENTAL IMPACT STATEMENT

LAHAINA FLOOD CONTROL PROJECT
LAHAINA DISTRICT, ISLAND OF MAUI, HAWAII

PROPOSING AGENCY:

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND
ENVIRONMENTAL MANAGEMENT
250 HIGH STREET
WAILUKU, HAWAII 96793

DOCUMENT PREPARED BY:

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SIGNATORY CERTIFICATION:

This Environmental Impact Statement has been prepared by Munekiyo & Hiraga, Inc. acting as a consultant to the County of Maui Department of Public Works and Environmental Management. This Environmental Impact Statement and all ancillary documents were prepared under the direction of the signatories and the information submitted, to the best of the signatories' knowledge, fully addresses the document content requirements as set forth in Hawaii Administrative Rules Title 11, Chapter 200-18 as appropriate.

County of Maui
Department of Public Works and
Environmental Management

| | |
|---|---|
| Gilbert Coloma-Agaran | 12/23/04 |
| Director | Date |

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| President | Date |

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| | |
|---|---|
| ***Action:*** | Agency |
| ***Proposing Agency:*** | County of Maui, Department of Public Works and Environmental Management |
| ***Project Sponsors:*** | U.S. Department of Agriculture, Natural Resources Conservation Service; County of Maui, Department of Public Works and Environmental Management; and West Maui Soil and Water Conservation District |
| ***Project Name:*** | Lahaina Watershed Flood Control Project |
| ***Project Location:*** | Lahainaluna Road to Waianukole, Lahaina District, Maui, Hawaii |
| ***Present Use:*** | Agricultural Lands, Existing Highway (Honoapiilani Highway crossing) and Conservation Lands (second outlet) |
| ***State Land Use Designation:*** | Agricultural, Urban and Conservation |
| ***Community Plan Land Use Designations:*** | Agricultural, Open Space, Single-Family, Public/Quasi-Public |

### ***Background***

Flooding is a major problem in the Lahaina area. Floodwater and sediment damage occurs to homes, businesses, and roads in Lahaina Town and to agricultural fields, roads, irrigation systems, and ditches. Sediment-laden storm runoff turns the nearshore ocean waters a reddish-brown color resulting in income losses for ocean-front hotels and ocean-based businesses, reduced recreational and cultural gathering opportunities, and reduced visitor appeal of the Lahaina area. Sedimentation and floodwater runoff are also recognized as a threat to the coral reef and marine ecosystems.

The County of Maui, Department of Public Works and Environmental Management (DPWEM) and the West Maui Soil and Water Conservation District (WMSWCD), in partnership with the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) propose the implementation of a floodwater diversion system in the Lahaina Watershed. The proposed project is intended to reduce flooding and erosion problems on land and to relieve the effects of excess sedimentation on the nearshore coral reefs.

The Lahaina Watershed is located in the West Maui region of the island of Maui, Hawaii. The watershed is 5,250 acres in area and includes three (3) subwatersheds; the 2,140-acre Lahaina subwatershed, the 2,780-acre Kauaula subwatershed, and the 330-acre subwatershed to the south of Kauaula Stream to Waianukole at the coastline.

***Proposed Action***

The proposed project is based upon work conducted by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), and contained in the August, 1992 report *Final Watershed Plan and Environmental Assessment, Lahaina Watershed*, with revised hydrological analysis due to the termination of sugar cultivation in the project area. The project's design concept involves the construction of a floodwater diversion system that starts south of Lahainaluna Road at approximately 153.0 feet above mean sea level (amsl) and extends across the watershed in a southwesterly direction to a debris basin at Kauaula Stream. The diversion channel is proposed to be grass-lined except for reinforced concrete channel reaches near Lahainaluna Road and adjacent to Wainee Reservoir. The proposed project also includes the construction of an inlet basin and three (3) sediment basins. The debris basin at Kauaula Stream provides a primary outlet to a 3,600 foot long grass-lined channel with a sediment basin, leading to a shoreline outlet. A secondary spillway is also proposed to release flows to the concrete-lined Puamana channel during higher flow events. All bare earth areas, including all diversion surfaces, will be vegetated.

The proposed project will provide a 100-year level of flood protection.

***Potential Impacts and Mitigation Measures***

The proposed construction of the Floodwater Diversion System will result in unavoidable construction-related impacts on air quality and noise. These short-term impacts will be minimized and mitigated through accepted design and construction practices such as Best Management Practices to control dust and erosion as well as compliance with Hawaii Administrative Rules, Chapter 11-46 relating to "Community Noise Control".

From a long-term perspective, the proposed project will provide a 100-year level of flood protection to a benefitted area which includes single- and multi-family residential, business, commercial, public/quasi-public and agricultural land uses, as well as properties within the Lahaina Historic District No. 1. Viewed in this context, the proposed project will have a positive impact on surrounding land uses.

The proposed project is designed to reduce the overall sediment discharge in the project area approximately 25 percent. Sediment discharge into the nearshore environment fronting Lahaina Town will be mitigated. Sediment outflow of Kauaula Stream at Makila Point will be reduced by approximately 52 percent. The proposed project will have a beneficial impact on the nearshore reef ecosystem and invigorate the well defined coral reefs fronting Lahaina Town. The proposed project ~~will~~may result in impacting two (2) species of limu (seaweed) in a limited area adjacent to the second outlet and redistribute the development of limu in the project area. However, the net impact on marine resources ~~will~~is anticipated to be positive due to the overall reduction in sediment discharge.

Coastal processes have been assessed and long-term monitoring and mitigation may be required to enrich beaches between the Lahaina Harbor and Makila Point as a result of reducing sediment discharge. In the long term, new beaches may be formed in the area of the second outlet as a result of increased sediment discharge. A monitoring program will be carried out to establish post-construction conditions and will determine if more specific mitigation measures will be warranted.

The proposed project is not anticipated to have an adverse impact on flora, fauna, visual resources, educational facilities nor population in the region. Emergency services such as police, fire and ambulance would benefit from the proposed project since incidence of road closure caused by flooding would be reduced. Threat to human safety and health caused by flooding will be decreased with the installation of the project. Coastal recreational opportunities will benefit from the proposed action as reduction in sediment laden storm waters will result in less turbid post-storm conditions.

The proposed project is not anticipated to result in adverse cumulative or secondary impacts.

***Alternatives Considered***

The proposed project utilizing an earthen grass-lined section for the primary diversion works represents the preferred alternative. However, the Draft EIS for the proposed project examined several alternatives to address the flooding in the Lahaina Watershed.

Consideration may be given to an alternative channel design which involves the application of shotcrete to the trapezoidal channel section to enhance bank stabilization and reduce operation, maintenance and right-of-way requirements. Under this alternative, the bottom of the channel will be grassed and the slopes of the channel will be increased to a 1.5 to 1 bank slope.

A number of alternatives were considered which incorporated an outlet channel through the Lahaina Town area. However, high project costs and environmental concerns about sediment discharge within the fringing reef fronting the town area gave low priority to these alternatives.

A single outlet at Kauaula Stream presented many advantages as an alternative for the floodwater diversion system. However, concerns about excessive sediment pollution at the Puamana outlet and possible construction impacts of the Puamana channel, and maintenance of the Puamana channel resulted in placing this alternative as a lower priority option.

A full range of non-structural alternatives to provide flood protection to the Lahaina Watershed were evaluated but found to be ineffective in preventing flood damage during high intensity storms.

Use of the Kahoma Flood Channel as an outlet was under investigation during the formulation of alternatives for this project in the late 1980s. At that time, the U.S. Army Corps of Engineers (USACE) stated that the additional flow from the Lahaina subwatershed would decrease the level of flood protection for the lowlying areas of the Kahoma floodplain and the use of Kahoma Stream as an outlet was unacceptable. A recent inquiry to the flood program manager at the USACE on the use of the Kahoma Stream produced the same negative result.

***Unresolved Issues***

~~Two~~The State Department of Transportation Lahaina Bypass roadway infrastructure project~~s~~ in the vicinity of the proposed project ~~are~~is in the planning stages. ~~They are the Lahaina Bypass proposed by the State Department of Transportation and the Dickenson Street Extension Project proposed by the County of Maui, Department of Public Works and Environmental Management.~~ Further coordination with ~~these~~this ~~agencies~~agency will need to take place during thei~~r~~ design phases in order to ensure the functional integrity of the proposed flood protection plan. The status of the Dickenson Street Extension Project proposed by the County of Maui, while under consideration during the preparation of the DEIS, is inactive.

# Chapter I

## Project Overview

# I. PROJECT OVERVIEW

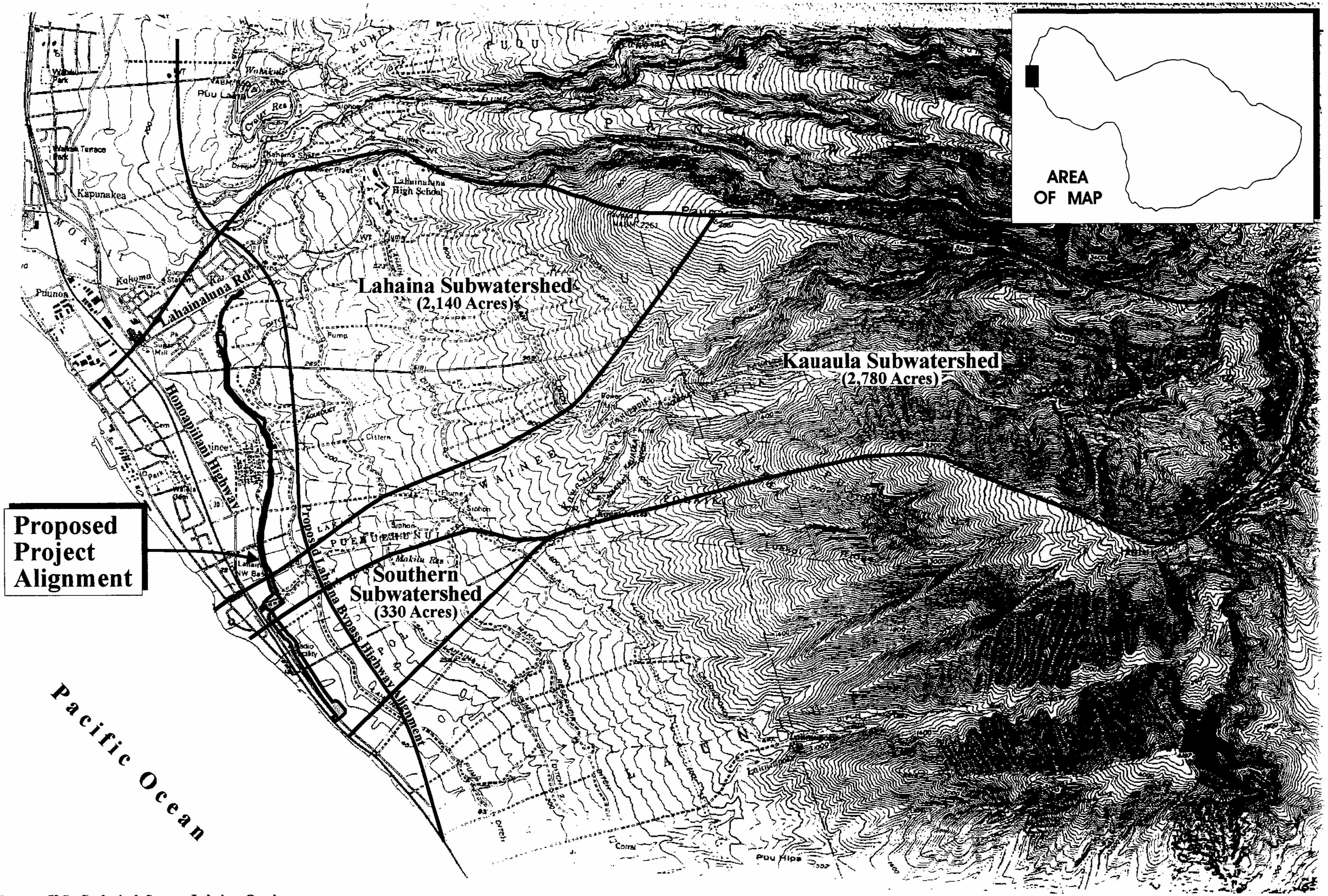
## A. PROJECT LOCATION, EXISTING USE, AND LAND OWNERSHIP

The County of Maui, Department of Public Works and Environmental Management (DPWEM) and the West Maui Soil and Water Conservation District (WMSWCD), in partnership with the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) propose the implementation of a floodwater diversion system in the Lahaina Watershed. The proposed project is intended to reduce flooding and erosion problems on land and to relieve the effects of excess sedimentation on the nearshore coral reefs.

The Lahaina Watershed is located in the West Maui region of the island of Maui, Hawaii. See Figure 1. The watershed is 5,250 acres in area and includes three (3) subwatersheds; the 2,140-acre Lahaina subwatershed, the 2,780-acre Kauaula subwatershed, and the 330-acre subwatershed to the south of Kauaula Stream to Waianukole at the coastline.

The proposed floodwater diversion system commences in the vicinity of Lahainaluna Road and extends for a distance of 6,831 feet across the Lahaina subwatershed in a southwesterly direction to a debris basin discharging into Kauaula Stream. A grass-lined channel extension is proposed from Kauaula Stream for a distance of 3,600 feet in a southerly direction mauka (mountain side) of the Honoapiilani Highway right-of-way and leading to a sediment basin then to a culvert under the highway and discharging into an outlet at the shoreline at Waianukole. See Figure 2.

The floodwater diversion system is adjacent to and traverses lands which are in single-family residential uses, open space uses, public/quasi-public uses, agricultural lands which were formerly used for sugarcane cultivation but presently lie fallow, and the former Wainee Village site.




Source: U.S. Geological Survey Lahaina Quad

Figure 1

# Lahaina Watershed Flood Control Project

## Regional Location Map

NOT TO SCALE

Prepared for: County of Maui, Department of Public Works and Environmental Management

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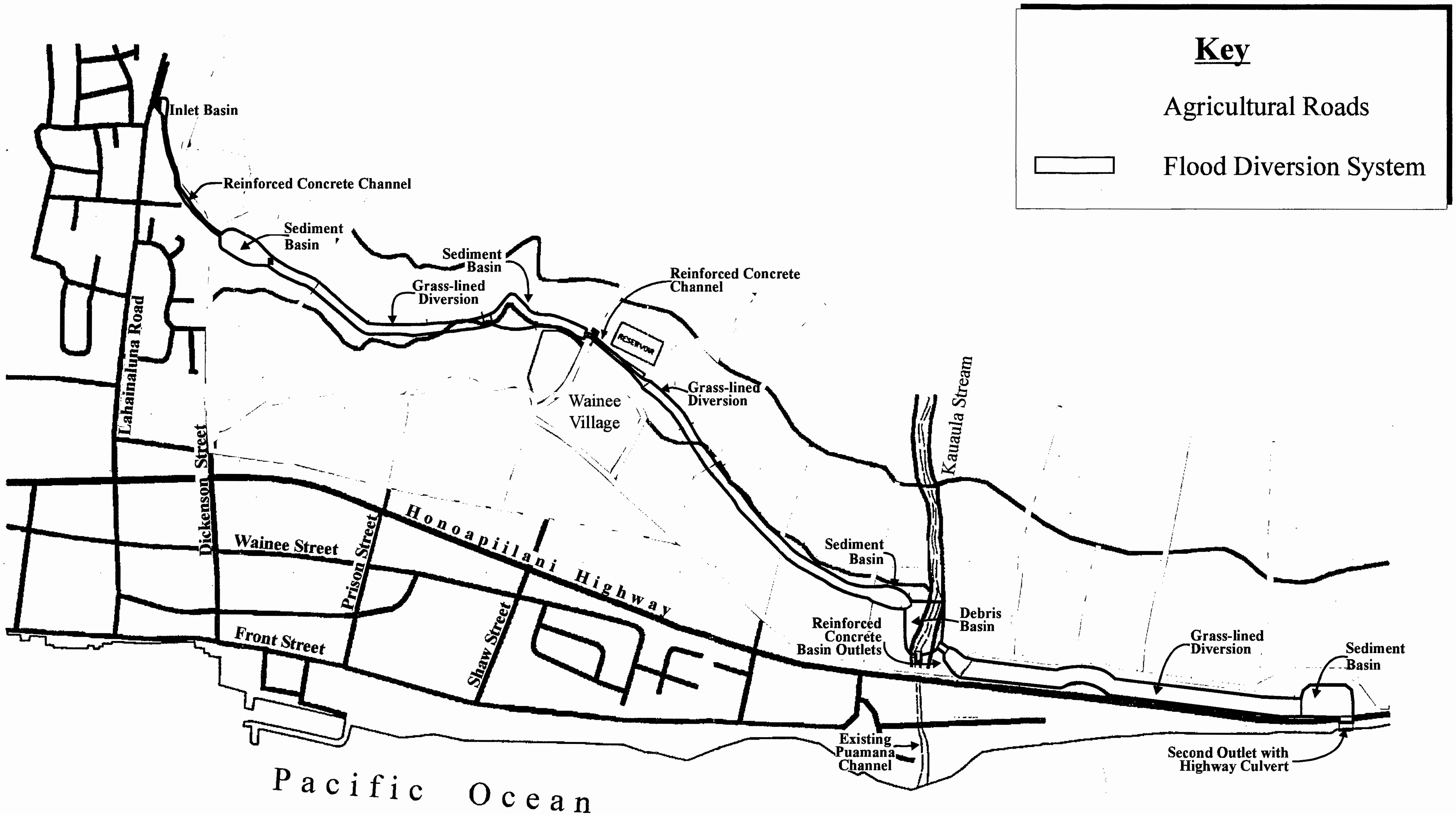


Source: USDA, Soil Conservation Service

Figure 2

# Lahaina Watershed Flood Control Project

## Project Location Map

NOT TO SCALE

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Prepared for: County of Maui, Department of Public Works and Environmental Management

Approximately 42 acres of land will be required for installation of the proposed floodwater diversion system and related structures.

The majority of the lands required for the proposed project are owned by Amfac/JMB, Inc. (the parent company of Pioneer Mill Company), Kamehameha Schools, Makila Land Company, LLC, Kauaula Land Company, LLC, the State of Hawaii, and the County of Maui.

## B. <u>*PROJECT NEED*</u>

Flooding is the main problem in the Lahaina Watershed. Floodwater and sediment damage occurs to homes, businesses, and roads in Lahaina Town and to agricultural fields, roads, irrigation systems, and ditches. Sediment-laden storm runoff turns the nearshore ocean waters a reddish-brown color resulting in income losses for ocean-front hotels and ocean-based businesses, reduced recreational and cultural gathering opportunities, and reduced visitor appeal of the Lahaina area. Sedimentation, nutrients and floodwater runoff are also recognized as a threat to the coral reef and marine ecosystems.

## C. <u>*PROPOSED ACTION*</u>

The proposed project is based upon work conducted by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), and contained in the August, 1992 report *Final Watershed Plan and Environmental Assessment, Lahaina Watershed*, with revised hydrological analysis and design parameters due to the termination of sugar cultivation in the project area. The project's design concept involves the construction of a floodwater diversion system that starts south of Lahainaluna Road at approximately 153.0 feet above mean sea level (amsl) and extends across the watershed in a southwesterly direction to a debris basin at Kauaula Stream. The diversion channel is proposed to be grass-lined except for reinforced concrete channel reaches near Lahainaluna Road and adjacent to Wainee Reservoir. The proposed project also includes the construction of an inlet basin and three (3) sediment basins. The debris basin at Kauaula Stream provides a primary outlet to a 3,600 foot long grass-lined downstream channel with a sediment basin, leading to a shoreline outlet two-thirds of a mile to the south. A secondary spillway is also proposed to release flows to the concrete-lined Puamana channel during higher flow events. All bare earth areas, including all diversion surfaces, will be vegetated. A preliminary description of each plan element starting from the upstream sector of the improvements follows.

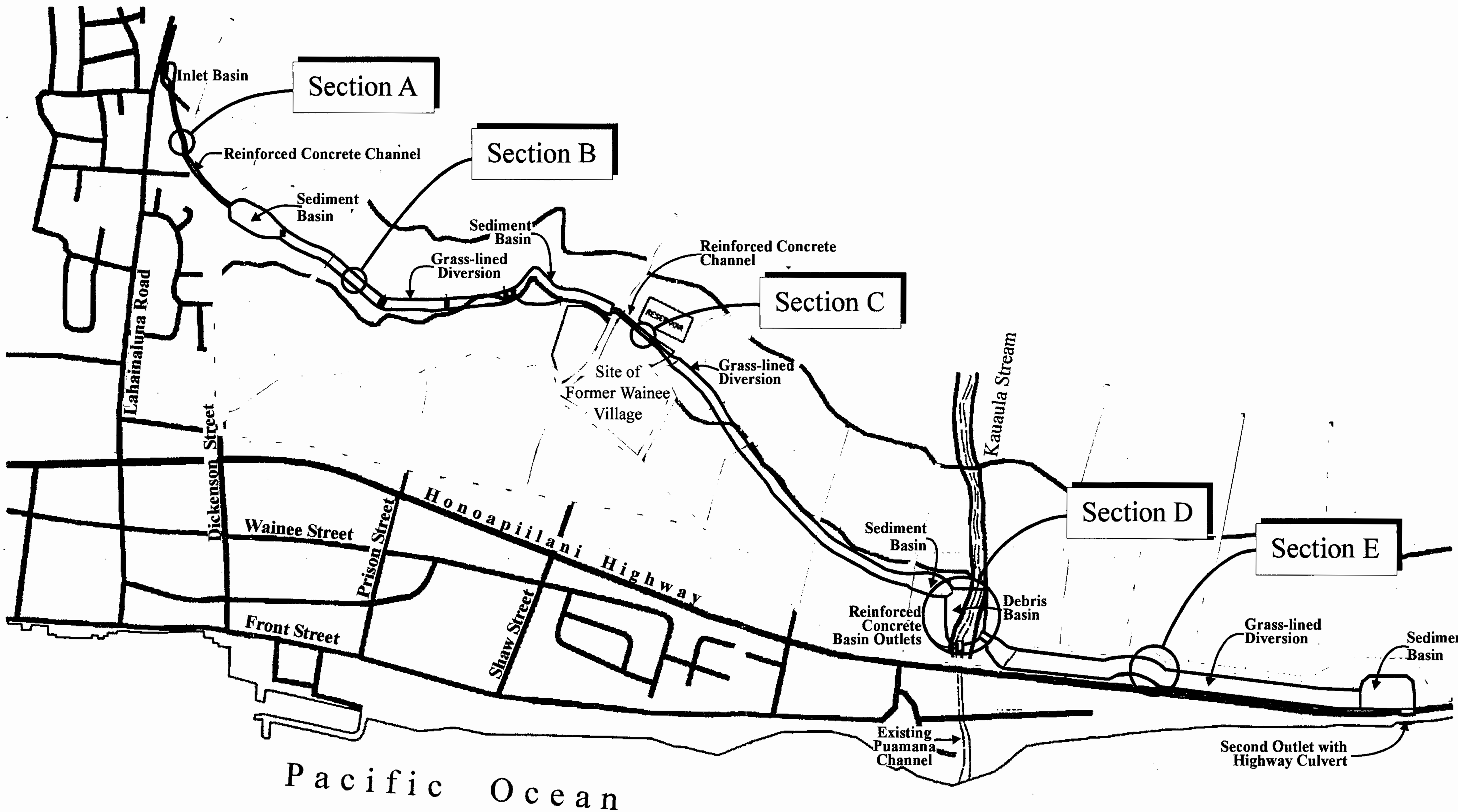
### 1. ***Lahainaluna Road Inlet Basin***

The inlet basin into the reinforced concrete channel section of the proposed diversion system is proposed to be constructed alongside Lahainaluna Road. The 150-foot long by 50-foot wide by 10-foot high basin will be partially excavated and partially embanked with loose rock riprap armoring the entrance. Flows from the drainageway along the south side of Lahainaluna Road and flows from the 18-inch diameter culvert from the subdivision on the north side of the road are proposed to be routed into the basin.

### 2. ***Diversion Channel***

The rectangular reinforced concrete channel leading from the Lahainaluna Road inlet basin to the grass-lined diversion channel is designed to be 13 feet wide, 5 feet high, 1,031 feet long, and set at a 4 percent grade. Refer to Figure 3 and Figure 4, Section A. Flows will enter from the inlet basin over a 31-foot long side inlet weir. An 85-foot long energy dissipating basin will be constructed at the downstream end of the channel.

Below the high velocity channel, runoff from the upper agricultural fields is designed to be intercepted by a 5,800-foot long diversion channel set at 0.20 to 0.35 percent grade. Except for 500 feet of reinforced concrete channel adjacent to Wainee Reservoir, the channel is proposed to be earthen with grass lining and 3 to 1 side slopes. Refer to Figure 3 and Figure 4, Section B. Riprap




Source: USDA, Soil Conservation Service

Figure 3

# Lahaina Watershed Flood Control Project

Reference Map for Sections

NOT TO SCALE

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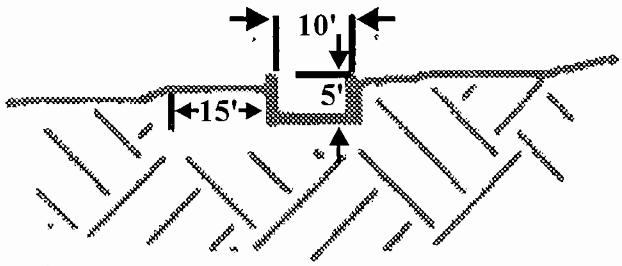
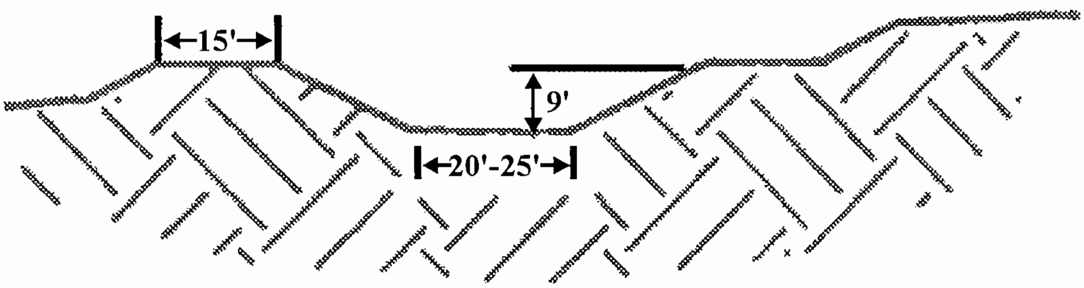
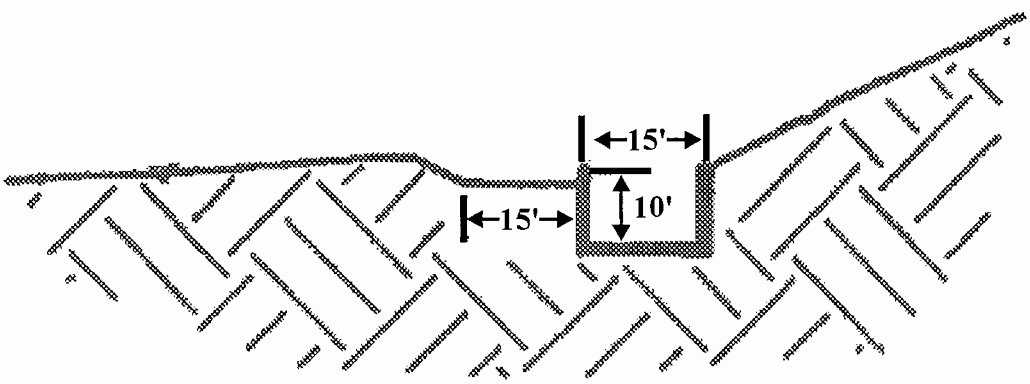



**Section A: Concrete Channel Below Inlet Basin**




**Section B: Grass-Lined Diversion**




**Section C: Concrete Channel Along Wainee Reservoir**

***All Views Upstream**

Source: USDA, Soil Conservation Service

Figure 4

# Lahaina Watershed Flood Control Project

## Flood Diversion Channel Sections

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protected inlets will be provided where the diversion intercepts a drainageway.

It is noted that alternative typical channel sections may be considered based on design and operations and maintenance criteria. Such alternatives may include the application of shotcrete along the earthen banks to provide added stability against erosion, as well as to reduce operations and maintenance requirements. Additionally, shotcrete channel sections may be considered to reduce the overall width of the channel and reduce right-of-way requirements. These alternatives are further discussed in Chapter VI of this document.

Three (3) sediment basins are proposed to be constructed along the diversion to trap sediment. The basins will have a total capacity of 4,000 cubic yards or approximately 4,000 tons of gravel and finer sediment.

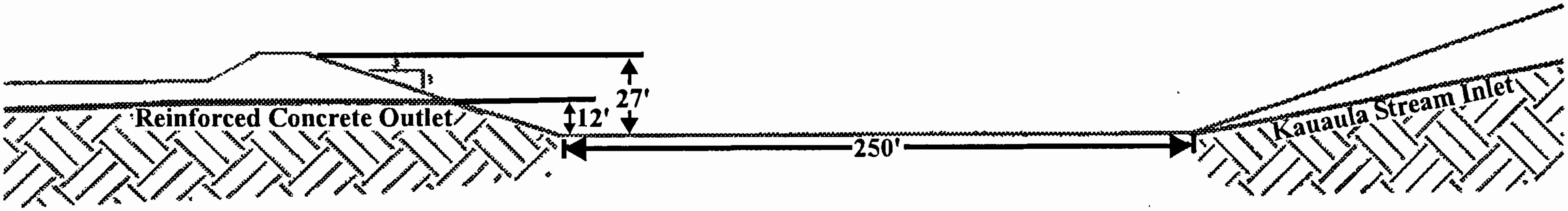
Five hundred feet of reinforced concrete channel is proposed to be installed near the base of Wainee Reservoir embankment to reduce right-of- way needs. The rectangular reinforced concrete channel will generally be 20 feet wide and 10 feet in depth. Refer to Figure 3 and Figure 4, Section C.

### 3. ***Debris Basin at Kauaula Stream***

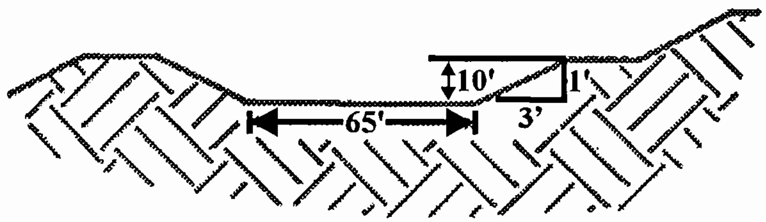
A debris basin is proposed to be installed at the junction of the grass-lined diversion channel and Kauaula Stream. The debris basin will trap boulders and cobbles transported by the high gradient Kauaula Stream. The basin is designed to be a flow-through structure with no flood storage or detention capability. Debris storage capacity will be approximately 7,100 cubic yards or 9,240 tons. Refer to Figure 3 and Figure 5, Section D.

The debris basin will be partially excavated with a horseshoe shaped earth embankment that rises a maximum of 10 feet from the natural ground. Rock riprap chutes will convey flows from the diversion and from Kauaula Stream into the debris basin.

Two (2) weir outlets from the debris basin will be used. The Kauaula Stream outlet will be set at 28 feet amsl and have a weir length of 50 feet. The outlet will smoothly transition to the existing improved channel that extends up from the Pioneer Mill bridge just upstream of Honoapiilani Highway and to the Puamana channel. The second outlet to the south will be set at 26 feet amsl and have




**Section D: Debris Basin along Kauaula Stream Viewed from Southeast**




**Section E: Grass-Lined Diversion South of Kauaula Stream**

Source: USDA, Soil Conservation Service

Figure 5

# Lahaina Watershed Flood Control Project

## Flood Diversion Channel Sections

**NOT TO SCALE**

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Prepared for: County of Maui, Department of Public Works and Environmental Management

a weir length of 34 feet. A reinforced concrete chute with a stilling basin will convey flow into the grass-lined outlet channel. Initial flows from the basin will be routed toward the second outlet. At the 100-year peak discharge, the flows will be divided almost evenly between the two (2) outlets.

### 4. ***Kauaula Stream***

Kauaula Stream, downstream of the debris basin, is currently concrete-lined to adequately convey flows through the Puamana Condominium project. This channel from the Pioneer Mill bridge seaward will not be improved by the project. The debris basin will virtually eliminate the coarse terrigenous sediment that is presently deposited in the Puamana area of the existing channel.

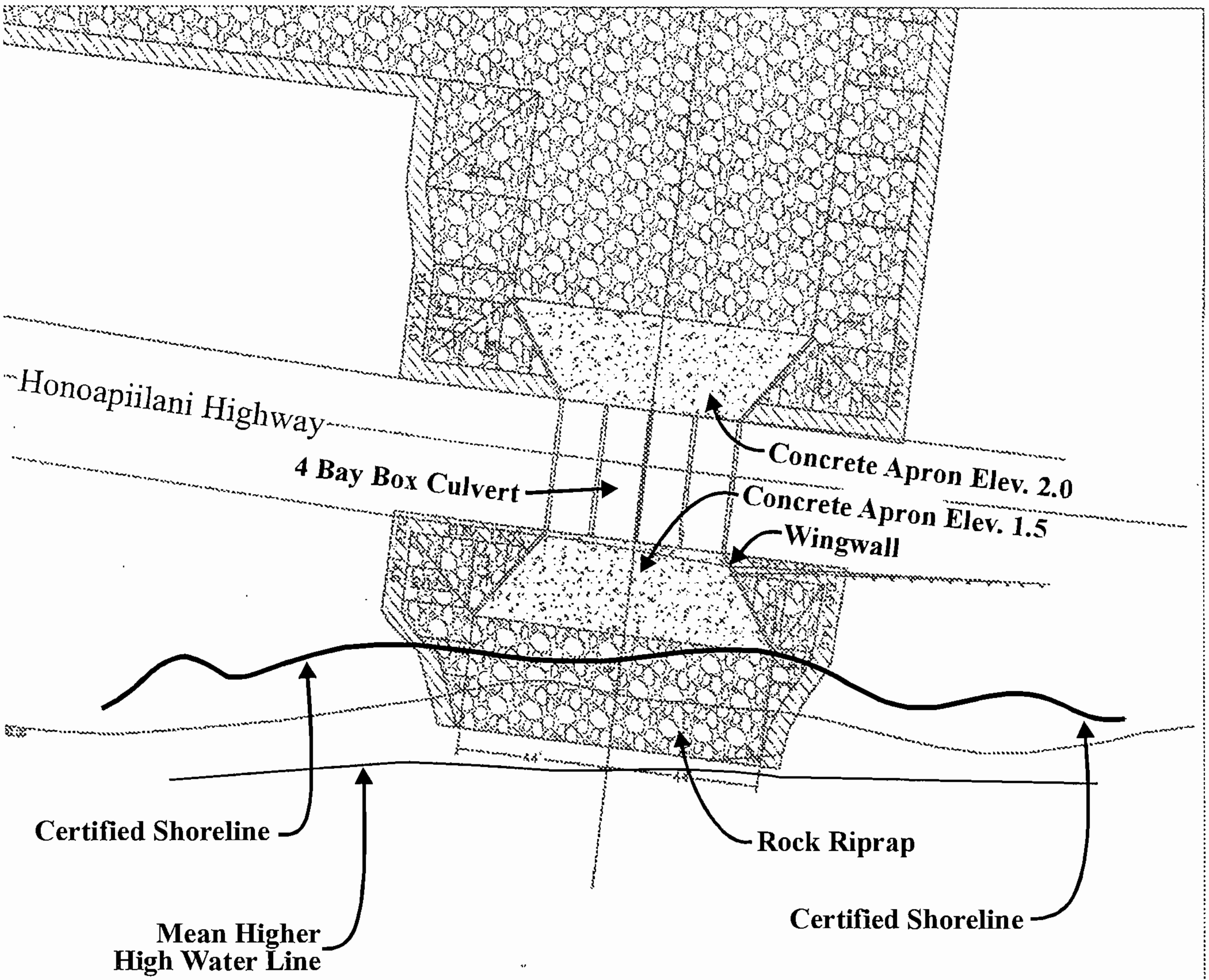
### 5. ***Second Outlet***

The floodwater diversion system from Kauaula Stream to the second outlet consists of 3,600 feet of grass-lined waterway, a sediment basin, a culvert under Honoapiilani Highway, and a discharge outlet at the shoreline. The channel cross section is designed to be trapezoidal with a 65-foot bottom width and an average depth of 10 feet. Refer to Figure 3 and Figure 5, Section E. The channel will be set at an approximate grade of 0.3 percent and flow into a rock riprap sediment basin 110 feet long and 58 feet wide. The culvert under Honoapiilani Highway is proposed to be a 4-bay box culvert approximately 48 feet wide and 11 feet high. The runoff will then flow onto a concrete apron and a rock riprap spillway which will extend makai (ocean side) of the certified shoreline. See Figure 6.

## D. ***PROJECT IMPLEMENTATION***

The estimated cost of the proposed project is approximately $12.0 to $14.0 million. The implementation of the project is anticipated to occur upon receipt of necessary approvals and approval of Federal and County funds. It is anticipated that project construction will take 24 to 36 months to complete.

Inasmuch as the proposed action will utilize Federal and County monies and will require works within the State Department of Transportation right-




Source: USDA, Natural Resources Conservation Service

Figure 6

# Lahaina Watershed Flood Control Project

## Second Outlet Location in Relation to the Shoreline

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of-way (for the culvert) and in the Conservation District (for the second outlet), ~~an~~this Environmental Impact Statement (EIS) ~~will be~~has been prepared in accordance with Chapter 343, Hawaii Revised Statutes. Given compliance with Chapter 343 is triggered by three (3) categories of action, pursuant to HRS, Title 11, Chapter 200, Environmental Impact Statement Rules, Subchapter 4, Identification of accepting authority, the Office of Environmental Quality Control has concurred the proposing agency to be the County of Maui, Department of Public Works and Environmental Management and the accepting authority to be the Mayor, or an authorized representative. ~~and~~ The EIS will also be filed concurrently under the Federal National Environmental Policy Act.

## E. ***OPERATIONAL RESPONSIBILITIES***

### 1. ***County of Maui***

The County of Maui will be responsible for acquiring the necessary permits, licenses, and other entitlements to install the proposed structural measures in the floodwater diversion system.

The County of Maui will be responsible for financing all non-federal costs, obtaining rights-of-way, contracting, and maintaining coordination with federal and state agencies. The County will be responsible for designing and inspecting all road crossings or modifications to road crossings made necessary by the plan. Relocation of pipelines and utility lines will also be the responsibility of the County. The County of Maui will finance its portion of the costs from its general fund.

### 2. ***U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)***

Federal assistance for installing the proposed project will be provided under the authority of the Watershed Protection and Flood Prevention Act, Public Law 566, 83rd Congress, 68 Stat, 666, as amended (PL-566).

The NRCS will be responsible for securing all PL-566 appropriation, preparing all designs for the flood protection works of improvement, and providing construction inspection services for the flood protection works.

## F. ***OPERATION, MAINTENANCE AND REPLACEMENT***

### 1. ***Conditions for Providing Assistance***

A fund-obligating Project Agreement will be executed by the County of Maui and NRCS prior to the issuance of the invitations to bid for each construction phase. Preparation of this Draft EIS document and project permitting does not constitute a document for obligation of PL-566 or other funds. Financial or other assistance furnished by NRCS in carrying out the plan is contingent upon appropriation of funds for this purpose.

The Sponsors will ensure full conformance with County, State, and Federal laws and regulations.

### 2. ***Operation, Maintenance and Replacement***

The operation, maintenance, and replacement (OM&R) of structural measures will be the responsibility of the County of Maui. Prior to signing a project agreement, an Operation and Maintenance Agreement will be entered into by the County and NRCS. The agreement will be based on the NRCS National Operation and Maintenance Manual 180-V of June 1982 and Amendments and will provide guidelines for operation, maintenance, and replacement of each structural measure. At the time of signing the agreement, the County will assure NRCS that it has adequate staffing and equipment to carry out their maintenance responsibilities.

All works of improvement will be inspected annually and after unusually severe events or conditions to determine the maintenance required. The inspection party will consist of representatives of the County of Maui and the West Maui Soil and Water Conservation District. NRCS representatives will participate in the inspections during the first five (5) years following project completion. The County will prepare a report for each inspection and submit a copy to NRCS.

The following describes the essential elements of the OM&R responsibilities of the County.

1. ***Grass-lined Diversions:*** Grass lining is to be kept viable through irrigation and fertilization and mowed to prescribed length. Obstructions to channel flow such as debris, large rooted plants, trash, and sediment deposits are to be removed. Scoured areas and scour causes are to be corrected. Sideslopes must be maintained.

2. ***Concrete channels:*** Adequate backfill must be maintained along exterior sidewalls. Weepholes are to be kept free of obstructions. Assure surfaces are aligned and show no signs of stress. Monitor concrete channel sidewalls and floor for signs of damage from debris or cavitation scour and repair when necessary.

3. ***Sediment and debris basin:*** Maintain adequate storage capacity. Clean out at regularly scheduled intervals and

when storage limits are neared. County landfills or storage sites will accept clean soil material.

The average annual cost for OM&R is estimated to be $260,000.00 for the proposed action.

Further discussion between the project sponsors and the County of Maui will be required to finalize the OM&R budget and responsibilities.

# Chapter II

## Description of the Existing Environment

# II. DESCRIPTION OF THE EXISTING ENVIRONMENT

## A. PHYSICAL SETTING

### 1. Surrounding Uses

The proposed floodwater diversion system traverses lands formerly cultivated in sugarcane. Lands surrounding the project include residential, agricultural, and public/quasi-public uses. Starting in the north at the inlet basin are existing single-family residences along Lahainaluna Road. To the east lie large acreages of former agricultural lands which are now fallow except for a 50-acre section in mixed crop agricultural use. Continuing south to Kauaula Stream and to the west lie former sugarcane fields, which are now fallow, and the former Wainee Village site, a plantation camp whose last remaining structures were demolished in late 1999. Continuing south along the diversion system to the second ocean outfall and to the west lie the Honoapiilani Highway, single- and multi-family residences, Puamana Park, and the Pacific Ocean beyond. The Lahaina Aquatic Center and the Lahaina Recreation Center are located along Honoapiilani Highway, west of the proposed project alignment.

The proposed site of the West Side Resource Center is located west or makai of the flood diversion system alignment (in the vicinity of the former Wainee Village site). This 5.0-acre site will be developed as a homeless resource center and provide long-term affordable rental housing and emergency/transitional housing.

The alignment of the proposed Lahaina Bypass Highway lies to the east of the diversion channel. Refer to Figure 1.

## 2. ***Hydrogeology***

The West Maui volcanic rocks have been subdivided into the Wailuku, Honolua, and Lahaina series. The West Maui volcano first built an oval shield-shaped dome of primitive olivine basalt in layers averaging 15 feet thick. The dome reached a height of approximately 7,000 feet above the sea during the Wailuku series. The Wailuku basalts are very permeable and yield water freely. Dike complexes (a parallel group of closely spaced dikes) in the higher elevations confine water far above sea level. Streams which cut into the dikes are spring fed and are perennial. The Honolua lavas are andesites and soda trachytes characterized by platy cleavage faces which contain small specks of feldspar. The layers of Honolua lavas average approximately 75 feet in thickness and form a protective veneer over the easily eroded dome of Wailuku basalts. There is a thin interbedded layer of red soil ranging from several inches to 5 feet in thickness between the two (2) volcanic series. The Lahaina volcanic series is comprised of lava flows emitted after erosion approached the present stage. All Lahaina lava flows lie on the dry leeward side of West Maui near Lahaina. They usually lie on gravel deposits and are comprised of pictritic basalts and nepheline basanite. (Stearns and MacDonald, 1942).

The geomorphology of the project area is characterized by three (3) features. The first feature are deep canyons and valleys such as Kauaula Valley, which have been formed by stream erosion caused by water flowing over steep surfaces, the presence of alternating layers of resistant and nonresistant rock and high rainfall in the higher elevations and low rainfall in the lower elevations. The second feature are domes ranging from 100 to 600 feet in height and from 1,000 to 3,000 feet in diameter such as

Puu Hipa and Puu Mahanalua Nui. These domes are composed of trachyte and closely related rocks and are formed by lava being squeezed from a small vent. The third feature are the flow-slope plains, as represented by the agricultural lands along the lower western flank of the West Maui Mountains, with grades ranging from three (3) to six (6) percent and conforming closely to the underlying lava flows. (Stearns and MacDonald, 1942.)

Basal ground water floats on salt water and underlies a peripheral belt approximately one and a half (1½) to four (4) miles wide inland. The basal water table stands about one (1) foot above mean sea level near the coastline and rises at a rate of approximately two (2) feet per mile inland. The high level water table is confined in the dyke complexes in the Wailuku basalt layers in the higher elevations. (Stearns and MacDonald, 1942.)

The works of improvement contained in the Lahaina Watershed plan will not affect recharge to groundwater due to their location considerably downhill of significant recharge areas. No domestic water supply wells exist downhill of or in the vicinity of the project.

An indication of the possible use of the underlying aquifer as a domestic water source is the location of the State of Hawaii Department of Health's Underground Injection Control (UIC) line. The UIC line delineates the extent of the drinking water aquifer and restricts installation of effluent injection wells upslope of the line. The proposed project straddles the UIC line with two (2) sediment basins just above the line. Most of the project improvements, including the debris basin, are below the line and, as such, does not contribute to effective aquifer recharge.

### 3. *Climate*

Like most areas of Hawaii, West Maui's climate is relatively uniform year-round. The region's tropical latitude, its position relative to storm tracts and the Pacific anticyclone, and the surrounding ocean combine to produce this stable climate. Variations in climate among different regions, then, is largely left to local terrain.

In Lahaina, August is historically the warmest month with an average high temperature of approximately 88 degrees Fahrenheit and average low temperature of 70 degrees Fahrenheit. January is normally the coolest month of the year with an average high temperature of 80 degrees Fahrenheit and an average low temperature of approximately 62 degrees Fahrenheit.

The Lahaina Watershed has a very steep rainfall gradient due to the proximity of the mountains to the ocean. In general, average annual rainfall varies from 15 inches at the coast to 300 inches in the mountains, only four (4) miles inland.

Rainfall at Lahaina is highly seasonal, with most precipitation occurring from November to April when winter storms hit the area. Precipitation data for 2001 shows that on average, January was the wettest month, with 3.49 inches of rainfall, while May, August, September, and October were the driest with no rainfall at all. Total precipitation at Lahaina for the year was 6.11 inches. This was a (-)13.89 inches departure from normal (Maui County Data Book, 2001).

The winds in the region are also seasonal. The northeasterly tradewind occurs 90 percent of the time during the summer, and just 50 percent of the time in the winter with average wind speeds of approximately 10 miles per hour. However, wind patterns vary on a daily basis, with tradewinds generally being stronger in the afternoon. During the day, winds blow onshore toward the warmer land mass. In the evening, the reverse occurs, as breezes blow toward the relatively warm ocean.

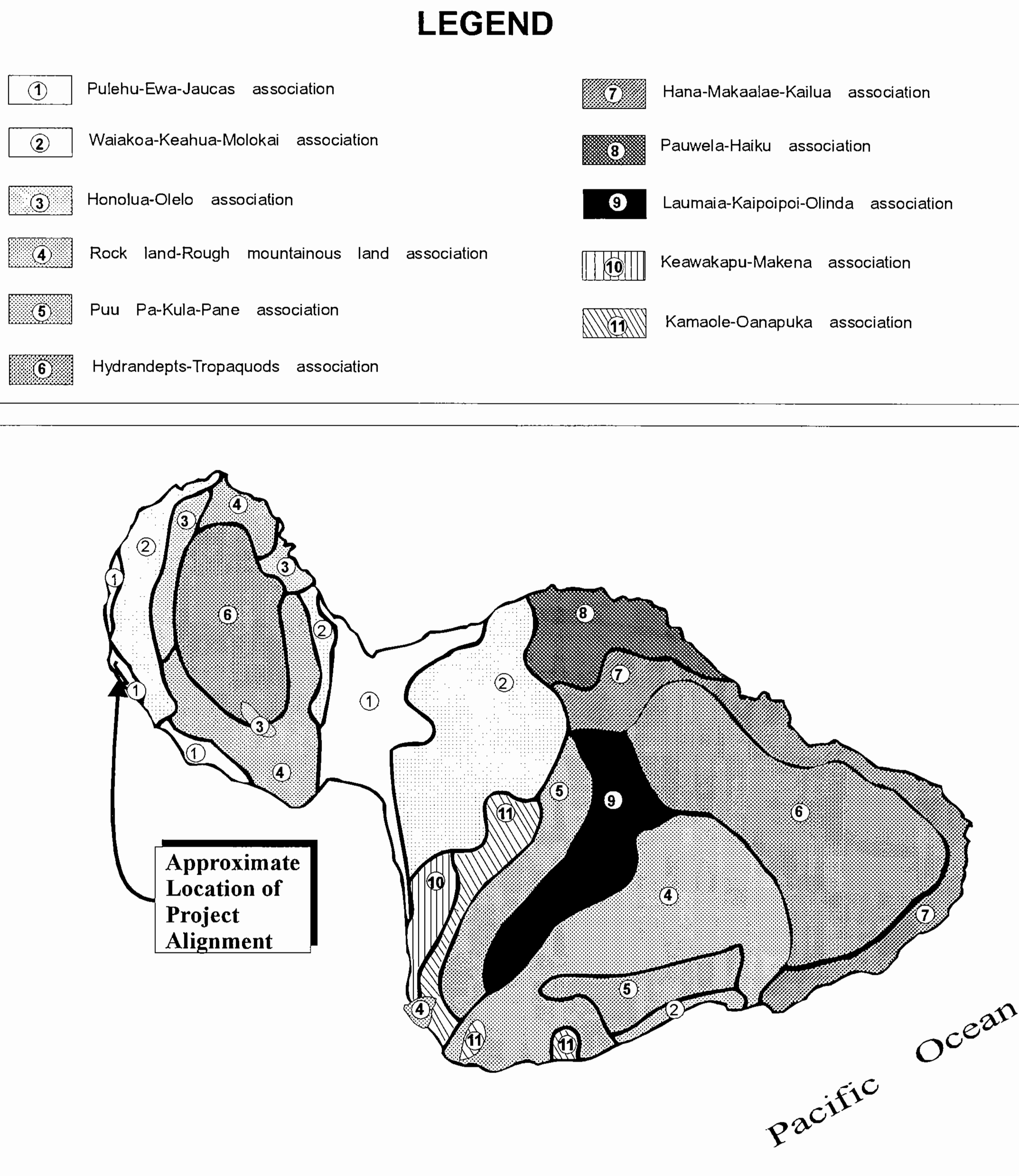
### 4. *Topography and Soils*

The land surrounding the proposed floodwater diversion system is characterized by gently sloping topography and generally slopes in a westerly direction towards the ocean. Elevations within the project area range from approximately 153 feet above mean sea level (amsl) in the north to approximately 1.5 feet amsl in the south at the second channel outlet.

At a regional scale, the Lahaina subwatershed rises from the Pacific Ocean to 2,561 feet amsl and the Kauaula subwatershed rises from the ocean to 5,220 feet amsl. The coastal areas of both subwatersheds are relatively flat and have been developed for residential, commercial and public/quasi-public uses. The area above the developed flatland to about the 1,400 foot elevation is gently sloping with an average slope of 10 percent and was formerly used for growing sugarcane. The remaining upper area of the Lahaina subwatershed is steep and was formerly used for sugarcane or pasture. The upper portion of the Kauaula subwatershed is mountainous with deeply incised canyons and is part of the West Maui Forest Reserve.

Underlying the proposed floodwater diversion system project site are soils of the Pulehu-Ewa-Jaucas association with deep, nearly level to moderate sloping, well-drained and excessively drained soils that have a moderately fine textured to coarse-textured subsoils or underlying material. See Figure 7. The specific soils types are as follows: Ewa (EaA) silty clay loam with 0 to 3 percent slopes; Wainee (WxB) very stony silty clay with 3 to 7 percent slopes; Wainee (WxC) stony silty clay with 7 to 15 percent slopes; Wainee (WyC) extremely stony silty clay with 7 to 15 percent slopes; Pulehu (PpA) silt loam with 0 to 3 percent slopes; and Pulehu (PtB) cobbly clay loam with 3 to 7 percent slopes. Runoff on the Ewa soils is very slow and erosion hazard is slight. Runoff on the Wainee soils is slow to medium and erosion hazard is slight. Runoff on the Pulehu soils is slow and erosion hazard is no more than slight. See Figure 8.

In 1977, the State Department of Agriculture established a classification system for identifying Agricultural Lands of Importance to the State of Hawaii (ALISH), primarily, but not exclusively, on the basis of soil characteristics. The three (3) classes of ALISH lands are: “prime”, “unique”, and “other”. As reflected by the ALISH map for the Lahaina area, the proposed floodwater diversion system project site traverses lands which have been classified in the “Other” important agricultural land category and lands which have been classified in the "Prime" agricultural land category. Approximately 24.0 acres of "Prime" and 13.0 acres of "Other" important agricultural land will be required for the proposed project. The remaining 5.0 acres of land required for the proposed project are within lands that have not been classified. See Figure 9.




Source: USDA, Soil Conservation Service

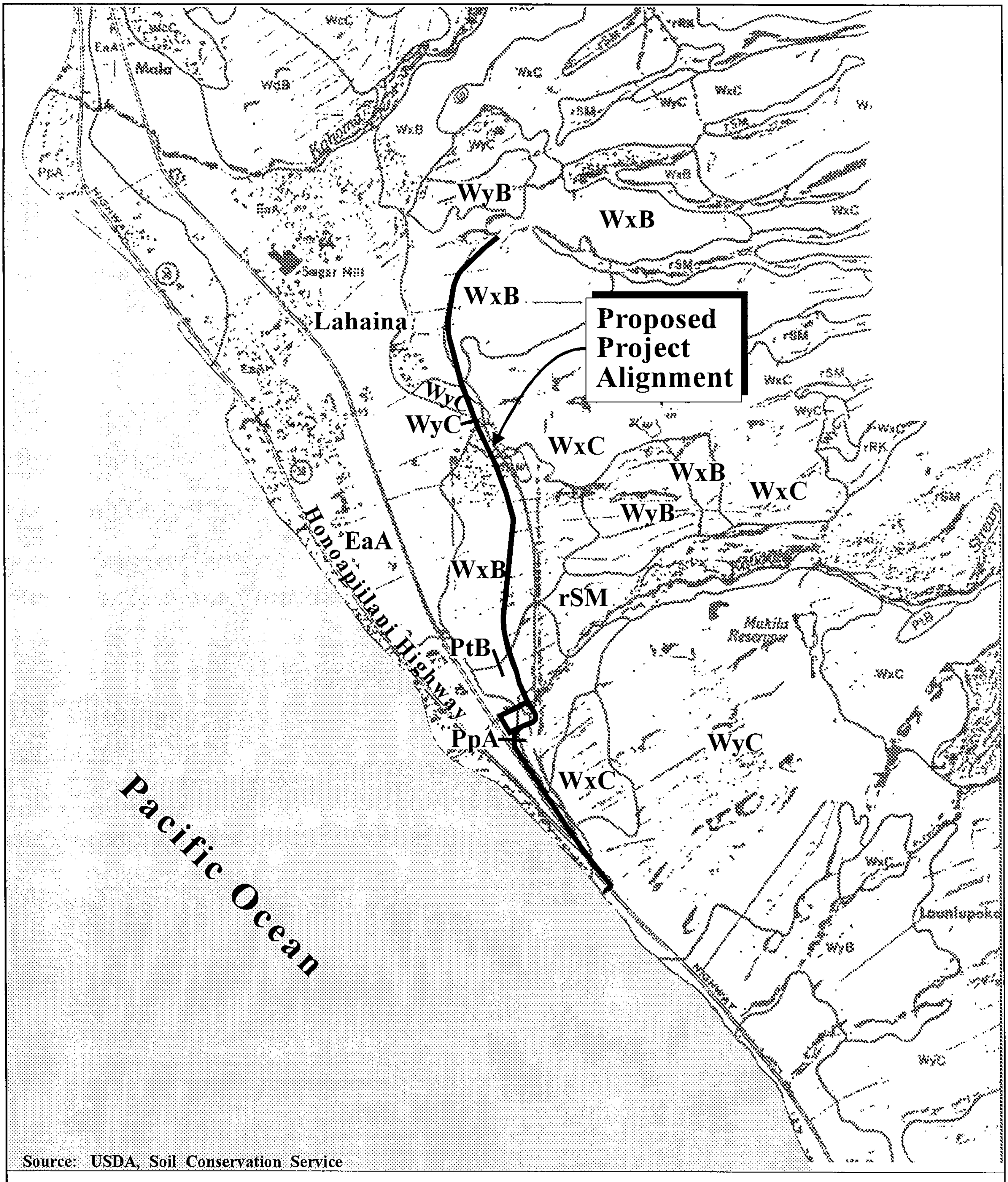
Figure 7 Lahaina Watershed Flood Control Project

Soil Association Map

NOT TO SCALE

Prepared for: County of Maui, Department of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.




Source: USDA, Soil Conservation Service

Figure 8

# Lahaina Watershed Flood Control Project
## Soil Classification Map

NOT TO SCALE

Prepared for: County of Maui, Department of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

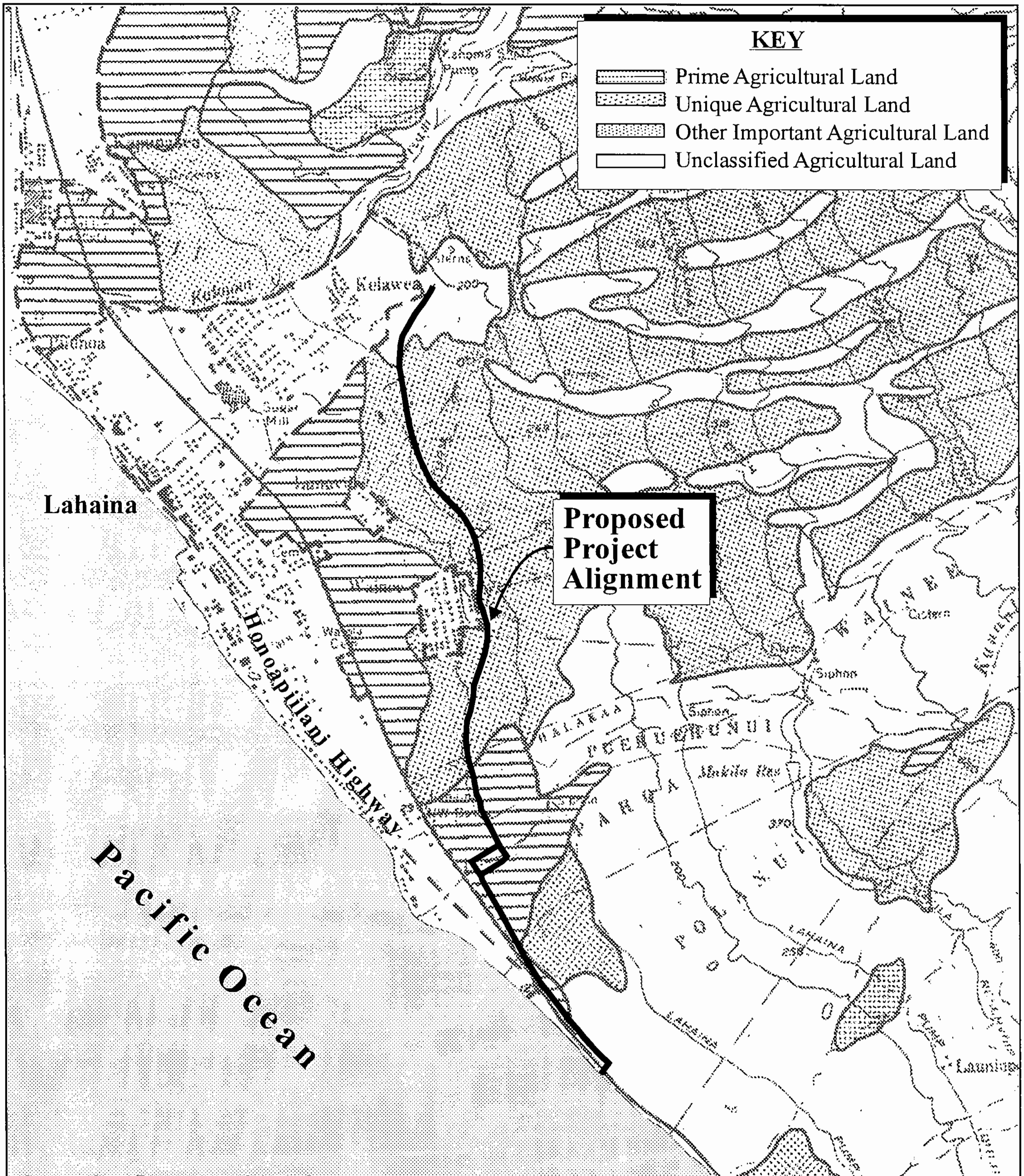



Figure 9

Lahaina Watershed Flood Control Project
Agricultural Lands of Importance to the State of Hawaii

NOT TO SCALE

Prepared for: County of Maui, Department of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

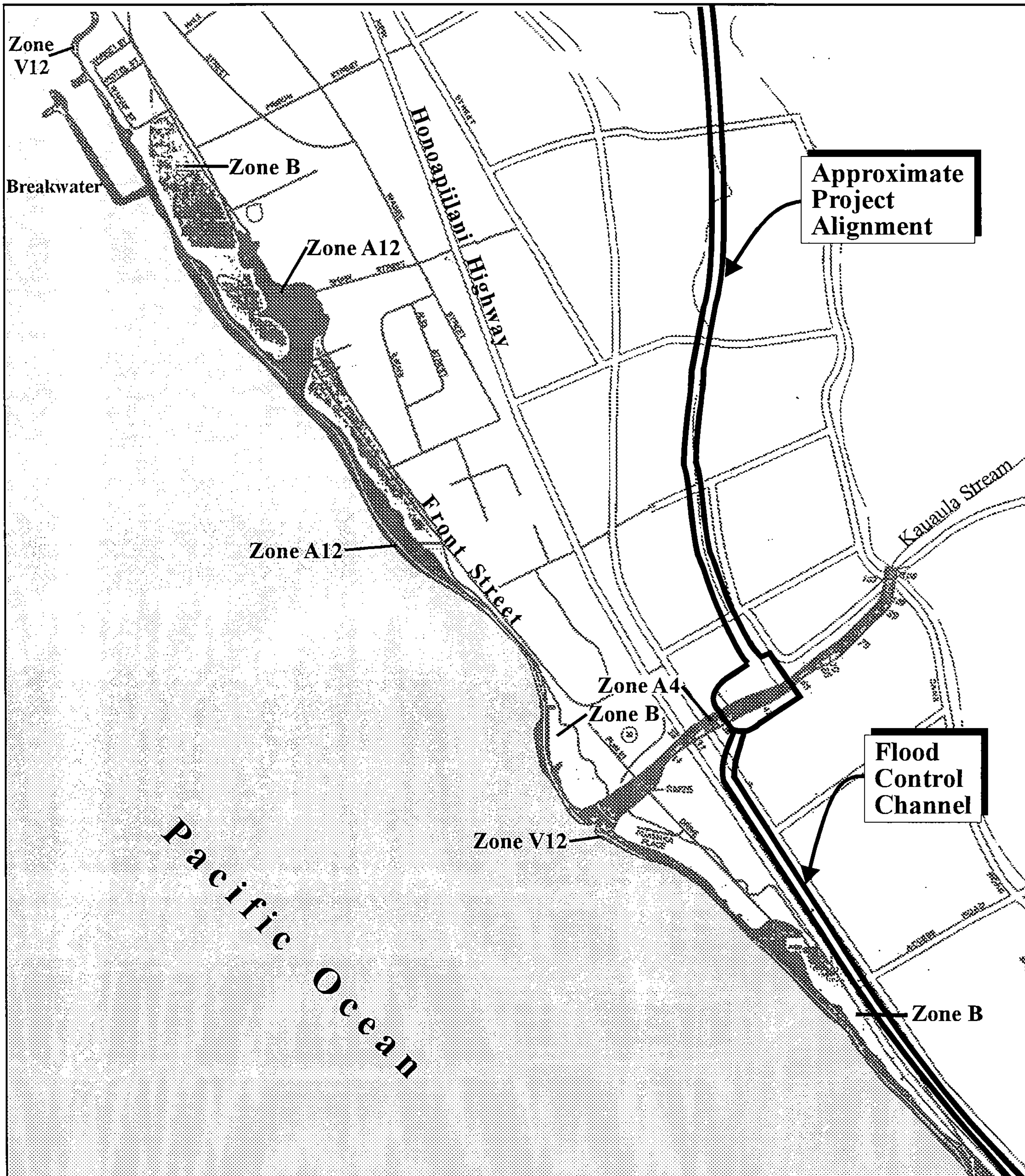
### 5. ***Flood Zone***

As indicated by the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) panel 0163C (August 3, 1998) the proposed floodwater diversion system is located within a Special Flood Hazard Areas (SFHA) designated as Zone C, Zone A4 and Zone B. See Figure 10. Zone C is areas of minimal flooding; Zone A4 is areas within the 100-year flood with Base Flood Elevations ranging between 36 plus or minus feet amsl to 53 plus or minus feet amsl; and Zone B is areas within the 100-year flood with average depths less than one foot.

### 6. ***Flora, Fauna and Wetlands Habitat***

A large portion of the lands surrounding and within the proposed floodwater diversion system was utilized for sugarcane cultivation until Pioneer Mill Company, Ltd. terminated its sugar operations in September 1999. A portion of the proposed project also borders the site of the former Wainee Village, a plantation camp whose last remaining structures were demolished in October 1999. Since then, introduced species of grasses, weeds, shrubs, and trees have occupied the lands surrounding and within the proposed floodwater diversion system. A narrow strip of vegetation, including haole koa brush and kiawe trees, are found on both banks of Kauaula Stream.

The region's avifauna include a host of introduced species, including the Japanese White-eye, Zebra Dove, Cardinal, Spotted Dove, and Common Myna. ~~The Golden-plover (*Kolea*), Black-crowned Night Heron (*'auku'u*), and the Hawaiian Owl (*pueo*) are also found within the vicinity of the proposed project site. These latter species are considered indigenous but not endangered.~~ The




Source: Federal Emergency Management Agency 15000 0163C, August 1998

Figure 10 Lahaina Watershed Flood Control Project
Flood Insurance Rate Map

NOT TO SCALE

Prepared for: County of Maui, Department of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

Golden-plover or Kolea (*Pluvialis fulva*), Black-crowned Night Heron or Auku'u (*Nycticorax nycticorax hoacti*), and the Hawaiian Owl or Pueo (*Asio flammeus sanwichensis*) are also found within the vicinity of the project site. These species are considered indigenous but not listed as federally endangered. However, the Golden-plover and the Black-crowned Night Heron are protected under the Migratory Bird Treaty Act (MBTA) (16 USCS 703-712). The Short-eared Owl or Pueo, an endemic species of the main Hawaiian Islands, is also afforded protection under the MBTA and is listed as endangered by the State of Hawaii. Other mammals common to the project area include rats, mice, and mongoose.

The only known plant or animal species listed or proposed by the Federal government as endangered or threatened that occur in or near the proposed project area are the Hawaiian green sea turtle (*Chelonia mydas*) and the Humpback whale (*Megaptera novaeangliae*).

According to local residents, Hawaiian green sea turtles are frequently sighted along the Lahaina coastline. This was confirmed by reconnaissance of the marine macrobiota and water quality conditions by Brock and Grigg, in 1989 and 1991, respectively. An important resource in the intertidal habitat fronting the project site are the locally developed stands of algae which is an important forage food for the threatened turtle. Five (5) marine algae known to serve as forage for the green turtle, inventoried from the recent marine survey carried out by Sea Engineering, Inc, (Appendix "A") in the area of the second outlet location are the genera, *Acanthophora, Cladophora, Dictyosphaeria, Hypnea and Microdictyon.* These algal genera are among the most common, widely distributed algae, in the Hawaiian Islands. These algae are common almost everywhere in shallow coastal waters where turtles occur.

Endangered Humpback whales are seasonally present in nearshore waters from approximately December through May. Calf rearing and reproductive activities often occur in proximity to the reefs fronting the watershed.

Critical habitat for any listed, proposed, or candidate species has not been designated or proposed within or near the project area.

In the upper reaches, Kauaula Stream is perennial, while in the project area, the stream flows only during times of heavy rain. The Commission on Water Resource Management's Hawaii Stream Assessment does not rank Kauaula Stream for aquatic resource values nor for outstanding riparian resource values and ranks the recreational resource values of the stream as "limited".

### 7. *Coastal Environmental Setting*

The coastal processes, marine water quality and nearshore biological investigations for the proposed project were carried out by Sea Engineering, Inc. (SEI). Field work was carried out in March/April, 2002. See Appendix A. A summary of the SEI assessment follows.

#### a. *Coastal Morphology*

The project shoreline, located on the southwest flank of the West Maui Mountains trends northwest-southeast. Makila Point (Puamana) is a deltaic cobble point that forms a prominent salient at the outlet of Kauaula Stream. To the north, the shoreline curves back into an embayment approximately 1,500 feet across. In this area, the coast is characterized by seawalls with no beaches. The Front Street beaches begin where sand returns at the north side of an embayment and continues to the Lahaina Yacht Harbor.

South of Makila Point, the Puamana subdivision continues for about 2,000 feet. The fronting shoreline is narrow sand and cobble beach. The beach at Puamana Park extends south for approximately 800 feet and pinches out a small rocky headland. The second outlet is located approximately 100 feet south of the headland. The shoreline south to Launiupoko Wayside Park is mostly rocky and very close to the Honoapiilani Highway.

The bathymetry appears relatively even between Launiupoko to Makila Point. A gentle slope of 1 vertical to about 50 horizontal exists between the shore and the 15-ft contour depth. The bottom slope then steepens to about 1 to 25 between the 15-ft depth and the 60-ft depth. North of Makila Point, between the point and the yacht harbor, a narrow fringing reef stands 600 to 1,000 feet offshore. The nearshore bathymetry south of the point consists of gradually shoaling terrain with isolated coralline limestone outcrops and sand. The small headland south of Puamana Park appears to be matched by an offshore rock and cobble shoal.

b. ***Winds***

Winds on Maui are heavily influenced by the island topography. The project site is located on the west coast of Maui, and is sheltered from direct exposure to the northeast tradewinds by the West Maui mountains. Light and variable winds often predominate nearshore in the Lahaina region, and will follow a diurnal cycle associated with thermal gradients with onshore sea breezes commonly blowing at mid-day during typical tradewind conditions.

The Lahaina region is directly exposed to Kona winds blowing from the south-southwest to west. Periods of Kona winds are generally of short duration (1 to 3 days).

c. ***Waves***

The project site is almost completely protected from both northeast tradewind waves and North Pacific swell by the island of Molokai and a portion of the island of Maui. The islands of Lanai and Kahoolawe offer partial shelter to the project area from southern swells and Kona storm waves. The most prevalent wave approach direction to Lahaina is from the southwest. The southern swell with deep water wave heights of 1 to 6 feet occur about 53 percent of the time and may occur throughout the year, but are most common during the months of April through October.

d. ***Storm Waves***

There are two (2) distinct types of storms that typically affect the Hawaiian Islands, these are Kona storms and tropical storms and hurricanes. Kona storm waves approach from the south to the west. Hurricanes are spawned in the eastern tropical Pacific Ocean and travel westward. Wave heights up to 12 feet were reported at Lahaina during hurricane Iwa (Grigg, 1983). High waves during hurricane Iniki (1992) damaged or destroyed numerous boats moored in the Lahaina Roadstead, and resulted in considerable erosion of the west facing Lahaina and Kaanapali shorelines.

*e.* ***Tsunamis***

Tsunamis, or seismic sea waves, are primarily generated by submarine earthquakes and earth movement with magnitudes greater than about 6.5 on the Richter scale. Loomis (1976) reports tsunami wave heights ranging from 6 to 11 feet in the vicinity of the project area for tsunamis occurring in 1946, 1957 and 1960. The predicted 100-year recurrence interval tsunami water surface elevations in the project area have been determined to range from 8 to 10 feet, based on methodology described in the Manual for Determining Tsunami Runup Profiles on Coastal Areas of Hawaii (USACE, 1978).

*f.* ***Currents***

Sea Engineering, Inc.'s studies indicate the general characteristics of the currents in the project area can be summarized as follows.

1. The prevailing currents are semi-diurnal reversing tidal currents. The coastal current sets primarily parallel to the shore, with little cross-shore movement except for wind-induced surface currents which

generally have an offshore component during prevailing tradewind conditions. During Kona winds, the surface waters can be expected to be held against the shore.

2. Some previous studies and "local knowledge" report reversing tidal currents with a slow net transport to the north. The 1988 SEI data show a net transport to the south, and data from the present study show net transport to the north. The net flow thus appears to fluctuate. The causes of this are not known, although it could be due to either spatial location, or to very long period cycles that have yet to be determined.

3. Current speeds appear to increase with offshore distance. North flowing current speeds also appear to increase with location from south to north, toward Makila Point. South flowing currents appear to increase from north to south, away from Makila Point.

4. Ebb tide currents consistently flow to the northwest, and flood tide currents flow to southeast, however, there are variable phase lags between tide stages and current flow. (Sea Engineering, Inc., 2002, page 20.)

### *g. Sediment Transport*

Hawaii beaches are formed primarily from calcareous sands derived from offshore reef organisms. Usually only a very small percentage of beach sediment is derived from terrigenous sources. However, a sand sample collected near the second outlet site at Waianukole by Sea Engineering, Inc. during the field investigations, showed 67 percent carbonate (i.e., 33 percent terrigenous) and a sample collected on Front Street beach to the north showed 46 percent carbonate (54 percent terrigenous). These are unusual percentages that indicate that much of the beach sediment in the project reach is derived from terrigenous sources. Wave generated sediment transport processes allow sediments discharged from Kauaula Stream to be transported north to the Front Street beaches, and, to a lesser degree, south to Puamana Park and beyond.

The watershed plan incorporates sediment settling basins that are projected to reduce total annual sediment outflow by about 25 percent. Sediment outflow at Kauaula Stream will be reduced by about 52 percent, from 1,850 tons per year, to 960 tons per year. The sediment basins will also be designed to capture all stones larger than 6 inches in diameter. Sediment discharge in the area between Lahaina Harbor and Kauaula Stream will change from about 3,400 tons to no sediment discharge with the diversion and sediment basins in place. Presently, about 310 tons of sediment are discharged near Puamana Park, this sediment will be diverted to the second outlet, where the discharge will increase to approximately 3,280 tons per year.

### 8. ***Stream Fish Habitat***

The proposed project will not affect fish rearing habitat of the lower reaches of Kauaula Stream since this section of the stream is a cement rock masonry channel with a concrete channel bottom which is dry throughout the year except during periods of heavy rainfall. The cobble/boulder bed of the unimproved upper reach is also usually dry. Except for the tidal backwater in the improved outlet channel, no fish habitat exists in the project-affected reaches of Kauaula Stream.

## 9. *Marine Biology*

The marine biology assessment carried out by Sea Engineering, Inc. was based on a review of information gained from earlier marine surveys in and around the study area and supplemented by area specific marine field work and reconnaissance.

### a. *Previous Biological Surveys*

Earlier marine studies in and around the project area (ECI, 1977 and AECOS, 1988) showed that in general, the development of the fish and coral communities is much greater in the vicinity of Launiupoko, further south of the second outlet location. Later marine surveys by AECOS (1988), Grigg (1983) and Sea Engineering Inc. and AECOS Inc. (1994) showed that the richness of the biological community increases north of Makila Point to the vicinity of Lahaina Boat Harbor.

The marine study by AECOS (1988) provided qualitative estimates of coral cover and diversity, abundance of fishes and distribution and coverage of major biological elements. The area covered is just south of the second marine outlet location, but very likely also applies to the marine environment directly off the second drainage outlet.

The characteristics of the marine biology offshore from the second outlet location from the 1988 marine study is described by Sea Engineering Inc., as follows,

> The cobble biotope (a region uniform in environmental conditions) is directly off the shoreline where rounded cobbles predominate.

This biotope extended out to a depth of less than 1 to 2 feet. Although larger stones are sometimes coated with algae, movement of the sands and the stones whenever large waves impinge on the shore, makes this unstable bottom unsuitable for all but a few marine organisms. Mean coral coverage in this biotope was approximately 1.3 percent and was represented by one (1) species. Mean algae coverage was approximately 6.4 percent and 11 species of algae were found in this biotope. The rolling sand biotope is where sand predominates and this biotope extends approximately 650 feet off the shore at the second outlet location. No species of coral were found in this biotope. Here, where outcrops rise above the sand, many species of limu were noted: *Codium arabicum, Dictyosphaeria cavernosa, Halimeda discoidea, Neomeris annulata, Dictyota acutiloba, D. bartayresii, D. sandwicensis, Padina japonica, Turbinaria ornata, Acanthophora spicifera, Ahnfeltia concinna, Coelothrix irregularis, Gelidiopsis scoparia, ogo or Gracilaria bursapastoris, huluhuluwaena or Grateloupia filicina, Jania sp., Laurencia obtusa Desmia hornemanni, Porolithon gardineri, and P. onkodes*.. Mean algae coverage was approximately 16.7 percent. Few fishes or macroinvertebrates were present in this biotope due to the absence of bottom relief to provide shelter. The flat limestone biotope occurs further offshore where the water depth may range from 4 to 8 feet. This biotope is subject to the forces impinging surf. Coral cover in this biotope was sparse with only scattered heads of Porites lobata, P. evermanni, Pocillopora meandrina, and Poc. damicornis observed in the 1987 survey. Mean coral coverage was estimated at 0.2 percent. Mean algae coverage was estimated at 2.4 percent and 10 species of algae were recorded in this biotope. There were 19 fish species and 4 macroinvertebrate species observed in this biotope. The spur and groove

> biotope oriented perpendicular to the shore is located on the outer face of the limestone biotope at depths exceeding 15 feet. The mean coral coverage in this biotope was approximately 3.6 percent and 8 species of coral were recorded. The mean algae coverage in this biotope was approximately 10.6 percent and 10 species of algae were observed. There were 22 fish species recorded in this biotope and 5 species of macroinvertebrates. (Sea Engineering, Inc. 2002, page 56-57)

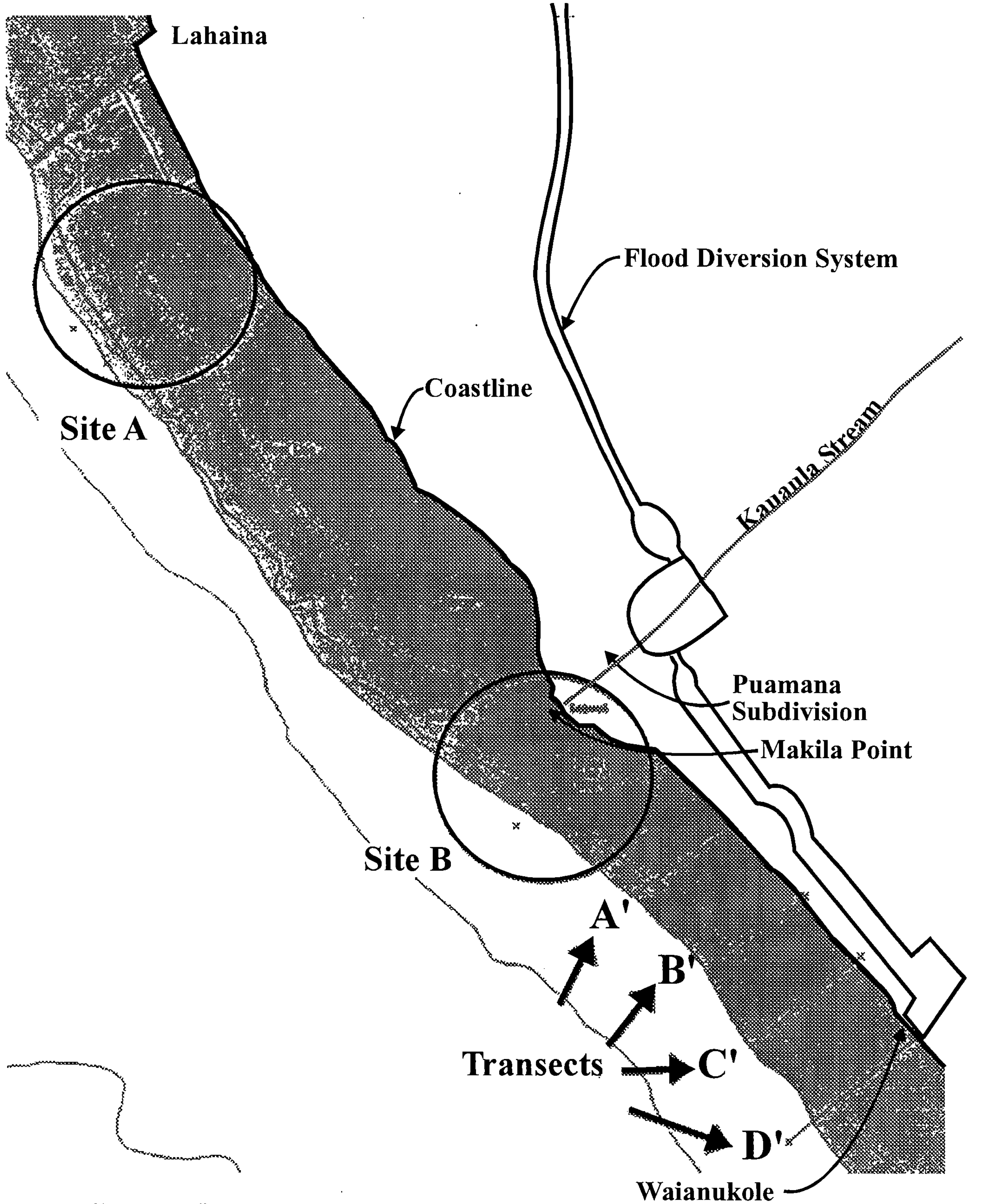
The summary of the coverage and recorded number of species in each of the biotopes is presented in Table 1.

## Table 1

| *Summary of the Number of Fishes, Corals, Algae, and Macroinvertebrate Species, as well as the Average Number of Individuals and Mean Coverage in the Four Biotopes Surveyed in the 1987 Study* | | | | |
|---|---|---|---|---|
| | *Biotopes* | | | |
| *Group* | *Cobble* | *Rolling Sand* | *Flat Limestone* | *Spur and Groove* |
| **Corals:** | | | | |
| Mean coverage (%)/total species | 1.3/1 | 0/0 | 0.2/2 | 3.6/8 |
| **Algae:** | | | | |
| Mean coverage (%)/total species | 6.4/11 | 16.7/10 | 2.4/10 | 10.6/1 |
| **Fish:** | | | | |
| Mean No. ind.s./total species | 205/9 | 1/3 | 9/19 | 54/22 |
| **Macroinvertebrates:** | | | | |
| Mean No. ind.s./total species | 1,813/9 | 6/4 | 4/4 | 5/5 |
| Source: AECOS, 1986. | | | | |

### *b. Current Marine Biology*

The marine biology field work for the EIS was carried out in August 2002. The scope of the marine biology assessment was to extend the efforts of the previous marine studies undertaken by Grigg in 1983, 1986 and 1991 for the Lahaina Watershed Plan. Six (6) sites ( A, B, A', B', C' and D') in the project area were relocated as accurately as practical from earlier descriptions. See Figure 11. Algae have rapid life cycles and distribution can be influenced by many factors, such as water temperature that can vary seasonally, or with




Source: Sea Engineering, Inc., 2002

Figure 11

Lahaina Watershed
Flood Control Project
Marine Biology Study Sites

NOT TO SCALE

Prepared for: County of Maui, Department of Public Works and Environmental Management

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other episodic weather fluctuations. Algae can also quickly re-establish themselves after a strong negative event. In the arid climate of West Maui, the second outlet will flow only during strong precipitation events, so there will be long periods when the outlet will have no effect on the offshore biota. Abundance and distribution are therefore, not necessarily good indices for judging species health.

The impacts of the proposed project on the coastal environment are anticipated to be measurable only following significant flood events, organism populations especially sensitive to such impacts would be relatively slow-growing, attached forms like corals. Algae, although attached, can regenerate a population in a matter of months after a storm discharge. Most other marine organisms will have a response similar to that of benthic algae. Fishes will leave the area to return after outflow ceases; smaller invertebrates may be destroyed over an area immediately off of the discharge point, but will return to former population numbers on a time scale less than the frequency of damaging storms. The approach of the current marine biological assessment and the earlier studies has been to initially determine the location for the second outlet where it would have the least long-term effect. Coral species diversity and bottom cover were used as indices rather than algae or fishes as they provide habitat, grow slowly, and are slow to recruit. The paucity of coral at the second outlet site initially makes it the most attractive location based on the biological environment. ~~The~~Similarly, the marine ~~assessment~~survey to assess potential adverse impacts to the marine environment was focused on coral cover rather than species richness, fishes and algae in concordance with Grigg's earlier reports. A summary of the results of the marine biology assessment by Sea Engineering, Inc. follows.

~~c. Sites A and B~~

(1) Sites A and B

The nearshore reef ecosystems at Sites A and B are comprised of similar faunal assemblages but different structural elements. Site A is characterized by a shallow reef flat with low coral cover from shore to the reef crest. Outside of the surf break, the reef is well developed out to a depth of approximately 36 feet. At Site B, waves break generally closer to shore due to the absence of a reef crest and flat. Low coral cover typifies the habitat close to shore. Outside of the breakers, the reef is moderately well developed to a depth of approximately 36 feet.

The number of coral species recorded at both sites remained fairly constant. Fish and algae appeared to increase in richness between Grigg's surveys and the present study. See ~~Table 1~~Table 2. Enumerated data for each species of algae, coral and fish are presented in Appendix A.

~~Table 1~~**Table 2**

| NUMBERS OF SPECIES AT SITES A AND B IN 1982, 1983, 1991 AND 2002 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Group** | **Site A** | | | | **Site B** | | | |
| | **1982** | **1983** | **1991** | **2002** | **1982** | **1983** | **1991** | **2002** |
| Coral | 10 | 9 | 12 | 8 | 6 | 6 | 8 | 8 |
| Algae | 12 | 13 | 9 | 17 | 8 | 8 | 9 | 19 |
| Fish | 38 | 32 | -- | 50 | 38 | 30 | -- | 54 |
| Source: Sea Engineering, Inc. 2002 | | | | | | | | |

~~d. Sites A' to D'~~

**(2) Sites A' to D'**

The nearshore reef ecosystems at Sites A', B', C' and D' are very similar and consist of a gently sloping fringing reef tract grading into sand and eventually giving way to beds of algae (*Halimeda incrassata*). Coral cover is very poor close to shore and becomes patchy until approximately 10 foot depth. At approximately 10 to 20 foot depth, there is a moderately well developed reef. From 20 to 30 foot depth, large sand patches form a belt between the fringing reef and the deeper *Halimeda incrassata* fields. Occasional patch reefs are found in the *Halimeda* beds whenever there is some form of substrate relief.

The number of coral and fish species recorded at all four (4) sites remained relatively constant. However, the number of fish species appeared to be lower at

Site D' in 1986. Algae species appeared to increase between Grigg's surveys and the present study except for Site D'. See ~~Table 2~~Table 3.

**~~Table 2~~Table 3**

| *NUMBERS OF SPECIES AT SITES A', B', C' ~~and~~AND D' IN 1986 AND 2002* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Group** | ***Site A'*** | | ***Site B'*** | | ***Site C'*** | | ***Site D'*** | | |
| | **1986** | **2002** | **1986** | **2002** | **1986** | **2002** | **1986** | **1991*** | **2002** |
| Coral | 6 | 3 | 5 | 3 | 7 | 4 | 3 | 3 | 3 |
| Algae | 9 | 20 | 9 | 22 | 9 | 17 | 12 | 11 | 12 |
| Fish | 25 | 23 | 22 | 23 | 16 | 29 | 10 | -- | 30 |

Source: Sea Engineering, Inc. 2002
Note: Site D' was also surveyed in 1991.

Enumerated data for each species of algae, coral and fish are presented in Appendix A.

~~***e. Site Comparison 2002***~~

***(3) Site Comparison 2002***

The number of coral and fish species at Sites A and B appear higher than at Sites A' through D'. See ~~Table 3~~Table 4. The number of algae species appears to remain relatively constant at all sites except D', which supported slightly lower numbers of algae.

**~~Table 3~~Table 4**

| NUMBERS OF SPECIES AT SITES A, B, A', B', C', D' ~~and~~IN 2002 | | | | | | |
|---|---|---|---|---|---|---|
| ***Group*** | ***Site A*** | ***Site B*** | ***Site A'*** | ***Site B'*** | ***Site C'*** | ***Site D'*** |
| Coral | 8 | 8 | 3 | 3 | 4 | 3 |
| Algae | 17 | 19 | 20 | 22 | 17 | 12 |
| Fish | 50 | 54 | 23 | 23 | 29 | 30 |
| Source: Sea Engineering, Inc., 2002 | | | | | | |

From a spatial perspective, Site A has significantly better coral cover than the other sites. Site B has significantly less coral cover than Site A, but more than Site A'. The lower coral cover at Site B compared to A may be a result of the presence of Kauaula Stream discharge at this site. There is no statistical difference between Site B and Sites B', C' and D'. Generally, Sites A' through D' have low coral cover compared to Sites A and B, although they do not appear to differ from each other. The number of coral species appears relatively constant among the six (6) sites and through time, with the suggestion that Sites A and B may have more than Sites A' through D'.

~~*f.* ***Marine Macroalgae***~~

***(4) Marine Macroalgae***

A total of five (5) species of culturally important marine macroalgae (i.e. seaweed or "limu") were found during the 2002 survey work. These species are used locally as a traditional food source. They were *Dictyopterus plagiogramma* (limu lipoa), *Asparagopsis taxiformis* (limu kohu), *Ulva Fasciatus* (palahalaha), *Codium spp.* (wawae'iole), and *Enteromorpha spp.* ('ele'ele). Of these, palahalaha is probably the least used today. At the site closest to the proposed second outlet site (D'), two (2) out of the five (5) culturally important species were found (limu lipoa and limu kohu). None of these species were observed at Site B, which is where Kauaula Stream discharges.

### *10.* ***Water Quality***

An assessment of the inshore and offshore water quality in the project area was carried out by Sea Engineering, Inc. See Appendix A. The field work for the water quality assessment was conducted in March and April, 2002. Water samples were collected at four (4) ocean stations and three (3) shoreline stations in the vicinity of the Puamana channel outlet and off Puamana Park. An additional set of samples were collected in April, 2002 further southward along the coast. The results of the water quality analysis in the project area are summarized as follows.

#### *a.* ***Temperature and Salinity***

Temperature and salinity showed small variation from place to place. Temperatures ranged from 24.3 to 26.2 degrees Celsius. Salinity measured in the range from 34 to 36 parts per thousand (ppt). The reading measurements were sufficient to establish that no great influence from terrestrial drainage or groundwater seepage was evident in the samples taken.

b. ***Dissolved Oxygen***

Dissolved oxygen (DO) values measured in March, 2002 were normal in the range of 92 to 115 percent saturation (percentage present as a function of oxygen solubility at the given temperature and salinity).

c. ***pH***

The pH values in the March 2002 samples measured 8.1 with very little variation and is very ordinary for sea water samples.

d. ***Turbidity and Suspended Solids***

Turbidity and total suspended solids (TSS) are measures of the concentrations of fine particulates in the water. Turbidity is a measure of the light reflecting off the small particles and TSS is the dry weight of the suspended material. Both turbidity and TSS tended to show greater variability than any of the other parameters measured in the water quality analysis. Turbidities measured from spot samples ranged from 0.44 to 15.6 ntu, with the highest values always at inshore locations. Suspended solids varied from 1.8 to 223 mg/l and appear to reasonably correlate with the turbidity values.

e. ***Nutrients***

Nutrients are measured because of the influence these chemicals have on growth rates and abundance of phytoplankton and benthic algae. Excessive benthic algal growth washing up on West Maui beaches has been a serious problem for a number of years. Nutrient (ammonia, nitrate + nitrite, total nitrogen, and total phosphorus) values collected in March and April 2002 off the project coastline tended to be low and not particularly variable from place to place.

f. ***Chlorophyll***

The measurement of chlorophyll in water samples provides an estimate of the relative abundance of phytoplankton. Chlorophyll values measured were somewhat variable. Low values (range 0.04 to 0.73 ug/l) characterized all of the offshore stations in the March sample while elevated values characterized the inshore samples. Low values obtained in the April sample characterized all of the values obtained (inshore and offshore).

g. ***Pesticides***

Testing the chemical quality of the sediment due to residual agricultural pesticides, since a component of the expected increase in turbidity will be sediment originating from fallow agricultural lands, was considered to be ineffective in assessing potential impacts of the proposed project. The sediments found on the marine floor along the project shoreline are coarse-grained sands, gravels, and cobbles from terrigenous and marine sources. Pesticides and other pollutants, when attached to sediment particles, are usually associated with fine-grained sediments such as clays and silts. Fine-grained sediments remain in suspension in the energetic marine environment fronting the project area and are dispersed by ocean currents. Therefore, fine-grained sediments would not settle in the nearshore marine environment in measurable quantity.

### 11. *Mineral Resources*

There are no identified mineral resources within the proposed project channel.

### 12. *Archaeological Resources*

As previously indicated, lands surrounding and within the proposed project channel were formerly utilized for growing sugarcane, while the remaining portion of the proposed project channel is situated within the limits of the former Wainee Village.

An Archaeological Inventory Survey by Xamanek Researches was undertaken to identify archaeological resources within the project area. Field work was carried out over a six (6) week period between August and September 2002.

A pedestrian portion of the inventory survey did not locate any surface structural remains. A total of 86 backhoe trenches were excavated during the course of the archaeological inventory survey. One (1) previously unrecorded site (Site 50-50-03-5239) was identified during the course of the inventory survey. This site consists of an in situ human burial that was located during subsurface testing. The remains appeared to be a flexed burial, placed in a pit, suggesting a native Hawaiian burial. A preservation plan was prepared for the burial find and approved in principle by the Maui/Lana'i Islands Burial Council. No recognizable precontact cultural layers were found during the subsurface testing. See

Appendix "B".

### 13. *Air Quality*

The Lahaina region is not exposed to adverse air quality conditions. There are no point sources of airborne emissions in the immediate vicinity and the air quality in the vicinity of the proposed project is considered good. Motor vehicles are the primary source of indirect emissions in the region.

### 14. *Noise Characteristics*

There are no significant fixed noise generators in the vicinity of the proposed project channel. Existing background noise in the project area is attributable to vehicles travelling along Honoapiilani Highway, as well as vehicles on Lahainaluna Road proceeding to or from Princess Nahienaena Elementary School, Lahaina Intermediate School, and Lahainaluna High School.

### 15. *Scenic Resources*

Elevations of the proposed project channel range from about 153 feet amsl at its northern intake channel to sea level at the second outlet to the south. The West Maui Mountains are visible to the east of the proposed project channel, while the town of Lahaina, the Pacific Ocean, and the offshore island of Lanai, are visible to the west of the project area.

## B. *COMMUNITY SETTING*

### 1. *Land Use and Community Character*

The vast majority of lands in West Maui are either State designated "Conservation" or "Agricultural". Generally, "Conservation" lands occupy the higher elevations and along the shoreline, while the

"Agricultural" district spans the middle ground. The major exception to this trend is the Honolua Stream area where the "Conservation" district extends from the higher elevations down to sea level.

"Urban" designated lands occupy the lower elevations along the coast. Kapalua and Kaanapali contain Community Plan designations reflective of their resort nature. The communities of Kahana and Napili contain a mixture of resort, residential and business uses. Lahaina, meanwhile, encompasses a diverse mix of land uses, including residential, public/quasi-public, business, light industrial, recreational and agricultural uses.

The town of Lahaina is the commercial center for West Maui. The town contains several shopping centers and retail business areas, and serves as a hub for the region's residential housing.

West Maui's attraction can be attributed to its year-round dry and warm climate, complemented by many white-sand beaches and scenic landscape. Visitor accommodations are located in Lahaina and the resort communities of Kaanapali, Kahana, Napili, and Kapalua. The State of Hawaii's Kapalua-West Maui Airport at Mahinahina links the region to Oahu and other neighbor islands.

Diversified agriculture and pineapple fields occupy much of the land in the West Maui region. Pioneer Mill Company cultivates their agricultural lands in the Kaanapali area with seed corn. Maui Land & Pineapple Company's fields span along the slopes of the West Maui Mountains north of Lahaina. Within the Lahaina Watershed approximately 1,262 acres of agricultural land were formerly used for the production of sugarcane. However, the majority of these lands are fallow and only approximately 50 acres are used for diversified agriculture, such as sweet corn, bananas, papayas and coffee.

### 2. ***Population***

In 2000, the population of the island of Maui was 120,038, with 17,748 persons (15 percent) of the island's population residing in West Maui. Since 1970, West Maui has seen an increase in population, with the population increasing from about 5,500 persons in 1970, to approximately 10,300 persons in 1980, and to about 14,600 persons in 1990.

West Maui's annual average population growth over the last three (3) decades has kept pace with that of Maui County. The year 2000 County population was 128,241, compared to a 1990 population of 100,374.

### 3. ***Demography***

The overall West Maui population in 2000 differed from the County in terms of age and ethnic distribution as reflected in ~~Table 4~~Table 5. West Maui had proportionally a larger eligible labor force.

As noted in the preceding table, 66 percent of West Maui's population were in the labor force ages between 20 to 64 years of age, while County-wide 61 percent of the population were in this age category. West Maui had a slightly higher median age of 39.3 years, when compared to the County-wide median of 36.8 years.

~~Table 4~~Table 5

| AGE AND ETHNICITY | | |
|---|---|---|
| ***Population*** | ***Maui County*** | ***West Maui*** |
| | 128,094 | 17,748 |
| ***Age*** | | |
| Under 5 | 7 percent | 7 percent |
| 5 to 19 | 21 percent | 17 percent |
| 20 to 44 | 37 percent | 42 percent |
| 45 to 64 | 24 percent | 24 percent |
| 65 and older | 11 percent | 10 percent |
| Median age | 36.8 years | 39.3 years |
| ***Ethnicity*** | | |
| Caucasian | 34 percent | 55 percent |
| Japanese | 10 percent | 5 percent |
| Hawaiian | 9 percent | 6 percent |
| Filipino | 17 percent | 13 percent |
| All Others | 30 percent | 21 percent |
| Source: U.S. Census Bureau, 2000. | | |

## 4. *Household and Family Characteristics*

In 2000, West Maui contained 5,951 households, accounting for 14 percent of all of Maui County's 43,507 households. The average household sizes in Maui County and West Maui were 2.91 and 2.79 persons, respectively.

In terms of the proportion of family households, 69 percent of Maui County's households in the year 2000 were family households. In West Maui, 67 percent of the total households comprised families.

Based on 1990 household income information, West Maui's poverty rate of 3 percent for that year was one-half the County-wide rate.

### 5. ***Housing***

West Maui's 2000 housing stock of 10,314 units had a vacancy rate of 52 percent, which was higher than the County-wide rate of 23 percent. West Maui's housing vacancy rate stems from units reserved for visitor use and secondary homes of absentee owners.

County-wide, owners lived in 58 percent of the occupied homes. Owner occupancy tended to be slightly higher in West Maui, with 60 percent of the units being owner-occupied.

Housing values in West Maui were noticeably higher than those of the County-wide housing supply. Whereas the median home valuation for December 2002 in Maui County was $400,891.00, Lahaina's median was $477,500.00 (Realtor Association of Maui, February 2003). The region's median monthly rent of $776.00 was more than $100.00 above the County median of $658.00.

### 6. ***Labor Force***

As of December 2002, the unemployment rate for Maui County and the island of Maui stood at 4.1 percent and 3.9 percent, respectively (State Department of Labor and Industrial Relations, February 2003).

In terms of the profile of employed persons, West Maui generally follows the County-wide trends for the labor force characteristics shown in ~~Table 5~~Table 6.

~~Table 5~~Table 6

| LABOR FORCE CHARACTERISTICS | | |
|---|---|---|
| ***Occupational Category*** | ***Maui County*** | ***West Maui*** |
| Agriculture | 3 percent | 1 percent |
| Manufacturing | 2 percent | 1 percent |
| Construction | 4 percent | 4 percent |
| Transportation, Communication and Utilities | 6 percent | 3 percent |
| Trade | 21 percent | 22 percent |
| Banking, Finance | 4 percent | 4 percent |
| Hotel | 14 percent | 27 percent |
| Other Services | 16 percent | 12 percent |
| Government | 9 percent | 4 percent |
| Self-Employed | 21 percent | 22 percent |
| Source: SMS, 2002 | | |

In terms of the profile of employed persons, more West Maui workers were employed in the hotel service industry (27 percent) when compared to the County-wide profile (14 percent). Because of West Maui's emphasis on hotel service jobs, all other job sectors exhibited slightly lower participation rates.

## 7. Economy

The economy of Maui is heavily dependent upon the visitor industry. The dependency on the visitor industry is especially evident in West Maui, which is one of the State's major resort destination areas. As such, a community of tourism service sector workers has developed in the area. This group includes former sugar company workers and their families, younger mobile workers, and immigrants from Asia and other Pacific Islands.

Agriculture, another component of the West Maui economy, is handled by Pioneer Mill Company, Ltd. and Maui Land & Pineapple Company, Inc. Until the closure of sugarcane cultivation in September 1999 and coffee in 2001, Pioneer Mill cultivated most of its approximately 6,700 acres of fee simple and leased lands with sugarcane and coffee. Pioneer Mill is currently in the process of diversifying its agricultural operations by utilizing portions of its lands for seed corn in the Kaanapali area. Kamehameha Schools presently leases approximately 50 acres of its land in the Lahaina area for diversified agriculture and plans to expand its agricultural leases.

Pineapple fields cultivated by Maui Land & Pineapple Company also remain an important component of the region's agricultural base.

### 8. ***Police and Fire Protection***

The proposed project is within the Lahaina Police Station service area, which services all of the Lahaina district. The Lahaina Station is located in the Lahaina Civic Center complex at Wahikuli, and was built in the early 1970's. The Lahaina Patrol includes 54 full-time personnel, consisting of one (1) captain, one (1) lieutenant, seven (7) sergeants, and 39 police officers. The remaining six (6) personnel consist of public safety aides and administrative support staff.

Fire prevention, suppression and protection services for the Lahaina District is provided by the Lahaina Fire Station, also located in the Lahaina Civic Center, and the Napili Fire Station, located about 9 miles to the north of the project site. The Lahaina Fire Station includes an engine and a ladder company, and is staffed by 30 full-time personnel. The Napili Fire Station consists of an engine company including 15 full-time firefighting personnel.

### 9. ***Medical Facilities***

The only major medical facility on the Island is Maui Memorial Medical Center, located midway between Wailuku and Kahului. The 196-bed facility provides general, acute, and emergency care services.

Private medical offices, however, are found in West Maui. For example, regular hours are offered by the Maui Medical Group, Lahaina Physicians, West Maui Healthcare Center, and Kaiser Permanente Lahaina Clinic.

### 10. ***Recreational Facilities***

West Maui is served by numerous recreational facilities offering diverse opportunities for the region's residents. These facilities include several County parks and beach parks in West Maui. Approximately one-third of the County parks are situated along the shoreline and are excellent swimming, diving, and snorkeling areas. In addition, Kaanapali and Kapalua Resorts operate world-class golf courses which are available for public use.

Recreational facilities in the vicinity of the project site include the Lahaina Aquatic Center, West Maui Youth Center, and the Lahaina Recreation Center. The Lahaina Aquatic Center contains an Olympic-size swimming pool, a children's wading pool, a paved parking lot, and office and storage space, as well as facilities containing showers, restrooms, and changing rooms. The West Maui Youth Center provides a building for youth activities, as well as paved parking and an outdoor playground and basketball court. The Lahaina Recreation Center includes baseball fields and playfields for soccer and football, as well as restroom and paved parking facilities.

In addition, just west of the proposed project channel in the vicinity of the former Wainee Village, Amfac/JMB Hawaii has completed site work for a 13-acre park which will be dedicated to the County of Maui and will expand the existing Lahaina Recreation Center facilities. The park, which is nearing completion, will include playfields, landscape plantings, restroom facilities, and paved parking areas.

Lahaina's coastal environment offers many recreational opportunities for residents and visitors. Many tourism-based businesses also rely on shoreline and marine resources for their operation.

Fishing by shorecasting and netting is practiced in the nearshore ocean waters near the outlet of Kauaula Stream and Makila Point. Edible seaweed collecting, octopus fishing, and spearfishing occur on the adjacent reef flat. During periods of wave activity, the area is a good location for surfing and several instructors use it on a daily basis to teach the sport.

An inventory of Maui's coral reefs, published by the Corps of Engineers, documents excellent visibility in deeper waters off Lahaina Town, with extensive coral cover. This water quality characteristic is important to the commercial diving charter and glass-bottom boats operating out of Lahaina Harbor.

### 11. Educational Facilities

The State of Hawaii, Department of Education operates four (4) public schools in West Maui: Lahainaluna High School; Lahaina Intermediate School; King Kamehameha III Elementary School; and Princess Nahienaena Elementary School. All of the public schools are located within the Lahaina Town area.

The region is also served by privately operated pre-elementary and elementary schools.

## C. INFRASTRUCTURE

### 1. Roadways

#### Honoapiilani Highway

Honoapiilani Highway (State Highway 30), the principal arterial roadway in West Maui, provides north-south regional mobility and access to communities in the region. For most of its length, Honoapiilani Highway operates as a two-lane arterial roadway with median left-turn lanes provided at major intersections. From Lahaina Town (just south of Dickenson Street) to the Honokowai Stream Bridge, Honoapiilani Highway functions as a four-lane arterial roadway. In the vicinity of the proposed project channel, Honoapiilani Highway has a posted speed limit of 35 mph.

#### Lahainaluna Road

Lahainaluna Road is a two-lane County roadway providing east-west access from Front Street in the west to Lahainaluna High School in the east at approximately 600 feet amsl. The proposed project intake basin is located south of Lahainaluna Road at approximately 153 feet amsl. The posted speed limit on Lahainaluna Road in the vicinity of the project is 20 miles per hour (mph).

***HoKioKio Place***

HoKioKio Place is a east-west, two-lane private road located south of Kauaula Stream. The road will form a T-intersection with Honoapiilani Highway. The road crosses the proposed flood control channel to provide access to the Puunoa agricultural subdivision located mauka of the channel and the proposed Lahaina Bypass. The proposed flood control channel will be designed to accommodate this new road and allow flood water to pass under the road.

***Lahaina Bypass***

The proposed Lahaina Bypass Highway from Launiupoko in the south to Honokowai in the north is located to the east of the floodwater diversion system. The Environmental Impact Statement for the Lahaina Bypass has recently been accepted by the Governor. This project is anticipated to be developed in phases with the Phase I improvements to begin in late 2004. The roadway section from Lahainaluna Road south to approximately 1,000 feet north of Launiupoko Point would initially consist of two (2) travel lanes and a separate northbound truck-climbing lane. This roadway section is located approximately 500 feet mauka (east) from the proposed floodwater diversion channel from Lahainaluna to Kauaula Stream and approximately 1,500 feet (mauka) of the proposed floodwater diversion channel south of Kauaula Stream. Where the proposed highway traverses drainageways, within the project subwatersheds, the existing drainage pattern will be maintained by construction of culvert structures to allow runoff to flow under the highway. The intent of this "pass-through" system is to ensure that the functional characteristics of the flood diversion project is not adversely impacted by the future roadway.

***Dickenson Street Extension***

The County of Maui, Department of Public Works and Environmental Management, ~~proposes to extend~~proposed the extension of Dickenson Street. Work for the project ~~will~~would have involved the ~~construction~~extension of a two-lane roadway within a 60-foot right-of-way, a distance of approximately 4,250 feet mauka of Honoapiilani Highway. ~~The proposed project will extend Dickenson Street mauka of Honoapiilani Highway a distance of approximately 4,250 feet. From this point, the Dickenson Street Extension will head north about 750 feet where it will form a T-intersection with Lahainaluna Road. The Dickenson project will traverse the Lahaina Watershed floodwater diversion system in the vicinity of the northern intake basin adjacent to Lahainaluna Road. Design coordination with the County of Maui and NRCS has been carried out to ensure that the functional characteristics of the floodwater diversion channel, as well as operational characteristics along the Dickenson Street Extension project will not be adversely impacted.~~ The County has placed this project on inactive status. Instead, an extension of Keawe Street (north of Kahoma Stream) to the Lahaina Bypass is proposed.

***Agricultural Roads (Non-Public)***

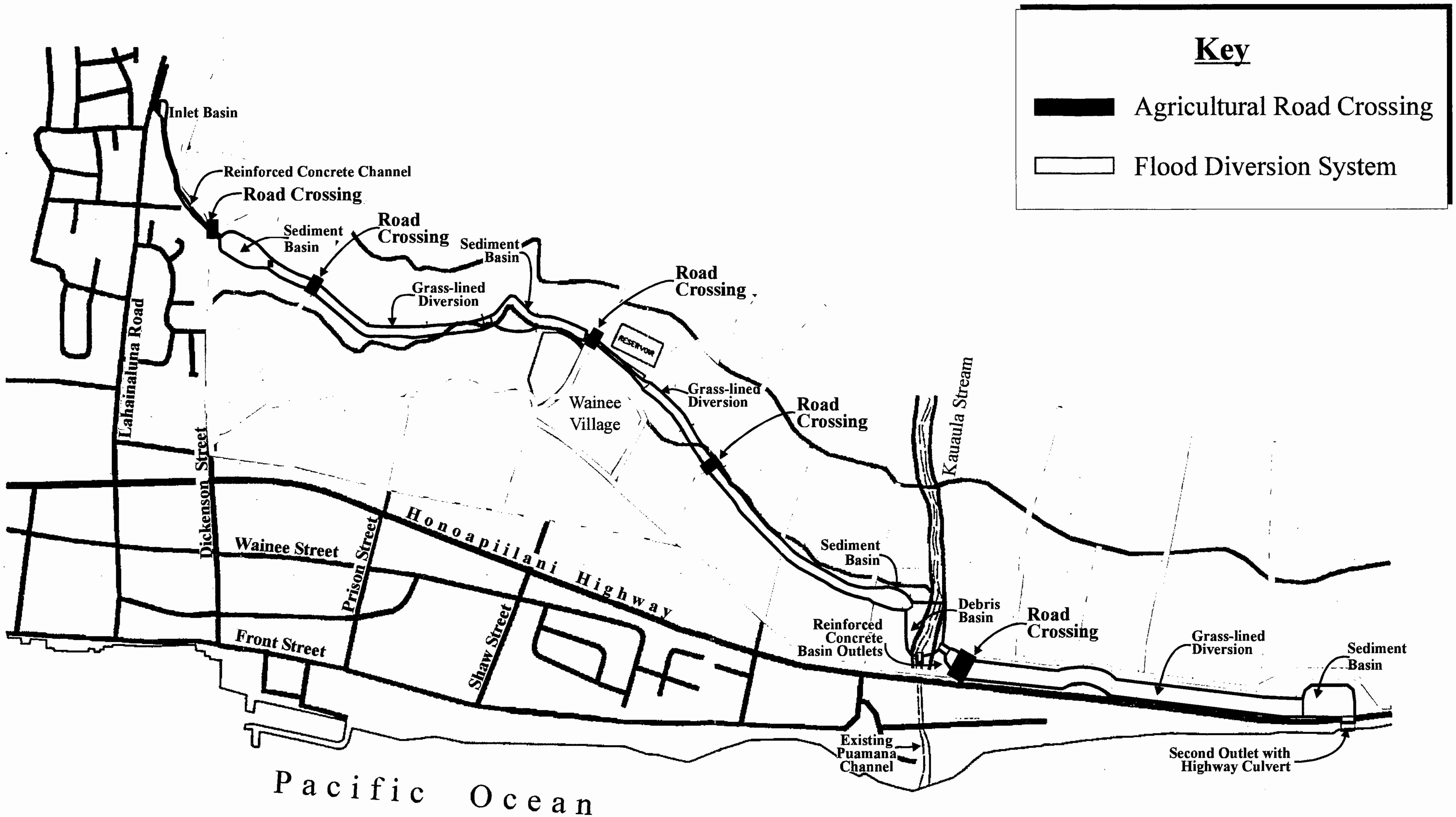
There are a number of non-public roads in the vicinity of the floodwater diversion system which formerly were used for cane hauling roads and other agricultural related accesses within the project area. In particular, Aholo Road provides access to Kamehameha Schools and Pioneer Mills' agricultural lands and the Kauaula Road is a traditional road serving Kauaula Valley residents. The proposed floodwater diversion system traverses these and a number of other non-public roads along its alignment corridor. Early consultation with the owners and users of these non-public roads has taken place and maintenance of future access through the floodwater diversion system for agricultural purposes and for the residents of Kauaula Valley has been accommodated in the proposed flood control project. See Figure 12.

## 2. ***Water***

The West Maui region is served by the County's Department of Water Supply domestic water system. The County water system services the coastal areas from Launiupoko to Kaanapali and from Honokowai to Napili. The County's system includes both surface and groundwater sources.

The source of water for Lahaina are five (5) deepwells located above Alaeloa and referred to as Napili Wells A, B, and C, and Honokahua Wells A and B. These wells are supplemented by water treatment plants above Honokowai and Lahainaluna High School that draws surface water from the Honolua Ditch and Kanaha Valley. Several miles of 12- and 16-inch lines and two (2) in-line booster stations convey water from these sources to consumers in Lahaina.

Storage is provided by a 1.5 million gallon (MG) storage tank




Source: USDA, Soil Conservation Service

Figure 12

Lahaina Watershed Flood Control Project
Agricultural Road Access

NOT TO SCALE

MUNEKIYO & HIRAGA, INC.

Prepared for: County of Maui, Department of Public Works and Environmental Management

above Wahikuli and a 1.0 MG tank on Lahainaluna Road. There is an 8-inch line on Shaw Street. This line connects to a 12-inch line on Mill Street that loops back to an 8-inch line on the west side of Honoapiilani Highway.

West Maui is also served by other private water systems serving the Kaanapali Resort and Kapalua Resort areas and the Launiupoko and Olowalu areas.

### 3. *Wastewater Systems*

The County's wastewater collection and transmission system and the Lahaina Wastewater Reclamation Facility (LWRF) accommodate the region's wastewater needs. The LWRF, located along Honoapiilani Highway just north of Kaanapali Resort, has a design capacity of 9.0 MGD.

### 4. *Solid Waste*

Residential refuse collection is provided by the County's Solid Waste Division. Private refuse collectors provide solid waste disposal services for commercial and institutional accounts. With the exception of the Hana region, residential and commercial solid waste from throughout the island is transported to the Central Maui Landfill at Puunene.

A refuse transfer station located at Olowalu accepts household and green wastes, as well as used oil, for transport to the Central Maui Landfill in Puunene. The disposal of commercial and institutional refuse is not permitted at the Olowalu transfer station.

## 5. Drainage

### a. Existing Watershed and Drainage Conditions

The proposed project alignment gently slopes in an easterly to westerly direction and varies in elevation from about 153 feet amsl at its northern extent to approximately 1.5 feet amsl at the outlet of the second channel where it crosses under Honoapiilani Highway and discharges into the ocean.

The proposed project is situated within the lower limits of the 5,250-acre Lahaina Watershed. The Lahaina Watershed is made up of three (3) subwatersheds: the Lahaina subwatershed covers an area of 2,140 acres; the Kauaula subwatershed covers an area of 2,780 acres; and the subwatershed draining into the second outlet channel covers an area of 330 acres.

The Lahaina subwatershed rises from the Pacific Ocean to an elevation of 2,561 feet amsl. The coastal area of the subwatershed is relatively flat and has been developed for residential and commercial uses. The area above the developed flatland to about the 1,400 foot elevation is gently sloping and was formerly utilized for growing sugarcane. The remaining upper area of the Lahaina subwatershed is steep, rising to an elevation of 2,561 feet amsl and was previously utilized for sugarcane cultivation or pasture use.

There are no streams or large well-defined drainageways in the Lahaina subwatershed. Runoff generated in the former sugarcane fields above Lahaina Town is conveyed by numerous small gullies through the former sugarcane fields and cane haul roads, through culverts under Honoapiilani Highway, and into Lahaina Town where it drains into the ocean or ponds in low spots in the vicinity of Malu-ulu-o-Lele Park and commercial areas around Front and Wainee Streets and dissipates through infiltration or evaporation. The storm drainage system within Lahaina Town consists of short, limited capacity culverts which outlet to the ocean.

Kauaula Stream is the major drainageway through the Kauaula subwatershed. The stream, which originates on the western slopes of the West Maui mountains at an elevation of 5,220 feet amsl, follows a westerly course through the subwatershed discharging into the ocean at the Puamana channel located at Makila Point. The upper reaches of the stream are perennial, while in the lower reaches in the vicinity of the proposed project area, the stream is intermittent.

The contributory drainage area above the proposed project channel contains two (2) former irrigation reservoirs. The first reservoir is located mauka of the proposed project in the vicinity of the former Wainee Village, while the second reservoir is situated approximately 2,000 feet upslope of the proposed project. The lands within this area were previously planted in sugarcane and are bisected by several dry north-south irrigation ditches. With the exception of a 50-acre area in diversified agricultural use, the remaining lands are now fallow due to the termination of Pioneer Mill's sugarcane cultivation operations in 1999. The proposed project will not impinge upon the irrigation reservoirs.

**b.** ***Interim Improvements***

WMSWCD, with assistance from NRCS, recently constructed an interim diversion channel mauka of the proposed project approximately two (2) miles in length from Lahainaluna Road to Kauaula Stream. The diversion channel connects to the reservoir located near the former Wainee Village. The reservoir was converted into a catchment basin and runoff flows downslope in a southwesterly direction to Kauaula Stream. A second shorter diversion channel was constructed to pick up the runoff from Lahainaluna Road and from the upper diversion channel. The lower diversion channel empties into a large catchment basin and spills over into an existing drainage sump south of the Lahaina Aquatic Center. The County of Maui provided funding in the 2002/03 fiscal year for additional improvements to the catchment basin to contain storm runoff and sediment. These interim measures will be replaced by the proposed project.

In addition, Kamehameha Schools and the State of Hawaii, Department of Land and Natural Resources, with design support from NRCS, have worked cooperatively to terrace portions of their lands above Lahainaluna Ditch to prevent erosion and manage storm runoff.

**6.** ***Hydrology***

**a.** ***Storm Runoff***

Revisions to the 1992 storm runoff analyses were carried out by U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) in October 2002 to account for the changes in land use due to the closure of Pioneer Mill and the cessation of sugarcane cultivation in the Lahaina Watershed. The hydrological reevaluation resulted in increase peak discharge in the Lahaina Subwatershed while peak discharge in the Kauaula Subwatershed remained generally unchanged from the 1992 Watershed Plan. See Appendix C.

The results of the October 2002 stormwater runoff calculation are displayed in ~~Table 6~~Table 7.

**~~Table 6~~Table 7**

| ***LAHAINA WATERSHED PEAK STORM DISCHARGES, 2002 (Cubic Feet/Second)*** | | | | | | |
|---|---|---|---|---|---|---|
| | ***2 year*** | ***5 year*** | ***10 year*** | ***25 year*** | ***50 year*** | ***100 year*** |
| Ocean Discharge at Puamana | 723 | 1,590 | 2,338 | 3,320 | 4,037 | 4,773 |
| Ocean Discharge at Second Outlet | 765 | 1,683 | 2,478 | 3,714 | 4,753 | 5,824 |
| Source: USDA, NRCS, October 2002. | | | | | | |

***b.*** ***<u>Sediment Discharge</u>***

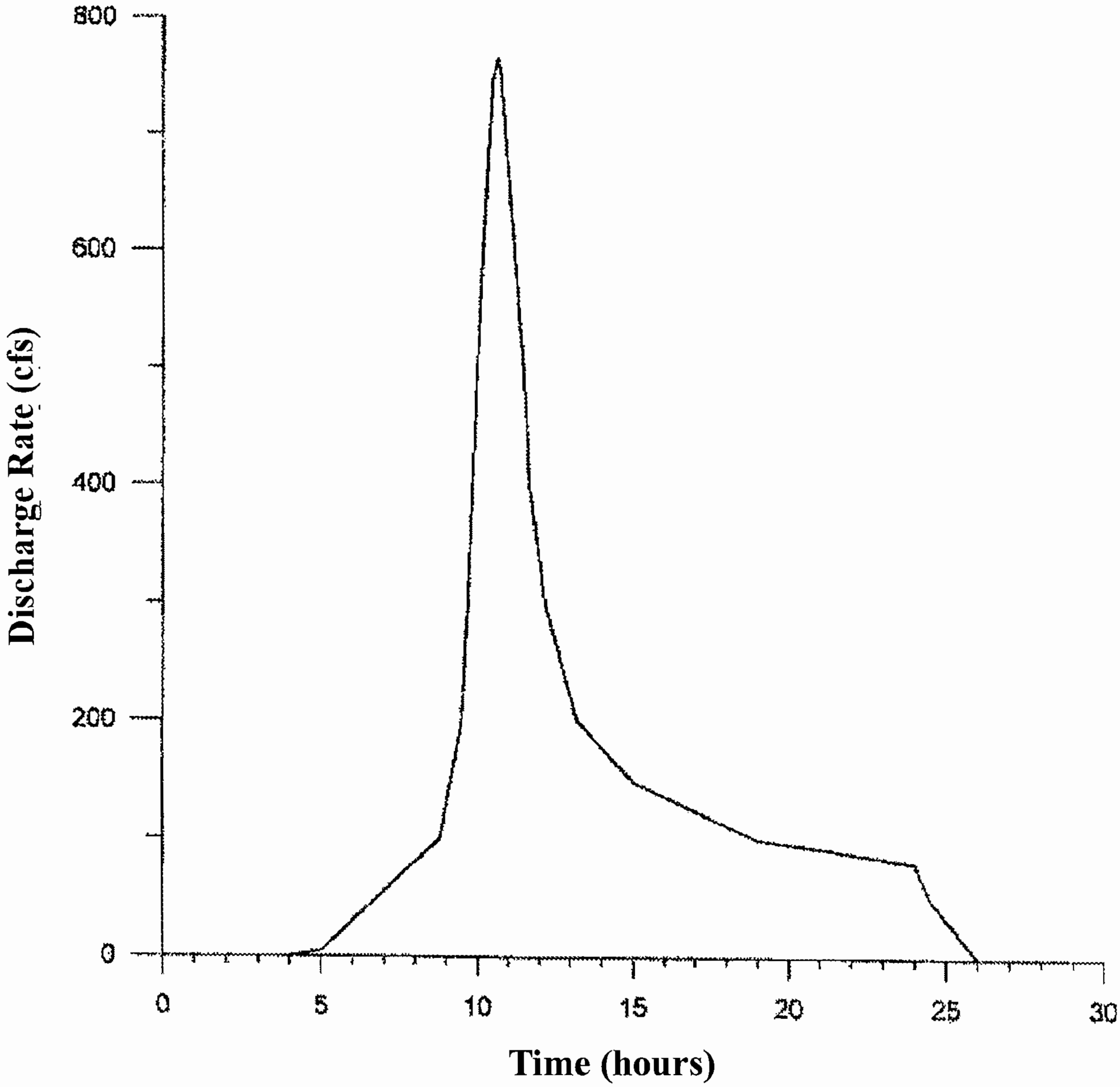
Sediment discharge from the former sugarcane fields in the Lahaina Subwatershed will increase because of the changes in land use and runoff volume. Therefore, the earlier estimated quantities of sediment yield from the Lahaina Subwatershed was revised with the increased runoff quantities. As the sediment basins along the diversions are designed to limit flow velocity, the sizes of the basins have been enlarged accordingly.

### c. ***Storm Discharge***

The discharge rate as a function of time for a 2-year storm in the project area is shown in Figure 13. Sea Engineering, Inc. describes the discharge flow activities as follows.

> "The shape of the curve is typical for a storm in this area, and also applies to the 5-year and 10-year storms. The discharge event lasts about 26 hours. Discharge slowly builds during the first 9 hours of the storm, and then increases 6-fold in the next 1 to 2 hours. The peak discharge occurs about 10.5 hours after the onset of the rain and lasts less than 30 minutes. Discharge rate declines rapidly on either side of the peak. The peak 6-hour average discharge rate is about 45 percent of the absolute peak flow, but accounts for 63 percent of the total discharge volume of the storm." (Sea Engineering, Inc., 2002, page 43)

~~Table 7~~Table 8 lists the peak and peak 6-hour average discharges for the 2-, 5- and 10-year discharge events which were used to assess discharge plum impact at the second outlet.




Source: Sea Engineering, Inc., 2002

Figure 13

Lahaina Watershed Flood Control Project

Discharge Rate at Waianukole Outlet During 2-Year Storm

NOT TO SCALE

Prepared for: County of Maui, Department of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

**~~Table 7~~Table 8**

| SECOND OUTLET DESIGN DISCHARGE RATES | | | |
|---|---|---|---|
| | ***2-year storm*** | ***5-year storm*** | ***10-year storm*** |
| Peak discharge rate (cfs) | 765 | 1,683 | 2,478 |
| Peak 6-hour average discharge rate (cfs) | 341 | 751 | 1,106 |
| Source: Sea Engineering, Inc. 2002. | | | |

## 7. *Electrical, Telephone and CATV Service*

Electrical, telephone, and cable television (CATV) services for the West Maui region are provided by Maui Electric Company, Ltd., Verizon Hawaii, and Hawaiian Cablevision Company, respectively. Power is currently available along Lahainaluna Road and on Shaw Street up to the Lahaina Aquatic Center.

# Chapter III

## Potential Impacts and Mitigation Measures

# III. POTENTIAL IMPACTS AND MITIGATION MEASURES

## A. IMPACTS TO THE PHYSICAL ENVIRONMENT

### 1. Land Use

The proposed project will provide a 100-year level of flood protection to a benefitted area which includes single- and multi-family residential land uses, business and commercial land uses, public/quasi-public land uses, and agricultural and former agricultural land uses. Viewed in this context, the potential impacts to surrounding properties from the proposed project are positive.

The floodwater diversion system will, however, require approximately 42 acres of land for installation of the floodwater diversion channel and related structures. Of this total, approximately 24 acres of land classified as "Important" agricultural land and approximately 13 acres of land classified as "Other" important agricultural will be lost due to the proposed project. However, commitment of the 24 acres of land in the "Important" category are not considered significant in light of the 1,262 acres of potentially productive agricultural land in the Lahaina Watershed and the flood protection benefits accrued to residents, businesses and public/quasi-public resources downstream of the diversion channel.

### 2. Discharge Plume Modeling

Plume transport and mixing in coastal waters is a complex process that depends on physical characteristics of both the discharging and ambient waters. To evaluate these processes and possible plume impacts to the environment, Sea Engineering, Inc. applied the numerical model CORMIX 3 to the second outlet discharge at Waianukole. It should be noted that the model describes the plume of freshwater and that because of the density difference between freshwater and saltwater, plume mixing and extent may not precisely predict the distribution of sediment. However, the plume model is a good predictor for turbidity caused by fine particulates suspended in the plume, as dilution contours are valid for any conservative tracer (i.e., not reduced by factors other than dilution). This may not be precisely accurate for turbidity caused by suspended sediment, as some material will fall out of suspension over time, but it is useful as a conservative estimate. Therefore, it is in this context, the plume model has been used to predict the spread and dilution of suspended sediment in order to assess the impact of the marine discharge at the second outlet. See Appendix A.

The CORMIX 3 model computes the position of the center of the plume as it is transported away from the discharge point, the concentration and dilution at the center of the plume, and the plume width and thickness.

The floodwater diversion system is designed to accommodate flows generated by a 100-year storm event. However, since the impacts to ocean processes, water quality and marine biology are caused by recurring events of shorter intervals, the 2-year, 5-year and 10-year storm events were calibrated for modeling purposes to assess project impacts. The results of the modeling analysis are summarized in ~~Table 8~~Table 9. The characteristics of the discharge plume are described as follows.

> "The plume generated by storm discharge will initially mix rapidly with the ambient water and flow directly offshore 500 to 1,000 feet. Beyond this, the plume

forms a thin surface layer that is transported by ambient currents, mixes slowly, is attached to the shoreline, and spreads and thins due to buoyant forces. The zone of possible impacts, therefore, is directly offshore of the outlet, where the low salinity plume directly contacts the seafloor. The areas of seafloor that are possibly directly impacted by the storm plumes are 52,424, 116,332 and 121,708 square feet for the 2, 5 and 10-year storms, respectively. Beyond this, the plume generally does not contact the seafloor, but forms a thin surface layer that should have little impact on the marine environment. The surface plumes are predicted to meet the State water quality standard of being within 10 percent of ambient salinity (31.5 ppt) within about 17 to 21 hours." (Sea Engineering, Inc., 2002, pages 45-46).

**~~Table 8~~Table 9**

| ***SUMMARY OF MODELING RESULTS*** | | | |
|---|---|---|---|
| | ***2-Year Storm*** | ***5-Year Storm*** | ***10-Year Storm*** |
| Peak Discharge Rate (cfs) | 765 | 1,683 | 2,478 |
| 6-Hour Average Discharge Rate (cfs) | 341 | 751 | 1,106 |
| Area of ~~seaflow~~seafloor impacted by plume with salinity less than 28 ppt (square feet) | 52,424 | 116,332 | 121,708 |
| Time for plume to meet salinity water quality standards (hours) | 17.3 | 19.7 | 20.7 |
| Source: Sea Engineering, Inc., 2002. | | | |

### ***3. <u>Flora and Fauna</u>***

Vegetation on the lands surrounding and within the proposed project channel include weeds, grasses, shrubs, and trees. The scrub vegetation within the proposed project channel developed following the abandonment of sugarcane cultivation and the demolition of the remnant structures in the former Wainee Village. There are no known rare, endangered or threatened species of flora in the vicinity of the proposed project channel that will be adversely affected by the proposed action.

The indigenous species of avifauna in the proposed project area are the Golden-plover (*kolea*), Black-crowned Night Heron (*'auku'u*), and the Hawaiian Owl (*pueo*). Kolea are generally found on mudflats, lawns, and fields, while, 'auku'u frequent water features such as ponds, streams, marshes and lagoons, and pueo hunt rats and mice in the open fields. These species of avifauna are protected under the Migratory Bird Treaty Act and are considered indigenous, but not listed as Federally endangered. However, the pueo is listed as endangered by the State of Hawaii. Moreover, since only 42 acres of land will be directly utilized for the proposed floodwater diversion channel, of which approximately 36 acres will be maintained as a grassed earthen swale, the impact on habitat of the kolea, 'auku'u, and pueo are not considered to be significant.

Both the Grigg study (1991) and the Sea Engineering, Inc. study (2002) concludes the proposed project will not adversely impact the green sea turtle or humpback whale. The Sea Engineering, Inc. report states:

> "Grigg (1991) concluded that the proposed project would not pose any significant negative impacts to endangered or threatened species in the area including the Hawaiian green sea turtle, Chelonia mydas. The shoreline in the area of the proposed second drainage outlet is mostly rocky, with only narrow deposits of sand and virtually no sand

backshore where turtles might lay eggs. Inland from the shore deposits of mostly rounded stones and rocky outcrops, is an eroding embankment that rises steeply to the highway. Thus, turtles would utilize this area only for feeding on algae covered hard bottom off the shore. Changes in the abundance and types of algae due to the second outlet will likely occur over a limited area that should not significantly alter the turtle population.

With respect to humpback whale (Megaptera novaeangliae), these animals would never inhabit the shallow nearshore waters directly off the proposed drainage outlet or the waters close in where turbidity, influenced by runoff might be high. The purpose of the project is to reduce flooding and, through a series of settlement and debris basins, reduce the amount of sediment discharged from the Lahaina watershed. Therefore, the impact on the waters offshore where whales seasonally occur should be one of no change or improved water quality." (Sea Engineering, Inc., 2002, page 72)

The Hawaiian monk seal (Monachus schauinslandi) haul out opportunistically at remote areas. They prefer sandy beaches for haul out. A recent review of the Hawaii Natural Heritage Database indicated that an endangered Hawaiian monk seal was sighted in 1985 near Mala Wharf, approximately one mile north of the project boundary. Subsequent sightings of the monk seal in or near the same location are not indicated by the Heritage Database. The reef area fronting Lahaina may provide a foraging area for the seals, but is not unique along the Maui coastline. Their prey is known to include octopus, lobster and fish, including eels and flatfish. The descriptive monograph posted by the National Marine Fisheries Service on their Stock Assessment Program website states that "a small number of seals are distributed throughout the main Hawaiian Islands" and that the major populations are located in the Northwest Hawaiian Islands. Habitat critical to the monk seal population recovery does not appear to exist near or in the project area. Installation of the proposed project should not adversely affect the habitat of the Hawaiian monk seal.

No impacts to federally-listed endangered or threatened species are expected from the implementation of the proposed project. Informal consultation in conformance with Section 7 of the Federal Endangered Species Act has been initiated with the U.S. Fish and Wildlife Service and the U.S. National Marine Fisheries Service.
In consideration of the five (5) species of "limu" (seaweed used locally as a food source) identified in the project area, two (2) of the culturally important species (limu lipoa and limu kohu) were found at Waianukole, the site of the second outlet. Since salinity and nutrient levels affect algal communities, these species ~~will~~may be impacted by the pulses of freshwater and nutrients in the second outlet stormwater discharge. The impact is estimated to be limited to an approximate area of 121,708 square feet based on a 10-year storm event. Overall, removal of discharge from the Lahaina and Makila Point area where all five (5) species of limu were found, will offset the local impact on the two (2) species near the second outlet site.

The Lahaina area has experienced blooms of nuisance algae caused by exceptional blooms of algae which are washed up onto area beaches in great windrows. Various studies have looked into the relationships between terrestrial sources of nutrients and the coastal waters (Tetra Tech, 1993; Soicher and Peterson, 1996; DeCarlo and Dollar, 1996; Kinetic Laboratories, 1997; Dollar and Andrews, 1997; and Dollar et al., 1999). The studies suggest that groundwater inputs are more significant than episodic stream inputs. Therefore, the proposed project is not anticipated to have a significant impact on benthic algal growth in the project area. Adverse cumulative impacts on the benthic algal communities in the nearshore environment due to nutrients bound to sediments discharged from the second outlet are also not anticipated. Nutrients in particulate form cannot be utilized directly by algae nor remain in the area for very long. Coastal processes will permit only limited accumulation of material contributed by the episodic discharges since, organic matter will be preferentially removed because of small particle size and/or low density.

### 4. ***Shoreline and Coastal Processes***

The proposed floodwater diversion system is estimated to reduce total annual sediment outflow by approximately 25 percent. In the evaluation of shoreline and coastal processes, Sea Engineering, Inc., assessed the impacts and mitigation measures of the proposed project as follows.

a. The Front Street Beaches were found to be composed of a high percentage (54%) of terrigenous sediment. Less terrigenous sand supply from Kauaula stream may eventually impact these beaches. Reduced sediment discharge, however, may also invigorate the coral reef habitat in the area and thereby increase the production of reef derived marine sediments (carbonate) to nourish the beaches. Mitigation measures may require a coastal management process that would include measurement of beach changes and institution of nourishment programs if necessary. If beach loss does become a problem over the long term, sand-sized sediment trapped in the project sediment basins can be placed on the beaches. This effort would be aided by designing the sediment basins to segregate the sand-sized sediment from finer silts and clays (Sea Engineering, Inc., 2002, page 72.)

b. Slow changes may also occur at Makila Point as cobbles and boulders that form the point are transported by storms while new material will be retained in the sediment and debris basins. In the long term, this change may be mitigated by feeding the system with cobbles and boulders trapped in the basins. (Sea Engineering, Inc., 2002, page 73.)

c. At the second outlet site at Waianukole, most of the suspended sediment in the discharge will move offshore with the discharge plume, however, a general increase in turbidity can be expected. High wave events should help to re-suspend and disperse turbidity-causing silts and clays. In the long term, new beaches may form in the vicinity due to the influx of sandy sediment from the discharge. (Sea Engineering, Inc., 2002, page 73.) Moreover, since pesticides and other pollutants are usually associated with fine-grained sediments such as clay and silts, adverse impacts to the nearshore environment caused by pesticides are not anticipated.

A monitoring program of the project area shoreline will be carried out to establish post-construction conditions and which will determine if more specific mitigation measures will be warranted.

5. ***Nearshore Reef Ecosystems***

During sugarcane cultivation, it was estimated that an average of 3,400 tons of sediment were annually discharged into the ocean area between Lahaina Harbor and Kauaula Stream. Although most of the sediment remained in suspension and was transported away from the area by currents, larger sediment particles and sediment aggregates were deposited on the reef.

The proposed floodwater diversion system with the second marine outlet, will greatly reduce freshwater and sediment discharge at Lahaina and at Makila Point. Negative environmental effects due to both suspended silts and clays and sands and gravel will therefore be reduced at these locations. The proposed project will have a positive impact on the nearshore reef ecosystem at these locations.

The proposed project is estimated to reduce total annual sediment outflow by approximately 25 percent. Sediment discharge in the area between Lahaina Harbor and Kauaula Stream is estimated to be reduced from approximately 3,400 tons per year to no sediment discharge with the flood control system and sediment basins in place. Sediment outflow at Kauaula Stream and Puamana channel is estimated to be reduced by approximately 52 percent, from approximately 1,850 to approximately 960 tons per year. The approximately 310 tons of sediment per year discharged near Puamana Park will be diverted to the second outlet, where discharge will increase to 3,280 tons per year.

The presence of a second outlet at the coastline at Waianukole, approximately 3,600 feet to the south of the Puamana outlet, will cause an impact over a generally smaller nearshore area (approximately 121,701 square feet based on a 10-year flood) than currently impacted by sediment discharge. Based on the marine biology of the second outlet site (D') the coral cover is very poor close to the shore and becomes patchy until approximately the 10 foot depth. The numbers of fish species and algae species are lowest at the second outlet site (D'). Overall, based on the current conditions, the proposed project will result in a net beneficial impact to the nearshore reef ecosystem resulting from an estimated total sediment discharge reduction of approximately 1,320 tons per year throughout the project area.

## 6. ***Archaeological Resources***

An archaeological inventory survey was completed for the proposed action. The overall scope of the inventory survey covered the corridor that was nearly two (2) miles long and ranged from 150 to 250 feet in width. One previously unidentified burial was located during testing. The Site 5239 burial retains its significance under both Criterion "d" and Criterion "e" of the Federal and State historic preservation guidelines. Criterion "d" is defined as having yielded, or is likely to yield, important information for research on prehistory or history. Criterion "e" is defined as having an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts. Passive "as is" preservation is recommended for this burial site.

A conceptual preservation plan was reviewed by the Maui/Lana'i Islands Burial Council. The conceptual plan which calls for in-place preservation of the Site 5239 burial, was tentatively approved, assuming that the County of Maui chooses a grass-lined swale design and the burial site is located within the project right-of-way. It is also recommended that archaeological monitoring be carried out during construction of the Lahaina Watershed Flood Control Project. This step will help mitigate adverse effects to any significant material culture remains and/or human burials that may be contained in untested portions of the project corridor. Interim protection measures will be carried out by the County of Maui to protect the burial until adoption of a final preservation plan.

Pursuant to Section 106 of the National Historic Preservation Act (1966), a Memorandum of Agreement with the State Historic Preservation Division will be executed to outline procedures for identification of, preservation of, and if required, mitigation of effects on cultural material and/or human burials that may be discovered during project installation in untested portions of the project corridor.

### 7. *Cultural Impact Assessment*

#### a. *Settlement Context*

The Lahaina District was considered to be a favorable place by high chiefs because of its natural resource qualities and its proximity to Lana‘i and Moloka‘i (Rosendahl, 1994). The majority of lands up to approximately the 700-foot elevation comprised a nearly continuous band of agricultural and related habitation features. Initial development of the field systems likely occurred between AD 1200 to 1400. Seasonal dryland agricultural practices eventually evolved to year-round cultivation as water diversion and distribution improvements were implemented.

Historical accounts document Lahaina as an important population center. Such accounts note the continued presence of agriculture through the early 1800's. Crops included taro, potatoes, yams and sugarcane.

With the decline of the whaling industry, which brought a new populace to Lahaina, the sugar industry began to evolve. The sugar industry was developed in the mid-1800's and over the next few years, further developed with the eventual consolidation of multiple smaller mills into what is known today as Pioneer Mill Company, Ltd. As with other sugar plantation communities, the late 1800's and early 1900's saw the rapid expansion and growth of the Pioneer Mill Company. In the early part of the $20^{th}$ century, Pioneer Mill controlled approximately 12,500 acres of land (Xamanek Researches, 2000). A 1919 map by W.E. Wall further reveals that approximately 15,000 acres were under sugarcane cultivation by Pioneer Mill (Rosendahl, 1989.) Sugar cultivation areas extended from Ukumehame to Honokowai.

In addition to sugar, pineapple was established as a viable commercial crop in West Maui. Baldwin Packers opened a cannery in Lahaina in 1919 to provide the product processing component of the pineapple industry. Pineapple cultivation lands are generally delineated from Honokowai, north to Honokohau.

The historic significance of Lahaina Town itself is well documented. Lahaina was the home of Kahekili until his death in 1794 (Spenser Mason Architects/Austin Tsutsumi & Associates, Inc., 1988). It became the home of Kamehameha I and was designated the capital of the Hawaiian Kingdom until 1843. Evidence of this historic era is apparent today, and includes remnants of Kamehameha's Brick Palace which was built at Lahaina Harbor in 1803 (Belt Collins & Associates). The restoration of Moku'ula, the royal residence of King Kamehameha III, is further evidence of the historic significance of Lahaina to the former Kingdom of

Hawaii. Today, Lahaina is designated a National Historic Landmark.

### b. *Floodwater Diversion System Location and Physical Parameters*

The proposed floodwater diversion system for the Lahaina Watershed encompasses lands formerly cultivated in sugarcane. The alignment lies at elevations ranging from approximately 153 feet amsl at the northern intake terminus, to sea level in the vicinity of the second outlet. The only major mauka-makai gulch crossing in the proposed project area is the Kauaula Stream.

### c. *Cultural Impact Considerations*

With regard to the Kauaula Stream which will be traversed by the proposed floodwater diversion channel, it is important to recognize that streams have influenced day-to-day living practices by virtue of their water resource values. Stream waters were crucial for irrigation of taro lo'i (patches), as well as other traditional agricultural crops.

The marine resources in the area were also culturally important. Fishing and gathering "limu" (seaweed) were and are currently important to the sustenance and economy of the Native Hawaiian population.

Cultural implications of more recent plantation era use of lands in the vicinity of the proposed floodwater diversion system should also be considered. Such uses include the former Waine'e Village site. Unpublished interviews of former Waine‘e Village residents provide an indication of the kind of lifestyle experienced at plantation era camps in the project vicinity. Interviews conducted by Munekiyo & Hiraga, Inc. (on behalf of Amfac), in connection with the historical documentation of the Waine‘e Village, involved former residents who resided in the plantation camp between the mid-1920's to the mid-1960's.

The camp lifestyle, as conveyed by informants, reflect early plantation worker housing environs, with recreational and local retail needs provided within the camp. For example, a pool hall, small store, and social hall were a part of the camp make-up. Vegetable trucks would come through the camp, allowing residents to buy locally grown produce.

The camp and individual homes were equipped with conveniences considered appropriate to the time. A community bath house, kerosene and wood-burning stoves, outdoor toilets, and lanterns for lighting were part of the camp "fixtures". Families raised their own chickens, pigs, and vegetables as a means of supporting themselves.

Residents working on the plantation experienced demanding working conditions. Typical work days would start as early as 4:30 A.M. Despite the hard labor faced by residents, life in the camp was remembered with fondness. A close-knit community and cohesive family groups contributed to these memories.

The experiences of the former Waine‘e Camp residents typify the kind of life experienced by Lahaina residents during the sugar's prosperous years.

### d. *Informant Data*

Further interviews with knowledgeable informants were conducted during the preparation of the Draft EIS to obtain a broader range of cultural resource perspectives in the proposed project area.

Four (4) interviews were held in Lahaina on June 10, 2002. The interviews were with Na Kupuna O Maui (represented by William Waiohu and Paul Keahi), Tammy Harp and Isaac Harp. The interviewees were referred by the Office of Hawaiian Affairs, Maui Office, as cultural informant contacts in West Maui. An interview with Ke'eaumoku Kapu was held in Lahaina on August 2, 2002. Mr. Kapu and members of the Kapu Ohana live in the Kauaula Valley. The following are summaries of the interviews.

#### (1) *William Waiohu*

William Waiohu was born in West Maui at Ukumehame. His father is William Waiohu who was born in Olowalu. His mother was born in Wailuku. William is very familiar with the proposed project area, having lived in Lahaina all his life. William lived in Wainee Village from 1950 to 1971. William is a member of Na Kupuna O Maui and is also on the Maui/Lanai Islands Burial Council.

William worked in the sugarcane fields in the Lahaina area for Pioneer Mills for 47 years, where he was a bulldozer operator. His job was to clear the fields after harvest and get the area ready so the fields could be "dressed" prior to planting. He recalled that as well as clearing the fields, they also built flood diversion channels to control storm water runoff. William mentioned that when the area was in sugarcane cultivation, a system of diversion channels played an important role in flood prevention. He retired in 1998.

William is not aware of any cultural practices that are or have been carried out on the upland slopes of the proposed project. With respect to cultural resources within the project area, William felt that the area around Kauaula Stream may have cultural resources. However, from the time he remembers, the area was in sugarcane cultivation.

***(2) Paul Keahi***

Paul Keahi, affectionately known as “Uncle Moon”, was born and raised in Lahaina. His mother is Emily Haia Keahi who was born in Lahaina. His father was born in Hoolehua on the island of Molokai. In his early years Paul lived near Mala Wharf. He lived in Wainee Village from 1966 to 1998. He is presently retired and living in Waiehu. He is a member of Na Kupuna O Maui.

Paul worked for Pioneer Mills for 47 years in the sugarcane fields in the Lahaina area. His job on the sugar plantation was to "dress" the fields prior to planting which involved taking the rocks out of the soil after the bulldozer had ploughed the fields. Paul mentioned the field crews also dug storm runoff diversion channels, as well as dressing the fields. He thought that the diversion channels were very important to control storm runoff. The slopes were steep so the diversion channels would help take the water away.

Paul was not aware of any cultural practices that are or have been carried out in the project area. Asked, “If the Lahaina floodwater diversion system project went ahead, what precautions should be taken?”, he mentioned that the outlets should be located in areas where there are no coral reefs for it is important to protect the marine resources.

### (3) Tammy Harp

Tammy Harp was born and raised in Lahaina, on the island of Maui, Hawaii, and is a 7th generation resident. Her family, both paternally and maternally, have resided in Lahaina for 9 generations. She is a member of various committees and organizations related to Hawaiian culture and marine resources. She is a board member of the Mala Wharf Fishing and Recreational Association. the Lahaina Open Space Society, and is the Native Hawaiian cultural seat alternate for the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve Advisory Council. Tammy has been actively involved in sustainable fishery management and marine resource issues for over a decade as a member of various advisory bodies to the Western Pacific Regional Fishery Management Council, and she has been invited to speak before the U.S. Coral Reef Task Force. On December 4, 2000, Tammy introduced President William J. Clinton on-stage at the National Geographic Auditorium in Washington, D.C. for the public announcement of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve designation. The Reserve is the second largest marine protected area in the world, for which her husband Isaac wrote the Draft management plan in 1999.

Tammy has a long family history of fishing in her family. Her mother, the late Mary Neizmen, was a well-known Hawaiian music entertainer. Many in the Lahaina/West Maui community also knew her as the "Limu Lady" for her sharing of prepared limu (seaweed) dishes. Mary harvested limu and other traditional seafood throughout the West Maui coastal area and passed her knowledge on to Tammy, who continues these practices today. Tammy's father, Gilbert Neizmen, Sr., came from a family who cultivated taro in the Kahoma/Kanaha Valleys above Lahaina and harvested 'opelu (mackerel scad) in the Lahaina Roadstead area. Author, Bob Krauss' book "Here's Hawaii" lists some of the family's fishing activity, including fishing for 'opelu with the *"opelu mama"* or Great Barracuda. Mr. Neizmen has fished the nearshore and offshore waters around Maui, Lanai, Molokai, and Kaho'olawe for various pelagic, shallow and deepwater bottomfish species since he was a child, and continues to do so today. He is also a lifelong throw net fisherman and harvests 'opihi (limpets) and 'aama crab from the coastline. Tammy's parents harvested seafood for home consumption, family gatherings and not for commercial exploitation.

Tammy's knowledge of the Lahaina Flood Control Project stems from her participation in community meetings, and more recently consultation meetings with Project Impact Maui, an emergency response assessment initiative sponsored by the County of Maui. One such meeting was to address community concerns regarding flooding impacts in the Waine'e Street area between Prison and Shaw Streets. Tammy recalls that some years ago the Lahaina Flood Control Project issue was brought up, and that Ms. Mary Helen Lindsey stated in one of the local papers that the Puamana Park area was not a good area for a drainage outlet for the project. Ms. Lindsey expressed concern for the limu and several fish species that were harvested in the area by the local people.

Tammy was not aware of any cultural practices taking place on the upland slopes of the project area in recent years. She said the area was in sugar cultivation for many years. She does remember her paternal grandmother telling her about graves that were to the right side of Lahainaluna High School in or near the fields below Pu'u Pa'u'Pa'u (Mount Ball) where the large L is. She was also unaware of any historical mountain trails within the project area. She felt that the Kaua'ula Stream could be significant in regards to potential cultural resource sites. She identified the area along the shore from Puamana to Launiupoko as a culturally important limu, reef fish, and other marine life harvesting area, as well as a nursery for some juvenile reef species and shark pups.

Tammy's main concern with the proposed project is the impact it may have on the marine environment and feels that water from heavy rains should be kept on the land as much as possible. Tammy did note that the county's proposed homeless resource center will be built in the proximity of the now abandoned Waine'e Plantation Village (a.k.a. Lahaina Pump). She also noted the presence of a potential sediment basin (old lua) located behind the old Plantation village.

Tammy felt that the residences located in the vicinity of the intake basin near Lahainaluna Road would be negatively impacted by the project and so would those residences along the first proposed sediment basin along the Paunau residential area where a potential continuation of Dickenson Street might be built in the future.

### *(4)* ***<u>Isaac Harp</u>***

Isaac Harp was born in New Orleans, Louisiana in 1957 and moved to Hawaii shortly after the death of his father in 1964. Isaac's mother is pure Hawaiian and comes from a fishing family from Honokohau Iki, Kona, HI. Isaac is married to Tammy (Neizman) Harp, 7th generation Lahaina resident. Isaac has lived in Lahaina since 1985.

Isaac is actively involved in a number of Native Hawaiian environmental organizations, and he currently serves as

1) Kako'o (Helper), Na Kupuna 0 Maui;
2) Member of the Board of Directors, Ilio'ula'okalani;
3) Citizen-At-Large and Vice-Chair, Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve Advisory Council,
4) Fishing Representative, Hawaiian Islands Humpback Whale National Marine Sanctuary Advisory Council;
5) Member, Kaho'olawe Ocean Management Advisory Group;
6) President, Coalition Against C02 Dumping;
7) Member Board of Directors, Mala Wharf Fishing and Recreation Association.

Isaac has also served as a volunteer on the State of Hawaii Bottomfish Task Force. He has served on all six (6) Advisory Panels to the Western Pacific Regional Fishery Management Council. He is a member of the Gillnet Task Force, a multi-island citizen based group created to submit suggestions on gillnet use in Hawaii to the Department of Land and Natural Resources, Division of Aquatic Resources. Isaac has commercially fished for deep-sea bottomfish in the Main Hawaiian Islands, but no longer does so. He continues to fish for shallow-water bottomfish, and nearshore species, including the gathering of limu (seaweed) and other coral reef species for subsistence (home consumption) purposes.

Isaac is a former volunteer with the environmental organization EnviroWatch, Inc. Isaac is currently employed as the Ocean Program Director with KAHEA: The Hawaiian-Environmental Alliance, where he focuses on issues related to marine resource and marine environment and ecosystems protection.

Isaac stated that he believes that the problem of flooding in the Lahaina town vicinity is a result of the elimination of the natural lowlying areas by developers, who have filled in many of these areas to raise the elevation to avoid flooding, and some have built in lowlying areas with no regard to the potential of flooding. He stated that the elimination of "natural de-silting basins" such as Moku'ula has contributed not only to the problem of flooding, but also to the degradation of the nearshore water quality of Lahaina, now listed on the EPA's list of polluted waters. Isaac stated that as designed; the proposed flood control project would exacerbate the problem of degradation of the nearshore water quality and coral reefs.

Isaac stated that he is uncomfortable with the current plan to divert floodwaters directly into the ocean without some means of reducing the potential impacts on the marine environment, both immediate and cumulative. Isaac made several suggestions that may be incorporated into the proposed plan to reduce potential impacts from floodwater diversion into the ocean. He suggested a focus on retaining as much of the rainwater and associated silt as possible "on the land", rather than diverting the water and silt directly into the ocean. He said the silt smothers coral reefs, and contain nutrients and pesticides used on these former sugar cane lands over the past several decades.

Isaac also stated that he believes another contributing factor to the flooding problem is the decades of heavy equipment use in the fields above Lahaina, which have contributed to the compaction of the subsurface soil and prevents the natural percolation of rainwater. He made a suggestion to "deep rip" or deep till the former sugar cane fields above the project area. He suggested the use of bulldozers with a ripping claw attached to the rear be used to rip the soil to a depth of 6 to 8 feet to allow for the percolation of rainwater, which he believes could help to recharge Maui's stressed water table. Isaac also suggested the "back sloping" of the deep tilled areas to facilitate the retention of water over these areas to allow time for percolation. He believes that discharging the rainwater into the ocean is throwing away water, Hawaii's most valuable commodity.

Isaac also suggested additional de-silting basins be added to the proposed plan, above the drainage channel. He stated that for the de-silting basins to work, they would need to be properly maintained in a timely manner, citing on-going problems with silt run-off at the Mala Wharf boating facility. Isaac explained that the Mala Wharf boat launch and nearshore area has been continually impacted by silt coming down from the Kahoma Flood Control Project, which is similar to this proposed project focus of channeling and diverting rainwater into the ocean. Isaac said that this approach has already been proven to cause negative impacts to nearshore water quality nationwide and the status quo is no longer acceptable by the Hawaiian or environmental communities.

Isaac also notes the significant increase in litigation regarding environmental issues such as degradation of natural resources, and he believes as proposed, the Lahaina Watershed Project would cause significant negative cumulative impacts to the cultural resources and practices of the Native Hawaiian and non-Hawaiian community, including tourism, Hawaii's number one economic engine.

### *(5)* ***Ke'eaumoku Kapu***

Ke'eaumoku Kapu was born on Oahu and returned four (4) years ago to his ancestral home in the Kauaula Valley. He lives in the valley with his wife, four (4) children and two (2) brothers and their families. The Kapu's have re-established taro and native Hawaiian plants in the valley and live in the traditional ways. There are also six (6) families living in the Kauaula Valley, approximately one (1) mile from the Kapu Ohana. These families are relatives of the Kapu Ohana. The Kapu's and other residents are allowed access through the Kamehameha Schools' lands at Lahainaluna Road to reach their homes in the Kauaula Valley. Mr. Kapu is involved in many cultural activities in West Maui and assists in cultural workshops for the Friends of Moku'ula and presents cultural lectures to students in Lahaina and abroad. He is also taking care of precontact sites in the Kauaula Valley and surrounding area and having them identified through the State Historic Preservation Division.

Mr. Kapu explained the historical importance of the Kauaula Valley to Lahaina and his family's historical connection to the valley. He mentioned that prior to the Land Commission Awards (LCAs), the lands of Kauaula were controlled by the kingdom of Lahaina. The lands were "poalima properties" which paid taxes to the kingdom through the production of taro and sweet potatoes. There were 12 poalimas in the Kauaula Valley. The kingdom awarded the poalimas to families to be the caretaker of the lands. Through their stewardship, the lands would sustain the life of the people in Lahaina. Mr. Kapu's ancestors were awarded a few of the poalimas and his family returned to carry on their responsibilities to the land.

The Kapu's use the lands in the vicinity of the proposed flood diversion system for travel. Mr. Kapu believes the family will be impacted by the project since they use the area for access to and from the Kauaula Valley. He mentioned that many of the agricultural roads they use for travel get washed out during the rains. Mr. Kapu believes agricultural use of the upland area is key to retaining water and preventing flooding of downstream properties. He noted that the traditional Hawaiian practice of taro cultivation and terracing would retain the water in the upland area. Mr. Kapu believes the outlet at Puumana and the 2nd outlet to the south would impact the cultural gathering of the marine indigenous species such as "oopu" (fish) and "hihiwai" (clam). He also commented that the sediment would cause fishing grounds to disappear.

### e. ***Assessment of Cultural Impacts***

In the context of the cultural impact assessment, it is important that consideration be given to the following components.

#### ~~i.~~(1) ***Maintenance of Non-Public and Agricultural Access***

The proposed project will traverse lands which were formerly used for sugarcane cultivation. There are a number of non-public roads providing mauka/makai access to the surrounding agricultural lands and to the Kauaula Valley in the vicinity of the proposed project. The proposed project will not adversely impact these access roads. Five (5) agricultural crossings are provided in the plan to maintain mauka/makai access where the floodwater diversion system traverses established agricultural roads. Refer to Figure 12.

#### ~~ii.~~(2) ***Agricultural Irrigation Systems***

The underground irrigation system which provided water to the agricultural fields is still in place and operational on the Kamehameha Schools' lands. The lands were formerly leased to Pioneer Mills for growing sugarcane. Kamehameha Schools continues to seek improvements to these lands for agricultural development and is investigating ways to extend the irrigation supply to these lands. Therefore, allowances for continuing the existing irrigation system over Kamehameha Schools' lands will need to be incorporated in the project design in order to mitigate adverse impacts to the irrigation system.

### ~~iii.~~(3) ***Maintenance of Access to Kauaula Valley***

The entrance to the non-public access road to Kauaula Valley is located on the Lahainaluna High School property and traverses private land in a southerly direction to the Kauaula Stream. The proposed project will not impinge upon nor impact the non-public access to the Kauaula Valley which is further upslope of the floodwater diversion system.

### ~~iv.~~(4) ***Presence of Cultural Resources in the Vicinity of the Kauaula Stream***

An archaeological inventory survey was completed for the proposed action. The overall scope of the inventory survey covered the corridor that was nearly two (2) miles long and ranged from 150 to 250 feet in width. One previously unidentified burial was located during testing. Passive "as is" preservation is recommended for this burial site. Based on discussions with the State Historic Preservation Division and the Maui/Lana'i Islands Burial Council, archaeological monitoring is also recommended during construction.

As noted by interviewees, there still exists a potential to uncover features which may underlie exposed former sugarcane lands and cultural resources in the vicinity of Kauaula Stream. Appropriate stop-work, coordination and mitigation measures will need to be incorporated in the project specifications to ensure that proper protocol is followed in the event that archaeological features are discovered during construction.

Work will be conducted in stream and gulch areas. Work performed in stream areas will incorporate best management practices to ensure that downstream properties are not adversely impacted.

### ~~v.~~(5) *Marine Resources*

The proposed project is designed to reduce the overall sediment discharge in the area from Lahaina Harbor to Waianukole by approximately 25 percent. Sediment outflow of Kauaula Stream at Makila Point will be reduced by approximately 52 percent. This will have a beneficial impact on the nearshore reef ecosystem and invigorate the well defined coral reefs fronting Lahaina Town. ~~The proposed project will result in the impacting of two (2) species of limu (limu lipoa and limu kohu) in a limited area adjacent to the second outlet, and redistribute the development of limu in the project area.~~A total of five (5) species of culturally important marine macroalgae (i.e. seaweed or "limu") were found during the 2002 survey work. These species are used locally as a traditional food source. They were *Dictyopterus plagiogramma* (limu lipoa), Asparagopsis taxiformis (limu kohu), Ulva fasciatus (palahalaha), Codium spp. (wawae'iole), and Enteromorpha spp. ('ele'ele). Of these, palahalaha is probably the least used today. At the site closest to the proposed new discharge site (D'), two out of the five culturally important species were found (limu lipoa and limu kohu).

None of these species were observed at Site B, which is where Kauaula Stream discharges. Palahalaha and ele'ele were found at Site A', which is a current discharge site. Because a discharge outlet can be associated with pulses of freshwater and nutrients, and because salinity and nutrient levels affect algal communities, movement of the outlet may alter the current algal distribution. Routing discharge to D' (the second outlet location) may impact limu lipoa and limu kohu in this area. Conversely, removal of discharge from its current location(s) may balance this impact.

Algae have rapid life cycles and can quickly re-establish themselves after a strong negative event. Since the second outlet will flow only during strong precipitation events, there will be long periods when the outlet will have no effect on the offshore biota. Algae can therefore regenerate a population in a matter of months after a storm discharge. There has been an increase of algae species inventoried throughout the study area from 1986 to 2002, (Refer to Tables 1 and 2). Since types and distribution of algae will be influenced more by salinity and substratum impacts which will be localized in the vicinity of the second outlet, the algal communities should continue to flourish throughout the project area. Therefore, the need for mitigation is not anticipated. ~~However, t~~The net impact on marine resources will be positive due to the overall reduction in sediment discharge by approximately 25 percent in the project area, as well as from the increase in water quality provided by the project.

Post-storm fishing opportunities will be affected at the second outlet due to the increase in sediment discharge at this location. Water quality recovery time (salinity) for a 10-year storm is estimated to be 20.7 hours at the second outlet. Refer to Table 9. However, water quality in the remaining offshore areas fronting the Lahaina Watershed should be maintained for these storm events. With overall improvement to water quality, it is expected that post storm event fishing opportunities will be enhanced.

### ~~vi.~~(6) *Impacts to Surrounding Residences*

The proposed floodwater intake basin in the north will be located in close proximity to existing single-family residences. Short-term impacts caused by noise and fugitive dust during construction will be mitigated in compliance with Department of Health Noise Permit requirements as set by the Department of Health and Best Management Practices requirements as set by the Department of Public Works and Waste Management for building and grading permits.

### ~~vii.~~(7) Land Management Practices

Effective floodwater control involves establishing appropriate land management practices in the upland to retain runoff from impacting downstream properties. The traditional ahupua'a land division from the mountain to the ocean effectively allowed the integration of land and water resources. Active agricultural cultivation of the upland area for sugarcane helped retain runoff and flooding of downstream properties. Presently, a number of public and private groups (U.S. Department of Agriculture, NRCS, West Maui Soil and Water Conservation District, State of Hawaii, Department of Land and Natural Resources, County of Maui, Kamehameha Schools, Pioneer Mills, Makila Land Company, and the Kapu family in the Kauaula Valley) are involved in upland management issues. In this context, coordination and cooperation with the various upland interests will be required to integrate land and water management. Recently, Kamehameha Schools and the State of Hawaii, Department of Land and Natural Resources, with design support offered through NRCS, have constructed terraces mauka of the Lahainaluna Ditch to help prevent erosion and manage storm runoff.

## 8. Air Quality

Air quality impacts attributed to the project will include dust generated by short-term construction-related activities. Site work such as clearing, grubbing and grading, and debris channel and concrete channel construction for example, will generate air-borne particulates. Dust control measures, such as regular watering and sprinkling, will be implemented to minimize wind-blown emissions. Best Management Practices will be followed during construction to minimize air quality impacts. These impacts will be short-term and are not considered to be significant.

All bare earth areas, including all diversion surfaces, will be vegetated to mitigate dust generated impacts. In the long term, the proposed action is not expected to adversely impact local and regional ambient air quality conditions.

### 9. *Noise*

Dominant noise sources in the project area include traffic on Honoapiilani Highway and Lahainaluna Road.

Ambient noise conditions will be temporarily impacted by construction activities. Heavy construction equipment, such as bulldozers, front-end loaders, and material-transport vehicles, will likely be the dominant source of noise during the proposed floodwater diversion system construction period. Construction activities will be limited to normal daylight working hours. Noise generated by construction activities will comply with Hawaii Administrative Rules, Chapter 11-46, relating to "Community Noise Control".

Once completed, the proposed project is not anticipated to be a noise source which will adversely impact surrounding properties.

### 10. *Visual Resources*

The plan proposes the construction of a floodwater diversion channel, sediment and debris detention basins and a second channel outlet, all of which have been assessed relative to potential impacts on the area's visual resources.

The proposed floodwater diversion system will be located across the slope above Lahaina Town at the 153-foot elevation and traverse the slope in a southwesterly direction to sea level. The grassed channel embankment may be visible from the highway and Lahaina Town.

The debris basin will be located on Kauaula Stream 200 feet from Honoapiilani Highway and may be visible from the highway. Vegetative screening will be applied to reduce the visual impact of the basin. The grassed embankment for the second outlet channel will parallel Honoapiilani Highway for two-thirds of a mile. Planting along the berm will minimize the visual effects of the embankment.

Overall, past cultivation practices by the sugar company have produced landscapes that are similar to those proposed by this plan. Terraces, irrigation storm ditches, and field roads follow the contour of the hillside as does the floodwater diversion system. Large rock piles that dot the former sugarcane fields are similar in form to the proposed debris basin embankment. As a result, the proposed project is not anticipated to have an adverse impact on visual resources. The reduction of "red water pollution days" in the ocean environment off Lahaina Town is considered a positive visual benefit resulting from the proposed project.

## B. IMPACTS TO COMMUNITY SETTING

### 1. Land Use and Community Character

The proposed floodwater diversion system is bordered by residential properties to the north, former agricultural lands on the immediate west, east, and south and beyond to the west, the former Wainee Village site to the west which is designated single-family residential, public/quasi-public, single and multi-family, commercial and recreational lands.

Approximately 210 acres in the watershed are located within the 100-year floodplain. The floodplain includes about 130 acres of urban land that is situated mostly west of the Honoapiilani Highway.

Some representative depths of flooding that can be expected in Lahaina Town during a 100-year flood event in the future without project conditions are: 1.9 feet in the Front Street area and 1.3 feet in the Wainee Street area. Maximum velocities are between 0.9 feet per second and 0.5 feet per second. Depths of 1.5 feet with velocities up to 2 feet per second can be expected in the Puamana Subdivision adjacent to Kauaula Stream. The foregoing figures may vary depending upon local topography and drainage conditions.

The proposed project will provide a 100-year level of flood protection to the residential communities of Lahaina Town and Puamana and the commercial core of Lahaina. It will also provide flood protection to the cultural and historic resources in the Lahaina Historic District No. 1. The proposed measure will prevent or reduce flood and sediment damage to single- and multi-family residences, business and commercial designated lands, public and quasi-public designated lands, and agricultural designated lands. Viewed in this context, the proposed project will have a positive impact on surrounding land uses.

### 2. ***Population and Economy***

The proposed project will provide construction employment which will support the construction industry in the short term. Employment provided through the construction phase of project development will also help to support other businesses which are economically linked to the construction industry.

The project is not a stimulus for population in-migration.

The area from the northern boundary of the watershed to Kauaula Stream is valuable to Lahaina's tourism-based commercial operators and for shoreline and nearshore recreational pursuits. Although "red water" episodes will continue to occur as a result of storm runoff along the entire West Maui coastline, peak-suspended sediment concentrations and the duration of the episodes will be significantly reduced in the nearshore marine environment fronting Lahaina Town.

Impacts to coastal-dependent businesses in the watershed due to "red-water" will be reduced as sediment loads along the nearshore area fronting Lahaina Town are expected to decrease with the proposed improvements. Viewed in this context, the proposed project will have a positive effect on local commerce.

### 3. *Police, Fire and Medical Services*

The proposed project is not anticipated to affect service area limits nor adversely affect capabilities of police, fire and emergency medical operations. The incidence of road closures and traffic problems caused by flooding and sediment deposition will be reduced. During storm events, access by emergency units, such as ambulances, fire and rescue trucks, police vehicles, and utility service trucks, will be improved. The threat to human safety and health caused by floodwater and sediment deposition in lowlying areas will be markedly decreased with installation of the project.

Viewed in this context, the proposed project will have a positive impact on police, fire and medical services.

### 4. *Recreational and Educational Facilities*

The proposed floodwater diversion project will not adversely affect recreational and educational facilities. Regional population changes are not expected with the proposed action. Additionally, the improvements will provide floodwater protection to the Lahaina Aquatic Center and the Lahaina Recreation Center, both located makai of the proposed diversion channel. Coastal recreational opportunities will benefit from the proposed action, as reduction in sediment laden storm waters will result in less turbid post-storm conditions.

## C. *IMPACTS TO INFRASTRUCTURE*

### 1. *Roadways*

Short-term impact to traffic on Honoapiilani Highway may result during work on the culvert and second outlet within the highway right-of-way. Traffic control measures will be implemented in coordination with the State Department of Transportation and adjacent landowners. In the long term, the proposed project will not adversely impact roadways. As mentioned previously, the incidence of road closures and traffic problems caused by flooding and sediment deposition will be reduced.

### 2. *HoKioKio Place*

The proposed flood control channel will be designed to accommodate this new road and allow flood water to pass under the road. No adverse impact to HoKioKio Place is anticipated.

### ~~2.~~3. *Lahaina Bypass*

As previously mentioned, the proposed Lahaina bypass will be located approximately 500 to 1,000 feet mauka (east) of the proposed floodwater diversion system. Runoff generated mauka of the bypass will "pass" through the roadway via culverts and bridges, and will continue downslope to be captured and conveyed by the proposed floodwater diversion channel. Further coordination will be required as the details of the Lahaina Bypass are developed to ensure design coordination with the proposed project.

### ~~3.~~4. *Agricultural Roads (Non-Public)*

The floodwater diversion system has been planned to accommodate five (5) mauka/makai crossings of non-public roads to maintain agricultural use and access to lands within the project area. The access to the Kauaula Valley is off Lahainaluna Road in the vicinity of the Lahainaluna High School and traverses lands mauka of the floodwater diversion system. Therefore, the proposed project will not adversely impact agricultural (non-public) roads or the access to the Kauaula Valley.

### ~~4.~~5. *Dickenson Street Extension*

Preliminary design coordination between the County of Maui, Department of Public Works and NRCS has been carried to accommodate both projects. ~~Runoff generated upslope of the floodwater diversion system will be diverted around the Dickenson roadway improvements and enter the intake basin to the south of Dickenson Street, thereby avoiding culverts and limiting use of Kamehameha School's land bounded by the Dickenson Street project. Design coordination will be undertaken to ensure the functional integrity of both projects.~~However, the Dickenson Street extension project is currently inactive. The County is pursuing an alternate route utilizing Keawe Street, which is outside of the project area. Detailed engineering design of the flood control project will consider the Dickenson Street extension as a likely long-term future project.

~~5.~~6. ***Water***

The proposed project will not affect the water source or distribution system in the West Maui region.

~~6.~~7. ***Wastewater***

The proposed project will not affect the County's wastewater treatment facilities nor distribution system.

~~7.~~8. ***Solid Waste***

Solid waste generated from the construction of the proposed project will not be disposed at the County's Central Maui Landfill. Instead, alternative disposal/stockpile sites will be utilized. These sites will be identified during project design and acquired as part of the right-of-way requirements. The proposed action is not anticipated to adversely impact the County's solid waste disposal facilities.

~~8.~~9. ***Drainage***

The proposed project will divert existing storm runoff and sedimentation into a floodwater diversion system which will discharge into two (2) ocean outlets. Site work for the proposed project will involve clearing and grubbing, as well as excavating, filling, and grading. Funding constraints are expected to result in a multiphase project. Upon completion of site work, all exposed areas will be grassed to minimize soil loss and erosion.

The results of the reevaluation of storm runoff by NRCS (See Appendix C) indicate that for the 100 year storm event, the ocean discharge at Puamana is estimated to be approximately 4,773 cfs (cubic feet per second) and at the second outlet approximately 5,824 cfs.

The earlier estimated quantities (1992) of sediment yield from the Lahaina Subwatershed were adjusted with the change in land use (i.e., termination of sugar cultivation) to reflect an increase runoff quantities. The sizes of the sediment and debris basins similarly are being enlarged accordingly with the increased storm discharge during the project design phase.

### ~~9.~~10. ***Electrical, Telephone and CATV Service***

The proposed project will not adversely impact electrical, telephone, or CATV services.

## D. ***CUMULATIVE AND SECONDARY IMPACTS***

A cumulative impact is defined as an impact to the environment which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. ~~The Lahaina Bypass and the Dickenson Street Extension are two (2) infrastructure projects in the planning stages in the vicinity of the proposed project. Design coordination to maintain an effective drainage plan will be carried out with these projects.~~

This cumulative impact analysis examines past, present, and reasonably foreseeable future projects in the area that have the potential to contribute to cumulative effects. The analysis uses the best available information at the present time to assess these projects and their potential impacts. Depending on the status of a particular project, each of the projects included in this cumulative impact analysis is supported by different levels of information. Public documents, conceptual plans and documents or applications prepared for environmental reviews or regulatory approvals were the primary sources of this information. When adequate data on specific aspects of other projects was unavailable, and could not be obtained through reasonable efforts, professional judgment was used to estimate potential impacts.

### *1. Projects Included in the Cumulative Impacts Analysis*

The following criteria were considered in identifying past, present, and reasonable foreseeable future projects that could result in cumulative impacts to the region's resources.

a. Projects that are of a similar nature, could affect similar resources, or are located in geographic proximity to the proposed project.

b. Projects that have the potential to generate environmental impacts and when addressed collectively with the proposed project, could result in cumulative impacts to the environment.

c. Projects that are proposed for development that have received or are pending environmental and/or regulatory reviews or approvals and are expected to be implemented.

To assess cumulative impacts, the Lahaina Flood Control Project was grouped together with three other projects in the area having scope and scale of a regional nature. These projects include:

a. **<u>Pu'unoa Affordable Housing Subdivision</u>** - This proposed affordable single-family residential subdivision is located to the south of Kauaula Stream and is immediately mauka of the Lahaina Flood Control channel. The proposed project involves the development of approximately 254 residential units and covers an area of approximately 54 acres. The buildout of this project is expected to occur over a ___ year period.

b. **<u>Pu'unoa Agricultural Subdivision</u>** - This proposed agricultural subdivision encompasses 254 acres and is located immediately mauka of the Pu'unoa Affordable Housing Subdivision Project and the Lahaina Flood Control Project and south of Kauaula Stream. It involves the development of 24 agricultural lots of approximately 5 acres and 4 large lots. The buildout of this project is expected to occur over a 5-year period.

c. **<u>Lahaina Bypass</u>** - The Lahaina Bypass project is intended to serve as a new north-south arterial providing capacity relief to Honoapiilani Highway. The Bypass will originate at Launiupoko, south of Lahaina Town, extending north to Honokowai. The ultimate typical section would provide two (2) travel lanes in each direction. The Bypass and Honoapiilani Highway will be integrated through a proposed system of connector roads in the vicinity of Puamana, Lahainaluna Road, Keawe Street, Kapunakea Street, and Puukolii Road. The Bypass will be constructed in phases over an approximately 20-year time horizon.

Two (2) other major land owners in the vicinity of the proposed project are Kamehameha Schools and Kaanapali Development Corp. (formerly Pioneer Mills Company, Ltd). Their fallow agricultural lands are located mauka of the Lahaina Flood Control project and Kauaula Stream to the south and Lahainaluna Road to the north. Kamehameha Schools has expressed interest in retaining their 1,171 acres of lands in agriculture production. Kaanapali Development Corp.'s plans for their acreage have not yet been formalized, therefore, this project has not been included in the cumulative impacts analysis.

Discussion has been initiated between the landowner and interested parties regarding a proposal to create a linear shoreline park from approximately Olowalu to Puamana. This proposal also includes the realignment of portions of Honoapiilani Highway further inland to create open space and park lands along the shoreline. This proposal is in the very preliminary stages, and therefore, has not been included in the cumulative impact analysis.

### 2. *Assessment of Cumulative Impacts*

In considering the impacts of the Lahaina Flood Control Project, together with the proposed Pu'unoa Agricultural Subdivision, Pu'unoa Affordable Residential Subdivision and the Lahaina Bypass, the following resource parameters were examined: (1) topography, (2) plant and animal life; (3) noise and air quality; (4) visual resources; (5) cultural resources; (6) water quality; (7) land use; (8) public services; and (10) infrastructure. In assessing cumulative impacts of the Lahaina Flood Control Project and the other projects noted, a qualitative approach was taken since specific designed-based plans for each of the projects are not fully developed at this time. Further, cumulative impact considerations may change as new projects are introduced or proposed projects modified in scope and scale over time. Accordingly, the assessment presented herein is intended to identify potential issues, concerns and mitigative measures based on best available planning-level information. Cumulative impact issues relating to each of these resource parameters are described below.

### a. *Topography*

Due to strict regulatory controls and cost considerations, projects such as Pu'unoa Agricultural Subdivision, Pu'unoa Affordable Housing Subdivision and the Lahaina Bypass seek to minimize cut and fill quantities, thereby minimizing alterations to topographic features. The need to respect existing landforms is required to ensure that visual impacts are minimized, drainage patterns are maintained, and infrastructure design criteria are met. When taken collectively, therefore, the cumulative impacts of these projects upon regional topography are not anticipated to be adverse.

### b. *Plant and Animal Life*

Each of the projects studied flora and fauna resources affected by their respective actions. For the most part, the proposed actions will affect lands formerly used for sugar or pineapple cultivation activities. Gulch areas where native vegetation remain undisturbed are not anticipated for development, although bridge crossings required for the Lahaina Bypass will involve foundation work within gulch areas. The flora and fauna study for the Lahaina Bypass (Char, 1988) indicated that there are no species of flora in the project vicinity which are considered rare, threatened or endangered. Impacts to flora and fauna parameters are mitigated through proper land planning measures, utilizing to the maximum extent practicable, previously disturbed lands for proposed new development.

### c. *Noise and Air Quality*

Construction-related noise is expected for each project. All projects shall comply with Department of Health noise regulations and are expected to employ best management practices to minimize construction-related noise. In the long term, development of areas previously utilized for agricultural purposes will result in changes in noise characteristics in the vicinity of each project area. Whereas agricultural equipment and cultivation activities are currently the primary source of noise, once projects are completed, noise generation will be primarily attributed to traffic utilizing project roadways. There are no point sources of noise identified in any of the projects which may result in adverse impacts to surrounding communities. With respect to the Lahaina Bypass, it is recognized that noise generated from traffic traveling the highway would need to be addressed by future developments. Appropriate setbacks will be considered along the proposed Bypass to ensure that noise standards for noise sensitive receptors are respected.

As with noise, air quality will be temporarily affected during construction. Best management practices are required to ensure compliance with Department of Health and County grading requirements. There are no new point sources of air emissions associated with any of the projects. In the long term, automobile traffic is expected to be the primary source of air emissions. As projects are implemented, air impacts associated with agricultural lands will be replaced by automobile-related emissions. From a cumulative standpoint, however, the projects cited are not anticipated to have an adverse impact upon regional conditions.

### *d. Visual Resources*

The visual landscape of the West Maui community will change as each of the projects are implemented. At the Pu'unoa Affordable Housing Subdivision, for example, former sugar cane fields will be replaced by single-family residential uses. It is expected that the Pu'unoa Agricultural Subdivision will follow the agricultural plans in order to meet the agricultural land use criteria. The Lahaina Bypass is not expected to have an adverse impact from a visual standpoint. Similarly, the Lahaina Watershed Flood Control Project is not anticipated to have an adverse impact to the visual environment.

Collectively then, lands formerly used for sugar cane cultivation will reflect an urban residential and agricultural residential character.

### *e. Cultural Resources*

Projects of the size and scale noted consider effects of their individual actions on cultural resources. Based on archaeological studies conducted for each project, appropriate mitigative measures including preservation or avoidance will be utilized to address archaeological resource issues. Collectively, cultural resources which may be affected by the projects include marine resources, access to shoreline and mauka areas, and areas and sites for cultural practice. It is anticipated that all developments in West Maui will be sensitive to cultural resource issues and provide needed mitigation through cooperative processes.

### f. ***Water Quality***

Surface runoff and other non-point source pollutants can affect water quality if unmitigated. Construction activities for each project are subject to the NPDES permitting process and implementation of best management practices to control erosion and sediment loss. It is expected that all projects will comply with applicable regulatory requirements to minimize impacts to downstream water bodies. On a long-term basis, each project will be required to comply with County of Maui drainage regulations to provide required mitigation, including drainage storage areas to ensure that runoff velocities are controlled and water quality effects minimized. From a regional water quality standpoint, compliance with State and local regulatory requirements will help to mitigate adverse impacts to water quality. Implementation of the Lahaina Flood Control Project is anticipated to improve overall water quality in the area by the removal of sediment in storm runoff.

### g. ***Land Use***

Taken collectively, the Lahaina Watershed Flood Control Project, Lahaina Bypass, Pu'unoa Affordable Residential Subdivision and the Pu'unoa Agricultural Subdivision establishes an evolving land use pattern reflecting changes in socio-economic conditions in the West Maui region. The flood control and the bypass projects are significant public infrastructure elements intended to mitigate impacts to residents and visitors in the West Maui region. The residential subdivision reflects the need to meet affordable housing requirements for West Maui residents, while the agricultural subdivision indicates the transition of large scale agricultural uses to small farm uses.

Changes in land use patterns over time, must respect land spatial allocations and goals, objectives and policies of the West Maui Community Plan. The community plan provides the framework for managing change anticipated in the region.

### h. ***Public Services***

Public service parameters addressed from a cumulative perspective include parks and recreation, schools and medical and emergency services. The flood control and bypass projects are anticipated to be beneficial from an emergency services standpoint as access for emergency service vehicles will be improved. There are no direct impacts to other public service components associated with these projects.

With regard to the Pu'unoa Residential Subdivision and Pu'unoa Agricultural Subdivision, compliance with State and County dedication and contribution policies, rules and ordinances are required. For example, parks and playground assessment requirements set forth by Chapter 18.16.320 of the Maui County Code sets forth provisions for land dedication or in lieu payment for parks facilities. Similarly, Department of Education school facilities assessment provisions are expected to be addressed for individual residential development projects.

On a collective basis, the projects noted herein are not anticipated to have adverse impacts to public service parameters.

### *i. Infrastructure*

Infrastructure requirements of the major projects will be met by the respective applicants. A private water system operated by Kauaula Land Company, LLC will serve the Pu'unoa Agricultural Subdivision project. Appropriate source, transmission and storage facilities will be provided in keeping with domestic and fire requirements. A key cumulative impact issue which should be considered as implementation of each project progresses is the availability of source and the maintenance of groundwater withdrawals which do not exceed sustainable capacities of underlying aquifers. It is anticipated that as project phasing and implementation progresses for each project, coordination with the State Commission on Water Resource Management will be undertaken.

Wastewater transmission and treatment services are provided by the County Department of Public Works and Environmental Management (DPWEM). Individual projects are expected to provide their own internal collection systems to connect to the County system or acceptable individual wastewater systems. The Pu'unoa Affordable Housing Subdivision can be serviced with existing transmission and treatment capacity allocations. The project applicant shall be responsible for facility upgrades required to service the project. Any required upgrades will be coordinated with the DPWEM. The Pu'unoa Agricultural Subdivision will use individual septic tank and drainage fields to process and treat wastewater.

Each project is responsible for addressing and mitigating drainage impacts. Pu'unoa Affordable Housing Subdivision, for example, will provide detention and desilting basins within the planned development to maintain current levels of runoff flowing from the site. Collectively, through these measures, it is anticipated that there will be no adverse impacts to downstream or adjacent properties.

The final infrastructure component which should be examined are roadway systems. Pu'unoa Affordable Housing Subdivision project and Pu'unoa Agricultural Subdivision each require a preparation of a traffic impact analysis report. Traffic impacts attributed to each project in the immediate vicinity of the respective project would be mitigated by the respective developers. The State of Hawaii has concluded the Final Supplemental Environmental Impact Statement for the Bypass and is currently working towards initiating design and construction for the first phase of work. As individual projects are implemented, it is assumed that traffic impact analysis will be prepared to provide continuing and current information on levels of service along Honoapiilani Highway.

On a long-term basis, the proposed project will benefit the socio-economic fabric of the community by reducing damage to properties from flooding. The proposed project as viewed in the context of a public infrastructure development is not a population generator. The proposed action will not adversely impact infrastructure and public service systems and facilities. The proposed project will not result in adverse cumulative or secondary impacts.

# Chapter IV

## Relationship to Land Use Plans, Policies and Controls

# IV. RELATIONSHIP TO LAND USE PLANS, POLICIES AND CONTROLS

## A. STATE LAND USE DISTRICTS

Chapter 205, Hawaii Revised Statutes, relating to the Land Use Commission, established the four (4) major land use districts in which all lands in the State are placed. These districts are designated "Urban", "Rural", "Agricultural", and "Conservation". The proposed project is situated within the State "Agricultural" and "Urban" districts as shown on Figure 1. The proposed action is deemed permitted in the "Agricultural" and "Urban" districts.

As reflected by the shoreline certification map, a portion of the second outlet is also situated within the "Conservation" district. Refer to Figure 6 and Appendix "D". Therefore, a Conservation District Use Permit will be required from the State Board of Land and Natural Resources.

An analysis of the proposed action relative to Conservation District use criteria follows.

## B. STATE CONSERVATION DISTRICT

Lands within the State Conservation district are under the jurisdiction of the Department of Land and Natural Resources. Title 13, Hawaii Administrative Rules, establishes rules and procedures which regulate land use in the Conservation district. Title 13 establishes subzones within the Conservation district. These subzones are designated "Protective" (P), "Limited" (L), "Resource" (R), "General" (G), and "Special" (S). A portion of the second outlet is located within the limits of the Conservation district's Limited subzone. As noted in HAR Section 13-5-12, the objective of this subzone is "to limit uses where natural conditions suggest constraints on human activities". In addition, all land uses identified for

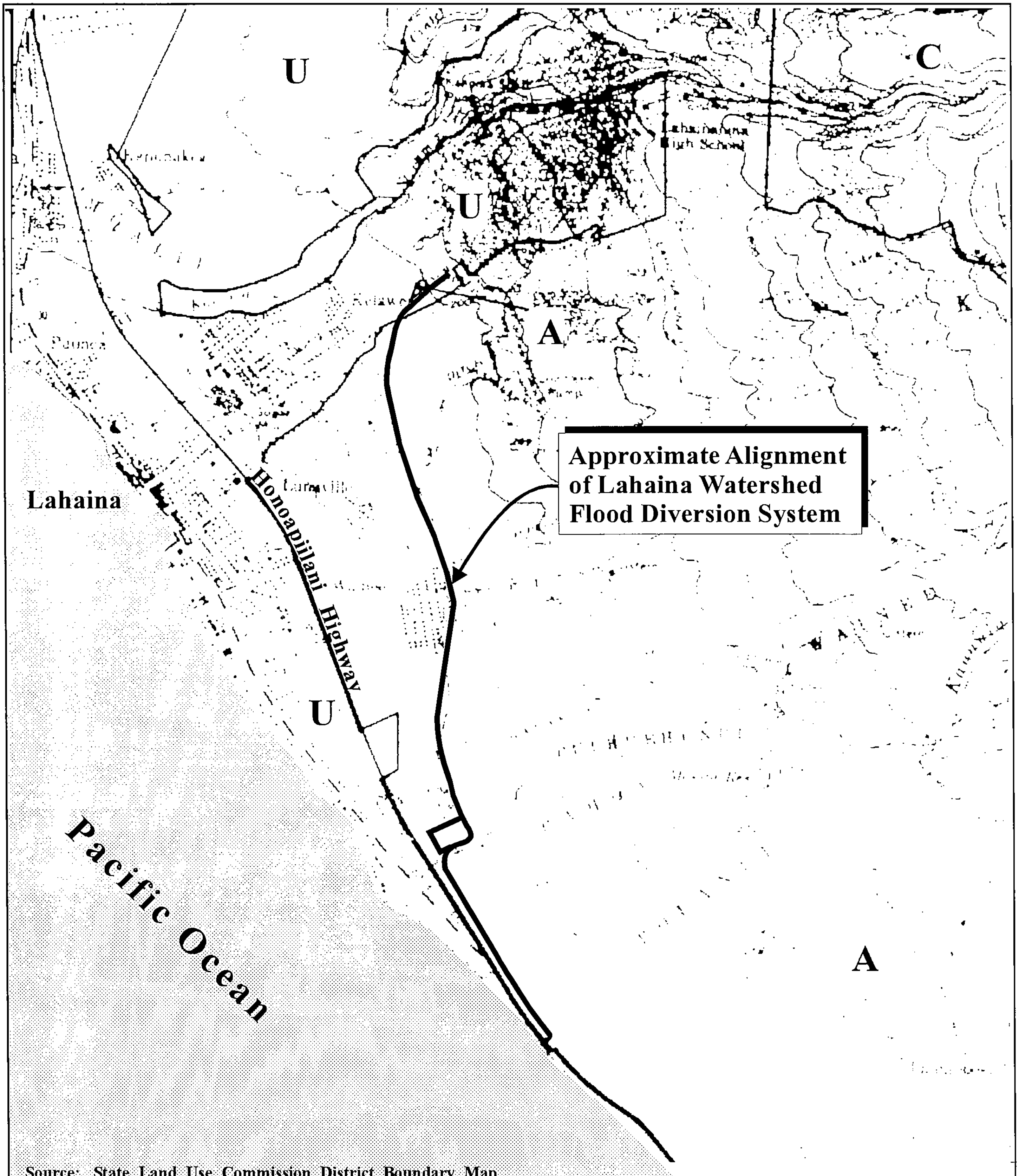



Figure 14 Lahaina Watershed Flood Control Project

State Land Use District Classification

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the Protective subzone also apply to the Limited subzone. As reflected by HAR Section 13-5-22, one of the identified land uses in the Protective subzone is for public purpose uses. This use encompasses:

> "land uses undertaken by the State of Hawaii or the counties to fulfill a mandated governmental function, activity, or service for public benefit and in accordance with public policy and the purposes of the conservation district. Such land uses may include transportation systems, water systems, communications systems, and recreational facilities".

The proposed floodwater diversion system improvements in the Conservation district are in consonance with the identified land uses for the Limited subzone.

In evaluating the merits of a proposed land use, the Department or Board shall apply the following criteria:

*(1)* ***The proposed land use is consistent with the purpose of the conservation district.***

***Response:*** The purpose of the Conservation district is to conserve, protect and preserve the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety, and welfare. The proposed project is needed to mitigate the damaging and life-threatening effects of major storms which flood the Lahaina Town area. Moreover, project implementation will reduce the adverse impacts of sediment-laden storm waters to the nearby marine environment. The use of Conservation lands for the outlet structure for the project is deemed consistent with the purpose of the district.

*(2)* ***The proposed land use is consistent with the objectives of the subzone of the land which the use will occur.***

***Response:*** As noted above, the proposed action is a permitted use in the Limited subzone.

(3) ***The proposed land use complies with provisions and guidelines contained in Chapter 205A, HRS, entitled "Coastal Zone Management", where applicable.***

***Response:*** An assessment of the Coastal Zone Management objectives and policies has been completed and included in Section G of this chapter. The proposed action is deemed in compliance with Chapter 205A.

(4) ***The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region.***

***Response:*** The proposed action is designed to yield community benefits both in terms of flood hazard mitigation and overall improvement to marine water quality.

(5) ***The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels.***

***Response:*** The proposed action will not create adverse impacts to the physical conditions or capabilities of the affected parcels. The proposed action is recognized as appropriate by the County of Maui's West Maui Community Plan.

(6) ***The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable.***

***Response:*** The proposed action is not anticipated to result in adverse physical or environmental conditions. The diversion works will be topographically integrated with surrounding land forms to minimize visual impacts.

(7) ***Subdivision of land will not be utilized to increase the intensity of land uses in the conservation district.***

***Response:*** The proposed project does not involve the subdivision of Conservation lands.

**(8)** ***The proposed land use will not be materially detrimental to the public health, safety and welfare.***

***Response:*** The proposed flood diversion project is designed to mitigate the effects of stormwater runoff and is not considered an action detrimental to the public health, safety and welfare.

## C. *HAWAII STATE PLAN*

Chapter 226, HRS, also known as the Hawaii State Plan, is a long-range comprehensive plan which serves as a guide for the future long-term development of the State by identifying goals, objectives, policies, and priorities, as well as implementation mechanisms. As reflected by Section 226-13, HRS, the plan outlines objectives and policies for the physical environment, specifically land, air and water quality.

More specifically, the State objectives include the maintenance and pursuit of improved quality in Hawaii's land, air and water resources. To achieve this objective, it shall be the State's policy to:

> Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters (Hawaii State Plan, Section 226-13(a)(b)(5)).

The proposed project is in keeping with the Hawaii State Plan objective to improve land resources.

## D. *MAUI COUNTY GENERAL PLAN*

The Maui County General Plan (1990 Update) sets forth broad objectives and policies to help guide the long-range development of the County. As stated in the Maui County Charter, "The purpose of the General Plan is to recognize and state the major problems and opportunities concerning the needs and the development of the County and the social, economic and environmental effects of such development and set forth the desired sequence, patterns and characteristics of future development".

The proposed action is in keeping with the following General Plan objectives and policies:

***Objectives:***

1. To preserve and protect the County's unique and fragile environmental resources.

2. To create an atmosphere which will convey a sense of security for all residents and visitors and aid in the protection of life and property.

***Policies:***

1. Support programs to reduce air, land and water pollution.

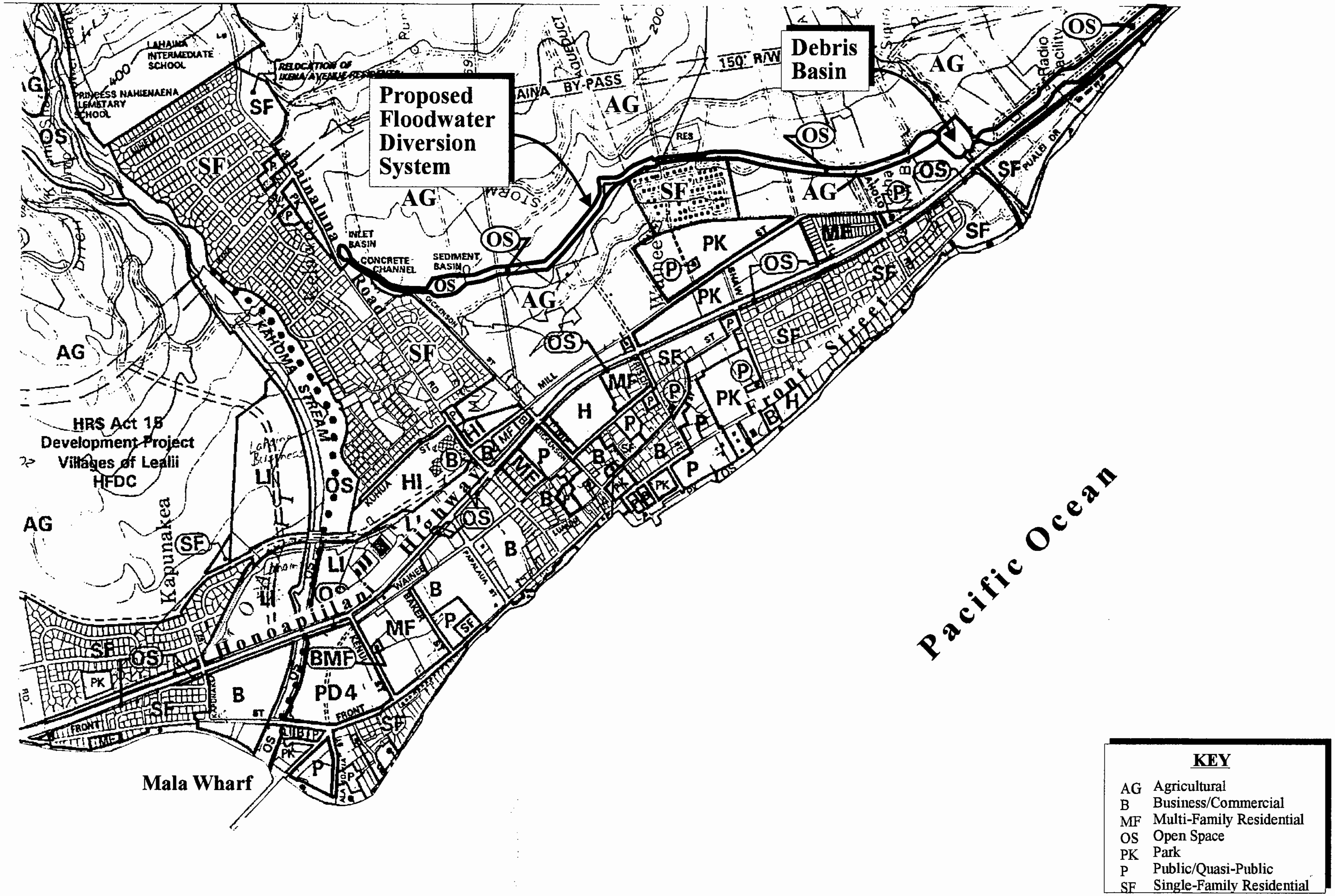
2. Support programs to protect rare and endangered species and programs which will enhance their habitat.

3. Maintain a proper state of preparedness for man-made or natural disasters.

## E. WEST MAUI COMMUNITY PLAN

Nine (9) community plan regions have been established in Maui County. Each region's growth and development is guided by a Community Plan, which contain objectives and policies drafted in accordance with the County General Plan. The purpose of the Community Plan is to outline a relatively detailed agenda for carrying out these objectives.

The proposed project falls within the jurisdiction of the West Maui Community Plan adopted in 1996. Land use guidelines are set forth by the Lahaina Community Plan Land Use Map. See Figure 2. The proposed floodwater diversion channel project has been incorporated into




Source: County of Maui, Department of Planning

Figure 15

Lahaina Watershed Flood Control Project
West Maui Community Plan Land Use Map

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Prepared for: County of Maui, Department of Public Works and Environmental Management

the Lahaina Community Plan Land Use Map and is designated for "Open Space" use.

The proposed project is in keeping with the following goals, objectives, and policies of the West Maui Community Plan.

***Goals:***

A clean and attractive physical, natural and marine environment in which man-made developments on or alterations to the natural and marine environment are based on sound environmental and ecological practices, and important scenic and open space resources are preserved and protected for public use and enjoyment.

Timely and environmentally sound planning, development, and maintenance of infrastructure systems which serve to protect and preserve the safety and health of the region's residents, commuters, and visitors through the provision of clean water, effective waste disposal and efficient transportation systems which meets the needs of the community.

***Objectives and Policies:***

1. Protect the quality of nearshore and offshore waters.

2. Promote drainage and stormwater management practices that prevent flooding and protect coastal water quality.

3. Protect and enhance the quality of the marine environment.

4. Support the construction of the Lahaina Watershed Drainage Improvement Project above Wainee Village and desilting basins as shown on the land use map.

## F. COUNTY ZONING

The lands underlying the proposed flood diversion system are zoned "Agricultural" by Maui County Zoning. The proposed action is considered an integral element for agricultural land conservation. In keeping with the County's Agricultural District Ordinance (Chapter 19.30A), the earthen diversion channel will be grass planted. The objective of the channel is to manage soil erosion and storm runoff. The benefits of management of agricultural lands extend to the urban lands makai, as sediment-laden storm runoff will be directed to desilting and debris basins for safe discharge.

## G. ***COASTAL ZONE MANAGEMENT/SPECIAL MANAGEMENT AREA***

The Hawaii Coastal Zone Management Program (HCZMP), as formalized in Chapter 205A, HRS, establishes objectives and policies for the preservation, protection, and restoration of natural resources of Hawaii's coastal zone. It is noted that a portion of the project, at the second outlet, falls within the County of Maui's Special Management Area.

As set forth in Chapter 205A, HRS, and rules of the Maui Planning Commission, this section addresses the project's relationship to applicable coastal zone management considerations.

### *(1)* ***Recreational Resources***

***Objective:***

Provide coastal recreational opportunities accessible to the public.

***Policies:***

(A) Improve coordination and funding of coastal recreational planning and management; and

(B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

- (i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;
- (ii) Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary

compensation to the state for recreation when replacement is not feasible or desirable;

(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

(v) Ensuring public recreational use of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;

(vi) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;

(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of Section 46-6, HRS.

***Response***: The project itself is not anticipated to adversely impact demands on regional recreational facilities. In addition, the project is not anticipated to adversely impact coastal recreational opportunities and resources. The proposed project will help to enhance the marine habitat by reducing the sedimentation caused by flooding coastal waters. The proposed project will also help improve water quality and thereby enhance the recreational value of coastal waters. Viewed in this context, the proposed project will have a positive impact to the West Maui region's recreational value.

**(2) *Historic Resources***

***Objective:***

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

***Policies:***

(A) Identify and analyze significant archeological resources;
(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and
(C) Support state goals for protection, restoration, interpretation, and display of historic resources.

***Response***: An archaeological inventory survey was carried out in preparation of the EIS document in order to identify, protect and preserve historic resources. A preservation plan has been developed to protect cultural resources. Archaeological monitoring will be carried out during construction to protect cultural resources.

Overall sediment discharge in the project area will be reduced by 25 percent and result in an increase in water quality and marine resources. The project will have a net positive benefit to cultural resource values in the project area.

**(3) *Scenic and Open Space Resources***

***Objectives:***

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

***Policies:***

(A) Identify valued scenic resources in the coastal zone management area;

(B) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

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

(D) Encourage those developments which are not coastal dependent to locate in inland areas.

***Response:*** The proposed floodwater diversion system will be located along the western slope of the West Maui mountains above Lahaina Town at the 153 foot amsl elevation and approximately 1,500 feet uphill and gradually sloping in a southwesterly direction to Kauaula Stream and then paralleling the Honoapiilani Highway for a distance of 3,600 feet. Past agricultural practices for sugar cultivation have produced landscape forms that are similar to those of the proposed project. Terraces, irrigation and storm ditches, grassed swales, and field roads follow the contour of the hillside, as will the floodwater diversion system. Large rock piles that dot the former sugarcane fields are similar in form to the proposed debris basin embank. Vegetative screening and application of architectural concrete colors will be applied to concrete sections where appropriate, to mitigate impact on visual resources.

***(4) Coastal Ecosystems***

***Objective:***

Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

***Policies:***

(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

(B) Improve the technical basis for natural resource management;

(C) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

(D) 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; and

(E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

***Response:*** The proposed project is expected to eliminate sediment discharge in the area between Lahaina Harbor and Kauaula Stream and approximately fifty-two percent (52%) of the present sediment outflow at Puamana Channel. This reduction in sediment discharge will have a positive impact on the nearshore coral reef ecosystem. Sediment discharge will be increased at the second outlet location to approximately 3,280 tons per year. This area is less intensely represented by coral cover, algal and fish species than the area between the Lahaina Harbor and to the north of the second outlet. Overall, there will be a total reduction of approximately twenty-five percent (25%) of sediment discharge in the project area. Therefore, the project will result in a net beneficial impact on the coastal ecosystem.

***(5) Economic Uses***

***Objectives*:**

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

***Policies*:**

(A) Concentrate coastal dependent development in appropriate areas;

(B) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

  (i) Use of presently designated locations is not feasible;

  (ii) Adverse environmental effects are minimized; and

  (iii) The development is important to the State's economy.

***Response:*** The alignment of the proposed floodwater diversion system follows the natural contours where possible and is suitably located to divert existing runoff patterns. In this context, the proposed floodwater diversion system is suitably located to protect residences, businesses and historic properties in Lahaina Town. The proposed action will mitigate adverse economic impacts associated with flooding which has historically affected residences, businesses, and public/quasi-public uses makai of Honoapiilani Highway.

***(6) Coastal Hazards***

***Objectives*:**

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

***Policies*:**

(A) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;
(B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint pollution hazards;
(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and
(D) Prevent coastal flooding from inland projects.

***Response:*** The proposed project is necessary to prevent coastal flooding from inland storm runoff. The proposed project will reduce hazard to life and damage to property caused by flooding within the Lahaina Watershed.

***(7) Managing Development***

***Objectives*:**

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

***Policies*:**

(A) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;
(B) Facilitate timely processing of applications for development permits and resolve overlapping of conflicting permit requirements; and
(C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

***Response:*** Public information meetings have been incorporated into the EIS process. Further opportunities for public understanding of the proposed project are provided for in accordance with Chapter 343, HRS, notice and public review provisions. A Notice of Intent (NOI) for the proposed project for public informational purposes was also published in the Maui News (May 8, 2002) as required under the National Environmental Policy Act. Opportunity for public review and participation will also be provided pursuant to Chapter 205A HRS and Sections 12-202-10 and 11 Rules of Practice and Procedures for the Maui Planning Commission, Special Management Area.

***(8)*** ***Public Participation***

***Objectives*:**

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

***Policies*:**

(A) Promote public involvement in coastal zone management processes;
(B) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and
(C) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

***Response:*** As previously mentioned, public information meetings have been incorporated into the EIS process and public awareness of coastal management objectives and its relationship to storm runoff will be achieved as a result of the public information program. This EIS document will be processed in accordance with Chapter 343, HRS, and the National Environmental Policy Act and opportunity for comment by government agencies and the public will be provided. In addition, opportunity for public review and participation will also be provided pursuant to Chapter 205A HRS and Sections 12-202-10 and 11 Rules of Practice and Procedures for the Maui Planning Commission, Special Management Area.

**(9) *Beach Protection***

***Objectives*:**

Protect beaches for public use and recreation.

***Policies*:**

(A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;

(B) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.

***Response:*** In broad objective terms, the proposed project in the long term will help protect beach resources from flood damage and reduce the adverse impact to recreation caused by "red tide" from upland sedimentation in storm runoff. In order to achieve this objective, structures will have to be constructed within the shoreline setback area. Issues relating to coastal processes have been assessed and long-term mitigation may be required to enrich beaches between the Lahaina Harbor and Makila Point as a result of reducing sediment discharge. In the long term, new beaches may be formed in the area of the second outlet as a result of increased sediment discharge at this location.

### *(10) Marine Resources*

***Objectives:***

Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

***Policies:***

(A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;
(B) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;
(C) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;
(D) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and
(E) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

***Response:*** As part of the EIS document preparation, marine studies were carried out jointly with Federal and local sponsors to increase the body of knowledge regarding understanding of ocean processes, marine life and marine inventory information in the West Maui region. These findings were applied to assess potential adverse impacts to marine resources and identification of mitigative measures to protect the marine resources and to assure their sustainability.

## *H. SHORELINE SETBACK VARIANCE*

A Shoreline Setback Variance will be required for the second outlet. An assessment of the County's shoreline setback criteria relative to the outlet design follows.

1. ***Analysis of Shoreline Setback Criteria***

A portion of the second outlet is located within the shoreline setback, as set forth in Chapter 5, Rules of the Maui Planning Commission Relating to the Shoreline Area of the Islands of Kahoolawe, Lanai, and Maui. Refer to Figure 6. Accordingly, the proposed action has been evaluated with respect to applicable criteria and considerations advanced by the subject rules.

It is noted that Section 12-5-13(a)(4) provides that facilities or improvements necessary for drainage may be permitted.

The shoreline rules (Section 12-5-13) also provide for mitigative conditions for actions within the shoreline setback, as follows:

(1) To maintain safe lateral access to and along the shoreline or adequately compensate for its loss;

***Response:*** The existing lateral access in the vicinity of the second outlet is poor due to the rocky shoreline and embankment that rises steeply to the Honoapiilani Highway. Notwithstanding the poor lateral access, the proposed project will compensate for the loss of safe lateral access to and along the shoreline by providing lateral access across the top of the second outlet structure.

(2) To minimize risk of adverse impacts on beach processes;

***Response:*** ~~Approval of the second outlet will provide for beach nourishment which will have a positive impact on beach development process.~~As noted in Section III.A.4 of this report, an evaluation of shoreline and coastal processes was undertaken by Sea Engineering, Inc. Since Front Street beaches were found to be composed of a high percentage of terrigenous sand, trapping of the sediment in the project's debris and sediment basins may reduce material naturally consumed in beach formation. Beach monitoring and mitigation in the form of man-induced nourishment will be employed to minimize beach degradation in the immediate vicinity.

(3) To minimize risk of structures falling and becoming loose rocks or rubble on public property;

***Response:*** Given the outlet design of a concrete apron and grouted riprap spillway, it is unlikely that the structure would fall or be displaced from its installed position. However, in the unlikely event that the structure were to become loose or degraded, appropriate repair and/or maintenance measures will be implemented by the Department of Public Works and Environmental Management following full coordination with the Department of Planning.

(4) To minimize adverse impacts on public views to, from, and along the shoreline.

***Response:*** The proposed action is not anticipated to have an adverse impact on scenic and open space resources. The shoreline rises steeply to the edge of the Honoapiilani Highway. The outlet will be set in the embankment and under the surface grade of the Honoapiilani Highway.

## *I. STATE COMMISSION ON WATER RESOURCE MANAGEMENT*

The work proposed to be conducted within Kauaula Stream involves construction of a debris basin which will be a horseshoe shaped earth embankment approximately 500 feet long and 350 feet wide and approximately 10 feet in height from the natural ground with a debris storage capacity of 7,100 cubic yards. The purpose of the detention basin is to trap boulders and cobbles transported by the high gradient stream. It is designed as a flow through structure with no water storage or detention capability. The work proposed will also involve construction of two (2) weir outlets which will route flows from the debris basin to the southern diversion channel leading to the second outlet and the Puamana channel. The weirs located at elevations of 26 amsl and 28 amsl, respectively, are designed to evenly divide the 100-year peak discharge between the two (2) outlets. Construction of the proposed works may require a Stream Diversion Works Permit and Stream Channel Alteration

Permit from the Commission on Water Resource Management, State Department of Land and Natural Resources. Coordination with the Commission on Water Resource Management staff will be carried out to prepare and process the applications as applicable.

## J. *U.S. DEPARTMENT OF ARMY CORPS OF ENGINEERS*

The proposed debris basin embankment work within Kauaula Stream may trigger the Department of Army permitting requirements as a result of the placement of fill on the stream banks, pursuant to Section 404 of the Clean Water Act. ~~The Kauaula Stream, however, is intermittent in the lower reaches. Therefore, further coordination will be carried out with staff of the Corps of Engineers to prepare and process the application as applicable.~~

The Clean Water Act was enacted to restore and maintain the chemical, physical, and biological integrity of the Nation's water. Section 404 of the Clean Water Act regulates the discharge of dredge and fill materials into the waters of the United States and establishes a permit process to ensure that such actions comply with environmental criteria used by the Corps of Engineers in evaluating all Section 404 permit applications.

The Section 404(b)(1) Guidelines direct the Corps of Engineers to permit the least damaging practicable alternative. Generally, this is the practicable alternative that either avoids waters of the U.S. or impacts the smallest areas. Minimization of impacts may occur where avoidance is not practical after due consideration of costs, existing technology, or logistics.

The array of alternatives evaluated to reduce flood losses in Lahaina included alternatives that did not require the construction of a debris basin at Kauaula Stream. Nonstructural, land treatment alternatives did not provide the required level of flood protection, however. Alternatives that included outlet channels through Lahaina town created unacceptable impacts to the fringing reef and were considerably more costly due to higher landrights costs. The alternative that diverted flood flow to Kahoma Stream was deemed unacceptable as the additional floodwater reduced the level of protection to the downstream properties along Kahoma Stream. The two (2) alternatives that utilized portions of Kauaula Stream - the single outlet at Puamana and the selected alternative with two (2) outlets - provided the only two (2) practicable alternatives. Neither alternative would be functional without a debris basin and water control structure on Kauaula Stream to protect downstream structural improvements from damaging boulders and to split the flood flow between two (2) outlets.

While the detailed design of the debris basin is yet to be completed, some placement of fill in Kauaula Stream for the basin embankment at a location approximately 150 feet upstream from Honoapiilani Highway is anticipated. Mitigation features to facilitate migration of native amphidromous species both downstream and upstream along Kauaula Stream will be investigated and incorporated into the design, as appropriate. Continual monitoring for cultural resources will be conducted during excavation.

Further coordination will be undertaken with the staff of the Corps of Engineers to prepare and process a Section 404 permit application, as applicable. The Section 404 permit application will be completed concurrently with the debris basin design and will conform to the Section 404(b)(1) Guidelines.

With regard to the second outlet, the outlet structure has been designed such that the rock riprap apron lies landward of the mean higher high water line. Refer to Figure 6. Based on this design, the Department of the Army has determined that the outlet structure is not in jurisdictional waters of the United States. Accordingly, a Department of the Army permit will not be required for this component of the project. See Appendix "D".

Application of a U.S. Department of Army Corps of Engineer permit will also trigger a Section 401 Water Quality Certification application permit from the State Department of Health and a Coastal Zone Management Consistency Assessment application permit from the Office of Planning, State Department of Business, Economic Development and Tourism. Therefore, coordination with respective departmental staff will be carried out to prepare and process the applications, as applicable.

With regard to the second outlet, the outlet structure has been designed such that the rock riprap apron lies landward of the mean higher high water line. Refer to Figure 6. Based on this design, the Department of the Army has determined that the outlet structure is not in jurisdictional waters of the United States. Accordingly, a Department of the Army permit will not be required for this component of the project. See Appendix "D".

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out to prepare and process the applications, as applicable.

## K. ***<u>NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COORDINATION</u>***

Preparation of the EIS document was coordinated with the USDA, NRCS pursuant to Council of Environmental Quality Regulations (40 CRF §§ 1500-1508) implementing the procedural provisions of the National Environmental Policy Act. Federal agency consultation was undertaken to meet the regulations under the Endangered Species Act with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service; National Historic Properties Act consultations under Section 106 with the State Historic Preservation Division to address applicable Federal Acts, Executive Orders and policies such as Civil Rights Act, Title VI, Clean Water Act, Floodplain Management Act and Wetlands Protection Act.

# Chapter V

## Summary of Adverse Environmental Effects Which Cannot Be Avoided and Unresolved Issues

# V. SUMMARY OF ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED AND UNRESOLVED ISSUES

## A. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Implementation of the proposed project will result in temporary construction-related impacts as described in Chapter III, Potential Impacts and Mitigation Measures.

Temporary noise and air quality impacts are typically associated with construction activities. These effects will be mitigated through appropriate construction management practices.

In the long term, a beach nourishment program may be required for the Front Street beach area south of Lahaina Harbor to mitigate the reduction in sediment discharge from Kauaula Stream and Puamana Channel which has contributed to the build up of sand on the area beaches. However, much of the abayment to the north is characterized by seawalls with no beaches. The Front Street beaches are located at the north end of the 1,500-foot long embayment. A nourishment program to feed the coastal process with cobbles and boulders which helps form Makila Point may also be required to mitigate the loss of material trapped in the project sediment and debris basins. Both these impacts can be mitigated by the above measures and their long-term impacts are not considered to be significant in the context of the overall project. New beaches may be formed in the vicinity of the second outlet as a result of the lateral transport of terrigenous sediment in stormwater discharge.

There will be a negative impact due to increased fine sediment and fresh water discharge, on a localized area, approximately 121,708 square feet based on a 10-year flood, in the vicinity of the second outlet at

Waianukole. This ~~will~~may adversely impact two (2) species of limu *(limu lipoa and limu kohu)* which have been identified in the marine survey and known to be collected by Native Hawaiians. The adverse localized impact to the two (2) species of limu will be more than offset by the positive impact of reducing overall sediment discharge in the project area improving water quality and invigorating the environmental conditions for the five (5) species of limu (*limu kohu, limu lipoa, palahala, wawae'iole and 'ele'ele*), the coral reef ecosystem and the marine resources throughout the project area. Overall, there will be a net beneficial impact to the marine environment as a result of the proposed project.

## B. UNRESOLVED ISSUES

### 1. Lahaina Bypass

The final environmental impact statement for the Lahaina Bypass project was recently accepted by the Governor of the State of Hawaii. Although the intersection with Lahainaluna Road is proposed as a grade separated intersection, the design of the intersection and drainage details are currently not available. Therefore, further coordination with the State of Hawaii, Department of Transportation will be required as the design progresses to ensure the drainage will flow through the Bypass improvements and into the flood diversion system.

### 2. Dickenson Street Extension

~~Design details of t~~The status of the Dickenson Street Extension project proposed by the County of Maui, was under consideration during the preparation of the DEIS. However, recent consultation with ~~the~~ West Maui residents has rendered this project inactive. Although long-term consideration may need to be given to the Dickenson Street Extension Project, immediate design coordination will not be required.~~and the northern intake structure of the flood diversion system have not been finalized. Based on the coordination meeting between the County of Maui, NRCS and the Dickenson Street project design team, and the comments received from Kamehameha Schools, the relocation of the flood diversion intake basin to the south of the Dickenson Street Extension and the channeling of the runoff from Lahainaluna Road is under consideration. Further coordination between the two (2) projects will be required to finalize drainage design features.~~

# Chapter VI

## Alternatives to the Proposed Action

# VI. ALTERNATIVES TO THE PROPOSED ACTION

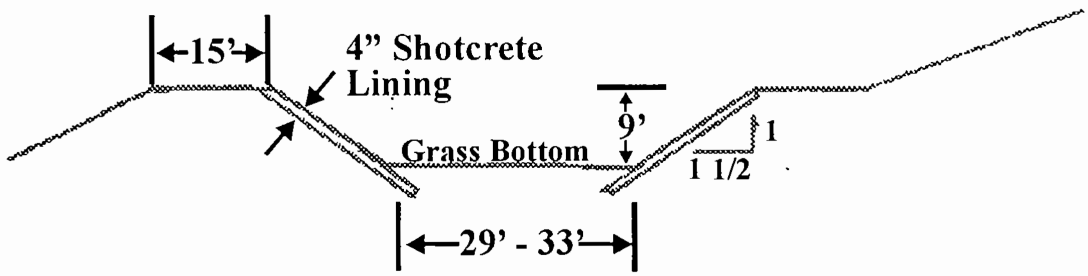
## A. PREFERRED ALTERNATIVE

The proposed project represents the preferred alternative. This alternative provides a cost-effective and technically viable solution to flooding and flood-related problems of the Lahaina Watershed.

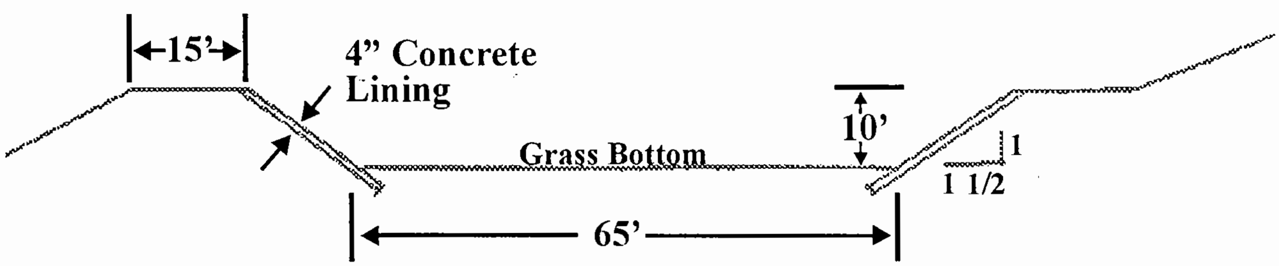
## B. SHOTCRETE BANKS WITH EARTH BOTTOM CHANNEL ALTERNATIVE

This alternative involves the application of shotcrete, a mixture of portland cement, aggregate and water conveyed by compressed air to a spray gun. Under this alternative, the earthen channel banks of the diversion works will be increased to a slope of 1.5:1. See Figure 3. The shotcrete would be applied to the side banks to enhance the stability of the channel banks. The design velocities and gradient will be similar to the grass-lined channel at 6 to 8 feet per second and a gradient of 0.03 percent. The bottom of the channel will continue to be grass-lined. Therefore, sediment discharge in storm runoff would have similar impact characteristics. The steeper slopes, however, would reduce the channel right-of-way width from 158 feet to 135 feet and the overall right-of-way area required for the channel section will be reduced from 23 acres to 19 acres. This alternative presented a primary advantage to reduce operation and maintenance requirements associated with the vegetative upkeep of the banks. The cost for the shotcrete alternative is estimated to be approximately $14.5 million. Although the initial capital cost for the shotcrete alternative is slightly higher than the earthen, grass-lined channel alternative, this alternative may, in the long term, be more cost efficient as annual OM & R costs would decrease.

If used, shotcrete is not anticipated to result in impacts different from those assessed under the earthen grass-lined channel alternative. It is




**Shotcrete-Lined Channel Section**
**North of Kauaula Stream**




**Shotcrete-Lined Channel Section**
**South of Kauaula Stream**

Source: Natural Resources Conservation Service

Figure 16

Lahaina Watershed
Flood Control Project
Shotcrete Channel Section

NOT TO SCALE

Prepared for: County of Maui, Department of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

noted, however, that shotcrete may be more visible in the context of the surrounding agricultural lands. The visual impacts of shotcrete application may be mitigated through the use of colors which can be incorporated in the application to visually blend the channel with surrounding lands. No other substantive changes to project impacts are anticipated with the shotcrete channel bank alternative.

In addition to visual differences between this alternative and the earthen bank, grass-lined channel alternative, consideration will need to be given to required mitigation for the burial (Site 5239). If the shotcrete bank section is utilized, the channel width would be reduced which may result in the burial being located outside of the channel right-of-way. The conceptual preservation plan reviewed by the Maui/Lana'i Islands Burial Council provides for passive "as is" preservation assuming the burial would be within the channel right-of-way. Accordingly, use of this alternative will require a new review by the Burial Council.

## C. ***LAHAINA TOWN FLOOD CONTROL OUTLET ALTERNATIVE***

Several alternatives were considered which incorporated an outlet channel through the Lahaina Town area. High project costs and environmental concerns about sediment discharge within the fringing reef fronting the town area gave low priority to these alternatives.

## D. ***KAUAULA STREAM SINGLE OUTLET ALTERNATIVE***

Kauaula Stream presented many advantages as an outlet for the floodwater diversion channel. The Kauaula subwatershed discharge is nearly four (4) times greater than the discharge of the Lahaina subwatershed. Therefore, the stream capacity and the ocean outlet have been naturally developed to accommodate high runoff and high sediment concentrations. The Kauaula subwatershed is greater in length than the

Lahaina subwatershed and thus the peak discharges would not occur at the same time. The Lahaina peak discharge would pass well before that from the Kauaula subwatershed. However, concerns about excessive sediment pollution at the Puamana outlet and possible construction impacts of the Puamana channel, and maintenance of the Puamana channel resulted in placing this alternative as a lower priority option.

## E. *KAHOMA STREAM OUTLET ALTERNATIVE*

Use of the Kahoma Flood Channel as an outlet was investigated during the formulation of alternatives for this project in the late 1980s. At that time, the U.S. Army Corps of Engineers stated in the coordination meeting that the additional flood flow from the Lahaina subwatershed would decrease the level of flood protection for the lowlying areas of the Kahoma floodplain and that the use of Kahoma Stream as an outlet was unacceptable. A recent inquiry to the flood program manager at the USACE on the use of Kahoma Stream produced the same negative result.

## F. *NON-STRUCTURAL ALTERNATIVES*

Non-structural alternatives investigated included land treatment or conservation practices recommended by NRCS listed and described in the NRCS National Handbook of Conservation Practice. These include, but are not limited to, conservation cover, critical area planting, diversion dam, deep tillage, terracing, field borders and filter strips. The NRCS Field Office Technical Guide provides standards and specifications for the design and installation of the practices. Land treatment practices are generally intended to control runoff and provide soil erosion protection during frequently occurring storms. NRCS standards for enduring land treatment practices require a minimum capacity to handle the 10-year, 24-hour storm without overtopping or other failure. Evaluation of the non-structural alternatives were not found to be effective in preventing flood damage during high intensity storms.

## ~~E.~~G. NO ACTION ALTERNATIVE

In light of the established need for flood control measures in the Lahaina Watershed, the “no action alternative” does not represent a responsible option towards alleviating the problems and damage caused by periodic flooding and associated sediment damage. Businesses and residences located in the Lahaina Historic District No. 1 and floodplain will continue to be damaged by flooding. Honoapiilani Highway and local streets will continue to be closed to traffic and clean-up of the roads and public areas will continue to be required following flooding. Numerous small drainageways will continue to transport fine sediments into the nearshore reef area fronting Lahaina Town causing discoloration of the water and adversely affecting the reef biota. In light of the established need for the proposed project the "no action" alternative does not represent a responsible option towards flood control in the Lahaina Watershed.

## ~~F.~~H. DEFERRED ACTION ALTERNATIVE

A "deferred action" alternative will have similar consequences as a "no action" alternative as problems and damage resulting from flooding will continue to persist and potentially increase. Deferring implementation of the proposed flood control improvements may also result in higher implementation costs in the future due to inflation.

# Chapter VII

## Irreversible and Irretrievable Commitments of Resources

# VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The development of the proposed project would involve the commitment of land and funds. In addition, labor and materials resources would be expended as part of the project's construction phase. Commitment of these resources are considered irreversible and irretrievable. This commitment, however, is considered appropriate in the context of protecting the community from flooding within the Lahaina Watershed.

# Chapter VIII

## Findings and Conclusions

# VIII. FINDINGS AND CONCLUSIONS

Every phase of the proposed action, expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action have been evaluated in accordance with the Significance Criteria of Section 11-200-12 of the Administrative Rules. Discussion of project conformance to the criteria is noted as follows:

1. ***No Irrevocable Commitment to Loss or Destruction of any Natural or Cultural Resource Would Occur as a Result of the Proposed Project***

   A marine survey and assessment, as well as an archaeological inventory were carried out to address issues relating to loss or destruction of natural or cultural resources. With respect to archaeology, the overall scope of the inventory survey covered the corridor that was nearly two (2) miles long and ranged from 150 to 250 feet in width. One previously unidentified burial was located during testing. Passive "as is" preservation is recommended for this burial site. Based on discussions with the State Historic Preservation Division and the Maui/Lana'i Islands Burial Council, archaeological monitoring is also recommended during construction. These foregoing mitigation measures will be incorporated in the project plans and specifications.

2. ***The Proposed Action Would Not Curtail the Range of Beneficial Uses of the Environment***

   The proposed project will not curtail the range of beneficial uses of the environment. There are no impacts attributed to the project which will limit the use of surrounding lands. Environmental parameters such as air quality will similarly not be adversely affected by the project. Adverse effects on scenic views resulting from the proposed project can be mitigated by landscape screening and use of architecturally colored concrete where appropriate. Assessment of water quality parameters indicate a net benefit to water quality. Assessment of marine biology indicate a net benefit to marine resources in the project area. Long-term mitigation for beach enrichment between Lahaina Harbor and Puamana Channel and cobble and boulder enrichment of Makila Point may be required. New sand beaches may be formed in the vicinity of the second outlet. The proposed action is not anticipated to have a significant effect on the beneficial uses of the environment.

### *3. The Proposed Action Does Not Conflict With the State's Long-Term Environmental Policies or Goals or Guidelines as Expressed in Chapter 344, HRS*

The State Environmental Policy and Guidelines are set forth in Chapter 344, HRS. The proposed action is in consonance with the following policies and guidelines:

***Policy:***

(1) Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social economic, and other requirements of the people of Hawaii.

***Guidelines:***

(2) Land, water, mineral, visual, air and other natural resources.

(D) Encourage management practices which conserve and protect watersheds and water sources, forest, and open space areas.

4. ***The Economic or Social Welfare of the Community or State Would Not Be Substantially Affected***

The project will directly benefit the local economy by providing construction and construction-related employment. In the long term, the project will support the local economy through the contribution of salaries, wages, benefits and taxes, as well as through the purchases of goods and services. The proposed project will have a beneficial effect upon the economy by reducing the damage and loss to businesses caused by flooding conditions.

5. ***The Proposed Action Does Not Affect Public Health***

No adverse impacts to the public's health and welfare are anticipated as a result of the proposed project. The proposed project will reduce flood conditions in Lahaina and reduce public hazards caused by flooding. In this context, the proposed project will be beneficial to public health.

6. ***No Substantial Secondary Impacts, Such as Population Changes or Effects on Public Facilities, are Anticipated***

The proposed project is not a source of new population to the region. In this regard, the proposed project is not anticipated to adversely affect public services in the region, such as schools, police, and fire protection.

7. ***No Substantial Degradation of Environmental Quality is Anticipated***

Excavation and grading activities will create temporary short-term nuisances related to noise and dust. Appropriate dust control and noise mitigation measures will be implemented during construction to ensure that fugitive dust and noise generated in connection with construction is minimized.

Debris and sedimentation channels have been designed to mitigate impacts to downstream properties and coastal ecosystems.

Marine processes and marine water quality were investigated as part of the EIS preparation phase and appropriate mitigation measures were identified. Overall, a net benefit to environmental quality will be achieved by the proposed project.

8. ***The Proposed Action Does Not Involve a Commitment to Larger Actions, Nor Would Cumulative Impacts Result in Considerable Effects On The Environment***

There are no additional development components associated with the project. Accordingly, the impacts assessed in this EIS document are based on the entire action. The proposed project will not result in a cumulative impact that will result in considerable effects on the environment.

9. ***No Rare, Threatened or Endangered Species or Their Habitats Would be Adversely Affected By The Proposed Action***

There are no known rare, threatened or endangered terrestrial species or habitats of flora and fauna within the proposed project area. A marine biological assessment was conducted as an element of the EIS preparation. The findings of this study did not reveal any adverse impact to rare, threatened or endangered species or their habitats by the proposed project.

10. ***Air Quality, Water Quality or Ambient Noise Levels Would Not Be Detrimentally Affected By The Proposed Project***

Construction activities will result in short-term air quality and noise impacts. Dust control measures, such as regular watering and sprinkling, and installation of dust screens will be implemented to minimize wind-blown emissions. Noise impacts will occur primarily from construction equipment. Equipment mufflers or other noise attenuating equipment, as well as proper equipment and vehicle maintenance, will be used during construction activities.

The proposed project will reduce the water pollution caused by sediment discharge entering the ocean fronting the Lahaina Watershed. In the long term, the proposed project is not anticipated to have a significant impact on air quality or ambient noise conditions. Long-term impacts on water quality resulting from the proposed project will be positive.

### 11. ***The Proposed Project Would Not Affect Environmentally Sensitive Areas, Such As Flood Plains, Tsunami Zones, Erosion-prone Areas, Geologically Hazardous Lands, Estuaries, Fresh Waters or Coastal Waters***

The proposed project will help reduce the flood hazard within the watershed area. The proposed project will not adversely affect any environmentally sensitive areas, geologically hazardous, fresh or coastal waters.

### 12. ***The Proposed Project Will Not Substantially Affect Scenic Vistas and Viewplanes Identified in County or State Plans or Studies***

Adverse effects to coastal scenic and open space resources and scenic view corridors resulting from the proposed project will be mitigated by landscaping and application of architecturally colored and treated concrete where necessary.

### 13. ***The Proposed Project Will Not Require Substantial Energy Consumption***

The subject project will involve the commitment of fuel for construction equipment, vehicles, and machinery during construction and maintenance activities.

However, in the context of the region's overall energy consumption, the project's demand for energy is not considered excessive, nor is it considered substantial.

# Chapter IX

## List of Permits and Approvals

# IX. LIST OF PERMITS AND APPROVALS

The following Federal, State and County permits and approvals may be required for project implementation:

***Federal Permits***

1. Department of Army Permits (U.S. Army Corps of Engineers), pursuant to Section 404, Clean Water Act
2. Federal Emergency Management Agency (FEMA), Conditional Letter of Map Revisions (CLOMR) and Letter of Map Revisions (LOMR)

***State of Hawaii***

1. Section 401 Water Quality Certification (Department of Health)
2. Coastal Zone Management Consistency Approval (State Office of Planning)
3. Stream Diversion Works Permit and Stream Channel Alteration Permit (State Commission on Water Resource Management)
4. State Work-to-Perform Permit (Department of Transportation)
5. Conservation District Use Permit (Department of Land and Natural Resources)
6. National Pollutant Discharge Elimination System Permit (NPDES) (Department of Health)

***County of Maui***

1. Special Management Area Use Permit (Maui Planning Commission)
2. Shoreline Setback Variance Approval (Maui Planning Commission)
3. Special Flood Hazard Area Development Permit
4. Grading and Grubbing Permit (Department of Public Works and Environmental Management)

Coordination with the appropriate administering agencies will be conducted during the EIS process and project permitting requirements.

# Chapter X

## Initial Public Information Meeting of February 21, 2002

## X. INITIAL PUBLIC INFORMATION MEETING OF FEBRUARY 21, 2002

Prior to the preparation and filing of the EIS Preparation Notice, a public information meeting was held to present the project's design parameters and to receive early input for EIS preparation purposes. The meeting was held at the Lahaina Intermediate School Cafeteria with approximately 60 people in attendance. Representatives of the County of Maui Department of Public Works and Environmental Management, U.S. Department of Agriculture Natural Resources Conservation Service, and the West Maui Soil and Water Conservation District, along with project consultants, presented the project and responded to questions and received comments regarding the proposal.

Notification of the meeting was made through letters sent directly to affected landowners, community organizations and interested individuals. In addition, notification of the meeting was made through local newspapers.

A summary of comments received at the meeting follows.

1. A number of meeting participants expressed concern regarding property damage caused by the recent flooding in Lahaina. Concern was also noted regarding the timeframe for plan implementation. The project consultant explained that the EIS process is estimated to take about 15 months, with an additional 12 months to complete project permitting and design. Construction would take about 12 months to complete.

2. Representatives of the WMSWCD explained that they have sponsored temporary improvements to provide interim mitigation against flooding. A temporary diversion channel was constructed in the vicinity of the proposed Lahaina floodwater diversion channel on Kamehameha Schools' land. The interim measure involved construction of over 2 miles of diversion channel and utilization of 3 basins,one of which is the reservoir above the former Wainee Village. These measures, although temporary (until the proposed project is completed) helped to divert a good portion of the recent storm flows.

3. WMSWCD representatives noted that maintenance of the interim

measures will need to continue to ensure the functional integrity of the system. The work carried out for the interim improvements was funded by government grants (319P) and matching private funds. Much of the work done in constructing and maintaining the system is through volunteer efforts.

4. Meeting participants expressed concern that the temporary measures were not effective in preventing flooding in January of 2002. WMSWCD representatives stated that they will work with landowners to clean up debris basins to improve the functional integrity of the system.

5. Questions regarding drainage improvements in Lahaina town were asked by meeting participants. Representatives of the Department of Public Works and Environmental Management explained that the County's Drainline "F" project is intended to take storm runoff from below the proposed floodwater diversion system to an ocean outlet in the vicinity of Maluuluolele Park. They noted that the Lahaina floodwater diversion project will work hand-in-hand with the Drainline "F" project.

6. Meeting participants commented on the need for upland landowners to implement and maintain best management practices for soil erosion control, including the use of terraces.

7. In light of flooding incidents in 1997 and in 2002, the need for the project was confirmed. In this regard, WMSWCD representatives confirmed that construction funding is being addressed at this time. They asked meeting participants to communicate with their congressional representatives to request support for project funding.

# Chapter XI

## Agencies and Organizations Consulted in the Preparation of the Draft EIS

# XI. AGENCIES AND ORGANIZATIONS CONSULTED IN THE PREPARATION OF THE DRAFT EIS

The following agencies, organizations and individuals have been consulted in the preparation of the Draft EIS. Consultation with the listed Native Hawaiian organizations will take place during the Draft EIS process in compliance with Section 106, National Historic Preservation Act. In addition, NRCS published a Notice of Intent (NOI) to prepare an environmental impact statement for the Lahaina Watershed Flood Control Project in the Federal Register on April 22, 2002. The NOI was also published on May 8, 2002 in the Maui News and in the Office of Environmental Quality Control, Environmental Notice. The agencies and organization receiving copies of the Draft EIS pursuant to Chapter 343, HRS are listed in Section A, below. The agencies and organization receiving copies of the Draft EIS pursuant to NEPA are listed in Section B, below.

## A. *Agencies and Organizations Consulted Pursuant to Chapter 343, HRS*

1. William Lennan
   **Department of the Army**
   U.S. Army Engineer District, Hnl.
   Attn: Operations Division
   Bldg. T-1, Room 105
   Fort Shafter, Hawaii 96858-5440

2. Robert P. Smith
   Pacific Islands Manager
   **U. S. Fish and Wildlife Service**
   P.O. Box 50167
   Honolulu, Hawaii 96850

3. Mary Lou Kobayashi, Director
   State of Hawaii
   **Office of Planning**
   **Department of Business, Economic Development and Tourism**
   P.O. Box 2359
   Honolulu, Hawaii 96804

4. Denis Lau, Chief
   **Clean Water Branch**
   State of Hawaii
   **Department of Health**
   919 Ala Moana Blvd., Room 300
   Honolulu, Hawaii 96814

5. Herbert Matsubayashi
District Environmental Health
Program Chief
State of Hawaii
**Department of Health**
54 High Street
Wailuku, Hawaii 96793

6. Peter Young
State of Hawaii
**Department of Land and Natural Resources**
P. O. Box 621
Honolulu, Hawaii 96809

7. P. Holly McEldowney
State of Hawaii
**Department of Land and Natural Resources**
**State Historic Preservation Division**
601 Kamokila Blvd., Room 555
Kapolei, Hawaii 96707

8. Rodney Haraga, Director
State of Hawaii
**Department of Transportation**
869 Punchbowl Street
Honolulu, Hawaii 96813

9. Fred Cajigal, Maui District Engineer
State of Hawaii
**Department of Transportation**
**Highways Division**
650 Palapala Drive
Kahului, Hawaii 96732

10. Colin Kippen, Deputy Administrator
**Office of Hawaiian Affairs**
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

11. Richard A. Fernandez, Chief
County of Maui
**Department of Fire Control**
200 Dairy Road
Kahului, Hawaii 96732

12. Alice Lee, Director
County of Maui
**Department of Housing and Human Concerns**
200 S. High Street
Wailuku, Hawaii 96793

13. Michael W. Foley, Director
County of Maui
**Department of Planning**
2200 Main Street, Suite 610
Wailuku, Hawaii 96793

14. Cultural Resources Commission
c/o Maui Planning Department
2200 Main Street, Suite 335
Wailuku, Hawaii 96793

15. Glenn Correa, Director
County of Maui
**Department of Parks and Recreation**
1580-C Kaahumanu Avenue
Wailuku, Hawaii 96793

16. Tom Phillips, Chief
County of Maui
**Police Department**
55 Mahalani Street
Wailuku, Hawaii 96793

17. Gilbert Coloma-Agaran, Director
County of Maui
**Department of Public Works and Waste Management**
200 South High Street
Wailuku, Hawaii 96793

18. George Tengan, Director
County of Maui
**Department of Water Supply**
200 South High Street
Wailuku, Hawaii 96793

19. **Maui Electric Company, Ltd.**
P. O. Box 398
Kahului, Hawaii 96732

20. Lahaina Town Action Committee
648 Wharf Street, Suite 102
Lahaina, Hawaii 96761

21. West Maui Taxpayers Association
P.O. Box 10338
Lahaina, Hawaii 96761

22. Lahaina Restoration Foundation
695 Front Street, 2nd Floor
Lahaina, Hawaii 96761

23. Richard Meaney
General Manager
**Puamana Community Association**
34 Puailima Place
Lahaina, Hawaii 96761

24. Jeffrey Melrose
Land Planner/Land Manager
Kamehameha Schools
P.O. Box 495
Pa'auilo, Hawaii 96776

25. Mr. Kimo Falconer
Pioneer Mill
349 Lahainaluna Road
Lahaina, Hawaii 96761

26. Councilmember JoAnne Johnson
Maui County Council
200 South High Street
Wailuku, Hawaii 96793

27. Steve Lovelette
Executive Vice President
Amfac/JMB Hawaii, LLC
2530 Kekaa Drive
Lahaina, Hawaii 96761

28. Buddy Nobriga
Chair, West Maui Soil and Water Conservation District
P.O. Box 1170
Wailuku, Hawaii 96793

29. Mr. Jim Riley
Launiupoko Associates
173 Hoohana, Suite 201
Kahului, Hawaii 96732

30. Mr. Glenn Shishido
State of Hawaii
Division of Forestry and Wildlife
54 South High Street
Wailuku, Hawaii 96793

31. Mr. William Shauney
Disaster Services American Red Cross
1032 S. Kihei Road #B502
Kihei, Hawaii 96753

32. Terryl Vencl, Executive Director
Maui Hotel Association
1727 Wili Pa Loop
Wailuku, Hawaii 96793

33. Carolyn Nuyen
Lahaina Public Library
680 Wharf Street
Lahaina, Hawaii 96761

34. Akoni Akana, Executive Director
Friends of Moku'ula
505 Front Street
Lahaina, Hawaii 96761

35. Thelma Shimaoka, Community Resource Coordinator
Office of Hawaiian Affairs
140 Ho'ohana Street, Suite 206
Kahului, Hawaii 96732

36. Vanessa Medeiros, District Supervisor
Department of Hawaiian Home Lands
Maui District Office
1063 East Main Street, Suite C-206
Wailuku, Hawaii 96793

37. Rose Marie Duey, Island Representative
Alu Like, Inc.
Maui Island Center
1977 Kaohu Street
Wailuku, Hawaii 96793

38. Maui/Lana'i Islands Burial Council
c/o State Historic Preservation Division
State of Hawaii, Department of Land and Natural Resources
601 Kamokila Boulevard, Room 555
Kapolei, Hawaii 96707

## *B. Agencies and Organizations Consulted Pursuant to NEPA*

1. Rueben Flores, State Executive Director
Farm Services Agency
P.O. 50008
Honolulu, HI 96850

2. John Ewel, Director
Pacific Southwest Research Station
USDA Forest Service
1151 Punchbowl St., Room 323
Honolulu, HI 96813

3. Director, Office of Advocacy and Enterprise
Room 1322, South Bldg
U.S. Department of Agriculture
Washington, DC 20250

4. Director
Office of Equal Opportunity
Room 102-W
U.S. Department of Agriculture
Washington, DC 20250

5. Lorraine Shin, State Director
Rural Development
1154 Waianuenue Rm 311
Hilo, HI 96720

6. Division Engineer
U.S. Army Corps of Engineers
Building 230
Ft. Shafter, HI 96858-5440

7. Directorate of Facilities Engineer
U.S. Army Support Command Hawaii
ATTN: Environmental Management Office
Fort Shafter, HI 96858-5000

8. Director, Ecology and Conservation Office
NOAA
U.S. Department of Commerce
14th and Constitution, NW, Room 6117
Washington, DC 20230

9. Director, Honolulu Office
Community Planning and Development Div.
Dept. of Housing and Urban Dev.
500 Ala Moana Blvd, #7-500
Honolulu, HI 96813-4918

10. Terence N. Martin, Chief
USDOI Transportation and Water Resources Div.
Office of Env. Policy and Compliance
1849 C St., NW, Room 2340
Washington, DC 20240

11. Robert P. Smith
Pacific Islands Administrator
U.S. Fish and Wildlife Service
PO Box 50167
Honolulu, HI 96850

12. Gorden Tribble
District Chief
U.S. Geological Survey
677 Ala Moana Blvd., Ste. 415
Honolulu, HI 96813-5412

13. Commander
Naval Base Pearl Harbor
ATTN: Base Civil Engineer
Box 110
Pearl Harbor, HI 96860-5020

14. Coordinator, Water Resources
U.S. Coast Guard G-WS/11
U.S. Department of Transportation
2100 Second Street, SW
Washington, DC 20590

15. Director, Region IX
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105

16. Environmental Protection Agency
Pacific Islands Contact Office
P.O. Box 50003
Honolulu, HI 96850

17. Senator Daniel K. Inouye
U. S. Senate
PJKK Federal Bldg.
300 Ala Moana Blvd. Rm 7325
Honolulu, HI 96850

18. Senator Daniel K. Akaka
U. S. Senate
PJKK Federal Bldg.
300 Ala Moana Blvd. Room 3104
Honolulu, HI 96850

19. Representative Ed Case
U.S. House of Representatives
PJKK Federal Bldg.
300 Ala Moana Blvd. Room 5104
Honolulu, HI 96850

# Chapter XII

## Comments Received During the 30-Day Comment Period for the Environmental Impact Statement Preparation Notice (EISPN) and Notice of Intent (NOI) and Responses to Substantive Comments

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Box 50088
Honolulu, Hawaii 96850

MAY 31 2002

In Reply Refer To: PI-02-77

Kenneth M. Kaneshiro, State Conservationist
Natural Resources Conservation Service
300 Ala Moana Blvd., Rm 4-118
Honolulu, HI 96850

Re: Notice of Intent to Prepare an Environmental Impact Statement, Lahaina Watershed Project, Maui, Hawaii.

Dear Mr. Kaneshiro:

The U.S. Fish and Wildlife Service (Service) has reviewed the notice of intent to prepare an environmental impact statement (EIS) for the Lahaina Watershed Project, Maui, Hawaii. The project sponsor is the Natural Resources Conservation Service (NRCS). This letter has been prepared under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 *et seq.*; 48 Stat. 401], as amended, and the and the Federal Clean Water Act [33 U.S.C. 1251 *et seq.*; 62 stat. 1155], as amended (CWA). These comments are also consistent with the National Environmental Policy Act of 1969 [42 U.S.C. 4321 *et seq.*; 83 Stat. 852] (NEPA).

The purpose of the proposed project is flood prevention. An alternative under consideration includes a design that incorporates a floodwater diversion channel that transfers water to Kauaala Stream, an inlet basin, three sediment basins, and additional floodway modifications that involve debris basins and outlets from the Puamana Channel.

None of the streams in the Lahaina area are perennial in their lower reaches, therefore they are not expected to contain larger aquatic organisms or waterbirds. The primary concern of the Service is the potential effects of delivering nutrient- and sediment-laden floodwaters to the nearshore coastal environment. Water quality of the west Maui coastline is a source of concern for resource managers because of the detrimental effects of sediment upon coral reefs, and the recurring "blooms" of nuisance algae that occur in the area. No single source of nutrients has been identified for these blooms, though run-off from terrestrial sources may contribute to these episodic events.



The Service recommends that the planning process and resulting EIS for this project explore a variety of alternatives that retain floodwaters and incorporate features that reduce sediment and nutrient loads to the maximum extent possible for the purpose of protecting the nearshore coastal environment, particularly protection of coral reef resources. A thorough analysis of expected flood frequency volumes and the necessary basin size needed to achieve an acceptable reduction in sediment loads is needed to adequately describe the potential effects of this project. In addition, a description of the need and funding requirements for continued maintenance of sediment basins and debris basins, either by NRCS or sponsoring local organizations such as the Maui County is required. The Service encourages NRCS to utilize restoration of riparian areas, buffer strips, conservation reserves and other non-structural means to achieve floodwater reduction and retention to the extent feasible.

The Service appreciates the opportunity to provide comments on the proposed project. If you have questions regarding these comments, please contact Fish and Wildlife Biologist Gordon Smith at 808/541-3441.

Sincerely,

Paul Henson

Paul Henson
Field Supervisor
Ecological Services

cc: EPA Region IX, Honolulu
ACOE, Honolulu
DLNR-DAR, Maui

NRCS
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850

United States Department of Agriculture

*Our People...Our Islands...In Harmony*

June 5, 2002

Paul Henson, Field Supervisor
Ecological Services
Pacific Islands Fish and Wildlife Office
U.S. Fish and Wildlife Service
P.O. Box 50088
Honolulu, Hawaii 96850

Dear Mr. Henson:

Subject: Lahaina Watershed (PI-02-77)

Thank you for your review of the Notice of Intent to prepare an environmental impact statement for Lahaina Watershed and the comments provided in your May 31, 2002 letter.

The USFWS recommendations regarding reduction of sediment and nutrient discharge to the nearshore reef area, funding of maintenance activities, and use of land treatment and non-structural measures will be fully considered during preparation of the Watershed Plan and EIS.

Also, NRCS will continue to consult with the USFWS during the planning of this project to ensure conformance with the Endangered Species Act.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist



NRCS
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850

United States Department of Agriculture

*Our People...Our Islands...In Harmony*

March 24, 2003

Paul Hensen, Field Supervisor
U.S. Fish and Wildlife Service
Pacific Islands Ecoregion
300 Ala Moana Blvd., Room #3-108
Honolulu, HI 96850

Dear Mr. Hensen:

The Natural Resources Conservation Service (NRCS), in cooperation with County of Maui and the West Maui Soil and Conservation District, is planning to implement a Flood Prevention project in Lahaina, Maui. The project has been planned and will be implemented under the federal authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566.

The proposed project was initially planned and approved for installation in 1992 when the Watershed Plan and Environmental Assessment were completed and finalized. Funding constraints resulted in the postponed installation of the project. In 2002, the Lahaina Watershed Plan was reviewed and updated by NRCS and the sponsors who decided to upgrade the Environmental Assessment to an Environmental Impact Statement. The draft Environmental Impact Statement for the project is currently being prepared.

The project involves the construction of a floodwater diversion system that starts south of Lahainaluna Road at approximately 150 feet above mean sea level and extends across the watershed in a southwesterly direction to a debris basin at Kauaula Stream. The draft Project Overview, with maps, is attached. The diversion channel is proposed to be grass-lined except for reinforced concrete reaches near Lahainaluna Road and adjacent to Wainee Reservoir. The proposed project also includes the construction of an inlet basin and three sediment basins. The debris basin at Kauaula Stream provides an outlet to Kauaula Stream and a secondary outlet to a 3,600 foot long grass-lined channel with a sediment basin to a shoreline outlet. Storm runoff will be divided between the two outlets to ensure that the streamflow capacity of the existing Kauaula Stream channel through the Puamana development is not exceeded.

A large portion of the lands surrounding and within the floodwater diversion system was utilized for sugarcane cultivation until Pioneer Mill Company, Ltd. terminated its sugar operations in September 1999. Since then, introduced species of grasses, weeds, shrubs, and trees have occupied the lands surrounding and within the proposed floodwater diversion system. A narrow strip of vegetation, including haole koa brush and kiawe trees, are found on both banks of Kauaula Stream.

NRCS
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850

United States Department of Agriculture

*Our People...Our Islands...In Harmony*

March 24, 2003

Margaret Akamine
National Marine Fisheries Service
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814

Dear Ms. Akamine:

The Natural Resources Conservation Service (NRCS), in cooperation with County of Maui and the West Maui Soil and Conservation District, is planning to implement a Flood Prevention project in Lahaina, Maui, under the federal authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566.

The proposed project was initially planned and approved for federal funding in 1992 when the Watershed Plan and Environmental Assessment were completed and finalized. Funding constraints resulted in the postponed installation of the project. In 2002, the Lahaina Watershed Plan was reviewed and updated by NRCS and the sponsors who decided to upgrade the Environmental Assessment to an Environmental Impact Statement. The draft Environmental Impact Statement for the project is currently being prepared.

The project involves the construction of a floodwater diversion system that starts south of Lahainaluna Road at approximately 150 feet above mean sea level and extends across the watershed in a southwesterly direction to a debris basin at Kauaula Stream. The draft Project Overview, with maps, is attached. The diversion channel is proposed to be grass-lined except for reinforced concrete reaches near Lahainaluna Road and adjacent to Wainee Reservoir. The proposed project also includes the construction of an inlet basin and three sediment basins. The debris basin at Kauaula Stream provides an outlet to Kauaula Stream and a secondary outlet to a 3,600 foot long grass-lined channel with a sediment basin to a shoreline outlet. Storm runoff will be divided between the two outlets to ensure that the streamflow capacity of the existing Kauaula Stream channel through the Puamana development is not exceeded.

Four nearshore marine investigations, which include biological assessments, have been made for the Lahaina Watershed project. Dr. Richard W. Grigg conducted assessments in 1983, 1986, and 1991. Sea Engineering, Inc. conducted their investigation in 2002. Copies of the reports are attached. The biological assessments covered the potential areas of floodwater discharge resulting from project installation and ranged from the area fronting the Lahaina Harbor to Waianukole, 3,600 feet south



The region's avifauna include a host of introduced species, including the Japanese white-eye, Zebra dove, Cardinal, and Common myna. The Golden plover (kolea), Black-crowned night heron ('auku'u), and the Hawaiian owl (pueo), a Species of Concern, are also found in the vicinity of the proposed project site. These latter species are considered indigenous but not endangered. Mammals common to the project areas include rats, mice, and mongoose.

The Hawaii Natural Heritage Database indicates sightings of the listed endangered Hawaiian hoary bat (Lasiurus cinereus semotus) along the shore area near Lahaina. The first instance is near Lahaina Harbor in 1874. The second record is dated 1992 near the mouth of Kahoma Stream, approximately one mile north of the project area. It is likely that the clear views provided over the ocean improved conditions for seeing the bat in flight. The improvements proposed by the project will be made on land which was recently in sugarcane cultivation and should have no impact on Hawaiian hoary bat habitat.

While the Heritage Database indicates records of numerous other threatened and endangered plant and animal species in the Lahaina Watershed, all are well uphill of the project area and will not be impacted by this project. The highest elevation for project improvements is approximately 150 feet above mean sea level. The Heritage Database records are at elevation 1,000 feet and higher. The project improvements will have no effect on the upper portions of the Lahaina Watershed.

The technical assistance of the Fish and Wildlife Service is requested to assist us in ensuring that all pertinent information regarding the presence of threatened or endangered species in or near the project area and effects of the proposed project to habitat are given careful consideration during our planning effort.

Based on the available information above, the NRCS has determined that the project is not likely to adversely affect threatened or endangered species, including the Hawaiian hoary bat (Lasiurus cinereus semotus). Your concurrence with this determination is requested within 30 days, in accordance with the consultation requirements of Section 7 of the Endangered Species Act of 1973, as amended. If you have any questions, please contact Dudley Kubo, Planning Engineer, at (808) 541-2600 ext.124.

Sincerely,

LAWRENCE T. YAMAMOTO
Acting State Conservationist

Attachment

cc: (without attachments)
Joe Krueger, Civil Engineer, Dept. of Public Works, County of Maui
Mich Hirano, Planner, Munekiyo & Hiraga, Inc.
Neal Fujiwara, DC, Wailuku FO, NRCS

of Kauaula Stream, to depths of 10-12 meters. Species lists for algae, coral, and fish are presented in the 1986 and 2002 assessment reports.

Three marine animal species listed by the federal government as endangered or threatened occur in or near the proposed project area. They are the Hawaiian green sea turtle (Chelonia mydas), the Humpback whale (Megaptera novaeangliae), and the Hawaiian monk seal (Monachus schauinslandi). We request technical assistance of the National Marine Fisheries Service to ensure that all pertinent information regarding the presence of these species in or near the project area and effects of the proposed project to marine habitat are given careful consideration during our planning effort.

According to local residents, Hawaiian green sea turtles are frequently sighted along the Lahaina coastline. Green sea turtles were sighted and documented by investigators in 1989 and 1991 while conducting the marine macrobiota and water quality investigations for this project. A resource in the intertidal habitat fronting the project site are the locally developed strands of algae which may be important as a forage food for the endangered turtle.

Endangered Humpback whales are seasonally present in offshore waters from approximately December through May. Calf-rearing and reproductive activities often occur in sight of the reefs fronting the watershed.

The project is not likely to adversely affect the Hawaiian green sea turtle or the Humpback whale. The Sea Engineering, Inc. biological investigation report (2002) states that, "The shoreline in the area of the proposed new drainage outlet is mostly rocky, with only narrow deposits of sand and virtually no sand backshore where turtles might lay eggs. Inland from the shore deposits of mostly rounded stones and rock outcrops, is an area of eroding embankment that rises steeply to the highway. Thus, turtles would utilize this area only for feeding on algae covered hard bottom off the shore. The new drainage outlet would not significantly alter the abundance or types of algae growing here.

"With respect to humpback whale (Megaptera novaeangliae), these animals would never inhabit the shallow nearshore waters directly off the proposed drainage outlet or the waters close in where turbidity, influenced by runoff, might be high. The purpose of the project is to reduce flooding and, through a series of detention structures, reduce the amount of sediment discharged from the watershed. Therefore, the impact on the waters offshore where whales seasonally occur should be one of no change or improved water quality."

A recent review of the Hawaii Natural Heritage Database indicated that an endangered Hawaiian monk seal (Monachus schauinslandi) was sighted in 1985 near Mala Wharf, approximately one mile north of the project boundary. Subsequent sightings of the monk seal in or near the same location are not indicated by the Heritage Database. The reef area fronting Lahaina may provide a foraging area for the seals, but is not unique along the Maui coastline. Their prey is known to include octopus, lobster and



fish, including eels and flatfish. The descriptive monograph posted by the National Marine Fisheries Service on their Stock Assessment Program website states that "a small number of seals are distributed throughout the main Hawaiian Islands" and that the major populations are located in the Northwest Hawaiian Islands. Habitat critical to the monk seal population recovery does not appear to exist near or in the project area. Installation of the proposed project should not adversely affect the habitat of the Hawaiian monk seal.

Based on the available information above, the NRCS has determined that the project is not likely to adversely affect threatened or endangered marine species, including the Hawaiian green sea turtle (Chelonia mydas), the Humpback whale (Megaptera novaeangliae), and the Hawaiian monk seal (Monachus shauinslandi). Your concurrence with this determination is requested within 30 days, in accordance with the consultation requirements of Section 7 of the Endangered Species Act of 1973, as amended. If you have any questions, please contact Dudley Kubo, Planning Engineer, at (808) 541-2600 ext.124.

Sincerely,

LAWRENCE T. YAMAMOTO
Acting State Conservationist

Attachments (5)

cc: (without attachments)
Joe Krueger, Civil Engineer, Dept. of Public Works, County of Maui
Mich Hirano, Planner, Munekiyo & Hiraga, Inc.
Neal Fujiwara, DC, Wailuku FO, NRCS

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

An Equal Opportunity Provider and Employer

1301

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

'02 JUN 12 P1 :20

In reply, please refer to:
File: 02-126/epo

June 10, 2002

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

Dear Mr. Goode:

Subject: Environmental Impact Statement Preparation Notice (EISPN)
Lahaina Watershed Flood Control Project, Lahaina, Maui

Thank you for the opportunity to review and comment on the subject proposal. The EISPN was routed to the various branches of the Environmental Health Administration. We have the following comments.

Maui District Health Office

1. Any construction discharge into state waters will require a National Pollutant Discharge Elimination System (NPDES) permit coverage; and

2. The noise created during the construction phase of the project may exceed the maximum allowable levels as set forth in the Hawaii Administrative Rules, Chapter 11-46, "Community Noise Control". A noise permit may be required before the commencement of work.

If you have any questions, please contact Herbert Matsubayashi at (808) 984-8280.

Clean Air Branch (CAB)

Proposed actions that would affect air quality include removing vegetation, grading, trenching, excavation, and other construction activities.



*Control of Fugitive Dust*

There is a significant potential for fugitive dust emissions during the removal of debris, grading, trenching, and construction activities that would impact nearby residents and thoroughfares. It is recommended that a dust control management plan be developed which identifies and addresses those activities that have a potential to generate fugitive dust. Implementation of adequate dust control measures during all phases of development and construction activities is warranted.

Construction activities must comply with provisions of Hawaii Administrative Rules, Chapter 11-60.1, "Air Pollution Control," Section 11-60.1-33, Fugitive Dust.

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

a. Planning the different phases of construction, focusing on minimizing the amount of dust generating materials and activities, centralizing on-site vehicular traffic routes, and locating potentially dusty equipment in areas of the least impact;

b. Providing an adequate water source at the site prior to start up of construction activities;

c. Landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;

d. Controlling of dust from shoulders and access roads;

e. Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and

f. Controlling of dust from debris being hauled away from project site.

If you have any questions regarding these issues on fugitive dust, please contact the Clean Air Branch at (808) 586-4200.

Sincerely,

GARY GILL
Deputy Director
Environmental Health Administration

c: Maui District Health Office
CAB

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS**
**AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Dr. Jane Kadohiro, Deputy Director
Environmental Health Administration
State of Hawaii-DOH
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Kadohiro:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your Department's letter dated June 10, 2002 providing comments to the subject Environmental Impact Statement Preparation Notice (EISPN). We wish to provide the following information in response to your comments.

We acknowledge your comments regarding a National Pollutant Discharge Elimination System (NPDES) for construction discharge into state waters and a noise permit for noise created during the construction phase of the project. We will ensure that these permitting requirements will be established as appropriate prior to construction.

We acknowledge your comments regarding fugitive dust resulting from construction activities and confirm that a dust control management plan will be developed for approval prior to issuance of the building and grading permits and all construction activities will be in compliance with provisions of HAR, Chapter 11-60.1, "Air Pollution Control," Section 11-60.1-33, Fugitive Dust.



Again, thank you for your Department's comments and participation in the EISPN review process.

Sincerely,

for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-235)
S:\ENG\ALL\Joe\LAHEA-08

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

BENJAMIN J. CAYETANO
GOVERNOR

BRIAN K. MINAAI
DIRECTOR

DEPUTY DIRECTORS
JEAN L. OSHITA
JADINE Y. URASAKI

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

1297

'02 JUN 13 P1:19

IN REPLY REFER TO:
HWY-PS
2.6825

JUN 1 2 2002

6/14

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

Dear Mr. Goode:

Subject: Environmental Impact Statement Preparation Notice, Lahaina Watershed Flood Control Project, Lahaina, Maui

Thank you for the opportunity to review the subject EISPN.

We have the following comments:

1. Stormwater is being concentrated and discharged at two outlet points. The flow must be managed so that it does not impact Honoapiilani Highway and adjacent properties.
2. The planned alignment for the future Lahaina Bypass is shown on Figure 11. It should also be shown and labeled on Figures 1, 2, and 3.
3. To speed up our review process for the draft Environmental Impact Statement, please send two additional copies, one directly to the Highways Division at the address above and one to the Highways Division Maui District Office, 650 Palapala Drive, Kahului, Maui 96793.

If you have any questions, you may contact Ronald Tsuzuki, Head Planning Engineer, Highways Division, at 587-1830.

Very truly yours,

BRIAN K. MINAAI
Director of Transportation

---

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

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

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Mr. Rodney Haraga, Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Haraga:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your Department's letter dated June 12, 2002 providing comments on the subject Environmental Impact Statement Preparation Notice (EISPN). We wish to provide the following information in response to your comments.

***Response to Item 1.***

We acknowledge your comment regarding management of flow to prevent adverse impacts to Honoapiilani Highway. We wish to confirm the project design would evenly distribute flows (based on a 100-year event) between the Kauaula Stream/Puamana Channel outlet and the second ocean outlet located approximately 3,600 feet to the south at Waianukole. We confirm that flows will not adversely impact Honoapiilani Highway or adjacent properties.

***Response to Item 2.***

We acknowledge your comment regarding the planned alignment for the future Lahaina Bypass and confirm that the alignment will be shown on Figure 1 and referenced in the document in Chapter II, Description of the Existing Environment, Section D. Infrastructure and in Chapter III, Potential Impacts and Mitigation Measures, Section D. Impacts to Infrastructure.

Mr. Rod Haraga
SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10
March 7, 2003
Page 2

***Response to Item 3.***

We acknowledge and confirm two (2) copies of the Draft EIS document will be sent to the Department of Transportation. One (1) copy will be sent to the Honolulu Office and one (1) copy will be sent directly to the Maui District Office at the address provided. We thank you for your suggestion to facilitate the review period.

Again, thank you for your Department's comments and participation in the EISPN review process.

Sincerely,

for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-239)
S:\ENG\ALL\Joe\LAHEA-12

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

---

BENJAMIN J. CAYETANO
GOVERNOR

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

LORRIN W. PANG, M.D., M.P.H
MAUI DISTRICT HEALTH OFFICER

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, MAUI, HAWAII 96793

'02 JUN -6 P1:49

June 4, 2002

14

Mr. David Goode
Director of Public Works
and Waste Management
County of Maui
200 South High Street
Wailuku, Hawai'i 96793

Dear Mr. Goode:

Subject: **Environmental Impact Statement Preparation Notice Lahaina Watershed Flood Control Project**

Thank you for the opportunity to comment on the Environmental Impact Statement Preparation Notice for the Lahaina Watershed Flood Control Project. Comments from this office were transmitted to our Honolulu Office. A coordinated response is forthcoming.

Should you have any questions, please call me at 984-8230.

Sincerely,

Herbert S. Matsubayashi
District Environmental Health Program Chief

c: Lance Tauoa, EPO

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 10, 2003

Mr. Herbert S. Matsubayashi
District Environmental
Health Program Chief
Maui District Health Office
State of Hawaii-DOH
54 High Street
Wailuku, Hawaii 96793

Dear Mr. Matsubayashi:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your letter dated June 4, 2002 providing comments on the subject Environmental Impact Statement Preparation Notice (EISPN). We wish to confirm that a coordination response has been received from the Honolulu Department of Health Office. A response letter was forwarded to the Honolulu Office.

Again, thank you for your participation in the EISPN review process.

Sincerely,

Milton Arakawa
for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-238)
S:\ENG\ALL\Joe\LAHEA-11

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

1296

# POLICE DEPARTMENT
COUNTY OF MAUI

JAMES "KIMO" APANA
MAYOR

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

THOMAS M. PHILLIPS
CHIEF OF POLICE

KEKUHAUPIO R. AKANA
DEPUTY CHIEF OF POLICE

OUR REFERENCE ty
YOUR REFERENCE

'02 -7 1:13

June 4, 2002

Mr. David Goode
County Department of Public Works
and Waste Management
200 S. High Street
Wailuku, HI 96793

Dear Mr. Goode:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) - LAHAINA WATERSHED FLOOD CONTROL PROJECT

This is in response to your letter dated May 2, 2002, requesting comments on the above subject.

Please refer to the enclosed copy of the To/From submitted by Officer Scott Migata for our comments and recommendations. We are returning the EISPN which was submitted to us for review.

Sincerely,

A/A/C Lawrence Hudson
Acting Assistant Chief Lawrence Hudson
for: Thomas M. Phillips
Chief of Police

Enclosure

TO : THOMAS PHILLIPS, CHIEF OF POLICE, COUNTY OF MAUI

VIA : CHANNELS

FROM : SCOTT Y. MIGITA, P.O. III, LAHAINA BIKE PATROL

SUBJECT : ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE-LAHAINA WATERSHED FLOOD CONTROL PROJECT

This To-From is being submitted for review and comment by the County Of Maui, Department Of Public Works And Waste Management, Engineering Division for an Environmental Impact Statement Preparation Notice for a Lahaina Watershed Flood Control Project.

The proposed floodwater diversion system project as mentioned on page 48 of the booklet is not anticipated to affect service area limits or capabilities of emergency services. Upon completion of the project, road closures and traffic problems caused by flooding will be reduced. Also, as mentioned, a threat to public safety caused by floodwater and sediment deposition in lowlying areas will be decreased with this system.

Overall, the proposed project will appear to have a positive impact on emergency services. Also, there is no safety concern from a police standpoint. At this time, I have no further comment regarding this proposal.

Submitted for your information and perusal.

Noted Sgt. [signature] 65588

RESPECTFULLY SUBMITTED,

[signature]
SCOTT Y. MIGITA, E-1122
P.O. III, BIKE PATROL OFFICER
052502 AT 2112 HOURS

Concur with Officer Migita.
Capt. [signature]
5/30/02

---

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Mr. Thomas M. Phillips, Chief of Police
Maui Police Department
County of Maui
55 Mahalani Street
Wailuku, Hawaii 96793

Dear Chief Phillips:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your letter dated June 4, 2002 providing comments on the subject Environmental Impact Statement Preparation Notice (EISPN). We would like to provide the following information in response to your comments.

We acknowledge your department's comment and confirmation that the proposed project will not affect service area limits or capabilities of emergency services. We also acknowledge and appreciate your department's comment that the proposed project will have a positive impact on emergency services.

Again, thank you for your comments and participation in the EISPN review process.

Sincerely,

[signature]
for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-246)
con/dpwlahws/mpdltr.001

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

PHONE (808) 594-1888

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

FAX (808) 594-1865

1236

'02 JUN -5 P2:39

May 28, 2002

HRD02-623

Mr. David Goode
Director of Public Works and
Waste Management
County of Maui
200 South High Street
Wailuku, Maui, Hawaii 96793

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) – LAHAINA WATERSHED FLOOD CONTROL PROJECT

Dear Mr. Goode:

Thank you for the opportunity to review the above referenced EISPN for the Lahaina Watershed Flood Control Project. The Office of Hawaiian Affairs (OHA) has the following comments:

*Coastal Waters*

During the construction of the watershed project, every mitigation effort should be made to prevent any adverse effects that may occur to marine life in coastal waters near the proposed project area.

In addition, OHA urges that access to the beaches and shoreline waters at the proposed project area be available for public use. Access to shoreline and beaches are an important part of the Hawaiian culture for fishing, cultural and recreational activities.

*Section 106 Consultation*

The Office of Hawaiian Affairs (OHA) notes that federal funds are being used for this project, which requires a NHPA Section 106 Consultation. A formal consultation does not begin until a written Request for Consultation is made by the respective Federal agency to OHA. The request should be sent by mail to the following address:



Attn: Request for Section 106 Consultation
Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd. – Suite 500
Honolulu, HI 96813-5249

*Stakeholder Identification*

OHA's position with regards to the propriety and adequacy of any and all Section 106 consultations is that without proper identification of all potentially interested stakeholders at the outset, the consultation process will be flawed and inadequate. NHPA requires any Federal agency contemplating an undertaking to attempt to identify all potentially interested stakeholders. OHA cannot speak for all Hawaiian organizations and individuals that may be affected by an undertaking. Some potential organizations that you should contact include:

- Local Hawaiian civic clubs
- Local chapters of the royal societies
- Individuals familiar with cultural practices of the areas affected by your undertakings

You may wish to contact the OHA Maui Community Affairs Coordinator:

Ms. Thelma Shimaoka
Maui Community Affairs Coordinator
140 Hoohana Street – Ste. 206
Kahului, HI 96732
(808) 243-5219 FAX: (808) 243-5016

These individuals and organizations may further assist you in contacting other parties.

If you have any questions, please contact Jerry B. Norris at 594-1847 or email him as jerryn@oha.org.

Sincerely,

Jalna S. Keala
Jalna S. Keala
Acting Director, Hawaiian Rights Division

cc: OHA Board of Trustees
Clyde W. Namu'o, OHA Administrator
Thelma Shimaoka, Maui CRC

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

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

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Ms. Jalna S. Keala
State of Hawaii
Office of Hawaiian Affairs
711 Kapi`olani Boulevard, Suite 500
Honolulu, Hawaii 96813

Dear Ms. Keala:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your letter dated May 28, 2002 providing comments on the subject Environmental Impact Statement Preparation Notice (EISPN). We wish to provide the following information in response to your comments.

***Response to Comment on Coastal Waters***

We acknowledge the concerns regarding mitigation efforts to prevent any adverse effects that may occur to the water quality and marine life in coastal waters near the proposed project. We wish to advise you that Sea Engineering, Inc. has assessed the coastal processes, water quality and marine biology in the ocean environment from the Lahaina Harbor south to Waianokule, approximately 3,600 feet south of Kauaula Stream. Their report has been included in the preparation of the Draft EIS document to ensure the proposed project will not adversely impact water quality, marine life or coastal processes.

We acknowledge your comment regarding access to beaches and the shoreline waters and confirm that these aspects will be assessed in the Draft EIS document and appropriate mitigation will be put forward to ensure the proposed project will not adversely impact access to the shoreline or beaches.

Ms. Jaina S. Keala
SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10
March 7, 2003
Page 2

**Response to Section 106 Consultation**

We acknowledge and note your comment regarding compliance with Section 106 Consultation. We have forwarded your letter to Carol Kawachi, Cultural Specialist, U.S. Department of Agriculture, Natural Resources Conservation Service, to coordinate the Section 106 Consultation process on behalf of the federal project sponsor. We also wish to advise you that under Chapter 343, HRS, a cultural resources impact assessment will be carried out and the findings will be included in the Draft EIS document.

Again, thank you for your comments and participation in the EISPN review process.

Sincerely,

for GILBERT COLOMA-AGARAN
Director of Public Works and
Environmental Management

LL/JK:c(ED03-233)
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xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

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1239

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

REPLY TO ATTENTION OF

May 30, 2002

Regulatory Branch

'02 JUN -3 P2:14

Mr. David Goode, Director
Department of Public Works
and Waste Management
County of Maui
200 South Street
Wailuku, Hawaii 96793

Dear Mr. Goode:

This letter responds to your request for comments on the Environmental Impact Statement Preparation Notice (EISPN) - Lahaina Watershed Flood Control Project, dated May 2, 2002. Based on the information provided in the EISPN I am unable to determine if a Department of the Army (DA) permit will be required for this project. Please include this office on the mailing list for the draft and final Environmental Impact Statements, and include information concerning the present or absence of perennial or intermittent streams or wetlands in the project area.

If you have any questions concerning this matter, please contact William Lennan of my staff at 438-6986 or FAX 438-4060, and reference File No. 200200337.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

Return to ____
Ref. No. ____
By: ____

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Mr. George P. Young, P. E.
Chief Regulatory Branch
U. S. Department of the Army
Engineer District, Honolulu
Fort Shafter, Hawaii 96858-5440

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Dear Mr. Young:

Thank you for your letter dated May 30, 2002 providing comments on the subject Environmental Impact Statement Preparation Notice (EISPN). We wish to provide the following information in response to your comments.

We acknowledge your comments regarding the presence or absence of perennial or intermittent streams or wetlands in the project area and have included where appropriate, information on these features in the Draft EIS document. We note that in the upper reaches, water flow in Kauaula Stream is perennial and in the project area, the water flow in the stream is intermittent. There are no wetlands in the vicinity of the project area. Based on the pre-application consultation meeting held with the Department of the Army Corps of Engineers and the project sponsors on November 8, 2002, further coordination will be carried out with your department to determine permitting requirements.

We confirm a copy of the Draft EIS document will be forwarded to the Department of the Army for further review.

Again, thank you for your comments and participation in the EISPN review process.

Sincerely,

for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-231)
S:\ENG\ALL\Lahaina-04.wpd

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

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1222

'02 JUN -4 A9:09

**DEPARTMENT OF WATER SUPPLY**
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 270-7816 • Fax (808) 270-7833

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DEP DIR
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Return to
Ref No.
By

May 24, 2002

Mr. David Goode, Director
County of Maui
Department of Public Works and Waste Management
200 S High Street
Wailuku HI 96793

SUBJECT: Environmental Impact Statement Preparation Notice (EISPN)
Lahaina Watershed Flood Control Project

Dear Mr. Goode:

Thank you for the opportunity to review this EISPN. The Department of Water Supply provides the following comments:

We understand that this project involves the construction of floodwater diversion, an inlet basin, three (3) sediment basins, a debris basin and vegetation of bare earth areas including diversion surfaces.

The project is located in the Maui County Planting Plan - Plant Zones 3, 4, and 5. We encourage the applicant to utilize appropriate native and non invasive species and avoid the use of potentially invasive plants. Native plants adapted to the area, conserve water and protect the watershed from degradation due to invasive alien species. Attached is a list of appropriate plants for the zones as well as potentially invasive plants to avoid.

We further recommend the use of brackish and/or reclaimed water sources for dust control during construction, if such alternative sources are available.

The project overlies the Launiupoko aquifer which has a sustainable yield of 8 MGD. The Department of Water Supply strives to protect the integrity of surface and groundwater resources by encouraging the applicant to adopt best management practices (BMPs) designed to minimize infiltration and runoff from construction and vehicle operations. We have attached sample BMPs for principle operations for reference. Additional information can be obtained from the State Department of Health.

Should you have any questions, please contact our Water Resources and Planning Division at 270-7199.

Sincerely,

David Craddick
Director

eam
c:: engineering division
applicant, with attachments
Maui County Planting Plan-Plant Zones 3, 4, and 5, Saving Water in the Yard-What and How to Plant in Your Area"
Selected BMPs from "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters"

United States Environmental Protection Agency | Office of Water Washington, DC 20460 | 840-B-92-002 January 1993

EPA

# Guidance Specifying Management Measures For Sources Of Nonpoint Pollution In Coastal Waters

Issued Under the Authority of
Section 6217(g) of the Coastal Zone Act
Reauthorization Amendments of 1990

# III. CONSTRUCTION ACTIVITIES

## A. Construction Site Erosion and Sediment Control Management Measure

**(1) Reduce erosion and, to the extent practicable, retain sediment onsite during and after construction, and**

**(2) Prior to land disturbance, prepare and implement an approved erosion and sediment control plan or similar administrative document that contains erosion and sediment control provisions.**

### 1. Applicability

This management measure is intended to be applied by States to all construction activities on sites less than 5 acres in areas that do not have an NPDES permit[3] in order to control erosion and sediment loss from those sites. This management measure does not apply to: (1) construction of a detached single family home on a site of 1/2 acre or more or (2) construction that does not disturb over 5,000 square feet of land on a site. (NOTE: All construction activities, including clearing, grading, and excavation, that result in the disturbance of areas greater than or equal to 5 acres or are a part of a larger development plan are covered by the NPDES regulations and are thus excluded from these requirements.) Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

### 2. Description

The goal of this management measure is to reduce the sediment loadings from construction sites in coastal areas that enter surface waterbodies. This measure requires that coastal States establish new or enhance existing State erosion and sediment control (ESC) programs and/or require ESC programs at the local level. It is intended to be part of a comprehensive land use or watershed management program, as previously detailed in the Watershed and Site Development Management Measures. It is expected that State and local programs will establish criteria determined by local conditions (e.g., soil types, climate, meteorology) that reduce erosion and sediment transport from construction sites.

Runoff from construction sites is by far the largest source of sediment in urban areas under development (York County Soil and Water Conservation District, 1990). Soil erosion removes over 90 percent of sediment by tonnage in urbanizing areas where most construction activities occur (Canning, 1988). Table 4-14 illustrates some of the

[3] On May 27, 1992, the United States Court of Appeals for the Ninth Circuit invalidated EPA's exemption of construction sites smaller than 5 acres from the storm water permit program in *Natural Resources Defense Council* v. *EPA*, 965 F.2d 759 (9th Cir. 1992). EPA is conducting further rulemaking proceedings on this issue and will not require permit applications for construction activities under 5 acres until further rulemaking has been completed.





measured sediment loading rates associated with construction activities found across the United States. As seen in Table 4-14, erosion rates from natural areas such as undisturbed forested lands are typically less than one ton/acre/year, while erosion from construction sites ranges from 7.2 to over 1,000 tons/acre/year.

**Table 4-14. Erosion and Sediment Problems Associated With Construction**

| Location | Problem | Reference |
|---|---|---|
| United States | Sediment loading rates vary from 36.5 to 1,000 ton/ac/yr. These are 5 to 500 times greater than those from undeveloped land. Approximately 600 million tons of soil erodes from developed sites each year. Construction site sediment in runoff can be 10 to 20 times greater than that from agricultural lands. | York County Soil and Water Conservation District, 1990 |
| Franklin County, FL | Sediment yield (ton/ac/yr): forest < 0.5; rangeland < 0.5; tilled 1.4; construction site 30; established urban < 0.5 | Franklin County, FL |
| Wisconsin | Erosion rates range from 30 to 200 ton/ac/yr (10 to 20 times those of cropland). | Wisconsin Legislative Council, 1991 |
| Washington, DC | Erosion rates range from 35 to 45 ton/ac/yr (10 to 100 times greater than agriculture and stabilized urban land uses). | MWCOG, 1987 |
| Anacostia River Basin, VA, MD, DC | Sediment yields from portions of the Anacostia Basin have been estimated at 75,000 to 132,000 ton/yr. | U.S. Army Corps of Engineers, 1990 |
| Washington | Erosion rates range from 50 to 500 ton/ac/yr. Natural erosion rates from forests or well-sodded prairies are 0.01 to 1.0 ton/ac/yr. | Washington Department of Ecology, 1989 |
| Anacostia River Basin, VA, MD, DC | Erosion rates range from 7.2 to 100.8 ton/ac/yr. | USGS, 1978 |
| Alabama | 1.4 million tons eroded per year. | Woodward-Clyde, 1991 |
| North Carolina | 6.7 million tons eroded per year. | |
| Louisiana | 5.1 million tons eroded per year. | |
| Oklahoma | 4.2 million tons eroded per year. | |
| Georgia | 3.8 million tons eroded per year. | |
| Texas | 3.5 million tons eroded per year. | |
| Tennessee | 3.3 million tons eroded per year. | |
| Pennsylvania | 3.1 million tons eroded per year. | |
| Ohio | 3.0 million tons eroded per year. | |
| Kentucky | 3.0 million tons eroded per year. | |

Eroded sediment from construction sites creates many problems in coastal areas including adverse impacts on water quality, critical habitats, submerged aquatic vegetation (SAV) beds, recreational activities, and navigation (APWA, 1991). For example, the Miami River in Florida has been severely affected by pollution associated with upland erosion. This watershed has undergone extensive urbanization, which has included the construction of many commercial and residential buildings over the past 50 years. Sediment deposited in the Miami River channel contributes to the severe water quality and navigation problems of this once-thriving waterway, as well as Biscayne Bay (SFWMD, 1988).

ESC plans are important for controlling the adverse impacts of construction and land development and have been required by many State and local governments, as shown in Table 4-13 (in the Site Development section of this chapter). An ESC plan is a document that explains and illustrates the measures to be taken to control erosion and sediment problems on construction sites (Connecticut Council on Soil and Water Conservation, 1988). It is intended that existing State and local erosion and sediment control plans may be used to fulfill the requirements of this management measure. Where existing ESC plans do not meet the management measure criteria, inadequate plans may be enhanced to meet the management measure guidelines.

Typically, an ESC plan is part of a larger site plan and includes the following elements:

- Description of predominant soil types;
- Details of site grading including existing and proposed contours;
- Design details and locations for structural controls;
- Provisions to preserve topsoil and limit disturbance;
- Details of temporary and permanent stabilization measures; and
- Description of the sequence of construction.

ESC plans ensure that provisions for control measures are incorporated into the site planning stage of development and provide for the reduction of erosion and sediment problems and accountability if a problem occurs (York County Soil and Water Conservation District, 1990). An effective plan for urban runoff management on construction sites will control erosion, retain sediments on site, to the extent practicable, and reduce the adverse effects of runoff. Climate, topography, soils, drainage patterns, and vegetation will affect how erosion and sediment should be controlled on a site (Washington State Department of Ecology, 1989). An effective ESC plan includes both structural and nonstructural controls. Nonstructural controls address erosion control by decreasing erosion potential, whereas structural controls are both preventive and mitigative because they control both erosion and sediment movement.

Typical nonstructural erosion controls include (APWA, 1991; York County Soil and Water Conservation District, 1990):

- Planning and designing the development within the natural constraints of the site;
- Minimizing the area of bare soil exposed at one time (phased grading);
- Providing for stream crossing areas for natural and man-made areas; and
- Stabilizing cut-and-fill slopes caused by construction activities.

Structural controls include:

- Perimeter controls;
- Mulching and seeding exposed areas;
- Sediment basins and traps; and
- Filter fabric, or silt fences.

Some erosion and soil loss are unavoidable during land-disturbing activities. While proper siting and design will help prevent areas prone to erosion from being developed, construction activities will invariably produce conditions where erosion may occur. To reduce the adverse impacts associated with construction, the construction management measure suggests a system of nonstructural and structural erosion and sediment controls for incorporation into an





ESC plan. Erosion controls have distinct advantages over sediment controls. Erosion controls reduce the amount of sediment transported off-site, thereby reducing the need for sediment controls. When erosion controls are used in conjunction with sediment controls, the size of the sediment control structures and associated maintenance may be reduced, decreasing the overall treatment costs (SWRPC, 1991).

## 3. Management Measure Selection

This management measure was selected to minimize sediment being transported outside the perimeter of a construction site through two broad performance goals: (1) **reduce** erosion and (2) **retain** sediment onsite, to the extent practicable. These performance goals were chosen to allow States and local governments flexibility in specifying practices appropriate for local conditions.

While several commentors responding to the draft (May 1991) guidance expressed the need to define "more measurable, enforceable ways" to control sediment loadings, other commentors stressed the need to draft management measures that do not conflict with existing State programs and allow States and local governments to determine appropriate practices and design standards for their communities. These management measures were selected because virtually all coastal States control construction activities to prevent erosion and sediment loss.

The measures were specifically written for the following reasons:

(1) Predevelopment loadings may vary greatly, and some sediment loss is usually inevitable;

(2) Current practice is built on the use of systems of practices selected based on site-specific conditions; and

(3) The combined effectiveness of erosion and sediment controls in systems is not easily quantified.

## 4. Erosion Control Practices

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

Erosion controls are used to reduce the amount of sediment that is detached during construction and to prevent sediment from entering runoff. Erosion control is based on two main concepts: (1) disturb the smallest area of land possible for the shortest period of time, and (2) stabilize disturbed soils to prevent erosion from occurring.

■ a. *Schedule projects so clearing and grading are done during the time of minimum erosion potential.*

Often a project can be scheduled during the time of year that the erosion potential of the site is relatively low. In many parts of the country, there is a certain period of the year when erosion potential is relatively low and construction scheduling could be very effective. For example, in the Pacific region if construction can be completed during the 6-month dry season (May 1 - October 31), temporary erosion and sediment controls may not be needed. In addition, in some parts of the country erosion potential is very high during certain parts of the year such as the spring thaw in northern areas. During this time of year, melting snowfall generates a constant runoff that can erode soil. In addition, construction vehicles can easily turn the soft, wet ground into mud, which is more easily washed offsite. Therefore, in the north, limitations should be placed on grading during the spring thaw (Goldman et al., 1986).

■ b. *Stage construction.*

void areawide clearance of construction sites. Plan and stage land disturbance activities so that only the area urrently under construction is exposed. As soon as the grading and construction in an area are complete, the area hould be stabilized.

3y clearing only those areas immediately essential for completing site construction, buffer zones are preserved and oil remains undisturbed until construction begins. Physical markers, such as tape, signs, or barriers, indicating the imits of land disturbance, can ensure that equipment operators know the proposed limits of clearing. The area of he watershed that is exposed to construction is important for determining the net amount of erosion. Reducing the xtent of the disturbed area will ultimately reduce sediment loads to surface waters. Existing or newly planted egetation that has been planted to stabilize disturbed areas should be protected by routing construction traffic around nd protecting natural vegetation with fencing, tree armoring, retaining walls, or tree wells.

■ c. *Clear only areas essential for construction.*

Often areas of a construction site are unnecessarily cleared. Only those areas essential for completing construction ctivities should be cleared, and other areas should remain undisturbed. Additionally, the proposed limits of land disturbance should be physically marked off to ensure that only the required land area is cleared. Avoid disturbing vegetation on steep slopes or other critical areas.

■ d. *Locate potential nonpoint pollutant sources away from steep slopes, waterbodies, and critical areas.*

Material stockpiles, borrow areas, access roads, and other land-disturbing activities can often be located away from critical areas such as steep slopes, highly erodible soils, and areas that drain directly into sensitive waterbodies.

■ e. *Route construction traffic to avoid existing or newly planted vegetation.*

Where possible, construction traffic should travel over areas that must be disturbed for other construction activity. This practice will reduce the area that is cleared and susceptible to erosion.

■ f. *Protect natural vegetation with fencing, tree armoring, and retaining walls or tree wells.*

Tree armoring protects tree trunks from being damaged by construction equipment. Fencing can also protect tree trunks, but should be placed at the tree's drip line so that construction equipment is kept away from the tree. The tree drip line is the minimum area around a tree in which the tree's root system should not be disturbed by cut, fill, or soil compaction caused by heavy equipment. When cutting or filling must be done near a tree, a retaining wall or tree well should be used to minimize the cutting of the tree's roots or the quantity of fill placed over the tree's roots.

■ g. *Stockpile topsoil and reapply to revegetate site.*

Because of the high organic content of topsoil, it cannot be used as fill material or under pavement. After a site is cleared, the topsoil is typically removed. Since topsoil is essential to establish new vegetation, it should be stockpiled and then reapplied to the site for revegetation, if appropriate. Although topsoil salvaged from the existing site can often be used, it must meet certain standards and topsoil may need to be imported onto the site if the existing topsoil is not adequate for establishing new vegetation.





■ h. *Cover or stabilize topsoil stockpiles.*

Unprotected stockpiles are very prone to erosion and therefore stockpiles must be protected. Small stockpiles can be covered with a tarp to prevent erosion. Large stockpiles should be stabilized by erosion blankets, seeding, and/or mulching.

■ i. *Use wind erosion controls.*

Wind erosion controls limit the movement of dust from disturbed soil surfaces and include many different practices. Wind barriers block air currents and are effective in controlling soil blowing. Many different materials can be used as wind barriers, including solid board fence, snow fences, and bales of hay. Sprinkling moistens the soil surface with water and must be repeated as needed to be effective for preventing wind erosion (Delaware DNREC, 1989); however, applications must be monitored to prevent excessive runoff and erosion.

■ j. *Intercept runoff above disturbed slopes and convey it to a permanent channel or storm drain.*

Earth dikes, perimeter dikes or swales, or diversions can be used to intercept and convey runoff above disturbed areas. An earth dike is a temporary berm or ridge of compacted soil that channels water to a desired location. A perimeter dike/swale or diversion is a swale with a supporting ridge on the lower side that is constructed from the soil excavated from the adjoining swale (Delaware DNREC, 1989). These practices should be used to intercept flow from denuded areas or newly seeded areas to keep the disturbed areas from being eroded from the uphill runoff. The structures should be stabilized within 14 days of installation. A pipe slope drain, also known as a pipe drop structure, is a temporary pipe placed from the top of a slope to the bottom of the slope to convey concentrated runoff down the slope without causing erosion (Delaware DNREC, 1989).

■ k. *On long or steep, disturbed, or man-made slopes, construct benches, terraces, or ditches at regular intervals to intercept runoff.*

Benches, terraces, or ditches break up a slope by providing areas of low slope in the reverse direction. This keeps water from proceeding down the slope at increasing volume and velocity. Instead, the flow is directed to a suitable outlet, such as a sediment basin or trap. The frequency of benches, terraces, or ditches will depend on the erodibility of the soils, steepness and length of the slope, and rock outcrops. This practice should be used if there is a potential for erosion along the slope.

■ l. *Use retaining walls.*

Often retaining walls can be used to decrease the steepness of a slope. If the steepness of a slope is reduced, the runoff velocity is decreased and, therefore, the erosion potential is decreased.

■ m. *Provide linings for urban runoff conveyance channels.*

Often construction increases the velocity and volume of runoff, which causes erosion in newly constructed or existing urban runoff conveyance channels. If the runoff during or after construction will cause erosion in a channel, the channel should be lined or flow control BMPs installed. The first choice of lining should be grass or sod since this reduces runoff velocities and provides water quality benefits through filtration and infiltration. If the velocity in the channel would erode the grass or sod, then riprap, concrete, or gabions can be used.

■ n. *Use check dams.*

Check dams are small, temporary dams constructed across a swale or channel. They can be constructed using gravel or straw bales. They are used to reduce the velocity of concentrated flow and, therefore, to reduce the erosion in a swale or channel. Check dams should be used when a swale or channel will be used for a short time and therefore it is not feasible or practical to line the channel or implement flow control BMPs (Delaware DNREC, 1989).

### o. *Seed and fertilize.*

Seeding establishes a vegetative cover on disturbed areas. Seeding is very effective in controlling soil erosion once a dense vegetative cover has been established. However, often seeding and fertilizing do not produce as thick a vegetative cover as do seed and mulch or netting. Newly established vegetation does not have as extensive a root system as existing vegetation and therefore is more prone to erosion, especially on steep slopes. Care should be taken when fertilizing to avoid untimely or excessive application. Since the practice of seeding and fertilizing does not provide any protection during the time of vegetative establishment, it should be used only on favorable soils in very flat areas and not in sensitive areas.

### p. *Use seeding and mulch/mats.*

Seeding establishes a vegetative cover on disturbed areas. Seeding is very effective in controlling soil erosion once the vegetative cover has been established. The mulching/mats protect the disturbed area while the vegetation becomes established.

The management of land by using ground cover reduces erosion by reducing the flow rate of runoff and the raindrop impact. Bare soils should be seeded or otherwise stabilized within 15 calendar days after final grading. Denuded areas that are inactive and will be exposed to rain for 30 days or more should also be temporarily stabilized, usually by planting seeds and establishing vegetation during favorable seasons in areas where vegetation can be established. In very flat, non-sensitive areas with favorable soils, stabilization may involve simply seeding and fertilizing. Mulching and/or sodding may be necessary as slopes become moderate to steep, as soils become more erosive, and as areas become more sensitive.

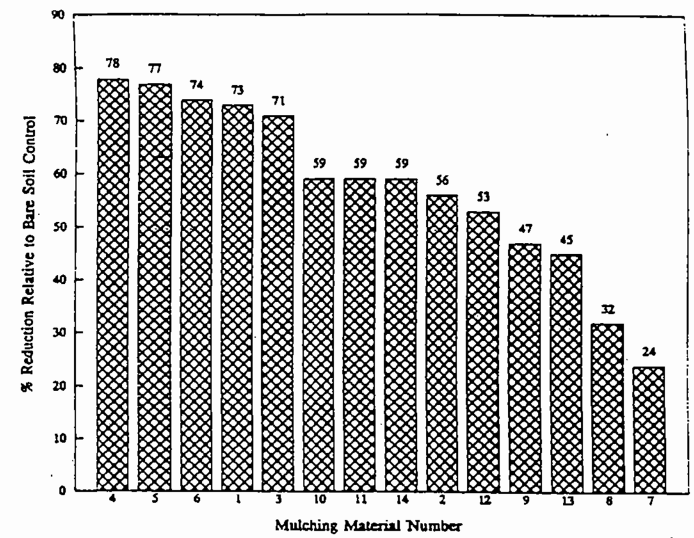
### q. *Use mulch/mats.*

Mulching involves applying plant residues or other suitable materials on disturbed soil surfaces. Mulchs/mats used include tacked straw, wood chips, and jute netting and are often covered by blankets or netting. Mulching alone should be used only for temporary protection of the soil surface or when permanent seeding is not feasible. The useful life of mulch varies with the material used and the amount of precipitation, but is approximately 2 to 6 months. Figure 4-5 shows water velocity reductions that could be expected using various mulching techniques. Similarly, Figure 4-6 shows reductions in soil loss achievable using various mulching techniques. During times of year when vegetation cannot be established, soil mulching should be applied to moderate slopes and soils that are not highly erodible. On steep slopes or highly erodible soils, multiple mulching treatments should be used. On a high-elevation or desert site where grasses cannot survive the harsh environment, native shrubs may be planted. Interlocking ceramic materials, filter fabric, and netting are available for this purpose. Before stabilizing an area, it is important to have installed all sediment controls and diverted runoff away from the area to be planted. Runoff may be diverted away from denuded areas or newly planted areas using dikes, swales, or pipe slope drains to intercept runoff and convey it to a permanent channel or storm drain. Reserved topsoil may be used to revegetate a site if the stockpile has been covered and stabilized.

Consideration should be given to maintenance when designing mulching and matting schemes. Plastic nets are often used to cover the mulch or mats; however, they can foul lawn mower blades if the area requires mowing.

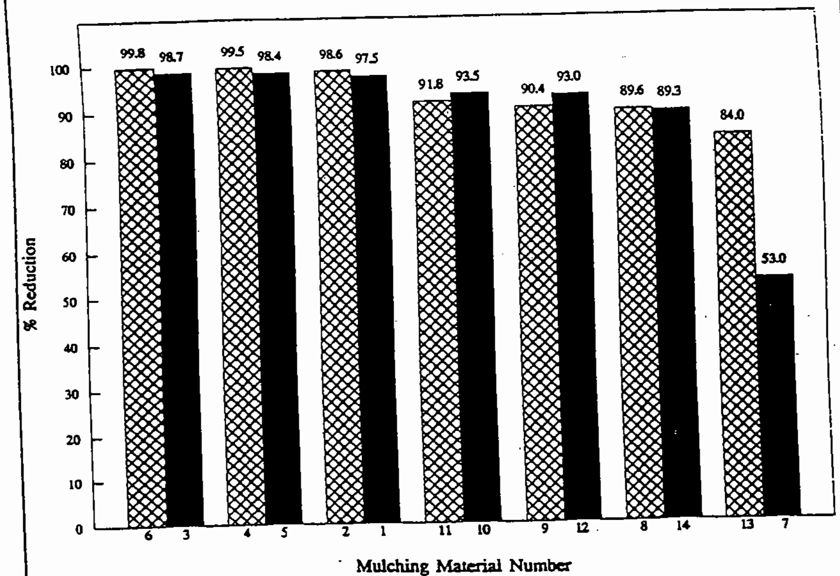







| Mulch Material | Characteristics |
|---|---|
| 1 | 100% wheat straw/top net |
| 2 | 100% wheat straw/two nets |
| 3 | 70% wheat straw/30% coconut fiber |
| 4 | 70% wheat straw/30% coconut fiber |
| 5 | 100% coconut fiber |
| 6 | Nylon monofilament/two nets |
| 7 | Nylon monofilament/rigid/bonded |
| 8 | Vinyl monofilament/flexible/bonded |
| 9 | Curled wood fibers/top net |
| 10 | Curled wood fibers/two nets |
| 11 | Antiwash netting (jute) |
| 12 | Interwoven paper and thread |
| 13 | Uncrimped wheat straw – 2,242 kg/ha |
| 14 | Uncrimped wheat straw – 4,484 kg/ha |

**Figure 4-5.** Water velocity reductions for different mulch treatments (adapted from Harding, 1990).




| Mulch Material | Characteristics |
|---|---|
| 1 | 100% wheat straw/top net |
| 2 | 100% wheat straw/two nets |
| 3 | 70% wheat straw/30% coconut fiber |
| 4 | 70% wheat straw/30% coconut fiber |
| 5 | 100% coconut fiber |
| 6 | Nylon monofilament/two nets |
| 7 | Nylon monofilament/rigid/bonded |
| 8 | Vinyl monofilament/flexible/bonded |
| 9 | Curled wood fibers/top net |
| 10 | Curled wood fibers/two nets |
| 11 | Antiwash netting (jute) |
| 12 | Interwoven paper and thread |
| 13 | Uncrimped wheat straw – 2,242 kg/ha |
| 14 | Uncrimped wheat straw – 4,484 kg/ha |

**Figure 4-6.** Actual soil loss reductions for different mulch treatments (adapted from Harding, 1990).





### r. *Use sodding.*

Sodding permanently stabilizes an area. Sodding provides immediate stabilization of an area and should be used in critical areas or where establishment of permanent vegetation by seeding and mulching would be difficult. Sodding is also a preferred option when there is a high erosion potential during the period of vegetative establishment from seeding.

### s. *Use wildflower cover.*

Because of the hardy drought-resistant nature of wildflowers, they may be more beneficial as an erosion control practice than turf grass. While not as dense as turfgrass, wildflower thatches and associated grasses are expected to be as effective in erosion control and contaminant absorption. Because thatches of wildflowers do not need fertilizers, pesticides, or herbicides, and watering is minimal, implementation of this practice may result in a cost savings (Brash et al., undated). In 1987, Howard County, Maryland, spent $690.00 per acre to maintain turfgrass areas, compared to only $31.00 per acre for wildflower meadows (Wilson, 1990).

A wildflower stand requires several years to become established; maintenance requirements are minimal once the area is established (Brash et al., undated).

## 5. Sediment Control Practices[4]

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

Sediment controls capture sediment that is transported in runoff. Filtration and detention (gravitational settling) are the main processes used to remove sediment from urban runoff.

### a. *Sediment Basins*

Sediment basins, also known as silt basins, are engineered impoundment structures that allow sediment to settle out of the urban runoff. They are installed prior to full-scale grading and remain in place until the disturbed portions of the drainage area are fully stabilized. They are generally located at the low point of sites, away from construction traffic, where they will be able to trap sediment-laden runoff.

Sediment basins are typically used for drainage areas between 5 and 100 acres. They can be classified as either temporary or permanent structures, depending on the length of service of the structure. If they are designed to function for less than 36 months, they are classified as "temporary"; otherwise, they are considered permanent structures. Temporary sediment basins can also be converted into permanent urban runoff management ponds. When sediment basins are designed as permanent structures, they must meet all standards for wet ponds.

### b. *Sediment Trap*

Sediment traps are small impoundments that allow sediment to settle out of runoff water. Sediment traps are typically installed in a drainageway or other point of discharge from a disturbed area. Temporary diversions can be

[4] Adapted from Goldman (1986).

used to direct runoff to the sediment trap. Sediment traps should not be used for drainage areas greater than 5 acres and typically have a useful life of approximately 18 to 24 months.

### c. *Filter Fabric Fence*

Filter fabric fence is available from many manufacturers and in several mesh sizes. Sediment is filtered out as urban runoff flows through the fabric. Such fences should be used only where there is sheet flow (i.e., no concentrated flow), and the maximum drainage area to the fence should be 0.5 acre or less per 100 feet of fence. Filter fabric fences have a useful life of approximately 6 to 12 months.

### d. *Straw Bale Barrier*

A straw bale barrier is a row of anchored straw bales that detain and filter urban runoff. Straw bales are less effective than filter fabric, which can usually be used in place of straw bales. However, straw bales have been effectively used as temporary check dams in channels. As with filter fabric fences, straw bale barriers should be used only where there is sheet flow. The maximum drainage area to the barrier should be 0.25 acre or less per 100 feet of barrier. The useful life of straw bales is approximately 3 months.

### e. *Inlet Protection*

Inlet protection consists of a barrier placed around a storm drain drop inlet, which traps sediment before it enters the storm sewer system. Filter fabric, straw bales, gravel, or sand bags are often used for inlet protection.

### f. *Construction Entrance*

A construction entrance is a pad of gravel over filter cloth located where traffic leaves a construction site. As vehicles drive over the gravel, mud, and sediment are collected from the vehicles' wheels and offsite transport of sediment is reduced.

### g. *Vegetated Filter Strips*

Vegetated filter strips are low-gradient vegetated areas that filter overland sheet flow. Runoff must be evenly distributed across the filter strip. Channelized flows decrease the effectiveness of filter strips. Level spreading devices are often used to distribute the runoff evenly across the strip (Dillaha et al., 1989).

Vegetated filter strips should have relatively low slopes and adequate length and should be planted with erosion-resistant plant species. The main factors that influence the removal efficiency are the vegetation type, soil infiltration rate, and flow depth and travel time. These factors are dependent on the contributing drainage area, slope of strip, degree and type of vegetative cover, and strip length. Maintenance requirements for vegetated filter strips include sediment removal and inspections to ensure that dense, vigorous vegetation is established and concentrated flows do not occur. Maintenance of these structures is discussed in Section II.A of this chapter.

## 6. Effectiveness and Cost Information

### a. *Erosion Control Practices*

The effectiveness of erosion control practices can vary based on land slope, the size of the disturbed area, rainfall frequency and intensity, wind conditions, soil type, use of heavy machinery, length of time soils are exposed and unprotected, and other factors. In general, a system of erosion and sediment control practices can more effectively reduce offsite sediment transport than can a single system. Numerous nonstructural measures such as protecting natural or newly planted vegetation, minimizing the disturbance of vegetation on steep slopes and other highly





erodible areas, maximizing the distance eroded material must travel before reaching the drainage system, and locating roads away from sensitive areas may be used to reduce erosion.

Table 4-15 contains the available cost and effectiveness data for some of the erosion controls listed above. Information on the effectiveness of individual nonstructural controls was not available. All reported effectiveness data assume that controls are properly designed, constructed, and maintained. Costs have been broken down into annual capital costs, annual maintenance costs, and total annual costs (including annualization of the capital costs).

### b. *Sediment Control Practices*

Regular inspection and maintenance are needed for most erosion control practices to remain effective. The effectiveness of sediment controls will depend on the size of the construction site and the nature of the runoff flows. Sediment basins are most appropriate for drainage areas of 5 acres or greater. In smaller areas with concentrated flows, silt traps may suffice. Where concentrated flow leaves the site and the drainage area is less than 0.5 ac/100 ft of flow, filter fabric fences may be effective. In areas where sheet flow leaves the site and the drainage area is greater than 0.5 acre/100 ft of flow, perimeter dikes may be used to divert the flow to a sediment trap or sediment basin. Urban runoff inlets may be protected using straw bales or diversions to filter or route runoff away from the inlets.

Table 4-16 describes the general cost and effectiveness of some common sediment control practices.

### c. *Comparisons*

Figure 4-7 illustrates the estimated TSS loading reductions from Maryland construction sites possible using a combination of erosion and sediment controls in contrast to using only sediment controls. Figure 4-8 shows a comparison of the cost and effectiveness of various erosion control practices. As can be seen in Figure 4-8, seeding or seeding and mulching provide the highest levels of control at the lowest cost.

Table 4-15. (Continued)

| Practice | Design Constraints or Purpose | Percent Removal of TSS | Useful Life (years)[a] | Construction Cost | Annual Maintenance Cost (as % construction cost) | Total Annual Cost |
|---|---|---|---|---|---|---|
| Mulch | Temporary stabilization of disturbed area. | Observed range:<br><br>sand:<br>20% slope / 50% slope<br>wood fiber @ 1500 lb/ac 50-60% / 0-20%<br>wood fiber @ 3000 lb/ac 50-65% / 50-70%<br>straw @ 3000 lb/ac 90-100% / 95%<br><br>Silt-loam:<br>20% slope / 50% slope<br>wood fiber @ 1500 lb/ac 20-60% / 40-60%<br>wood fiber @ 3000 lb/ac 60-90% / 60-70%<br>straw @ 3000 lb/ac 80-95% / 70-90%<br><br>Silt-clay-loam:<br>10-30% slope / 30-50% slope<br>wood fiber @ 1500 lb/ac 5% / --<br>wood fiber @ 3000 lb/ac 40% / --<br>jute netting 30-60% / 30%<br>straw @ 3000 lb/ac 40-70% / 20-40%<br>wood chips @ 10,000 lb/ac 80-80% / 50-60%<br>mulch blanket 60-80% / 50-60%<br>excelsior blanket 60-80% / 50-80%<br>multiple treatment (straw and jute) 90% / 90%<br><br>References: Minnesota Pollution Control Agency, 1989; Kay, 1983 cited in Goldman, 1986 | Straw mulch: 0.25<br><br>Wood fiber mulch: 0.33<br><br>Jute netting: 0.33<br><br>Straw and jute: 0.33 | Straw mulch:<br>Average: $1,700 per acre<br>Range: $500 - $5,000 per acre<br>References: Wisconsin DOT cited in SWRPC, 1991; Washington DOT, 1990; Virginia, 1980<br><br>Wood fiber mulch:<br>Average: $1,000 per acre<br>Range: $100 - $2,300 per acre<br>References: Washington DOT, 1990; Virginia, 1980<br><br>Jute netting:<br>Average: $3,700 per acre<br>Range: $3,500-$4,100 per acre<br>References: Washington DOT, 1990; Virginia, 1980<br><br>Straw and jute:<br>Average: $5,400 per acre<br>Range: $4,000-$9,100 per acre<br>References: Washington DOT, 1990; Virginia, 1980 | Average: NA[b]<br>Range: NA<br>References: None | Straw mulch: $7,500 per acre<br><br>Wood fiber mulch: $3,500 per acre<br><br>Jute netting: $12,500 per acre<br><br>Straw and jute: $18,000 per acre |





Table 4-15. ESC Quantitative Effectiveness and Cost Summary

| Practice | Design Constraints or Purpose | Percent Removal of TSS | Useful Life (years)[a] | Construction Cost | Annual Maintenance Cost (as % construction cost) | Total Annual Cost |
|---|---|---|---|---|---|---|
| Sod | Immediate erosion protection where there is high erosion potential during vegetative establishment. | Average: 99%<br>Observed range: 98% - 99%<br>References: Minnesota Pollution Control Agency, 1989; Pennsylvania, 1983 cited in USEPA, 1991 | 2 | Average: $0.2 per ft$^2$<br>[$11,300 per acre]<br>Range: $0.1 - $1.1<br>References: SWRPC, 1991; Schueler, 1987; Virginia, 1980 | Average: 5%<br>Range: 5%<br>Reference: SWRPC, 1991 | $0.20 per ft$^2$<br>$7,500 per acre |
| Seed | Establish vegetation on disturbed area. | After vegetation established-<br>Average: 90%<br>Observed range: 50% - 100%<br>References: SCS, 1985 cited in EPA, 1991; Minnesota Pollution Control Agency, 1989; Oberts, 1984 cited in City of Austin, 1988; Delaware Department of Natural Resources, 1989 | 2 | Average: $400 per acre<br>Range: $200 - $1000 per acre<br>References: Wisconsin DOT cited in SWRPC, 1991; SWRPC, 1991; Goldman, 1986; Virginia, 1980 | Average: 20%<br>Range: 15% - 25%<br>References: Wisconsin DOT cited in SWRPC, 1991; SWRPC, 1991 | $300 per acre |
| Seed and Mulch | Establish vegetation on disturbed area. | After vegetation established-<br>Average: 90%<br>Observed range: 50% - 100%<br>References: SCS, 1985 cited in EPA, 1991; Minnesota Pollution Control Agency, 1989; Oberts, 1984 cited in City of Austin, 1988; Delaware Department of Natural Resources, 1989 | 2 | Average: $1,500 per acre<br>Range: $800 - $3,500 per acre<br>References: Goldman, 1986; Washington DOT, 1990; NC State, 1990; Schueler, 1987; Virginia, 1980; SWRPC, 1991 | Average: NA[b]<br>Range: NA<br>References: None | $1,100 per acre |

**Table 4-16. ESC Quantitative Effectiveness and Cost Summary for Sediment Control Practices**

| Practice | Design Constraints or Purpose | Percent Removal of TSS | Useful Life (years)[a] | Construction Cost | Annual Maintenance Cost (as % construction cost) | Total Annual Cost |
|---|---|---|---|---|---|---|
| Sediment basin | Minimum drainage area = 5 acres, maximum drainage area = 100 acres | Average: 70%<br>Observed range: 55% - 100%<br>References: Schueler, 1990; Engle, BW and Jarrett, AR, 1990; Baumann, 1990 | 2 | Less than 50,000 $ft^3$ storage<br>Average: $0.60 per $ft^3$ storage<br>($1,100 per drainage acre[c])<br>Range: $0.20 - $1.30 per $ft^3$<br><br>Greater than 50,000 $ft^3$ storage<br>Average: $0.3 per $ft^3$ storage<br>($550 per drainage acre[c])<br>Range: $0.10 - $0.40 per $ft^3$<br>References: SWRPC, 1991 | Average: 25%<br>Range: 25%<br>References: Denver COG cited in SWRPC, 1991; SWRPC, 1991 | Less than 50,000 $ft^3$ storage<br>$0.40 per $ft^3$ storage<br>$700 per drainage acre[b]<br><br>Greater than 50,000 $ft^3$ storage<br>$0.20 per $ft^3$ storage<br>$900 per drainage acre[c] |
| Sediment trap | Maximum drainage area = 5 acres | Average: 60%<br>Observed range: (-7%) - 100%<br>References: Schueler, et al., 1990; Tahoe Regional Planning Agency, 1989; Baumann, 1990 | 1.5 | Average: $0.60 per $ft^3$ storage<br>($1,100 per drainage acre[c])<br>Range: $0.20 - $2.00 per $ft^3$<br>References: Denver COG cited in SWRPC, 1991; SWRPC, 1991; Goldman, 1986 | Average: 20%<br>Range: 20%<br>References: Denver COG cited in SWRPC, 1991; SWRPC, 1991 | $0.70 per $ft^3$ storage<br>$1,300 per drainage acre[c] |
| Filter Fabric Fence | Maximum drainage area = 0.5 acre per 100 feet of fence. Not to be used in concentrated flow areas. | Average: 70%<br>Observed range: 0% - 100%<br>sand: 60% - 99%<br>silt-loam: 50% - 80%<br>silt-clay-loam: 0% - 20%<br>References: Munson, 1991; Fisher et al., 1984; Minnesota Pollution Control Agency, 1989 | 0.5 | Average: $3 per lin ft<br>($700 per drainage acre[c]<br>Range: $1 - $8 per lin ft<br>References: Wisconsin DOT cited in SWRPC, 1991; SWRPC, 1991; Goldman, 1986; Virginia, 1991; NC State, 1990 | Average: 100%<br>Range: 100%<br>References: SWRPC, 1991 | $7 per lin ft<br>$850 per drainage acre[c] |





**Table 4-15. (Continued)**

| Practice | Design Constraints or Purpose | Percent Removal of TSS | Useful Life (years)[a] | Construction Cost | Annual Maintenance Cost (as % construction cost) | Total Annual Cost |
|---|---|---|---|---|---|---|
| Terraces | Break up long or steep slopes. | Observed range:<br>Land Slope / Reduction in Erosion<br>1-12% / 70%<br>12-18% / 60%<br>18-24% / 55%<br><br>Additionally, if the slope steepness is halved, while other factors are held constant, the soil loss potential decreases 2-1/2 times. If both the slope and length are halved, the soil loss potential is decreased 4 times.<br>References: Goldman, 1986; Beasley, 1972 | 2 | Average: $5 per lin ft<br>Range: $1 - $12<br>References: SWRPC, 1991; Goldman, 1986; Virginia, 1991 | Average: 20%<br>Range: 20%<br>Reference: SWRPC, 1991 | $4 per lin ft |
| All Erosion Controls | Reduce amount of sediment entering runoff. | Average: 85%<br>Observed range: 85%<br>Reference: Schueler, 1990 | -- | Varies but typically low | Varies but typically low | Varies but typically low |

NA - Not available.
[a] Useful life estimated as length of construction project (assumed to be 2 years).
[b] For Total Annual Cost, assume Annual Maintenance Cost = 2% of construction cost.

**Table 4-16. (Continued)**

| Practice | Design Constraints or Purpose | Percent Removal of TSS | Useful Life (years)[a] | Construction Cost | Annual Maintenance Cost (as % construction cost) | Total Annual Cost |
|---|---|---|---|---|---|---|
| Vegetative Filter Strip | Must have sheet flow. | Average: 70%<br>Observed Range: 20% - 80%<br>References: Hayes and Hairston, 1983 cited in Casman, 1990; Dillaha et al., 1989, cited in Glick et al., 1991; Virginia Department of Conservation, 1987; Nonpoint Source Control Task Force, 1983 cited in Minnesota PCA, 1989; Schueler, 1987 | 2 | Established from existing vegetation-<br>Average: $0<br>Range: $0<br>References: Schueler, 1987<br><br>Established from sod-<br>Average: $11,300 per acre<br>Range: $4,500 - $48,000 per acre<br>References: Schueler, 1987; SWRPC, 1991 | Average: NA<br>Range: NA<br>References: None | NA |

NA - Not available.
[a] Useful life estimated as length of construction project (assumed to be 2 years)
[e] For Total Annual Cost, assume Annual Maintenance Cost=20% of construction cost.
[b] Assumes trap volume = 1800 cf/ac (0.5 inches runoff per acre).
[c] Assumes drainage area of 0.5 acre per 100 feet of fence (maximum allowed).
[d] Assumes drainage area of 0.25 acre per 100 feet of barrier (maximum allowed).









**Table 4-16. (Continued)**

| Practice | Design Constraints or Purpose | Percent Removal of TSS | Useful Life (years)[a] | Construction Cost | Annual Maintenance Cost (as % construction cost) | Total Annual Cost |
|---|---|---|---|---|---|---|
| Straw Bale Barrier | Maximum drainage area = 0.25 acre per 100 feet of barrier. Not to be used in concentrated flow areas. | Average: 70%<br>Observed Range: 70%<br>References: Virginia, 1980 cited in EPA, 1991 | 0.25 | Average: $4 per lin ft ($1,600 per drainage acre[d])<br>Range: $2 - $6 per lin ft<br>References: Goldman, 1986; Virginia, 1991 | Average: 100%<br>Range: 100%<br>References: SWRPC, 1991 | $17 per lin ft<br>$6,800 per drainage acre[d] |
| Inlet Protection | Protect storm drain inlet. | Average: NA<br>Observed Range: NA<br>References: None | 1 | Average: $100 per inlet<br>Range: $50 - $150<br>References: SWRPC, 1991; Denver COG cited in SWRPC, 1991; Virginia, 1991; EPA cited in SWRPC, 1991 | Average: 60%<br>Range: 20% - 100%<br>References: SWRPC, 1991; Denver COG cited in SWRPC, 1991 | $150 per inlet |
| Construction Entrance | Removes sediment from vehicles wheels. | Average: NA<br>Observed Range: NA<br>References: None | 2 | Average: $2,000 each<br>Range: $1,000 - $4,000<br>References: Goldman, 1986; NC State, 1990<br><br>With washrack:<br>Average: $3,000 each<br>Range: $1,000 - $5,000<br>References: Virginia, 1991 | Average: NA[e]<br>Range: NA<br>References: None | $1,500 each<br><br>$2,200 each |

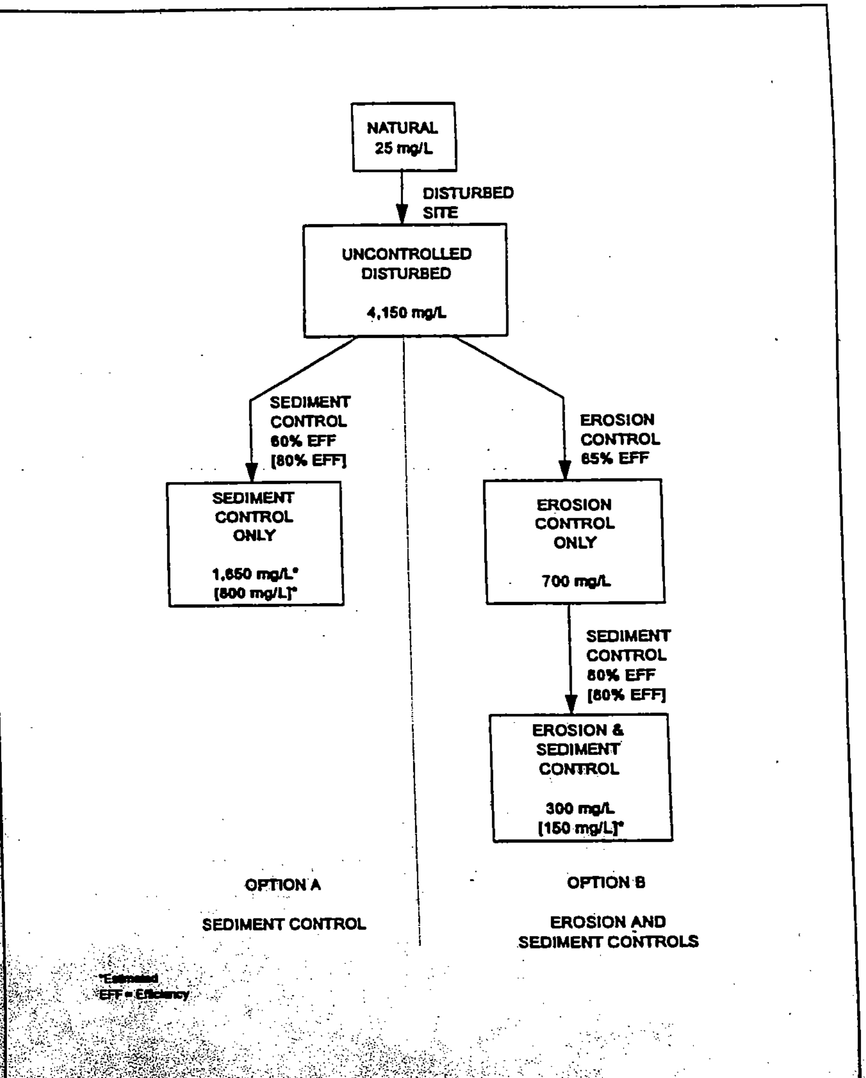



Figure 4-7. TSS concentrations from Maryland construction sites (Schueler, 1987).





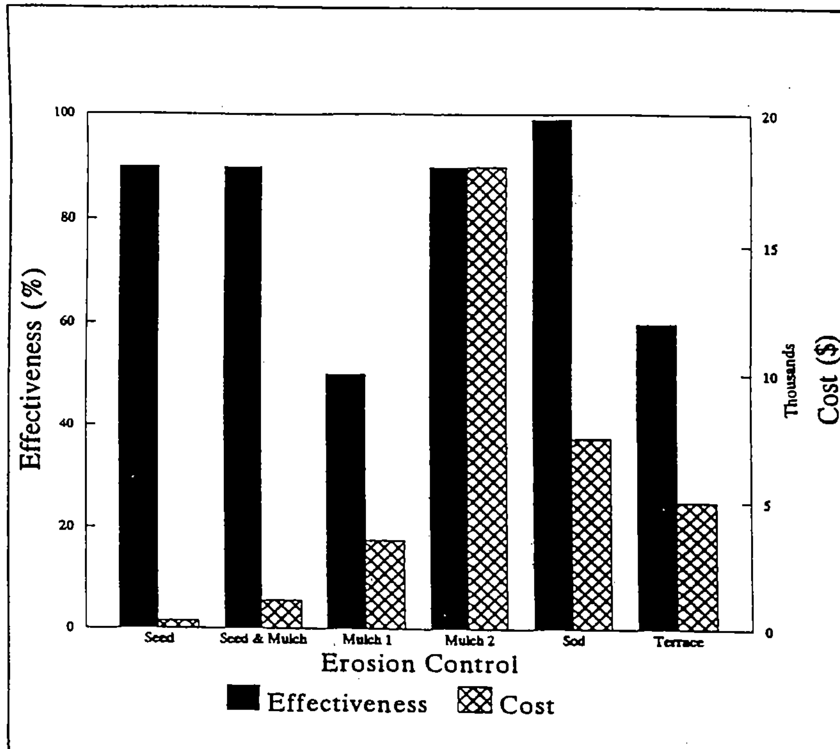



Figure 4-8. Comparison of cost and effectiveness for erosion control practices (based on information in Tables 4-15 and 4-16).

## B. Construction Site Chemical Control Management Measure

**(1) Limit application, generation, and migration of toxic substances;**

**(2) Ensure the proper storage and disposal of toxic materials; and**

**(3) Apply nutrients at rates necessary to establish and maintain vegetation without causing significant nutrient runoff to surface waters.**

### 1. Applicability

This management measure is intended to be applied by States to all construction sites less than 5 acres in area and to new, resurfaced, restored, and reconstructed road, highway, and bridge construction projects. This management measure does not apply to: (1) construction of a detached single family home on a site of 1/2 acre or more or (2) construction that does not disturb over 5,000 square feet of land on a site. (NOTE: All construction activities, including clearing, grading, and excavation, that result in the disturbance of areas greater than or equal to 5 acres or are a part of a larger development plan are covered by the NPDES regulations and are thus excluded from these requirements.) Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformance with this management measure and will have flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

### 2. Description

The purpose of this management measure is to prevent the generation of nonpoint source pollution from construction sites due to improper handling and usage of nutrients and toxic substances, and to prevent the movement of toxic substances from the construction site.

Many potential pollutants other than sediment are associated with construction activities. These pollutants include pesticides (insecticides, fungicides, herbicides, and rodenticides); fertilizers used for vegetative stabilization; petrochemicals (oils, gasoline, and asphalt degreasers); construction chemicals such as concrete products, sealers, and paints; wash water associated with these products; paper; wood; garbage; and sanitary wastes (Washington State Department of Ecology, 1991).

The variety of pollutants present and the severity of their effects are dependent on a number of factors:

(1) **The nature of the construction activity.** For example, potential pollution associated with fertilizer usage may be greater along a highway or at a housing development than it would be at a shopping center development because highways and housing developments usually have greater landscaping requirements.

(2) **The physical characteristics of the construction site.** The majority of all pollutants generated at construction sites are carried to surface waters via runoff. Therefore, the factors affecting runoff volume,





such as the amount, intensity, and frequency of rainfall; soil infiltration rates; surface roughness; slope length and steepness; and area denuded, all contribute to pollutant loadings.

(3) **The proximity of surface waters to the nonpoint pollutant source.** As the distance separating pollutant-generating activities from surface waters decreases, the likelihood of water quality impacts increases.

#### a. Pesticides

Insecticides, rodenticides, and herbicides are used on construction sites to provide safe and healthy conditions, reduce maintenance and fire hazards, and curb weeds and woody plants. Rodenticides are also used to control rodents attracted to construction sites. Common insecticides employed include synthetic, relatively water-insoluble chlorinated hydrocarbons, organophosphates, carbamates, and pyrethrins.

#### b. Petroleum Products

Petroleum products used during construction include fuels and lubricants for vehicles, for power tools, and for general equipment maintenance. Specific petroleum pollutants include gasoline, diesel oil, kerosene, lubricating oils, and grease. Asphalt paving also can be particularly harmful since it releases various oils for a considerable time period after application. Asphalt overloads might be dumped and covered without inspection. However, many of these pollutants adhere to soil particles and other surfaces and can therefore be more easily controlled.

#### c. Nutrients

Fertilizers are used on construction sites when revegetating graded or disturbed areas. Fertilizers contain nitrogen and phosphorus, which in large doses can adversely affect surface waters, causing eutrophication.

#### d. Solid Wastes

Solid wastes on construction sites are generated from trees and shrubs removed during land clearing and structure installation. Other wastes include wood and paper from packaging and building materials, scrap metals, sanitary wastes, rubber, plastic and glass, and masonry and asphalt products. Food containers, cigarette packages, leftover food, and aluminum foil also contribute solid wastes to the construction site.

#### e. Construction Chemicals

Chemical pollutants, such as paints, acids for cleaning masonry surfaces, cleaning solvents, asphalt products, soil additives used for stabilization, and concrete-curing compounds, may also be used on construction sites and carried in runoff.

#### f. Other Pollutants

Other pollutants, such as wash water from concrete mixers, acid and alkaline solutions from exposed soil or rock, and alkaline-forming natural elements, may also be present and contribute to nonpoint source pollution.

Revegetation of disturbed areas may require the use of fertilizers and pesticides, which, if not applied properly, may become nonpoint source pollutants. Many pesticides are restricted by Federal and/or State regulations.

Hydroseeding operations, in which seed, fertilizers, and lime are applied to the ground surface in a one-step operation, are more conducive to nutrient pollution than are the conventional seedbed-preparation operations, in which fertilizers and lime are tilled into the soil. Use of fertilizers containing little or no phosphorus may be required by local authorities if the development is near sensitive waterbodies. The addition of lime can also affect the pH of sensitive waters, making them more alkaline.

Improper fueling and servicing of vehicles can lead to significant quantities of petroleum products being dumped onto the ground. These pollutants can then be washed off site in urban runoff, even when proper erosion and sediment controls are in place. Pollutants carried in solution in runoff water, or fixed with sediment crystalline structures, may not be adequately controlled by erosion and sediment control practices (Washington Department of Ecology, 1991). Oils, waxes, and water-insoluble pesticides can form surface films on water and solid particles. Oil films can also concentrate water-soluble insecticides. These pollutants can be nearly impossible to control once present in runoff other than by the use of very costly water-treatment facilities (Washington Department of Ecology, 1991).

After spill prevention, one of the best methods to control petroleum pollutants is to retain sediments containing oil on the construction site through use of erosion and sediment control practices. Improved maintenance and safe storage facilities will reduce the chance of contaminating a construction site. One of the greatest concerns related to use of petroleum products is the method for waste disposal. The dumping of petroleum product wastes into sewers and other drainage channels is illegal and could result in fines or job shutdown.

The primary control method for solid wastes is to provide adequate disposal facilities. Erosion and sediment control structures usually capture much of the solid waste from construction sites. Periodic removal of litter from these structures will reduce solid waste accumulations. Collected solid waste should be removed and disposed of at authorized disposal areas.

Improperly stored construction materials, such as pressure-treated lumber or solvents, may lead to leaching of toxics to surface water and ground water. Disposal of construction chemicals should follow all applicable State and local laws that may require disposal by a licensed waste management firm.

## 3. Management Measure Selection

This management measure was selected based on the potential for many construction activities to contribute to nutrient and toxic NPS pollution.

This management measure was selected because (1) construction activities have the potential to contribute to increased loadings of toxic substances and nutrients to waterbodies; (2) various States and local governments regulate the control of chemicals on construction sites through spill prevention plans, erosion and sediment control plans, or other administrative devices; (3) the practices described are commonly used and presented in a number of best management practice handbooks and guidance manuals for construction sites; and (4) the practices selected are the most economical and effective.

## 4. Practices

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

■ *a. Properly store, handle, apply, and dispose of pesticides.*

Pesticide storage areas on construction sites should be protected from the elements. Warning signs should be placed in areas recently sprayed or treated. Persons mixing and applying these chemicals should wear suitable protective clothing, in accordance with the law.





Application rates should conform to registered label directions. Disposal of excess pesticides and pesticide-related wastes should conform to registered label directions for the disposal and storage of pesticides and pesticide containers set forth in applicable Federal, State, and local regulations that govern their usage, handling, storage, and disposal. Pesticides and herbicides should be used only in conjunction with Integrated Pest Management (IPM) (see Chapter 2). Pesticides should be the tool of last resort; methods that are the least disruptive to the environment and human health should be used first.

Pesticides should be disposed of through either a licensed waste management firm or a treatment, storage, and disposal (TSD) facility. Containers should be triple-rinsed before disposal, and rinse waters should be reused as product.

Other practices include setting aside a locked storage area, tightly closing lids, storing in a cool, dry place, checking containers periodically for leaks or deterioration, maintaining a list of products in storage, using plastic sheeting to line the storage area, and notifying neighboring property owners prior to spraying.

■ *b. Properly store, handle, use, and dispose of petroleum products.*

When storing petroleum products, follow these guidelines:

- Create a shelter around the area with cover and wind protection;
- Line the storage area with a double layer of plastic sheeting or similar material;
- Create an impervious berm around the perimeter with a capacity 110 percent greater than that of the largest container;
- Clearly label all products;
- Keep tanks off the ground; and
- Keep lids securely fastened.

Oil and oily wastes such as crankcase oil, cans, rags, and paper dropped into oils and lubricants should be disposed of in proper receptacles or recycled. Waste oil for recycling should not be mixed with degreasers, solvents, antifreeze, or brake fluid.

■ *c. Establish fuel and vehicle maintenance staging areas located away from all drainage courses, and design these areas to control runoff.*

Proper maintenance of equipment and installation of proper stream crossings will further reduce pollution of water by these sources. Stream crossings should be minimized through proper planning of access roads. Refer to Chapter 3 for additional information on stream crossings.

■ *d. Provide sanitary facilities for constructions workers.*

■ *e. Store, cover, and isolate construction materials, including topsoil and chemicals, to prevent runoff of pollutants and contamination of ground water.*

■ *f. Develop and implement a spill prevention and control plan. Agencies, contractors, and other commercial entities that store, handle, or transport fuel, oil, or hazardous materials should develop a spill response plan.*

Post spill procedure information and have persons trained in spill handling on site or on call at all times. Materials for cleaning up spills should be kept on site and easily available. Spills should be cleaned up immediately and the contaminated material properly disposed of. Spill control plan components should include:

- Stop the source of the spill.
- Contain any liquid.
- Cover the spill with absorbent material such as kitty litter or sawdust, but do not use straw. Dispose of the used absorbent properly.

■ g. *Maintain and wash equipment and machinery in confined areas specifically designed to control runoff.*

Thinners or solvents should not be discharged into sanitary or storm sewer systems when cleaning machinery. Use alternative methods for cleaning larger equipment parts, such as high-pressure, high-temperature water washes, or steam cleaning. Equipment-washing detergents can be used, and wash water may be discharged into sanitary sewers if solids are removed from the solution first. (This practice should be verified with the local sewer authority.) Small parts can be cleaned with degreasing solvents, which can then be reused or recycled. Do not discharge any solvents into sewers.

Washout from concrete trucks should be disposed of into:

- A designated area that will later be backfilled;
- An area where the concrete wash can harden, can be broken up, and then can be placed in a dumpster; or
- A location not subject to urban runoff and more than 50 feet away from a storm drain, open ditch, or surface water.

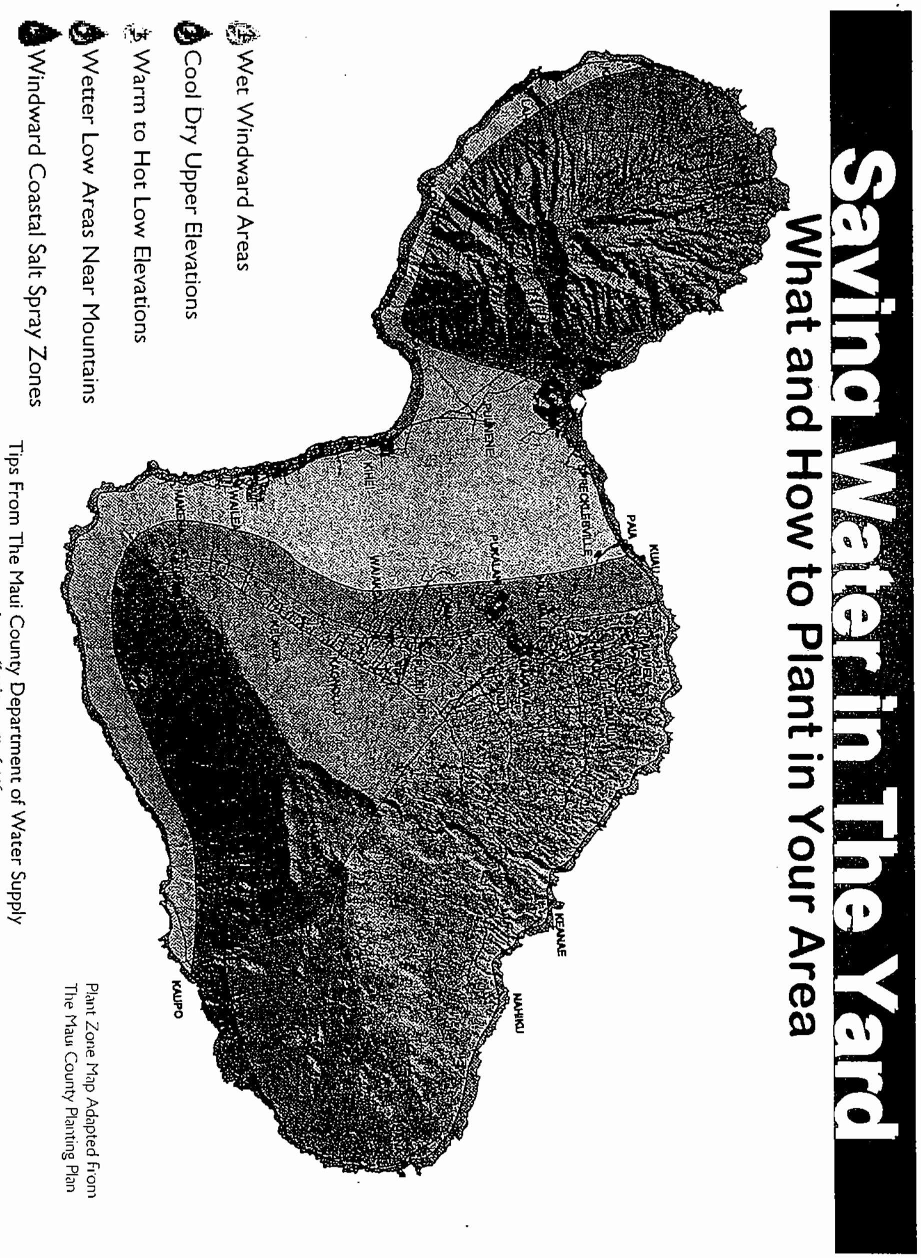
Never dump washout into a sanitary sewer or storm drain, or onto soil or pavement that carries urban runoff.

■ h. *Develop and implement nutrient management plans.*

Properly time applications, and work fertilizers and liming materials into the soil to depths of 4 to 6 inches. Using soil tests to determine specific nutrient needs at the site can greatly decrease the amount of nutrients applied.

■ i. *Provide adequate disposal facilities for solid waste, including excess asphalt, produced during construction.*

■ j. *Educate construction workers about proper materials handling and spill response procedures. Distribute or post informational material regarding chemical control.*



Yellow

Zone 3

## Zone-specific Native and Polynesian plants for Maui County

| Type | Scientific Name | Common Name | Height | Spread | Elevation | Water req. |
|---|---|---|---|---|---|---|
| Sh | Argemone glauca var. decipiens | pua kala | 3' | 2' | sea to 3,000' | Dry to Medium |
| Sh | Bidens mauiensis | ko'oko'olau | 1' | 3' | sea to 1,000' | Dry to Medium |
| Sh | Bidens menziesii ssp. menziesii | ko'oko'olau | 1' | 3' | | |
| Sh | Bidens micrantha ssp. micrantha | ko'oko'olau | 1' | 3' | | |
| Sh | Chenopodium oahuense | 'aheahea, 'aweoweo | 6' | | sea to higher | Dry to Medium |
| Sh | Dianella sandwicensis | 'uki | 2' | 2' | 1,000' to higher | Dry to Medium |
| Sh | Gossypium tomentosum | mao, Hawaiian cotton | 5' | 8' | sea to 1,000' | Dry to Medium |
| Sh | Hedyotis spp. | au, pilo | 3' | 2' | 1,000' to 3,000' | Dry to Wet |
| Sh | Lipochaeta lavarum | nehe | 3' | 3' | sea to 3,000' | Dry to Medium |
| Sh | Osteomeles anthyllidifolia | 'ulei, eluehe | 4' | 6' | sea to 3,000' | Dry to Medium |
| Sh | Scaevola sericea | naupaka, naupaka-kahakai | 6' | 8' | sea to 1,000' | Dry to Medium |
| Sh | Senna gaudichaudii | kolomana | 5' | 5' | sea to 3,000' | Dry to Medium |
| Sh | Solanum nelsonii | 'akia, beach solanum | 3' | 3' | sea to 1,00' | Dry to Medium |
| Sh | Styphelia tameiameiae | pukiawe | 6' | 6' | 1,000' to higher | Dry to Medium |
| Sh | Vitex rotundifolia | pohinahina | 3' | 4' | sea to 1,000' | Dry to Medium |
| Sh | Wikstroemia uva-ursi kauaiensis kauaiensis | 'akia, Molokai osmanthus | | | | |
| Sh - Tr | Broussonetia papyrifera | wauke, paper mulberry | 8' | 6' | sea to 1,000' | Dry to Medium |
| Sh - Tr | Myoporum sandwicense | naio, false sandalwood | 10' | 10' | sea to higher | Dry to Medium |
| Sh - Tr | Nototrichium sandwicense | kulu'i | 8' | 8' | sea to 3,000' | Dry to Medium |
| Sh-Tr | Dodonaea viscosa | 'a'ali'i | 6' | 8' | sea to higher | Dry to Medium |
| Tr | Aleurites moluccana | candlenut, kukui | 50' | 50' | sea to 3,000' | Medium to Wet |
| Tr | Calophyllum inophyllum | kamani, alexandrian laurel | 60' | 40' | sea to 3,000' | Medium to Wet |
| Tr | Canthium odoratum | Alahe'e, 'ohe'e, walahe'e | 12' | 8' | sea to 3,000' | Dry to Medium |
| Tr | Cordia subcordata | kou | 30' | 25' | sea to 1,000' | Dry to Wet |
| Tr | Diospyros sandwicensis | lama | 12' | 15' | sea to 3,000' | Dry to Medium |
| Tr | Erythrina sandwicensis | wiliwili | 20' | 20' | sea to 1,000' | Dry |
| Tr | Metrosideros polymorpha var. macrophylla | ohi'a lehua | 25' | 25' | sea to 1,000' | Dry to Wet |

Yellow

Zone 3

## Zone-specific Native and Polynesian plants for Maui County

TYPE: **F** Fern **G** Grass **Gr** Ground Cover **Sh** Shrub **P** Palm **S** Sedge **Tr** Tree **V** Vine

| Type | Scientific Name | Common Name | Height | Spread | Elevation | Water req. |
|---|---|---|---|---|---|---|
| F | Psilotum nudum | moa, moa kula | 1' | 1' | sea to 3,000' | Dry to Wet |
| G | Colubrina asiatica | 'anapanapa | 3' | 10' | sea to 1,000' | Dry to Wet |
| G | Eragrostis monticola | kalamalo | 1' | 2' | sea to 3,000' | Dry to Medium |
| G | Eragrostis variabilis | 'emo-loa | 1' | 2' | sea to 3,000' | Dry to Medium |
| G | Fimbristylis cymosa ssp. spathacea | mau'u'aki'aki fimbristylis | 0.5' | 1' | sea to 1,000' | Dry to Medium |
| Gr | Boerhavia repens | alena | 0.5' | 4' | sea to 1,000' | Dry to Medium |
| Gr | Chamaesyce celastroides var. laehiensis | 'akoko | 2' | 3' | sea to 1,000' | Dry to Medium |
| Gr | Cressa truxillensis | cressa | 0.5' | 1' | sea to 1,000' | Dry to Medium |
| Gr | Heliotropium anomalum var. argenteum | hinahina ku kahakai | 1' | 2' | sea to 1,000' | Dry to Medium |
| Gr | Ipomoea tuboides | Hawaiian moon flower, 'uala | 1' | 10' | sea to 3,000' | Dry to Medium |
| Gr | Jacquemontia ovalifolia ssp. sandwicensis | pa'u o hi'iaka | 0.5' | 6' | sea to 1,000' | Dry to Medium |
| Gr | Lipochaeta integrifolia | nehe | 1' | 5' | sea to 1,00' | Dry to Medium |
| Gr | Peperomia leptostachya | 'ala'ala-wai-nui | 1' | 1' | sea to 3,000' | Dry to Medium |
| Gr | Plumbago zeylanica | 'ilie'e | 1' | | | |
| Gr | Sesuvium portulacastrum | 'akulikuli, sea-purslane | 0.5' | 2' | sea to 1,000' | Dry to Wet |
| Gr | Sida fallax | 'ilima | 0.5' | 3' | sea to 1,000' | Dry to Medium |
| Gr | Tephrosia purpurea var. purpurea | 'auhuhu | 2' | 2' | sea to 1,000' | Dry to Medium |
| Gr - Sh | Hibiscus calyphyllus | ma'o hau hele, Rock's hibiscus | 3' | 2' | sea to 3,000' | Dry to Medium |
| Gr - Sh | Lipochaeta rockii | nehe | 2' | 2' | sea to 3,000' | Dry to Medium |
| Gr - Sh | Lipochaeta succulenta | nehe | 2' | 5' | sea to 1,000' | Dry to Wet |
| Gr - Sh | Lycium sandwicense | 'ohelo-kai, 'ae'ae | 2' | 2' | sea to 1,000' | Dry to Medium |
| P | Cocos nucifera | coconut, niu | 100' | 30' | sea to 1,000' | Dry to Wet |
| P | Pritchardia hillebrandii | lo'ulu, fan palm | 25' | 15' | sea to 1,000' | Dry to Wet |
| S | Mariscus javanicus | marsh cypress, 'ahu'awa | 0.5' | 0.5' | sea to 1,000' | Dry to Medium |

Blue

Zone 4

## Zone-specific Native and Polynesian plants for Maui County

TYPE: F Fern G Grass Gr Ground Cover Sh Shrub P Palm S Sedge Tr Tree V Vine

| Type | Scientific Name | Common Name | Height | Spread | Elevation | Water req. |
|---|---|---|---|---|---|---|
| F | Psilotum nudum | moa, moa kula | 1' | 1' | sea to 3,000' | Dry to Wet |
| F | Sadleria cyatheoides | 'ama'u, ama'uma'u | | | | |
| G | Colubrina asiatica | 'anapanapa | 3' | 10' | sea to 1,000' | Dry to Wet |
| G | Eragrostis monticola | kalamalo | 1' | 2' | sea to 3,000' | Dry to Medium |
| G | Eragrostis variabilis | 'emo-loa | 1' | 2' | sea to 3,000' | Dry to Medium |
| G | Fimbristylis cymosa ssp. spathacea | mau'u'aki'aki fimbristylis | 0.5' | 1' | sea to 1,000' | Dry to Medium |
| Gr | Chamaesyce celastroides var. laehiensis | 'akoko | 2' | 3' | sea to 1,000' | Dry to Medium |
| Gr | Ipomoea tuboides | Hawaiian moon flower, 'uala | 1' | 10' | sea to 3,000' | Dry to Medium |
| Gr | Jacquemontia ovalifolia ssp. sandwicensis | pa'u o hi'iaka | 0.5' | 6' | sea to 1,000' | Dry to Medium |
| Gr | Lipochaeta integrifolia | nehe | 1' | 5' | sea to 1,00' | Dry to Medium |
| Gr | Peperomia leptostachya | 'ala'ala-wai-nui | 1' | 1' | sea to 3,000' | Dry to Medium |
| Gr | Plumbago zeylanica | 'ilie'e | 1' | | | |
| Gr | Sida fallax | 'ilima | 0.5' | 3' | sea to 1,000' | Dry to Medium |
| Gr | Tephrosia purpurea var. purpurea | 'auhuhu | 2' | 2' | sea to 1,000' | Dry to Medium |
| Gr - Sh | Hibiscus calyphyllus | ma'o hau hele, Rock's hibiscus | 3' | 2' | sea to 3,000' | Dry to Medium |
| Gr - Sh | Lipochaeta rockii | nehe | 2' | 2' | sea to 3,000' | Dry to Medium |
| Gr - Sh | Lipochaeta succulenta | nehe | 2' | 5' | sea to 1,000' | Dry to Wet |
| P | Cocos nucifera | coconut, niu | 100' | 30' | sea to 1,000' | Dry to Wet |
| P | Pritchardia arecina | lo'ulu, hawane | 40' | 10' | 1,000' to 3,000' | Dry to Wet |
| P | Pritchardia forbesiana | lo'ulu | 15' | | | |
| P | Pritchardia hillebrandii | lo'ulu, fan palm | 25' | 15' | sea to 1,000' | Dry to Wet |
| S | Mariscus javanicus | marsh cypress, 'ahu'awa | 0.5' | 0.5' | sea to 1,000' | Dry to Medium |
| Sh | Argemone glauca var. decipiens | pua kala | 3' | 2' | sea to 3,000' | Dry to Medium |
| Sh | Artemisia australis | 'ahinahina | 2' | 3' | sea to 3,000' | Dry to Medium |

Yellow

Zone 3

## Zone-specific Native and Polynesian plants for Maui County

| Type | Scientific Name | Common Name | Height | Spread | Elevation | Water req. |
|---|---|---|---|---|---|---|
| Tr | Morinda citrifolia | indian mulberry, noni | 20' | 15' | sea to 1,000' | Dry to Wet |
| Tr | Nesoluma polynesicum | keahi | 15' | 15' | sea to 3,00' | Dry |
| Tr | Nestegis sandwicensis | olopua | 15' | 15' | 1,000' to 3,000' | Dry to Medium |
| Tr | Pandanus tectorius | hala, puhala (HALELIST) | 35' | 25' | sea to 1,000' | Dry to Wet |
| Tr | Pleomele auwahiensis | halapepe | 20' | | | |
| Tr | Rauvolfia sandwicensis | hao | 20' | 15' | sea to 3,000' | Dry to Medium |
| Tr | Reynoldsia sandwicensis | 'ohe makai | 20' | 20' | 1,000' to 3,000' | Dry |
| Tr | Santalum ellipticum | coastal sandalwood, 'ili-ahi | 8' | 8' | sea to 3,000' | Dry to Medium |
| Tr | Thespesia populnea | milo | 30' | 30' | sea to 3,000' | Dry to Wet |

Blue

Zone 4

## Zone-specific Native and Polynesian plants for Maui County

| Type | Scientific Name | Common Name | Height | Spread | Elevation | Water req. |
|---|---|---|---|---|---|---|
| Tr | Nestegis sandwicensis | olopua | 15' | 15' | 1,000' to 3,000' | Dry to Medium |
| Tr | Pandanus tectorius | hala, puhala (HALELIST) | 35' | 25' | sea to 1,000' | Dry to Wet |
| Tr | Pleomele auwahiensis | halapepe | 20' | | | |
| Tr | Rauvolfia sandwicensis | hao | 20' | 15' | sea to 3,000' | Dry to Medium |
| Tr | Santalum ellipticum | coastal sandalwood, 'ili-ahi | 8' | 8' | sea to 3,000' | Dry to Medium |
| Tr | Sophora chrysophylla | mamane | 15' | 15' | 1,000' to 3,000' | Medium |
| Tr | Thespesia populnea | milo | 30' | 30' | sea to 3,000' | Dry to Wet |
| V | Alyxia oliviformis | maile | Vine | | sea to 6,000' | Medium to Wet |

Blue

Zone 4

## Zone-specific Native and Polynesian plants for Maui County

| Type | Scientific Name | Common Name | Height | Spread | Elevation | Water req. |
|---|---|---|---|---|---|---|
| Sh | Artemisia mauiensis var. diffusa | Maui wormwood, 'ahinahina | 2' | 3' | 1,000' to higher | Dry to Medium |
| Sh | Bidens hillebrandiana ssp. hillebrandiana | ko'oko'olau | 1' | 2' | sea to 1,000' | Dry to Wet |
| Sh | Bidens menziesii ssp. menziesii | ko'oko'olau | 1' | 3' | | |
| Sh | Bidens micrantha ssp. micrantha | ko'oko'olau | 1' | 3' | | |
| Sh | Cordyline fruticosa | ti, ki | 6 | | | |
| Sh | Dianella sandwicensis | 'uki | 2' | 2' | 1,000' to higher | Dry to Medium |
| Sh | Lipochaeta lavarum | nehe | 3' | 3' | sea to 3,000' | Dry to Medium |
| Sh | Osteomeles anthyllidifolia | 'ulei, eluehe | 4' | 6' | sea to 3,000' | Dry to Medium |
| Sh | Scaevola sericea | naupaka, naupaka-kahakai | 6' | 8' | sea to 1,000' | Dry to Medium |
| Sh | Solanum nelsonii | 'akia, beach solanum | 3' | 3' | sea to 1,00' | Dry to Medium |
| Sh | Styphelia tameiameiae | pukiawe | 6' | 6' | 1,000' to higher | Dry to Medium |
| Sh | Vitex rotundifolia | pohinahina | 3' | 4' | sea to 1,000' | Dry to Medium |
| Sh | Wikstroemia uva-ursi kauaiensis kauaiensis | 'akia, Molokai osmanthus | | | | |
| Sh - Tr | Broussonetia papyrifera | wauke, paper mulberry | 8' | 6' | sea to 1,000' | Dry to Medium |
| Sh - Tr | Myoporum sandwicense | naio, false sandalwood | 10' | 10' | sea to higher | Dry to Medium |
| Sh - Tr | Nototrichium sandwicense | kulu'i | 8' | 8' | sea to 3,000' | Dry to Medium |
| Sh-Tr | Dodonaea viscosa | 'a'ali'i | 6' | 8' | sea to higher | Dry to Medium |
| Tr | Acacia koa | koa | 50' - 100' | 40' - 80' | 1,500' to 4,000' | Dry to Medium |
| Tr | Aleurites moluccana | candlenut, kukui | 50' | 50' | sea to 3,000' | Medium to Wet |
| Tr | Calophyllum inophyllum | kamani, alexandrian laurel | 60' | 40' | sea to 3,000' | Medium to Wet |
| Tr | Canthium odoratum | Alahe'e, 'ohe'e, walahe'e | 12' | 8' | sea to 3,000' | Dry to Medium |
| Tr | Charpentiera obovata | | 15' | | | |
| Tr | Cordia subcordata | kou | 30' | 25' | sea to 1,000' | Dry to Wet |
| Tr | Diospyros sandwicensis | lama | 12' | 15' | sea to 3,000' | Dry to Medium |
| Tr | Hibiscus furcellatus | 'akiohala, hau-hele | 8' | | | |
| Tr | Metrosideros polymorpha var. macrophylla | ohi'a lehua | 25' | 25' | sea to 1,000' | Dry to Wet |
| Tr | Morinda citrifolia | indian mulberry, noni | 20' | 15' | sea to 1,000' | Dry to Wet |

Purple

**Zone 5**

## Zone-specific Native and Polynesian plants for Maui County

| Type | Scientific Name | Common Name | Height | Spread | Elevation | Water req. |
|---|---|---|---|---|---|---|
| Sh | Hedyotis spp. | au, pilo | 3' | 2' | 1,000' to 3,000' | Dry to Wet |
| Sh | Lipochaeta lavarum | nehe | 3' | 3' | sea to 3,000' | Dry to Medium |
| Sh | Osteomeles anthyllidifolia | 'ulei, eluehe | 4' | 6' | sea to 3,000' | Dry to Medium |
| Sh | Scaevola sericea | naupaka, naupaka-kahakai | 6' | 8' | sea to 1,000' | Dry to Medium |
| Sh | Senna gaudichaudii | kolomana | 5' | 5' | sea to 3,000' | Dry to Medium |
| Sh | Solanum nelsonii | 'akia, beach solanum | 3' | 3' | sea to 1,00' | Dry to Medium |
| Sh | Vitex rotundifolia | pohinahina | 3' | 4' | sea to 1,000' | Dry to Medium |
| Sh | Wikstroemia uva-ursi kauaiensis kauaiensis | 'akia, Molokai osmanthus | | | | |
| Sh - Tr | Myoporum sandwicense | naio, false sandalwood | 10' | 10' | sea to higher | Dry to Medium |
| Sh-Tr | Dodonaea viscosa | 'a'ali'i | 6' | 8' | sea to higher | Dry to Medium |
| Tr | Aleurites moluccana | candlenut, kukui | 50' | 50' | sea to 3,000' | Medium to Wet |
| Tr | Calophyllum inophyllum | kamani, alexandrian laurel | 60' | 40' | sea to 3,000' | Medium to Wet |
| Tr | Cordia subcordata | kou | 30' | 25' | sea to 1,000' | Dry to Wet |
| Tr | Hibiscus furcellatus | 'akiohala, hau-hele | 8' | | | |
| Tr | Morinda citrifolia | indian mulberry, noni | 20' | 15' | sea to 1,000' | Dry to Wet |
| Tr | Pandanus tectorius | hala, puhala (HALELIST) | 35' | 25' | sea to 1,000' | Dry to Wet |
| Tr | Thespesia populnea | milo | 30' | 30' | sea to 3,000' | Dry to Wet |
| V | Ipomoea pes-caprae | beach morning glory, pohuehue | 1' | | | |

Purple

**Zone 5**

## Zone-specific Native and Polynesian plants for Maui County

TYPE: F Fern G Grass Gr Ground Cover Sh Shrub P Palm S Sedge Tr Tree V Vine

| Type | Scientific Name | Common Name | Height | Spread | Elevation | Water req. |
|---|---|---|---|---|---|---|
| G | Colubrina asiatica | 'anapanapa | 3' | 10' | sea to 1,000' | Dry to Wet |
| G | Eragrostis variabilis | 'emo-loa | 1' | 2' | sea to 3,000' | Dry to Medium |
| G | Fimbristylis cymosa ssp. spathacea | mau'u'aki'aki fimbristylis | 0.5' | 1' | sea to 1,000' | Dry to Medium |
| Gr | Boerhavia repens | alena | 0.5' | 4' | sea to 1,000' | Dry to Medium |
| Gr | Chamaesyce celastroides var. laehiensis | 'akoko | 2' | 3' | sea to 1,000' | Dry to Medium |
| Gr | Cressa truxillensis | cressa | 0.5' | 1' | sea to 1,000' | Dry to Medium |
| Gr | Heliotropium anomalum var. argenteum | hinahina ku kahakai | 1' | 2' | sea to 1,000' | Dry to Medium |
| Gr | Jacquemontia ovalifolia ssp. sandwicensis | pa'u o hi'iaka | 0.5' | 6' | sea to 1,000' | Dry to Medium |
| Gr | Lipochaeta integrifolia | nehe | 1' | 5' | sea to 1,00' | Dry to Medium |
| Gr | Sesuvium portulacastrum | 'akulikuli, sea-purslane | 0.5' | 2' | sea to 1,000' | Dry to Wet |
| Gr | Sida fallax | 'ilima | 0.5' | 3' | sea to 1,000' | Dry to Medium |
| Gr | Tephrosia purpurea var. purpurea | 'auhuhu | 2' | 2' | sea to 1,000' | Dry to Medium |
| Gr - Sh | Hibiscus calyphyllus | ma'o hau hele, Rock's hibiscus | 3' | 2' | sea to 3,000' | Dry to Medium |
| Gr - Sh | Lycium sandwicense | 'ohelo-kai, 'ae'ae | 2' | 2' | sea to 1,000' | Dry to Medium |
| P | Cocos nucifera | coconut, niu | 100' | 30' | sea to 1,000' | Dry to Wet |
| P | Pritchardia hillebrandii | lo'ulu, fan palm | 25' | 15' | sea to 1,000' | Dry to Wet |
| S | Mariscus javanicus | marsh cypress, 'ahu'awa | 0.5' | 0.5' | sea to 1,000' | Dry to Medium |
| Sh | Argemone glauca var. decipiens | pua kala | 3' | 2' | sea to 3,000' | Dry to Medium |
| Sh | Artemisia australis | 'ahinahina | 2' | 3' | sea to 3,000' | Dry to Medium |
| Sh | Bidens hillebrandiana ssp. hillebrandiana | ko'oko'olau | 1' | 2' | sea to 1,000' | Dry to Wet |
| Sh | Bidens mauiensis | ko'oko'olau | 1' | 3' | sea to 1,000' | Dry to Medium |
| Sh | Chenopodium oahuense | 'aheahea, 'aweoweo | 6' | | sea to higher | Dry to Medium |
| Sh | Dianella sandwicensis | 'uki | 2' | 2' | 1,000' to higher | Dry to Medium |
| Sh | Gossypium tomentosum | mao, Hawaiian cotton | 5' | 8' | sea to 1,000' | Dry to Medium |

## DO NOT PLANT THESE PLANTS !!!

| Common name | Scientific name | Plant family |
|---|---|---|
| | Jasminum fluminense | Oleaceae |
| | Arthrostema ciliatum | Melastomataceae |
| | Dissotis rotundifolia | Melastomataceae |
| | Erigeron karvinskianus | Asteraceae |
| | Eucalyptus robusta | Myrtaceae |
| | Hedychium gardnerianum | Zingiberaceae |
| | Juncus planifolius | Juncaceae |
| | Lophostemon confertus | Myrtaceae |
| | Medinilla cumingii | Melastomataceae |
| | Medinilla magnifica | Melastomataceae |
| | Medinilla venosa | Melastomataceae |
| | Melastoma candidum | Melastomataceae |
| | Melinis minutiflora | Poaceae |
| | Olea europaea | |
| | Oxyspora paniculata | Melastomataceae |
| | Panicum maximum | Poaceae |
| | Paspalum urvillei | Poaceae |
| | Passiflora edulis | Passifloraceae |
| | Phormium tenax | Agavaceae |
| | Pinus taeda | Pinaceae |
| | Prosopis pallida | Fabaceae |
| | Pterolepis glomerata | Melastomataceae |
| | Rhodomyrtus tomentosa | Myrtaceae |
| | Schefflera actinophylla | Araliaceae |
| | Syzygium jambos | Myrtaceae |
| Australian blackwood | Acacia melanoxylon | Mimosaceae |
| Australian tree fern | Cyathea cooperi | Cyatheaceae |
| Australian tree fern | Sphaeropteris cooperi | Cyatheaceae |
| Beggar's tick, Spanish needle | Bidens pilosa | Asteraceae |
| California grass | Brachiaria mutica | Poaceae |
| Chinese banyon, Maylayan banyon | Ficus mirocarpa | Moraceae |
| Chinese violet | Asystasia gangetica | Acanthaceae |
| Christmasberry, Brazilian pepper | Schinus terebinthifolius | Anacardiaceae |
| Formosan koa | Acacia confusa | Mimosaceae |
| German ivy | Senecio mikanioides | Asteraceae |
| Japanese honeysuckle | Lonicera japonica | Caprifoliaceae |
| Koster's curse | Clidemia hirta | Melastomataceae |
| Lantana | Lantana camara | Verbenaceae |
| Mauritius hemp | Furcraea foetida | Agavaceae |
| Mexican ash, tropical ash | Fraxinus uhdei | Oleaceae |
| Mexican tulip poppy | Hunnemannia fumariifolia | Papaveraceae |
| Mules foot, Madagascar tree fern | Angiopteris evecta | Marattiaceae |
| New Zealand laurel, karakaranut | Corynocarpus laevigatus | Corynocarpaceae |
| New Zealand tea | Leptospermum scoparium | Myrtaceae |
| Pampas grass | Cortaderia jubata | Poaceae |
| Panama rubber tree, Mexican rubber tree | Castilloa elastica | Moraceae |
| Shoebutton ardisia | Ardisia elliptica | Myrsinaceae |
| banana poka | Passiflora mollissima | Passifloraceae |

## DO NOT PLANT THESE PLANTS !!!

| Common name | Scientific name | Plant family |
|---|---|---|
| black wattle | Acacia mearnsii | Mimosaceae |
| blackberry | Rubus argulus | Rosaceae |
| blue gum | Eucalyptus globulus | Myrtaceae |
| bocconia | Bocconia frutescens | Papaveraceae |
| broad-leaved cordia | Cordia glabra | Boraginaceae |
| broomsedge, yellow bluestem | Andropogon virginicus | Poaceae |
| buffelgrass | Cenchrus ciliaris | Poaceae |
| butterfly bush, smoke bush | Buddleja madagascariensis | Buddlejaceae |
| cats claw, Mysore thorn, wait-a-bit | Caesalpinia decapetala | Caesalpiniaceae |
| common ironwood | Casuarina equisetifolia | Casuarinaceae |
| common velvet grass, Yorkshire fog | Holcus lanatus | Poaceae |
| fiddlewood | Citharexylum spinosum | Verbenaceae |
| fire tree, faya tree | Myrica faya | Myricaceae |
| glorybower | Clerodendrum japonicum | Verbenaceae |
| hairy cat's ear, gosmore | Hypochoeris radicata | Asteraceae |
| haole koa | Leucaena leucocephala | Fabaceae |
| ivy gourd, scarlet-fruited gourd | Coccinia grandis | Cucurbitaceae |
| juniper berry | Citharexylum caudatum | Verbenaceae |
| kahili flower | Grevillea banksii | Proteaceae |
| klu, popinac | Acacia farnesiana | Mimosaceae |
| logwood, bloodwood tree | Haematoxylon campechianum | Caesalpiniaceae |
| loquat | Eriobotrya japonica | Rosaceae |
| meadow ricegrass | Ehrharta stipoides | Poaceae |
| melaleuca | Melaleuca quinquenervia | Myrtaceae |
| miconia, velvet leaf | Miconia calvescens | Melastomataceae |
| narrow-leaved carpetgrass | Axonopus fissifolius | Poaceae |
| oleaster | Elaeagnus umbellata | Elaeagnaceae |
| oriental mangrove | Bruguiera gymnorrhiza | Rhizophoraceae |
| padang cassia | Cinnamomum burmanii | Lauraceae |
| palmgrass | Setaria palmifolia | Poaceae |
| pearl flower | Heterocentron subtriplinervium | Melastomataceae |
| quinine tree | Cinchona pubesens | Rubiaceae |
| satin leaf, caimitillo | Chrysophyllum oliviforme | Sapotaceae |
| silkwood, Queensland maple | Flindersia brayleyana | Rutaceae |
| silky oak, silver oak | Grevillea robusta | Proteaceae |
| strawberry guava | Psidium cattleianum | Myrtaceae |
| swamp oak, saltmarsh, longleaf ironwood | Casuarina glauca | Casuarinaceae |
| sweet vernalgrass | Anthoxanthum odoratum | Poaceae |
| tree of heaven | Ailanthus altissima | Simaroubaceae |
| trumpet tree, guarumo | Cecropia obtusifolia | Cecropiaceae |
| white ginger | Hedychium coronarium | Zingiberaceae |
| white moho | Heliocarpus popayanensis | Tiliaceae |
| yellow ginger | Hedychium flavescens | Zingiberaceae |

## Selection

As a general rule, it is best to select the largest and healthiest specimens. However, be sure to note that they are not pot-bound. Smaller, younger plants may result in a low rate of plant survival.[1] When selecting native species, consider the site they are to be planted in, and the space that you have to plant. For example: Mountain species such as koa and maile will not grow well in hot coastal areas exposed to strong ocean breezes. Lowland and coastal species such as wiliwili and Kou require abundant sunshine and porus soil. They will not grow well with frequent cloud cover, high rainfall and heavy soil.

Consider too, the size that the species will grow to be. It is not wise to plant trees that will grow too large.[2] Overplanting tends to be a big problem in the landscape due to the underestimation of a species' height, width or spread.

A large, dense canopied tree such as the kukui is a good shade tree for a lawn. However, it's canopy size and density of shade will limit what can be planted in the surrounding area. Shade cast by a koa and ohia lehua is relatively light and will not inhibit growth beneath it.

Keep seasons in mind when you are selecting your plants. Not all plants look good year round, some plants such as ilima will look scraggly after they have flowered and formed seeds. Avoid planting large areas with only one native plant. Mixing plants which naturally grow together will ensure the garden will look good all year round.[3] Looking at natural habitats helps to show how plants grow naturally in the landscape.

When planting an area with a mixed-ecosystem, keep in mind the size and ecological requirements of each plant. Start with the hardiest and most easily grown species, but allow space for fragile ones in subsequent plantings.

### Acquiring natives

Plants in their wild habitat must be protected and maintained. It is best and easiest to get your plants from nurseries (see list), or friend's gardens. Obtain proper permits from landowners and make sure you follow a few common sense rules:

- collect sparingly from each plant or area.
- some plants are on the state or Federal Endangered Species list. Make sure you get permits (see app. A,B)

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[1] K. Nagata, P.6

[2] K. Nagata, P.9

[3] Nagata, P.9

### Soil

Once you have selected your site and the plants you wish to establish there, you must look at the soil conditions on the site. Proper soil is necessary for the successful growth of most native plants, which preform poorly in hard pan, clay or adobe soils. If natives are to be planted in these types of soil, it would be wise to dig planting holes several times the size of the rootball and backfill with 50-75% compost.[4] A large planting hole ensures the development of a strong root system. The plant will have a headstart before the roots penetrate the surrounding poor soil.[5]

It is recommended that native plants not be planted in ground that is more dense than potting soil. If there is no alternative, dig a hole in a mound of soil mixed with volcanic cinder which encourages maximum root development. Fill the hole with water, if the water tends to puddle or drain too slowly, dig a deeper hole until the water does not puddle longer than 1 or 2 minutes.[6] Well-drained soil is one of the most important things when planting natives as you will see in the next section.

### Irrigation

Most natives do very poorly in waterlogged conditions. Do not water if the soil is damp. Water when the soil is dry and the plants are wilting. Once established, a good soaking twice a week should suffice. Deep soaking encourages the development of stronger, and deeper root systems. This is better than frequent and shallow watering which encourage weaker, more shallow root systems.

The following is a watering schedule from Kenneth Nagata's Booklet, *How To Plant A Native Hawaiian Garden*:

| WATER REQUIREMENT | WATERING FREQUENCY |
|---|---|
| Heavy | 3x / week |
| Moderate | 2x / week |
| Light | 1x / week |

Red clay soils hold more water for a longer period of time than sandy soils do. If your area is very sunny or near a beach, things will dry out faster. Even in the area of one garden, there are parts that will need more or less water. Soils can vary and amount of shade and wind differ. After plants are established (a month or two for most plants, up to a year for some trees), you can back off watering.

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[4] Nagata, p. 6

[5] Nagata, p. 8

[6] Nagata, p. 8

Automatic sprinkler systems are expensive to install and must be checked and adjusted regularly. Above-ground systems allow you to monitor how much water is being put out, but you lose a lot due to malfunctioning of sprinkler heads and wind. The most efficient way to save water and make sure your plants get enough water, is to hand-water. This way you are getting our precious water to the right places in the right amounts.[7]

## Fertilizer

An all-purpose fertilizer 10-10-10 is adequate for most species. They should be applied at planting time, 3 months later, and 6 months thereafter. Use half the dosage recommended for ornamentals and pay special attention to native ferns which are sensitive to strong fertilizers. Use of organic composts and aged animal manures is suggested instead of chemical fertilizers. In addition, use of cinders for providing trace minerals is strongly recommended.[8]

Natives are plants which were here hundreds of years before the polynesians inhabited the Hawaiian Islands. They were brought here by birds, or survived the harsh ocean conditions to float here. They are well-adapted to Hawaii's varying soil and environmental conditions. This is why they make prime specimens for a xeriscape garden. However, natives will not thrive on their own, especially under harsh conditions. On the other hand, like any other plant, if you over-water and over-fertilize them, they will die. Follow the instructions given to you by the nursery you buy the plant from, or from this booklet. Better yet, buy a book (suggested readings can be found in the bibliography in the back of this pamphlet), read it, and learn more about native plants. I guarantee that you will be pleased with the results.

[7] Bornhorst, p. 19-20

[8] Nagata, p. 6

# Propagation

There are many ways to propagate and plant-out native Hawaiian species. One of the most thourough and helpful book is Heidi Bornhorst's book, *Growing Native Hawaiian Plants*. The easiest, and best way to obtain natives for the novice gardener is to get them from a reputable nursery (see appendix c). That way all you will have to do is know how to transplant (if necessary) and plant-out when you are ready. These are the two methods I have listed here.

## Transplanting

1. Use pots that are one size bigger than the potted plant is in
2. Get your potting medium ready

Good potting medium is a ½, ½ mixture of peat moss and perlite. If the plant is from a dry or coastal area, add chunks of cinder or extra perlite. If it is a wet forest species, add more peat moss or compost. Be aware that peat moss is very acidic and certain plants react severely to acidity.

If the plant is to eventually be planted into the ground, make a mix of equal parts peat moss, perlite, and soil from the area in which the plant is to be planted. Slow-release fertilizer can be mixed into the potting medium.

3. Once pots, potting medium, fertilizer and water are ready, you can begin re-potting.

Keep the plant stem at the same depth it was in the original pot. Avoid putting the plant in too large a pot, as the plant may not be able to soak up all the water in the soil and the roots may drown and rot.

Mix potting medium and add slow-release fertilizer at this time. Pre-wet the medium to keep dust down and lessen shock to the plant. Put medium in bottom of pot. Measure for the correct depth in the new pot. Make sure there is from ½ to 2 inches from the top of the pot so the plant can get adequate water. Try to stand the plant upright and center the stem in the middle of the pot.

Water the plant thoroughly after transplanting. A vitamin B-1 transplanting solution can help to lessen the transplant shock. Keep the plant in the same type of environment as it was before, sun or shade. If roots were broken, trimm off some of the leaves to compensate for the loss.[9]

## Planting out

1. Plant most native Hawaiian plants in a sunny location in soil that is well-drained.
2. Make the planting hole twice as wide as the root ball or present pot, and just as deep.

If the soil is clay-like, and drains slowly, mix in some coarse red or bland cinder, coarse perlite or

[9] Bornhorst, p.20-21

coarse compost. Place some slow-release fertilizer at the bottom of the hole.

3. Carefully remove the plant from the container and place it in the hole.

The top of the soil should be at the same level as the top of the hole, if it is too high or too low, adjust the soil level so that the plant is at the right depth.

4. Water thoroughly after you transplant.

## Mulch

Most natives cannot compete with weeds, and therefore must be weeded around constantly in order to thrive. Mulch is a practical alternative, which discourages and prevents weeds from growing.

Hawaii's hot, humid climate leads to the breaking down of organic mulches. Thick organic mulches such as wood chips and leaves, may also be hiding places for pests.

Stone mulches are attractive, permanent and can help to improve soil quality. Red or black cinder, blue rock chips, smooth river rocks and coral chips are some natural choices.[10] Macadamia nut hulls are also easy to find and can make a nice mulch.[11]

Never pile up mulch right next to the stem or trunk of a plant, keep it a few inches away.

[10] Bornhorst, p. 24

[11] Nagata, p. 7

## PLACES TO SEE NATIVES ON:

The following places propagate native Hawaiian plants from seeds and/or cuttings. Their purpose is to protect and preserve these native plants. Please contact them before going to view the sites, they can provide valuable information and referral to other sources.

Maui:

1. Hoolawa Farms, P.O. Box 731, Haiku, Hawaii, 96708 — 572-4835

2. The Hawaiian Collection, 1127 Manu St., Kula, Hawaii, 96790 — 878-1701

3. Kula Botanical Gardens, RR 4, Box 228, Kula, Hawaii, 96790 — 878-1715

4. Maui Botanical Gardens, Kanaloa Avenue across from stadium — 243-7337

5. Kula Forest Reserve, access road at the end of Waipouli Rd.
   Call the Maui District Forester — 984-8100

6. Wailea Point, Private Condominium residence, 4000 Wailea Alanui, — 875-9557
   public access points at Four Seasons Resort or Polo Beach

7. Kahanu Gardens, National Tropical Botanical Garden,
   Alau Pl, Hana, Hawaii, 96713 — 248-8912

9. Kahului Library Courtyard, 20 School Street, Kahului, Hawaii — 873-3097

## ZONES

The Maui County Planting Plan has compiled a system of 5 zones of plant growth for Maui County. The descriptions of zones and maps for these zones are as follows:

Zone 1:
Wet areas on the windward side of the island. More than 40 inches of rain per year. Higher than 3,000 feet.

Zone 2:
Cool, dry areas in higher elevations (above 1,000 feet). 20 to 40 inches of rain per year.

Zone 3:
Low, drier areas, warm to hot. Less than 20 inches of rain per year. Sea level to 1,000 feet.

Zone 4:
Lower elevations which are wetter due to proximity of mountains. 1,000 to 3,000 feet.

Zone 5:
Salt spray zones in coastal areas on the windward side.

These zones are to be used as a general guide to planting for Maui County. In addition to looking at the maps, read the descriptions of the zones and decide which zone best fits your area. Plants can be listed in more than one zone and can be planted in a variety of conditions. For best results, take notes on the rainfall, wind, sun and salt conditions of your site. Use the zones as a general guide for selection and read about the plants to decide which best fits your needs as far as care and or function.

## PLACES TO BUY NATIVES ON:

**Maui:**

1. **Hoolawa Farms** — **575-5099**
   **P O Box 731**
   **Haiku HI 96708**
   **The largest and best collection of natives in the state. They will deliver, but it's worth the drive to go and see!**
   **Will propagate upon request**

2. **Kula True Value Nursery** — **878-2551**
   **Many natives in stock**
   **Get most of their plants from Hoolawa Farms**
   **They take special requests**

3. **Kihei Garden and Landscape** — **244-3804**

4. **Kihana Nursery, Kihei** — **879-1165**

5. **The Hawaiian Collection** — **878-1701**
   **Specialize in Sandalwood propagation**
   **Will propagate special requests**

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

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

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Mr. George Tengan, Director
County of Maui
Department of Water Supply
P.O. Box 1109
Wailuku, Maui, Hawaii 96793-7109

Dear Mr. Tengan:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT

Thank you for your Department's letter dated May 24, 2002 providing comments on the subject Environmental Impact Statement Preparation Notice (EISPN). We would like to provide the following information in response to your comments.

We acknowledge and note the proposed project is located in the Maui County Planting Plan - Plant Zones 3, 4, and 5. We also note your encouragement to utilize appropriate native and non-invasive species for the landscaping of the earthen swales and the use of reclaimed water for irrigation. We will forward your comments to the project design team for consideration.

We acknowledge the need to protect the Launiupoko aquifer and will incorporate adoption of best management practices (BMPs) during the project building permitting to minimize adverse impacts caused by infiltration and runoff during construction.

Again, thank you for your Department's comments and participation in the EISPN review process.

Sincerely,

Milton Arakawa

for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-241)
com/dpw/lahws/dwslr.001

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

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JUN 12 2002

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

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND DIVISION
STATE PARKS
WATER RESOURCE MANAGEMENT

June 7, 2002

LD-NAV
L-2402/2814/3290/3188/3359
LAHAINAWATERSHED.RCM2

Munekiyo and Hiraga, Inc.
Mitch Hirano
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Hirano:

SUBJECT: Environmental Impact Statement Preparation Notice
Applicant: County of Maui Department of Public Works
Project Name: Lahaina Water Shed Flood Control
Consultant: Munekiyo and Hiraga, Inc.

This is a follow-up to our letter (Ref.: LAHAINWATERSHED.RCM) to you dated June 6, 2002, pertaining to the subject matter.

Attached herewith is a recently received copy of the Commission on Water Resource Management comment.

The Department of Land and Natural Resources has no other comment to offer on the subject matter.

Should you have any questions, please contact Nicholas A. Vaccaro of the Land Division Support Services Branch at (808) 587-0438.

Very truly yours,

Charlene E. Unoki

for DIERDRE S. MAMIYA
Administrator

C: Maui District Land Office

RECEIVED

02 MAY 17 A10:21

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

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND DIVISION
STATE PARKS
WATER RESOURCE MANAGEMENT

May 16, 2002

LD-NAV
LAHAINAWATERSHED.CMT

L-2402/2814
Suspense Date: 6/3/02

MEMORANDUM:

To! TO: XXX Division of Aquatic Resources
Division of Forestry & Wildlife
Division of State Parks
XXX Historic Preservation
XXX Commission on Water Resource Management
**Land Division Branches of:**
Planning and Technical Services
XXX Engineering Branch
XXX Maui District Land Office

From! FROM: Dierdre S. Mamiya, Administrator Dualene
Land Division

SUBJECT: Environmental Impact Statement Preparation Notice
Authority: County of Maui, Department of Public Works
Consultant: Munekiyo & Hiraga, Inc. (Mich Hirano)
Project: Lahaina Water Shed Flood Control Project

Please review the subject document covering the proposed project and submit your comment (if any) on Division letterhead signed and dated by the suspense date. Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0438.

If this office does not receive your comments on or before the suspense date, we will assume there are no comments.

( ) We have no comments. (✓) Comments attached.

Signed: [signature]

Date: JUN -6 2002

---

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

RECEIVED

2002 JUN -6 P 5:00

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

JUN - 6 2002

GILBERT S. COLOMA-AGARAN
CHAIRPERSON

BRUCE S. ANDERSON
MEREDITH J. CHING
CLAYTON W. DELA CRUZ
BRIAN C. NISHIDA
HERBERT M. RICHARDS, JR

LINNEL T. NISHIOKA
DEPUTY DIRECTOR

TO: Ms. Dierdre Mamiya, Administrator
Land Division

FROM: Linnel T. Nishioka, Deputy Director
Commission on Water Resource Management (CWRM)

SUBJECT: Environmental Impact Statement Preparation Notice, Lahaina Watershed Flood Control Project

FILE NO.: LAHAINAWATERSHED.CMT, I-2402/2814

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

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

[ ] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

[ ] We recommend coordination with the Land Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[ ] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] A Well Construction Permit and/or a Pump Installation Permit from the Commission would be required before ground water is developed as a source of supply for the project.

[ ] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the Commission would be required prior to use of this source.

[ ] Groundwater withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] We are concerned about the potential for degradation of instream uses from development on highly erodible slopes adjacent to streams within or near the project. We recommend that approvals for this project be conditioned upon a review by the corresponding county's Building Department and the developer's acceptance of any resulting requirements related to erosion control.

[X] If the proposed project includes construction of a stream diversion, the project may require a stream diversion works permit and amend the instream flow standard for the affected stream(s).

[X] If the proposed project alters the bed and banks of a stream channel, the project may require a stream channel alteration permit.

[X] OTHER: A stream channel alteration permit may be required for modification of Kauaula Stream Channel

If there are any questions, please contact David Higa at 587-0249.

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS
AND ENVIRONMENTAL MANAGEMENT
ENGINEERING DIVISION**
200 SOUTH HIGH STREET
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LLOYD P.C.W. LEE, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Ms. Dierdre S. Mamiya, Administrator
State of Hawaii
Department of Land and Natural Resources
Land Division
P.O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Mamiya:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB 01-10

Thank you for your letter dated June 7, 2002 providing comments from the Commission on Water Resource Management (CWRM) on the subject Environmental Impact Statement Preparation Notice (EISPN). We wish to provide the following information in response to the comments provided.

We acknowledge your comments with respect to permitting requirements for the proposed project. We wish to advise and confirm that the following listed permitting requirements will be included in the Draft EIS document:

1. Stream diversion work's permit for the debris basin and weir outlets which will route the flows to Kauaula Stream and the second outlet.

2. Stream channel alteration permits for the debris basin to be installed at the junction of the flood water diversion channel and Kauaula Stream.

We will coordinate with the staff of the CWRM to prepare and process the applications, as applicable.



Again, thank you for your comments and participation in the EISPN review process.

Sincerely,

Milton Arakawa
for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-234)
S:\ENG\ALL\Joe\LAHEA-07

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

JUN 1 0 2002

BENJAMIN J. CAYETANO
GOVERNOR

GENEVIEVE SALMONSON
DIRECTOR

**STATE OF HAWAII**
**OFFICE OF ENVIRONMENT QUALITY CONTROL**
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

June 7, 2002

Mr. J. Krueger
Department of Public Works and Waste Management
County of Maui
200 South High Street
Wailuku, Hawai'i 96793

Mayor James Apana
County of Maui
200 South High Street
Wailuku, Hawai'i 96793

Mr. Michael Munekiyo
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawai'i 96893

Dear Messrs. Apana, Krueger and Munekiyo:

The Office of Environmental Quality Control has reviewed the final environmental assessment and environmental impact statement preparation notice (FEA/EISPN) entitled: "Lahaina Watershed Flood Control Project" dated April 2002, for TMKs 4-6-1-01; 4-6-15-01; 4-6-14-01; 4-6-13-01; 4-6-13-06; 4-7-02-04; 4-7-02-05; 4-7-02-11; and 4-7-01-02, Lahaina District. We offer the following comments for your consideration and response.

1. **CULTURAL IMPACT ASSESSMENT**: Under recreational activities the FEA notes that "fishing by shorecasting and netting is practiced in the nearshore ocean waters near the outlet of Kaua'ula Stream and Makila Point. Edible seaweed collecting, octopus fishing and spearfishing occur on the adjacent reef flat. During periods of wave activity, the area is a good location for surfing and several instructors use it on a daily basis to teach the sport." The FEA continues to note that shorecasting, net-throwing and skin diving also occurs in nearshore waters southeast of Lahaina Harbor.

   Page 40 provides a cultural impact assessment which details the historical significance of Lahaina, the drainage pathways and plantation era use of lands in the vicinity. While this provides the historic context for cultural activities in the region, <u>the project's direct, indirect and cumulative impacts on contemporary activities such as fishing and gathering (shorecasting, neeting, limu collecting) must also be assessed.</u> This will necessarily involve a multidisciplinary approach to characterizing the environmental setting (What is the water quality like now? What will the water quality be like after the project is constructed? Will the change in water quality impact contemporary cultural practices in the region?)



   It is a requirement of State law (see, Act 50, Session Laws of Hawai'i 2000) that the impacts to cultural resources and cultural practices be assessed in an environmental assessment. In 1997, the Environmental Council of the State of Hawai'i issued guidance on the methodology to assess such impacts. A copy is enclosed for your use. Please consult with cultural practicioners in the Lahaina area (fishermen and hunter/gatherers as well as cultural practicioners) to ascertain whether direct, indirect or cumulative impacts to cultural resources or practices may occur as a result of this project. Please document your consultation in the environmental impact statement.

2. **HYDROGEOLOGICAL DATA**: Please include hydrogeological information in the EIS's environmental setting along with an assessment of direct, indirect and cumulative impacts of the project to water quality, cultural activities and practices, and marine life.

3. **INDIGENOUS AND POLYNESIAN INTRODUCED PLANTS FOR USE IN PUBLIC LANDSCAPING**: As provided for by State law, we ask that you consider the use of native, indigenous and polynesian introduced plants in your landscaping.

4. **NATIONAL ENVIRONMENTAL POLICY ACT**: We understand that this project is a joint Federal-State-County project subject to both the provisions of the National Environmental Policy Act (NEPA) and Chapter 343, Hawai'i Revised Statutes. We would appreciate your confirmation that the draft and final environmental impact statements will be joint documents fulfilling the requirements of both NEPA and Chapter 343, HRS, having joint and simultaneous public review and comment periods to minimize public confusion.

If there are any questions, please call Leslie Segundo of my staff at (808) 586-4185. Thank you for the opportunity to comment.

Sincerely,

for GENEVIEVE SALMONSON
Director

Enclosures

c: U.S. Department of Agriculture, National Resources and Conservation Service, Honolulu
State of Hawai'i, Department of Land and Natural Resources, Maui Soil and Water Conservation District

# State of Hawaii
**OFFICE OF ENVIRONMENTAL QUALITY CONTROL**
## Guidelines for Assessing Cultural Impacts

**Adopted by the Environmental Council, State of Hawaii**
**November 19, 1997**

### I. INTRODUCTION

It is the policy of the State of Hawaii under Chapter 343, HRS, to alert decision makers, through the environmental assessment process, about significant environmental effects which may result from the implementation of certain actions. An environmental assessment of cultural impacts gathers information about cultural practices and cultural features that may be affected by actions subject to Chapter 343, and promotes responsible decision making.

Articles IX and XII of the State Constitution, other state laws, and the courts of the state require government agencies to promote and preserve cultural beliefs, practices, and resources of native Hawaiians and other ethnic groups. Chapter 343 also requires environmental assessment of cultural resources, in determining the significance of a proposed project.

The Environmental Council encourages preparers of environmental assessments and environmental impact statements to analyze the impact of a proposed action on cultural practices and features associated with the project area. The Council provides the following methodology and content protocol as guidance for any assessment of a project that may significantly affect cultural resources.

### II. CULTURAL IMPACT ASSESSMENT METHODOLOGY

Cultural impacts differ from other types of impacts assessed in environmental assessments or environmental impact statements. A cultural impact assessment includes information relating to the practices and beliefs of a particular cultural or ethnic group or groups.

Such information may be obtained through scoping, community meetings, ethnographic interviews and oral histories. Information provided by knowledgeable informants, including traditional cultural practitioners, can be applied to the analysis of cultural impacts in conjunction with information concerning cultural practices and features obtained through consultation and from documentary research.

In scoping the cultural portion of an environmental assessment, the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. Thus, for example, a proposed action that may not physically alter gathering practices, but may affect access to gathering areas would be included in the assessment. An ahupua'a is usually the appropriate geographical unit to begin an assessment of cultural impacts of a proposed action, particularly if it includes all of the types of cultural practices associated with the project area. In some cases, cultural practices are likely to extend beyond the ahupua'a and the geographical extent of the study area should take into account those cultural practices.

The historical period studied in a cultural impact assessment should commence with the initial presence in the area of the particular group whose cultural practices and features are being assessed. The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs.

The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural, including submerged cultural resources, which support such cultural practices and beliefs.

If the subject area is in a developed urban setting, cultural impacts must still be assessed. Many incorrectly assume that the presence of urban infrastructure effectively precludes consideration of current cultural factors. For example, persons are known to gather kauna''oa, ''ilima, ''uhaloa, noni or ki on the grassy slopes and ramps of the H-1 freeway and some state highways on the neighbor islands. Certain landmarks and physical features are used by Hawaiian navigators for sailing, and the lines of sight from landmarks to the coast by fisherman to locate certain fishing spots. Blocking these features by the construction of buildings or tanks may constitute an adverse cultural impact.

The Environmental Council recommends that preparers of assessments analyzing cultural impacts adopt the following protocol:

(1) identify and consult with individuals and organizations with expertise concerning the types of cultural resources, practices and beliefs found within the broad geographical area, e.g., district or ahupua`a;

(2) identify and consult with individuals and organizations with knowledge of the area potentially affected by the proposed action;

(3) receive information from or conduct ethnographic interviews and oral histories with persons having knowledge of the potentially affected area;

(4) conduct ethnographic, historical, anthropological, sociological, and other culturally related documentary research;

(5) identify and describe the cultural resources, practices and beliefs located within the potentially affected area; and

(6) assess the impact of the proposed action, alternatives to the proposed action, and mitigation measures, on the cultural resources, practices and beliefs identified.

Interviews and oral histories with knowledgeable individuals may be recorded, if consent is given, and field visits by preparers accompanied by informants are encouraged. Persons interviewed should be afforded an opportunity to review the record of the interview, and consent to publish the record should be obtained whenever possible. For example, the precise location of human burials are likely to be withheld from a cultural impact assessment, but it is important that the document identify the impact a project would have on the burials. At times an informant may provide information only on the condition that it remain in confidence. The wishes of the informant should be respected.

Primary source materials reviewed and analyzed may include, as appropriate: Mahele, land court, census and tax records, including testimonies; vital statistics records; family histories and genealogies; previously published or recorded ethnographic interviews and oral histories; community studies, old maps and photographs; and other archival documents, including correspondence, newspaper or almanac articles, and visitor journals. Secondary source materials such as historical, sociological, and anthropological texts, manuscripts, and similar materials, published and unpublished, should also be consulted. Other materials which should be examined include prior land use proposals, decisions, and rulings which pertain to the study area.

## III. CULTURAL IMPACT ASSESSMENT CONTENTS

In addition to the content requirements for environmental assessments and environmental impact statements, which are set out in HAR §§§§ 11-200-10 and 16 through 18, the portion of the assessment concerning cultural impacts should address, but not necessarily be limited to, the following matters:

1. A discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints or limitations which might have affected the quality of the information obtained.

2. A description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.

3. Ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained.

4. Biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area.

5. A discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations or biases.

6. A discussion concerning the cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.

7. A discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project.

8. An explanation of confidential information that has been withheld from public disclosure in the assessment.

9. A discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.

10. An analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place.

11. A bibliography of references, and attached records of interviews which were allowed to be disclosed.

The inclusion of this information will help make environmental assessments and environmental impact statements complete and meet the requirements of Chapter 343, HRS. If you have any questions, please call 586-4185.

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

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

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Ms. Genevieve Salmonson, Director
State of Hawaii
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your letter dated June 10, 2002 providing comments on the subject Environmental Impact Statement Preparation Notice (EISPN). We wish to provide the following information in response to your comments.

1. ***Response to Cultural Impact Assessment***

We acknowledge your comments regarding an interdisciplinary approach to assess potential impacts to water quality, shoreline processes and marine biology. To meet the needs for a multi-disciplinary approach, we wish to advise that the project consultant team involved in the preparation of the environmental impact statement includes planners, coastal engineers, marine biologists and archaeologists. Their respective findings will be included in the Draft EIS document in order to address the direct, indirect and cumulative impacts on the physical environment, as well as contemporary cultural activities relating to limu gathering, octopus fishing and net casting. The Draft EIS will also include interviews with cultural practitioners in the Lahaina area to ascertain impacts to cultural resources or practices in the project area.

2. ***Response to Hydrogeological Data***

We wish to advise, in response to your comments regarding hydrogeological information that the Draft EIS document will include



appropriate description of the physical environmental setting including geology and hydrology and an assessment of direct, indirect and cumulative impacts of the project to water quality, coastal processes, marine biology and cultural practices.

3. ***Response to Indigenous and Polynesian Introduced Plants for Use in Public Landscaping***

We acknowledge your comments regarding the use of indigenous plants in the landscaping of the earthen swales and will forward these comments to the project design team for consideration.

4. ***Response to National Environmental Policy Act (NEPA)***

We acknowledge your comments regarding coordination of the Chapter 343, HRS process and the NEPA since the subject project is a joint Federal-State-County undertaking. We confirm the Draft and Final EIS documents will be coordinated with Federal, County and local sponsors, to jointly meet the requirements of Chapter 343, HRS and the NEPA and will, to the extent possible, have joint and simultaneous public review and comment periods.

Thank you again, for your comments. Please call me at (808) 270-7845 if you have any questions.

Sincerely,

Milton Arakawa

for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-247)
S:\ENG\ALL\Job\LAHEA-21

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

JUN 17 2002


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




June 14, 2002

LD-NAV
L-3455
LAHAINAWATERSHED.RCM3

Munekiyo and Hiraga, Inc.
Mitch Hirano
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Hirano:

SUBJECT: Environmental Impact Statement Preparation Notice
Applicant: County of Maui Department of Public Works
Project Name: Lahaina Water Shed Flood Control
Consultant: Munekiyo and Hiraga, Inc.

This is a follow-up to our letters (Ref.: LAHAINWATERSHED.RCM&RCM2) to you dated June 6 & 7, 2002, pertaining to the subject matter.

Attached herewith is a recently received copy of the Land Division Engineering Branch comment.

The Department of Land and Natural Resources has no other comment to offer on the subject matter.

Should you have any questions, please contact Nicholas A. Vaccaro of the Land Division Support Services Branch at (808) 587-0438.

Very truly yours,

Charlene E. Unoki
for DIERDRE S. MAMIYA
Administrator

C: Maui District Land Office

DEPARTMENT OF LAND AND NATURAL RESOURCES
Land Division
Engineering Branch

COMMENTS

Thank you for the opportunity to review the subject project's Environmental Impact Statement Preparation Notice (EISPN). We have completed our review and offer the following comments:

According to the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) panel 0163C (August 3, 1998), the subject property is within Special Flood Hazard Areas (SFHA) designated as Zone C, Zone A4 with Base Flood Elevations (BFEs) ranging between 36± ft msl to 53± ft msl. and Zone B. The EISPN does not reference the most current FIRM and has the incorrect BFE interpreted. Please revise report accordingly.

Since the proposed project is within a FEMA designated SFHA (Zone A4) and because of the nature of the proposed improvements, the project is subject to the National Flood Insurance Program (NFIP) Rules and Regulations, Maui County Code 19.62 (Flood Hazard Areas), and Executive Order 11988. The project may also be subject to the State of Hawaii Dam Safety Program requirements.

The EISPN describes the proposed action as a "floodwater diversion system". Part 60 Subpart C of Title 44 Code of Federal Regulations describes additional considerations in managing floodprone areas. Specifically, § 60.22 (c)(13) states:

"Prohibition of any alteration or relocation of a watercourse, except as part of an overall drainage basin plan. In the event of an overall drainage basin plan, provide that the flood carrying capacity within the altered or relocated portion of the watercourse is maintained."

Although this is merely a planning consideration and not a mandatory Federal regulation, the Community shall completely evaluate this standard and all other applicable standards of this subpart.

However, Maui County Code does regulate watercourse alterations. The code defines a "Watercourse" as a *"...stream, wash, channel, or other topographic feature on or over which waters flow at least periodically."* Since flow will be diverted from the existing Kauaula Stream to the proposed 3,600 feet grass-lined channel, § 19.62.050 (E)(13) of the Code would apply. It states:

"...Whenever a watercourse is to be altered or relocated, the director shall:

1. *Require the applicant to notify the State of Hawaii Department of Land and Natural Resources, Division of Water Resource Management, before such alteration or relocation, and submit evidence of such notification to the Federal Emergency Management Agency (FEMA);*

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LAND DIVISION

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

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND DIVISION
STATE PARKS
WATER RESOURCE MANAGEMENT

May 16, 2002

LD-NAV
LAHAINAWATERSHED.CMT

L-2402/2814
Suspense Date: 6/3/02

'02 MAY 17 PM03:02 WATER & LAND

MEMORANDUM:

TO: XXX Division of Aquatic Resources
Division of Forestry & Wildlife
Division of State Parks
XXX Historic Preservation
XXX Commission on Water Resource Management
**Land Division Branches of:**
Planning and Technical Services
XXX Engineering Branch
XXX Maui District Land Office

FROM: Dierdre S. Mamiya, Administrator
Land Division
Dierdre

SUBJECT: Environmental Impact Statement Preparation Notice
Authority: County of Maui, Department of Public Works
Consultant: Munekiyo & Hiraga, Inc. (Mich Hirano)
Project: Lahaina Water Shed Flood Control Project

Please review the subject document covering the proposed project and submit your comment (if any) on Division letterhead signed and dated by the suspense date. Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0438.

If this office does not receive your comments on or before the suspense date, we will assume there are no comments.

( ) We have no comments.

(X) Comments attached.

Signed: [signature]
ANDREW M.MONDEN, CHIEF ENGINEER

Date: JUN 12 2002

---

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS
AND ENVIRONMENTAL MANAGEMENT
ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Dierdre S. Mamiya, Administrator
State of Hawaii-DLNR
Land Division
P.O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Mamiya:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your letter of June 18, 2002 providing comments from the Engineering Branch on the subject Environmental Impact Statement Preparation Notice (EISPN). We wish to provide the following information in response to the Engineering Branch's comments.

***Response to Flood Insurance Rate Map (FIRM)***

We acknowledge your comments regarding the location of the project within the Special Flood Hazard Area and have revised the Draft EIS document accordingly.

***Response to Compliance with Federal Emergency Management Agency (FEMA) and National Flood Insurance Program (NFIP) Rules and Regulations and County Code 19.62***

We acknowledge your comments regarding compliance with NFIP Rules and Regulations and with County of Maui Code, Chapter 19.62.050. A. Special Flood Hazard Area Development Permit. We have included these regulatory steps and approvals in the Draft EIS document under required permits and approvals, namely a Special Flood Hazard Area Development Permit from the County of Maui and a Conditional Letter of Map Revisions (CLOMPR) and a Letter of Map Revisions (LOMR), from the FEMA.

***Response to Compliance with Part 60 Subpart C of Title 44 Code of Federal Regulations***

We acknowledge that Chapter 60.22 (c) (13) references alteration or relocation of a watercourse is prohibited, except as part of an overall drainage basin plan. In this regard, we wish to advise that the proposed project was evaluated in the context of the Final Lahaina Watershed Plan which underwent federal environmental assessment in 1992. This plan was prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566 and in accordance with the National Environmental Policy Act of 1969, Public Law 91-190. We also acknowledge compliance with Maui County Code Chapter 19.62.050 and in this regard have included in the Draft EIS document under required permits and approvals, a Stream Channel Alteration Permit from the State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management. We also note and confirm that evidence of such application or notification will be submitted to the FEMA before such alteration or relocation will take place. We also confirm that based on the design parameters of the floodwater diversion system, the flood-carrying capacity of the altered portion of Kauaula Stream will be maintained.

***Response to Compliance with Executive Order 1198 (Floodplain Management)***

We note your comments regarding the State of Hawaii Dam Safety Program and regulations governing dams/reservoirs in the State of Hawaii with particular reference to Wainee Reservoir. We wish to advise that Wainee Reservoir will not be impacted, altered, or repaired as part of the proposed project. The floodwater diversion system will operate independently of Wainee Reservoir and flows from the reservoir will not discharge into the concrete channel nor are design alterations to Wainee Reservoir anticipated in relation to the proposed project . Nevertheless, we wish to provide the following information as requested. The Wainee Reservoir is located on property identified by TMK: (2) 4-6-15:01. This property is owned by Pioneer Mills Co. Ltd. The contact is, General Manager, Pioneer Mills, P.O. Box 727, Lahaina, Maui, Hawaii 96761.



Again, thank you for your comments and participation in the EISPN review process. Please call me at (808) 270-7845 if you have any questions.

Sincerely,

Milton Arakawa

for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-236)
S:\ENG\ALL\08\LAHEA-09

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

KAMEHAMEHA SCHOOLS

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(8) RUSH

DEPT. OF PUBLIC WORKS

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| DIRECTOR | | | | | | |
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5/16

Return to ________ Due ________

Ref. No. ________

By: ________ Date: ________

COUNTY OF MAUI PUBLIC WORKS

May 10, 2002

Mr. David Goode, Director
Department of Public Works
County Of Maui
200 South High St.
Wailuku, HI 96793

Dear Mr. Goode,

EIS Preparation Notice (EISPN), Lahaina Watershed Flood Control Project

This is in response to the EISPN. Kamehameha Schools is a landowner under the northern section of the proposed project. We are supportive of this effort and glad to see progress underway. We do have several issues that need to be considered in the EIS. They are as follows:

1. We need further detail on the design of the most northern portion of the project. It appears that the concrete inlet basin is intended to take flow directly from Lahainaluna Rd. If this were the case we would like a better understanding of how the inlet structure and the concrete channel will impact our use of road frontage along Lahainaluna Rd. We would like to retain as much use of this frontage as possible without compromising a reasonable flood control plan.

2. There is no discussion in the Prep Notice of the impacts of the project on non-public roads. I draw attention to Aholo Rd and Kauaula Road in particular and to other agricultural roads that will be crossed by this flood control channel. Aholo Rd serves our parcel 246-014-002 as well as other non-KS properties. Kauaula Rd. is a traditional road that served Kauaula Valley residents and may be a reasonable long-term legal access alternative based on its historical usage. Please include a discussion and mitigation measures for retaining access to non-public roads.

3. The proposed alignment cuts across buried in-field irrigation lines that we intend to continue to utilize to serve agricultural users below the flood canal in the area of TMK 246-016-032 and 033. Please address the impact on irrigation systems in the Draft EIS.

4. The Dickenson Street Extension Project is currently in a preliminary design phase. We suggest that the EIS include a discussion of this possible new project and discuss related impacts and mitigation measures.

P.O. Box 495 Paauilo, Hawai'i 96776 Telephone (808) 776-1104 Fax (808) 776-1598

*Founded and Endowed by the Legacy of Princess Bernice Pauahi Bishop*



5. How is the proposed open swale going to be maintained both in the removal of sediment and in the suppression of weed growth?

6. Figure 6 identifies the Olowalu area as the location of the project and therefore misrepresents the appropriate soil association.

Thank you for the opportunity to comment.

Sincerely,

J Melrose

Jeffrey Melrose, Land Manager/Planner
Land Assets Division-Hawaii Island

Cc: Neil Hannahs

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

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Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Mr. Jeffrey Melrose, Land Planner/Manager
Lands Assets Division - Hawaii Island
Kamehameha Schools
P. O. Box 495
Paauilo, Hawaii 96776

Dear Mr. Melrose:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your letter dated May 10, 2002 providing comments on the subject Environmental Impact Statement Preparation Notice (EISPN). We would like to provide the following information in response to the comments raised in your letter.

***Response to Item 1.***

We acknowledge your comment regarding the inlet structure along side Lahainaluna Road. As described in the EISPN document, the inlet basin will be approximately 150 feet long, 50-feet wide and 10-feet high and will be partially excavated and partially embanked with loose rock riprap armoring the entrance. This inlet basin will flow into a reinforced concrete channel section approximately 10 feet wide and 5 feet high and approximately 1,031 feet in length. The inlet basin is located south of the non-public road fronting Lahainaluna Road. We understand your concern with losing frontage on Lahainaluna Road. Design coordination will also involve measures to mitigate potential adverse impacts to Kamehameha Schools' property. We wish to acknowledge Kamehameha Schools' cooperation and interest to maintain design elements which will not compromise the flood control plan.



***Response to Item 2.***

We acknowledge your comments regarding impact of the project on non-public roads which are important for agricultural access. We have included a description of the non-public roads in Chapter II of the Draft EIS document. There is discussion on the impact to the roads, as well as in Chapter III of the Draft EIS document. The proposed project will accommodate the five (5) existing accesses provided by the non-public roads traversed by the proposed flood water diversion system. Therefore, access provided by these non-public roads will not be adversely impacted by the proposed project. The access road to the Kauaula Valley is mauka of the proposed project and therefore, will not be adversely impacted by the proposed project.

***Response to Item 3.***

We acknowledge your comments regarding buried infield irrigation lines and thank you for bringing this matter to our attention. We have incorporated your comments in the Draft EIS document and have addressed mitigation measures to ensure the irrigation systems will not be adversely impacted by the proposed project.

***Response to Item 4.***

See response to Item 1.

***Response to Item 5.***

The maintenance of the floodwater diversion system will be the responsibility of the County of Maui, Department of Public Works and Waste Management. The sediment and debris basins, as well as the grass diversion channel will be designed to be accessible to heavy machinery and equipment which will enable the material to be loaded onto dump trucks for disposal. Suppression of weed growth will be controlled by regular brush/grass cutting.

***Response to Item 6.***

We acknowledge and thank you for your comments regarding the location of the project in relation to the Soil Association Map. The project location has been adjusted in the Draft EIS document to more accurately show the position in relation to the Soils Association Map. The underlying soils are still within the Pulehu-Ewa-Jaucas Association as described in the EISPN.

Thank you again for your comments and participation in the EISPN review process. Please call me at 270-7845 if you have any questions.

Sincerely,

GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-242)
S:\ENG\ALL\Joe\LAHEA-15

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

JUN 10 2002

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



June 6, 2002

LD-NAV
LAHAINAWATERSHED.RCM

L-2402/2814/3290/3188

Munekiyo and Hiraga, Inc.
Mitch Hirano
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Hirano:

SUBJECT: Environmental Impact Statement Preparation Notice
Applicant: County of Maui Department of Public Works
Project Name: Lahaina Water Shed Flood Control
Consultant: Munekiyo and Hiraga, Inc.

Thank you for the opportunity to review and comment on the subject matter.

The Department of Land and Natural Resources' (DLNR) Land Division distributed a copy of the document covering the proposed project to the following Department of Land and Natural Resources' Divisions for their review and comment:

- Division of Aquatic Resources
- Historic Preservation Division
- Commission on Water Resource Management
- Land Division Engineering Branch
- Land Division Maui District Land Office

Attached herewith is a copy of the Land Division Maui District Land Office comment.

The Department of Land and Natural Resources has no other comment to offer based on the attached responses. Should additional comment be received, they will be forwarded to your office at that time.

Should you have any questions, please contact Nicholas A. Vaccaro of the Land Division Support Services Branch at (808) 587-0438.

Very truly yours,

Charlene E. Unoki
for DIERDRE S. MAMIYA
Administrator

C: Maui District Land Office

RECEIVED

2002 MAY 30 A 11:52

RECEIVED
DIVISION OF
LAND MANAGEMENT
2002 MAY 21 PM 1:15

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



May 16, 2002

LD-NAV
LAHAINAWATERSHED.CMT

L-2402/2814
Suspense Date: 6/3/02

MEMORANDUM:

TO: XXX Division of Aquatic Resources
Division of Forestry & Wildlife
Division of State Parks
XXX Historic Preservation
XXX Commission on Water Resource Management
**Land Division Branches of:**
Planning and Technical Services
XXX Engineering Branch
✓ XXX Maui District Land Office

FROM: Dierdre S. Mamiya, Administrator
Land Division

Darlene

SUBJECT: Environmental Impact Statement Preparation Notice
Authority: County of Maui, Department of Public Works
Consultant: Munekiyo & Hiraga, Inc. (Mich Hirano)
Project: Lahaina Water Shed Flood Control Project

Please review the subject document covering the proposed project and submit your comment (if any) on Division letterhead signed and dated by the suspense date. Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0438.

If this office does not receive your comments on or before the suspense date, we will assume there are no comments.

( ) We have no comments. (✓) Comments attached.

Signed: Jason K. Koga

Date: 5-29-02

---

**STATE OF HAWAII**
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
54 South High Street, Room 101
Wailuku, Hawaii 96793-2198



May 29, 2002

***MEMORANDUM***

TO: Dierdre S. Mamiya, Administrator
Land Division

FROM: Jason K. Koga
Maui District Land Agent

SUBJECT: Environmental Impact Statement Preparation Notice, County of Maui, Department of Public Works, Lahaina Water Shed Flood Control Project

Thank you for allowing us to review and comment on the subject matter.

The report states that lands required for the proposed project include those owned by the State of Hawaii. Although the Project Location Map is conceptual in nature, it appears that the only State-owned lands that may be involved are the Honoapiilani Highway right of way and perhaps some lands that may exist makai of the Highway right of way for the "Second Outlet." An earlier request to determine ownership of the portion of Kauaula Stream, mauka of Honoapiilani Highway, could not be completed. Other roads that the Flood Control Project may traverse appear to be either County or privately owned roadways.

The Maui District Land Office supports the efforts of the County of Maui, Natural Resources Conservation Service, and the West Maui Soil and Water Conservation District to develop a project to prevent flood damage to the Lahaina area.

We have no further comment to offer.

c: Central Files
District Files

| DIVISION OF AQUATIC RESOURCES | | |
|---|---|---|
| DIRECTOR | Suspense Date: | |
| CON FISHERIES | Draft Reply | ☐ |
| AQ REC/ENV | Reply Direct | ☐ |
| AQ ATCRN | Comments | ☐ |
| STAFF SVCS | Information | ☐ |
| FISH DEV | Comp Act & File | ☐ |
| STATISTICS | Return to: | |
| AFRC | Copies to: | |
| EDUCATION | Remarks: | |
| SECRETARY | 02-397 | |
| OFFICE SVCS | | |
| FED AID | | |

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

RECEIVED
2002 JUN -4 P 12:03



May 16, 2002

LD-NAV
LAHAINAWATERSHED.CMT

L-2402/2814
Suspense Date: 6/3/02

MEMORANDUM:

RECEIVED
MAY 20 2002
DIV. AQUATIC RESOURCES

TO: XXX Division of Aquatic Resources
Division of Forestry & Wildlife
Division of State Parks
XXX Historic Preservation
XXX Commission on Water Resource Management
**Land Division Branches of:**
Planning and Technical Services
XXX Engineering Branch
XXX Maui District Land Office

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Environmental Impact Statement Preparation Notice
Authority: County of Maui, Department of Public Works
Consultant: Munekiyo & Hiraga, Inc. (Mich Hirano)
Project: Lahaina Water Shed Flood Control Project

Please review the subject document covering the proposed project and submit your comment (if any) on Division letterhead signed and dated by the suspense date. Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0438.

If this office does not receive your comments on or before the suspense date, we will assume there are no comments.

(X) We have no comments.
Will comment on the DEIS.

( ) Comments attached.

Signed:

Date: 6-3-02

---

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

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

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Ms. Dierdre S. Mamiya, Administrator
State of Hawaii-DLNR
Land Division
P.O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Mamiya:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your letter dated June 6, 2002 providing comments from the Maui District Land Division on the subject Environmental Impact Statement Preparation Notice (EISPN). We wish to provide the following information in response to the comments provided.

We acknowledge and confirm that State-owned lands involved with the proposed project will be the Honoapiilani Highway right-of-way where the proposed second outlet crosses beneath the highway and State lands makai of the shoreline where a portion of the second outlet is located.

We also acknowledge and appreciate the Maui District office's support for the project and the sponsors' effort to control flooding in the Lahaina area.

Sincerely,

fr GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-237)
S:\ENG\ALL\JOB\LAHEA.10

xc: Buddy Nobriga, West Maui Soil and Water Conservation District
Dudley Kubo, Natural Resources Conservation Service

JAMES "KIMO" APANA
Mayor

FLOYD S. MIYAZONO
Director

GLENN T. CORREA
Deputy Director

(808) 270-7230
Fax (808) 270-7934

MAY 22 2002 1093

# DEPARTMENT OF PARKS & RECREATION

1580-C Kaahumanu Avenue, Wailuku, Hawaii 96793

'02 MAY 15 AM 9:37

COUNTY OF MAUI
PUBLIC WORKS

May 13, 2002

DEPT. OF PUBLIC WORKS

DIRECTOR
DEP. DIR.
SECTY.

5/15

Mr. David Goode
Director of Public Works and Waster Management
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Goode:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) - LAHAINA WATERSHED FLOOD CONTROL PROJECT

Return to ____ Due ____
Ref. No. ____
Date ____

We have reviewed the Environmental Impact Statement Preparation Notice for the subject project and are in support of the proposed actions.

Thank you for the opportunity to review and comment. If you have any questions, please contact Mr. Patrick Matsui, Chief of Parks Planning and Development, at extension 7387.

Sincerely,

Floyd S. Miyazono

FLOYD S. MIYAZONO
Director

c: Patrick Matsui, Chief of Planning and Development



---

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

# COUNTY OF MAUI
# DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT
## ENGINEERING DIVISION

200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 10, 2003

Mr. Glenn Correa, Director
Department of Parks & Recreation
1580-C Kaahumanu Avenue
Wailuku, Hawaii 96793

Dear Mr. Correa:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your Department's letter of support for the subject project. We appreciate your Department's participation in the environmental impact statement review process.

Sincerely,

Milton Arakawa

for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-240)
S:\ENG\ALL\Joe\LAHEA-13

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

**Maui Electric Company, Ltd.** • 210 West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96733-6898 • (808) 871-8461

MAY 22 2002

1079

2002 MAY 13 P 2:50

May 10, 2002

Mr. David Goode
Director
County of Maui
Department of Public Works and Waste Management Engineering Division
200 S. High Street
Wailuku, HI 96793

Dear Mr. Goode:

Subject: Environmental Impact Statement Preparation Notice(EISPN) – Lahaina Watershed Flood Control Project

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

In reviewing the information transmitted and our records, we have no objection to the subject project. We encourage the County's consultant to meet with us as soon as practical to verify if any existing poles need to be relocated 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,

Neal Shinyama

Neal Shinyama
Manager, Energy Delivery

---

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Mr. Neal Shinyama, Manager
Energy Delivery
Maui Electric Company
210 West Kamehameha Avenue
P.O. Box 398
Kahului, Maui, Hawaii 96733-6898

Dear Mr. Shinyama:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your letter dated May 10, 2002 providing comments to the subject project. We acknowledge your supportive comment for the proposed project. We will coordinate with your office during the project design phase to verify if the relocation of poles or any MECO facilities will be required.

Again, thank you for your comments.

Sincerely,

Milton Arakawa

for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-245)
S:\ENG\ALL\Joe\LAHEA-19

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

DEPARTMENT OF
**HOUSING AND HUMAN CONCERNS**
COUNTY OF MAUI

MAY 22 2002

1091

JAMES "KIMO" APANA
Mayor
ALICE L. LEE
Director
PRISCILLA P. MIKELL
Deputy Director

200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • PHONE (808) 270-7805 • FAX (808) 270-7165

May 9, 2002

'02 MAY 13 P3:09

RUSH (12)

TO: DAVID GOODE, Director
Department of Public Works and
Waste Management

FROM: ALICE L. LEE, Director
Department of Housing and
Human Concerns

SUBJECT: **ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) - LAHAINA WATERSHED FLOOD CONTROL PROJECT**

We have reviewed the EISPN for the Lahaina Watershed Flood Control Project and wish to inform you that we fully support the construction of the project. We are returning the project's EISPN for your use.

Thank you for the opportunity to comment.

ETO:df

Enclosure

c: Housing Administrator



ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Ms. Alice Lee, Director
Department of Housing and Human Concerns
County of Maui
200 High Street
Wailuku, Hawaii 96793

Dear Ms. Lee:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your letter dated May 9, 2002 supporting the subject project. We appreciate your comments and participation in the Environmental Impact Statement Preparation Notice (EISPN) review process.

Sincerely,

Milton Arakawa

for GILBERT COLOMA-AGARAN
Director of Public Works and
Environmental Management

LL/JK:c(ED03-232)
S:\ENG\ALL\Joe\Lahaa-05.wpd

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

APR 08 2002

**KAUAULA LAND COMPANY LLC**
173 Ho'ohana Street • Suite 201
Kahului, HI • 96732
Phone 808• 877•4202 Fax 808•877•9409

March 14, 2002

Mr. Michael Munekiyo
Munekiyo, Arakawa & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Re: *Lahaina Watershed Flood Control Project*

Dear Mike:

Kauaula Land Company LLC (KLC) is the owner of an approximately 235-acre parcel of land immediately south of Kauaula Stream that is just mauka of Honoapiilani Highway. Representatives of KLC attended the February 21, 2002 public hearing on the proposed *Lahaina Watershed Flood Control Project* at the Lahaina Intermediate School cafeteria. Kauaula Land Company would oppose the project for the following reasons:

1. The project involves use of our land south of Kauaula Stream to solve drainage problems north of Kauaula Stream.

    a) Kauaula Stream should be used to drain the lands bordering Kauaula Stream both to the north (Lahaina side) and to the south (Olowalu side).

    b) Solutions to the drainage problems above Lahaina Town should use both Kauaula Stream and Kahoma Stream, as well as other drainage improvements within the core of Lahaina Town.

2. The Lahaina Watershed Flood Control Project is not a comprehensive solution to the problem of flooding of Lahaina Town.

    a) This "Flood Control Project" is very expensive, poorly thought out, and requires the use of federal funds. If the County of Maui and all of the property owners involved were required to pay for this project, much more efficient and effective solutions would be found. The project is a waste of federal funds and taxpayers' money.

    b) The problem of flooding in Lahaina Town should be analyzed and the solution to the problem determined. Cost-efficient methods of solving the problem should be derived. Berming and redirecting the flow in the upper field would be one part of a much larger solution. Pursing the "Lahaina Watershed Flood Control Project" as currently drafted is a flawed approach.

        i. It deceives the public into thinking that a solution to the flooding of Lahaina is being pursued, when in fact that is only partially true;



        ii. It requires the pursuit of federal funds that may never become available to complete the project;

        iii. It directs the use of County resources into the long-term pursuit of federal funds, when those resources could be directed in attempting to solve the problems;

        iv. Simply put, the County of Maui will do nothing to solve the problem of the flooding of Lahaina, other than to pursue this overpriced, federal-works pork-barrel project; and

        v. Time will go by (three, five, seven, ten years), and nothing will be done other than to spend millions of County dollars researching the problem and pursing federal funding.

For these and other reasons, KLC cannot support this project and will not willingly participate in its implementation.

Sincerely,

KAUAULA LAND COMPANY LLC

James C. Riley

James C. Riley
Member

JCR:tk

cc: Mr. David Goode, DPWWM, County of Maui

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

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

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

March 7, 2003

Mr. James C. Riley
Kauaula Land Company, LLC
173 Ho`ohana Street, Suite 201
Kahului, Hawaii 96732

Dear Mr. Riley:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB NO. 01-10

Thank you for your letter of March 14, 2002 providing comments in response to the February 21, 2002 public information meeting on the subject project, which was further described in the Environmental Impact Statement Preparation Notice and forwarded to your office for review. We would like to provide the following information in response to the items raised in your letter.

***Response to item 1.***

We acknowledge and agree that the proposed project will involve use of land owned by Makila Land Company, LLC and Kauaula Land Company, LLC adjacent to Honoapiilani Highway for right-of-way purposes. The proposed floodwater diversion system will capture storm water runoff from approximately 330 acres of the subwatershed south of Kauaula Stream, which includes part of the lands owned by Makila Land Company, LLC and Kauaula Land Company, LLC, as well as flows from the Kauaula and Lahaina subwatersheds.

a. We acknowledge your comment that Kauaula Stream should be used to drain the bordering lands both to the north and south. Based on the Lahaina Quadrangle, U. S. Geological Survey map, the boundary of the Kauaula subwatershed is a narrow area defined by the stream bed and upper ridges of the Kauaula Valley. This area lies both to the north and south of the Kauaula Stream. The naturally defined subwatershed to the south of the Kauaula subwatershed presently sheetflows over the land in a southwesterly direction toward the ocean. This area is approximately 330 acres and is proposed to be drained by the southern diversion channel adjacent to Honoapiilani Highway with an ocean outlet at Waianukole



b. We acknowledge your comment that "Solutions to the drainage problems above Lahaina Town should use both Kauaula Stream and Kahoma Stream, as well as other drainage improvements within the core of Lahaina Town". A past flood control project with the participation of the Army Corps of Engineers involved improvements to channel runoff to Kahoma Stream which provides flood control to the northern portion of Lahaina Town. The southern boundary to this area is Lahainaluna Road. The area to the south of Lahainaluna Road defined by the Lahaina subwatershed continues to present flooding problems in Lahaina. In assessing the drainage issues in this area, consideration was given to: evaluating land management practices and treatment such as terracing and contour farming, chiseling, subsoiling and irrigation water management; evaluating nonstructural measures to lessen the impact of flooding such as land zoning, acquisition, flood proofing; and relocation and evaluating structural measures to provide protection such as flood channels and detention reservoirs. It was determined that the flooding in Lahaina Town results from runoff conveyed through numerous small drainages spread along the width of the Lahaina subwatershed. For this reason, a diversion channel to intercept the runoff from the subwatershed and carry it to a safe ocean outlet was considered the most practical solution to the flooding problem. The diversion system which was initially considered in 1992, involved taking the flows south of Lahainaluna Road to the Kauaula Subwatershed with a single ocean outlet using Kauaula Stream and Puamana channels. However, due to public concerns raised during the 1992 project environmental assessment reviews process, this alternative was rejected. The preferred alternative involved two outlets, one at Puamana and the second outlet approximately 3,600 feet south of Kauaula Stream. The preferred alternative also extended the drainage area to include the approximate 330-acre subwatershed south of Kauaula Stream.

The area makai of the proposed floodwater diversion system will be captured by drainage improvements currently planned for central Lahaina Town (Drainline "F").

***Response to Item 2.***

The U.S. Department of Agriculture, Natural Resources Conservation Service, and the local project sponsors, West Maui Soil and Water Conservation District and the County of Maui, Department of Public Works and Waste Management have considered a broad range of options in addressing flooding issues in Lahaina Town, makai of the Lahaina Watershed. In terms of infrastructure requirements, the proposed diversion work is considered both appropriate and effective in mitigating flooding to residences, businesses and public/quasi-public uses in Lahaina Town. In this regard, we offer the following information which we hope will clarify the basis for project development.

(a) The proposed project is estimated to cost approximately $10-12 million and will require the use of federal funds, as well as County funds. The preliminary benefit-to-cost ratio for the project providing a 100-year flood protection level was estimated in 1992 to be 1.24: 1.00. With other things being equal, the proposed project will have a positive benefit.

(b) The problem of flooding in Lahaina Town was analyzed by the U.S. Department of Agriculture, Natural Resources Conservation Service and the local project sponsors, West Maui Soil and Water Conservation District and the County of Maui, Department of Public Works and Waste Management. The proposed project was one of five alternatives considered. We acknowledge and agree that berming and redirecting the flow in the upper field would be one part of a much larger solution. However, as previously mentioned, a diversion channel and two ocean outlets were considered to be the appropriate solution to the flooding problems.

(i) Based on the design parameters of a 100-year flood, the proposed project will prevent the flooding of Lahaina Town and the area west of the flood diversion channel south to Puamana Park. Project sponsors also recognize that appropriate land and water management must be carried out by the upland owners to deal with storm runoff.

(ii) The County, State and private resources and funds will utilize federal funds since the project meets federal funding criteria for assistance. It is the understanding of the local sponsors that the Lahaina Watershed Project is a priority for funding. The first step in this process is to complete the environmental impact statement process and permitting for the project as outlined at the information meeting.

(iii) In the short-term, the County is working with the West Maui Soil and Water Conservation District to implement interim measures to improve temporary flood diversions of storm runoff into existing channels and sediment basins. These measures have proven to effectively handle the recent October 2002 storms which brought more than 4 inches of rain to Lahaina in a 24-hour period.



(iv) See Item (iii) above.

(v) See Item (iii) above. In addition, the County, as well as USDA, NRCS and the West Maui Soil and Water Conservation District, will continue to work with property owners in the area on water and land resource issues to improve drainage.

We would appreciate your review of the Draft EIS document which will be sent to you in the near future. We would also be pleased to meet with you to respond to your concerns. We hope you may be able to support the project after reviewing the Draft EIS document which provides a complete assessment of the proposed project.

Thank you again for your response and participation in the Environmental Impact Statement review process.

Please do not hesitate to call me at 270-7845 if you have any further questions.

Sincerely,

Milton Arakawa
for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-243)
S:\ENG\ALL\Joe\LAHEA-16

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

**Mich**

**From:** "Marty Stevenson" <mstevens@kinneticlabs.com>
**To:** <mich@mhinconline.com>
**Cc:** <puamanaas001@hawaii.rr.com>
**Sent:** Tuesday, May 28, 2002 12:52 PM
**Subject:** EIS Prep notice

Hi Mich:

I did a quick run through on your EIS Prep. Notice for the Lahaina Watershed. I have just a few, very minor comments. You probably caught it already, but the arrow pointing to the approximate location of the Project Alignment is in the wrong location but the soil association would still be the same. There were also a couple of statements that were either unsupported or premature.

P. 39 under **Nearshore Reef Ecosystems** states "The healthy condition of the seaward reef communities in this area over a (9) year observation indicate the effective dispersal of suspended sediments ocean environment subject to wave and current action". I assume this would be Eric Brown's data, not Rick Griggs work, but there is no reference. This is a highly transitional area at the mouth of Kauaula Stream. The fringing reef ends just to the north with scattered coral heads and rubble to the south. I tend to reserve judgement on this issue until seeing details on the location of this nine year study and the data. I would like to get a copy of that study if possible or, preferably, you could let me know where to obtain an original.

There was also a statement on p. 50 that indicated that "Average annual fine sediment discharge, clay and silt, will be reduced by about one-quarter." referring to the Kauaula Stream outlet. I don't have time to dig out my old records at the moment but I thought that Dudley Kubo's calculations had actually predicted an increase in fines or at least no change at the stream mouth? Perhaps that statement applies to the impact of the entire project?

Good luck on the project. As I have mentioned before, I would hope that land conservation BMPs in the watershed itself can be incorporated into this project. Preventing the soils from being mobilized in the first place and preventing development of runoff with high velocity within the watershed itself must be used as the first line of defense.

One more thing..you mention designing to the 100-year level of flood protection. I expect that you will elaborate more on this in the EIS. Since recurrence frequencies of rainfall and floods are so poorly understood by so many people, I think it would be valuable to explain derivation of these in some detail when you write the EIS.

Marty

Marty Stevenson, Regional Manager
Kinnetic Laboratories, Inc.
55-1 Puapake Place
Lahaina, HI 96761
Phone (808) 661-1110 Cell (831) 901-7019
Fax (808) 661-0766

5/30/02



COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793



March 7, 2003

Mr. Marty Stevenson, Regional Manager
Kinnetic Laboratories, Inc.
55-1 Puapake Place
Lahaina, Hawaii 96761

Dear Mr. Stevenson:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT
JOB 90-10

Thank you for your correspondence dated May 28, 2002 providing comments on the subject Environmental Impact Statement Preparation Notice (EISPN). We wish to provide the following information in response to the comments.

***Response to the Near shore Reef Ecosystem***

The comment regarding the healthy condition of the near shore reef ecosystem was made by Dr. Richard Grigg and the reference is The Final Watershed Plan and Environmental Assessment, Lahaina Watershed, U.S. Department of Agriculture, Soil Conservation Service, August 1992 (Page 30). The comment was based on studies conducted by Dr. Grigg in 1982, 1983, 1986 and 1991 to assess the potential marine ecological impacts of the proposed project. The 1986 assessment was carried out to identify the best location for the second outlet. The 1991 assessment was carried out by Dr. Grigg to ascertain changes to the reef environment since the earlier surveys. Copies of the assessment reports can be obtained by contacting Dudley Kubo, P.E., Water Resources Planner, U.S. Department of Agriculture, Natural Resources Conservation Service in Honolulu.

***Response to Fine Sediment Discharge***

The sediment basin and debris basin at Kauaula Stream is anticipated to virtually reduce all the course sediment discharge into Kauaula Stream. The annual fine sediment discharge will be reduced by approximately twenty-five (25) percent. Total average annual sediment discharge, both coarse and fine, will be reduced by approximately fifty (50) percent. The proposed project is anticipated to reduce the overall sediment discharge in the project area from Lahaina Harbor to Waianukole by approximately 25 percent.

***Response to Best Management Practices***

We acknowledge your comments with respect to appropriate land management practices in the watershed uplands to prevent storm runoff from impacting downstream properties. The draft Environmental Impact Statement document will include references to management practices in the upland area and incorporation of Best Management Practices during construction to minimize erosion and downstream impacts as appropriate.

***Response to 100-year Level of Flood Protection***

We acknowledge your comment regarding the 100-year level of flood protection and the relationship of recurrent and more frequent storm events which impact the marine environment. This relationship is more fully described in the draft Environmental Impact Statement document in connection with the plum modeling analysis used to assess the impact of sediment discharge at the second outlet.

Thank you again for your comments and participation in the EISPN review process.

Sincerely,

for GILBERT COLOMA-AGARAN
Director of Public Works
and Environmental Management

LL/JK:c(ED03-244)
S:\ENG\ALL\Joe\LAHEA-18

xc: Dudley Kubo, Natural Resources Conservation Service
Buddy Nobriga, West Maui Soil and Water Conservation District

# Chapter XIII

## Public Information Meeting to Present the Draft Environmental Impact Statement and to Receive Public Comments Held on June 17, 2003

# XIII. PUBLIC INFORMATION MEETING TO PRESENT THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND TO RECEIVE PUBLIC COMMENTS HELD ON JUNE 17, 2003

Prior to the conclusion of the 45-day comment period on the Draft EIS, a public information meeting was held to present the findings of the Draft EIS. The meeting was held at the Lahaina Intermediate School Cafeteria with approximately 40 people in attendance. Representatives of the County of Maui, Department of Public Works and Environmental Management, U.S. Department of Agriculture Natural Resources Conservation Service, and the West Maui Soil and Water Conservation District, along with project consultants presented an update on the Lahaina Flood Control project and a summary of the Draft EIS. A court reporter was provided for the meeting to prepare a verbatim transcript of the meeting. See Appendix "E".

Notification of the meeting was made through letters sent directly to affected landowners, community organizations and interested individuals. In addition, notification of the meeting was made through the local weekly newspaper. A summary of the meeting and responses to comments made during the meeting follows.

## A. *Comments on Land Treatment and Flood Storage for Lahaina Watershed*

Many of the comments made by community members at the June 17, 2003 Public Meeting for the Lahaina Watershed project dealt with conditions in the upper watershed area that could affect the rates of runoff and sediment discharge. Most speakers desired more consideration be given to install or improve measures on the uphill agricultural fields and in the forested areas to:

- Increase infiltration and aquifer recharge
- Store storm water for agricultural use
- Use the existing infrastructure more efficiently.

## B. *Response to Comments on Land Treatment of Upper Watershed Area to Reduce Runoff and Sediment Discharge*

Land treatment practices can be installed to protect the watershed by reducing the rate and/or volume of runoff and erosion. These practices can result in the reduction of downstream flood peaks, sedimentation, and the delivery of other damaging material carried by floodwater. However, the effectiveness of land treatment practices is limited to moderate storm intensities

Extensive land treatment in the Lahaina subwatershed was conducted by Pioneer Mill Company, Ltd. (PMC), with assistance from the West Maui Soil and Water Conservation District and NRCS, during their years of operation. The major land treatment practices utilized by PMC during their operational period were cross slope farming and terraces. Cross slope farming is cultivation with row patterns arranged perpendicular to the slope of the land. A terrace is a combination ridge and channel constructed across the field slope with a waterway to a stable outlet. Cross slope farming generally prevents concentration of the runoff. Both cross slope farming and terraces reduce average runoff velocity thereby providing conditions for increased infiltration and longer retention before concentrating in the waterways and gullies. The reduced runoff velocities in the fields decreased erosion rates and the amount of sediment transported out of the cropland.

Since the closure of the PMC operation, land treatment practices that are currently installed in the agricultural land in the subwatershed include terraces reconstructed by PMC, Maui Land and Pineapple Company, Ltd., State of Hawaii DLNR, and Kamehameha Schools. Small-sized diversified agricultural farming is also occurring on Kamehameha School's lands. A major impediment to the establishment of many conservation practices that are dependent on vegetation for effectiveness is the lack of soil moisture and irrigation water in the former sugar fields above Lahaina.

Land treatment or conservation practices recommended by NRCS are listed and described in the NRCS National Handbook of Conservation Practice (NHCP). The NRCS Field Office Technical Guide provides standards and specifications for the design and installation of the practices.

Land treatment practices listed in the NHCP that can be considered to increase infiltration and reduce runoff are:

- Conservation Cover
- Contour Buffer Strips

- Critical Area Planting
- Diversion Dam
- Deep Tillage
- Field Border
- Filter Strip
- Grade Stabilization Structure
- Irrigation Storage Reservoir
- Terrace
- Water and Sediment Control Basin

Land treatment practices listed in the NHCP that can be considered to increase infiltration and reduce erosion and sediment discharge are:

- Access Roads
- Alley Cropping
- Conservation Cover
- Contour Buffer Strips
- Critical Area Planting
- Diversions
- Field Border
- Filter Strip
- Grade Stabilization Structure
- Grassed Waterway
- Hillside Ditch
- Rock Barrier
- Sediment Basin
- Terrace
- Vegetative Barrier
- Water and Sediment Control Basin

Any conservation practice or combination of practices listed in the NRCS National Handbook of Conservation Practices can be considered for land treatment. The suitability of a conservation practice or combination of practices will be dependent on many factors including:

- Effectiveness to achieve the desired objectives.
- Cost of implementing the practice including installation, maintenance, and lost opportunities on the land area used for the practice.
- Interaction with intended land use, i.e. cultivation methods.
- Effects to other natural and cultural resources.

The preparation of a Conservation Plan, which will evaluate the suitability of land treatment options, should be conducted to identify the appropriate level of land treatment for a land parcel.

Land treatment practices are generally intended to control runoff and provide soil erosion protection during frequently occurring storms. NRCS standards for enduring land treatment practices require a minimum capacity to handle the 10-year, 24-hour storm without overtopping or other failure. Most structures installed by landowners and producers, even with financial assistance, will lose their erosion reduction and water handling effectiveness as the storm intensity nears the 10-year storm. Failure of some of the structures resulting from embankment or waterway erosion can be expected during storms exceeding the 10-year storm intensity.

Therefore, despite the extensive land treatment of the sugarcane fields during the period of Pioneer Mill operation, high intensity storms would periodically wash through the sugarcane fields causing considerable damage to the fields and land treatment practices. The sediment-laden flood water would inundate the residential and commercial areas of Lahaina Town.

The change from plantation-style agriculture to small diversified farms will likely reduce the effectiveness of land treatment to reduce runoff and sediment discharge. Unified treatment of large tracts of land will be replaced by farm implementation of conservation practices, often without coordination between neighboring properties. The amounts of effort and land area that the new farmers are willing or able to devote to conservation practices will probably be less than that provided by the sugar plantation.

Additional land treatment of the upper Lahaina subwatershed areas can be implemented under the NRCS's conservation technical assistance program, which in coordination with the West Maui SWCD, provides landowners and producers with conservation planning and design assistance and financial assistance for practice installation. This assistance can be requested by the landowners and farmers through the NRCS Wailuku Field Office or the West Maui Soil and Water Conservation District. Because of the availability of the conservation technical assistance program, a separate watershed project component for land treatment has not been included.

## C. *Response to Comments on Floodwater Detention*

In the United States, the two main structural approaches considered during planning of a flood protection project are channelization and detention. Floodwater detention consists of the installation of a storage reservoir to receive and temporarily store the floodwater while releasing water at a rate not exceeding the capacity of the downstream channels. This method of flood control is widely used in the Midwest in the upper tributaries areas of the Mississippi River basin to reduce the peak flood rates on the river.

The hydrologic model indicates that the 100-year, 24-hour storm will result in the runoff of nearly 1,000 acre-feet or 330 million gallons of water from the Lahaina subwatershed. The 10-year storm results in 460 acre-feet or 150 million gallons. Approximately 80 percent of the runoff occurs in a four-hour period during which the peak discharge occurs.

The following provides an order of magnitude of the structural requirements to retain the storm runoff. If all of the 100-year storm runoff is to be retained, a 1,000 acre-foot reservoir, with a depth of 30 feet, will be required which will cover nearly 40 acres of surface area. 40 acres in a square configuration is 1,320 feet to a side. In a 1:9 aspect, the sides will be 440 feet and 3,960 feet long. An embankment about 40 feet in height will be needed along the downstream side of the reservoir. The land area for the excavation and embankment for the reservoir that will need to be acquired will be considerably greater than the 40-acre pool surface.

If we assume that the release rate for the flood retention reservoir is limited to 1,000 cfs (cubic feet per second), a storage volume of 310 acre-feet or 100 million gallons is needed. A 300 acre-foot reservoir, with a depth of 30 feet, will require approximately 14 acres of surface area. In a square configuration, each side will be approximately 800 feet. In a 1:4 aspect, the sides will be 400 feet and 1,600 feet. The footprint for the excavation and embankment of the reservoir will be considerably greater. The 300 acre-foot (100 million gallon) reservoir is estimated to cost $13 million before land acquisition costs.

A flood retention reservoir to include Kauaula subwatershed would be considerably larger than that for the Lahaina subwatershed. If the release rate of the combined Kauaula and Lahaina subwatersheds is to be limited to 5,000 cfs, to be able to use the existing outlet through Puamana Community, an 800 acre-foot (250 million gallons) detention reservoir would be required.

Flood protection and water storage for other uses are not fully compatible uses of a reservoir. The designed water detention volume of the reservoir needs to be emptied as soon as practical to be ready to properly function in the next storm. Additional storage capacity to permanently store water can be designed as part of the reservoir project, but at a substantial cost.

Outlet improvements and crossings of roads and highways will also be needed.

A flood detention reservoir will likely need to comply with State Dam Safety requirements due to the need for a sizeable embankment on the sloping landscape. Due to these cost considerations, floodwater detention in the upper watershed would not be feasible.

## D. *Response to Comments on the Rehabilitation and Use of Existing Plantation Infrastructure for Flood Reduction*

The sugar-era irrigation water structures in the Lahaina subwatershed can provide limited floodwater control. The plantation operators would shut off the water to the irrigation ditches in times of impending storms to allow them to handle storm runoff. It is estimated that the ditches could handle 50 to 100 cfs. Therefore, the Lahainaluna Ditch and the Lahaina Pump Ditch could probably divert a total of 100 to 200 cfs from the subwatershed. This contribution to floodwater reduction can be significant during the less intense storms such as the 2-year storm with a peak discharge of 264 cfs or the 5-year storm with a peak discharge of 678 cfs. However, during more intense storms, the contribution of these ditches is less significant as the peak discharges of the 50-year and 100-year storms are 2,097 cfs and 2,574 cfs, respectively. Moreover, the sediment deposited into the ditches by the storms would require a constant level of maintenance (which was performed by the Pioneer Mill). Failure to maintain the ditch would greatly decrease the ditch's ability to carry storm waters.

Other ditches in the upper part of the subwatershed, such as the Paupau Ditch, do not flow toward a safe outlet and do not provide floodwater reduction.

The sugar-era reservoirs in the Lahaina area have limited capacity and cannot provide significant flood storage. The Wainee and Lahaina Pump reservoirs have storage volumes of less than 5 million gallons. If these reservoir are used as storm water catchments (for which they were not designed), sediments will be deposited further decreasing their maximum capacity and regular maintenance will be required.

The existing agricultural ditches and reservoirs in Lahaina provide limited flood protection and will not satisfy the flood safety criteria for major storms (greater than 10-year, 24-hours). However, it is recommended that these ditches and reservoirs be maintained for irrigation purposes. Technical assistance is available through the NRCS conservation technical assistance program.

In summary, NRCS and the West Maui SWCD will work with landowners and stewards in the Lahaina Watershed to provide assistance and program delivery to implement land treatment practices which will help manage runoff and erosion. These initiatives will be carried out in conjunction with the proposed project to provide a comprehensive flood control program.

# Chapter XIV

## Agencies and Organizations Consulted in the Preparation of the Final Environmental Impact Statement

# XIV. AGENCIES AND ORGANIZATIONS CONSULTED IN THE PREPARATION OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT

Copies of the Draft EIS were distributed to agencies and organizations listed below.

## A. Agencies and Organizations Consulted Pursuant to Chapter 343, HRS

1. William Lennan
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13. Michael W. Foley, Director
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14. Cultural Resources Commission
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15. Glenn Correa, Director
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16. Tom Phillips, Chief
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17. Gilbert Coloma-Agaran, Director
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18. George Tengan, Director
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19. **Maui Electric Company, Ltd.**
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20. Lahaina Town Action Committee
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21. West Maui Taxpayers Association
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22. Lahaina Restoration Foundation
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24. Jeffrey Melrose
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25. Mr. Kimo Falconer
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27. Steve Lovelette
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Amfac/JMB Hawaii, LLC
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28. Buddy Nobriga
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32. Terryl Vencl, Executive Director
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33. Carolyn Nuyen
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34. Akoni Akana, Executive Director
Friends of Moku'ula
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35. Thelma Shimaoka, Community Resource Coordinator
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36. Vanessa Medeiros, District Supervisor
Department of Hawaiian Home Lands
Maui District Office
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37. Rose Marie Duey, Island Representative
Alu Like, Inc.
Maui Island Center
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Wailuku, Hawaii 96793

38. Maui/Lana'i Islands Burial Council
c/o State Historic Preservation Division
State of Hawaii, Department of Land and Natural Resources
601 Kamokila Boulevard, Room 555
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39. Sandra Lee Kunimoto, Chairperson
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40. Russ K. Saito, Comptroller
State of Hawaii
Department of Accounting and General Services
P.O. Box 119
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41. Major General Robert Lee, Adjutant General
State of Hawaii
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42. U.H. Manoa Environmental Center
2550 Campus Road, Crawford 317
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43. U.H. Water Resources Research Center
Holmes Hall, Room 283
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44. Maui Community College Library
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Kahului, Hawaii 96732

45. U.H. Hamilton Library
Hawaiian Collection
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Honolulu, Hawaii 96822

46. Legislative Reference Bureau
State Capitol, Room 004
Honolulu, Hawaii 96813

47. Department of Business Economic Development and Tourism Library
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48. Hawaii Documents Center
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49. Kaimuki Regional Library
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52. Hawaii Kai Regional Library
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12. Gorden Tribble
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13. Commander
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14. Coordinator, Water Resources
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16. Environmental Protection Agency
    Pacific Islands Contact Office
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    Honolulu, HI 96850

17. Senator Daniel K. Inouye
U. S. Senate
PJKK Federal Bldg.
300 Ala Moana Blvd. Rm 7325
Honolulu, HI 96850

18. Senator Daniel K. Akaka
U. S. Senate
PJKK Federal Bldg.
300 Ala Moana Blvd. Room 3104
Honolulu, HI 96850

19. Representative Ed Case
U.S. House of Representatives
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# Chapter XV

## Comments Received During the 45-Day Comment Period for the Draft Environmental Impact Statement and Responses to Substantive Comments

# XV. COMMENTS RECEIVED DURING THE 45-DAY COMMENT PERIOD FOR THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND RESPONSES TO SUBSTANTIVE COMMENTS

Agency and public comments were received during the 45-day comment period for the Draft EIS. Comment letters and responses to substantive comments are included in this chapter.

MAUI HOTEL ASSOCIATION

1727 Wili Pa Loop, Suite B • Wailuku, Maui, Hawai'i 96793 • Phone (808) 244-8625 • Fax (808) 244-3094

MAY 13 2003

May 12, 2003

Department of Public Works and Environmental Management
Gilbert Coloma-Agaran, Director
200 South High Street
Wailuku, HI 96793

RE: Lahaina Watershed Flood Control Project

Aloha Mr. Coloma-Agaran:

Thank you for allowing the Maui Hotel Association to comment on the Draft Environment Impact Statement for Lahaina Watershed. I will not attempt to address technical issues as I am not qualified to do so, but rather will congratulate your office on moving ahead on this project.

Aside from the obvious flooding that happens in the Lahaina town, Front Street area and its cost to residents and businesses, it further presents a vision for visitors to our island that is frankly disgusting. The red sediment that flows into our ocean at the shoreline is not only damaging but ugly. It sends a message to people that we are not taking care of our greatest resource and visitors have no understanding of the fact we no longer have the agriculture that once held back the sediment. They only see ugly red sediment and know that it's not the beautiful blue ocean they came to see and play in.

We have worked hard to maintain a lure for the "luxury" vacationer and to keep our rates high and headcount stable. That type of vacationer certainly expects to see the kind of visions they see in our advertising. They pay top dollar to see pristine beaches and participate in ocean activities, not to see what their streams look like back home.

My only concern is that we pay attention to keeping the area where the sediment collects. I don't want to see problems because the catch areas for sediment are not properly cleaned and maintained. Consequently, I hope your office will be on top of the maintenance of this project.



In conclusion, I thank you and all those involved in helping this project to come to fruition. We need it badly and I hope it can happen sooner than later.

Sincerely,

Terryl Vencl

Terryl Vencl
Executive Director

Cc: Mayor Alan Arakawa
Department of Planning
Munekiyo & Hiraga, Inc
Office of Environmental Quality Control

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

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**COUNTY OF MAUI**
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LLOYD P.C.W. LEE, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Terryl Vencl, Executive Director
Maui Hotel Association
1727 Wili Pa Loop, Suite B
Wailuku, Hawaii 96793

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Ms. Vencl:

Thank you for your letter dated May 12, 2003 commenting on the subject project.

We note the Maui Hotel Association's concurrence that the sediment outflow during major storm events has a negative impact on ocean recreational activities for both visitors and residents.

The operation, maintenance and replacement (OM & R) of the proposed structural improvements have been estimated to cost approximately $260,000 per annum and will be the responsibility of the County. Included in this cost estimate is regularly scheduled clean out of sediment deposits in basins and channels. A condition of federal funding is an undertaking by the County that OM & R funding will be available for the proposed project.



Again, thank you for your comments and review of the DEIS.

Sincerely,

Milton Arakawa
for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpw/ghws/feis/responses/mauihotel

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

MAY 13 2003

REPLY TO ATTENTION OF

May 9, 2003

Regulatory Branch

Mr. Gilbert Coloma-Agaran, Director
Department of Public Works
and Environmental Management
County of Maui
200 South Street
Wailuku, Hawaii 96793

Dear Mr. Coloma-Agaran:

This letter responds to the request for comments on the Draft Environmental Impact Statement (DEIS) for the Lahaina Watershed Flood Control Project, dated April 2003. Based on the information provided in the EISPN I am unable to determine if a Department of the Army (DA) permit will be required for portions of this project.

Based on the current design, I have determined that the second outlet is not within our jurisdiction because it is located above the Higher High Water Line. The work proposed in and around Kauaula Stream however may require a DA permit. Please include this office on the mailing list for the Final Environmental Impact Statement.

Copies of this letter have been sent to Mayor Alan Arakawa, the Maui Department of Planning, the Office of Environmental Quality Control and Munekiyo & Hiraga, Inc.

If you have any questions concerning this matter, please contact William Lennan of my staff at 438-6986 or FAX 438-4060, and reference File No. 200200337.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

George P. Young, P.E.
Chief, Regulatory Branch
Department of the Army
U.S. Army Engineer District
Honolulu, Ft. Shafter, Hawaii 96858-5440

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Young:

Thank you for your letter dated May 9, 2003 commenting on the subject project.

We note your Department's determination that the second outlet will not require a DA permit.

We also note, however, the Department's comment that work proposed in and around Kauaula Stream may require a DA permit. In this regard, the following comment will be incorporated in the Final EIS.

> While the design of the debris basin is yet to be completed, some placement of fill in Kauaula Stream for the basin embankment at a location approximately 150 feet upstream from Honoapiilani Highway is unavoidable. Mitigation features to facilitate migration of native amphidromous species both downstream and upstream along Kauaula Stream will be investigated and incorporated into the design. Continual monitoring for cultural resources will be conducted during excavation. The Section 404 permit application will be completed concurrently with the debris basin design and will conform to the Section 404(b)(1) Guidelines.

A copy of the Final EIS will be forwarded to your office as requested.

Again, thank you for your comments and review of the DEIS.

Sincerely,

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpw/ahws/feis/responses/army

---

MAY 1 3 2003

ALAN M. ARAKAWA
Mayor

GLENN T. CORREA
Director

JOHN L. BUCK III
Deputy Director

(808) 270-7230
Fax (808) 270-7934

**DEPARTMENT OF PARKS & RECREATION**

700 Hali'a Nakoa Street, Unit 2 , Wailuku, Hawaii 96793

May 8, 2003

Mr. Gilbert Coloma-Agaran, Director
Department of Public Works and
Environmental Management
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Coloma-Agaran:

SUBJECT: LAHAINA WATERSHED FLOOD CONTROL PROJECT

We have reviewed the Draft Environmental Impact Statement for the subject project and are in support of the proposed project.

Thank you for the opportunity to review and comment. Should there be any questions, please contact Mr. Patrick Matsui, Chief of Parks Planning and Development, at 270-7387.

Sincerely,

GLENN T. CORREA
Director

c: Mayor Alan Arakawa, County of Maui
Michael W. Foley, Director of Planning
Michael T. Munekiyo, Munekiyo & Hiraga, Inc.
Genevieve Salmonson, Office of Environmental Quality Control
Patrick Matsui, Chief of Parks Planning and Development

Maui Electric Company, Ltd. • 210 West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96733-6898 • (808) 871-8461

MAY 14 2003

May 12, 2003

Mr. Gilbert Coloma-Agaran
Director
County of Maui
Department of Public Works and Environmental Management
200 S. High Street
Wailuku, HI 96793

Dear Mr. Coloma-Agaran:

Subject: Lahaina Watershed Flood Control Project

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. Please reference our earlier comments to the County of Maui, Department of Public Works and Waste Management Engineering Division dated May 10, 2002, which is included in the Draft Environmental Impact Statement for the above project.

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

Sincerely,

Neal Shinyama

Neal Shinyama
Manager, Energy Delivery

NS/dt:lkh

cc: Alan Arakawa, Mayor, County of Maui
Michael W. Foley, Director, Dept. of Planning COM
Michael T. Munekiyo, AICP
Genevieve Salmonson, Director, Office of Environmental Quality Control

---

LINDA LINGLE
Governor

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 South King Street
Honolulu, Hawaii 96814-2512
Phone: (808) 973-9600 Fax: (808) 973-9613

SANDRA LEE KUNIMOTO
Chairperson, Board of Agriculture

DIANE LEY
Deputy to the Chairperson

MAY 16 2003 COPY

May 13, 2003

Mr. Gilbert Coloma-Agaran, Director
Department of Public Works and Environmental Management
County of Maui
200 South High Street
Wailuku, HI 96793

Dear Mr. Coloma-Agaran:

RE: Lahaina Watershed Flood Control Project

Thank you for the opportunity to review the draft EIS for the above project. The Department of Agriculture has no comments at this time.

Sincerely,

Sandra Lee Kunimoto
Chairperson, Board of Agriculture

c: Honorable Alan Arakawa
Michael W. Foley
Michael T. Munekiyo
Genevieve Salmonson

C:\Docs\word\misc\L051203gac.dpw.doc

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
COUNTY OF MAUI

ALAN M. ARAKAWA
Mayor

ALICE L. LEE
Director

HERMAN T. ANDAYA
Deputy Director

200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • PHONE (808) 270-7805 • FAX (808) 270-7165

MAY 21 2003

May 14, 2003

Mr. Gilbert Coloma-Agaran, Director
Department of Public Works and
Environmental Management
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Coloma-Agaran:

Subject: Lahaina Watershed Flood Control Project

We have reviewed the Draft Environmental Impact Statement (DEIS) for the Lahaina Watershed Flood Control Project and would like to offer the following comments:

1. With the changes in land use and storm runoff volume from the former sugar cane fields in and around the watershed area, the County should immediately require the developers of the former sugar cane fields to construct storm runoff improvements that would properly collect, de-silt and dispose of the runoff that is generated from such projects.

2. The DEIS states that the proposed project will reduce the overall sediment discharge in the project area by approximately 25 percent, mitigate the sediment discharge into the near shore environment fronting Lahaina town and reduce the sediment outflow of Kauaula Stream by approximately 52%.

   We would like to know if the sediment discharge could be decreased further with the construction of larger or more sediment basins. Was this considered as an alternative and is it economically feasible?





3. We concur that storm water runoff is a major problem in the Lahaina area which results in all of the adverse effects specified in the DEIS, and fully support the construction of the project as soon as possible.

Thank you for the opportunity to comment.

Very truly yours,

ALICE L. LEE
Director

ETO:df

c: Mayor Alan M. Arakawa
Michael W. Foley
Michael T. Munekiyo
Genevieve Salmonson
Edwin T. Okubo

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS**
**AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Alice L. Lee, Director
Department of Housing and Human Concerns
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Ms. Lee:

Thank you for your letter dated May 14, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the order presented in your letter.

1. ***Response to Comment No. 1***

The change in runoff from active sugar cane fields to fallow fields is considerable and has been considered in the recently updated hydrologic analysis for the project. In accordance with Maui County Code (MCC) Chapter 20.08 Soil Erosion and Sedimentation Control and Title 15, rules for the design of storm drainage facilities in the County of Maui, all land owners are responsible for addressing and mitigating drainage impacts. With respect to the development of the upland agricultural lands, in this case Makila Land Company, LLC and Kauaula Land Company, LLC will be responsible to provide detention and desilting basins within their respective agricultural subdivision developments to maintain current levels of runoff flowing from their lands (i.e., the fallow fields condition). Collectively, through these measures, it is anticipated that there will be no additional impacts to downstream or adjacent properties from the development of the former agricultural lands.



2. ***Response to Comment No. 2***

While larger basins can reduce sediment discharge to the ocean, the relationship of sediment removal to basin size is not linear. A significant increase in basin size may not significantly increase sediment trapping. The Wainee Soil found on the surface in the Lahaina Subwatershed is a silty clay with a high volume of stones. The soil particles less than 3 inches in diameter are 55 to 70 percent silts and clays. The soil has a relatively small fraction of sand and gravel which are the sizes trapped in the basins. Clays and silts will remain in suspension and pass through the basins with the floodwater.

During the design phase, the size of the sediment basins will be optimized with regard to land area available.

3. ***Response to Comment No.3***

We note your concurrence that storm water runoff is a major problem in the Lahaina area and support for the proposed project

Again, thank you for your comments and review of the DEIS.

Very truly yours,

Milton Arakawa
for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/dhhcltr

ALAN M. ARAKAWA
MAYOR

OUR REFERENCE tj
YOUR REFERENCE

# POLICE DEPARTMENT
COUNTY OF MAUI

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

THOMAS M. PHILLIPS
CHIEF OF POLICE

KEKUHAUPIO R. AKANA
DEPUTY CHIEF OF POLICE

MAY 22 2003

May 13, 2003

Mr. Mich Hirano, AICP
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Dear Mr. Hirano:

SUBJECT: Lahaina Watershed Flood Control Project

Thank you for your letter of May 6, 2003, requesting comments on the above subject.

We have reviewed the proposed summary and have enclosed our comments and recommendations. Thank you for giving us the opportunity to comment on this project.

Very truly yours,

Acting Assistant Chief Glenn Miyahira
for: Thomas M. Phillips
Chief of Police

Enclosure

c: Alan M. Arakawa, Mayor
Michael W. Foley, Dept. of Planning
Gilbert Coloma-Agaran, Dept. of Public Works
Michael T. Munekiyo, Munekiyo & Hiraga
Genevieve Salmonson, Office of Enviornmental Quality Control

COPY

TO : THOMAS PHILLIPS, CHIEF OF POLICE, MAUI POLICE DEPARTMENT

VIA : CHANNELS 5/11/03

FROM : CHARLES M. HIRATA, CAPTAIN, LAHAINA PATROL

SUBJECT : REVIEW OF LAHAINA WATERSHED FLOOD CONTROL PROJECT DEIS

Sir,

I was asked to review this document and to submit comments concerning this project.

I can find no adverse impacts to the operation of public safety components, to include police, fire and paramedics. The project should have positive impacts on public safety because it will protect homes and businesses in Lahaina town from flooding. The project should prevent sediment runoff onto the roads and highways. The problem of runoff on highways has, in the past, caused temporary road restrictions. Restrictions or closures, no matter how short in duration, have a negative impact on traffic flow.

Having observed past instances of sediment runoff into the ocean, I can say that this project has the potential to significantly reduce sediment from entering the ocean. The project area contains several ocean recreational areas for swimming, snorkeling, fishing, and surfing.

Under Chapter V, the unresolved issues concerning the Lahaina Bypass and the Dickenson Street Extension must seriously be considered and coordinated with the State DOT and County Public Works Department. This flood control project must be constructed with those two issues in mind.

The DEIS already contains Officer MIGITA's comments in which he has no concerns about this proposed project.

Respectfully submitted,

Charles M. HIRATA E-4855
Commander, Lahaina District
May 9, 2003 (8:36am)

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Thomas M. Phillips, Chief of Police
Maui Police Department
County of Maui
55 Mahalani Street
Wailuku, Hawaii 96793

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Phillips:

Thank you for your Department's letter dated May 13, 2003 commenting on the subject project.

We note your Department's comment that the project should have positive impacts on public safety and prevent sediment runoff on the roadway which have caused interruptions to traffic flow.

We also note and confirm that coordination with the State Department of Transportation will be required in connection with the design of the Lahaina Bypass and the proposed project. Although the Dickenson Street extension project is not actively under consideration, future design coordination will be carried out, as required.



Again, thank you for your comments and review of the DEIS.

Sincerely

Milton Arakawa
for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpw/ahws/feis/responses/mpdltr

MAY 27 2003

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

KATHERINE H. THOMASON
DEPUTY COMPTROLLER

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

(P)1165.3

MAY 23 2003

Mr. Gilbert Coloma-Agaran, Director
Department of Public Works and Environmental Management
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Coloma-Agaran:

Subject: Lahaina Watershed Flood Control Project
Draft Environmental Impact Statement

Thank you for the opportunity to review the Lahaina Watershed Flood Control Project Draft Environmental Impact Statement. This project does not impact any Department of Accounting and General Services projects or existing facilities. Therefore, we have no comments to offer.

If you have any questions, please call me at 586-0400 or have your staff call Mr. Allen Yamanoha of the Public Works Division at 586-0488.

Sincerely,

Russ K. Saito

RUSS K. SAITO
State Comptroller

c: Ms. Genevieve Salmonson, OEQC
Mr. Alan Arakawa, Mayor, County of Maui
Mr. Michael W. Foley, Director, DP, County of Maui
✓Mr. Michael T. Munekiyo, AICP, Munekiyo & Hiraga, Inc.

---

MAY 29 2003

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

LORRIN W. PANG, M.D., M.P.
DISTRICT HEALTH OFFICER

**STATE OF HAWAII**
**DEPARTMENT OF HEALTH**
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, HAWAII 96793-2198

May 27, 2003

Mr. Gilbert Coloma-Agaran
Director
Department of Public Works and
Environmental Management
County of Maui
200 South High Street
Wailuku, Hawai`i 96793

Dear Mr. Coloma-Agaran:

Subject: **Draft Environmental Impact Statement, Lahaina Watershed Flood Control Project**

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Lahaina Watershed Flood Control Project. Your office has acknowledged the concerns of the Department of Health as expressed in the Deputy Director's response to the Environmental Impact Statement Preparation Notice, dated June 10, 2002. We have no further comments to offer at this time.

Should you have any questions, please call me at 984-8230.

Sincerely,

Herbert S. Matsubayashi
District Environmental Health Program Chief

c: ✓Mich Hirano
Michael Foley

JUN 09 2003

From the Desk of . . .
GILBERT S. COLOMA-AGARAN, DIRECTOR

1811

TO MA MD
JKRUEGER

FOR LAHAINA WATERSHED
FILE

COPY TO MIKE MUNEKIYO

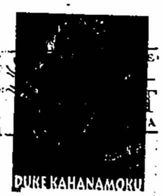
Mr. Coloma-Agaran (or Joe Krueger)

We strongly object and oppose the Lahaina Watershed Flood Control Project.

We want the "flood waters" to collect at Mokuula pond and return to the ocean through ocean gates (makaha). The water was diverted for sugar cane, the pond dried up, a baseball field, (over a buried place of alii) but no common sense return of the water!

Guillermo Ohana
511 Kolohala Dr
Kula, Maui, Hawaii 96790

HONOLULU HI 968
PM
03 JUN
2003




COUNTY OF MAUI
PUBLIC WORKS
JUN -4 P2:35

Mr. Gilbert Coloma-Agaran
200 South High Street
Wailuku, Maui, Hawai'i
96793

96793+2155

Stop the waste of 12-14 million dollars and 24 acres of farmland. Give it to native Hawaiians to farm with the wisdom of their horticulturist ancestors... and learn from the people who were able to use the land wisely!

Urgently + Sincerely,
The Guillermo Ohana
~~Prescott~~, Valerie, and Kainoa
(We both pay taxes!)
under separate response

THE CURTIS WILSON COST GALLERY, LTD.
TOLL FREE: 1-800-508-2278

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS**
**AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Guillermo Ohana
511 Kolohala Drive
Kula, Hawaii 96790

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Guillermo Ohana Members:

Thank you for your letter received on June 9, 2003 commenting on the subject project. We wish to provide the following information in response to your comment.

1. ***Response to comment, "have the flood waters collect at Moku`ula pond and return to the ocean through ocean gates (makaha)".***

In the discussion of alternatives in the DEIS (Chapter VI), it was mentioned that several alternatives were considered which incorporated an outlet channel through the Lahaina Town area. However, high project costs and environmental concerns about sediment discharge within the fringing reef fronting the Lahaina Town area gave low priority to these alternatives.

In particular, the following storm hydrology parameters were considered. The hydrologic model indicates that the 100-year, 24-hour storm will result in the runoff of nearly 1,000 acre-feet or 330 million gallons of water from the Lahaina subwatershed. The 10-year storm results in 460 acre-feet or 150 million gallons. Approximately 80 percent of the runoff occurs in a four hour period during which the peak discharge occurs. If we assume a release rate for the flood retention reservoir is limited to 1,000 cfs (cubic feet per second), a storage volume of 310 acre-feet or 100 million gallons is needed. A 300 acre-foot reservoir, with a depth of 30 feet will require approximately 14 acres of surface area. Additional land will be required to accommodate the footprint for the excavation and embankment of the reservoir.



The 100 million gallon reservoir is estimated to cost $13.0 million before land acquisition costs.

If Moku`ula pond is to function as a reservoir, this use for flood protection is not fully compatible with a reservoir for water storage and other uses. In the case of flood protection, the designed water detention volume of the reservoir needs to be emptied as soon as practicable in order to be ready to properly function in the next storm. The sediment collected in Moku`ula pond will also need to be cleaned as soon as practicable in order for it to function properly and to be ready for the next storm event. Consideration of these factors renders the use of Moku`ula pond as a reservoir ineffective for flood control purposes and will be cost prohibitive.

Again, thank you for your comments and review of the DEIS.

Sincerely

Milton Arakawa
for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/guillermo

JUN 1 6 2003


**DEPARTMENT OF WATER SUPPLY**
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 270-7816 • Fax (808) 270-7833


June 6, 2003

Mr. Gilbert Coloma-Agaran, Director
Department of Public Works and Environmental Management
County of Maui
200 S High Street
Wailuku HI 96793

Dear Mr. Coloma-Agaran:

SUBJECT: Lahaina Watershed Flood Control Project (DEIS) - Construction of Floodwater diversion, inlet basin, three (3) sediment basins, debris basin and vegetation of bare earth areas including diversion surfaces
TMK 4-6-013:001 & 006, 4-6-014:001, 4-6-015:001, 4-6-018:003, 4-7-001:002 & 018, and 4-7-002:004 & 005

Thank you for the opportunity to comment on this project.

The project is located in the Maui County Planting Plan - Plant Zones 3, 4, and 5. We encourage the applicant to utilize appropriate native and non-invasive species where planting is intended. Native plants adapted to the area, conserve water and protect the watershed from degradation due to invasive alien species.

We recommend the use of brackish and/or reclaimed water sources for dust control during construction.

We note that the Friends of Moku'ula are members of our West Maui Water Advisory Committee and that they have recently filed SMA permits for the restoration of Mokuhinia Pond and Moku'ula island, located roughly between Prison and Shaw Streets but fed in part by water from Kauaula Stream. The Army Corps is assisting with this project. We suggest that they be consulted for any design considerations necessary to make the two projects compatible.

The project overlies the Launiupoko aquifer which has a sustainable yield of 8 MGD. The Department of Water Supply strives to protect the integrity of surface and groundwater resources by encouraging the applicant to adopt best management practices (BMPs) designed to minimize infiltration and runoff from construction and vehicle operations.



Should you have any questions, please contact our Water Resources and Planning Division at 270-7199.

Sincerely,

George Y. Tengan
Director

eam
c:: engineering division
applicant
Mayor Alan Arakawa
Department of Planning
Munekiyo & Hiraga, Inc.
Office of Environmental Quality Control

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS**
**AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

George Tengan, Director
Department of Water Supply
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Tengan:

Thank you for your letter dated June 6, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the order presented in your letter.

We note and confirm that consideration will be given to the use of appropriate native plants and non-invasive species where planting is intended.

We also note and confirm that consideration will be given to use brackish or reclaimed water for dust control during construction.

A coordination meeting was carried out with the Corps of Engineers regarding the Moku`ula project in June 2003. The Corps of Engineers indicated that the Moku`ula study was in the reconnaissance phase and a Preliminary Restoration Plan will be prepared to determine if Federal interest is warranted in proceeding with detailed investigation.

We confirm, Best Management Practices will be adopted and followed to minimize infiltration and runoff during construction and from vehicle operations.



Again, thank you for your comments and review of the DEIS.

Sincerely

Milton Arakawa
for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/dwsltr

| | | | |
|---|---|---|---|
| Post-it® Fax Note 7671 | | Date 7 June | # of pages ▶ 2 |
| To Mich Hirano | | From Erik F | |
| Co./Dept. Munekiyo | | Co. Xamanek Res | |
| Phone # Hirano Inc | | Phone # 572-6118 | |
| Fax # 244-8729 | | Fax # ~ | |


PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

ERNEST Y.W. LAU
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

**STATE OF HAWAII**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**
HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING, ROOM 555
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707


June 9, 2003

Mr. Erik Fredericksen
Xamanek Researches
P.O. Box 880131
Pukalani, Hawai'i 96788

LOG NO: 2003.0819
DOC NO: 0306MK03

Dear Mr. Fredericksen,

**SUBJECT: Chapter 6E-42 Historic Preservation Review - Archaeological Inventory Survey Lahaina Watershed Flood Control Project Area**
**Polanui, Pahoa, Puehuehunui, Halaka'a, Waine'e, and Puako Ahupua'a**
**Lahaina District, Maui**
**TMK: (2)-4-6-013:016, 018, 026; 4-7-001:002**

Thank you for the opportunity to review this report which our staff received on March 21, 2003 (Fredericksen and Fredericksen, 2003, *An Archaeological Inventory Survey of the Lahaina Watershed Flood Control Project Area, Lands of Polanui, Pahoa, Puehuehunui, Halaka'a, Waine'e, and Puako, Lahaina District, Maui Island, TMK: 4-6-13-16, 18, 26, TMK: 4-7-01, 02.* Xamanek ms.). We apologize for the delay in our review.

The background section acceptably establishes the *ahupua'a* settlement pattern and predicts the likely site pattern in the project area. We would like to ask that you provide further, visual clarification of some of these data, however. The project area transects numerous LCAs, which are indicated on the TMK maps provided. Please plot the project corridor on the appropriate TMK maps and submit as replacement pages.

The survey has adequately covered the project area, documenting one historic property in the project area consisting of an *in situ* burial (SIHP 50-50-03-5239). The burial was identified in Backhoe Trench 33, located on LCA 5832 awarded to Ka'aumalewa. A total of 86 backhoe trenches were excavated during the inventory survey.

We agree with the significance assessments that Sites 5239 is significant under multiple criteria "D" and "E", for the potential information regarding mortuary practices, and for its cultural significance as a precontact burial.

We concur with the mitigation commitment that monitoring during construction of the flood control channel is appropriate. The fact that the project corridor crosses multiple Land Commission Awards suggests that subsurface historic properties may be identified along the corridor. The LCA on which the burial was identified was awarded for agricultural purposes,





and was not expected to contain burials. This being the case, we believe monitoring is the judicious approach to avoid impacting any historic properties. An acceptable archaeological monitoring plan should be submitted to our Maui and O'ahu Offices for review and acceptance, prior to the beginning of any ground disturbance. In addition, a Burial Treatment/Preservation Plan must be submitted to the Maui/Lana'i Islands Burial Council for review and acceptance.

We find this report to be acceptable on the condition that the above mentioned replacement pages are submitted to our Maui and O'ahu Offices in perforated replacement pages (please include a cover letter with the report title). As always, if you disagree with our comments or have questions, please contact Dr. Melissa Kirkendall (Maui/Lana'i SHPD 243-5169) as soon as possible to resolve these concerns.

Aloha,

P. Holly McEldowney

P. Holly McEldowney, Acting Administrator
State Historic Preservation Division

MK:jen

c: Michael Foley, Director, Department of Planning, County of Maui, FAX 270-7634
Bert Ratte, County of Maui, Land Use and Codes, FAX 270-7972
Glen Ueno, County of Maui, Land Use and Codes, FAX 270-7972
Kana'i Kapeliela, Burial Sites Program
Charles Maxwell, Chair, MLIBC
Cultural Resources Commission, Plng Dept, 250 S. High Street, Wailuku, HI 96793

JUN 16 2003



**STATE OF HAWAII**
**DEPARTMENT OF LAND AND NATURAL RESOURCES**
HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING, ROOM 555
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707



JUN 13 2003

Mr. Mich Hirano
Munekiyo & Hiraga, Inc.
305 South High Street, Suite 104
Wailuku, Hawaii 96793

LOG NO: 2003.0832
DOC NO: 0306CD23

Dear Mr. Hirano,

**SUBJECT: National Historic Preservation Act, Section 106 – Draft Environmental Assessment Impact Statement for the Proposed Lahaina Watershed Flood Control Project**
**Various Ahupua`a, Lahaina District, Island of Maui**
**TMK: 4-6-013: 001, 006; 4-6-014: 001; 4-6-014: 001; 4-6-015:001; 4-6-018:003; 4-7-001:002, 018; 4-7-002:004,005**

Thank you for the opportunity to review and comment on the Draft Environmental Impact Assessment (Draft EIS) for the proposed Lahaina Watershed Flood Control Project, which was received by our staff May 12, 2003. Our review is based on reports, maps, and aerial photographs maintained at the State Historic Preservation Division; no field inspection was conducted of the subject property.

We have previously commented on the Environmental Impact Statement Preparation Notice (EISPN) for the Proposed Lahaina Watershed Flood Control Project (SHPD DOC NO.: 0206CD38/30130). At that time we stated that we understood from the submitted EISPN that an archaeological inventory survey would be conducted of the proposed project area and that the report documenting the findings will be included in the environmental impact statement. We have recently received a copy of the report documenting the findings of the survey and it is currently under review. Therefore, we are unable to provide comments on the proposed undertaking at this time, its effects on significant historic sites within the Area of Potential Effect, or any proposed mitigation of "adverse effect" on significant historic sites. We will be better able to comment on the proposed undertaking after the inventory survey report has been reviewed.

If you have any questions, please call Cathleen Dagher at (808) 692-8023).

Sincerely,

Peter T. Young
State Historic Preservation Officer

CD:jen

c: Michael Foley, Director, Dept of Planning, County of Maui, 250 South High Street, Wailuku, HI 96793
Cultural Resources Commission, Planning Dept, County of Maui, 250 S. High Street, Wailuku, HI 96793

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**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793



November 24, 2003

P. Holly McEldowney, Acting Administrator
State Historic Preservation Division
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Ms. McEldowney:

Thank you for your letter of June 13, 2003 and your letter dated June 9, 2003 to Erik Fredericksen of Xamanek Researches commenting on the Archaeological Inventory Survey prepared for the subject project. We wish to provide the following information in response to your comments in your June 9th letter in the order presented in your letter.

The requested replacement pages of the TMK maps plotting the project corridor have been submitted to the State Historic Preservation Division (SHPD) under separate cover.

We confirm that an acceptable archaeological monitoring plan will be submitted to the Maui and O`ahu offices of the SHPD for review and acceptance prior to project construction.

A conceptual Burial Treatment/Preservation Plan has been reviewed and accepted by the Maui/Lana`i Islands Burial Council. This information will be incorporated in the Final EIS.

P. Holly McEldowney, Acting Administrator
November 24, 2003
Page 2

Again, thank you for your comments and review of the Archaeological Inventory Report.

Sincerely

Milton Arakawa
for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Peter Young, State Historic Preservation Officer
Charles Maxwell, Chair, Maui/Lana`i Islands Burial Council
Dawn Duensing, Chair, Maui Cultural Resources Commission
Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlehws/feis/responses/shpdltr

OCT 21 2003

SMITH DEVELOPMENT Real Estate Development & Consulting

1043 Makawao Avenue, Suite 208, Makawao, HI 96768
Phone: (808) 572-3011 Fax: (808) 572-8378
www.SDHawaii.com email: KRS@SDHawaii.com

June 19, 2003

Mr. Gilbert S. Coloma-Agaran, Director
Department of Public Works and
Environmental Management
County of Maui
200 South High Street
Wailuku, Hawai`i 96793

Dear Mr. Coloma-Agaran,

RE: Draft Environmental Impact Statement (EIS)
Lahaina Watershed Flood Control Project

On behalf of Kaua`ula Associates, LLC, we appreciate this opportunity to comment on the draft EIS for the Lahaina Watershed Flood Control Project ("Project").

Kaua`ula Associates is a partnership involving the principals of West Maui Land Company and Smith Development. We are proposing to develop "Pu`unoa," an affordable single-family residential subdivision on the south side of Kaua`ula Stream, across from the Puamana condominium complex, immediately mauka of lands to be used for the Project. The Project area, in fact, creates our makai boundary, while our mauka boundary is created by the proposed Lahaina bypass highway alignment. A location map and conceptual site plan are attached for your information.

Pu`unoa will be served by Hokiokio Place, a two-lane roadway that has already been constructed to serve the Kaua`ula Agricultural Subdivision that is located mauka of the Pu`unoa site. Hokiokio Place crosses one of the Project's grass-lined diversions, as does an existing cane haul road that parallels Honoapiilani Highway and terminates at the Lahaina Aquatic Center and the new athletic fields complex. We do not expect that the construction of the Project will interfere with Pu`unoa's ingress and egress.

The drainage design for Pu`unoa is anticipated to function independently of the Project, given the uncertain time frame in which this comprehensive and ambitious undertaking may ultimately be completed. While Pu`unoa's drainage plan will stand alone, it is also anticipated that it will be able to interface with the flood control project once it has been constructed, if such interface is desirable to Pu`unoa and the general public at that time.

Mr. Gilbert S. Coloma-Agaran
June 19, 2003
Page Two

As you know, the principals of West Maui Land Company have previously submitted written comments opposing the Project from a conceptual perspective; however, even though they own some of the land to be utilized for the Project, they authorized the County to proceed. In the same light, Kaua`ula Associates shares these conceptual concerns over the Project, but we support its technical merits and design, particularly the extensive use of grass-lined or natural drainage channels and features.

We foresee no difficulties with our Pu`unoa project and the flood control project proceeding concurrently or at different times. We appreciate Pu`unoa being considered in the flood control project design and its environmental review process, just as the design and development of Pu`unoa will contemplate and accommodate the flood control project.

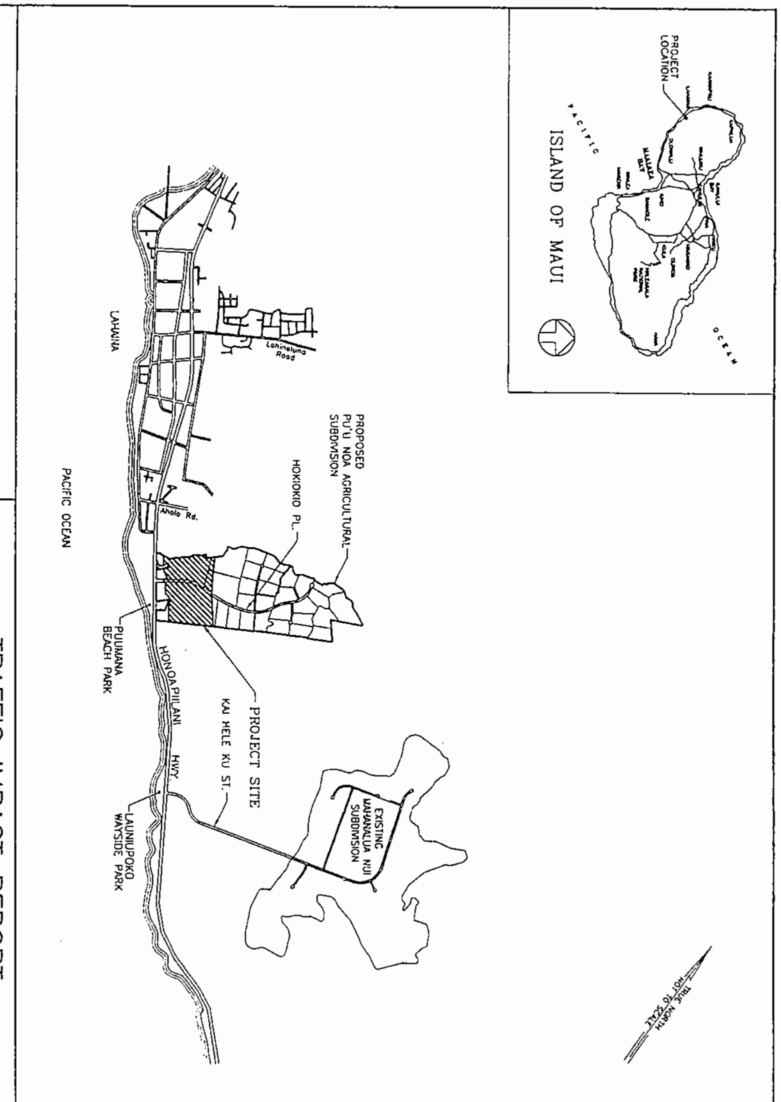
Again, thank you for this opportunity to offer these comments. Please do not hesitate to contact me if you have any questions or require additional information.

Sincerely,

Michele N. Chouteau
Land Use Planner
for Kaua`ula Associates, LLC

Attachments (2)

c: West Maui Land Company
Mich Hirano, Munekiyo & Hiraga, Inc.



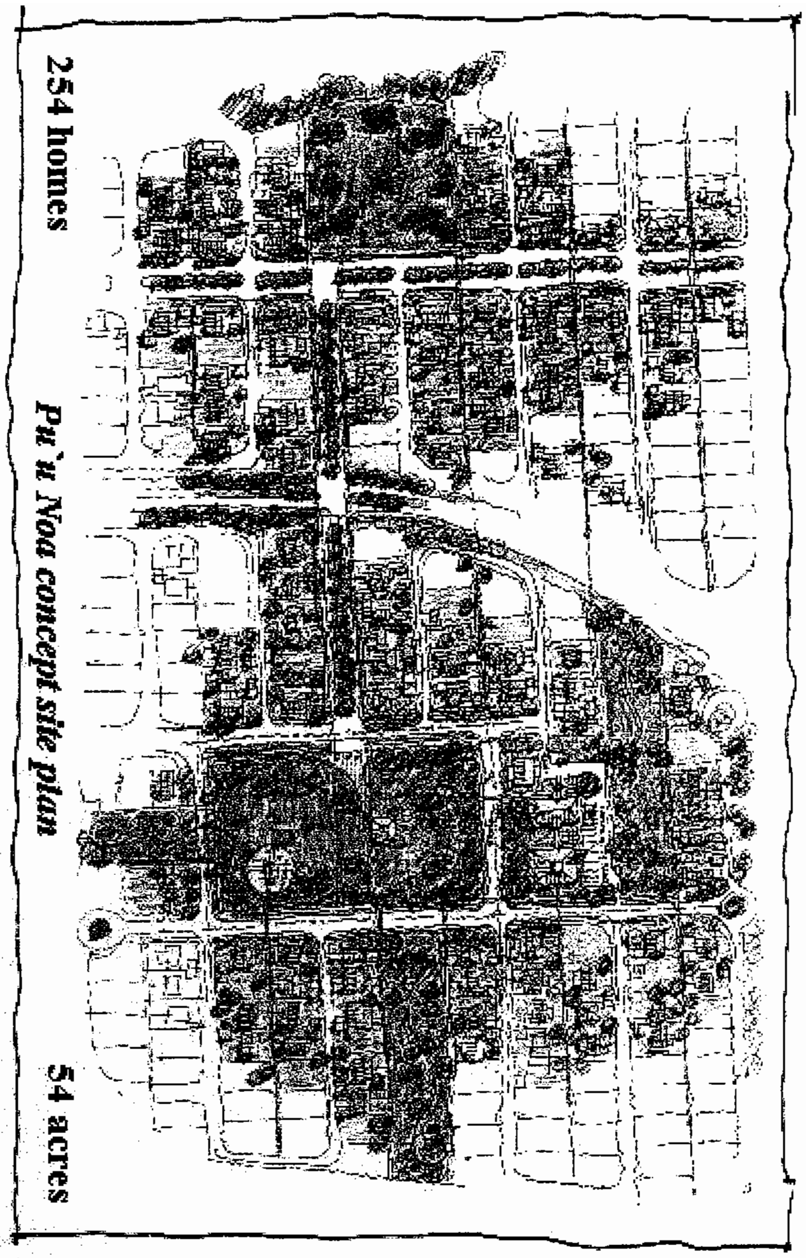

AYA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

TRAFFIC IMPACT REPORT
PU'U NOA RESIDENTIAL SUBDIVISION

LOCATION MAP

FIGURE 1

FN: 02-064\Fig1.DWG




ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
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**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS**
**AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
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RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Michele N. Chouteau, Land Use Planner
Kaua`ula Associates, LLC
c/o Smith Development
1043 Makawao Avenue, Suite 208
Makawao, Hawaii 96768

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Ms. Chouteau:

Thank you for your letter dated June 19, 2003 commenting on the subject project and the information provided on the proposed Pu`unoa affordable housing project. We wish to provide the following information in response to your comments in the same order as presented in your letter.

The information provided on the proposed Pu`unoa affordable housing development will be included in the assessment of cumulative impacts in the Final EIS.

Future coordination to accommodate the Hokiokio Place crossing and the proposed Pu`unoa affordable housing project will be carried out as appropriate.

Again, thank you for your comments and review of the DEIS.

Sincerely

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/kauaula

JUN 24 2003
1031

LINDA LINGLE
GOVERNOR OF HAWAII

RECEIVED
COUNTY OF MAUI
2003 JUN -5 P 1:48
ENGINEERING DIVISION
DEPT. OF PUBLIC WORKS

'03 MAY 28 P2:32
COUNTY OF MAUI
PUBLIC WORKS

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

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EMD / CWB

05062PKP.03

May 23, 2003

Mr. Gilbert Coloma-Agaran
Director
Department of Public Works and
Environmental Management
200 South High Street
Wailuku, Hawaii 96793

**Subject: Lahaina Watershed Flood Control Project**

The Department of Health, Clean Water Branch (CWB) has reviewed the subject document and offers the following comments:

1. The Army Corps of Engineers should be contacted at (808) 438-9258 to identify whether a Federal license or permit (including a Department of Army permit) is required for this project. Pursuant to Section 401(a)(1) of the Federal Water Pollution Act (commonly known as the "Clean Water Act"), a Section 401 Water Quality Certification is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters...."

2. A National Pollutant Discharge Elimination System (NPDES) general permit coverage is required for the following activities:

   a. Storm water associated with industrial activities, as defined in Title 40, Code of Federal Regulations, Sections 122.26(b)(14)(i) through 122.26(b)(14)(ix) and 122.26(b)(14)(xi).

   b. Construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. **An NPDES permit is required before the commencement of the construction activities.**

   c. Discharge of treated effluent from leaking underground storage tank remedial activities.

   d. Discharge of once through cooling water less than one (1) million gallons per day;

   e. Discharge of hydrotesting water.

   f. Discharge of construction dewatering effluent.

g. Discharge of treated effluent from petroleum bulk stations and terminals.

h. Discharge of treated effluent from well drilling activities.

i. Discharges of treated effluent from recycled water distribution systems.

j. Discharges of storm water from a small municipal separate storm sewer system.

k. Discharge of circulation water from decorative ponds or tanks.

The CWB requires that a Notice of Intent (NOI) to be covered by a NPDES general permit for any of the above activities be submitted at least 30 days before the commencement of the respective activities. The NOI forms may be picked up at our office or downloaded from our website at http://www.state.hi.us/doh/eh/cwb/forms/genl-index.html.

3. The applicant may be required to apply for an individual NPDES permit if there is any type of activity in which wastewater is discharged from the project into State waters and/or coverage of the discharge(s) under the NPDES general permit(s) is not permissible (i.e. discharges into Class 1 or Class AA waters). An application for the NPDES permit is to be submitted at least 180 days before the commencement of the respective activities. The NPDES application forms may also be picked up at our office or downloaded from our website at http://www.state.hi.us/doh/eh/cwb/forms/indiv-index.html.

4. Hawaii Administrative Rules, Section 11-55-38, also requires the owner to either submit a copy of the new NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD) or demonstrate to the satisfaction of the DOH that the project, activity, or site covered by the NOI or application has been or is being reviewed by SHPD. Please submit a copy of the request for review by SHPD or SHPD's determination letter for the project.

If you have any questions, please contact the CWB at (808) 586-4309.

Sincerely,

for Alec Wong

DENIS R. LAU, P.E., CHIEF
Clean Water Branch

KP:cu

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

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COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
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ENGINEERING DIVISION
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RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Denis R. Lau, P.E., Chief
Clean Water Branch
State of Hawii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Lau:

Thank you for your letter dated May 23, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the same order as presented in your letter.

Coordination with the Army Corps of Engineer has been carried out to identify whether a Federal license or permit (including a Department of Army permit) will be required for the proposed improvements. We confirm that the proposed project will comply with Section 401 (a)(1) of the Federal Water Pollution Act and conditions of a Section 401 Water Quality Certificate for any application for a Federal license or permit.

We confirm that an application for a National Pollutant Discharge Elimination System (NPDES) general permit or individual permit will be carried out as appropriate for the proposed activities. A Notice of Intent will be submitted within the respective time frames for the general or individual permits before the commencement of the respective activities.

We also confirm the proposed project will comply with the requirements of Hawaii Administrative Rules, Section 11-55-38, and will notify the Department of Land and Natural Resources, State Historic Preservation Division and Department of Health accordingly.

Again, thank you for your comments and review of the DEIS.

Sincerely

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/dohclean



JUN 24 2003

RECEIVED
COUNTY OF MAUI
2003 JUN 23 P 4:17
ENGINEERING DIVISION
DEPT. OF PUBLIC WORKS

June 22, 2003

County of Maui Dept of Public Works
and Environmental Management
200 So. High St.
Wailuku, HI 96793
Atten: Joe Krueger
VIA FAX: 270-7975

From: Sierra Club, Maui Group
PO Box 791180, Paia, HI 96779

Re: Lahaina Watershed Flood Control Project

Dear Mr Krueger and USDA/MRCS Staff,

Thank you for the opportunity to comment upon the DEIS for the Lahaina Watershed Flood Control Project proposed for the area surrounding Kaua`ula Stream. We would like to be a consulted party on this matter.

The Sierra Club Hawaii Chapter, Maui Group supports the protection of stream water flows in their natural state as essential to the survival of endemic and indigenous species of stream life. The Sierra Club also supports restoration of natural riparian zones, buffer zones and reforestation of watersheds with native plants as the most appropriate long term strategy to minimize impacts of naturally occurring flood water runoff in degraded watershed areas upslope of urban centers.

In simple terms: the best approach to controlling floodwater damage and enhancing the functioning of natural systems is to allow as much floodwater as possible to be naturally absorbed and utilized within the watershed area. While the favored alternative for this project makes an attempt to reflect some of these considerations, it has overlooked others that could prove both practical and cost effective in the long range. We hope you will make an attempt to incorporate the many worthwhile suggestions offered by various agencies and the public into the final planning process for this project.

The proposed flood control project addresses a very important and worthwhile objective- minimization of potentially destructive storm generated water flows from the Kaua`ula watershed. However, as the majority of public testimony at the recent public hearings suggested, the local community would favor a plan that utilized the funding for this project to accomplish this goal with a more natural approach and a wider range of benefits to the natural ecosystem of the watershed area. US Fish and Wildlife Services appears to support this same objective. The following suggestions reflect some opportunities to reach common goals that the currently favored project design does not address.

**COMMUNITY GOALS:**

**1. Increase storage capacity and recharge for fresh water within Lahaina watershed and Launiupoko aquifer:**
The proposed project does allow for some absorption of water into the Launiupoko watershed through grass lined swales, however, this is at lower elevations (below 500' elev.) which will not promote productive aquifer recharge. Much of the storm water originates at higher elevations. If the existing ditch systems at 500 ft , 900 ft and 1400 ft elevation could be incorporated into the flood control plan, waters could be channeled to both existing and additional reservoir systems to be tapped for reforestation and agricultural needs or be absorbed directly into the aquifer. Both activities would increase aquifer recharge. Kamehameha Schools has a need for agricultural water to re vegetate their lands in the flood control area. Current and future residents of Kaua`ula Valley also have need of additional non-potable water for traditional agriculture (taro), parks and open spaces and small ag operations. We urge this project to include investment in creation of enhanced and additional reservoir storage capacity, riparian and native forest zones within the Launiupoko aquifer region. This is a practical way to let a potential problem (flood water) help serve an important community need.

**2. Improved transportation access to Lahaina:**
The County is currently involved in several long range transportation projects for Lahaina area. One would relocate Honoapi`ilani Hwy a few hundred feet mauka (creating a linear open space/park on existing lands between the relocated and existing highways). The second would create a corridor for a 4 lane Lahaina bypass road considerably above the proposed drainage channel. Both projects need to be carefully integrated into any proposed flood control plan, yet there is minimum discussion of this in the DEIS. The hundreds of acres of linear park proposed for the area mauka of the existing Honoapi`ilani Hwy and South of Kaua`ula stream could be configured to provide a potential buffer zone to absorb a portion of lower elevation flood waters and promote wildlife as an intermittent wetlands.

SIERRA CLUB p2



**3. Restore natural stream flows in Kaua`ula stream to enhance native aquatic species survival, beach replenishment and marine ecosystems:**
Kaua`ula stream is one of the major water ways of the West Maui mountains and contrary to US Fish & Wildlife description has historical evidence of perennial flows in pre-diversion times. An average of 6.5 million gallons a day has been diverted from the stream over the past 10 years. Kaua`ula does have native stream life present in its upper reaches, but in order to flourish these species must be able to access the waterway from the upper pools to live a portion of their life cycle in the ocean and then return upstream to spawn. A number of Kaua`ula residents and local community groups support a plan to set minimum stream flows for Kaua`ula stream that will restore year round flows and allow native streamlife to recover. They are actively working towards that goal and the possibility of stream restoration, not just the current diverted conditions, should be a considered factor in planning for this flood control project.
It would make sense for any public works project in the Kaua`ula watershed area to include features that support survival and recovery of native stream life populations.

The current channelization of Kaua`ula stream at is mouth is an impediment to native stream life. The proposed project creates another sedimentation basin area on the stream mauka of Honoapi`ilani Hwy, which could create further impediments. Bringing a large, rapidly traveling volume of floodwater into Kaua`ula stream at the debris basin area could also have negative impacts upon future attempts of stream life to survive. USFWS staff in their comments indicate little need to be concerned about native streamlife in the project area, but this is based on the assumption that stream flows able to support native aquatic species would not be restored. USFWS still rightly recommends non structural means of reduction and retention of floodwater to the extent feasible. This would minimize large volumes of flood water arriving at ocean at sites where this has not been regularly occurring.

Thank you for your efforts to address this important community concern and incorporate these suggestions into your planning process.

Daniel Grantham

Daniel Grantham
Chair, Sierra Club, Maui Group
(808) 572-4571 Email: dannyg@flex.com

SIERRA CLUB p.3

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
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COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
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Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Daniel Grantham
Sierra Club, Maui Group
P.O. Box 791180
Paia, Hawaii 96779

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Grantham:

Thank you for your letter dated June 22, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the order presented in your letter.

1. ***Response to comments in regards to "Increase storage capacity and recharge for fresh water within Lahaina Watershed and Launiupoko aquifer".***

The sugar-era irrigation water structures in the Lahaina subwatershed can only provide limited floodwater control. In the past, the plantation operators would shut off the water to the irrigation ditches in times of impending storms to allow them to handle storm runoff. It is estimated that the ditches could handle 50 to 100 cubic feet per second (cfs). Therefore, the Lahainaluna Ditch and the Lahaina Pump Ditch could probably divert a total of 100 to 200 cfs from the subwatershed. This contribution to floodwater reduction can be significant during the less intense storms such as the 2-year storm with a peak discharge of 264 cfs or the 5-year storm with a peak discharge of 678 cfs. However, during more intense storms, the contribution of these ditches is less significant as the peak discharges of the 50-year and 100-year storms are 2,097 cfs and 2,574 cfs, respectively. Sediment deposited into the ditches by the storms would require a constant level of maintenance (which was performed in the past by Pioneer Mill Company). Failure to maintain the ditch would greatly decrease the ditch's ability to carry storm waters.



Other ditches in the upper part of the subwatershed, such as the Paupau Ditch, do not flow toward a safe outlet and do not provide floodwater reduction.

The sugar-era reservoirs in Lahaina have limited capacity and cannot provide significant flood storage. The Wainee and Lahaina Pump reservoirs have storage volumes of less than 5 million gallons. Since these reservoirs were not designed for stormwater retention, rehabilitation and continuing maintenance will be required.

In summary, the existing agricultural ditches and reservoirs in Lahaina provide limited flood protection and will not satisfy the flood safety criteria for major storms (greater than 10-year, 24-hours). However, it is recommended that these ditches and reservoirs be maintained for irrigation purposes. Technical assistance is available through the NRCS conservation technical assistance program.

The hydrologic model indicates that the 100-year, 24-hour storm will result in the runoff of nearly 1,000 acre-feet or 330 million gallons of water from the Lahaina subwatershed. The 10-year storm results in 460 acre-feet or 150 million gallons. Approximately 80 percent of the runoff occurs in a four hour period during which the peak discharge occurs. If we assume a release rate for the flood retention reservoir is limited to 1,000 cfs (cubic feet per second), a storage volume of 310 acre-feet or 100 million gallons is needed. A 300 acre-foot reservoir, with a depth of 30 feet, will require approximately 14 acres of surface area. Additional land will be required to accommodate the footprint for the excavation and embankment of the reservoir. The 100 million gallon reservoir is estimated to cost $13.0 million before land acquisition costs.

Flood protection and water storage for other uses are not fully compatible uses of a reservoir. The designed water detention volume of the reservoir needs to be emptied as soon as practical to be ready to properly function in the next storm. Additional storage capacity to permanently store water can be designed as part of the reservoir project, but at a substantial cost. The proposed project offers the most cost-effective method of providing a substantially improved condition in relation to the benefits.

2. ***Response to comments in regards to "improved transportation access to Lahaina".***

The Lahaina Bypass is a State of Hawaii, Department of Transportation project which just recently completed a State and pending Federal Environmental Impact Statement review process. As mentioned in the DEIS, the plan for the Lahaina Bypass is conceptually developed at this stage and further design coordination will need to be carried out during project design to ensure provisions for drainage "flow through" features to maintain the integrity of the flood control diversion channel. The proposal to relocate Honoapiilani Highway a few hundred feet east (or mauka) of the existing alignment is also very conceptual at this stage. At this time, it appears that the northern terminus of the highway relocation is further south of the second outlet. While there still remains some uncertainty with regard to implementation timeframe and design parameters for the highway relocation, we believe that the grassed channel to the second outlet does provide functional flexibility should multi-use opportunities present itself in the future.

3. ***Response to comments in regards to "Restore natural stream flows in Kauaula Stream to enhance native aquatic species survival, beach replenishment and marine ecosystems".***

While the Lahaina Watershed Project does not include within its scope the restoration of native stream ecosystems, NRCS will consider modifications during the design of project structures, i.e., Kauaula debris basin, to facilitate migration of native amphidromous fish and other organisms.

Again, thank you for your comments to the DEIS.

Sincerely

Milton Arakawa

fw GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/slems

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HRD03/623B

June 3, 2003

Gilbert Coloma-Agaran
Director
Department of Public Works and Environmental Management
200 South High Street
Wailuku, Hawaii 96793

Re: Lahaina Watershed Flood Control Project

Dear Mr. Agaran,

OHA in receipt of your May 6, 2003 request for comments on the draft EIS for the above referenced project. We offer the following comments.

***Archaeological Resources***

OHA notes that one previously unidentified burial was located during testing and that there is a reasonable probability that other burials or cultural deposits may be found during ground excavating activities. A conceptual preservation plan which calls for in-place preservation has been reviewed and given tentative approval by the Maui Island Burial Council.

OHA requests a copy of the conceptual preservation plan. We are concerned that the burials not be unearthed during flood events. It is not clear whether the burial lies within the drainage path, or only in the right-of-way. Furthermore, nothing in the archaeological review provides any assurances that the burials will not be eroded during flooding.

OHA also requests that Maui County develop a mitigation plan for burials that may be found during ground excavation. While this is not required under law, an agreed upon plan for inadvertent discoveries prior to ground breaking ensures that process of deciding to preserve the burials in place or move them goes smoothly.

**Section 106 Consultation**

Under the National Historic Preservation Act (NHPA) the Federal Agency involved in this project is required to consult with Native Hawaiian Organizations if Native Hawaiian traditional or cultural sites are included in the area of effect. OHA is a recognized Native Hawaiian Organization under NHPA. However, OHA was not consulted regarding the Memorandum of Agreement for this project. Our letter of May 28, 2002 outlines the process for initiating 106 consultations with our office. Until OHA and other Native Hawaiian organizations are consulted, 106 consultations are not complete, and ground cannot be broken on this project. Should this project start before our Office is consulted, we will consider the Federal Agency associated with the project to be in violation of Federal law. We remind you that a Cultural Impact Assessment does not replace 106 consultations, although the processes can be run simultaneously.

***Cultural Impact Assessment***

OHA notes that you consulted with key members of Hawaiian organizations in Lahaina. All of the informants noted that there are no existing cultural practices in the uplands of Lahaina, with the exception of kuleana tenants in Kauaula Valley. However, the Cultural Impact Assessment does not address the impact of this project on shoreline cultural activities such as limu gathering and fishing.

Two species of culturally important limu will be affected by sediment at the second outlet. The DEIS states that the impact will be offset by the redistribution of limu development in the project area. However, the DEIS does not provide any evidence that limu growth will, in fact, be redistributed. Should there be less limu in the project area, Native Hawaiian practices will be impacted, as limu lipoa and limu kohu are both highly prized species of limu.

The DEIS also does not address the impact that redistributing limu growth will have on cultural practices. Will redistribution affect access to limu beds? Will it be easier or more difficult for Native Hawaiian Kupuna to pick limu in proposed new growth areas?

The same types of questions need to be answered in relation to fishing practices. Will the new outlets affect access to areas traditionally used for cultural practices? Will the redistribution of resources enhance or impede Native Hawaiians' ability to continue their traditional practices along the shore? The Final EIS must address cultural practices at the shore, as well as cultural practices in the uplands.

We also note that there will be less "red water" episodes in the Lahaina area. OHA questions whether "red water" is being diverted from the tourist areas of Lahaina to areas where cultural practices occur. The final EIS should address the impact of "red water" episodes on cultural practices.



***Access to Kauaula Valley***

Although the DEIS states that access to Kauaula valley is through Lahainaluna Road, in the past year, Kauaula Road has been repaired. Will the floodwater diversion system accommodate Kauaula Road as one of the five Mauka/Makai crossings of non-public roads?

***Current Development at Makila and Kauaula***

Your division has granted subdivision permits to Makila Land, LLC and Kauaula Land LLC for much of the land in the Kauaula sub-watershed. Does the proposed flood control project account for increased run-off due to impervious surfaces in the proposed subdivisions? OHA notes that Kauaula Land Company LLC was opposed to the project as of March 14, 2002.

***Mitigation***

The DEIS notes that long-term mitigation may be required for the Front Street beaches, and at Makila Point. However, no positive plans or resources are indicated for mitigation in the DEIS, thus OHA can only conclude that there will be no mitigating actions for this project. If that is the case, then the final EIS should address the long-term impacts on cultural practices, without mitigation.

OHA realizes that a flood control project is needed in Lahaina. However, the draft EIS presented does not fully address the full impact of the proposed project. We trust that the county will fully assess all impacts due to the project before breaking ground.

Thank you for this opportunity to comment. If you have further questions, please contact Pua Aiu at 594-1931 or e-mail her at paiu@oha.org.

Sincerely,

Peter L. Yee
Director
Nationhood and Native Rights

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
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BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Peter L. Yee
Director, Nationhood and Native Rights
State of Hawaii
Office of Hawaiian Affairs
711 Kapi`olani Boulevard, Suite 500
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Yee:

Thank you for your letter dated June 3, 2003 commenting on the subject project. We wish to provide the following information in response to your specific comments in the order presented in your letter.

1. ***Response to comments on Archaeological Resources***

A copy of the conceptual preservation plan will be sent under separate cover as requested. The conceptual preservation plan established a thick concrete shroud on top of the burial site to protect it from eroding during heavy storm runoff events. The location of the burial site is in the proximity of the makai channel berm. It is anticipated that the burial will be further protected by the berm.

Your comments regarding a mitigation plan for burials will be forwarded to the archaeological consultant for consideration as appropriate. All matters in connection with burial finds or mitigation plans will be coordinated with the State Historic Preservation Division and the Maui/Lana`i Islands Burial Council.



2. ***Section 106 Consultation***

Pursuant to the National Historic Preservation Act (NHPA), the U.S. Department of Agriculture, Natural Resources Conservation Service (the federal agency involved in the subject project), contacted the Office of Hawaiian Affairs by letter dated August 21, 2002 to initiate Section 106 Consultation. No formal response to this request has been received to date.

In response to the comments on cultural gathering practices and limu distribution, the Final EIS (FEIS) will incorporate the following information.

> A total of five (5) species of culturally important marine macroalgae (i.e. seaweed or "limu") were found during the 2002 survey work. These species are used locally as a traditional food source. They were Dictyopterus plagiogramma (limu lipoa), Asparagopsis taxiformis (limu kohu), Ulva fasciatus (palahalaha), Codium spp. (Wawae`iole), and Enteronmorpha spp. (`ele`ele). Of these, palahalaha is probably the least used today. At the site closest to the proposed new discharge site (D1), two out of the five culturally important species were found (limu lipoa and limu kohu).
>
> None of these species were observed at Site B, which is where Kauaula Stream discharges. Palahalaha and ele`ele were found at Site A1, which is a current discharge site. Because a discharge outlet can be associated with pulses of freshwater and nutrients, and because salinity and nutrient levels affect algal communities, movement of the outlet may alter the current algal distribution. Routing discharge to D1 (the second outlet location) may impact limu lipoa and limu kohu in this area. Conversely, removal of discharge from its current location(s) may balance this impact.
>
> Algae have rapid life cycles and can quickly re-establish themselves after a strong negative event. Since the second outlet will flow only during strong precipitation events, there will be long periods when the outlet will have no effect on the offshore biota. Algae can therefore regenerate a population in a matter of months after a storm discharge. There has been an increase of algae species inventoried throughout the study area from 1986 to 2002 (Refer to Tables 1 and 2). Moreover, since types and distribution of algae will be influenced more by salinity and substratum impacts which will be localized in the vicinity of the second outlet, the algal communities should continue to

flourish throughout the project area. Therefore, the need for mitigation is not anticipated.

Shoreline resources are readily accessible throughout the project area. Therefore, the gathering of limu or fishing practices in the project area will not be impeded by access constraints.

The "red water" episodes in Lahaina currently occurs throughout the project area from Lahaina Harbor in the north to the proposed second outlet location, as sediment laden storm runoff enters the ocean in the form of non-source point pollution during heavy rainfall events throughout the project area. The advantage of a point source outlet is that the plume is more likely to move offshore due to its initial momentum. Although "red water" episodes will continue to occur as a result of storm runoff along the entire West Maui coastline, peak-suspended sediment concentrations and the duration of the episodes will be significantly reduced in the project area. The reduction of "red water" episodes in the project area will have a positive benefit to cultural practices.

3. ***Response to comment on access to Kauaula Valley***

Kauaula Road is a non-public agricultural road. Five (5) crossing of the flood control channel are proposed in order to maintain access to upland agricultural areas. As mentioned in the DEIS, coordination with the landowners and users of the non-public roads will be carried out during the design phase of the proposed project in order to mitigate adverse impacts to agricultural and upland access.

4. ***Response to comment on current development at Makila and Kauaula***

The change in runoff from active sugar cane fields to fallow fields is considerable and has been considered in the recently updated hydrologic analysis for the project. With respect to the development of the upland agricultural lands, all landowners are responsible for addressing and mitigating drainage impacts. In this case, Makila Land Company, LLC and Kauaula Land Company, LLC will be responsible to provide detention and desilting basins within their respective agricultural subdivision developments to maintain current levels of runoff flowing from their lands (i.e., the fallow fields condition). Collectively, through these measures, it is anticipated that there will be no additional impacts to downstream or adjacent properties from the Makila and Kauaula developments.



5. ***Response to comment on mitigation***

The FEIS will expand on the long-term mitigation initiatives which may be required for the Front Street beaches and at Makila Point. In this regard, a monitoring program will be carried out to establish post-construction conditions to determine if more specific mitigation measures will be warranted.

Again, thank you for your comments and participation in the DEIS review.

Sincerely

Milton Arakawa
for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Dudley Kubo, NRCS
Carol Kawachi, NRCS
Michael W. Foley, Director, Maui County Dept. of Planning

com/dpwlahws/feis/responses/oha

JUN 2 3 2003

Director
County of Maui
Department of Public Works and Waste Management
200 South High Street
Wailuku, HI 96793

Brian Pellin, Maui Coordinator, Statewide Watershed Project
Department of Health: Clean Water Branch
PO Box 791761
Paia, HI 96779

RE: Comments for the Lahaina Watershed Flood Control Project Draft EIS

I would like to offer my input concerning the Lahaina Watershed Flood Control Project. I feel that the project goals and design should be restructured to provide a more comprehensive solution. The proposed project design addresses the symptoms, rather than the causes, of the flooding/sediment problems. The symptoms include both flooding and soil runoff, yet the underlying causes are the lack of vegetation in the former cane fields, the lack of infrastructure and dependable quantities of water for irrigation of the fields, and the severe erosion in the upper watershed caused by feral animals and invasive flora.

Social/Cultural Impacts

The area of Kauaula has been a place of conflict for the past several years, with recent changes in ownership and land use creating conflicts between neighbors. I believe that the Lahaina Watershed Flood Control Project, which in its present form is unacceptable to many of these neighbors, can provide the opportunity to create a win-win situation for all of the parties involved. Innovative solutions that would benefit the entire community's interests, and resolve these conflicts, should be incorporated into the goals of this project.

From my interviews with numerous stakeholders in the Lahaina Area, it is clear that everyone supports diversified agriculture and preservation/restoration of the entire ahupua'a (watershed), from the high elevation Forest Reserve areas to the nearshore waters.

Rather than creating a new river, as the proposal intends, I feel that restoring the existing streams would be a better long-term strategy. USDA-NRCS programs such as the Wildlife Habitat Incentive Program, Conservation Reserve Program, and others should be utilized to comply with and promote agricultural land uses, and to provide technical and monetary incentives for landowners. Upgrading the existing water distribution infrastructure and constructing additional water storage systems would benefit all stakeholders. Increased aquifer recharge at higher elevations should also be considered.

Cumulative Effects

A cumulative effect that was not addressed adequately were the effects of polluted runoff from the proposed Lahaina Bypass Road and future residential developments flowing into the proposed channel, then being dispersed into near-shore waters.

Supporting Research

I believe that the background research contained in the proposal is already obsolete, and will become more so, with the changes in land ownership/use that are rapidly occurring. Additional Geographic Information System (GIS) analysis, incorporating both historical and current remote sensing data, as well as historical and future land use plans, should occur. Better information leads to better decision-making.

Since actual construction of the Lahaina Flood Control Project will not occur for several more years, I think that interim measures should be implemented to address runoff/flooding. The incorporation of agricultural Best Management Practices, such as those used successfully by Maui Land & Pineapple Company to control erosion and polluted runoff, should occur.

More collaborative research and discussion is needed between the various Federal, State, County, and community organizations to create a long term vision for the Lahaina area, and to make use of the Lahaina Watershed Flood Control Project to achieve those goals.

Sincerely,

Brian Pellin

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

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BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Brian Pellin, Maui Coordinator
Statewide Watershed Project
P.O. Box 791761
Paia, Hawaii 96779

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Pellin:

Thank you for your letter received on June 23, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the same order as presented in your letter.

1. ***Response to comment that "the project goals and design should be restructured to provide a more comprehensive solution".***

A full range of alternatives to provide flood protection to the Lahaina watershed was evaluated during preparation of the DEIS and discussion of the alternatives has been expanded in the Final EIS. Non-construction alternatives were evaluated, but were found to be ineffective in preventing flood damage during high intensity storms. Land treatment practices planned and designed by NRCS were also considered but were deemed ineffective during storms exceeding the 10-year recurrence storm. The selected alternative was deemed viable and preferred based on hydrologic and marine impact considerations. The proposed flood control system is designed to handle storm water runoff for a 100-year storm event.

2. ***Response to comments on Social/Cultural Impacts***

The assessment of cultural impact considerations in the DEIS included discussion of land management practices and recent initiatives by the West Maui Soil and Water Conservation District (WMSWCD) in collaboration with landowners and



stewards in the Lahaina watershed to manage storm water runoff. A range of alternatives were evaluated to provide flood protection to the Lahaina watershed which included both non-structural and structural measures. Land treatment or conservation practices recommended by NRCS listed and described in the NRCS National Handbook of Conservation Practice include, but are not limited to, conservation cover, critical area planting, diversion dam, deep tillage, terracing, field borders and filter strips. The NRCS Field Office Technical Guide provides standards and specifications for the design and installation of the practices. Land treatment practices are generally intended to control runoff and provide soil erosion protection during frequently occurring storms. NRCS standards for enduring land treatment practices require a minimum capacity to handle the 10-year, 24-hour storm without overtopping or other failure. Most structures installed by landowners, even with financial assistance, will lose their erosion reduction and water handling effectiveness as the storm intensity nears the 10-year storm. Failure of some of the structures resulting from embankment or waterway erosion can be expected during storms exceeding the 10-year storm intensity. As previously mentioned, the proposed flood control system is designed for the 100-year storm event.

Land treatment of the upper Lahaina subwatershed areas can be implemented under the NRCS's conservation technical assistance program, which in coordination with the West Maui Soil and Water Conservation District, provides landowners and stewards with conservation planning and design assistance and financial assistance for practice installation. In response to comments and interest from the community to participate in such a program, information and discussion will be provided on land treatment programs and assistance in the FEIS.

Upgrading the existing water distribution infrastructure in the Lahaina subwatershed can provide limited floodwater control. During the active sugar-era, plantation operators would shut off the water to the irrigation ditches in times of impending storms to allow the ditches to handle storm runoff. It is estimated that ditches could handle volumes of 50 to 100 cubic feet per second (cfs). Therefore, the Lahainaluna Ditch and the Lahaina Pump Ditch could probably divert a total of 100 to 200 cfs from the subwatershed. This contribution to floodwater reduction can be significant during the less intense storms such as the 2-year storm with a peak discharge of 264 cfs or the 5-year storm with a peak discharge of 678 cfs. However, during the more intense storms, contribution of these ditches is less significant as the peak discharges of the 50-year and 100-year storms are 2,097 cfs and 2,574 cfs, respectively. Other ditches in the upper part of the subwatershed, such as Paupau Ditch, do not flow toward a safe outlet and do not provide floodwater reduction.

Constructing additional water storage was evaluated, but deemed to be cost prohibitive. Two structural approaches to deal with floodwater control in the United States include channelization and detention. Floodwater detention consists of the installation of a storage reservoir to receive and temporarily store the floodwater, while releasing water at a rate not exceeding the capacity of downstream channels. The hydrologic model indicates that the 100-year, 24-hour storm will result in the runoff of nearly 1,000 acre-feet or 330 million gallons of water from the Lahaina subwatershed. The 10-year storm results in 460 acre-feet or 150 million gallons. Approximately 80 percent of the runoff occurs in a 4-hour period during which the peak discharge occurs. A flood retention reservoir to include the Kauaula subwatershed would be considerably larger than the Lahaina subwatershed. We note that a reservoir for flood protection is not fully compatible with a reservoir for water storage and other uses. In the case of flood protection, the designed water detention volume of the reservoir needs to be emptied as soon as practicable in order to be ready to properly function in the next storm. Additional storage capacity to store water for other uses will, therefore, be required as part of the reservoir design. This will add a substantial cost to the project.

***3. <u>Response to comments on cumulative effects</u>***

The cumulative impacts of the Lahaina Flood Control Project, together with the proposed Pu`unoa agricultural subdivision and the proposed Pu`unoa affordable housing subdivision, and the proposed Lahaina Bypass, will be considered in the Final EIS in regards to the following impact parameters: topography; plant and animal life; noise and air quality; visual resources; cultural resources; water quality; housing and land use; public services; and infrastructure. Based on the consideration of these parameters, the proposed project is not anticipated to result in adverse cumulative or secondary impacts.

***4. <u>Response to comments on Supporting Research</u>***

The background research contained in the DEIS included an updated hydrologic analysis to reflect the change in runoff from active sugar cane fields to fallow fields, as well as a marine biological survey and water quality analysis. The new information obtained from this research builds upon earlier studies to provide a historical body of knowledge pertaining to physical environmental parameters in the study area. The FEIS will be updated to reflect the current plans that are proposed for the surrounding agricultural lands. In this regard, we note, in accordance with Maui County Code (MCC) Chapter 20.08 Soil Erosion and Sedimentation Control and Title 15, rules for the design of storm drainage facilities in the County of Maui, all landowners are responsible for addressing and mitigating drainage impacts.



With respect to the development of the upland agricultural lands, in this case Makila Land Company, LLC and Kauaula Land Company, LLC will be responsible to provide detention and desilting basins within their respective agricultural subdivision developments to maintain current levels of runoff flowing from their lands (i.e., the fallow fields condition). Collectively, through these measures, it is anticipated that there will be no additional impacts to downstream or adjacent properties from the development of the former agricultural lands.

Interim measures to address management of storm runoff were identified in the DEIS, Chapter II.C.5.b. The WMSWCD with assistance from NRCS will continue to work with landowners and stewards in the project area to improve storm runoff management in the project area.

Again, thank you for your comments and review of the DEIS,

Sincerely,

Milton Arakawa

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpw/ahws/feis/responses/pellin

LINDA LINGLE
GOVERNOR OF HAWAII

JUN 24 2003

GENEVIEVE SALMONSON
DIRECTOR

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June 23, 2002

Mr. Joe Krueger
Department of Public Works and Waste Management
County of Maui
200 South High Street
Wailuku, Hawai'i 96793

Mr. Dudley Kubo, Water Resources Planner
Natural Resources and Conservation Service
United States Department of Agriculture
P.O. Box 50004
Honolulu, Hawai'i 96850

Mr. Michael Munekiyo
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawai'i 96793

Dear Messrs. Krueger, Kubo, and Munekiyo:

Having reviewed the draft environmental impact statement for the Lahaina Watershed Flood Control Project, Tax Map Keys 4-6-13, parcels 1 and 6; 4-6-14:1; 4-6-15:1; 4-6-18:3; 4-7-01:2; and 4-7-2, parcels 4 and 5, in the judicial district of Lahaina, the Office of Environmental Quality Control offers the following comments for your consideration and response:

1. *BEACH NOURISHMENT:* Reduction in sediment discharge from Kaua'ula Stream and Puamana Channel will likely result in loss of sand from area beaches and beach nourishment has been proposed in the DEIS as a mitigation measure. In 2000, the Department of Land and Natural Resources issued an environmental assessment for a plan for beach nourishment and restoration throughout the State of Hawai'i as a viable alternative to shoreline armoring (see, Finding of No-Significant Impact and Final Environmental Assessment, Hawaiian Islands Beach Nourishment Projects, June 8, 2000, *Environmental Notice*). The plan is an attempt to address the major social, economic, and environmental problems caused by coastal erosion. Also, the plan calls for the implementation of a statewide Conservation District Use Permit and State Program General Permit in order to streamline the permitting process for small scale beach nourishment projects, and consolidate permitting within one agency. Although beach nourishment may be the only feasible solution to the problem of coastal armoring and shoreline erosion, it is highly labor and cost-intensive and only provides a temporary solution. Nourishment will have definite impacts on quarried areas (e.g. sand dunes and the biological communities and historic-archaeological resources they contain) as future replenishment sources of sand need to be identified.



2. *NATIVE VEGETATION FOR LANDSCAPING*: Please consider the use of native xerophagic vegetation in the landscaping of the project. Please refer to our internet website, above, for more information on native species.

In closing, we would like to commend you on the preparation of a thorough and complete document under Chapter 343, Hawai'i Revised Statutes, which can only come about through extensive early assessment and consultation. If there are any questions, please call Leslie Segundo, Environmental Health Specialist, at (808) 586-4185. Thank you for the opportunity to comment.

Sincerely,

Genevieve Salmonson

GENEVIEVE SALMONSON
Director

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

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Solid Waste Division

November 24, 2003

Genevieve Salmonson, Director
State of Hawaii
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Ms. Salmonson:

Thank you for your letter dated June 23, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the order presented in your letter.

1. ***Response to comment on Beach Nourishment***

We acknowledge your comments regarding the initiative of the Department of Land and Natural Resources for a plan for beach nourishment and restoration throughout the State of Hawaii and will keep abreast of this initiative as it relates to the Lahaina Flood Control project. As identified in the DEIS, it is proposed that to the extent compatible, the sediment trapped in the sediment basins and the Kauaula debris basin will provide a source material to replenish the beaches and Makila Point.

2. ***Response to comment on Native vegetation for landscaping***

We confirm the use of native xerophagic vegetation will be considered in the project landscaping since it will lessen the irrigation requirements and conserve the use of water.



Again, thank you for your comments.

Sincerely,

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/oeqc

FRIENDS OF
MOKU'ULA, INC.
Ka Wā Mamua, Ka Wā Mahope
The Future is in The Past

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Fax (808) 661-1676
505 Front Street, Suite 234
Lāhainā, Maui, Hawai'i 96761
E-mail: friends@mokuula.com
www.mokuula.com

June 23, 2003

Via Facsimile: 270-7955

Mr. Gilbert Coloma-Agaran, Director
Department of Public Works
and Environmental Management
200 South High Street
Wailuku, HI 96793

**SUBJECT: Lāhainā Watershed Flood Control Project**

Dear Mr. Coloma-Agaran:

On behalf of the Friends of Moku'ula, Inc., the following are our comments to the Lāhainā Watershed Flood Control Project Draft Environmental Impact Statement.

1. The report should include the pros and cons for using Mokuhinia as a sediment basin for the Lāhainā Watershed Flood Control Project.

2. There should be ongoing consultation and communication between the Friends of Moku'ula, Inc. and the County of Maui, Department of Public Works and Environmental Management; US. Department of Agriculture; Natural Resources and Conservation Service; West Maui Soil and Water Conservation District, Munekiyo & Hiraga, Army Corps of Engineers and Townscape, Inc.

3. The full impact of the Lāhainā Watershed Flood Control Project cannot be accurately ascertained as this Draft Environmental Impact Statement addresses only the mauka portion of the project.

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4. Therefore, this EIS should not be approved until the Draft Environmental Impact Statement for the makai portion is also completed.

Have studies been done on the impact of the existing Kahoma Flood Control Project, and if so, that study should also be included in this report?

Sincerely,

Akoni Akana

Akoni Akana
Executive Director

AA:sak

Cc: Mayor Alan Arakawa, Fax #270-7870
Michael Foley, Director; Dept. of Planning, Fax #270-7634
Michael Munekiyo, Munekiyo & Hiraga, Fax #244-8729
Genevieve Salmonson, Director, QEQC, Fax #(808) 586-4186

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
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MILTON M. ARAKAWA, A.I.C.P.
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DEPARTMENT OF PUBLIC WORKS
AND ENVIRONMENTAL MANAGEMENT
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LLOYD P.C.W. LEE, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Akoni Akana, Executive Director
Friends of Moku`ula
505 Front Street, Suite 234
Lahaina, Hawaii 96761

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Akana:

Thank you for your letter dated June 23, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the order presented in your letter.

1. ***Response to comment regarding the pros and cons of using Mokuhinia as a sediment basin for the Lahaina Flood Control Project***

In the discussions of alternatives in the DEIS (Chapter VI), it was mentioned that several alternatives were considered which incorporated an outlet channel through the Lahaina Town area. However, high project costs and environmental concerns about sediment discharge within the fringing reef fronting the town area gave low priority to these alternatives.

A sediment basin is designed to allow the storm water to pass through, while trapping the sediments in the basin. Therefore, to use Mokuhinia as a sediment basin, a safe marine outlet to discharge the water will be required. The sediment basin would also require cleaning and maintenance in order to function properly and be ready for the next storm event. In the arid climate of West Maui, the flood control channel will only flow during strong precipitation events, so there will be long periods when the channel will be dry and water will not be available to feed Mokuhinia.



In considering the possible viability of having Mokuhinia function as a flood retention reservoir, the following storm hydrology parameters were reviewed. The hydrologic model indicates that the 100-year, 24-hour storm will result in the runoff of nearly 1,000 acre-feet or 330 million gallons of water from the Lahaina subwatershed. The 10-year storm results in 460 acre-feet or 150 million gallons. Approximately 80 percent of the runoff occurs in a four hour period during which the peak discharge occurs. If we assume a release rate for the flood retention reservoir is limited to 1,000 cfs (cubic feet per second), a storage volume of 310 acre-feet or 100 million gallons is needed. A 300 acre-foot reservoir, with a depth of 30 feet will require approximately 14 acres of surface area. Additional land will be required to accommodate the footprint for the excavation and embankment of the reservoir. The 100 million gallon reservoir is estimated to cost $13.0 million before land acquisition costs. The use of the reservoir for flood protection is not fully compatible with a reservoir for water storage and other uses. In the case of flood protection, the designed water detention volume of the reservoir needs to be emptied as soon as practicable in order to be ready to properly function in the next storm. With these factors in mind, the use of Mokuhinia as a sediment basin or a flood retention reservoir was deemed incompatible with overall project goals and objectives.

2. ***Response to comment regarding ongoing consultation.***

The County of Maui is the local sponsor for the Moku`ula Restoration Study carried out by the Army Corps of Engineers and their consultant, Townscape, Inc. Therefore, on going consultation and communication for these two (2) projects will be coordinated by the County of Maui.

3. ***Response to comment , "The full Impact of the Lahaina Watershed Flood Control Project cannot be accurately ascertained as this DEIS addresses only the mauka portion of the project."***

The impacts assessed in the DEIS are based on the entire action associated with the proposed improvements. Alternative design considerations (including improvements through Lahaina town) will be addressed in the Final EIS. There are no additional development components associated with the project. We note that the proposed action does not involve a commitment to larger actions.

4. ***<u>Response to comment that, "the EIS should not be approved until the DEIS for the makai portion is also completed".</u>***

See response to Item 3 above.

5. ***<u>Response to the comment regarding the Kahoma Flood Control project.</u>***

The Kahoma Flood Control project was carried out by the Army Corps of Engineers. An Environmental Statement was carried out for this project and published in October 1974. Reference to the report by the Office of the Chief of Engineers, Department of the Army, <u>Final Environmental Statement, Kahoma Stream Flood Control Project, Maui, Hawaii</u>, October 1974 will be cited in the FEIS.

Again, thank you for your comments and review of the DEIS.

Sincerely,

Milton Arakawa

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlshws/feis/responses/mokuula



**UNIVERSITY OF HAWAI'I AT MANOA**
**Environmental Center**

June 23, 2003

RE: 0736

Joe Krueger
County of Maui
Dept. of Public Works and Waste Management
200 South High Street
Wailuku, HI 96739

Dear Mr. Krueger:

Draft Environmental Impact Statement
Lahaina Watershed Flood Control Project
Lahaina, Maui

The County of Maui, Department of Public Works and Environmental Management (DPWEM) and the West Maui Soil and Water Conservation District (WMSWCD), in partnership with the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) propose the implementation of a floodwater diversion system in the Lahaina Watershed. The proposed project is intended to reduce flooding and erosion problems on land and to relieve the effects of excess sedimentation on the near shore coral reefs.

The project design involves the construction of a floodwater diversion system that starts south of Lahainaluna Road at approximately 153.0 feet above mean sea level and extends across the watershed in a southwesterly direction to a debris basin at Kauaula Stream. The proposed project includes the construction of an inlet basin and three sediment basins. The debris basin at Kauaula Stream provides a primary outlet to a 3,600 foot long grass-lined channel with a sediment basin, leading to a shoreline outlet. A secondary spillway is also proposed to release flows to the existing concrete lined Puamana channel during higher flow events.

This review was conducted with the assistance of Ed Laws, Oceanography and Glen Shepherd, Maui Community College.

2500 Dole Street, Krauss Annex 19, Honolulu, Hawai'i 96822-2313
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

Mr, Muraoka
Page 2

**General Comments**

We acknowledge the need for some kind of flood mitigation in the Lahaina area. Flooding and the effects of sedimentation have been a real concern there for some time. Overall, this document appears to be well written and comprehensive in its approach to most issues. We commend the preparers of this document on their diligence in complying with the EIS rules. All required sections are included and most areas of concern are well addressed. From a water pollution standpoint our reviewers feel that the overall impact of this project would be beneficial by reducing the overall sedimentation into the ocean. Also, we are pleased to see that the diversion channels will be mostly grass-lined which will still allow for some percolation of runoff water. This is a far better design than the solid concrete storm sewers that are so common on Oahu. We do have some concerns, however.

*(p. 14) The grass-lining is to be kept viable through irrigation and fertilization and mowed to prescribed length*

1) Has the idea of planting other vegetation such as shrubs or small trees within or around the ditches to further slow down the velocity of transport been explored?

2) Where will this irrigation water come from? Has a non-potable source been explored?

3) Has the use of native species that do not require irrigation or fertilizer been explored? This area is already plagued with blooms of nuisance algae associated with excess nutrients (p. 65).

**Beach Erosion**

There is no question that well-intentioned efforts to control flooding through engineering projects such as dam construction have in some cases dramatically reduced the natural transport of sediment to the ocean. This has caused serious beach erosion and land subsidence problems in some coastal areas. Although the reduction in overall sediment will not be large (25%), there will be a substantial redistribution in the pattern of release. This could have significant implications for accelerated beach erosion along Front Street. The authors of the EIS seem to be aware of this issue and acknowledge that beach nourishment programs may be necessary to prevent beach erosion. These beach nourishment programs can be quite costly especially if they are needed for the life of the flood control ditches.

1) Who would be responsible for beach nourishment?

Also our reviewers feel that carbonate sediment would be a better choice for beach nourishment than terrigenous sediment from the sediment basins (p. 66, a). Using carbonate sand would better restore these beaches to a more natural condition. The 54% terrigenous sediments that make up the Front Street beaches now are likely the result of already degraded



Mr, Muraoka
Page 3

beaches. The natural carbonate sediment that may naturally recharge the Front Street beaches may not reach them due to existing human intervention that inhibits natural carbonate sediment transport.

1) Where would the nurishment sand come from, especially if the sediment from the catch basin proves to be inappropriate?

Thank you for the opportunity to comment on this Draft EIS.

Sincerely,

David B. Sims

David B. Sims
Environmental Reviewer

cc: OEQC
Mayor, County of Maui
Michael Muneldyo, Munekiyo & Hiraga, Inc.
James Moncur

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

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November 24, 2003

David B. Sims
Environmental Center
University of Hawaii at Manoa
2600 Dole Street
Kraus Annex 10
Honolulu, HI 96822-3980

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Sims:

Thank you for your letter dated June 23, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the same order presented in your letter.

1. ***Response to the idea of planting other vegetation such as shrubs or small trees within or around the ditches to further slow down the velocity of transport.***

The flood control channel has been conceptually designed with a 0.20 to 0.35 percent grade to maintain flow but to minimize scouring and erosion within the channel. Providing shrubs and small trees within the ditches to further slow down the velocity would create maintenance problems and were therefore, not considered as a project element to effectively reduce flow velocities.

2. ***Response to source of irrigation water and if non-potable sources have been considered.***

To the extent possible, native plant species will be used to provide vegetative cover and maintain the side slopes of the flood control channel. Native plants adapted to



the area will conserve water and also protect the watershed from degradation due to invasive alien species. The closest source of non-potable irrigation water is from the Lahaina Wastewater Treatment Facility located approximately 5 miles north of the project area. Therefore, potable water will have to be used for irrigation purposes.

3. ***Response to whether the use of native species that do not require irrigation or fertilizer been explored.***

See response to Item 2.

4. ***Response to who would be responsible for beach nourishment.***

The County of Maui will be responsible for project maintenance and if required, for beach nourishment. As mentioned in the DEIS, one of the expected outcomes of the proposed project would be a greater influx of carbonate sand on the beaches due to invigorated reef-ecosystems off Lahaina Town. Carbonate sand was not recommended for beach nourishment due to limited source supplies and costs. Sediment trapped by the project will have to be periodically removed from the basins. This sediment can be processed to remove silts from sand and placed on the beach for the nourishment program. This would not only be the most cost effective alternative but also appropriate in the circumstances since the beaches fronting Lahaina Town are characterized by a high percentage terrigenous sand. Based on the coastal processes assessment carried out for the DEIS, terrigenous sediment has been transported to the Front Street beaches long before the modern era and is a natural occurrence. The coastal processes assessment did not identify "existing human intervention" that inhibits natural carbonate sediment transport in the project area.

5. ***Response to where the nourishment sand come from, especially if the sediment from the catch basin proves to be inappropriate.***

See response to Item 4.

Again, thank you for your comments to the DEIS.

Sincerely,

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/uhenvclr

JUN 2 7 2003

PUAMANA COMMUNITY ASSOCIATION
34 Puailima Place, Lahaina, Maui, Hawaii 96761
Tel. (808) 661-3423/Fax (808) 667-0398/Email: ~~pca@aloha.net~~ puamana.us

May 23, 2003

Michael T. Munekiyo, AICP
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

RE: Draft Environmental Impact Statement (E.I.S.), Lahaina Watershed Project

Aloha Mr. Munekiyo:

This letter is in response to the May 1, 2003 letter from the Department of Public Works concerning comments on the Draft E.I.S. for the Lahaina Watershed Flood Control Project. The Puamana community is indeed impacted by the current lack of adequate flood control protection within the subject area. Puamana is in favor of the above referenced project, which potentially will have a positive impact on the community of Puamana as well as the Lahaina area in general. Currently the Community is not in favor of the Kaua'ula Stream Single Outlet Alternative reflected on page 120 of the Draft.

We have a few issues to present, some of which were initially raised in the Final Watershed Plan and Environmental Assessment dated August 1992. On page 67 of the Draft it reads "The proposed project is estimated to reduce total annual sediment outflow by approximately 25%." The Draft further states that 59% of the sediment type falls within the clay sized category. Finally, the Draft states that this material will remain "fully suspended into the ocean". What action will be taken during the construction phase to insure that a significant increase in sediment discharge will not occur when a rain event occurs?

Currently there are at least two active plans concerning a Lahaina By-pass and/or the Pali to Puamana Beach park. Will there be a requirement to eliminate the second proposed outlet based on these projects? In addition, the landowner mauka of the current Honoapiilani Highway has continued efforts to develop the agricultural land on the South side of the Kaua'ula Stream. What changes if any will be necessary to preclude the increase of unplanned for or undesirable materials into the stream?

One of the key issues to the Puamana Community remains the future maintenance of the created structures. (OM & R costs in general) Failure to properly maintain the diversion channel, sediment basins or the debris basin at Kaua'ula Stream have a definite negative impact on both the property and homes within Puamana as well as the ocean ecosystems at the outlet of Kaua'ula Stream. Based upon the data presented on page 118, it may well be worth the initial Shotcrete expense in the long run.

Sincerely,

Richard A. Meaney
General Manager

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
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JOHN D. HARDER
Solid Waste Division

November 24, 2003

Richard Meaney, General Manger
Puumana Community Association
34 Puailima Place
Lahaina, Hawaii 9676

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Meaney:

Thank you for your letter dated May 23, 2003 to Michael Foley, Director of Planning, commenting on the subject project. We wish to provide the following information in response to your comments in the same order presented in your letter.

1. ***Response to comment "What action will be taken during the construction phase to insure that a significant increase in sediment discharge will not occur when a rain event occurs?"***

Pursuant to Maui County Code, Chapter 20.08. Soil Erosion and Sedimentation Control, an erosion control plan will be prepared. This plan will identify best management practices (BMPs) to the maximum extent practicable to prevent or reduce pollutants from water bodies, in discharges from a construction site. Site inspections will be carried out regularly during project construction to ensure the contractor is performing the work in accordance with approved plans.



2. ***Response to comment, "Currently there are two active plans concerning a Lahaina Bypass and or the Pali to Puamana Beach Park. Will there be a requirement to eliminate the second proposed outlet based on these two projects?"***

In regards to the plans concerning the Lahaina Bypass, no changes to the proposed second outlet are anticipated as a result of these two projects. Since the Lahaina Bypass design is only preliminarily formulated at this time, issues pertaining to the functional integration of the drainage design of the Lahaina Bypass and the proposed flood control project still need to be resolved. However, review of the Cumulative Impact Analysis contained in the Record of Decision, Honoapiilani Highway (Route 30) Launiupoko to Honokowai, Lahaina Bypass Project, issued by the U.S. Department of Transportation, Federal Highway Administration indicate that no adverse impacts are anticipated for the proposed flood control project. The need for further design coordination has been identified and will be carried out to ensure the functional integrity of the two projects.

In regards to the plans concerning the Pali to Puamana Beach Park, no information has been received indicating the requirement to eliminate the second proposed outlet. The proposed outlet will be built under the existing Honoapiilani Highway and therefore, no adverse impacts are anticipated on the future land uses. The proposed flood control system is compatible with the open space designation as established in the West Maui Community Plan. Drainage outlets are permitted land uses within Open Space districts by the Maui County Code.

3. ***Response to comment, "What changes if any will be necessary to preclude the increase of unplanned for or undesirable materials into the stream?"***

The FEIS will be updated to reflect the current plans that are proposed for the surrounding agricultural lands. In this regard, we note, in accordance with Maui County Code (MCC) Chapter 20.08 Soil Erosion and Sedimentation Control and Title 15, rules for the design of storm drainage facilities in the County of Maui, all landowners are responsible for addressing and mitigating drainage impacts. With respect to the development of the upland agricultural lands, in this case Makila Land Company, LLC and Kauaula Land Company, LLC will be responsible to provide detention and desilting basins within their respective agricultural subdivision developments to maintain current levels of runoff flowing from their lands (i.e., the fallow fields condition). Collectively, through these measures, it is anticipated that there will be no additional impacts to downstream or adjacent properties from the development of the former agricultural lands.

4. ***Response to comment, "Based upon the data presented on page 118, it may be worth the initial Shotcrete expense in the long run."***

The operation, maintenance and replacement (OM & R) of the proposed structural improvements have been estimated to cost approximately $260,000.00 per annum and will be the responsibility of the County. Included in this cost estimate is a regularly scheduled clean out of sediment deposits in basins and channels. A condition of federal funding is an undertaking by the County that OM & R funding will be available for the proposed project. The County Council will review the OM & R costs of the proposed project and will determine the selected surfacing alternative.

We note your support for the proposed project and that the Puumana Community Association is not in favor of the single Outlet Alternative using Kauaula Steam and Puumana channel.

Again, thank you for your comments and review of the DEIS.

Sincerely,

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/puumana

JUL 0 1 2003

**United States Department of the Interior**
OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1111 Jackson Street, Suite 520
Oakland, CA 94607

June 30th, 2003

ER: 03/442

Lawrence Yamamoto, State Conservationist
Natural Resources Conservation Service
United States Department of Agriculture
P.O. Box 50004
Honolulu, Hawaii 96850

Subject: Review of Draft Environmental Impact Statement for the Lahaina Watershed Flood Control Project, County of Maui, Hawaii

Dear Mr. Yamamoto:

The Department of the Interior has received and reviewed the subject document and has the following comments to offer.

We understand the project involves construction of a floodwater diversion system to extend across the Lahaina watershed on the island of Maui. The purpose of the proposed project is to reduce flooding, and to control land erosion and sediment deposition onto nearshore coral reefs. A grass-lined diversion channel will be constructed with reinforced concrete channel reaches at specified locations.

A debris basin will be constructed at Kauala Stream to serve as the primary outlet with sediment basins and a shoreline outlet. A new secondary outlet and sediment basin will be constructed about 3,600 feet south of the Kauala Stream and will discharge runoff into the marine environment. The project is intended to provide a 100-year level of flood protection. Total annual sediment outflow will be reduced by about 1,320 tons, or 25 percent, from current conditions.

**General Comments**

Analysis: We recommend that the DEIS provide a description of macro-algae abundance or distribution, an evaluation of project-related discharges and associated cumulative effects to these macro-algae species or other marine organisms, as well as a discussion of possible mitigation of these effects.

Adding this information would contribute to a better informed decision and would help determine if mitigation relative to these effects would be appropriate. We also note that without this information it is difficult to understand the DEIS's conclusion that the proposed alternative is the least environmentally damaging, practicable alternative.

An important feature of the proposed action is that while overall sediment discharge is expected to be reduced by 25 percent, the proposal would significantly concentrate water discharge and associated sediment and nutrient load into one area. The resulting effects in the discharge area would be much greater than under current conditions. On balance this may or may not be a substantially improved situation. The analysis in the DEIS does not, however, appear to provide all of the information necessary to make that determination.

To address this feedback we recommend the DEIS include a detailed description of discharged sediments, fresh water, and nutrients and provide an effects analysis of this discharge upon the marine community. In this analysis we recommend addressing the items in the bullet list below.

- What is the percent algal coverage that may be affected by project-related discharges?
- Does seagrass occur within the vicinity of the project area? If so, will seagrass beds be degraded as a result of the proposed activity?
- How will project-related discharges affect sea turtles that may rest or forage within the project area?
- How will the proposed new discharge affect herbivorous fish and macroinvertebrate populations if macro-algal species are degraded?
- Will the cumulative effects of the proposed discharge result in algal blooms and degrade coastal resources?

Adding this important information will also help to achieve the intent of Executive Order 13089, Coral Reef Protection, which directs Federal agencies to: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.

Maps: We note that the maps had no scale and no common base, and many features are not named. This made it difficult to compare the maps and resulted in limited utility, so we recommend adding this important detail. We also recommend all features named in the text be displayed on the relevant maps.



**Specific Comments**

Page 1 and 10: It would be helpful to the reader if the Hawaiian words *mauka* and *makai* were defined where they are first used in the text.

Page 4, Paragraph B: Sentence 5 states, "Sedimentation and floodwater runoff are also recognized as a threat to the coral reef and marine ecosystems." We appreciate your concern for coral reef ecosystem values by recognizing that project-related discharges of sediments and floodwater may negatively impact nearshore marine resources. The proposed project may also result in the discharge of nutrients (bound to sediments) into the marine environment and artificially raise their levels.

If nutrient loading occurs, macro-algae may expand beyond natural boundaries at rates that may exceed consumption by herbivorous predators. We recommend, therefore, revising the sentence to read as follows, "Sedimentation, nutrients and floodwater runoff are also recognized as threats to the coral reef ecosystems."

Page 17, Hydrogeology: We recommend the text indicate the source of recharge to ground water. If the water proposed for diversion to the sea in this DEIS represents recharge that will be lost to the system, we recommend this be identified and described as an impact in the analysis section of the document.

Conversely, if the inclusion of detention basins will produce a net increase in ground-water recharge, we recommend that this information be provided to decision makers as well.

Page 25, Paragraph 2: Sentences 2 & 3 state "The Golden-plover or Kolea (*Pluvialis fulva*), Black-crowned Night Heron or Auku 'u (*Nycticorax nycticorax hoacti*), and the Hawaiian Owl or Pueo (*Asio flammeus sanwichensis*) are also found within the vicinity of the proposed project site. These species are considered indigenous but not listed as federally endangered."

The Golden-plover and the Black-crowned Night Heron are protected under the Migratory Bird Treaty Act (MBTA) (16 USCS 703-712). The Short-eared Owl or Pueo, an endemic species of the main Hawaiian Islands, is also afforded protection under the MBTA and is listed as endangered by the State of Hawaii.

We recommend these designations be included in your description because they communicate the level of importance that effects to these species would have.

Page 25, Paragraph 4: Sentence 3 states "An important resource in the intertidal habitat fronting the project site is the locally developed stands of algae which is an important forage food for the threatened (green sea) turtle (*Chelonia mydas*)." We agree that certain macro-algae occurring within the proposed project site are preferred as forage items by green sea turtles.

We recommend that Chapter 2 of the DEIS be augmented to list species of macro-algae that occur within the proposed project site and are consumed by green sea turtles. For example, at marine survey site "D," five marine algae from the genera *Acanthophora*, *Cladophora*, *Dictyosphaeria*, *Hypnea* and *Microdictyon* are known to serve as forage for green sea turtles (NOAA-TM-NMFS-SWFSC-294). This would facilitate a more complete discussion in Chapter III, Potential Impacts and Mitigation Measures, of the full range of potential negative effects to green sea turtle forage habitat.

<u>Page 36, Water Quality</u>: Additional background information, specifically information regarding the potential contribution of land-derived constituents in overland runoff, would help put the water-quality sample information in context. In addition to the current data provided in Appendix A, information on the magnitude and timing of the last rainfall or other source of contribution from the land would be helpful. We recommend indicating whether runoff was present or not and stating if these conditions would affect whether the samples would accurately reflect background conditions.

<u>Page 38, Paragraph e</u>: Sentence 3 states "Nutrient (ammonia, nitrate + nitrite, total nitrogen, and total phosphorus) values collected in March and April 2002 off the project coastline tended to be low and not particularly variable from place to place." We also believe there is value in collecting sediment samples in addition to the water samples referenced in this sentence and screening them for nutrients since marine plants may uptake nutrients via marine sediments. These data will assist in the impact analysis of project-related discharges and their potential effects upon the marine algae community.

We recommend sediment sampling occur within the shallow nearshore marine environment surrounding the current discharge at Kauaula Stream, at the proposed new secondary discharge outlet, and at other representative locations. We recommend sediments at these locations be screened for nutrients and the results used as pre-construction information.

<u>Page 62, Discharge Plume Modeling</u>: We recommend the text indicate more clearly that the model describes the plume of freshwater and that, because of density difference between freshwater and saltwater, plume mixing and extent may not be a good predictor for the distribution of sediment.

<u>Page 65, Paragraph 2</u>: Sentences 3 and 4 state, "The studies suggest that groundwater inputs are more significant than episodic stream inputs. Therefore, the proposed project is not anticipated to have a significant impact on benthic algal growth in the project area." We generally agree that groundwater inputs of nutrients may be greater than stream inputs. However, this does not mean that stream inputs should be completely discounted.

Nutrients that are bound to sediments and discharged from stream outlets may represent a cumulative factor and affect the nearshore marine environment. It appears that additional analysis



is needed to support the conclusion that this project would not have a significant impact on the benthic algal community.

<u>Page 66, Paragraph c</u>: The text reports a "general increase in turbidity can be expected." Because the assumed origin of the sediment is partly from fallow fields, there may be issues of residential agricultural pesticides. We recommend providing more specific information regarding the chemical quality of the sediment.

<u>Page 115, Paragraph 3</u>: Sentences 1 & 2 state "There will be a negative impact due to increased fine sediment and freshwater discharge, on a localized area, approximately 121,708 square feet based on a 10-year flood, in the vicinity of the second outlet at Waianukole. This will adversely impact two species of limu (limu lipoa and limu kohu). . ." This acknowledgement is not followed by a discussion of possible mitigation for such impacts. We recommend developing and integrating such mitigation measures into the proposal, particularly with respect to algal species known to serve as forage items for green sea turtles.

You may direct questions regarding these comments to James Devine with the U.S. Geological Survey's National Center in Reston, Virginia at (703)648-6832, or Paul Henson at the U.S. Fish and Wildlife Service's Pacific Islands Office in Honolulu, Hawaii at (808)541-3441.

Thank you for the opportunity to review this report.

Sincerely,

Patricia Sanderson Port
Regional Environmental Officer

Cc: Director, OEPC, Headquarters

Director, U.S. Geological Survey, Headquarters

Director, Fish and Wildlife Service, Pacific Islands Office

**References**

NOAA-TM-NMFS-SWFSC-294. 2000. Identification Manual for Dietary Vegetation of the Hawaiian Green Turtle (*Chelonia mydas*). Dennis J. Russell and George H. Balazs. p. 49.

NOV 1 8 2003

United States Department of Agriculture

NRCS
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850

November 17, 2003

Patricia Sanderson Port, Regional Environmental Officer
Office of Environmental Policy and Compliance
United States Department of Interior
1111 Jackson Street, Suite 520
Oakland, CA 94607

SUBJECT: Lahaina Watershed Flood Control Project - Draft Environmental Impact Statement (DEIS)

Dear Ms. Sanderson Port:

Thank you for your letter, dated June 30, 2003, commenting on the DEIS for the Lahaina Watershed Flood Control Project. We provide the following responses to your comments in the same order as they appear in your letter.

1) ***Response to General Comments***

a) ***We recommend that the DEIS provide a description of macro-algae abundance or distribution... possible mitigation of the effects.***

The DEIS provides quantitative macro-algae species distribution at six (6) locations from Lahaina Harbor to the new outlet location which were designated as Sites A and B and Sites A1,B1 C1 and D1 and displayed in Tables 1, 2, and 3. As well, a summary of macro-algae abundance and distribution from previous marine surveys in 1987 (AECOS, 1988) was provided in Appendix A, Coastal Processes, Marine Water Quality, and Nearshore Biological Investigations for the Lahaina Watershed Flood Control Project prepared by Sea Engineering, Inc. This information will be incorporated into the Final Environmental Impact Statement (FEIS), as well as an evaluation of project-related discharges and associated cumulative effects to these macro-algae species. Please note that algae have rapid life cycles and distribution can be influenced by many factors (such as water temperature) that can vary seasonally, or with other episodic weather fluctuations. Algae can quickly re-establish themselves after a strong negative event. Abundance and distribution of macro-algae are therefore, not necessarily good indices for judging species health or potential adverse impacts of sediment discharge.





In the arid climate of West Maui, the new outlet will flow only during strong precipitation events, so there will be long periods when the outlet will have no effect on the offshore biota. Since the impacts of this project on the coastal environment are anticipated to be measurable only following significant flood events, organism populations, especially sensitive to such impacts, would be relatively slow-growing, attached forms like corals. Algae, although attached, can regenerate a population in a matter of months after a storm discharge. Most other marine organisms will have a response similar to that of benthic algae. Fishes will leave the area during heavy discharge and return after outflow. Therefore, the approach of this DEIS and the marine studies by Grigg in 1983, 1986 and 1991 used coral species diversity and bottom cover as indices rather than algae or fishes, as coral provides habitat, grow slowly, and are slow to recruit.

b) ***Response to the comment that while overall sediment discharge is expected to be reduced by 25 percent, ... that on balance this may or may not be a substantially improved situation.***

The purpose of the project is to protect Lahaina from flooding and thereby, protect lives and property. This is the primary "substantially improved situation" desired by the project. As discussed in the Draft EIS, the current non-point storm runoff is causing excess sedimentation on the nearshore coral reefs fronting Lahaina Town. Annually, approximately 3,400 tons of sediment is currently being discharged between Lahaina Harbor and Kauaula Stream. With the proposed improvements, the sediment discharge in the area from Lahaina Harbor to Kauaula Stream will not only be virtually eliminated from the nearshore coral reef, but will be reduced throughout the project area by approximately 25 percent. The sediment will be discharged to a point source at the second outlet which is located in an area of less diversified and abundant marine resources. The coastal processes and marine water quality assessment indicates that potential adverse impacts at the second outlet can be mitigated by monitoring and if required, a beach enrichment program. Assessment of these parameters leads to the conclusion, in this particular case, that combining numerous non-point discharges into a larger single-point discharge causes less overall environmental impact.

c) ***Response to the comment and recommendation that the DEIS include a detailed description of discharged sediments, fresh water, and nutrients and provide an effects analysis of this discharge upon the marine community. In this analysis, we recommend addressing the Items in the bullet list below.***

- ***What is the percent algal coverage that may be affected by project-related discharges?***

Bottom areas affected by different discharge events were modeled in the plume study. As presented in Table 8 of the DEIS, the bottom area affected by the discharge plume are as follows: 52,424 sq. ft. at the 2-year storm; 116,332 sq. ft. at the 5-year storm; and 121,708 sq. ft. at the 10-year storm. The algal species diversity at the site, as well as coral and fish species diversity are quantified in Table 3 of the DEIS. There are 3 species of coral, 12 species of algae and 30 species of fish at the proposed second outlet site (D1). Based on the 1987 survey reported in Table 6-1, Appendix A, the mean algae coverage in the cobble biotope was 6.4 percent with 11 species of algae recorded. However, as mentioned earlier, it should be noted that algal coverage is extremely variable.

- ***Does seagrass occur within the vicinity of the project area? If so, will seagrass beds be degraded as a result of the proposed activity?***

No sea grass beds occur within the vicinity of the project area. Although Hawaii has one species of sea grass (Halophyla), it is typically found on sand bottoms in somewhat deeper water or in protected coves and bays. It is far too fragile to survive the nearshore wave regime at the proposed discharge location.

- ***How will project-related discharges affect sea turtles that may rest or forage within the project area?***

As discussed in the DEIS, no adverse project-related impacts are anticipated to affect sea turtles that may rest or forage within the project area. Significant discharges will only occur when there are storms or heavy upland rainfall. These will be of short duration and water quality is anticipated to return to meet State Department of Health salinity water quality standards within approximately 20.7 hours after the discharge event.

- ***How will the proposed new discharge affect herbivorous fish and macroinvertebrate populations if macro-algal species are degraded?***

Changes in marine algae resulting from either reductions in salinity or substratum changes off the new discharge point will cause changes or shifts in populations of fishes and invertebrates. The same will also be true for those coastal marine areas where the discharge will be removed. The shifts in marine populations in the project area were not considered to significantly cause adverse impacts to the local marine ecosystem. Properly, the DEIS in this case, limited consideration to species that are deemed special, or listed as endangered, or play a significant economic or cultural role in human affairs.



- ***Will the cumulative effects of the proposed discharge result in algal blooms and degrade coastal resources?***

The cumulative effects of the proposed discharge are not anticipated to result in algal blooms nor degrade coastal resources. Research to-date on algal bloom and excessive benthic algal growth problems in West Maui have indicated that point source discharges from intermittent streams have not been the cause. The studies carried out on algal blooms in West Maui (Tetra Tech, 1993; Soicher and Peterson, 1996; DeCarlo and Dollar, 1996; Kinetic Laboratories, 1997; Dollar and Andrew, 1997; and Dollar et al., 1999), though not conclusive, suggest that groundwater inputs are more significant than episodic stream inputs to algal blooms in West Maui.

- ***Adding this important Information will also help to achieve the intent of Executive Order 13089, Coral Reef Protection, which directs Federal agencies to: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems.***

As discussed in Chapter VI, DEIS, the proposed project will help achieve the intent of Executive Order 13089, in that USDA, NRCS programs and authorities will be utilized to prevent flooding in the Lahaina Town area and prevent excessive sediment discharge from entering waters with high coral resource values. The "No Action Alternative" and the "Deferred Action Alternative" will allow the flooding and impacts to the reef biota fronting Lahaina Town to continue. As such, both alternatives would not represent a responsible option towards flood control and protecting the coral reef ecosystem in the project area. The obligation under the Executive Order is to insure that substantial weight be given to the least degrading, practicable alternative. This can be achieved, in the proposed project, by two (2) considerations as covered in the DEIS:1) designing the drainage system to minimize potentially adverse aspects of discharges (water quantity and quality) and 2) selecting a discharge location that is judged to have the least adverse impact on coral reef ecosystems present within the project area.

***d) Response to comments regarding maps.***

Maps in the FEIS will be revised, to the extent practicable, to include the feature named in the text to be displayed on the relevant map.

2) ***Response to Specific Comments***

a) ***Pages 1 and 10: It would be helpful to the reader if the Hawaiian words mauka and makai were defined where they are first used in the text.***

The FEIS will be revised to define the words mauka and makai where they are first used in the text.

b) ***Page 4, Paragraph B: The proposed project may also result in the discharge of nutrients (bound to sediments) into the marine environment and artificially raise their levels. If nutrient loading occurs, macro-algae may expand beyond natural boundaries at rates that may exceed consumption by herbivorous predators. We recommend, therefore, revising the sentence to read as follows, "Sedimentation, nutrients and floodwater runoff are also recognized as threats to the (sic) coral reef ecosystems".***

We accept the wording change and will revise the statement accordingly with the removal of "the" in front of "coral reef ecosystems." Nutrients (mostly dissolved nutrients) may contribute to excessive algal growth in the vicinity of the second outlet. As noted above, studies have shown that point source discharges from intermittent streams are likely not the cause of algal blooms in West Maui. In this instance, we do not believe that nutrients bound to sediments constitute a threat to the marine environment. See Response to Item i., below.

c) ***Page 17, Hydrogeology: Response to comment, "We recommend the text to indicate the source of recharge to groundwater. If the water proposed for diversion to the sea in this DEIS represents recharge that will be lost to the system we recommend this be identified and described as an impact in the analysis section of the document. Conversely, if the inclusion of detention basins will produce a net increase in ground-water recharge, we recommend that this information be provided to decision makers as well."***

The FEIS text will be amended to indicate the source of recharge to groundwater in the project area. In this regard, the works of improvement contained in the Lahaina Watershed Flood Control Project will not affect recharge to groundwater due to their location at considerably lower elevations than significant recharge areas. No domestic water supply wells exist downhill or in the vicinity of the project area, therefore, a net increase in groundwater recharge is not anticipated.

d) ***Page 25, Paragraph 2: Response to the comment, "The Golden-plover and the Black-crowned Night Heron are protected under the Migratory Bird Treaty Act (MBTA) (16USCS) 703-712). The Short-eared Owl or Pueo, an endemic species of the main Hawaiian Islands, is also afforded protection under the MBTA and is listed as endangered by the State of Hawaii. We recommend these designations be included in your description because***



***they communicate the level of importance that effects to these species would have."***

The FEIS text will be revised accordingly. Please note that no adverse impacts to these species are anticipated.

e) ***Page 25, Paragraph 4: Response to comment, "We recommend that Chapter 2 of the DEIS be augmented to list species of macro-algae that occur within the proposed project site and are consumed by green sea turtles. ... This would facilitate a more complete discussion in Chapter III, Potential Impacts and Mitigation Measures, of the full range of potential negative effects to green sea turtle forage habitat."***

Chapter II and III of the EIS text will be revised accordingly. Please note, all of the algal genera mentioned are among the most common, widely distributed algae, in the Hawaiian Islands. These algae (*Acanthophora spicifera, Cladophora spp., Dictyosphaeria versluysii, Hypnea cervicornis or H. musciformis, and Microdictyon spp.*) are common almost everywhere in shallow coastal waters where turtles occur. The presence of these algae, however, does not provide any real sense of potential impacts to the green sea turtle.

f) ***Page 36, Water Quality: Response to comment, "We recommend indicating whether runoff was present or not and stating if these conditions would affect whether the samples would accurately reflect background conditions."***

The Coastal Processes, Marine Water Quality and Nearshore Biological Investigations for the Lahaina Watershed Flood Control Project Report will be revised to include this information. Text revisions to the FEIS will be made, as appropriate.

g) ***Page 38, Paragraph: Response to comment, "We recommend sediment sampling occur within the shallow nearshore marine environment surrounding the current discharge at Kauaula Stream, at the proposed new secondary discharge outlet, and at other representative locations. We recommend sediments at these locations be screened for nutrients and the results used as pre-construction information."***

It is likely that directly off any stream mouth, organic particulates deposited with mineral sediments could constitute a source of nutrients to an estuarine environment. However, in the absence of confining conditions (such as a physical estuary), organic particles of low average density are readily dispersed by waves and currents over a wide area. Their nutrient contribution to the marine environment would be mediated through marine microbial processes, and become part of the general elevation in nutrients observed around islands in comparison with typically low nutrient content of tropical oceanic waters. Marine plants (macroalgae) do not take up nutrients directly from sediments. The "impact" of organic particulate would be a general one, and not sufficiently localized or confined to be of any significance, since as in this case, the discharge is not directed into confined waters. Because of currents, locally enhanced at times of high stream flows, only dissolved nutrients can be expected to influence plant (algae) growth off the discharge. Therefore, screening sediments for nutrients would not be an effective indicator to assess macroalgae and algae growth caused by sediment discharge.

*h)* ***Page 62, Discharge Plume Modeling: Response to recommendation that the text indicate more clearly that the model describes the plume of freshwater and that, because of density difference between freshwater and saltwater, plume mixing and extent may not be a good predictor for the distribution of sediment.***

The plume is described as a buoyant plume of fresh water that evolves into a thin surface layer. The buoyancy of the plume results from the density differences between freshwater and saltwater, with lighter fresh water floating on top of the heavier salt water. Mixing and dilution characteristics of the plume are described in detail in the DEIS, Appendix A, Section 5.1. The description of the limitations of the model will be amended as follows.

> It should be noted that the model describes the plume of freshwater and because of the density difference between freshwater and saltwater, plume mixing and extent may not precisely predict the distribution of sediment. However, the plume model is a good predictor for turbidity caused by fine particulates suspended in the plume, as dilution contours are valid for any conservative tracer (i.e., not reduced by factors other than dilution). This may not be precisely accurate for turbidity caused by suspended sediment, as some material will fall out of suspension over time, but it is useful as a conservative estimate. Therefore, it is in this context, the plume model has been used to predict the spread and dilution of suspended sediment in order to assess the impact of the marine discharge at the second outlet.

Moreover, comprehensive sediment transport requires computation of the fate of bed load transport, as well as suspended load transport. The bed load transport is not modeled by the plume model. Bed load, consisting of particulates nominally greater than fine sand or silt in size, cannot be transported by the outlet flow past the point where the plume touches the bottom, or 550 feet offshore for the 10-year flood. Most of the bed load will be deposited very near shore, where it will be worked and transported by the effect of waves and currents.



*i)* ***Page 65, Paragraph 2: Response to comment that, "Nutrients that are bound to sediments and discharged from stream outlets may represents a cumulative factor and affect the nearshore marine environment. It appears that additional analysis is needed to support the conclusion that this project would not have a significant impact on the benthic community."***

Refer to response Item 2.g., above. Nutrients bound to sediments will neither be taken up by algae nor remain in the area for very long. Coastal processes will permit only limited accumulation of material contributed by the episodic discharges. Organic matter will be preferentially removed because of small particle size and/or low density. Nutrients in particulate form cannot be utilized directly by algae. The types and distribution of algae in an area potentially impacted by the discharge will be determined by salinity and substratum impacts, not nutrients. Thus, assessment of the salinity and substratum impact parameters were used to determine potential impacts of the project on the benthic communities in the DEIS.

*j)* ***Page 66, Paragraph C: Response to comment, "Because the assumed origin of the sediment is partly from fallow fields, there may be issues of residential agricultural pesticides. We recommend providing more specific information regarding the chemical quality of the sediment."***

The sediments found along the project shoreline are coarse-grained sands, gravels, and cobbles from terrigenous and marine sources. Pesticides and other pollutants, when attached to sediment particles, are usually associated with fine-grained sediments such as clay and silts. Fine-grained sediments remain in suspension in the energetic marine environment fronting the project area and are dispersed by ocean currents. Thus, the potential "impact" of residual pesticides in the sediment would be a general one, and not sufficiently localized or confined to warrant chemical analysis. The FEIS will clarify this point.

*k)* ***Page 115, Paragraph 3: Response to comment, "We recommend developing and integrating such mitigation measures into the proposal, particularly with respect to algal species known to serve as forage items for green sea turtles."***

Statements predicting future outcomes with respect to the algal communities are probabilistic and qualitative because it is not possible to give a prediction with certainty. In this context, the comment in the DEIS will be amended as follows, "*This may adversely impact two (2) species of limu (limu lipoa and limu kohu) which have been identified in the marine survey and known to be collected by Native Hawaiians.*" This section of the DEIS will be further amended with the full text of the marine biology assessment concerning impacts to algae at the site as follows.

A total of five (5) species of culturally important marine macroalgae (i.e. seaweed or "limu" were found during the 2002 survey work. These species are used locally as a traditional food source. They were Dictyopterus plagiogramma (limu lipoa), Asparagopsis taxiformis (limu kohu), Ulva fasciatus (palahalaha), Codium spp. (Wawae`iole), and Enteronmorpha spp. (`ele`ele). Of these, palahalaha is probably the least used today. At the site closest to the proposed new discharge site (D1), two out of the five culturally important species were found (limu lipoa and limu kohu).

None of these species were observed at Site B, which is where Kauaula Stream discharges. Palahalaha and ele`ele were found at Site A1, which is a current discharge site. Because a discharge outlet can be associated with pulses of freshwater and nutrients, and because salinity and nutrient levels affect algal communities, movement of the outlet may alter the current algal distribution. Routing discharge to D1 (the second outlet location) may impact limu lipoa and limu kohu in this area. Conversely, removal of discharge from its current location(s) may balance this impact.

Algae have rapid life cycles and can quickly re-establish themselves after a strong negative event. Since the second outlet will flow only during strong precipitation events, there will be long periods when the outlet will have no effect on the offshore biota. Algae can therefore regenerate a population in a matter of months after a storm discharge. There has been an increase of algae species inventoried throughout the study area from 1986 to 2002 (Refer to Tables 1 and 2). Moreover, since types and distribution of algae will be influenced more by salinity and substratum impacts which will be localized in the vicinity of the second outlet, the algal communities should continue to flourish throughout the project area. Therefore, the need for mitigation is not anticipated.

Again, thank you for your comments and participation in the DEIS review process.

Sincerely,

LAWRENCE T. YAMAMOTO
State Conservationist

cc: Joe Krueger, Civil Engineer, Count of Maui, Department of Public Works and Environmental Management
Michael W. Foley, Director, Maui County Dept. of Planning

JUL 07 2003

## UNIVERSITY OF HAWAI'I

Sea Grant Extension Service
Maui Community College

June 23, 2003

Munekiyo and Hiraga, Inc.
Mitch Hirano
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Hirano:

**Re: Draft Environmental Impact Statement: Lahaina Watershed Flood Control Project**

Thank you for the opportunity to comment on this project. With regards to the potential for beach erosion as the terrigenous sediment input to the beaches is reduced, this does appear to be a valid concern. If beach loss does occur to a point where replenishment becomes necessary, I would recommend the use of sand from a clean, suitable source such as inland or offshore deposits, rather than from the settlement basins.

As the second outlet extends makai of the certified shoreline almost to the high water line, it is important to ensure that lateral shoreline access will not be impeded, and that the structure will not interfere with longshore sediment transport. While the shoreline consists of a predominantly cobble beach, this stretch was formerly a sandy beach that has undergone erosion of 0.6 to 0.8 feet per year since the early 1900's, and is periodically covered with a sandy veneer. Sand transport in the Hawaiian Islands is generally longshore-dominated. A method of sediment bypassing should be considered to minimize interference of the outlet on coastal processes in the event that the outlet structure should interfere with sediment transport.

As a final note, the source of the flooding problem was highlighted in the comments by William Waiohu, Paul Keahi, Tammy Harp, Isaac Harp and Ke'eaumoku Kapu. These local residents emphasized the importance of keeping the rainwater on the land as much as possible using agriculture, deep tilling and diversion channels. To effectively mitigate future flooding while concurrently increasing groundwater recharge and minimizing the numerous harmful effects of runoff on the marine environment, these options should be given priority, and used in conjunction with emergency flood control structures. Perhaps this would allow the scale and cost of the flood control structures to be downsized.

Thank you for your consideration. Please contact me if you have any questions.

Sincerely,

Zoe Norcross
Sea Grant Coastal Processes Extension Agent, Maui County

310 Kaahumanu Avenue Kahului, Maui, HI 96732 Telephone: (808) 984-3335 Facsimile (808) 242-8733
E-Mail: norcross@soest.hawaii.edu



ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

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**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793



November 24, 2003

Zoe Norcross
Sea Grant Coastal Processes Extension Agent
UH Sea Grant Extension Service
Maui Community College
310 Kaahumanu Avenue
Kahului, Hawaii 96732

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Ms. Norcross:

Thank you for your letter dated June 23, 2003, commenting on the subject project. We provide the following information in response to your comments.

1. ***Response to recommendation that sand from a clean, suitable source such as inland or offshore deposits, rather than from the settlement basins be used where beach replenishment becomes necessary.***

   As discussed in the DEIS, the need for beach replenishment may be mitigated by a coastal management program that would include measurement of beach change and if required, placing sand-sized sediment trapped in the project sediment basins on the beaches. This mitigative action is based on the principle that the appropriate size fraction of sediment trapped by the basins should be used for mitigation of beach loss due to diversion of the outflow and trapping of sediment. Borrow sources for beach sand are difficult to find and can be costly. Therefore, availability and cost criteria will be considered should it be necessary to implement a replenishment program.

2. ***Response to consideration for a method of sediment bypassing.***

Longshore sand transport occurs primarily in the swash zone (the area of the shore affected by wave run-up), and also the nearshore area inside the surf zone where sediment is moved by waves and currents. Effective barriers to longshore sediment (i.e., groins) must be substantial structures that are higher in elevation than nominal wave run-up values and extending well into the surf zone. The second drainage outlet will be relatively low and will not extend into the nearshore. It will therefore, not impede longshore transport. As such, a sand bypassing scheme will not be required.

3. ***Response to the importance of keeping the rainwater on the land as much as possible and using agriculture, deep tilling and diversion channels in conjunction with emergency flood control structures.***

As mentioned in the DEIS, effective floodwater control involves establishing appropriate land management practices in the upland to retain runoff from impacting downstream properties. During the public review process of the DEIS, this matter was raised by a number of individuals and organizations in West Maui. In response, the Final Environmental Impact Statement will more fully develop appropriate land management practices and non-structural measures that can be carried out in conjunction with the proposed flood control measures.

Again, thank you for your comments.

Sincerely,

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/uhseagrant

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**KAUAULA LAND COMPANY LLC**
33 Lono Avenue • Suite 450
Kahului, HI • 96732
Phone 808• 877•4202 Fax 808•877•9409

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June 20, 2003

Mr. Gilbert Coloma-Agaran, Director
Dept. of Public Works and Environmental Management
County of Maui
200 South High Street
Wailuku, HI 96793

***RE:*** ***Draft Environmental Impact Statement (E.I.S.)***
***Lahaina Watershed Flood Control Project***

Kauaula Land Co., LLC offers the following comments:

1. There is no mention in the E.I.S. of the proposed Shoreline Park stretching from Puamana Beach Park to the Pali. This proposed park has been discussed by the Planning Department and at numerous Community meetings. I think the "second outlet" will affect this proposed park and its affect should be discussed.

2. There is no mention in the E.I.S. of the new road, HoKioKio Place, which services the Pu'unoa Subdivision. The flood control channel will have to be designed to pass under this road.

3. Kauaula Land Company, LLC still feels that Kauaula Stream should accept floodwaters from both sides of Kauaula Stream and that Kauaula Stream should be the major flood control channel in this area. We are not in favor of the second outlet taking storm water from Lahaina and diverting the water over a half mile South. We believe the solutions to the flooding in Lahaina should be solved in Lahaina.

Sincerely,

KAUAULA LAND COMPANY, LLC

for: James C. Riley

JCR:mkg
cc: file

RUSH

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ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
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**COUNTY OF MAUI**
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RALPH NAGAMINE, L.S., P.E.
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LLOYD P.C.W. LEE, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

James C. Riley
Kauaula Land Company
33 Lono Avenue, Suite 450
Kahului, Hawaii 96732

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Riley:

Thank you for your letter dated June 20, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the same order presented in your letter.

1. ***Response to the comment that the DEIS does not mention of the proposed Shoreline Park stretching from Puamana Beach Park to the Pali.***

The Final EIS (FEIS) will include discussion of the proposed shoreline park in consideration to the surrounding land uses and cumulative impacts. As mentioned in the DEIS, the proposed project is anticipated to be a positive impact in that coastal recreational opportunities will benefit from the proposed action, as reduction in sediment laden storm waters will result in less turbid post-storm conditions. Storm drainage outlet structures are a permitted use in the open space district and as established in the West Maui Community Plan.

2. ***Response to the DEIS does not mention the new road, HoKioKio Place.***

The FEIS will include discussion of the new road, HoKioKio Place servicing the Pu`unoa Subdivision in consideration to the surrounding land uses. The proposed flood control channel will be designed to accommodate this new road and allow flood water to pass under the road.



3. ***Response to the comment that Kauaula Stream should accept floodwaters from both sides of Kauaula Stream and that Kauaula Stream should be the major flood control channel in this area.***

A full range of alternatives to provide flood protection to the Lahaina Watershed was evaluated during preparation of the DEIS and discussion of the alternatives has been expanded in the FEIS. Use of the Kahoma Flood Channel as an outlet was investigated during the formulation of alternatives for this project in the late 1980s. At that time, the U.S. Army Corps of Engineers (USACE) stated in the coordination meeting that the additional flood flow from the Lahaina subwatershed would decrease the level of flood protection for the lowlying areas of the Kahoma floodplain and that the use of Kahoma Stream as an outlet was unacceptable. A recent inquiry to the flood program manager at the USACE on the use of Kahoma Stream produced the same negative result.

The single outlet using Kauaula Stream and Puamana Channel was considered as an alternative. However, due to the concerns raised by the Puumana Community Association this alternative was given a lower priority than the preferred alternative. We note that the Puumana Community Association has recently expressed their concern against the single outlet alternative.

Again, thank you for your comments and participation in the DEIS review.

Sincerely,

Milton Arakawa
for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/kauaulaland

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Box 50088
Honolulu, Hawaii 96850

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DUDLEY

In Reply Refer To:
1-2-2003-I-122

APR 17 2003

Lawrence Yamamoto
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, Hawaii 96850

Dear. Mr. Yamamoto:

This responds to your request of March 24, 2003, for the U. S. Fish and Wildlife Service's concurrence with your determination under section 7 of the Endangered Species Act. You determined that the implementation of a flood prevention project with the Natural Resources Conservation Service, in cooperation with the County of Maui and the West Maui Soil and Conservation District in Lahaina is not likely to adversely affect any federally listed or proposed species, or proposed or designated critical habitat. Your letter was received in this office on March 24, 2003.

The proposed project involves the construction of a floodwater diversion system, that starts south of Lahainaluna Road at approximately 150 feet above mean sea level and extends across the watershed in a southwesterly direction to a debris basin at Kauaula Stream. The diversion channel is proposed to be grass-lined except for reinforced concrete reaches near Lahainaluna Road and adjacent to Wainee Reservoir. The proposed project also includes the construction of an inlet basin and three sediment basins. The debris basin at Kauaula Stream provides an outlet to Kaualua Stream and a secondary outlet to a 3,600 foot long grass-lined channel with a sediment basin to a shoreline outlet. Storm runoff will be divided between the two outlets to ensure that the streamflow capacity of the existing Kauaula Stream channel through the Puamana development is not exceeded. The vegetation on the project site is currently dominated by introduced species of grasses, weeds, shrubs, and trees. Haole koa brush and kiawe trees are found on both banks of Kauaula Stream.

According to data from the Hawaii Natural Heritage Program, the Hawaiian hoary bat (*Lasiurus cinereus semotus*), was last observed in 1992 near the mouth of Kahoma Stream, approximately one mile north of the project area. The improvements proposed by the project will be made on land which was recently in sugarcane cultivation and should have no impact on Hawaiian hoary bat habitat. No other endangered or threatened plant or animal species are known to occur in the area.



Based on the information you provided and information in our files, we concur with your determination that implementation of the proposed project is not likely to adversely affect any federally listed or proposed species, or proposed or designated critical habitat.

We appreciate your efforts to conserve endangered species. If you have any questions, please contact Eric Vanderwerf, Fish and Wildlife Biologist (phone: 808/541-3441; fax: 808/541-3470).

Sincerely,

for Paul Henson, Ph.D.
Field Supervisor

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
NATIONAL MARINE FISHERIES SERVICE
**Pacific Islands Regional Office**
**1601 Kapiolani Boulevard, Suite 1110**
**Honolulu, Hawaii 96814-0047**

June 13, 2003

Lawrence Yamamoto, State Conservationist
Natural Resources Conservation Service
United States Department of Agriculture
P.O. Box 50004
Honolulu, HI 96850

RE: Flood Prevention Project in Lahaina, Maui (I-PI-03-255)

Mr. Yamamoto:

Thank you for the opportunity to review the draft Environmental Impact Statement (DEIS) for the proposed Flood Prevention Project in Lahaina, Maui. The County of Maui, Department of Public Works and Environmental Management (DPWEM), and the West Maui Soil and Water Conservation District (WMSWCD), in partnership with the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) propose the implementation of a floodwater diversion system in the Lahaina Watershed.

The proposed project is intended to reduce the flooding and erosion problems on land and to relieve the effects of excess sedimentation on the nearshore environment. The project involves construction of a floodwater diversion system that starts south of Lahainaluna Road and extends to a debris basin at Kauaula Stream. The proposed project also includes construction of an inlet basin and three sediment basins. We provide the following comments and information under our statutory authorities under the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 *et seq*. (ESA), and the Marine Mammal Protection Act of 1972, as amended 16 U.S.C. 1361 *et seq.* (MMPA). These comments are also consistent with the National Environmental Policy Act of 1969, 42 U.S.C. 4321 *et seq.* (NEPA).

The primary concern of the National Marine Fisheries Service (NOAA Fisheries) is the potential alteration of water quality in the area of outflow. This could affect the abundance and types of algae that are a potential food source for green turtles or promote algae blooms which may be toxic to marine organisms. However, based on the available information regarding terrestrial sources of nutrients and coastal waters, NOAA Fisheries concurs with your determination that the project is not likely to adversely affect threatened or endangered marine species.

If you have any questions regarding our comments, please contact Margaret Akamine or David Nichols at 808/973-2937.

Sincerely,

C. Karnella

Sam Pooley
Acting Regional Administrator

NOV 18 2003

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850

November 17, 2003

Sam Pooley, Acting Regional Administrator
United States Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Pacific Islands Regional Office
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawaii 96814-0047

Subject: Draft Environmental Impact Statement - Lahaina Watershed Flood Control Project

Dear Mr. Pooley:

Thank you for your letter dated June 13, 2003 commenting on the subject project. We wish to confirm that the Draft Environmental Impact Statement adequately addresses the issues raised in your earlier letter of April 24, 2003, attached hereto as Exhibit A.

We wish to note National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) concurrence with NRCS's determination that the proposed project is not likely to adversely affect threatened or endangered marine species. We also note that NRCS's determination and NMFS's concurrence has been carried out in accordance with the consultation requirements under Section 7 of the Endangered Species Act.

Again, thank you for your response and comment.

Sincerely,

LAWRENCE T. YAMAMOTO
State Conservationist

Attachment

cc: Joe Krueger, Civil Engineer, Count of Maui, Department of Public Works and Environmental Management
Michael W. Foley, Director, Maui County Dept. of Planning



**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
NATIONAL MARINE FISHERIES SERVICE

Pacific Islands Regional Office
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawaii 96814-0047

April 24, 2003

Lawrence Yamamoto
Acting State Conservationist
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850

RE: Flood Prevention Project in Lahaina, Maui (I-PI-03-255)

Mr. Yamamoto:

This responds to your request dated March 24, 2003, for comment on the proposed Flood Prevention Project in Lahaina, Maui. The project involves construction of a floodwater diversion system that starts south of Lahainaluna Road and extends to a debris basin at Kauaula Stream. The proposed project also includes construction of an inlet basin and three sediment basins. We provide the following comments and information under our statutory authorities under the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 *et seq.*, and the Marine Mammal Protection Act of 1972, as amended 16 U.S.C. 1361 *et seq.* (MMPA).

There are endangered humpback whales (Megaptera novaeangliae) in the offshore waters of the proposed project area during the winter months. Also, the threatened green turtle (Chelonia mydas) is found throughout the year in the near-shore environment (intertidal zone and in the offshore reef structures) of the area. The endangered Hawaiian monk seal may also be found in the project area. Critical habitat has neither been designated nor proposed for any listed species under the jurisdiction of the National Marine Fisheries Service (NOAA Fisheries) in or near the project area.

Based on a review of the information provided, it is not likely that there will be an adverse affect on any of the protected species under the jurisdiction of NOAA Fisheries. However, in order to fully assess the potential effects of this project, it is important to receive complete information regarding the new drainage outlet and an analysis of the potential impacts (direct or indirect) from the discharge.

EXHIBIT A

NOAA Fisheries suggests including a complete analysis of impacts to protected species in the draft Environmental Impact Statement that is currently being prepared. Please forward this information to the Protected Species Program at the above address. If you have any questions regarding this request for information or the section 7 consultation process, please contact Margaret Akamine or David Nichols at 808/973-2937.

Sincerely,

for Margaret Akamine,
Protected Species Program

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION IX**
**75 Hawthorne Street**
**San Francisco, CA 94105-3901**

July 3, 2003

Lawrence Yamamoto
U.S. Department of Agriculture
Natural Resources and Conservation Service
P.O. Box 50004
Honolulu, HI 96850

Subject: Draft Environmental Impact Statement (DEIS) for the Lahaina Watershed Flood Control Project (CEQ#030227)

Rating: Environmental Concerns - Insufficient Information (EC-2)

Dear Mr. Yamamoto:

The Environmental Protection Agency (EPA) has reviewed the above referenced document pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act. This letter provides a summary of EPA's concerns. Our detailed comments are enclosed.

EPA supports the goals of the proposed project to control flooding and reduce sediment loading to nearshore waters. However, we are concerned about the proposed flood control project's impacts on the nearshore marine environment, waters of the U.S., and water quality. In addition, EPA is concerned about the range of alternatives evaluated in the DEIS, and whether future development on adjacent lands has been incorporated into project design and evaluation of impacts.

For these reasons, we have rated the DEIS as Environmental Concerns, Insufficient Information (EC-2). EPA's rating and a summary of our comments will be published in the *Federal Register*. Please see the enclosed Rating Factors for a description of EPA's rating system.

We appreciate the opportunity to review this DEIS. When the Final EIS is released for public review, please send two copies to the address above (mail code: CMD-2). If you have any questions, please contact me or Shanna Draheim, the lead reviewer for this project. Shanna can be reached at (415) 972-3851 or draheim.shanna@epa.gov.

Sincerely,

Laura Fujii for

Lisa B. Hanf, Manager
Federal Activities Office

Enclosures:
Detailed comments
EPA Summary Rating Sheet

cc:
Paul Henson, U.S. Fish and Wildlife Service, Pacific Islands Office





Impacts to the Nearshore Marine Ecosystem

Establishing a new stream outlet to the ocean, as proposed, will increase the amount of fresh water and nutrients discharged to the nearshore marine environment near the outlet. The DEIS provides only a limited discussion of the biological impacts from a new floodwater discharge outlet. The DEIS concludes that the impacts will be minimal because the marine community at the new outlet has a lower number and percent cover of coral species than other sites along the Lahaina shore. However, the number of coral and algal species and percentage of cover are not the only measures for evaluating the ecosystem impacts of a new discharge outlet. As was evaluated in previous studies, other useful measures to evaluate ecosystem impacts include coral health, recruitment, fish population, macroalgal cover, *Hypnea musciformis* cover, and percentage of silt in the marine sediments.

Recommendation:

The Final EIS (FEIS) should include an expanded discussion of the biological impacts to the nearshore marine ecosystem from the construction of a new discharge outlet, utilizing some of the measures identified above.

In addition, the DEIS states that the Lahaina area has nuisance algal blooms in the nearshore area. The cause of these algal blooms is not well understood, but studies have indicated that dissolved and particulate nutrients in surface runoff play a role in contributing to the overgrowth of the macroalgae at the shoreline. A particularly problematic species is *Hypnea musciformis*, an introduced species that has spread and proliferated along the Maui shoreline in the last two decades. The DEIS does not discuss whether the proposed new ocean outlet will contribute to an increase in growth of nuisance algae in the area.

Recommendation:

The FEIS should discuss the potential impacts of the proposed new floodwater discharge outlet on the nearshore algal communities along Lahaina, and on the spread of non-native species of macroalgae.

Waters of the U.S.

The DEIS does not include a discussion of the proposed project's consistency with Section 404 of the Clean Water Act (CWA). For example, the DEIS does not quantify or describe the potential impacts to waters of the U.S. from placement of fill material associated with construction of the proposed project. The document states that project sponsors will coordinate with the U.S. Army Corps of Engineers on a CWA Section 404 permit if one is necessary. However, it is not clear whether the Natural Resources Conservation Service (NRCS) has evaluated the likely impacts to waters of the U.S. from this project, and whether a CWA Section 404 (b)(1) alternatives analysis has been completed.

According to the CWA Section 404 (b)(1) Guidelines (40 CFR 230.10(a)), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant environmental consequences. The guidelines state that projects must first avoid (by choosing the Least Environmentally Damaging Practicable Alternative [LEDPA]), then minimize, and finally mitigate for any unavoidable impacts to wetlands.

Recommendation:

The FEIS should include a discussion of the impacts to waters of the U.S. from potential placement of fill materials associated with project construction. The document should also include a discussion of the CWA Section 404 permit requirements and identify how the project will avoid, minimize and mitigate impacts to waters of the U.S.

Consistency with State Water Quality Standards

The DEIS does not discuss whether the proposed project is consistent with state water quality standards. The document does not indicate whether Hawaii Department of Health Environmental Planning Office guidelines for characterizing water quality are incorporated into the project design, or whether the project meets state water quality standards. The outlet at Kauala stream and the new floodwater discharge outlet may be within a state-designated Water Quality Limited Segment. It is unclear whether NRCS and the local project sponsors have worked with the State to obtain a CWA Section 401 Water Quality Certification.

Recommendation:

The FEIS should include a thorough description of existing water quality conditions in the project area and the proposed project's consistency with state water quality standards. The FEIS should also discuss the state's role in issuing a water quality certification under CWA Section 401 for the proposed project.

Range of Alternatives:

National Environmental Policy Act implementing regulations require that lead agencies evaluate a full range of reasonable alternatives for a proposed project, including alternatives not within the jurisdiction of the lead agency. An EIS should present the impacts of the proposed action and the alternatives in comparative form, "thus sharply defining the issues and providing a





clear basis for choice among options by the decisionmaker and the public" (40 CFR Part 1502.14).

The DEIS identified five alternatives for addressing flood/surface runoff control in the Lahaina watershed, including no-action. However, the document only evaluated the environmental impacts associated with the preferred alternative. The other alternatives were only briefly described, and the environmental impacts were not evaluated or compared to the preferred alternative.

In addition, all but one of the action alternatives included construction of a new ocean outlet. No alternatives that utilize existing infrastructure, or non-construction measures were identified or evaluated in the DEIS.

Recommendation:

The FEIS should fully evaluate and compare the environmental impacts of all reasonable alternatives for controlling flood flows in the Lahaina watershed. The document should discuss whether less environmentally damaging alternatives, such as non-construction alternatives for reducing erosion and improving infiltration of surface flows or utilizing the existing channelized stream and outlet at Kahoma stream, were considered for the proposed project. If full consideration and evaluation of other reasonable alternatives is warranted, the NRCS should prepare a revised DEIS.

Impacts of Future Land Use

The DEIS describes the major land use surrounding the project area as sugar cane fields which have been abandoned and are no longer farmed. However, much of the former sugar cane land around the flood control project has been sold to a land development company. The DEIS does not discuss whether there is any planned or potential urban development of this land. Nor does the document discuss whether implementation of the proposed project will have growth-inducing impacts for these parcels. Increased urban development adjacent to the flood control project could affect runoff rates and quality.

Recommendation:

The FEIS should describe the current and planned land use in the area immediately surrounding the proposed flood control project. Environmental impacts associated with the likely urban development of former sugar cane lands should be identified and discussed. Inducement of urban growth on these parcels from the implementation of the proposed project should also be discussed.

# SUMMARY OF EPA RATING DEFINITIONS

This rating system was developed as a means to summarize EPA's level of concern with a proposed action. The ratings are a combination of alphabetical categories for evaluation of the environmental impacts of the proposal and numerical categories for evaluation of the adequacy of the EIS.

## ENVIRONMENTAL IMPACT OF THE ACTION

### *"LO" (Lack of Objections)*

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

### *"EC" (Environmental Concerns)*

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

### *"EO" (Environmental Objections)*

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

### *"EU" (Environmentally Unsatisfactory)*

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

## ADEQUACY OF THE IMPACT STATEMENT

### *Category 1" (Adequate)*

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

### *"Category 2" (Insufficient Information)*

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analysed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

### *"Category 3" (Inadequate)*

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analysed in the draft EIS, which should be analysed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

NOV 1 8 2003

United States Department of Agriculture

NRCS
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850

November 17, 2003

Lisa B. Hanf, Manager
Federal Activities Office
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105-3901

SUBJECT: Lahaina Watershed Flood Control Project - Draft Environmental Impact Statement (DEIS)

Dear Ms. Hanf:

Thank you for your letter, dated July 3, 2003 commenting on the DEIS for the Lahaina Watershed Flood Control Project. We provide the following responses to your comments in the same order as they appear in your letter.

1) ***Response to recommendation: "The Final EIS (FEIS) should include an expanded discussion of the biological Impacts to the nearshore marine ecosystem from the construction of a new discharge outlet, utilizing some of the measures identified above."***

The FEIS will include an expanded discussion of the biological impacts to the nearshore marine ecosystem from the subject project utilizing coral health, recruitment, fish populations and macroalgal cover and assessment of marine sediments.

The DEIS provides quantitative information on coral, fish and macro-algae species diversity and abundance at six (6) locations from Lahaina Harbor to the new outlet location which were designated as Sites A and B and Sites A1,B1 C1 and D1 and displayed in Tables 1, 2, and 3. As well, a summary of species diversity and abundance from previous marine surveys in 1987 (AECOS, 1988) was provided in Appendix A, Coastal Processes, Marine Water Quality, and Nearshore Biological Investigations for the Lahaina Watershed Flood Control Project prepared by Sea Engineering, Inc. This information will be incorporated into the FEIS, as well as an evaluation of project-related discharges and associated cumulative effects to these marine resources. Please note that algae have rapid life cycles and distribution can be influenced by many factors (such as water temperature) that can vary seasonally, or with other episodic weather fluctuations. Algae can quickly re-establish





themselves after a strong negative event. Abundance and distribution of macro-algae are therefore, not necessarily good indices for judging species health or potential adverse impacts of sediment discharge.

In the arid climate of West Maui, the new outlet will flow only during strong precipitation events, so there will be long periods when the outlet will have no effect on the nearshore marine resources. Since the impacts of this project on the coastal environment are anticipated to be measurable only following significant flood events, organism populations, especially sensitive to such impacts, would be relatively slow-growing, attached forms like corals. Algae, although attached, can regenerate a population in a matter of months after a storm discharge. Most other marine organisms will have a response similar to that of benthic algae. Fishes will leave the area during heavy discharge and return after outflow. Therefore, the approach of this DEIS and the marine studies by Grigg in 1983, 1986 and 1991 used coral species diversity and bottom cover as indices rather than algae or fishes, as coral provides habitat, grow slowly, and are slow to recruit.

In regards to the marine sediments found along the project shoreline, they are coarse-grained sands, gravels, and cobbles from terrigenous and marine sources. The fine-grained sediments such as clay and silts, remain in suspension in the energetic marine environment fronting the project area and are dispersed by ocean currents. Thus, silt in the marine sediment is not anticipated to have an adverse impact on the nearshore marine environment. This information will be incorporated in the FEIS.

2) ***Response to recommendation: "The FEIS should discuss the potential impacts of the proposed new floodwater discharge outlet on the nearshore algal communities along Lahaina, and on the spread of non-native species of macroalgae."***

The potential impacts of the proposed project on the nearshore algal communities along Lahaina will be discussed in the FEIS as follows.

> The cumulative effects of the proposed discharge from the second outlet on the nearshore algal communities along Lahaina are not anticipated to result in algal blooms nor influence the spread of non-native species of macroalgae. Research to-date on algal bloom and excessive benthic algal growth problems in West Maui, though not conclusive, have indicated that point source discharges from intermittent streams have not been the cause. Studies carried out by Tetra Tech, 1993; Soicher and Peterson, 1996; DeCarlo and Dollar, 1996; Kinetic Laboratories, 1997; Dollar and Andrew, 1997; and Dollar et al., 1999 suggest that groundwater inputs are more significant than episodic stream inputs as long-term contributors to nearshore growth-promoting nutrients. On the basis of studies completed, it is anticipated that moving storm runoff flows from one area (non-point source) to another (point source) will not result in reducing or enhancing

benthic algal growth in either of the areas affected by the proposal.

3) ***Response to recommendation: "The FEIS should include a discussion of the impacts to waters of the U.S. from potential placement of fill materials associated with project construction. The document should also include a discussion of the CWA Section 404 permit requirements and identify how the project will avoid, minimize and mitigate impacts to waters of the U.S."***

In the FEIS, the following discussions will be added to the DEIS, Chapter IV.J.

The Clean Water Act was enacted to restore and maintain the chemical, physical, and biological integrity of the Nation=s water. Section 404 of the Clean Water Act regulates the discharge of dredge and fill materials into the waters of the United States and establishes a permit process to ensure that such actions comply with environmental criteria used by the Corps of Engineers in evaluating all Section 404 permit applications.

The Section 404(b)(1) Guidelines direct the Corps of Engineers to permit the least damaging practicable alternative. Generally, this is the practicable alternative that either avoids waters of the U.S. or impacts the smallest areas. Minimization of impacts may occur where avoidance is not practical after due consideration of costs, existing technology, or logistics.

The array of alternatives evaluated to reduce flood losses in Lahaina included alternatives that did not require the construction of a debris basin Kauaula Stream. Nonstructural, land treatment alternatives did not provide the required level of flood protection, however. Alternatives that included outlet channels through Lahaina town created unacceptable impacts to the fringing reef and were considerably more costly due to higher landrights costs. The alternative that diverted flood flow to Kahoma Stream was deemed unacceptable as the additional floodwater reduced the level of protection to the downstream properties along Kahoma Stream. The two (2) alternatives that utilized portions of Kauaula Stream - the single outlet at Puamana and the selected alternative with two (2) outlets - provided the only two (2) practicable alternatives. Neither alternative would be functional without a debris basin and water control structure on Kauaula Stream to protect downstream structural improvements from damaging boulders and to split the flood flow between two (2) outlets.

While the detailed design of the debris basin is yet to be completed, some placement of fill in Kauaula Stream for the basin embankment at a location approximately 150 feet upstream from Honoapiilani Highway is unavoidable. Mitigation features to facilitate migration of native amphidromous species both downstream and upstream along Kauaula Stream will be investigated and incorporated into the design, as appropriate. Continual monitoring for cultural



resources will be conducted during excavation. The section 404 permit application will be completed concurrently with the debris basin design and will conform to the Section 404(b)(1) Guidelines.

4) ***Response to Recommendation: "The FEIS should include a thorough description of existing water quality conditions in the project area and the proposed project's consistency with state water quality standards. The FEIS should also discuss the state's role in issuing a water quality certification under CWA Section 404 for the proposed project."***

The water quality in the nearshore area is discussed in the assessment prepared by Sea Engineering, Inc. and included in the DEIS and in Appendix A.

In the FEIS, the following discussion will be added to a new section Chapter IV. K. Water Quality Certification.

The water quality in the nearshore area is discussed in the assessment prepared by Sea Engineering, Inc.

The State of Hawaii Water Quality Standards designate the marine water of the Lahaina Watershed as Class A and inland water as Class 2. Both designations are the less restrictive classifications provided under the Water Quality Standards. The receiving water in the project area is not listed as a Water Quality Limited Segment by the State Department of Health.

A Water Quality Certification provided by the State of Hawaii Department of Health is anticipated to be required for project installation. The certification, required by Section 401 CWA for projects applying for federal permits, asserts that the proposed activity will not violate the applicable water quality standards. The Section 401 permit conditions will direct construction timing and activities to minimize contamination of stream and ocean waters during construction.

For the long-term operation of the flood control project, a National Pollutant Discharge Elimination system (NPDES) permit will be acquired from the State Department of Health to authorize discharge of floodwater into the Kauaula Stream and into the ocean.

5) ***Response to Recommendation: "The FEIS should fully evaluate and compare the environmental impacts of all reasonable alternatives for controlling flood flows in the Lahaina watershed. The document should discuss whether less environmentally damaging alternatives, such as non-construction alternatives for reducing erosion and improving infiltration of surface flows or utilizing the existing channelized stream outlet at Kahoma stream, were considered for the proposed project. If full consideration and evaluation of other reasonable***

***alternatives is warranted, the NRCS should prepare a revised DEIS."***

A full range of alternatives to provide flood protection to the Lahaina watershed was evaluated during preparation of the DEIS and discussion of the alternatives has been expanded in the FEIS. Non-construction alternatives were evaluated, but were found to be ineffective in preventing flood damage during high intensity storms. Land treatment practices planned and designed by NRCS generally are ineffective during storms exceeding the 10-year recurrence storm. Use of the newly-completed Kahoma Flood Channel as an outlet was investigated during the formulation of alternatives for this project in the late 1980s. At that time, the U.S. Army Corps of Engineers stated in the coordination meeting that the additional flood flow from the Lahaina subwatershed would decrease the level of flood protection for the lowlying areas of the Kahoma floodplain and that the use of Kahoma Stream as an outlet was unacceptable. A recent inquiry to the flood program manager at the USACE on the use of Kahoma Stream produced the same negative result. Chapter VI, relating to Alternatives to the Proposed Action, will be revised to clarify the issues noted above.

*6)* ***Response to Recommendation: "The FEIS should describe the current and planned land use in the area immediately surrounding the proposed flood control project. Environmental impacts associated with the likely urban development of former sugar cane lands should be identified and discussed. Inducement of urban growth on these parcels from the implementation of the proposed project should also be discussed."***

The environmental impacts associated with the likely urban development of the surrounding agricultural lands will be identified and discussed in the FEIS as suggested. Generally, the lands adjacent to the uphill side of the flood control improvements are zoned agricultural. The two (2) major owners of the land north of Kauaula Stream are Kamehameha Schools and Pioneer Mill Company, Ltd. Kamehameha Schools has stated intentions to continue to keep the land in agriculture. Pioneer Mill Company, Ltd. plans for their lands are not formalized. To the south of Kauaula Stream, the Kauaula Land Company has subdivided its land into smaller agricultural lots which are presently being marketed.

It is noted that the recently updated hydrologic analysis for this project has considered the change in runoff characteristics due to changes in land cover from sugar cane to fallowed conditions. Should future land uses in the vicinity of the project include residential or related urban types of development, such uses shall conform to the County of Maui's drainage regulations. These regulations require that any post-development increase in runoff shall not be discharged downstream.

The inducement for urban growth from the implementation of the project will be in the relatively small area of land downhill of the diversion and above the aquatic center and recreational park. The County of Maui's West Maui Community Plan is the key land planning document governing spatial allocations of land uses within the



region. While marginal inducement to growth may result from the project, new proposals for growth which require new urban land designations are subject to strict review (including State of Hawaii environmental impact reviews) and approval by County ordinances. The processes in place are intended to ensure that impacts attributed to individual development proposals are appropriately addressed and mitigated.

Thank you for your comments and review of the DEIS.

Sincerely,

LAWRENCE T. YAMAMOTO
State Conservationist

cc: Joe Krueger, Civil Engineer, Count of Maui, Department of Public Works and Environmental Management
Michael W. Foley, Director, Maui County Dept. of Planning

7

TESTIMONY OF PETER W. MCKENNEY
EIS LAHAINA FLOOD CONTROL PROJECT
June 21, 2003

Lahaina has a flooding problem that I believe must be addressed. Dedicated and knowledgeable volunteers, such as Wes Nohara and Buddy Nobriga have given years of work to get this project going. Wes has received numerous awards for his soil management practices with Maui Pine and has extensive experience with flood control further up our coast. I believe we must all keep our comments constructive to be sure we do not kill this project by causing unreasonable delays. Here are some comments that I hope will be helpful.

I believe that most of the concerns expressed in the meeting could be addressed by dealing with *prevention.* Recommending prevention in the EIS would help by confirming its importance and help in funding. Planting, terracing, contouring, building settling ponds or reservoirs and reviving the infrastructure from the Pioneer Mill days could be very effective. The result could be a less costly and less intrusive design and will likely reduce the County's maintenance costs. The projected net improvement in silt discharge will also be improved. Soil and water will be retained on the mountain lands. The Natural Resource Conservation Service (NRCS) and the West Maui Soil and Water Conservation District (WMSWCD) have been working on this and could quickly provide data and suggestions that could improve the EIS.

The EIS needs to deal with the cumulative impact of the proposed by-pass highway. Neither the bypass nor the flood control EIS deals with the effect of the flooding on the highway, which will lie uphill in the path of the proposed flood control. The flood control EIS does not adequately deal with the impact of the highway on the proposed ditch.

Shouldn't the EIS deal with the impact of the Peter Martin subdivisions on the drainage problem? The EIS seems to pass of the former cane land use as "diversified ag". Shouldn't the EIS mention the new paving, roofs etc. that might affect the run-off? Will sub-division also affect the ownership, which could complicate the acquisition of land?

I feel that including the above matters in the revised EIS should help move the process along with strong community support.

Very respectfully,

Peter W. McKenney
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Lahaina 96767

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pmck222@aol.com

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November 24, 2003

Peter W. McKenney
Box 519
Lahaina, Hawaii 9676

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. McKenney:

Thank you for your written testimony dated June 21, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the order presented in your testimony.

*1.* ***Response to comment recommending prevention in the EIS would help by confirming its importance and help in funding***

A range of alternatives was evaluated to provide flood protection to the Lahaina watershed which included both non-structural and structural measures. Land treatment or conservation practices recommended by NRCS listed and described in the NRCS National Handbook of Conservation Practice include, but are not limited to, conservation cover, critical area planting, diversion dam, deep tillage, terracing, field borders and filter strips. The NRCS Field Office Technical Guide provides standards and specifications for the design and installation of the practices. Land treatment practices are generally intended to control runoff and provide soil erosion protection during frequently occurring storms. NRCS standards for enduring land treatment practices require a minimum capacity to handle the 10-year, 24-hour storm without overtopping or other failure. Most structures installed by landowners, even with financial assistance, will lose their erosion reduction and water handling effectiveness as the storm intensity nears the 10-year storm. Failure of some of the structures resulting from embankment or waterway erosion can be expected during storms exceeding the 10-year storm intensity. The proposed flood control system is designed for the 100-year storm event.

Land treatment of the upper Lahaina subwatershed areas can be implemented under the NRCS's conservation technical assistance program, which in coordination with the West Maui Soil and Water Conservation District, provides landowners and stewards with conservation planning and design assistance and financial assistance for practice installation. In response to comments and interest from the community to participate in such a program, information and discussion will be provided on land treatment programs and assistance in the FEIS.

Upgrading the existing water distribution infrastructure in the Lahaina subwatershed can provide limited floodwater control. During the active sugar-era, plantation operators would shut off the water to the irrigation ditches in times of impending storms to allow the ditches to handle storm runoff. It is estimated that ditches could handle 50 to 100 cubic feet per second (cfs). Therefore, the Lahainaluna Ditch and the Lahaina Pump Ditch could probably divert a total of 100 to 200 cfs from the subwatershed. This contribution to floodwater reduction can be significant during the less intense storms such as the 2-year storm with a peak discharge of 264 cfs or the 5-year storm with a peak discharge of 678 cfs. However, during the more intense storms, contribution of these ditches is less significant as the peak discharges of the 50-year and 100-year storms are 2,097 cfs and 2,574 cfs, respectively. Other ditches in the upper part of the subwatershed, such as Paupau Ditch, do not flow toward a safe outlet and do not provide floodwater reduction.

Constructing additional water storage was evaluated, but deemed to be cost prohibitive. Two structural approaches to deal with floodwater control in the United States include channelization and detention. Floodwater detention consists of the installation of a storage reservoir to receive and temporarily store the floodwater, while releasing water at a rate not exceeding the capacity of downstream channels. The hydrologic model indicates that the 100-year, 24-hour storm will result in the runoff of nearly 1,000 acre-feet or 330 million gallons of water from the Lahaina subwatershed. The 10-year storm results in 460 acre-feet or 150 million gallons. Approximately 80 percent of the runoff occurs in a 4-hour period during which the peak discharge occurs. A flood retention reservoir to include the Kauaula subwatershed would be considerably larger than the Lahaina subwatershed. We note that a reservoir for flood protection is not fully compatible with a reservoir for water storage and other uses. In the case of flood protection, the designed water detention volume of the reservoir needs to be emptied as soon as practicable in order to be ready to properly function in the next storm. Additional storage capacity to store water for other uses will, therefore, be required as part of the reservoir design. This will add a substantial cost to the project and was not considered to be feasible.



2. ***Response to cumulative impacts of the Lahaina Bypass***

As discussed in the DEIS, where the proposed Lahaina Bypass highway traverses drainageways, within the project subwatersheds, the existing drainage pattern will be maintained by construction of culvert structures to allow runoff to flow under the highway and into the diversion channel. The intent of this "pass-through" system is to ensure that the functional characteristics of the flood diversion project are not adversely impacted by the future roadway. The updated hydrologic study provided information on the storm runoff volumes generated during a 100-year, 24-hour storm event based on the current surrounding fallow agricultural lands.

Since the Lahaina Bypass design is only preliminarily formulated at this time, issues pertaining to the functional integration of the drainage design of the Lahaina Bypass and the proposed flood control project still need to be resolved. However, review of the Cumulative Impact Analysis contained in the Record of Decision, Honoapiilani Highway (Route 30) Launiupoko to Honokowai, Lahaina Bypass Project, issued by the U.S. Department of Transportation, Federal Highway Administration indicate that no adverse impacts are anticipated for the proposed flood control project. The need for further design coordination has been identified and will be carried out to ensure the functional integrity of the two projects.

3. ***Response to comments on the impacts of surrounding agricultural subdivisions***

The DEIS included an updated hydrologic analysis to reflect the change in runoff from active sugar cane fields to fallow fields. The FEIS will be updated to reflect the current plans that are proposed for the surrounding agricultural lands. In this regard, we note, in accordance with Maui County Code (MCC) Chapter 20.08 Soil Erosion and Sedimentation Control and Title 15, rules for the design of storm drainage facilities in the County of Maui, all landowners are responsible for addressing and mitigating drainage impacts. With respect to the development of the upland agricultural lands, in this case Makila Land Company, LLC and Kauaula Land Company, LLC will be responsible to provide detention and desilting basins within their respective agricultural subdivision developments to maintain current levels of runoff flowing from their lands (i.e., the fallow fields condition). Collectively, through these measures, it is anticipated that there will be no additional impacts to downstream or adjacent properties from the development of the former agricultural lands.

Peter W. McKenney
November 24, 2003
Page 4

Again, thank you for your comments and review of the DEIS.

Sincerely,

Milton Arakawa

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/mckenney



1144

To: Mr. Gilbert Coloma-Agaran, Director
Department of Public Works and Environmental Management
200 S. High Street, Wailuku, HI 96793

June 22, 2003

From: Isaac D. Harp and Tammy A. Harp
PMB 791, 843 Wainee St., F-5
Lahaina, HI 96761
Phone: (808) 661-4527

Re: Draft Environmental Impact Statement - Lahaina Watershed Flood Control Project

Dear Mr. ~~Coloma-Agaran~~ Bill,

First congratulations on your appointment as Director. We are submitting the following comments regarding the Draft Environmental Impact Statement (DEIS) prepared for the proposed Lahaina Watershed Flood Control Project for your consideration.

Summary of Comments:

The proposed flood control project takes the approach of diverting the problem (rainwater runoff) rather than addressing it directly at the location of the problem. As proposed, the project would create significant negative effects to the near-shore marine ecosystems South of Lahaina Town. Marinelife and cultural practices that occur South of Lahaina Town appear in the DEIS to be expendable to protect flood prone dwellings and business in the Lahaina Town vicinity. According to the Executive Summary, Background Section on page "i": "*Sediment laden storm runoff turns the near shore ocean water a reddish-brown color resulting in income losses for ocean-front hotels and ocean related businesses, reduced recreational and cultural gathering opportunities, and reduced visitor appeal of the Lahaina area.*" The DEIS unjustifiably states that "*...ocean-front hotels and ocean related businesses, reduced recreational and cultural gathering opportunities, and reduced visitor appeal of the Lahaina area.*" There are very few ocean-front hotels in Lahaina Town, ocean related businesses are primarily boat based businesses that transport tourists out of the Lahaina area due to high vessel traffic in the area, and many ocean activities involve offshore activities such as charter fishing, snorkeling and scuba trips to Molokini and Lanai, as well as seasonal whale watching.

Granted, during times of heavy rains in the West Maui area, the near shore ocean waters do turn a reddish-brown, a result of the now widely exposed and unplanted agricultural fields that skirt the western flanks of the West Maui Mountains. Pioneer Mill Sugar Company ceased their sugarcane planting operation several years ago, thus leaving the former sugarcane fields barren. Agriculture lands of West Maui are now sprouting "gentlemen's estates." Estates above Launiupoko Beach Park are now generously donating their runoff to the ocean South of the park, through the drainage outlet that flows under the highway. Runoff from the estates' roadway also flows over the highway entering the beach park, which now conveniently serves as the sediment basin for estate owners. Best Management Practices such as terracing and trenching to aid in rainwater percolation, grass planting and other efforts should be required of the large landowners to assist in alleviating the problem of rainwater becoming sediment laden runoff and floodwaters in the lower elevations. Landowners be held accountable and accept responsibility for problems that originate on their properties.

Cultural gathering is very rare within the vicinity of Lahaina Town due to the oily runoff from the roadways, discharge from dozens of moored vessels, pollution from Lahaina Harbor, polluted runoff from urban and light industrial commercial development in the area, etc. South of Lahaina Town, the water and marinelife is much cleaner and the area is frequented much more often by cultural practitioners than the Lahaina Town area because of the availability of a variety of marinelife found in clean waters. We note that the ocean water fronting Lahaina Town is already on the Environmental Protection Agency's list of polluted waters.

Alternatives exist that are not listed in the DEIS, but should be explored before resorting to old technology of diverting runoff directly into the ocean, a technology that has resulted in significant negative environmental effects in so many locations throughout Hawaii, and in fact, the world. We have provided a few actions that could help mitigate problems associated with floodwaters in our comments below, that if implemented, could reduce the effects of the problem and reduce the need for taking the extreme action of diverting floodwaters and related sediments into the ocean. For these reasons, amongst others, we strongly recommended that the project as proposed be rejected and alternative measures fully investigated prior to the preparation of the Final Environmental Impact Statement.

The focus of the proposed project is to reduce floodwater concerns in the Lahaina Town area, but we cannot allow actions that would clearly result in significant negative effects to other areas. Diverting rainwater runoff into the ocean is the last resort, and we cannot waste such a precious commodity by dumping it. Retention is the key to alleviating some of the problems associated with rainwater, a gift from the heavens.

We have provided below for context, underlined excerpts from Act 50 adopted by Governor Cayetano on April 26, 2000.

**Excerpts from Act 50:**

SECTION 1. The legislature finds that there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawaii's culture, and traditional and customary rights. *(emphasis added)*

The legislature also finds that native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the "aloha spirit" in Hawaii. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on government agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups. *(emphasis added)*

Moreover, the past failure to require native Hawaiian cultural impact assessments has resulted in the loss and destruction of many important cultural resources and has interfered with the exercise of native Hawaiian culture. The legislature further finds that due consideration of the effects of human activities on native Hawaiian culture and the exercise thereof is necessary to ensure the continued existence, development, and exercise of native Hawaiian culture. *(emphasis added)*

The purpose of this Act is to: (1) Require that environmental impact statements include the disclosure of the effects of a proposed action on the cultural practices of the community and State; and (2) Amend the definition of "significant effect" to include adverse effects on cultural practices.

SECTION 2. Section 343-2, Hawai'i Revised Statutes, is amended by amending the definitions of "environmental impact statement" or "statement" and "significant effect," to read as follows.

"Environmental impact statement" or "statement" means an informational document prepared in compliance with the rules adopted under section 343-6 and which discloses the environmental effects of a proposed action, effects of a proposed action on the economic welfare, social welfare, and cultural practices of the community and State, effects of the economic activities arising out of the proposed action, measures proposed to minimize adverse effects, and alternatives to the action and their environmental effects. (emphasis added)

"Significant effect" means the sum of effects on the quality of the environment, including actions that irrevocably commit a natural resource, curtail the range of beneficial uses of the environment, are contrary to the State's environmental policies or long-term environmental goals as established by law, or adversely affect the economic welfare, social welfare, or cultural practices of the community and State. (emphasis added)

**SPECIFIC COMMENTS TO DEIS:** (*Quoted Text from DEIS is italicized*, and Comments are in plain text.)

**Pg. [illegible]:**
*The proposed project is designed to reduce the overall sediment discharge in project area approximately 25%.*

The project as designed may reduce sediment discharge in the area fronting Lahaina Town, but will adversely affect areas South of Lahaina Town at and around planned discharge outlets. The significant effects that are perceived to occur at the second outlet within the DEIS warrants a redesign of the proposed plan, or selection of an alternative plan.

**Pg. [illegible]:**
*Sediment outflow of Kauaula Stream at Makila Point will be reduced by approximately 52 percent.*

It is not possible to reduce the sediment outflow of Kauaula Stream by 52% utilizing the proposed plan. Sufficient means of addressing sediment flow into the stream at higher elevations are lacking to justify this claim.





**Pg. [illegible]:**
*The proposed project will result in impacting two (2) species of limu (seaweed) in a limited area adjacent to the second outlet and redistribute the development of limu in the project area*

Although this statement may be true, the DEIS fails to recognize that many other cultural resources would also be negatively impacted by the proposed project. Other resident, transient, and seasonal species occur in the project area, including various species of finned fish, crustaceans, urchins, shellfish, and other species of limu. The area is also know by long-time Lahaina families as shark pup habitat.

The sediment discharge from the second discharge outlet will significantly effect the Hawaiian green sea turtle (threatened species) that forage and transit the area, as well as the Hawaiian monk seal (endangered species) that occasionally hauls out along the coastline between Kauaula Stream and Launiupoko Beach Park to the South of the second discharge outlet.

The statement that the proposed project would redistribute the development of limu in the project area needs to be expanded to explain how and where redistribution would occur, and what species would be redistributed. [***Please note that smothering the benthic habitat with sediment does not justify a claim that the proposed project would "redistribute the development" of any marinelife in the project area. Elimination of an ecosystem does not constitute a redistribution of development.***]

The marine assessment prepared by Sea Engineering, Inc. for the Lahaina Watershed Flood Control Project DEIS, appears to favor the acceptance of the proposed project rather than provide a full-unbiased analysis of potential effects. Throughout the DEIS, material is provided that appears to mislead the reader to conclude that there will be no negative effects from the proposed project, and if there are, such effects will be short-term and minimal. One example is found on page 62, where the issue discusses the "*plume*" generated by storms of 2, 5, and 10 years. Here we find this statement: "*The surface plumes are predicted to meet the State water quality standard of being within 10 percent of ambient salinity (31.5 ppt) within about 17 to 21 hours.*" The concern is not the salinity of the water, but the silt and sediment associated with storm water runoff. This type of information appears to intentionally mislead, and most readers unfamiliar with terminology used in the DEIS, they may not realize that the plume discussion only involves salinity, and not silt or sedimentation.

Cumulative effects could result in the most significant impact of all, a total destruction of the existing coastal marine ecosystems found South of Lahaina Town, particularly at and near the second discharge outlet northward. Sediments will be transported northward towards Lahaina Town by prevailing northerly coastal currents. If the intent of the proposed project includes long-term improvements to the water quality fronting Lahaina Town, and a diversion system is found to be absolutely necessary, discharge outlets should be located North of Lahaina Town, not South. Common sense appears to be absent throughout much of the DEIS.

**PROJECT LOCATION, EXISTING USE, AND LAND OWNERSHIP**

**Pg. [illegible]:**
*Approximately 42 acres of land will be required for installation of the proposed floodway diversion system and related structures.*

Forty-Two (42) acres is a significant amount of land to acquire for a project that could lead to significant environmental and cultural resource impacts. Although this is true, 42 acres of land is a significant amount of land that may be utilized for a relocation of flood-prone residents and businesses, an alternative to the diversion proposal that should be fully investigated.

**Pg. [illegible]:**
*A debris basin is proposed to be installed at the junction of the grass-lined diversion channel and Kauaula Stream. The debris basin will trap boulders and cobbles transported by the high gradient Kauaula Stream. The basin is designed to be a flow-through structure with no flood storage or detention capability.*

The estimated requirement of 42 acres of land and the estimated $12-14 million to develop the project that will undeniably result in significant effect to the marine environment and cultural resources is a large price to pay for a project the will result in the need to mitigate environmental damage at some later date. It is estimated on page 14, that the County of Maui will need to provide an estimated $260,000 annually for ongoing operations and maintenance of the project.

An alternative approach to reducing flooding would be relocation of flood prone residential units to higher ground, and utilization of vacated lots as de-silting and floodwater retention basins. As it is now, *these lots already experience* flooding during heavy rains. Modifications to increase retention capacity and discharge characteristics could make the vacated lots a valuable asset in flood control, and provide much needed open space in the Lahaina Town area. This alternative would:

- Reduce flooding to existing residential units by eliminating flood prone units;
- Provide for retention of silt and sediments from lands situated upland of Lahaina Town;
- Reduce the negative effects from discharge outlets planned South of Lahaina Town.

We must address the problem at the location of the problem rather than diverting the problem. Methods to reduce sedimentation such as retention of as much rainwater on the land as possible, increasing percolation capabilities on the land itself. Increasing retention basins in the higher elevations, etc.. are some of the actions that should be consider the first activities of action rather than moving directly to what should be the last resort.

There are activities that would cost little, but could provide significant results that can and should be employed immediately. The use of bulldozers with ripping claws attached to the rear to rip the former sugar lands to a minimum depth that would allow percolation of rainwater into the ground is one alternative that should be considered a priority. After decades of plowing the surface of these lands for agriculture, the sub-surface soils have become compacted and water cannot readily percolate through the compacted soil. This prevention of rainwater percolation forces the rainwater to sheet down towards lower elevations, eventually reaching the ocean. The core sampling could be done to determine what areas would provide the best percolation qualities and ripping through the compacted layer could begin in these areas to reduce runoff from upper elevations.

Rather than going on end on, page-by-page with typically the same type of comments already provided, I would like to mention that I graded Chapter VII. FINDINGS AND CONCLUSIONS during the last Public Hearing held in Lahaina in June 2003 and came up with the following results, condensed for brevity.

Pg. 123

1. *No Irrevocable Commitment to Loss or Destruction of any Natural or Cultural Resource Would Occur as a Result of the Proposed Project*

Response: The DEIS page 105 projects that the second drainage outlet would increase sediment discharge into the ocean by approximately 3,280 tons per year. It is predicted that sediments from this area will be sufficient to "refresh" other beaches, which tells even the layperson that 3,280 tons of sediment per year is a significant amount. The sediment would smother the benthic marine habitat directly seaward and the ocean area surrounding and down current of the outlet, resulting in not only the loss of the two species cited in the DEIS, but the loss of the entire ecosystem in the area.

2. *The Proposed Action Would Not Curtail the Range of Beneficial Uses of the Environment*

Response: The loss of the marine ecosystem and its associated cultural resources at and near the second discharge outlet from the anticipated 3,280 tons of sediment annually states otherwise.

Pg. 124

3. *The Proposed Action Does Not Conflict With the State's Long-Term Environmental Policies or Goals or Guidelines as Expressed in Chapter 344, HRS*

Response: The DEIS seems to be citing the wrong Chapter of the Hawaii Revised Statutes in their statement as the proposed project clearly conflicts with the language explaining the purpose of HRS 344 below.

"[344-1] Purpose. *The purpose of this chapter is to establish a state policy which will encourage productive and enjoyable harmony between people and their environment, promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, and enrich the understanding of the ecological systems and natural resources important to the people of Hawaii. [L 1974, c 247, pt of §1; gen ch 1993]*" (emphasis added)

Pg. 125

4. *The Economic or Social Welfare of the Community or State Would Not Be Substantially Affected*

Response: The economic welfare of the community would not be substantially affected, but the Social welfare would be. The project would result in the loss of cultural resources, thus loss of opportunity *to continue cultural* practices in an area that has historically provided for such, which is contrary to Act 50.





5. *The Proposed Action Does Not Affect Public Health*

Response: The residents that depend on the limu and other resources, including enjoyment of the existing coastal area in it's natural state will affect the health of those who will no longer be able to access their subsistence resources, which is to say customary and traditional foods. This would have a direct negative affect on a small but definite community of cultural practitioners.

6. *No Substantial Secondary Impacts, Such as Population Changes or Effects on Public Facilities, are Anticipated*

Response: Agree with this statement.

7. *No Substantial Degradation of Environmental Quality Is Anticipated*

Response: The annual discharge of 3,280 tons of silt and sediments from one of two discharge ocean outlets would result in more than substantial degradation to the area, it would lead to the destruction of the marine ecosystems in the immediate area, and could lead to the same in more distant locations as the prevailing currents will transport sediments northwards over the years.

Pg. 126

8. *The Proposed Action Does Not Involve a Commitment to Larger Actions, Nor Would Cumulative Impacts Result In Considerable Effects On The Environment*

Response: Cumulative impacts would result in considerable effects on the environment. Please see previous responses.

9. *No Rare, Threatened or Endangered Species or Their Habitats Would be Adversely Affected By The Proposed Action*

Response: Green sea turtles, a threatened species forages in the area of the second outlet. There are recent reports of Hawaiian monk seals hauling out in the area of the second outlet. The project would adversely affect the ecosystem in the immediate area and could have significant effects on these threatened and endangered marine mammals.

10. *Air Quality, Water Quality or Ambient Noise Levels Would Not Be Detrimentally Affected By The Proposed Project*

Response: Air quality and ambient noise levels may not be detrimentally affected by the proposed project, but water quality will definitely detrimentally affected. See response to number 7.

Pg. 127

11. *The Proposed Project Would Not Affect Environmentally Sensitive Areas, Such As Flood Plains, Tsunami Zones, Erosion-prone Areas, Geologically Hazardous Lands, Estuaries, Fresh Waters or Coastal Waters*

Response: Near shore marine estuaries and coastal waters will be negatively affected by silt and sediment concentration resulting from the proposed project.

12. *The Proposed Project Will Not Substantially Affect Scenic Vistas and Viewplanes Identified in County or State Plans or Studies.*

Response: This may be true. Due to the lack of time to seek information relative to this statement, I have little alternative at this time but to agree with this statement.

13. *The Proposed Project Will Not Require Substantial Energy Consumption*

Response: Other than the energy required to excavate the thousands of feet of lands, estimated in the DEIS to be 12 acres, energy would not be required beyond the County's responsibility to operate, maintain, and repair the project once built. The DEIS page 14 estimates that it will require approximately $260,000 of annual funding by the County of Maui to operate, maintain and repair the project.

**Questions to the DEIS Preparers:**

1. Has an assessment of Lahaina's existing rainwater drainage system been conducted? If so, how much of the existing drainage system remains functional?
2. Has a marine assessment along the entire project site shoreline ever been conducted? If so, what are the existing conditions South of Lahaina Town, fronting Lahaina Town, and North of Lahaina Town?
3. Where and what are the conditions of the existing drainage outlets along the project site shoreline from Launiupoko Park to the North end of Front Street?
4. Has flooding occurred historically in the areas of Shaw St. / Waine'e Street / Prison Street / Front St.? If so, why were residential structures allowed to be constructed in these flood zones?
5. Is federal funding available to upgrade the existing rainwater drainage system?
6. Could federal funding be utilized to relocate residents currently living in known flood zones?
7. Could federal funds be obtained to rip agricultural lands to promote percolation of rainwater?
8. Could federal funds be obtained to increase availability of retention and desilting basins for existing drainage systems?

Mahalo for your time and consideration of our comments to the Draft Environmental Impact Statement prepared for the Lahaina Watershed Flood Control Project. If you have any questions, please do not hesitate to give us a call.

Sincerely, Isaac D. Harp Tammy A. Harp

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Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Isaac and Tammy Harp
PMB 791
843 Wainee Street, F-5
Lahaina, Hawaii 96761

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. and Mrs. Harp:

Thank you for your letter dated June 22, 2003 commenting on the subject project. We wish to provide the following information in response to your specific comments in the same order presented in your letter.

1. ***Page 2: Response to comments that "the significant effects that are perceived to occur at the second outlet within the DEIS warrants a redesign of the proposed plan, or selection of an alternative plan."***

   Alternative designs were considered during the project development phase. The selected alternative was deemed viable and preferred based on hydrologic and marine impact considerations. We note that changes in marine algae distribution may result from either reductions in salinity or substratum at the second outlet and the improvement in water quality and reduction of sedimentation throughout the study area. The shifts in marine populations in the project area were not considered a significant adverse impact to the local marine ecosystem.

2. ***Page 2: Response to comment, "It is not possible to reduce the sediment outflow of Kauaula Stream by 52% utilizing the proposed plan. Sufficient means of addressing sediment flow into the stream at higher elevations are lacking to justify this claim."***

The estimate of the reduction in sediment outflow at Kauaula Stream was based on sediment discharge calculations provided by the hydrology model developed for the Lahaina and Kauaula subwatersheds and the "trap efficiency" of the sediment basins based on design flows. The flood control system will be designed to capture the stormwater runoff from higher elevations at designated intake channels and convey the runoff through three sediment basins and divert flows at the Kauaula debris basin between Puamana channel and the second outlet.

3. ***Page 3: Response to comments that "the DEIS fails to recognize that many other cultural resources would also be negatively impacted by the proposed project. Other resident transient, and seasonal species occur in the project area, including various finned fish, crustaceans, urchins, shellfish, and other species of limu. The area is also know (sic) by long-time Lahaina families as "shark pup habitat."***

The potential impacts of this project on the coastal environment are anticipated to be measurable only following significant flood events. Organism populations especially sensitive to such impacts would be relatively slow-growing, attached forms like corals. Algae, although attached, can regenerate a population in a matter of months after a storm discharge. Most other marine organisms will have a response similar to that of benthic algae. Fishes will leave the area to return after outflow ceases. Smaller invertebrates may be impacted over an area immediately off the second discharge outlet, but will return to former population numbers on a time scale less than the frequency of damaging storms. Algae and invertebrate species better adapted to surviving short-term salinity depression will naturally have an advantage for living near the second outlet.

4. ***Page 3: Response to the comment "The sediment discharge from the second discharge outlet will significantly affect the Hawaiian green sea turtle (threatened species) that forage and transit the area, as well as the Hawaiian monk seal (endangered species) that occasionally hauls out along the coastline between Kauaula Stream and Launiupoko Beach Park to the south of the second discharge outlet."***

As discussed in the DEIS, no adverse project-related impacts are anticipated to affect sea turtles that may rest or forage within the project area. Significant



discharges will only occur when there are storms or heavy upland rainfall. These will be of short durations and water quality is anticipated to return to meet State Department of Health salinity water quality standards within approximately 20.7 hours after the discharge event.

The Hawaiian monk seal (Monachus schauinslandi) haul out opportunistically at remote areas. They prefer sandy beaches for haul out. A recent review of the Hawaii Natural Heritage Database indicated that an endangered Hawaiian monk seal was sighted in 1985 near Mala Wharf, approximately one mile north of the project boundary. Subsequent sightings of the monk seal in or near the same location are not indicated by the Heritage Database. The reef area fronting Lahaina may provide a foraging area for the seals, but is not unique along the Maui coastline. Their prey is known to include octopus, lobster and fish, including eels and flatfish. The descriptive monograph posted by the National Marine Fisheries Service on their Stock Assessment Program website states that "a small number of seals are distributed throughout the main Hawaiian Islands" and that the major populations are located in the Northwest Hawaiian Islands. Habitat critical to the monk seal population recovery does not appear to exist near or in the project area. Installation of the proposed project should not adversely affect the habitat of the Hawaiian monk seal.

5. ***Page 3: Response to comment, "The statement that the proposed project would redistribute the development of limu in the project area needs to be expanded to explain how and where redistribution would occur, and what species would be redistributed."***

Discussion of the marine biology assessment concerning the impacts to the algae in the project area will be expanded in the Final EIS as follows.

> A total of five species of culturally important marine macroalgae (i.e. seaweed or "limu") were found during the 2002 survey work. These species are used locally as a traditional food source. They were *Dictyopterus plagiogramma* (limu lipoa), Asparagopsis taxiformis (limu kohu), Ulva fasciatus (palahalaha), Codium spp. (wawae`iole), and Enteromorpha spp. (`ele`ele). Of these, palahalaha is probably the least used today. At the site closes to the proposed new discharge site (D`), two out of the five culturally important species were found (limu lipoa and limu kohu).
>
> None of these species were observed at Site B, which is where Kauaula Stream discharges. Palahalaha and ele`ele were found at

Site A1, which is a current discharge site. Because a discharge outlet can be associated with pulses of freshwater and nutrients, and because salinity and nutrient levels affect algal communities, movement of the outlet may alter the current algal distribution. Routing discharge to D1 (the second outlet location) may impact limu lipoa and limu kohu in this area. Conversely, removal of discharge from its current location(s) may balance this impact.

Algae have rapid life cycles can quickly re-establish themselves after a strong negative event. Since the second outlet will flow only during strong precipitation events, there will be long periods when the outlet will have no effect on the offshore biota. Algae can therefore regenerate a population in a matter of months after a storm discharge. There has been an increase of algae species inventoried throughout the study area from 1986 to 2002, (Refer to Tables 1 and 2). Moreover, since types and distribution of algae will influenced more by salinity and substratum impacts which will be localized in the vicinity of the second outlet, the algal communities should continue to flourish throughout the project area. Therefore, the need for mitigation is not anticipated.

6. ***Page 3: Response to comment that, "The concern is not the salinity of the water, but the silt and sediment associated with storm water runoff.***

In response to the comment regarding the plume modeling analysis, salinity was used as a tracer in the plume study because there was no other available quantitative information on the expected runoff. However, the plume model is a good predictor for turbidity caused by fine particulates suspended in the plume, as dilution contours are valid for any conservative tracer (i.e., not reduced by factors other than dilution).

The potential impact of sediment discharge resulting from the second outlet was modeled and anticipated to be limited to a seafloor area of approximately 121,708 square feet based on a 10-year storm. This area fronting the second outlet was less diverse in marine resource parameters inventoried, such as coral, algae and fish species. Removing sediment discharge from the more abundant and species diverse area fronting Lahaina Town to the second outlet location is not anticipated to have cumulative adverse impacts on the nearshore marine environment.



7. ***Page 3: Response to comment that "If the intent of the proposed project includes long-term improvements to water quality fronting Lahaina Town and a diversion system is found to be absolutely necessary, discharge outlets should be located North of Lahaina Town, not South".***

The intent of the proposed project is to protect Lahaina from flooding, and thereby protect lives and property. In essence, combining numerous non-point discharges into a single point discharge was determined to cause less overall environmental impact. By removing approximately 25 percent of the sediment in the storm runoff throughout the project area, an overall improvement to water quality is anticipated throughout the project area. The outlet plume at the point source outlet, is more likely to move offshore due to its initial momentum.

As noted in the DEIS (Chapter II.A.7.f.), prevailing coastal currents off Lahaina were specified as semi-diurnal reversing tidal currents.

A full range of alternatives to provide flood protection in the Lahaina watershed was evaluated during the preparation of the DEIS and discussion of the alternatives has been expanded in the Final EIS. Use of the Kahoma Flood Channel, to the north of Lahaina Town, as an outlet was investigated during the formulation of alternatives for this project in the late 1980s. At that time, the U.S. Army Corps of Engineers (USACE) stated in the coordination meeting that the additional flood flow from the Lahaina subwatershed would decrease the level of flood protection for the lowlying areas of the Kahoma floodplain and that the use of the Kahoma Stream as an outlet was unacceptable. A recent inquiry to the flood program manager at the USACE on the use of Kahoma Stream produced the same negative result.

8. ***Page 3: Response to comment "42 acres of land is a significant amount of land that may be utilized for a relocation of flood-prone residents and businesses, an alternative to the diversion proposal that should be fully investigated".***

A number of alternatives to provide flood protection to the Lahaina watershed were evaluated during the preparation of the DEIS and discussion of the alternatives will be expanded in the Final EIS. Non-structural alternatives were evaluated, but found to be cost prohibitive in the case of the acquisition of vacant parcels and the removal of flood prone homes, or ineffective in protecting or preventing flood damage during high intensity storms in the case of floodproofing public and commercial buildings.

9. ***Page 3: Response to comment that, "An alternative approach to reducing flooding would be relocation of flood prone residential units to higher ground, and utilization of vacated lots as de-silting and floodwater retention basins. As it is now, these lots already experience flooding during heavy rains."***

See response to Item 3.a. above.

10. ***Page 4: Response to comment "Methods to reduce sedimentation such as retention of as much rainwater on the land as possible, increasing retention basins in the higher elevations, etc. are some of the actions that should be consider (sic) the first activities of action rather than moving to what should the last resort".***

As mentioned earlier, alternatives to provide flood protection to the Lahaina watershed included both non-structural and structural measures. Land treatment or conservation practices recommended by NRCS listed and described in the NRCS National Handbook of Conservation Practice include, but are not limited to, conservation cover, critical area planting, diversion dam, deep tillage, terracing, field borders and filter strips. The NRCS Field Office Technical Guide provides standards and specifications for the design and installation of the practices. Land treatment practices are generally intended to control runoff and provide soil erosion protection during frequently occurring storms. NRCS standards for enduring land treatment practices require a minimum capacity to handle the 10-year, 24-hour storm without overtopping or other failure. Most structures installed by landowners, even with financial assistance, will lose their erosion reduction and water handling effectiveness as the storm intensity nears the 10-year storm. Failure of some of the structures resulting from embankment or waterway erosion can be expected during storms exceeding the 10-year storm intensity. The proposed flood control system is designed for the 100-year storm event.

Land treatment of the upper Lahaina subwatershed areas can be implemented under the NRCS's conservation technical assistance program, which in coordination with the West Maui Soil and Water Conservation District, provides landowners and stewards with conservation planning and design assistance and financial assistance for practice installation. In response to comments and interest from the community to participate in such a program, information and discussion will be provided on land treatment programs and assistance in the FEIS.

Two structural approaches to deal with floodwater control in the United States include channelization and detention. Floodwater detention consists of the installation of a storage reservoir to receive and temporarily store the floodwater,



while releasing water at a rate not exceeding the capacity of downstream channels. The hydrologic model indicates that the 100-year, 24-hour storm will result in the runoff of nearly 1,000 acre-feet or 330 million gallons of water from the Lahaina subwatershed. The 10-year storm results in 460 acre-feet or 150 million gallons. Approximately 80 percent of the runoff occurs in a 4-hour period during which the peak discharge occurs. A flood retention reservoir to include the Kauaula subwatershed would be considerably larger than the Lahaina subwatershed. If we assume a release rate for the flood retention reservoir is limited to 1,000 cfs (cubic feet per second), a storage volume of 310 acre-feet or 100 million gallons is needed. A 300-acre-foot reservoir, with a depth of 30 feet will require approximately 14 acres of surface area. Additional land will be required to accommodate the footprint for the excavation and embankment of the reservoir. The 100 million gallon reservoir is estimated to cost $13.0 million before land acquisition costs. We note that a reservoir for flood protection is not fully compatible with a reservoir for water storage and other uses. In the case of flood protection, the designed water detention volume of the reservoir needs to be emptied as soon as practicable in order to be ready to properly function in the next storm. Additional storage capacity to store water for other uses will, therefore, be required as part of the reservoir design. This will add a substantial cost the project. Consideration of these factors renders the non-structural land treatment alternative coupled with channelization and detention ineffective and cost prohibitive.

11. ***Page 4: Response to comment "The sediment would smother the benthic marine habitat directly seaward and the ocean area surrounding and down current of the outlet, resulting in not only the loss of the two species cited in the DEIS but the loss of the entire ecosystem in the area."***

Bottom areas affected by different discharge events were modeled in the plume study. As presented in Table 8 of the DEIS, the bottom area affected by the discharge plume for the 10-year storm event is estimated to be approximately 121,708 square feet. The bed load of the sediment, consisting of particulates nominally greater than fine sand or silt in size, cannot be transported by the outlet flow past the point where the plume touches the bottom, or approximately 550 feet offshore for the 10-year flood. Most of the bed load will be deposited very near shore, where it will be worked and transported by the effect of waves and currents.

The algal species diversity at the site, as well as coral and fish species diversity are presented in Table 3 of the DEIS as follows, 3 species of coral, 12 species of algae and 30 species of fish at the proposed second outlet site. The marine biology assessment concluded the need for mitigation is not anticipated. See response to Item 5 above.

12. ***Page 4: Response to comment, "The loss of the marine ecosystem and its associated cultural resources at and near the second discharge outlet from the anticipated 3,280 tons of sediment annually states otherwise".***

See response to Item 3, 4 and 5 above.

13. ***Page 4: Response to comment, "The DEIS seems to be citing the wrong Chapter of the Hawaii Revised Statues in their statement as the proposed project clearly conflicts with the language explaining the purpose of HRS 344 below".***

As stated in the DEIS, the proposed action is in "consonance" with the policy and guidelines cited.

14. ***Page 4: Response to comment, "The project would result in the loss of cultural resources, thus loss of opportunity to continue cultural practices in an area that has historically provided for such, which is contrary to Act 50".***

See response to Item 3, 4, and 5 above.

15. ***Page 5: Response to comment, "This will have a direct negative effect on a small but definite community of cultural practitioners".***

See response to Item 3, 4 and 5 above.

16. ***Page 5: Response to comment, "The annual discharge of 3,280 tons of silt from one of two discharge ocean outlets would result in more than substantial degradation to the area, it would lead to the destruction of the marine ecosystem in the immediate area, and could lead to the same in more distant locations as the prevailing currents transport sediments northwards over the years."***

See response to Items 3, 4, 5 and 6 above.

17. ***Page 5: Response to comment, "Cumulative impacts would result in considerable effects on the environment".***

See response to Items 3, 4, 5 and 6 above. Mitigation measures have been identified as appropriate. The proposed project is not anticipated to result in long term cumulative or secondary impacts.



18. ***Page 5: Response to comment, "The project would adversely affect the ecosystem in the immediate area and could have significant effects on these threatened and endangered marine mammals".***

The proposed project in not anticipated to adversely affect green sea turtle nor Hawaiian monk seal populations . See response to Item 4 above.

19. ***Page 5: Response to comment, "Air quality and ambient noise levels may not be detrimentally affected by the proposed project, but water quality will definitely detrimentally (sic) affected."***

Based on the results of the modeling analysis, the surface plumes are predicted to meet the State water quality standard of being within 10 percent of ambient salinity (31.5 ppt) within about 17 to 21 hours for the 2-year and 10-year storm events, respectively. Overall, the water quality in the project area is anticipated to be improved due to the proposed improvements.

20. ***Page 5: Response to comment, "Nearshore marine estuaries and coastal waters will be negatively affected by silt and sediment concentration resulting from the proposed project."***

The second outlet will not discharge stormwater runoff into confined waters or an estuarine environment. Fine-grained sediments or silt remain in suspension in the energetic marine environment fronting the project area and are dispersed by ocean currents. With respect to sediment concentration, as mentioned in Item 6 above, most of the bed load will be deposited very near shore, where it will be worked and transported by the effect of waves and currents.

21. ***Page 6: Response to Questions to the EIS Preparers.***

1. The County of Maui, Department of Public Works and Environmental Management is currently preparing an overall drainage master plan for Lahaina. Current drainage improvements in the Lahaina area, although limited, remains functional.

2. Presently, there are 13 existing drainage outlets along the project site shoreline from Launiupoko Park to the north end of Front Street. All outlets are in working condition. The Lahaina Town Drainage Master Plan currently being carried out by the Department of Public Works and Environmental Management will indicate which outlets need to be replaced and which outlets need to be upgraded in size.

3. Flooding has occurred historically in the areas of Shaw, Wainee, Prison and Front Streets. Residential structures in flood prone areas must meet Maui County Code Chapter 19.62 Flood Hazard Area, which regulates construction in flood hazard areas and imposes restrictions upon manmade changes to improved and unimproved real estate within the areas. Lahaina Town is a National Historic Landmark and many structures in the flood prone areas of Lahaina were built before 1981, when the ordinance establishing Chapter 19.62 was enacted by County Council.

4. We are not aware of any Federal funding available to upgrade the existing rainwater drainage system.

5. Under certain conditions, federal funding is available to relocate residents currently living in known flood zones. Non-structural alternatives, including deep tillage, were investigated in the context of the Lahaina Watershed Plan and deemed to be ineffective to provide the necessary protection for the 100-year storm event.

6. As mentioned earlier, federal funding through NRCS is available for land treatment practices which increase infiltration and reduce erosion including deep tillage, water and sediment control basins, diversions, irrigation storage reservoirs.

Again, thank you for your comments and participation in the Draft EIS review process.

Sincerely,

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/harp

1341

LINDA LINGLE
GOVERNOR OF HAWAII

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Return to ________ Date ________
Ref. No. ________
By: ________ Date ________

July 11, 2003

LD-NAV
LAHAINWWFCPDEIS.RCM

Honorable Gilbert Coloma-Agaran
Director
Department of Public Works and
Environmental Management
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Agaran:

SUBJECT: Draft Environmental Impact Statement (DEIS) for Lahaina Watershed Flood Control Project - County of Maui, Department of Public Works and Environmental Management - Lahaina, Island of Maui, Hawaii Consultant: Munekiyo and Hiraga, Inc.

Thank you for the opportunity to review and comment on the subject matter.

The Department of Land and Natural Resources' (DLNR) Land Division transmitted or made available a copy of the subject DEIS to the following DLNR Divisions for their review and comment:

- Division of Aquatic Resources
- Engineering Division
- Commission on Water Resource Management
- Office of Conservation and Coastal Lands
- Land Division Maui District Land Office

Attached is a copy of the Commission on Water Resource Management comment.

The Department of Land and Natural Resources has no other comment to offer.

If you have any questions, please feel free to contact Nicholas A. Vaccaro of the Land Division Support Services Branch at 1-808-587-0384.

Very truly yours,

DIERDRE S. MAMIYA
Administrator

C: MDLO

LINDA LINGLE
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DEPUTY DIRECTOR

2003 JUL -7 A 9:55

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

July 8, 2003

TO: Ms. Dede Mamiya, Administrator
Land Division

FROM: Ernest Y.W. Lau, Deputy Director EYWL
Commission on Water Resource Management (CWRM)

SUBJECT: Lahaina Watershed Flood Control DEIS

FILE NO.: LAHAINAWWFCPDEIS.CMT

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

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

[ ] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

[ ] We recommend coordination with the Land Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[ ] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] A Well Construction Permit and/or a Pump Installation Permit from the Commission would be required before ground water is developed as a source of supply for the project.

[ ] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the Commission would be required prior to use of this source.

[ ] Groundwater withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] We are concerned about the potential for degradation of instream uses from development on highly erodible slopes adjacent to streams within or near the project. We recommend that approvals for this project be conditioned upon a review by the corresponding county's Building Department and the developer's acceptance of any resulting requirements related to erosion control.

[X] If the proposed project includes construction of a stream diversion, the project may require a stream diversion works permit and amend the instream flow standard for the affected stream(s).

[X] If the proposed project alters the bed and banks of a stream channel, the project may require a stream channel alteration permit.

[X] OTHER:

There is no discussion of why this is a problem at this time, how the problem arises, and therefore one cannot assess whether there has been adequate discussion of potential alternatives; the only "alternatives" are varying configurations and materials used for doing the same project. There is no evaluation of using existing stream channels, whose flows have long been diverted in entirety, as natural drainage channels.

There is no indication of the source for irrigating the grassed channel nor the cost of channel maintenance.

We are aware that the Kauaula Stream channel has been discussed as a potential historic district, with interest in restoring the Puu Honua. This does not appear in the document, but the project seems contrary to such an interest.

If there are any questions, please contact Charley Ice at 587-0251.

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LINDA LINGLE
GOVERNOR OF HAWAII

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June 18, 2003

LD/NAV
Ref.: LAHAINWWFCPDEIS.CMT

L-2642
Suspense Date: 6/23/03

MEMORANDUM:

TO:
XXX Division of Aquatic Resources
Division of Forestry & Wildlife
Na Ala Hele Trails
Division of State Parks
Division of Boating and Ocean Recreation
XXX Commission on Water Resource Management
XXX Conservation and Coastal Lands
XXX Engineering Division
XXX Maui District Land Office (Received)

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT Draft Environmental Impact Statement for Lahaina Watershed Flood Control Project - County of Maui, Department of Public Works and Environmental Management

Please review the DEIS pertaining to the subject matter and submit your comments (if any) on Division letterhead signed and dated by the suspense date.

**Note: One copy of the DEIS is available for review in the Land Division Office, room 220**

Should you need more time to review the subject matter, please contact Nicholas A. Vaccaro at ext.: 7-0384.

If this office does not receive your comments by the suspense date, we will assume there are no comments.

(✓) We have no comments. ( ) Comments attached.

Division: Maui District Land Office Signed: James K. Kyo

Title: District Land Agent Date: 7-2-03

ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

MILTON M. ARAKAWA, A.I.C.P.
Deputy Director

Telephone: (808) 270-7745
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**COUNTY OF MAUI**
**DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT**
**ENGINEERING DIVISION**
200 SOUTH HIGH STREET
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RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

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

BRIAN HASHIRO, P.E.
Highways Division

JOHN D. HARDER
Solid Waste Division

November 24, 2003

Dierdre S. Mamiya, Administrator
State of Hawaii
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Ms. Mamiya:

Thank you for your letter dated June 11, 2003 commenting on the subject project. We wish to provide the following information in response to comments provided by the Commission on Water Resource Management in the order presented in their letter.

We note that a stream diversion works permit and stream channel alteration permit alteration will be required for the proposed project. Application for these permits will be submitted during the design phase of the proposed improvements.

The discussion of the need for the project was presented in Chapter I.B of the DEIS. Existing watershed and drainage conditions were discussed in Chapter II.C.5. The updated hydrologic study provided an estimate of the storm runoff generated by various storm events and were discussed in Chapter II.C.6 and Appendix C. Discussion of the community concerns regarding problems caused by flooding were presented in Chapter X in the summary of the public information meeting held in Lahaina on February 21, 2002.

A full range of alternatives to provide flood protection to the Lahaina watershed was evaluated during preparation of the DEIS and discussion of the alternatives has been expanded in the FEIS. Non-construction alternatives were evaluated, but were found to be ineffective in preventing flood damage during high intensity storms. Land treatment practices planned and designed by NRCS generally are ineffective during storms exceeding the 10-year recurrence storm. Use of Kahoma Flood Channel as an outlet was



investigated during the formulation of alternatives for this project in the late 1980s. At that time, the U.S. Army Corps of Engineers stated in the coordination meeting that the additional flood flow from the Lahaina subwatershed would decrease the level of flood protection for the lowlying areas of the Kahoma floodplain and that the use of Kahoma Stream as an outlet was unacceptable. A recent inquiry to the flood program manager at the USACE on the use of Kahoma Stream produced the same negative result.

The operation, maintenance and replacement (OM & R) cost of the proposed structural improvements have been estimated at approximately $260,000.00 per annum (Refer to Chapter I.F., DEIS) and will be the responsibility of the County. Included in this cost estimate is regularly scheduled clean out of sediment deposits in basins and grass-lined channels. The channel banks will have to be irrigated. The closest County source of non-potable irrigation water is from the Lahaina Wastewater Treatment Facility located approximately 5 miles north of the project area. Non-potable surface irrigation water formerly provided by the plantation irrigation system is not functional. Therefore, potable water will have to be used for irrigation. The County of Maui, Department of Water Supply's domestic water distribution lines are in close proximity to the proposed project. A condition of federal funding is an undertaking by the County that OM & R funding will be available for the proposed project.

In regards to the potential plans for Kauaula Stream as a historic district, we understand that the State Historic Preservation Division, Maui Office has had discussions with interested parties to return flows to the Kauaula Stream. While the design of the debris basin is yet to be completed, some alteration of Kauaula Stream for the basin embankment at a location approximately 150 feet upstream from Honoapiilani Highway is proposed. Mitigation features to facilitate migration of native amphidromous species both downstream and upstream along Kauaula Stream will be investigated and incorporated into the design. Continual monitoring for cultural resources will be conducted during excavation. Coordination with SHPD will be carried out as necessary.

Again, thank you for your comments and review of the DEIS.

Sincerely,

Milton Arakawa

for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/dlnrland

SEP 25 2003

LINDA LINGLE
GOVERNOR

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

RODNEY K. HARAGA
DIRECTOR

Deputy Director
BRUCE Y. MATSUI

IN REPLY REFER TO:
HWY-PS
2.1731

SEP 23 2003

Mr. Mich Hirano, AICP
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Hirano:

Subject: Draft Environmental Impact Statement, Lahaina Watershed Flood Control Project

Thank you for the opportunity to review the subject project.

We have the following comments:

1. Crossing at Honoapiilani Highway shall be designed so there is no impact to the highway and designed according to the State's drainage design criteria;

2. Easements should be granted to the County of Maui so they will be responsible for maintenance of the structures and channels within the State highway right of way;

3. The inlet basin seems to be in the vicinity of the proposed Lahainaluna Road access to the proposed Lahaina Bypass; and

4. The Dickenson Street and Puamana connectors to the Lahaina Bypass will be affected. The flood control project must be coordinated with the responsible agency for the proposed connectors.

If you have any questions, please contact Ronald F. Tsuzuki, Head Planning Engineer, Highways Division, at 587-1830.

Very truly yours,

RODNEY K. HARAGA
Director of Transportation

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ALAN M. ARAKAWA
Mayor

GILBERT S. COLOMA-AGARAN
Director

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November 24, 2003

Rodney K. Haraga, Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Subject: Draft Environmental Impact Statement (DEIS) - Lahaina Watershed Flood Control Project

Dear Mr. Haraga:

Thank you for your letter dated September 23, 2003 commenting on the subject project. We wish to provide the following information in response to your comments in the same order presented in your letter.

1. ***Response to Comment No. 1***

We confirm that the culvert crossing at Honoapiilani Highway will be designed so there will be no impact to the highway and in accordance to the State's drainage design criteria.

2. ***Response to Comment No. 2***

We confirm, the County of Maui will apply to the State of Hawaii for an easement for the structures and channels within the State highway right of way for maintenance purposes.

3. ***Response to Comment Nos. 3 and 4***

We confirm, further coordination will be carried out with the agencies responsible for the Lahainaluna Road access to the proposed Lahaina Bypass and the Dickenson Street and Puamana connectors during the design stage of the projects to ensure the functional integrity of the proposed flood protection plan. We note that plans for the Dickenson Street Extension project are currently inactive.

Again, thank you for your comments and review of the DEIS.

Sincerely,

Milton Arakawa
for GILBERT S. COLOMA-AGARAN
Director

GSCA:tn
cc: Michael W. Foley, Director, Maui County Dept. of Planning
com/dpwlahws/feis/responses/dollr

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# Appendices

# Appendix A

## Coastal Processes, Marine Water Quality and Nearshore Biological Investigations for the Lahaina Watershed Flood Control Project, Sea Engineering, Inc., September 2002

# Coastal Processes, Marine Water Quality, and Nearshore Biological Investigations for the Lahaina Watershed Flood Control Project

**September, 2002**

*Prepared for*

Munekiyo and Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

*Prepared by*

Sea Engineering, Inc.
Makai Research Pier
Waimanalo, Hawaii 96795

02-04

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# 1. INTRODUCTION

## 1.1 Project Location and General Description

Drainage improvements are proposed for the Lahaina Watershed to reduce flooding and erosion problems on land, and to relieve the effects of excess sedimentation on the offshore coral reefs. The project is based upon work conducted by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), and contained in the August, 1992 report *Final Watershed Plan and Environmental Assessment, Lahaina Watershed*, with revised hydrological analysis due to the termination of sugar cultivation in the project area.

The project is located on the west side of the island of Maui, along a 2-mile stretch from the town of Lahaina to Waianukole. A map of the project site is shown in Figure 1-1, and an aerial photograph of the area is shown in Figure 1-2. The project was initiated in response to floods that caused extensive damage to low-lying areas in Lahaina, as well as damage to crops and infra-structure. The Lahaina Watershed is composed of two main sub-watersheds, the Lahaina sub-watershed and the Kauaula sub-watershed. Presently, the Lahaina sub-watershed has no dedicated high-capacity outlet. The runoff collects in low-lying areas, and dissipates through infiltration, evaporation, and movement to the ocean through several limited capacity culverts. The Kauaula sub-watershed flows out through Kauaula Stream, which runs through the Puamana subdivision

## 1.2 Proposed Action

The proposed improvements call for the diversion of runoff from the Lahaina sub-watershed to two outlets, one at the Kauaula stream and the other at Waianukole. The first diversion system to Kauaula stream is approximately 6,800 feet in length. Three sediment basins will be constructed along this diversion to collect sediment. Runoff will enter a debris basin at Kauaula Stream leading to an outlet at Puamana channel and a second outlet to the south. Initial flows from the basin will be routed towards the second outlet. At the 100-year peak discharge, the flows will be evenly divided between the two outlets. The second diversion will then continue past Kauaula stream 3,600 feet to the second outlet at Waianukole.

The projéct is designed to provide a 100-year level of flood protection to the residential communities of Lahaina Town and the Puamana subdivision. The plan will reduce or eliminate the multi-source and non-point-source runoff in Lahaina Town and divert the flow to Kauaula Stream and the second outlet at Waianukole. This will reduce or eliminate the sediment-laden "red water" episodes in Lahaina that can damage the coral reef ecosystem and adversely affect tourism. The Waianukole outlet will provide for the bulk of the runoff discharge. Previous studies (Grigg,1986, 1991) have shown the Waianukole site to be the least environmentally sensitive in the area, and therefore the most suitable site for a discharge outlet.



## 1.3 Previous Marine Environmental Analysis

The bulk of the previous marine environmental work done for this project was conducted by Dr. Richard W. Grigg, a University of Hawaii Marine Biologist and consultant, and detailed in a series of three reports in 1983, 1986, and 1991.

The first report addressed a preliminary design to release the combined runoff from the Lahaina watershed and the Kauaula watershed from one of two outlets: either the Kauaula Stream outlet at Makila Point ("Site B", Figure 1-1), or another outlet to be constructed near Lahaina Harbor ("Site A"). The 1983 study included a baseline biological assessment of both sites as well as general physical and oceanographic characteristics. Water quality at both sites was monitored during a 5-year storm event (December 23-24, 1982) in which 7.3 inches of rain fell in Lahaina. The studies found that the water quality had returned to near-normal conditions less than a week after the event. During water quality sampling, Grigg noted that the freshwater plume was only about 3 feet in thickness. In comparing the two outlet sites, the Makila Point site was found to be more favorable. As there is no fringing coral reef, there is consequently less algae and coral species diversity and coral coverage than present at the Lahaina Harbor site.

The second study, conducted in 1986, evaluated the option of placing a second outlet south of Makila Point. A second outlet would allow protection for a more extreme event, and reduce the potential impact of the Lahaina watershed diversion on the Puamana subdivision. The 1986 study evaluated four sites south of Makila Point for outlet location suitability. Each site, labeled A', B', C', and D' (Figure 1-1), was surveyed by conducting transects and counting all species of algae, coral and fish, and taking photographs of the bottom to determine percent coral cover. The results showed that site D', about 0.5 miles south of Puamana Park, was substantially poorer in terms of species diversity and living coral cover. This location, at Waianukole, was therefore chosen as the site for the second outlet.

The 1991 study was undertaken to determine if changes had taken place since the previous surveys. Sites A, B, and D' were therefore re-surveyed to ascertain any changes in the reef environment. None were found, and the survey affirmed station D' at Waianukole as the most suitable location for a second outlet due to its lack of species diversity and low percentage of live coral coverage.

## 1.4 Study Objectives

This study is to provide coastal engineering, marine water quality, and nearshore biological information for the preparation of an Environmental Impact Statement (EIS) for the project. Tasks include the assessment of the shoreline condition, characteristics, and coastal processes in the project area, the assessment of nearshore water quality, and baseline investigations of nearshore marine biology. Water quality and biological studies for this report were conducted by AECOS, Inc.

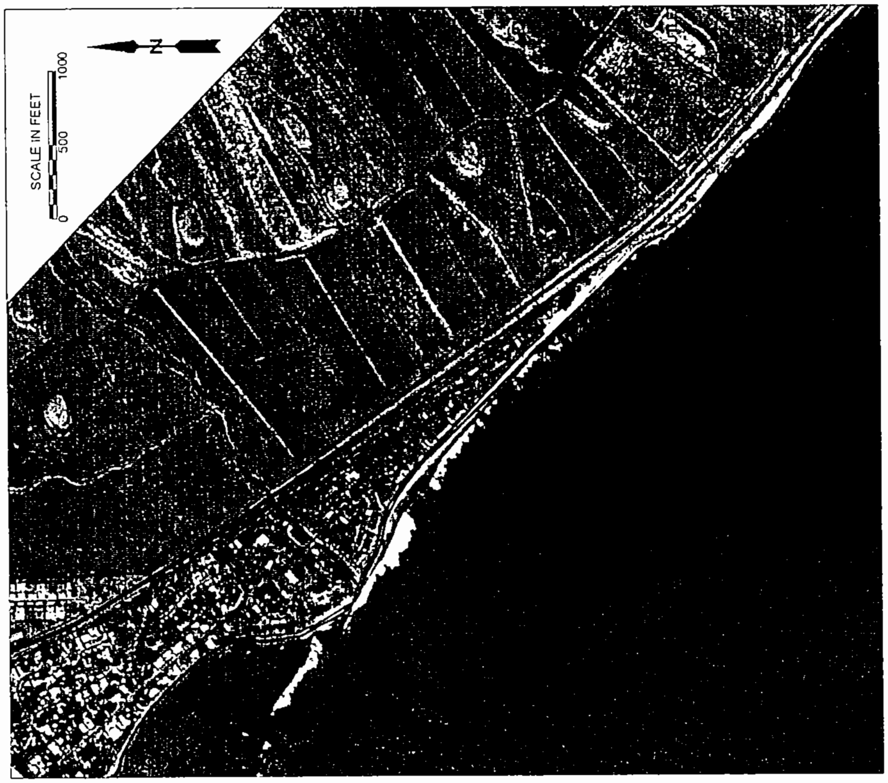



Figure 1-2 – Aerial Photograph of Project Area Near Lahaina

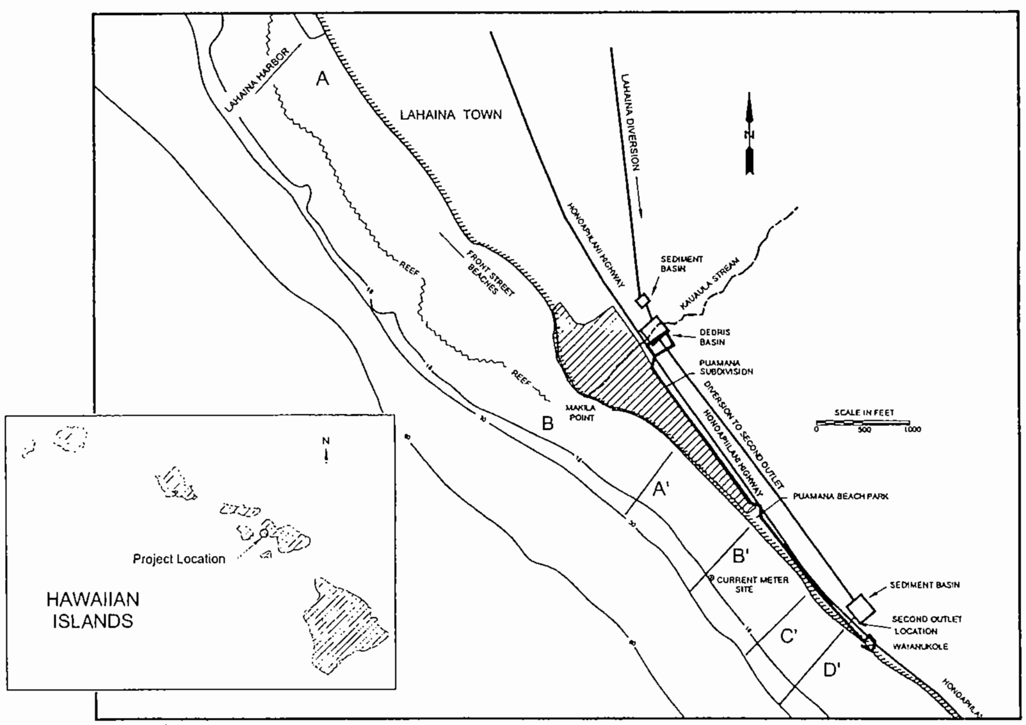



Figure 1-1 – Project Location

Oceanographic current data were measured at the site using both current drogues and a current meter that was deployed for 25 days. Measured data and data available from previous studies were used as input to a buoyant discharge plume model, CORMIX3, that enabled modeling of the physical characteristics of the freshwater discharge plume from the second outlet. The numerical model enabled input of different flood conditions, including 2-year, 5-year, and 10-year floods. While catastrophic design conditions (e.g. 50-year or 100-year flood) are typically used when life and property are at risk, the more frequent events are more important for monitoring environmental effects.

Water quality measurements were made at a total of five locations along the project shoreline during two field days. Site investigations of the nearshore marine biology were conducted by repeating quadrat surveys used previously at the same survey locations. The four transect lines south of Makila point (A', B', C', D') surveyed in 1986 were re-surveyed for this study and are compared with the previous work.



## 2. COASTAL ENVIRONMENTAL SETTING.

### 2.1 Coastal Morphology

The physical geography of West Maui is dominated by the ancient West Maui Volcano, which has collapsed and eroded into the West Maui Mountains. The nearly circular shape of the volcano has generated a similarly curved shoreline. The project shoreline, located on the southwest flank of the volcano, trends northwest-southeast, turning slightly more north at Makila Point (Puamana). Makila Point is a deltaic cobble point that forms a prominent salient at the outlet of Kauaula Stream. Just north of the point, the shoreline curves back into an embayment approximately 1500 feet across. The coast here is characterized by seawalls with no beaches. The Front Street beaches begin where sand returns at the north side of the embayment and continue to the Lahaina Yacht Harbor (Figure 1-1).

The Puamana sub-division continues for about 2000 feet south of Makila Point. The shoreline in front of the subdivision is a narrow sand and cobble beach. The sand beach is wider at Puamana Park, south of, and adjacent to the subdivision. The beach at Puamana Park extends south for approximately 800 feet and pinches out a small rocky headland. This headland extends south for about 500 feet. It is a minor feature that modifies the trend of the shoreline by only 50 to 100 feet, but it marks the limit of sandy beach. The second outlet location is about 100 feet south of the headland. From there to Launiupoko Beach Park, the coast is mostly rocky and very close to the highway. For much of this stretch, the highway is protected by a seawall.

The bathymetry appears relatively even between Launiupoko to Makila Point. A gentle slope of 1 vertical to about 50 horizontal exists between the shore and the 15-ft contour depth. The bottom slope then steepens to about 1 to 25 between the 15-ft depth and the 60 ft depth. North of Makila Point, between the point and the yacht harbor, a narrow fringing reef stands 600 to 1000 feet offshore. The nearshore bathymetry south of the point consists of gradually shoaling terrain with isolated coralline limestone outcrops and sand. The small headland south of Puamana Park appears to be matched by an offshore rock and cobble shoal.

### 2.2 Winds

The wind climate in the Hawaiian islands can be divided into two distinct seasons based upon the annual variation in persistence of the northeast tradewinds. The tradewinds predominate in the summer months of May through September, blowing 80 to 90 percent of the time with typical speeds from 10 to 25 mph. The tradewinds weaken in persistence during the winter months of November through March, and during this time southerly or westerly winds may blow intermittently. These are also known as Kona winds, and accompany the passage of storm fronts associated with low-pressure systems traveling across the North Pacific ocean.

Winds on Maui are heavily influenced by the island topography. The project site is located on the west coast of Maui, and is sheltered from direct exposure to the northeast tradewinds by the West Maui mountains. There is considerable local variation in wind speed and direction along the coast. Parts of the coast are subject to strong, gusty tradewinds funneled through narrow valleys in the West Maui mountains. However, light and variable winds often predominate nearshore in the Lahaina region, and will follow a diurnal cycle associated with thermal gradients. Therefore, on-shore sea breezes will commonly blow at mid-day during typical tradewind conditions.

Table 2-1 is a histogram of data compiled by the U.S. Naval Weather Service Command in the Summary of Synoptic Meterological Observations (SSMO, 1971). The SSMO data were obtained through direct synoptic observations on ships in passage and represents average conditions recorded during the 8 year period from 1963 to 1970. These data represent open-water conditions removed from the localized effects of island topography. National Ocean Service (NOS) data available for Maui are from on-land sites (e.g. Kahului airport) and are therefore skewed by island effects.

The data in Table 2-1 show that 70 percent of the island winds are from the east and northeast, with speeds between 7 and 16 knots about 52 percent of the time, and stronger winds between 17 and 27 knots occurring about 24 percent of the time. A limited wind data set collected at Pioneer Mill in Lahaina Town in 1962 and 1963 is shown in Table 2-2. These data illustrate the higher frequency of occurrence of southerly winds at Lahaina versus open water areas (32.6% for the Lahaina data versus 17.1% for the SSMO data). The difference, at least in part, is probably due to the presence of afternoon sea breezes in Lahaina. The data also illustrate that typical wind speeds are lower in Lahaina than open water areas. Studies by Haraguchi (1979) show that for moderate tradewind conditions of about 15 knots, wind speeds at the project site will be about 8 knots.

The Lahaina region is directly exposed to Kona winds blowing from the south-southwest to west. Periods of Kona winds are generally of short duration (1 to 3 days), and damaging Kona winds are not common. These do occur, however, and a severe Kona storm in January, 1980 had sustained wind speeds of about 30 knots or greater for a period of several days.

**Table 2-1. SSMO Wind Statistics for Leeward Hawaii**
**Percent Frequency of Wind Direction vs. Wind Speed**

| Wind Speed (knots) | Wind Direction | | | | | | | | Total (%) |
|---|---|---|---|---|---|---|---|---|---|
| | N | NE | E | SE | S | SW | W | NW | |
| Calm | | | | | | | | | 1.5 |
| 0 – 6 | 2.1 | 5.8 | 5.8 | 2.6 | 1.7 | 1.1 | 1.0 | 1.1 | 21.2 |
| 7 –16 | 2.8 | 16.0 | 21.1 | 5.2 | 2.6 | 1.5 | 1.1 | 1.2 | 51.6 |
| 17 – 27 | 0.8 | 9.6 | 11.1 | 1.3 | 0.6 | 0.3 | 0.2 | 0.3 | 24.2 |
| 28 – 40 | 0.1 | 0.7 | 0.6 | 0.1 | * | * | * | * | 1.6 |
| > 40 | 0.0 | * | * | * | 0.0 | 0.0 | 0.0 | 0.0 | * |
| **Total** | **5.8** | **32.1** | **38.6** | **9.3** | **4.9** | **2.9** | **2.4** | **2.6** | **100.0** |



**Table 2-2. Pioneer Mill Statistics for Lahaina**
**Percent Frequency of Wind Direction vs. Wind Speed**

| Wind Speed (knots) | Wind Direction | | | | | | | | Total (%) |
|---|---|---|---|---|---|---|---|---|---|
| | N | NE | E | SE | S | SW | W | NW | |
| 0 – 3 | 1 | 1.0 | | | 1.2 | | | | 3.2 |
| 4 - 7 | 2.2 | 7.2 | 7.3 | 0.6 | 7.3 | 0.4 | 1.2 | 0.2 | 26.4 |
| 7 - 10 | 2.3 | 2.3 | 31.1 | 3.0 | 5.2 | 10.0 | 7.0 | 0.3 | 61.2 |
| 11 - 16 | 1.0 | 1.3 | 0.5 | 0.5 | 1.1 | 3.1 | 1.0 | 0.1 | 8.6 |
| 17 - 21 | | 0.2 | 0.2 | | 0.2 | | | | 0.6 |
| **Total** | **6.5** | **12.0** | **39.1** | **4.1** | **15.0** | **13.5** | **9.4** | **0.6** | **100.0** |

## 2.3 Waves

There are four primary wave types that describe the wave climate of the Hawaiian Islands. These are northeast tradewind waves, southern swell, and North Pacific swell, and storm waves from hurricanes and Kona storms.

The project site is almost completely protected from both northeast tradewind waves and North Pacific swell by the islands of Maui and Molokai. In addition, the islands of Lanai and Kahoolawe offer partial shelter to the project area from southern swell and Kona storm waves. Direct wave approach directions are shown in Figure 2-1, which shows that the most prevalent wave approach direction to Lahaina is from the southwest.

Southern swell is generated from mid-latitude winter storms over the Southern Pacific Ocean. These waves must travel long distances in order reach the Hawaiian Islands, and are therefore characteristically long and low, with deep water wave heights of 1 to 6 feet, and periods of 12 to 20 seconds. Their approach can vary from southeast through southwest. They occur about 53 percent of the time and may occur throughout the year, but are most common during the summer months of April through October.

### 2.3.1 Storm Waves

There are two distinct types of storms that typically affect the Hawaiian Islands, these are Kona storms, and tropical storms and hurricanes. Kona storms occur when the winter low pressure systems that travel across the North Pacific ocean dip south and approach the islands. Southerly winds generated by these storms not only cause Kona storm waves, but bring considerable precipitation to the normally dry leeward coasts. The waves may be over 10 feet in height, with periods of 8 to 10 seconds. Kona storm waves approach from the south to the west, with the largest waves usually coming from the southwest. Deepwater wave heights during the severe Kona storm of January 1980 were about 17 feet with a wave period of 9 seconds.

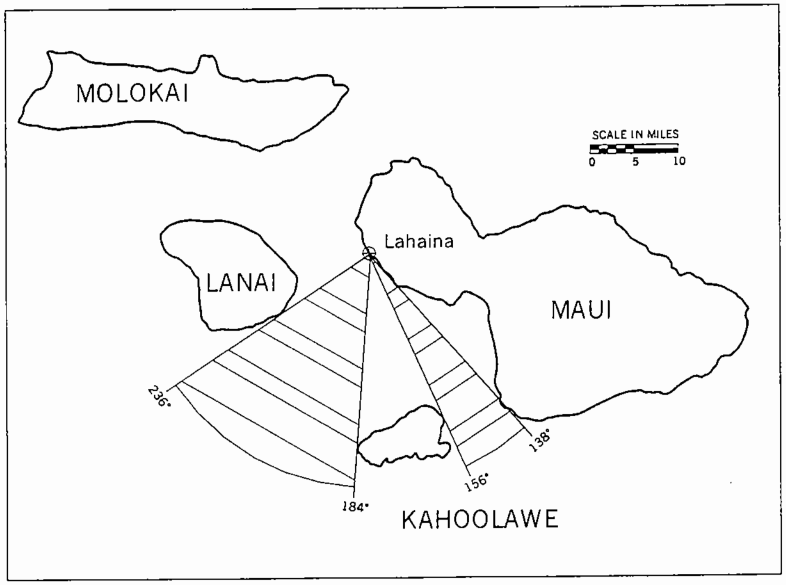



**Figure 2-1 – Direct Wave Approach Directions to the Project Site**

Hurricanes, the worst-case tropical cyclone storms, are caused by intense low pressure vortices that are usually spawned in the eastern tropical Pacific ocean and travel westward. While they typically pass south of the Hawaiian Islands, their paths are unpredictable and they will occasionally pass near or over the Hawaiian Islands. In recent years hurricane Iwa (1982) and hurricane Iniki (1992) directly hit the island of Kauai. Damage from these hurricanes was extensive, not only on Kauai which was subject to both high wind and waves, but also along coastal areas on other islands exposed to large hurricane storm waves.

Wave heights up to 12 feet were reported at Lahaina during hurricane Iwa (Grigg, 1983). High waves during hurricane Iniki damaged or destroyed numerous boats moored in the Lahaina Roadstead, and resulted in considerable erosion of the west facing Lahaina and Kaanapali shorelines.

### 2.3.2 Nearshore Wave Heights and Wave Patterns

As deepwater waves enter shallow depths, they can be significantly affected by the contours of the bottom. The process of wave shoaling generally steepens the wave and increases the



wave height. The refraction phenomenon will cause wave crests to bend and may locally increase or decrease the wave heights. Wave breaking is a mechanism for dissipating wave energy, and occurs when the wave shape becomes too steep to be maintained. This typically occurs when the ratio of wave height to water depth is about 0.8.

The wave refraction process causes waves to focus on submerged promontories such as the delta at Makila Point and the rock and cobble reef at Waianukole. Waves will tend to wrap around the delta and dissipate through the breaking process. The breaking process will also tend to generate longshore and offshore ("rip") currents in the wave-breaking zone near shore.

## 2.4 Tide and Water Level Rise

The tides in the Hawaiian Islands are semi-diurnal in nature, with high and low water occurring twice daily. Table 2-3 shows the tides at Lahaina, based on National Oceanic and Atmospheric Administration (NOAA) survey records.

**Table 2-3. Lahaina Water Elevation Data**

| | |
|---|---|
| Mean Higher High Water | 2.2 feet |
| Mean High Water | 1.7 feet |
| Mean Tide Level | 1.0 feet |
| Mean Low Water | 0.3 feet |
| Mean Lower Low Water | 0.0 feet |

## 2.5 Tsunamis

The Hawaiian Islands are directly exposed to the major tsunami wave generating areas in the Pacific Ocean: the Kuril-Kamchatka-Aleutian island arcs in the north and northwestern Pacific, the west coast of South America, and the seismically active southwest Pacific. Tsunamis, or seismic sea waves, are primarily generated by submarine earthquakes and earth movement with magnitudes greater than about 6.5 on the Richter scale. Coastal and submarine landslides and volcanic eruptions can also generate tsunamis.

Loomis (1976) listed 22 significant tsunamis in Hawaii since 1819, with the most damaging occurring in 1946 when and earthquake in the East Aleutian Islands generated a tsunami which killed 173 people in Hawaii and caused $26 million in property damage in Hilo alone. Loomis also reports tsunami wave heights in the vicinity of the project area for three recent tsunami events, which are among the most significant tsunamis to have occurred in Hawaii and for which data are available. He reports tsunami wave heights ranging from 6 to 11 feet in the vicinity of the project area for tsunamis occurring in 1946, 1957, and 1960.

Tsunamis generated by local earthquakes in Hawaii also pose a threat to coastal areas. In November, 1975 an earthquake with a Richter scale magnitude of 7.2, centered near Kalapana on the south coast of Hawaii, generated a tsunami which did considerable damage to shoreline areas on the southern two-thirds of the island. The largest wave was 20 feet high and overran the shoreline near the epicenter within seconds of the earthquake. Locally generated tsunamis pose a particular problem for Hawaii shorelines because of the lack of warning time for coastal residents.

The predicted 100-year recurrence interval tsunami water surface elevations in the project area have been determined to range from 8 to10 feet, based on methodology described in the *Manual for Determining Tsunami Runup Profiles on Coastal Areas of Hawaii* (USACE, 1978). The predicted 100-year tsunami elevations nearly correspond to the historical tsunami wave heights reported by Loomis. The only reported tsunami bore formation on the island of Maui has been at Sprecklesville; therefore the project area would be expected to have a tide-likc tsunami consisting of a rapid rising and falling of the water level over a period of ten to thirty minutes.

## 2.6 Currents

### 2.6.1 Previous Work

In the large scale of global oceanic circulation, the Hawaiian Islands are located within the stream of the North Equatorial Current. However, local currents are generally driven by the tidc. The U.S. Coast Pilot (NOAA, 1993) reports that the current off Lahaina usually sets north, with maximum velocities of one to two knots during ebb tide. In general, currents in the Lahaina region are semi-diurnal reversing tidal currents. USACE (1976), Grigg (1983), and Sea Engineering, Inc. (1989) all show data that correlate current reversals with tide reversals. The coastal currents set parallel to the coast, northerly during ebb tide and southerly during flood tide. Current meter and drogue data off West Maui indicate a lack of vertical shear, that is, the currents are approximately equal down to about 25 feet in the water column. There is, however, a horizontal shear, meaning that currents are stronger away from the shoreline in deeper water.

Ebb currents, in the northerly direction, are usually stronger than the southerly flood currents, indicating a net transport to the north. Local knowledge anecdotes from area fisherman indicate that during strong tradewind conditions the current may flow very slowly northward even during flood tide conditions (USACE, 1976). A net northerly flow does not always prevail, however. The SEI data, from 1988, show a net transport to the south. A Department of Health employee who observes plume propagation after high runoff events notes that while the large plumes generated by the Kahoma and Kaua'ula streams usually move to the north, occasionally they move south (Wiltse, 1994, pers. comm.). It is likely that the net transport is to the north a large percentage of the time, but that net southerly transport occasionally occurs.

Drogue studies off Lahaina have shown current speeds up to 3.28 ft/sec (2 knots) (Aki, 1975). Measurements in the Launiuopoko area, in shallower water (30 feet) show current speeds up to 0.98 ft/sec (0.6 knots) (Environmental Consultants, 1976). Grigg (1983) measured currents near



5Lahaina Harbor, and showed a maximum speed of approximately 0.8 ft/sec (0.5 knots) in a southerly direction.

In Grigg's supplemental 1986 study, he conducted fluorescene dye studies at the Waianukole project site, and off Puamana Park. The dye trajectories off the park hugged the shoreline as they moved north toward Makila Point, whereas the trajectory off the project site moved out into deeper water before moving north.

### 2.6.2 SEI Current Data

Sea Engineering has two sets of current data in the project area. Data were collected near the project site at Waianukole in 1988 as part of a coastal engineering assessment for the proposed West Maui Marina at Launiupoko. Data were collected for the present study off Puamana Park during the months of March and April, 2002.

In the 1988 study, a General Oceanics Model 6011 current meter was deployed in the project area for 15 days, from January 19 to February 3, 1988. The meter was located at the 22-foot depth in a total water depth of 32 feet. The meter recorded the date, time, water temperature, current speed and current direction on a digital data tape for 20 seconds at 15-minute intervals during the deployment period. Frequency histograms of the data are shown in Table 2-4, with additional data subsets for ebb and flood tide stages. Current rose diagrams, graphical representations of the speed and direction histograms are shown in Figure 2-2. Current speed and direction, converted into alongshore and onshore/offshore flow components and correlated with the tide, are shown in Figure 2-3. Positive numbers correspond to northwest and onshore directions on the figure.

The data clearly show preferred alongshore directions that reverse with the tide. During ebb conditions, the current flows 49.5 percent of the time to the northwest (WNW through NNW), with average speeds of 7.41 cm/sec (0.24 ft/sec, or 0.14 kts). During flood conditions, the current flows 55.1 percent of the time to the southeast (ESE through SSE) with average speeds of 9.5 cm/sec (0.31 ft/sec, or 0.18 knots). The maximum speed measured was 24.3 cm/sec (0.80 ft/sec, or 0.47 kts).

For the present study, an Aanderaa RCM-11 single bin Doppler current meter was deployed off Puamana Park in 18 feet of water, with the meter about 2 feet off the bottom. The meter also measures water turbidity. A planned 30-day deployment was cut short by a few days due to forecasts for a large southern swell wave event, so the meter was deployed for 26 days, from March 29 to April 25, 2002. A histogram of the data is shown in Table 2-5, and a current rose graph of the data is shown in Figure 2-4.

The data show lower current speeds and more variability in flow direction than the previous data set. The maximum speed was 10.3 cm/sec (0.34 ft/sec, or 0.20 kts). The current flows 37.2 percent of the time to the northwest (WNW through NNW), with average speeds of about 3.8 cm/sec (0.12 ft/sec, or 0.07 kts). Flow to the southeast occurs 19.6 percent of the time, with average speeds of 2.2 cm/sec (0.072 ft/sec, or 0.04 kts). The current rose (Figure 2-4) illustrates that the northwest flow is the preferred flow direction. Although southeast flow is the second most preferred direction, it does not rise much beyond the background levels as set by the other directions.

Figure 2-5 is a time series plot of: (1) the current speeds divided into alongshore (NW to SE) and cross-shore (SW to NE) components, (2) water turbidity, and (3) predicted tide elevation. As with the 1988 data, the figure shows the preference for alongshore flow, and the reversing influence of the tide. Flow speeds are shown greater to the northwest. A sustained flow in the offshore direction occurred from 4/9 to 4/11 that is coincident with high turbidity values. This high turbidity did not appear to be related to precipitation, wind, or wave events. The current meter was situated directly offshore from a drainage culvert, and the event may have been caused by turbid outflow from the culvert, or another nearshore to offshore flow such as a crosshore or "rip" current.

Dividing the current flow into alongshore and cross-shore components as in Figures 2-3 and 2-5 illustrates the periodic nature of the alongshore flow and how it relates to the tide stages. Conversely, the cross-shore flow is much smaller in amplitude and random in appearance. Figure 2-5 shows the preference for flow to the northeast in the 2002 data, while the Figure 2-3 shows flow preference to the southeast. Why this is so is not clear. It could be due either to local variations inherent at the site of each current meter, or it could be due to a very long period phenomenon that requires a longer time series to measure.

### 2.6.3 Drogue Data

Current drogue studies were conducted between Makila Point and Waianukole on March 29 and April 25, 2002. Windowshade drogues were set near the surface at three locations on each day. While current meter data are measurements of water flow at a particular location, showing changes over time, the drogue data show changes in time and space. Figure 2-6 shows drogue data collected on March 29, just after low tide. Two drogue sets were made. The currents are to the northwest in all measurements, however, current speeds are slower for the second set.



**Table 2-4. Current Speed and Direction Histograms, 1988 Data**

Station: 1 Depth: 22/32 Deployment Period: 1/19/88 – 2/3/88

**OVERALL RECORD** CALM: 0.6

| CM/S | N | NNE | NE | ENE | E | ESE | SE | SSE | S | SSW | SW | WSW | W | WNW | NW | NNW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 – 4.9 | 2.5 | 2.8 | 2.8 | 0.8 | 4.5 | 5.6 | 6.7 | 4.5 | 4.8 | 2.0 | 5.0 | 2.5 | 3.6 | 5.6 | 6.7 | 5.3 |
| 5 – 9.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 2.5 | 5.9 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 7.0 | 1.7 |
| 10 – 14.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.4 | 1.1 |
| 15 – 19.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 2.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 |
| 20 – 24.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 25 – 29.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 30 – 34.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 35 – 39.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| > 40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOTAL % | 2.5 | 2.8 | 2.8 | 0.8 | 4.8 | 8.4 | 21.6 | 5.3 | 4.8 | 2.0 | 5.0 | 2.5 | 3.6 | 6.7 | 17.6 | 8.1 |
| AVE SPD | 1.76 | 1.94 | 2.12 | 2.47 | 1.88 | 4.56 | 9.00 | 3.09 | 2.01 | 1.62 | 1.42 | 1.58 | 1.96 | 3.45 | 6.72 | 5.07 |
| MAX SPD | 4.85 | 3.66 | 4.54 | 2.80 | 5.36 | 17.03 | 24.29 | 8.97 | 2.98 | 2.55 | 2.87 | 3.08 | 4.14 | 8.49 | 16.99 | 14.09 |

Station: 1 Depth: 22/32 Deployment Period: 1/19/88 – 2/3/88

**EBB TIDE** CALM: 0.5

| CM/S | N | NNE | NE | ENE | E | ESE | SE | SSE | S | SSW | SW | WSW | W | WNW | NW | NNW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 – 4/0 | 2.7 | 2.7 | 3.8 | 1.6 | 3.8 | 3.8 | 3.2 | 4.3 | 4.8 | 1.6 | 5.4 | 1.6 | 4.8 | 8.1 | 8.6 | 4.8 |
| 5 – 9.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.2 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.2 | 13.4 | 2.7 |
| 10 – 14.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.5 | 2.2 |
| 15 – 19.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 | 0.0 |
| 20 – 24.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 25 – 29.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 30 – 34.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 35 – 39.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| > 40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOTAL % | 2.7 | 2.7 | 3.8 | 1.6 | 3.8 | 3.8 | 8.1 | 5.4 | 4.8 | 1.6 | 5.4 | 1.6 | 4.8 | 10.2 | 29.6 | 9.7 |
| AVE SPD | 1.87 | 1.73 | 1.84 | 2.47 | 1.37 | 2.34 | 6.9 | 3.28 | 2.40 | 1.80 | 1.55 | 1.97 | 2.30 | 3.66 | 7.41 | 6.40 |
| MAX SPD | 4.85 | 3.66 | 3.25 | 2.80 | 2.05 | 4.40 | 21.00 | 8.97 | 2.96 | 2.55 | 2.87 | 3.08 | 4.14 | 8.49 | 16.99 | 14.09 |

Station: 1 Depth: 22/32 Deployment Period: 1/19/88 – 2/3/88

**FLOOD TIDE** CALM: 0.6

| CM/S | N | NNE | NE | ENE | E | ESE | SE | SSE | S | SSW | SW | WSW | W | WNW | NW | NNW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 – 4.9 | 2.3 | 2.9 | 1.8 | 0.0 | 5.3 | 7.6 | 10.5 | 4.7 | 4.7 | 2.3 | 4.7 | 3.5 | 2.3 | 2.9 | 4.7 | 5.8 |
| 5 – 9.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 5.3 | 8.8 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 |
| 10 – 14.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 15 – 19.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 4.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 20 – 24.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 25 – 29.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 30 – 34.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 35 – 39.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| > 40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOTAL % | 2.3 | 2.9 | 1.8 | 0.0 | 5.8 | 13.5 | 36.3 | 5.3 | 4.7 | 2.3 | 4.7 | 3.5 | 2.3 | 2.9 | 4.7 | 6.4 |
| AVE SPD | 1.63 | 2.15 | 2.77 | 0.00 | 2.24 | 5.23 | 9.50 | 2.88 | 1.57 | 1.48 | 1.26 | 1.38 | 1.18 | 2.63 | 2.01 | 2.88 |
| MAX SPD | 2.45 | 2.36 | 4.54 | 0.00 | 5.36 | 17.03 | 24.29 | 6.93 | 2.98 | 2.46 | 2.61 | 2.81 | 2.57 | 4.07 | 4.40 | 6.95 |

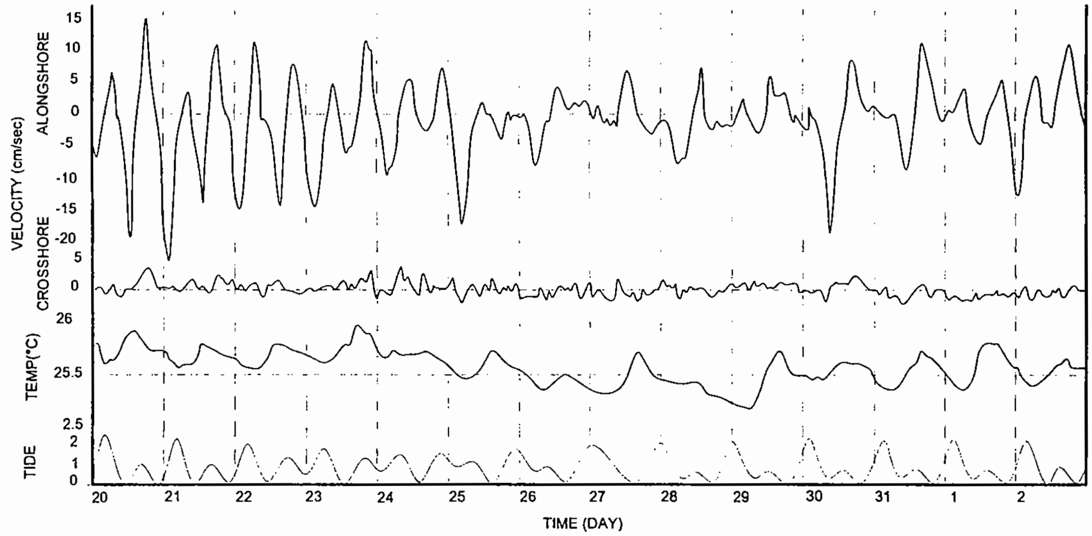



**Figure 2-3 – 1988 SEI Current Meter Time Series Data**



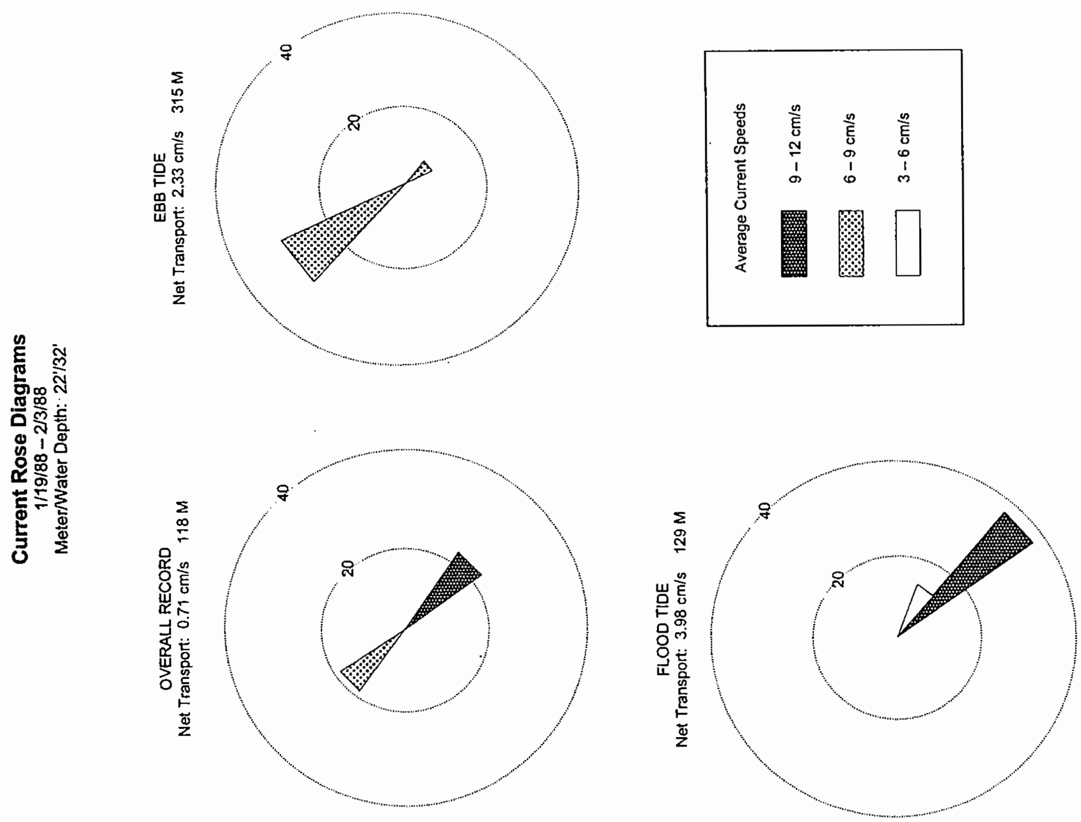



**Figure 2-2 – Current Rose Diagrams, 1988 Data**

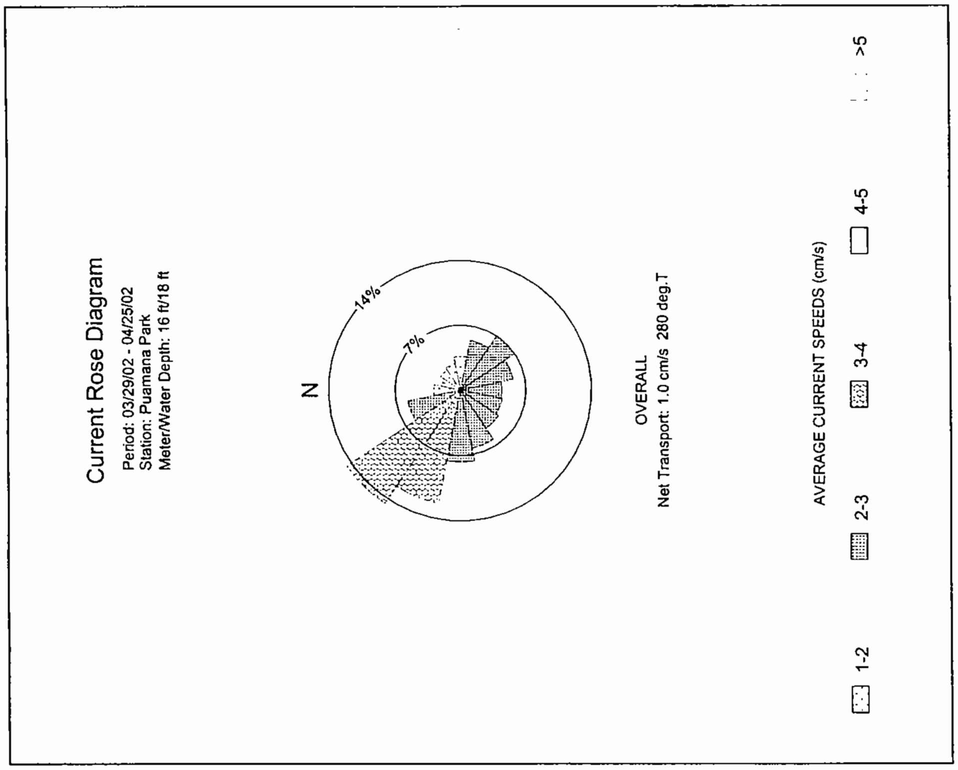



**Figure 2-4 – Current Rose Diagram, 2002 Data**



**Table 2-5. Current Speed and Direction Histograms, 2002 Data**

Station: Off Lahaina Depth: 16 ft/18 ft Deployment Period: 03/29/02 – 04/25/02

**OVERALL** NET TRANSPORT: 1.0 cm/s 280° T

| CM/S | CALM | N | NNE | NE | ENE | E | ESE | SE | SSE | S | SSW | SW | WSW | W | WNW | NW | NNW | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 – 0.9 | 0.2 | 0.9 | 0.8 | 1.1 | 0.8 | 0.7 | 0.8 | 1.0 | 1.1 | 0.7 | 1.1 | 1.2 | 1.3 | 0.9 | 1.2 | 1.1 | 0.9 | 15.8 |
| 1 – 1.9 | | 1.3 | 1.1 | 0.9 | 1.5 | 1.6 | 1.9 | 2.4 | 1.5 | 1.5 | 1.4 | 1.2 | 1.3 | 2.1 | 2.4 | 2.2 | 1.9 | 26.2 |
| 2 – 2.9 | | 0.8 | 0.5 | 0.7 | 0.7 | 1.3 | 2.2 | 2.6 | 2.4 | 1.5 | 1.1 | 1.1 | 2.0 | 2.4 | 3.4 | 3.1 | 1.5 | 27.3 |
| 3 – 3.9 | | 0.0 | 0.0 | 0.1 | 0.1 | 0.3 | 0.6 | 0.9 | 0.7 | 0.7 | 0.5 | 0.4 | 0.7 | 1.5 | 2.2 | 3.1 | 0.7 | 12.5 |
| 4 – 4.9 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.6 | 0.4 | 0.2 | 0.5 | 0.6 | 0.7 | 1.0 | 2.2 | 2.5 | 0.5 | 9.5 |
| 5 – 5.9 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.5 | 0.5 | 0.4 | 0.2 | 1.1 | 1.3 | 0.1 | 3.6 |
| 6 – 6.9 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.2 | 0.1 | 0.2 | 0.6 | 0.8 | 0.3 | 2.2 |
| 7 – 7.9 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.2 | 0.1 | 0.2 | 0.8 | 0.2 | 1.6 |
| 8 < | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.2 | 0.0 | 0.1 | 0.7 | 0.1 | 1.3 |
| TOTAL % | 0.2 | 3.1 | 2.3 | 2.8 | 3.1 | 3.9 | 5.9 | 7.5 | 6.2 | 4.7 | 4.9 | 5.2 | 6.8 | 8.3 | 13.3 | 15.6 | 6.2 | 100.0 |
| AVE SPD | | 1.6 | 1.3 | 1.5 | 1.5 | 1.8 | 2.2 | 2.2 | 2.2 | 2.2 | 2.3 | 2.8 | 2.7 | 2.6 | 3.1 | 3.8 | 2.7 | 2.6 |
| MAX SPD | | 3.8 | 2.9 | 3.8 | 3.5 | 3.8 | 5.6 | 5.3 | 5.0 | 6.2 | 7.9 | 10.3 | 9.4 | 7.0 | 8.5 | 10.3 | 9.4 | 10.3 |
| STD DEV | | 0.8 | 0.6 | 0.8 | 0.7 | 0.8 | 1.1 | 1.2 | 1.1 | 1.2 | 1.5 | 2.3 | 1.8 | 1.4 | 1.7 | 2.1 | 1.9 | 1.7 |

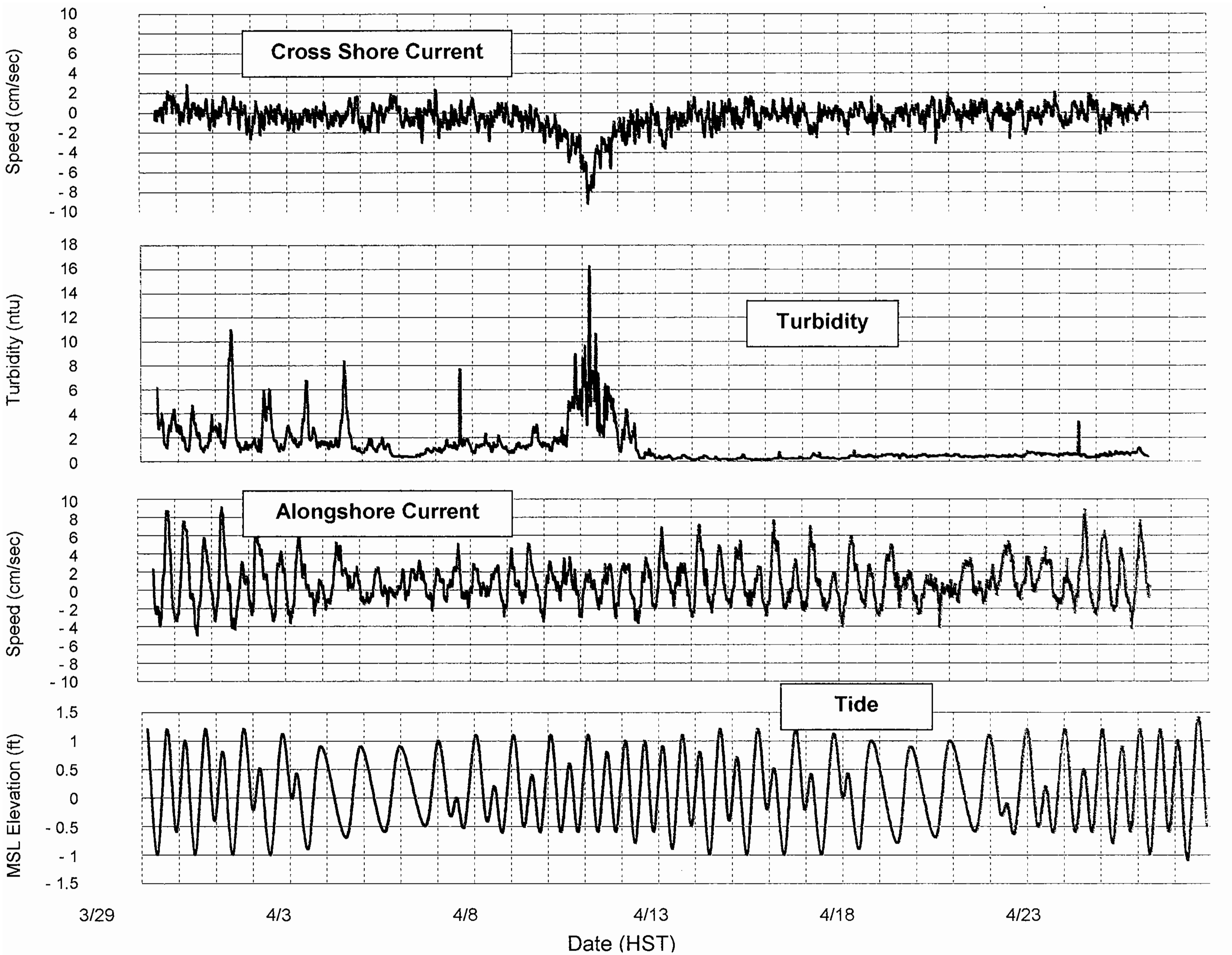



**Figure 2-5 – 2002 SEI Current Meter Time Series Data**

The model put forward previously, tying north currents to the ebb tide and south currents to the flood tide, is supported here as north current speeds are diminished by the approaching flood tide. However, there is a phase lag apparent, as the north flowing currents continue past the low tide stage into the flood. The north flowing currents also appear to increase in magnitude toward Makila Point.

Three sets were made on April 25 (Figure 2-7). The first set was made at a similar tide stage as the March 29 data, and shows a current reversal in progress. Speeds are low at all three locations, but direction was northward off Makila Point, and southward at the other two sites. The second set occurred at the end of the flood tide stage, and shows current flow to the south at all locations. Current speeds appear greater to the south, away from Makila Point. The third set was made after the turn of the tide to an ebb condition. Once again, the currents reversed with the tide and were flowing to the north, with speeds increasing toward Makila Point. The 4/25 data appeared to be closer in phase to the tide conditions than the 3/29 data.

General characteristics of the currents in the project area based on these studies can be summarized as:

1. The prevailing currents are semi-diurnal reversing tidal currents. The coastal current sets primarily parallel to the shore, with little cross-shore movement except for wind-induced surface currents which generally have an offshore component during prevailing tradewind conditions. During Kona winds, the surface waters can be expected to be held against the shore.

2. Some previous studies and "local knowledge" report reversing tidal currents with a slow net transport to the north. The 1988 SEI data show a net transport to the south, and data from the present study show net transport to the north. The net flow thus appears to fluctuate. The causes of this are not known, although it could be due to either spatial location, or to very long period cycles that have yet to be determined.

3. Current speeds appear to increase with offshore distance. North flowing currents speeds also appear to increase with location from south to north, toward Makila Point. South flowing currents appear to increase from north to south, away from Makila Point.

4. Ebb tide currents consistently flow to the northwest, and flood tide currents flow to southeast, however, there are variable phase lags between tide stages and current flow.



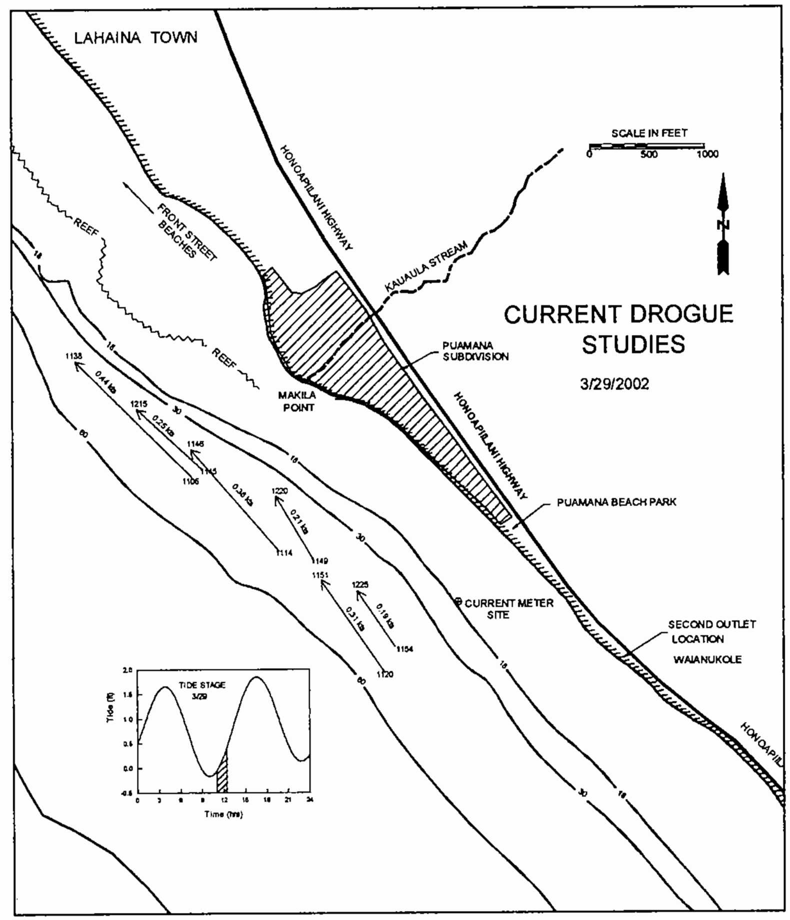



Figure 2-6 – Drogue Results 3-29-02

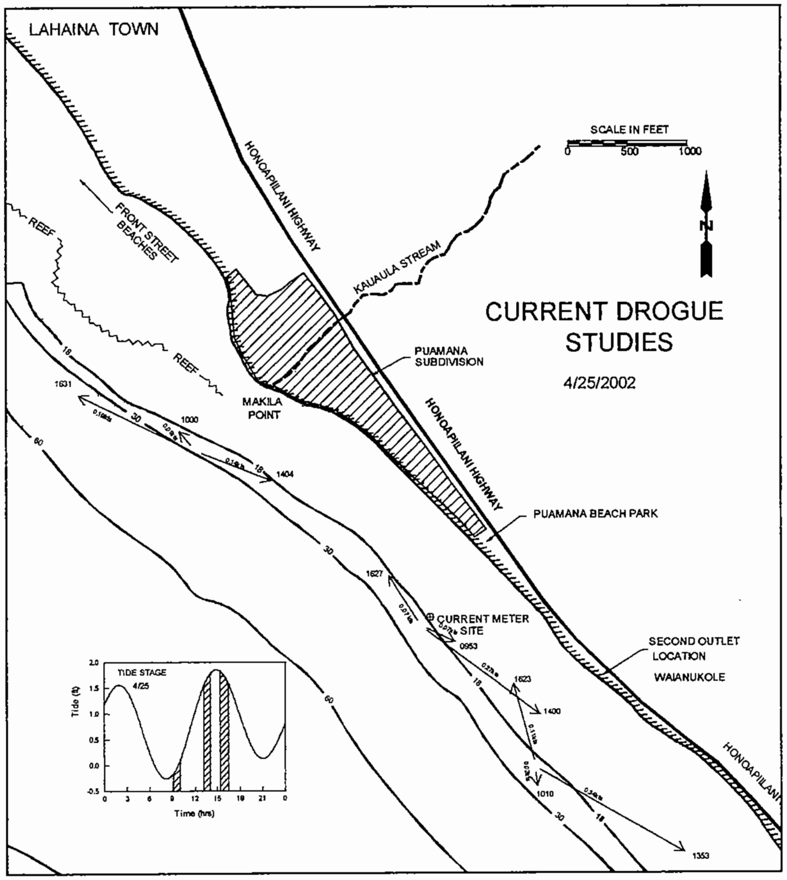



Figure 2-7 – Drogue Results 4-25-02



# 3. EXISTING SHORELINE CONDITIONS

## 3.1 Description of the Project Shoreline and Coastal Hazards History

The prominent salient of Makila Point is the dominant shoreline feature from Lahaina Harbor to Launiopoko (Figures 1-1 and 1-2). Much of the shoreline along this stretch is composed of gravel, cobbles and boulders. Sand beaches are few with the exception of the Front Street Beaches. These are a sandy shore front from Lahaina Yacht Harbor south for 2800 feet. Between there and Makila Point, the shore is fronted by vertical seawalls with no beaches. Makila Point is a delta formed by Kauaula Stream, and is composed predominately of basaltic cobbles and boulders that have been transported and deposited by the stream. The beach along the 2000-foot reach from Makila Point to Puamana Park is predominately made from theses cobbles, although a thin veneer of sand may cover them in places. Puamana Park has a sand beach and is heavily used by the local population.

Analysis of aerial photographs between 1963 and 1986 (Makai Ocean Engineering, and Sea Engineering, Inc., 1991) shows approximately 20 feet of shoreline accretion at Makila Point, and about 40 feet of erosion at Puamana Park.

The sand beach at Puamana Park pinches out 800 feet to the south at a small rocky headland. The headland covers about 500 feet of shoreline and the new outlet location is at the southern end of this headland. The substrate at the headland is composed of a volcanic ash flow with imbedded basalt rocks and boulders. Much of the shoreline between the headland and Launiupoko Beach Park is armored; the shore is mostly rocky with some minor sandy stretches.

## 3.2 Makila Point

Makila Point is the outlet for Kauaula Stream. It is a cobble and boulder delta that has been built over geologic time by the stream. In a natural state, the stream would occasionally change its course over the delta, but the stream channel has been armored and fixed, and now flows out from the south side of the point (Figure 3-1). The cobbles and boulders that form the point offer excellent natural shore protection. However, a seawall has been built approximately 100 feet north of the stream outlet to protect an elevated swimming pool. The lands in the vicinity of the point and extending to Puamana Beach Park are part of the Puamana subdivision, a gated community.

The 2000-foot stretch to Puamana Beach Park is a cobble beach with a veneer of sand that appears to get thicker closer to the park. Previous reports have mentioned the presence of seawalls protecting this stretch. Inspections during the site visit did not reveal the presence of seawalls. Most of the stretch is heavily vegetated with *Naupaka*, and a combination of vegetation and cobbles have produced a berm that may have buried or otherwise obscured the presence of the walls (Figure 3-2). The vegetation and cobble berms are excellent natural shore protection, and the stretch between Makila Point and Puamana Beach Park has no obvious signs of erosion.

**Figure 3-1 – Kau'aula Stream Outlet at Makila Point**

**Figure 3-2 – Natural Cobble and Naupaka Shore Protection Fronting the Puamana Subdivision, South of Makila Point**

### 3.3 Puamana Beach Park

Puamana Beach Park is an unprotected shoreline fronted by a narrow sand beach. There were many signs of erosion apparent during the site visit. Figure 3-3 shows a fresh erosional escarpment, with irrigation pipes showing a minimum extent of the shorefront loss. Cobbles and boulders on the beach are probably derived from erosion of the bank material (Figure 3-4).

### 3.4 Waianukole

The second outlet site at Waianukole is a rocky shore with some sand accretion (Figure 3-5). The substrate is composed of volcanic ash flow with imbedded basalt rocks (Figure 3-6). The beach rocks range in size from gravels to cobbles to boulders about 5 feet in nominal diameter. The rocks are derived from erosion of the volcanic ash matrix or remnants from overlying alluvium. The rocky reef area that is apparent offshore is probably an extension of the ash flow and basalt rock combination seen onshore.

There are no obvious signs of erosion at the site. A seawall south of the site is partially buried by a prism of accreted stone, indicating an energetic, but stable shoreline. The basalt cobbles and boulders are naturally occurring armor that offer relatively good shore protection. The ash flow matrix of the underlying substrate is also resistant to erosion and will promote stability.

Offshore observations showed an apparent sand channel about 200 feet east of the new outlet location. Relatively large waves (breaker height 4 ft) were occurring at the time due a southern swell event, and an offshore rip current was observed at the sand channel location. Offshore flow of this type will be helpful for moving outlet discharge away from the shoreline.

### 3.5 Sediment Transport

Hawaii beaches, and tropical beaches in general, are formed primarily from calcareous sands derived from offshore reef organisms. Usually only a very small percentage of beach sediment is derived from terrigenous sources. However, a sand sample collected at the second outlet site at Waianukole showed 67 percent carbonate (i.e. 33 percent terrigenous) and a sample collected on Front Street beach showed 46 percent carbonate (54 percent terrigenous). These are unusual percentages that indicate that, unlike most Hawaii beaches, much of the beach sediment in the project reach is derived from terrigenous sources. Models of terrigenous sand sources attribute most of the coastal sediment supply to watershed drainage (e.g. California Dept. of Boating and Waterways and State Coastal Conservancy, 2002). However, a small percentage can be derived from local sediment stored in seacliffs or other features. Kauaula stream is the dominant drainage feature south of Lahaina Harbor, and the prominent delta that it has created illustrates the volume of sediment that may be released there.



Sediment transport occurs in a variety of ways. Very fine sediments are easily suspended in the water column and carried by ocean currents. Larger grains such as sand, gravels and even cobbles and boulders, are moved by wave action on the bottom. On the beach itself, sand grains are moved by wave swash, the uprush and downrush of waves on the beach. If the waves approach at an angle to the beach, there is often alongshore transport up or down the beach. For this type of transport, even small short period waves, such as those generated by local winds, can be effective in moving large volumes of sediment. Longer period waves, such as are typical of southern swells, have water motions that are deep in the water column,

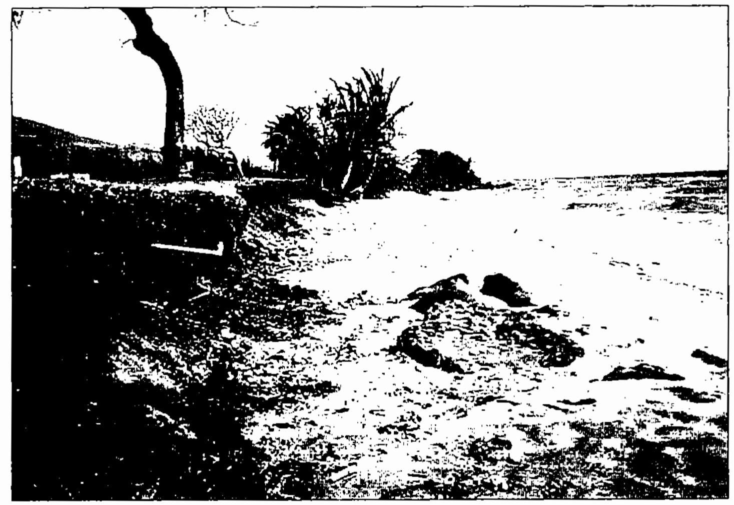


Figure 3-3 – Shoreline Erosion at Puamana Beach Park

Figure 3-4 – Alluvial Soils with Cobbles and Boulders, Puamana Beach Park

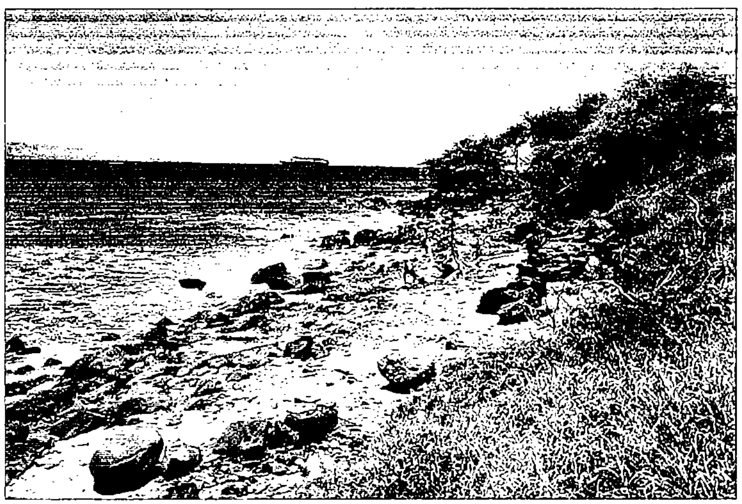


Figure 3-5 – Rocky Shoreline at Second Outlet Location, Waianukole



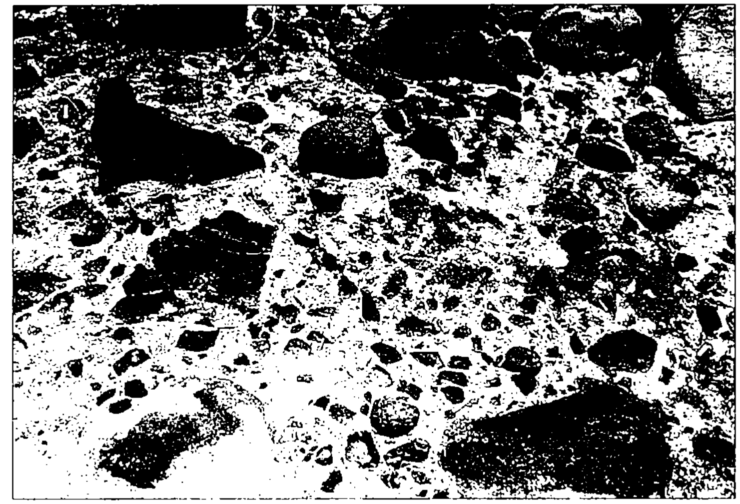


Figure 3-6 – Ash-Flow Substrate at Second Outlet Location

and they can consequently move sediment at deeper depths than the local wind waves. They can be effective in moving sediment both alongshore and toward the shore along the bottom, predominantly at depths less than about 30 feet.

Figure 2-1 shows that the Lahaina area is well protected from most directions of open ocean swell by the islands that surround Maui, and by the island itself. It is open only to southern swell from the south and southwest, and also to the southeast. The predominant direction of sand transport from Kauaula stream is therefore to the north. Because of the curvature of the delta at Makila Point, waves at the western margin of the swell window in Figure 2-1 (i.e. from about 225° to 236°), can possibly have an approach that will push sediment to the south. Southward transport can also occur in the swash zone on the beach from the action of locally generated waves during west and southwest winds.

The delta that defines Makila Point is formed from cobbles and boulders that were transported by the stream. They are deposited at the stream mouth when the flow parameters of the stream change drastically as it enters the ocean. The cobbles and boulders are large and stable enough so that they will only be moved by extreme storm wave events. Therefore, the rate of change of the shoreline at Makila Point can be expected to be very slow. However, the size and shape of the point is maintained by the infrequent outflow of large cobbles and small boulders.

Wave generated sediment transport processes allow sediments discharged from Kauaula Stream to be transported north to the Front Street beaches, and, to a lesser degree, south to Puamana Park and beyond. The reef that stands offshore from Makila Point to Lahaina Harbor is a barrier to sediments moving both onshore and offshore, and also protects the beaches from direct wave attack. In order to reach the beach from offshore, sand must move through channels in the reef. Sand stripped from the beach during an extreme event can be temporarily stored in the shallow nearshore trough between the beach and the reef until, over time, smaller waves can transport the sand back to the beach.

Sediment transport, especially nearshore, is a complicated process with many variables and uncertainties. Quantitative analysis is seldom satisfactory. Transport can be understood and discussed in a general way, but specific questions in terms of time scales and volumes are difficult to answer. Sediment discharge estimates at the project site vary. Based upon measurements made during a 5-year storm event, Grigg (1983) estimated a sediment discharge value for Kauaula Stream of 273 tons that included both settleable and suspended solids over a 12-hour period. The estimated average annual discharge (NRCS, 1992) is 1,850 tons. The discharge estimate for a 5-year storm at the stream in the USDA Environmental Assessment (NRCS, 1992) is 3,200 tons (note: a one-time extreme event can be larger than an average annual condition due to various non-linear factors involved such as ground saturation, stream bed volume increases, and stream velocity increases, and the effect these parameters have on sediment load). The discrepancy between Grigg's values and those of NRCS is in part due to the inclusion of bedload transport in the NRCS data, while Grigg's data are from measurements of material in the water column. But differences like these are not unusual and underline the difficulties in both the measurement and modeling of sediment transport. Recent observations and measurements near the mouth of Kauaula stream indicate a high rate of sediment influx (E. Brown, pers. comm.) from both terrigenous and marine sources.

The relationship between coral health and sedimentation on coral reefs is not well quantified, although some general principles are understood:

- Rapid sediment influx can bury and smother corals.
- Burial of hard bottom areas by mobile sediments can result in decreased recruitment, or establishment of juvenile colonies.
- Scouring of hard bottom areas by mobile sediments can result in mortality of juvenile colonies and decreased recruitment.
- Excess silt-sized sediment can blanket and destroy colonies.
- Excess turbidity from suspended sediments will reduce the amount of light available for photosynthesis.

Burial and scouring are effects produced predominately by sand and gravel sized sediments that quickly fall out of suspension and are moved on the bottom by wave motion. Water column turbidity and blanketing of corals is caused by finer grained sediments, such as silts and clays, that fall out of suspension slowly during periods of calm water. During active water motion conditions, such as occurs with the arrival of a southern swell, for example, the



silts and clays can be re-suspended in the water column, leading to turbid conditions nearshore. At locations such as the second outlet site, where the wave breaking zone is attached to the shoreline, that is, waves break offshore but the breaker bore continues to the shoreline, there are typically vigorous alongshore and offshore ("rip") currents that will help to move the suspended sediments offshore, and thereby clean up the nearshore area by dispersing the silt and clay sediments.

The watershed plan incorporates sediment settling basins that are projected to reduce total annual sediment outflow by about 25%. Sediment outflow at Kauaula Stream will be reduced by about 52%, from 1850 tons per year, to 960 tons per year. The sediment basins will also be designed to capture all stones larger than 6 inches in diameter. Sediment discharge in the area between Lahaina Harbor and Kauaula Stream will change from about 3,400 tons to no sediment discharge with the diversion and sediment basins in place. Presently, about 310 tons of sediment are discharged near Puamana Park, this sediment will be diverted to the second outlet, where the discharge will increase to 3,280 tons.

Results of these changes may include:

- The decrease in sediment discharge at Lahaina and Kauaula Stream should invigorate the coral reef habitat in these areas, and lead to increased production of reef-derived marine sediments.
- While less terrigenous sediment will be available to the Front Street beaches, new beaches may form at the second outlet site at Waianukole as a result of increased sediment discharge at that location.
- Slow changes may occur at Makila Point as cobbles and boulders that form the point are transported by infrequent extreme events, while new material is retained in the sediment basins.

Less sediment supply for the Front Street beaches may be mitigated somewhat by the increase in reef-derived sediment. If beach loss becomes a problem in the long term, a beach nourishment program can be instituted whereby sand-sized sediment trapped in the project sediment basins can be placed on the beaches. This effort would be aided by designing the sediment basins to segregate the sand-sized sediment from finer silts and clays. Similarly, if changes at Makila Point become a problem over the long term (say an estimated period of 10 to 50 years), the system can be fed with cobbles and boulders trapped in the sediment basins. In this way, the watershed project can be used to manage the area beaches and reef ecosystems as well as offer flood control.

# 4.0 WATER QUALITY

## 4.1 Previous Studies

Numerous studies have measured water quality in the Lahaina area over the years. An early survey by Environmental Consultants, Inc. (ECI, 1976) provides data from the vicinity of Makila Point south to Launiupoko State Wayside Park and Awalua collected over 25 years ago. A total of six locations were sampled on five occasions in March (three consecutive days) and April (two consecutive days) of 1976. Measured at that time were light penetration, turbidity, nutrients (phosphate, ammonia, nitrate, and nitrite), chlorophyll, salinity, temperature, and dissolved oxygen (DO). Salinity and nutrients were measured in 1988 in the same general area just North of Launiupoko State Wayside (*AECOS*, 1988). Of direct interest to the present undertaking are the surveys by Grigg (1983) which looked at water quality off Lahaina Town and off Kaua`ula Stream (at Makila Point) to the southeast in relation to storm conditions that generated terrestrial runoff.

A decade later, in June 1994, water quality samples were collected along and off the shoreline at Lahaina for the purpose of providing a characterization of these waters relative to similar data collected earlier and the State of Hawaii, marine water quality criteria for coastal waters (SEI, 1994). Samples were collected during the morning hours of June 14, 1994 at a total of ten locations between the mouth of Kaua`ula Stream at Puamana south of Lahaina and the mouth of Kahoma Stream at Mala north of Lahaina. Six samples were collected from immediately off the shore: four samples were from offshore areas paired with four of the shoreline stations (Figure 4-1).

Interest in seeking the cause(s) for algal blooms, particularly by *Cladophora sericea* and *Hypnea musciformis* in offshore benthic areas, has resulted in funding for both offshore and watershed monitoring programs (see Oceanit Laboratories, 1996; De Carlo and Dollar, 1996; and Kinetic Laboratories, 1997). A long-term water quality study of West Maui coastal waters (Dollar and Andrews, 1997) included a station ("Site 5") off the mouth of Kauaula Stream at Puamana. Water samples were collected weekly between December 1993 and January 1995 at the shoreline and at a depth of 1 m approximately 5 m off the shore. Results for this location are summarized in Table 4.1 and discussed with other samples below. All means are arithmatic means (not geometric means).

De Carlo and Dollar (1996) conducted a study to, among other objectives, assess particulate material input from anthropogenic sources as well as natural upland erosion carried by Honokowai Stream into West Maui coastal waters. Samples were collected in a grid that consisted of seven transects oriented perpendicular to the shoreline, centered at the mouth of Honokowai Stream and running from 1 m to 100 m offshore. The samples were collected on four different occasions days after a very intense storm that began on March 29, 1996. Samples were analyzed for phosphate, silica, nitrate + nitrite, ammonium, total nitrogen, total phosphorus, dissolved organic nitrogen, dissolved inorganic phosphorus, turbidity, salinity, total suspended solids, particulate phosphorus, and particulate nitrogen. Results showed that in stream water flowing to the ocean, the concentrations of all the dissolved and particulate constituents were at peak levels immediately following the storm. The concentrations of



many of the constituents decreased by one to two orders of magnitude within 500 m of the shoreline and also laterally from the stream mouth. By three days after the storm event, few gradients of increasing or decreasing concentrations were evident along the shoreline or with distance from shore. Kinetic Laboratories (1997) collected water samples to characterize nutrients and suspended solids loadings into Honokowai Stream from surface runoff. Results from these various earlier surveys are discussed below in Section 4.3 and beyond.

**Table 4-1. Mean, range, and standard deviations for selected water quality measurements made approximately weekly off Kaua`ula Stream, (Makila Point) between 1993 and 1995 (Dollar & Andrews, 1997).**

| SITE 5 shore | Salinity (ppt) | Turbidity (ntu) | Silicate (µg Si/l) | Ammonia (µg N/l) | Nitrate + nitrite (µg N/l) | Total N (µg N/l) | orho-P (µg P/l) | Total P (µg P/l) |
|---|---|---|---|---|---|---|---|---|
| **Mean** | 28.80 | 0.56 | 2534 | 15 | 46 | 153 | 3 | 9 |
| **St. Dev.** | ±7.92 | ±0.56 | ±2722 | ±24 | ±115 | ±123 | ±3 | ± 2 |
| **Min** | 0.26 | 0.09 | 127 | < 1 | < 1 | 62 | < 1 | 3 |
| **Max** | 34.58 | 2.10 | 10160 | 104 | 708 | 767 | 10 | 19 |
| **n** | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| SITE 5 5 m out | | | | | | | | |
| **Mean** | 32.94 | 0.31 | 671 | 3 | 8 | 93 | 3 | 9 |
| **St. Dev.** | ±5.50 | ±0.49 | ±1492 | ±4 | ±24 | ±34 | ±2 | ±2 |
| **Min** | 6.31 | 0.07 | 99 | < 1 | < 1 | 66 | < 1 | 5 |
| **Max** | 34/64 | 2.60 | 7752 | 21 | 119 | 250 | 7 | 17 |
| **n** | 42 | 42 | 4 | 4 | 4 | 4 | 4 | 4 |

## 4.2 Recent Water Quality Data

A total of seven samples were collected on March 29, 2002 for water quality analyses. These samples were collected at four ocean stations and three shoreline stations (see Figure 4-1) and the results are presented in Table 4-2. Station descriptions are as follows: **Station 1s** — at the shoreline in knee-deep water close to Makila Point. **Station 1d** — 10m (33 ft) depth of water, offshore from the stream mouth near Makila Point. **Station 2s** — at the shoreline in knee-deep water, near condominiums between Makila Point and Puamana Beach Park. **Station 2d** — 10m (33ft) depth of water, offshore from the condominiums between Makila Point and Puamana Park. **Station 3s** — at the shoreline in knee-deep water, near the northern road culvert at Puamana Beach Park. **Station 3d** - 12m (40 ft) depth of water, offshore from the condos between Makila Point and Puamana Park. **Station CM** — 6m (18 ft) depth of water, offshore from the northern culvert in Puamana Beach Park, near the current meter deployment.

An additional set of samples was collected on April 25, 2002. These were spread out further southward along the coast than those collected on March 29. Station descriptions are as follows: **Station 1s** and **1d** as described for March 29. **Station 4s** — approximately 50 feet offshore in 1.5 m (5ft) of water depth, at the proposed second outlet location (Waianukole) south of Puamana Beach Park. **Station 4d** — 5m (15 ft) depth of water, off the proposed diversion outlet location. **Station 5s** — approximately 50 feet offshore in 1.5 m (5ft) of water depth, north of Launiupoko State Wayside. **Station 5d** — 5m (15 ft) depth of water, north of Launiupoko State Wayside.

Water quality analyses methods are given in Table 4-2. Temperature, dissolved oxygen, salinity, and pH were measured with probes *in situ* on March 29 only. All collected samples were returned to *AECOS* Inc. laboratory (assigned laboratory Log No.s 15653 and 15773) soon after collection and either preserved or analyzed immediately as required by standard methodology for each analysis.

**Table 4-2. Analytical Methods and Instruments Used for the March and May 2002 Sampling in the Launiupoko and Puomana Areas**

| Analysis | Method | Reference | Instrument |
|---|---|---|---|
| Ammonia | alkaline phenol | Koroleff in Grasshoff et al. (1986) | Technicon AutoAnalyzer II |
| Conductivity | Method 2510B (EPA 120.1) | Standard Methods 18th Edition (1992) | Hydach pH/conductivity meter |
| Dissolved Oxygen | EPA 360.1 | EPA (1979) | YSI Model 57 DO meter |
| Nitrate + Nitrite | EPA 353.2 | EPA (1993) | Technicon AutoAnalyzer II |
| pH | EPA 150.1 | EPA (1979) | Orion SA 250 pH meter / Ross combination electrode |
| Salinity | refractive index | — | AO handheld Refractometer |
| Temperature | thermister calibrated to NBS cert. Thermometer (EPA 170.1) | EPA (1979) | YSI Model 57 DO meter |
| Total Nitrogen | persulfate digestion /EPA 353.2 | D'Elia et al. (1977) / EPA (1993) | Technicon AutoAnalyzer II |
| Total Phosphorus | persulfate digestion /EPA 365.1 | Koroleff in Grasshoff et al. (1986) / EPA (1993) | Technicon AutoAnalyzer II |
| Total Suspended Solids (TSS) | Method 2540D (EPA 160.2) | Standard Methods 18th Edition (1992); EPA (1979) | Mettler H31 balance |
| Turbidity | Method 2130B (EPA 180.1) | Standard Methods 18th Edition (1992); EPA (1993) | Hach 2100P Turbidimeter |


D'Elia, C.F., P.A. Stendler, & N. Corwin. 1977. *Limnol. Oceanogr.* 22(4): 760-764.
EPA. 1979. Methods for Chemical Analysis of Water and Wastes. U.S. Environmental Protection Agency, EPA 600/4-79-020.
EPA. 1993. Methods for the Determination of Inorganic Substances in Environmental Samples. EPA 600/R-93/100.
EPA. 1994. Methods for Determination of Metals in Environmental Samples, Supplement 1. EPA/600/R-94/111. May 1994.
Grasshoff, K., M. Ehrhardt, & K. Kremling (eds). 1986. Methods of Seawater Analysis (2nd ed). Verlag Chemie, GmbH, Weinheim.
Standard Methods. 1992. Standard Methods for the Examination of Water and Wastewater. 18th Edition. (Greenberg, Clesceri, and Eaton, eds.). APHA, AWWA, & WEF. 1100 p.



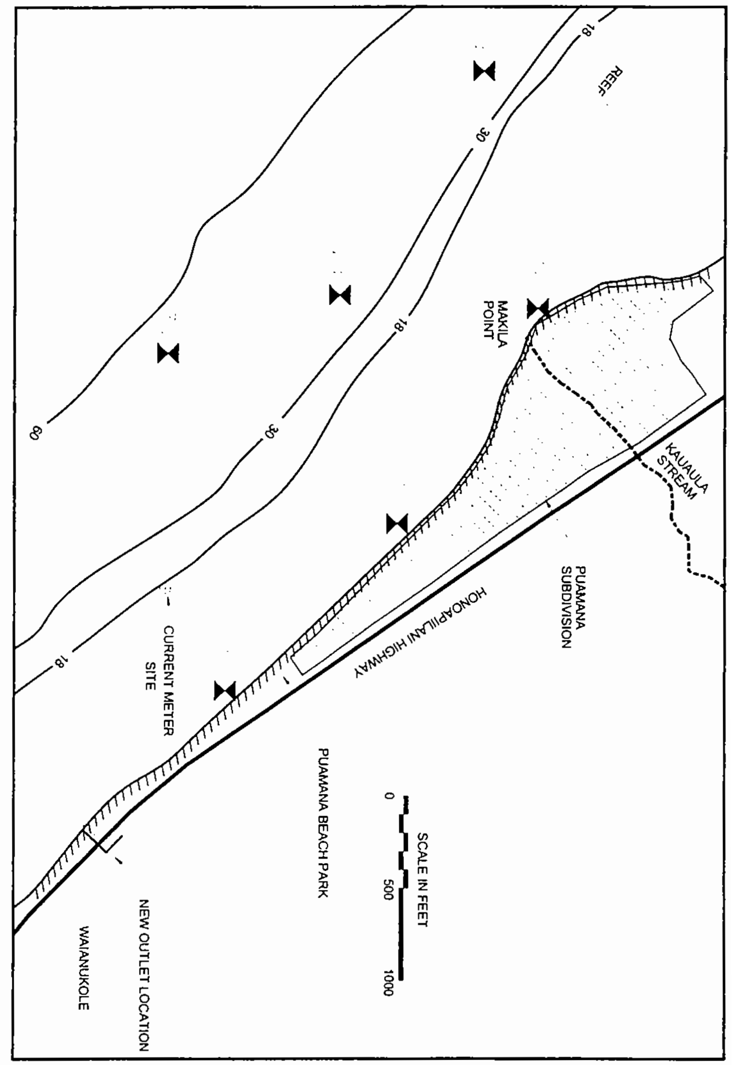




**Figure 4-1 – Station Locations for Water Samples Collected March 29, 2002**

**Table 4-3. Water Quality Characteristics from the March 29 and April 25, 2002 Sampling Events in the Puamana to Launiupoko Waters off West Maui**

| Station | Date | Time | Temp. (°C) | pH | DO (mg/l) | DO Sat. (%) | Salinity (ppt) | Turbidity (ntu) | TSS (mg/l) | Ammonia (µg N/l) | Nitrate + nitrite (µg N/l) | Total N (µg N/l) | Total P (µg P/l) | Chl. α (µg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sta. 1s** | 03/29/02 | 1445 | 25.7 | 8.1 | 7.60 | 115 | 36 | 6.06 | 25 | < 1 | < 1 | 164 | 30 | 1.00 |
| **Sta. 1d** | 03/29/02 | 1105 | 24.8 | 8.1 | 7.06 | 104 | 35 | 1.74 | 3.9 | < 1 | < 1 | 118 | 31 | 0.24 |
| **Sta. 2s** | 03/29/02 | 1520 | 26.2 | 8.1 | 7.45 | 92 | 35 | 15.6 | 223 | < 1 | < 1 | 226 | 39 | 2.14 |
| **Sta. 2d** | 03/29/02 | 1115 | 24.9 | 8.1 | 6.59 | 97 | 35 | 2.32 | 9.3 | < 1 | < 1 | 116 | 30 | 0.24 |
| **Sta. CM** | 03/29/02 | 1050 | 24.3 | 7.7 | 7.50 | 110 | 34 | 4.40 | 9.2 | < 1 | < 1 | 125 | 69 | 0.73 |
| **Sta. 3s** | 03/29/02 | 1505 | 26.4 | 8.1 | 7.06 | 107 | 36 | 15.0 | 71.2 | < 1 | 1 | 201 | 40 | 2.03 |
| **Sta. 3d** | 03/29/02 | 1215 | 24.7 | 8.1 | 7.02 | 104 | 35 | 0.44 | 1.8 | < 1 | < 1 | 106 | 21 | 0.08 |
| **Sta. 1s** | 04/25/02 | ~1610 | -- | -- | -- | -- | -- | 4.68 | 7.0 | < 1 | < 1 | 118 | 15 | 0.08 |
| **Sta. 1d** | 04/25/02 | ~1600 | -- | -- | -- | -- | -- | 1.29 | 3.7 | < 1 | 1 | 115 | 11 | 0.04 |
| **Sta. CM** | 04/25/02 | 1030 | -- | -- | -- | -- | -- | 0.68 | 4.4 | < 1 | < 1 | 104 | 11 | 0.05 |
| **Sta. 4s** | 04/25/02 | ~1540 | -- | -- | -- | -- | -- | 10.0 | 18.4 | < 1 | 2 | 112 | 22 | 0.10 |
| **Sta. 4d** | 04/25/02 | ~1530 | -- | -- | -- | -- | -- | 4.06 | 7.1 | < 1 | 1 | 104 | 13 | 0.05 |
| **Sta. 5s** | 04/25/02 | ~1620 | -- | -- | -- | -- | -- | 4.84 | 6.6 | < 1 | 1 | 117 | 14 | 0.09 |
| **Sta. 5d** | 04/25/02 | ~1615 | -- | -- | -- | -- | -- | 1.76 | 3.4 | < 1 | < 1 | 116 | 11 | 0.05 |



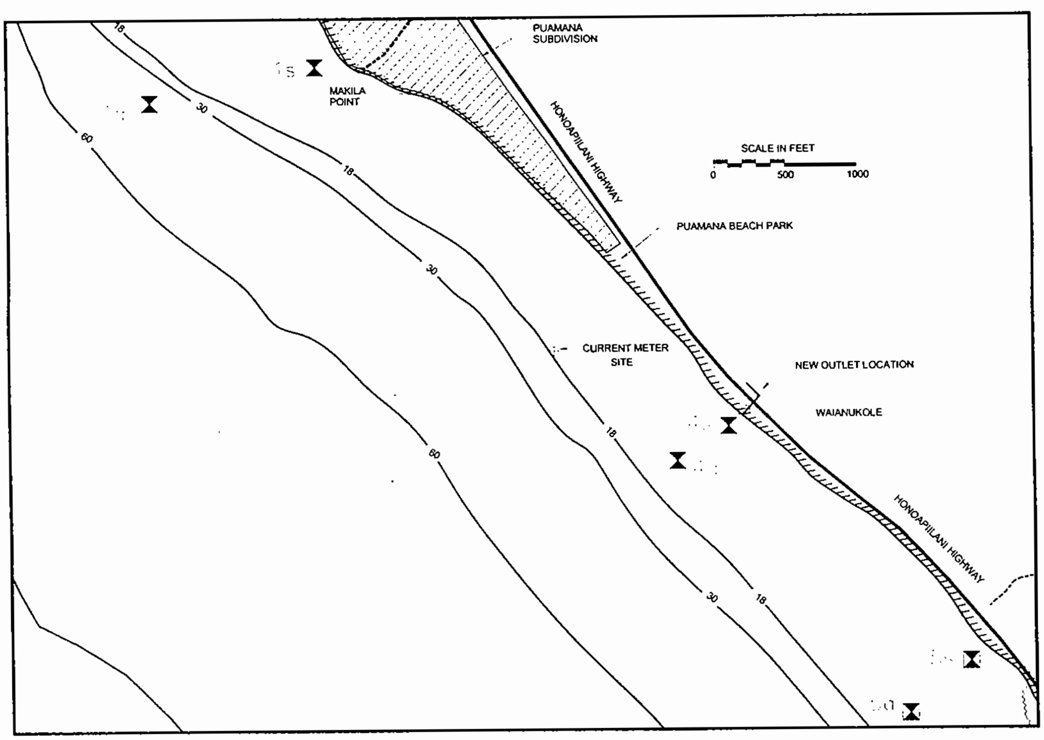



**Figure 4-2 – Station Locations for Water Samples Collected April 25, 2002**

As part of an environmental assessment, basic water quality measurements are useful to characterize a waterbody at the time of the survey. However, measurements taken at only one or two points in time have limited value when assessing compliance with the Hawai`i water quality standards (Hawai`i Administrative Rules (HAR) 11-54; DOH, 2000). For example, the State criteria for turbidity and nutrients in marine waters are based on comparing (geometric) mean values, which require at least three samples separated in time. Thus, our sampling results are not strictly comparable with State criteria, although they can be evaluated against the criteria as long as certain limitations are realized.

### 4.3 Temperature And Salinity

Temperature and salinity showed small variation from place to place on March 29, 2002. Temperatures ranged from 24.3 to 26.2°C. All of the offshore stations showed temperatures below 25.0°C (and in the range 24.3 to 24.9°C); the nearshore stations had temperatures above 25.0°C. Salinity was measured in the field with an instrument (hand-held refractometer) providing part per thousand (ppt) readings, sufficient to establish that no great influence from terrestrial drainage or groundwater seepage was evident. However, this instrument is suitable only for detecting large differences (e.g., in estuaries) and setting up proper correction factors on the oxygen meter.

Grigg (1983) reported salinities off Lahaina town at 35.0 to 35.5 ppt in September and 33.0 ppt on January 2 after a December 24, 1982 storm. Salinities off Kaua'ula Stream varied between 34.0 and 35.0 in September, and 0.0 (fresh water) and 32.5 in January. Temperatures also were depressed after the storm, averaging 27.5 °C (n=5) in September and 25.3 °C (n=5) in January off central Lahaina (very similar means were recorded off Kaua'ula Stream), presumably reflecting normal seasonal trends. Salinities off the old Ka'anapali Airport in April 1994 ranged from 34.55 to 34.88 (n=26; Bob Bourke, pers. communication).

De Carlo and Dollar (1996) reported salinities offshore from Honokowai Stream ranging from 0 ppt (within 26 hours following the onset of a March 29, 1996 storm) to 34.8 ppt at various locations on the transects over a period of 8½ days following the onset of the storm. Initially after the storm, nearly all (n= 30) samples taken along seven transects were below coastal ocean values of 34.5 ‰. Dollar and Andrews (1997) reported means based upon almost weekly sampling for one year off the mouth of Kaua`uls Stream of 28.8 ppt at the shoreline, and 32.9 ppt 5 m off the shoreline (and 1 m below surface; Table 4-1).

Temperatures reported in Table 4-3 are for mid-day surface waters in March 2002. Development of a diurnal thermocline was noted in the waters south of Lahaina during the investigation conducted by ECI (1976). Surface and bottom waters were seldom more than 0.5 C° apart, however.

### 4.4 Dissolved Oxygen

Oxygen is produced in the marine environment by algae as a by-product of photosynthesis. The atmosphere is the other source of oxygen found in the water, although solubility (less than 7 ppm in sea water) limits the concentration achievable by diffusive processes.



Dissolved oxygen (DO) values measured in March 2002 are normal or perhaps a bit elevated for sea water in the range of 92 to 115 percent saturation (percent present as a function of oxygen solubility at the given temperature and salinity). Although absolute values (in mg./l) tended to be higher at inshore locations as compared with offshore locations along the same transect (possibly indicating a contribution of oxygen produced by benthic algae), no other patterns were evident in the measurements.

The ECI (1976) study included many DO measurements at progressive depths in the water column at each of six stations on four different dates in March and April 1976. Nearly 150 separate measurements were taken, and the DO was always in the range of 6.1 to 6.8 mg/l (temperatures and salinities prevailing at the time were about the same as measured in our survey). Oxygen tended to increase with depth, indicating "...a significant input of oxygen to the water column due to benthic productivity" (ECI, 1976, p. 58). The influence of benthic algae on DO was tested in shallow waters by samples collected over shallow reef areas with a wide range of benthic algal cover. These consistently produced values above saturation (>100%).

### 4.5 pH

Sea water is relatively well buffered with respect to pH, which means that changes in pH are seldom very great. Elevated daytime pH in shallow reef waters may signal high productivity as algae remove $C0_2$ from the water (a high DO should also be observed at such times). pH values measured in March 2002 (Table 4-3) are very ordinary for sea water samples, with very little variation.

### 4.6 Turbidity And Suspended Solids

Turbidity and total suspended solids (TSS) are measures of the concentrations of fine particulates in the water. These may be silts and clays generated from land drainage or reef processes, and/or phytoplankton or other organic matter. Turbidity is a measure of the light reflecting off these small particles; TSS is the dry weight of the suspended material. Turbidity and TSS are important properties in assessing impacts from land drainage, because runoff is a significant source of fine sedimentary material to nearshore environments.

Both turbidity and TSS tended to show greater variability than any of the other parameters measured in March and April of 2002 (Table 4-3). This variability would no doubt be even greater were samples collected over a long period of time because land runoff and wave action can significantly elevate turbidities and suspended solids in nearshore waters. Turbidities measured from spot samples in 2002 ranged from 0.44 to 15.6 ntu, with the highest values (range 6.0 to 15.6 ntu in March; 4.7 to 10.0 ntu in April) always at inshore locations (Stations 1s, 2s, 3s, 4s, and 5s). Suspended solids varied from 1.8 to 223 mg/l and appear to reasonably correlate with the turbidity values. Offshore values averaged only 5.4 mg/l(n=8). The especially high nearshore values (e.g., Station 2s on March 29 at 223 mg/l) result presumably from wave action suspending particles at the shorebreak.

The current meter set up off Puamana measured turbidity in the water on a continuous basis, providing a picture of variability in water clarity for a period of one month (see Figure 2-5). These measurements appear to amplify our assessment above that nearshore waters are significantly more turbid than offshore waters. We can see from the graphical presentation that turbidity at the current meter site varied considerably during the first ten days, bearing a relationship to the tide (turbidities tended to spike at lower low water). Most interesting is the appearance around April 9 of a period of approximately 48 hours of elevated and highly variable turbidities that corresponds to development of a negative cross current (offshore flow). That is, while the meter was recording a flow of water from inshore to offshore, it was also recording a rise in turbidity, indicating nearshore water was being transported offshore past the meter's location. Thereafter (from April 12 on), turbidity was low and seemingly uninfluenced by tide at the current meter location. No strong offshore currents developed either. While we do not have measurements of inshore turbidities during this period, spot measurements collected on April 25 suggest they had decreased only a little from the March 29 values (Table 4-3).

De Carlo and Dollar (1996) reported suspended solid levels off Honokowai Stream to be between 1.60 and 523 mg/L within 26 hours of the onset of a two-day storm; and to be between 1.67 and 36.93 mg/L 8½ days following the onset of the storm. Turbidity levels were reported to be between 0.11 and 34 ntu initially and between 0.10 and 0.87 ntu 8½ days following the onset of the storm. Immediately after the storm, the highest TSS and turbidity levels were close to shore, but by 8½ days, some of the highest TSS levels were as much as 100 m (300 ft) from shore.

Measurements of settleable and suspended solids were made by Grigg (1983) in relation to a storm on December 24, 1982 in the Lahaina area. "During" samples were collected in Kaua'ula Stream and at three points seaward from the mouth giving settleable solids in the range of <0.02 to 0.10 ml/l and suspended solids (TSS) between 93 and 108 mg/l in the stream and <0.02 ml/l settleable solids and 38 to 89 mg/l TSS in the nearshore directly off the stream mouth. While settleable solids from nearshore samples collected off central Lahaina town and Kaua'ula Stream were not detectable (<0.02 ml/l), suspended solids ranged between 74 and 128 mg/l on January 2, 1983.

The weekly sampling reported by Dollar and Andrews (1997) at Makila Point yielded mean values of 0.56 and 0.31 ntu (see Table 4-1). These values appear low (more typical of turbidities encountered further offshore); even the maximum values measured seem anomalously low, although this was not the case for all of the sites sampled in the study. The fact that so many measurements were made over essentially a one year period, gives strong weight to the reported means being representative of the nearshore waters, subject perhaps to some year to year differences reflecting drier and wetter periods. Had TSS been monitored as well, these values could have served as a confirmation of the low levels of suspended matter in the samples.

Turbidity and suspended solids measured at a single station located 1500 feet offshore and midway between Puamana Park and Launiupoko State Park on January 20, 1988 gave values of <0.1 ntu and 2.1 mg/l, respectively (AECOS, 1988).



**4.7 Nutrients**

Nutrients are measured because of the influence these chemicals have on growth rates and abundance of phytoplankton and benthic algae. Excessive benthic algal growth washing up on West Maui beaches has been a serious problem for a number of years (Bennett and Keuper-Bennett, 1997; Dollar and Andrews, 1997). Nutrient (ammonia, nitrate + nitrite, total nitrogen, and total phosphorus) values collected in March and April 2002 off the project coastline tended to be low and not particularly variable from place to place and between the two sampling events. Ammonia was not detectable in any of the samples at a limit of 1 µg $NH_3$-N/l. Nitrate + nitrite was detected in only a few samples at a detection limit of 1 µg $NO_3$+$NO_2$-N/l. These low levels of inorganic nitrogen are typical of oceanic waters, but not in keeping with the somewhat turbid waters from which the samples were drawn. However, if a significant fraction of the turbidity were caused by an algal bloom (phytoplankton), it could well be that these algae pulled the available dissolved inorganic nitrogen forms out of the water. Total nitrogen (total N) and total phosphorus (total P) measure the amount of each element in dissolved inorganic, particulate organic and dissolved organic forms in the water. Total nitrogen was higher on average (126 µg N/l or ppb, n=6) nearshore than offshore (113 ppb, n=8). Total P distribution is similarly patterned (27 ppb, n=6 nearshore; 25 ppb, n=8 offshore), although for total P the biggest difference was between sampling events (March 29 mean of 37 ppb and April 25 mean of 14 ppb ; n=7 for both events). Total N showed a similar pattern (160 ppb compared with 112 ppb).

Historical values for inorganic nutrients come from ECI (1976), for stations in the Laniupoko area. Ammonia values were on the order of 5 ppb (µg N/l) in March and 1 to 2 ppb in April, 1976. Mean nitrates in this study ranged from 0.7 to 2.8 ppb. Mean nitrites (measured separately from nitrates) were consistently around 0.1 to 0.2 ppb. Orthophosphate means varied between 5.9 and 6.5 ppb. Ammonia values in 1976 were similar or slightly elevated relative to the 1994 values. The small differences may be analytical. The nitrate values are generally quite comparable. A single sample from this area on January 20, 1988 yielded an ammonia of <1 ppm and a nitrate + nitrite of 6 ppm (AECOS, 1988). This sample was collected from a point 1500 feet offshore between Puamana and Launiupoko Parks. Total N was not measured in the 1976 study, but the single sample collected in January 1988 from this area had a total N of 148 ppb.

Regularly measurements made weekly for a year off the mouth of Kaua`ula Stream by Dollar and Andrews (1997) are summarized in our Table 4-1. Somewhat surprising is the lesser average concentrations of inorganic forms of nitrogen over a distance of only 5 m (and depth change from surface to 1 m deep). However, when it is considered that the sampling took place at the mouth of a stream, the results can be explained by occasional inputs of nutrients in intermittent flow and seepage from the stream itself (note the lower salinity at the shore station).

Grigg (1983) measured inorganic nutrients (orthophosphate, nitrate + nitrite, silicate) before, during, and after storms in and seaward of Kaua'ula Stream. Measurements were also made on the "before" and "after" dates at four locations off central Lahaina town; however, the "after" samples were collected more than two weeks following the storm event. Nitrate +

nitrite values ranged from 0.4 to 0.8 ppb on September 21, 1982 ("before") and 1.5 to 3.1 ppb on January 2, 1983 ("after"). These values are comparable to or less than the values reported in the most recent sampling in this area (Table 1, Sta. IA and 1B). The values are certainly low in comparison with stream and nearshore samples (about 630 and 35 ppb, respectively) collected during the storm of December 24, 1982. Samples from off Kaua'ula Stream in September 1982 gave nitrate + nitrate values similar to those collected off Drainline "F" at the same time; samples from off the stream on January 2 were between 5.3 and 11.9 ppb. Three samples were collected in the marine environment from just off a drain north of Launiupoko Park in January 1988. The mean of three samples showed evidence of elevated nitrate + nitrite (195 ppb). Some individual values for ammonia (11 ppb) and orthophosphate (32 ppb) might be considered slightly elevated relative to typical offshore values. Although no discharge was occurring from the outlet, salinity was depressed (24 ppt), showing that seepage from the ground was occurring (AECOS, 1988).

Measurements of orthophosphates off central Lahaina in September 1982 gave values at or below about 1 ppb. In January 1983, values at these same locations ranged between 3.4 and 6.8 ppb. Values for orthophosphate off Kaua'ula Stream were similar to those off Lahaina town in September 1982, but were elevated during and after the December 24 storm (13.6 to 37.5 ppb during and 4.0 to 8.7 ppb after). These measurements demonstrate that fresh water runoff is a source of nitrogen and phosphorus to the nearshore environment in the Lahaina area.

Water quality data from a series of stations north of Lahaina collected in April 1994 and provided courtesy of Bob Bourke (Oceanit Laboratories, Inc.) gave surface water values for nitrates ranging from 1 to 5 µg NO3+NO2-N/l, total N ranging from 90 to 100 ug N/l, orthophosphates from 6 to 12 ug P04-P/l, and total P from 11 to 20 ug P/l. Values are all very similar to those measured south of Lahaina in 2002 (Table 4-3), although our inorganic nitrogen concentrations were generally lower.

### 4.8 Chlorophyll

The measurement of chlorophyll in water samples provides an estimate of the relative abundance of phytoplankton. Chlorophyll $\alpha$ values measured in March and April 2002 (Table 4-3) were somewhat variable. Low values (range 0.04 to 0.73 µg/l) characterized all of the offshore stations combined (Stations 1d, 2d, 3d, 4d, 5d, and CM) and all of the values (inshore and offshore) obtained on April 25 (0.04 ton 0.10 µg/l). Clearly elevated values characterized the three inshore stations (Stations 1s, 2s, and 3s; range 1.00 to 2.14 µg/l) on March 29. Station CM on March 29 at 0.73 µg/l was intermediary between the inshore and offshore values, and this sample was collected in the morning as opposed to the afternoon for all of the other samples.

Values obtained in March-April 1976 ranged from means of 0.04 µg/l (n=24) in April to a high mean of 0.42 µg/l (n=24) on March 18, 1976 (ECI, 1976). A single sample of offshore waters from this same area south of Puamana gave a chlorophyll a value of 0.19 µg/l for January 1988 (AECOS, 1988).



## 5.0 DISCHARGE PLUME MODELING

### 5.1 Cormix Numerical Model

Plume transport and mixing in coastal waters is a complex process that depends on the physical characteristics of both the discharging and ambient waters. To evaluate these processes and possible plume impacts to the environment, the numerical model CORMIX 3 was applied to the second outlet discharge at Waianukole. CORMIX 3 is an EPA-approved buoyant surface discharge model that was developed under several cooperative funding agreements between the U.S. EPA and Cornell University from 1985 to 1995 (Jirka and others, 1996; Jones and others, 1996). The model incorporates both near-field and far-field dynamics, and assumes steady ambient currents. In the near field, the plume dilution depends on the density, volume and momentum of the discharge. In the far-field, plume dilution and transport depends on the receiving water (ambient) characteristics such as currents, stratification, turbulence and wind, and also buoyant spreading. In a buoyant surface plume, the dominant factors in the far-field dilution are buoyant spreading, advection by currents, and mixing by wave and wind induced action.

CORMIX 3 has been tested and verified with laboratory data and field measurements, by both the system developers and numerous independent studies (Jones and others, 1996). Sample test cases include the Point Beach and Palisades Nuclear Power Plants on Lake Michigan, the Connecticut River Plume in Long Island Sound, the Thompson Creek Mine Facility, Mimico Creek discharge into Lake Ontario, and various cooling water discharges. In these cases, CORMIX 3 results have been shown to agree well with laboratory and field data. Limitations to the model occur in highly unsteady currents or stagnant environments.

### 5.2 Model Input Parameters

Key model input parameters include ambient currents and water density, discharge rate and water density, and wind speed. These parameters are discussed below.

1. Ambient current – Currents in the vicinity of the plume are discussed in Section 2. The average currents measured at the site during 1988 for the predominant flow directions northwest and southeast were used in the modeling analysis. These values are 0.13 knot (6.72 cm/s) to the northwest, and 0.18 knot (9.0 cm/s) to the southeast.

2. Seawater density – Typical seawater density assuming a salinity of 35ppt and temperature of 78 degrees Fahrenheit is 63.9 lb/cu ft. (1024 kg/m$^3$).

3. Discharge rate – The discharge rate at Waianukole outlet will vary with the intensity of the rainstorm. The modeling analysis was completed for 2-year, 5-year and 10-year rain events because these are significant events that have a reasonable probability of occurrence in any given year. The 100-year event was used for watershed design to minimize impacts on property and risk to human life during a catastrophic event. The more probable events considered would likely be responsible for environmental impacts due to the outlet.

The storm discharge rates were provided by NRCS and were recently calculated (2002) using TR-20, a computer hydrology model that was calibrated using gauged data from nearby watersheds (NRCS, 1992). Figure 5-1 shows the discharge rate as a function of time for a 2-year storm in this area of Maui. The shape of the curve is typical for a storm in this area, and also applies to the 5-year and 10-year storms. The discharge event lasts about 26 hours. Discharge slowly builds during the first 9 hours of the storm, and then increases 6-fold in the next 1 to 2 hours. The peak discharge occurs about 10.5 hours after the onset of the rain and lasts less than 30 minutes. Discharge rate declines rapidly on either side of the peak. The peak discharge rate is not appropriate to use in the modeling analysis because it occurs for such a brief time. The peak 6-hour average discharge, the highest average flow over a 6-hour period during the storm, was used for this study. The peak 6-hour average discharge rate is about 45% of the absolute peak flow, but accounts for 63% of the total discharge volume of the storm. Table 1 lists the peak and peak 6-hour average discharges for the 2, 5 and 10-year discharge events that were evaluated in the modeling analysis.

**Table 5-1. Waianukole Outlet Design Discharge Rates**

| | 2-year storm | 5-year storm | 10-year storm |
|---|---|---|---|
| Peak discharge rate (cfs) | 765 | 1683 | 2478 |
| Peak 6-hour average discharge rate (cfs) | 341 | 751 | 1106 |

4. Discharge density – The typical density of freshwater is 62.4 lb/cu ft. (998 $kg/m^3$).

5. Wind speed – CORMIX 3 incorporates the effects of wind on plume mixing and diffusion. A wind speed of 10 knots was used for the modeling analysis.

### 5.3 Model Results

The CORMIX 3 model computes the position of the center of the plume as it is transported away from the discharge point, the concentration and dilution at the center of the plume, and the plume width and thickness. In the near field area close to shore, the plume concentration distribution is represented by a Gaussian profile; the edges of the plume are defined as the location where plume concentration falls below 37% of the center concentration (Jirka and others, 1996). In the far field region, where buoyant spreading dominates plume dynamics, the plume is represented by a uniform concentration profile that abruptly drops to 0 beyond the plume edge. For contouring purposes, we have modified this shape slightly to assume that plume concentration is 90% of centerline concentration at the plume edge. The initial plume concentration is set to be 100% and the corresponding ambient concentration assumed to be 0; the computed plume centerline concentrations can therefore be interpreted as a percentage of the initial plume concentration, and can be applied to any tracer of interest with conservative properties (i.e. not reduced by factors other than dilution). For example, a computed concentration of 20% means that the center of the plume is composed of 20%



effluent and 80% ambient water; the concentration is 20% of the initial plume concentration, assuming an ambient tracer concentration of 0. If the component of interest is salinity, a computed concentration of 20% means the plume is 20% fresh water and 80% seawater. With seawater salinity at 35 ppt, this translates to a plume salinity concentration of 28 ppt. Similarly, a computed concentration of 10% translates to a plume salinity of 31.5 ppt (90% of ambient).

The model results are presented as contour plots of plume concentration. Salinity was uscd as the indicator of plume dilution and possible impacts. State water quality standards indicate that salinity shall not vary more than ten percent from natural conditions, or a value of about 31.5 ppt (State of Hawaii, Department of Health, 1992). Research on salinity toleranccs of corals, however, has shown that corals generally have a much wider rangc of tolerance than this (Coles, 1992). Experiments exposing several types of Hawaii corals to different levels of salinity for 20 days showed high mortality at salinity levels of 20 ppt and below, but good survivability at salinity levels of 25 ppt and higher (Coles, 1992). For our modeling analysis, a salinity of 28 ppt was selected as a conservative indicator of zones of possible impact of the fresh water discharge.

Figures 5-2 through 5-13 are graphical presentations of the model results.

The mixing and transport of the fresh water plume generated by rainstorms is characterized by two relatively distinct regions – the near-field and the far-field. The near-field occurs close to the discharge outlet, and plume mixing and transport depends on the characteristies of the discharge such as flow rate, velocity and buoyancy. In the near-field, the plume mixes rapidly with the ambient water and is transported primarily by the momentum of the discharge. Figures 5-2, 5-3, and 5-4 show the plume concentrations in the near-field rcgion close to the outlet calculated for the 2, 5 and 10-year storms, respectively. The plume concentration drops to 20% of the initial value, or plume salinity reaches 28 ppt, about 1900 feet from shore for the 2-year storm discharge, 1,100 feet from shore for the 5-year storm discharge, and 900 feet from shore for the 10-year storm discharge. The plumes are transported approximately directly offshore by the initial momentum of the flow at the outlet. Because the 5 and 10-year storms result in deeper and faster flows at the outlet, there is greater turbulence and more mixing with the ambient water. Faster dilution occurs, and plume concentrations therefore fall more rapidly to 20% of the initial concentration. The plumes, however, are thicker for the increased flow events. Figure 5-5 shows plume thickness and water depth as a function of distance offshore, and therefore shows the zone where the plume impacts the seafloor. About 500 feet offshore, the plume is 4, 7, and 9 feet thick for the 2, 5 and 10-year storms, respectively. The plume is initially composed of fresh water, and therefore floats on top of, or forms a surface layer above, the more dense saline seawater. Figure 5-5 also shows a profile of the seafloor, and thus the area of seafloor that is impacted by the plume. During the 10-year storm, the plume contacts the seafloor to a distance of 550 feet offshore. During the 5 and 2-year storms, the plume contacts the seafloor to a distance of 400 and 250 feet offshore, respectively. The hatched areas in Figures 5-2 to 5-4 show the zone wherc the plume contacts the bottom, and thus the area of most likely possible impacts. This translates to an area of seafloor impacted by a plume with salinity less than 28 ppt of 52,424 square feet, 116,332 square feet, and 121,708 square feet for the 2, 5, and 10-year storms, respectively.

Beyond this near-field zone of rapid mixing, plume transport and mixing are dominated by ambient conditions such as current flow and wind and wave-induced motion, and also by buoyant spreading. In general, the plume mixes relatively slowly. It is transported by the local currents, and spreads and thins because of the buoyancy difference with the denser seawater. Figures 5-6, 5-7 and 5-8 show the calculated plume after 6 hours of average peak discharge during the 2, 5 and 10-year storms, respectively, assuming average currents to the northwest of 0.13 knots (6.7cm/s). After 6 hours of heavy rain during the 2-year storm, the model calculates that the plume has spread 6,000 feet offshore and 3,000 feet to the northwest. The calculated concentration at the plume edge is about 15% of the initial plume concentration. Because of the weak ambient currents and the rapid buoyant spreading, the model predicts that the plume is attached to the shoreline. Similarly, after 6 hours of heavy rain during the 5 and 10-year storms, the plume is attached to the shoreline and has spread 8,000 and 10,800 feet offshore, respectively, and correspondingly further to the northwest. Yet, because of the more rapid mixing in the nearshore, the concentration at the plume edge is 13% for the 5-year storm, and 12% for the 10-year storm. Plume thickness at the edges are 1.2, 2.0 and 2.7 feet for the 2, 5 and 10-year storms, and thus form only a thin layer on the sea surface. In water depths greater than about 10 feet, the fresh water plumes should have little impact on the marine environment. The duration required for the entire plume to meet water quality standards (within 10% of ambient salinity) are 17.3 hours, 19.7 hours and 20.7 hours after the end of discharge for the 2, 5 and 10-year storms, respectively (Table 5-2).

Additional model runs were completed to evaluate the effects of different currents on plume transport. Figure 5-9 shows the model results for a plume generated by a 2-year storm, assuming currents are flowing to the southeast at 0.18 knots (9cm/s). Figure 5-9 shows the calculated plume after 6 hours of average peak discharge. The plume is of similar shape and magnitude to the plume shown in Figure 5-6, though oriented to the southeast. Figures 5-6 and 5-9 show the expected excursion of the plume over the course of one semi-diurnal tide cycle. As currents normally reverse with the tide change, a realistic plume footprint will be a combination of the two figures.

### 5.4 Summary and Impacts

The results of the modeling analysis are summarized in Table 5-2. The plume generated by storm discharge will initially mix rapidly with the ambient water and flow directly offshore 500 to 1,000 feet. Beyond this, the plume forms a thin surface layer that is transported by ambient currents, mixes slowly, is attached to the shoreline, and spreads and thins due to buoyant forces. The zone of possible impacts, therefore, is directly offshore of the outlet, where the low salinity plume directly contacts the seafloor. The areas of seafloor that are possibly directly impacted by the storm plumes are 52,424, 116,332 and 121,708 square feet for the 2, 5 and 10-year storms, respectively. Spatially, this area corresponds to the hatched area inside the plume in Figures 5-2 to 5-4. Beyond this, the plume generally does not contact the seafloor, but forms a thin surface layer that should have little impact on the



marine environment. The surface plumes are predicted to meet the State water quality standard of being within 10% of ambient salinity (31.5 ppt) within about 17 to 21 hours.

These results are consistent with observations made during a 5-year storm event in the area on December 23–24, 1982 (Grigg, 1983). As part of the initial planning for the Lahaina Watershed Project, Grigg monitored impacts to the marine environment of a 5-year storm in the area. His results show that runoff from Kauaula Stream, located about 3,500 feet northwest of the Waianukole outlet, formed a low salinity plume that was confined to the upper 3 feet of water. Follow-up monitoring one week later showed conditions to be nearly back to normal (Grigg, 1983).

**Table 5-2. Summary of Modeling Results**

| | 2-year storm | 5-year storm | 10-year storm |
|---|---|---|---|
| Peak discharge rate (cfs) | 765 | 1683 | 2478 |
| 6-hour average discharge rate (cfs) | 341 | 751 | 1106 |
| Area of seafloor impacted by plume with salinity less than 28 ppt (square ft) | 52,424 | 116,332 | 121,708 |
| Time for plume to meet salinity water quality standards (hours) | 17.3 | 19.7 | 20.7 |

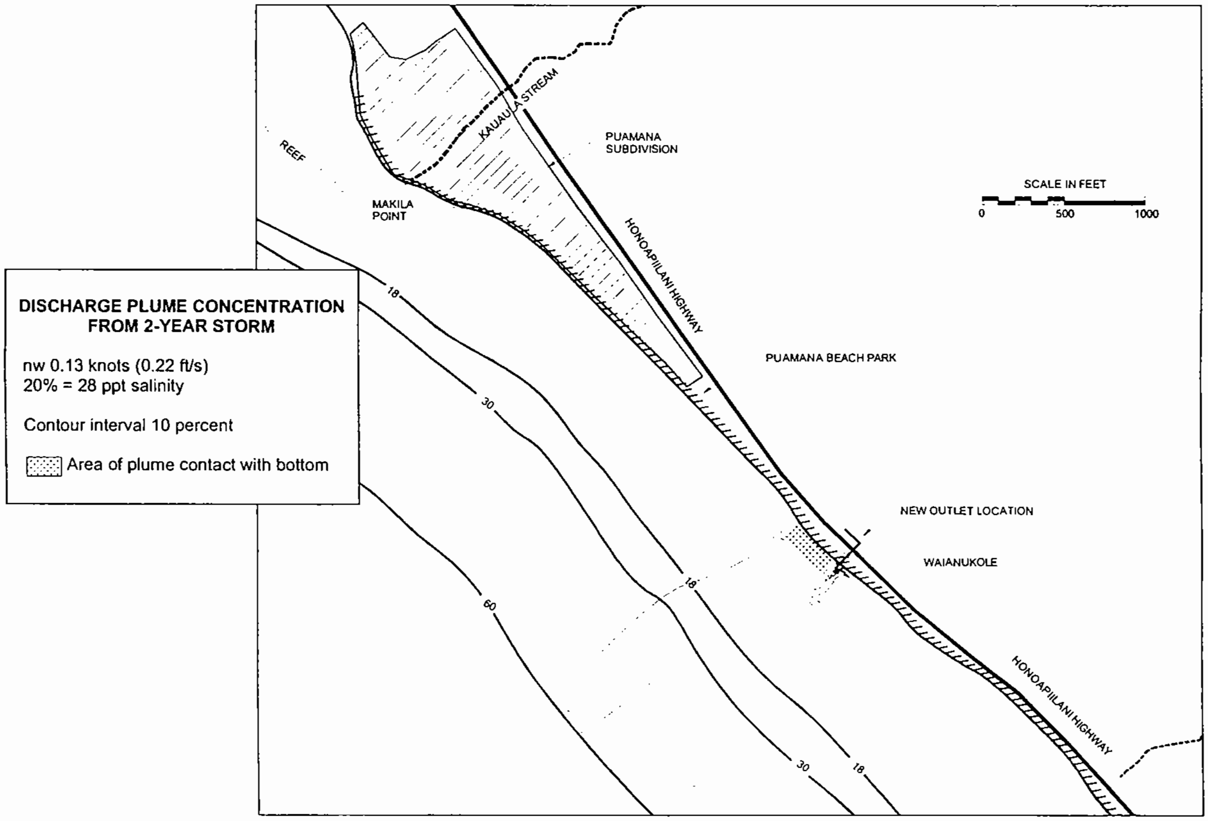



Figure 5-2 – Near Field Discharge Plume Concentration from 2-Year Storm



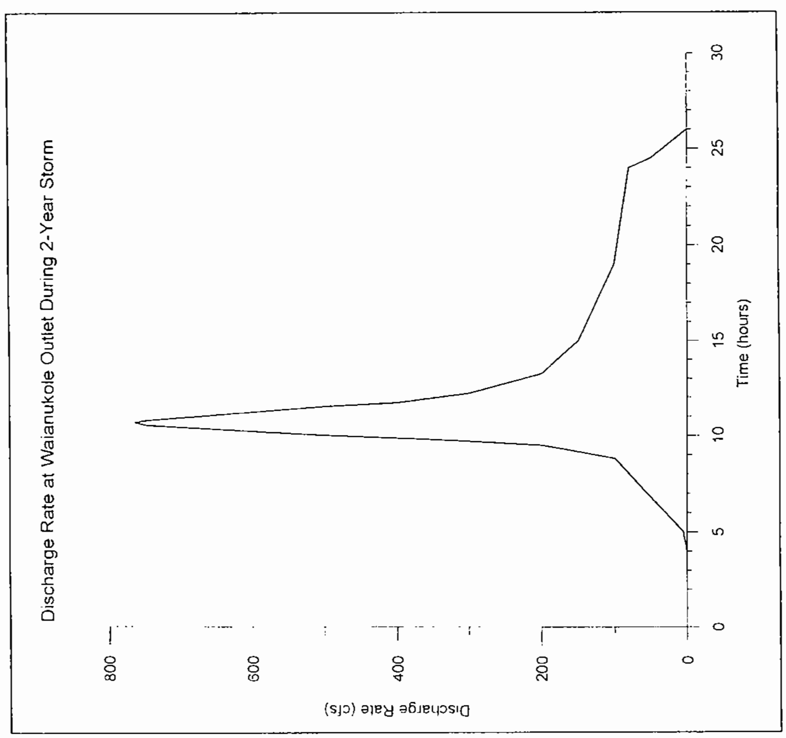



Figure 5-1 – Discharge Rate at Waianukole Outlet During 2-Year Storm

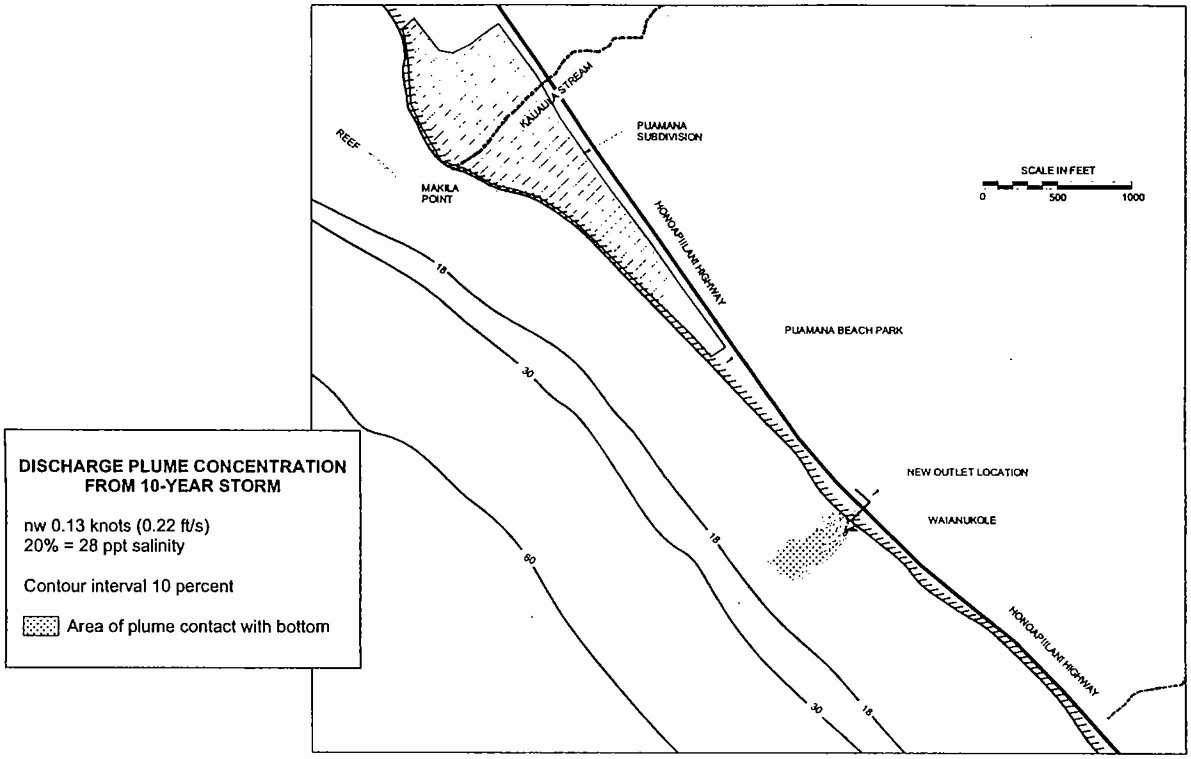



**Figure 5-4 – Near Field Discharge Plume Concentration from 10-Year Storm**



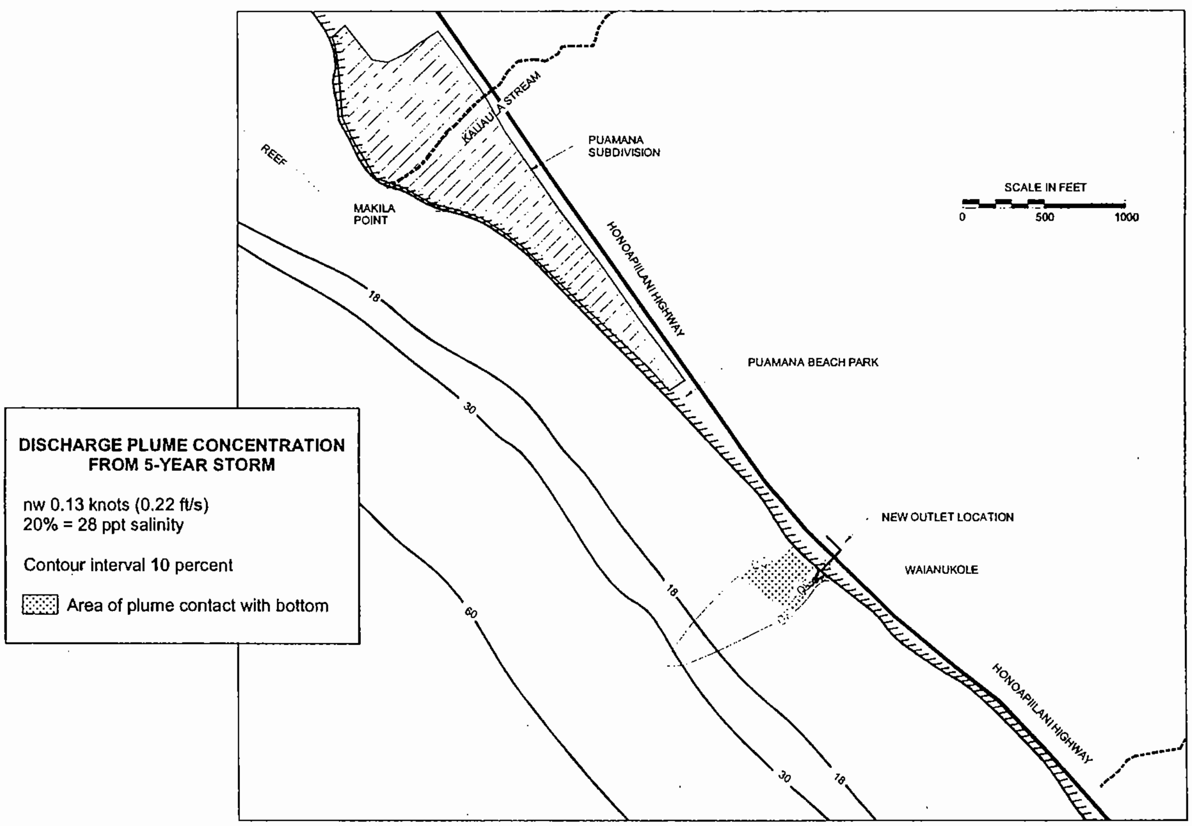



**Figure 5-3 – Near Field Discharge Plume Concentration from 5-Year Storm**

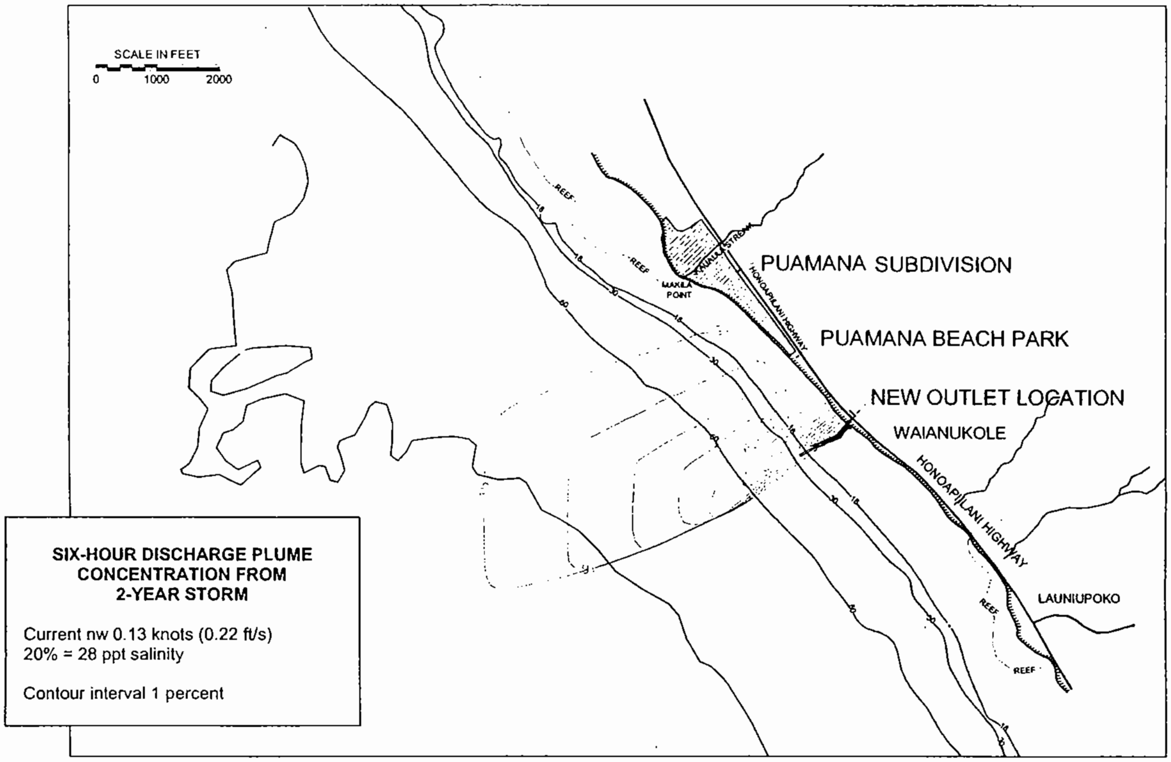
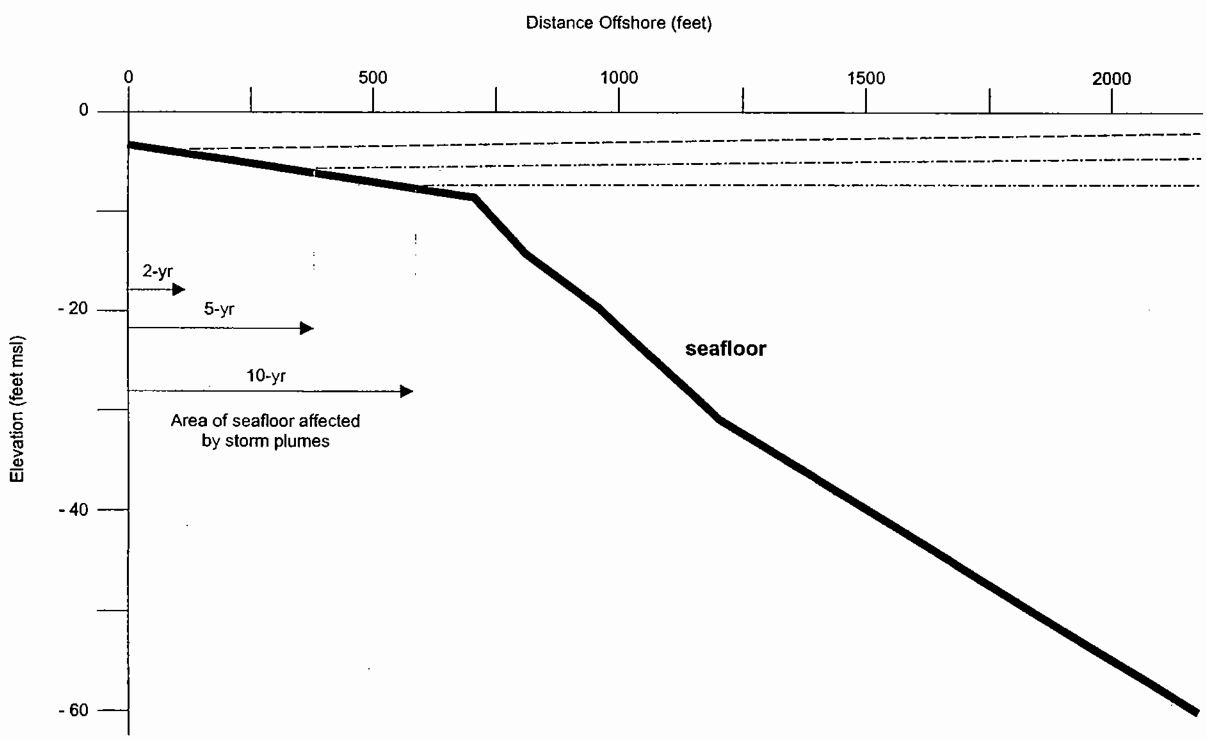



**Figure 5-6 – Six-Hour Discharge Plume Concentration from 2-Year Storm**



**Figure 5-5 – Discharge Plume Thickness vs. Water Depth**



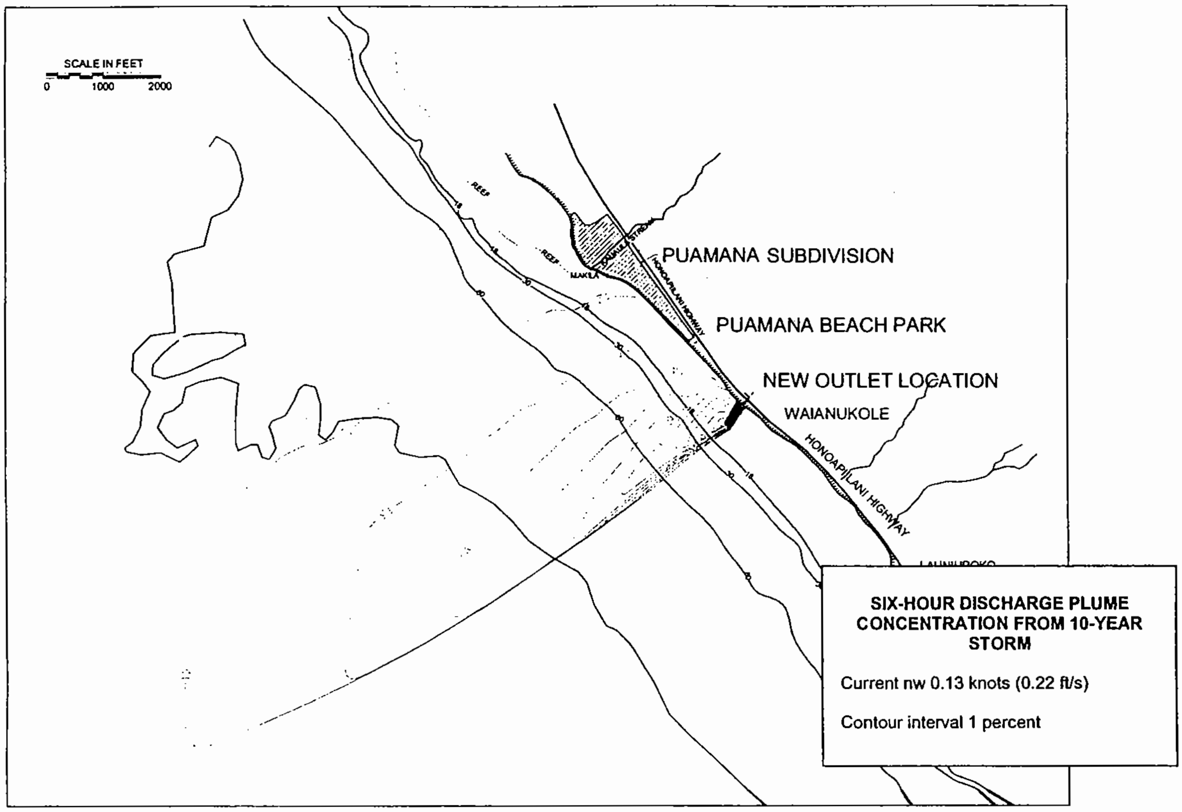



**Figure 5-8 – Six-Hour Discharge Plume Concentration from 10-Year Storm**



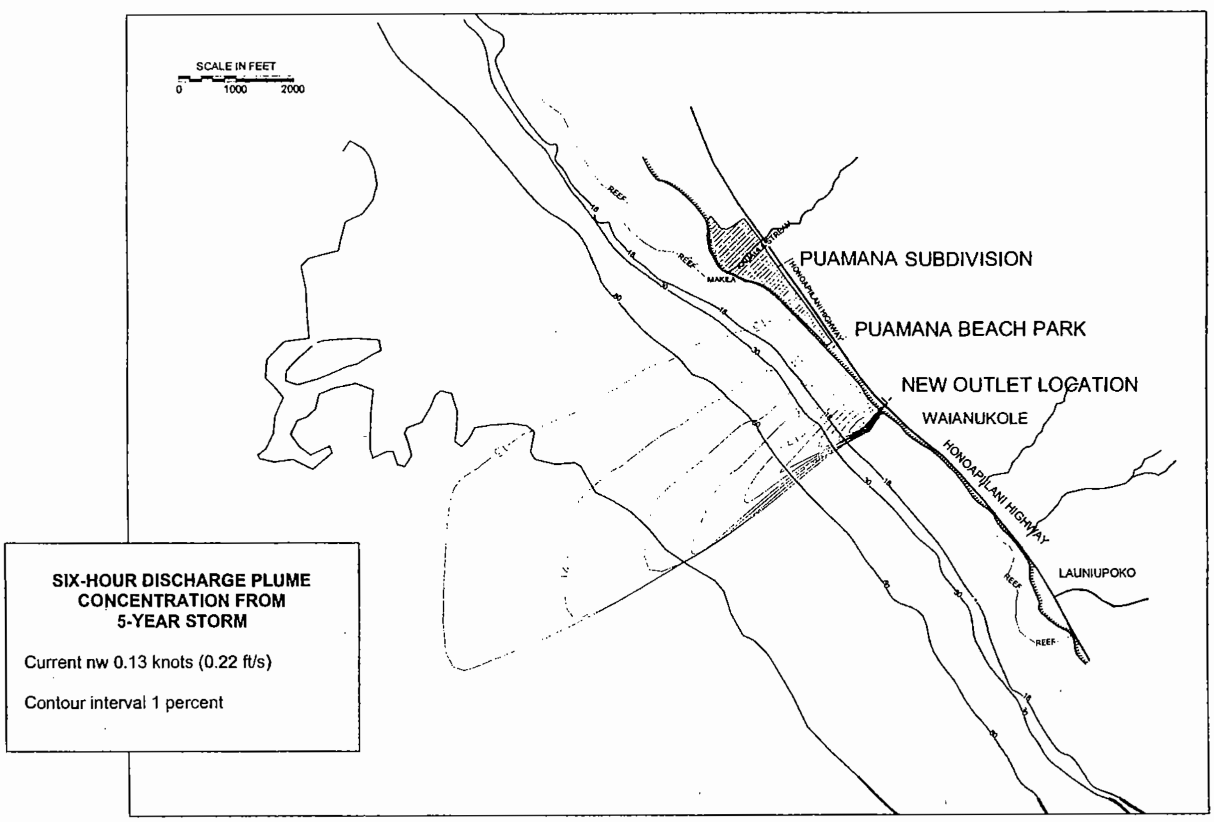



**Figure 5-7 – Six-Hour Discharge Plume Concentration from 5-Year Storm**

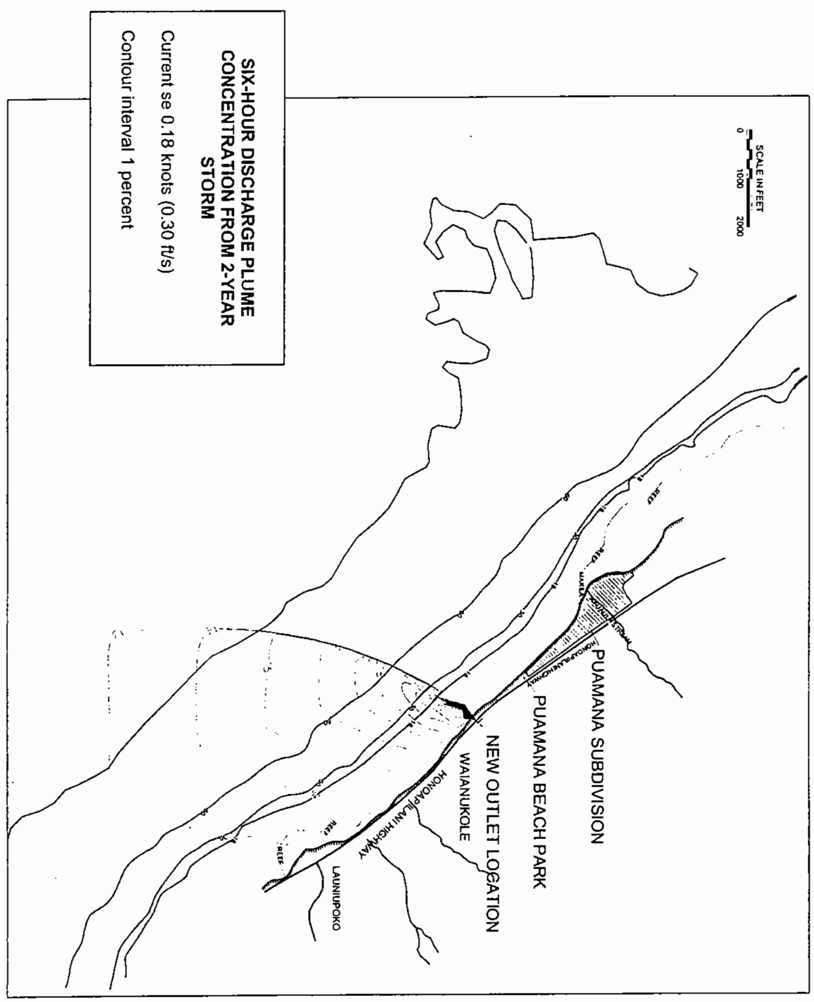



**Figure 5-9 – Six-Hour Discharge Plume Concentration from 2-Year Storm**



## 6.0 BIOLOGICAL SURVEYS

### 6.1 Previous Surveys

The area around Launiupoko was surveyed in 1976 for the U.S. Army Corps of Engineers (ECI, 1976). The survey included reconnaissance snorkeling as well as quantitative transect and quadrat surveys off the shore to depths of 7 m between Makila Point and Launiupoko Beach Park. Surveys were undertaken in nearly the same areas in 1987, with *AECOS*, Inc. biologists conducting brief reconnaissance surveys in the nearshore waters north of Olowalu Landing to Awalua Beach, and a section of coast north of Launiupoko State Wayside Park (*AECOS*, 1988). The results of these surveys showed that in general the development of the fish and coral communities is much greater offshore of Launiupoko and further south in the Olowalu area than in the area north of Launiupoko State Wayside Park. Later surveys by *AECOS* (1988), Grigg (1983), and Sea Engineering Inc. and *AECOS* Inc. (1994) showed that biological community richness increases north of Makila Point to the vicinity of Lahaina Small Boat Harbor.

A survey of the waters off the coast between Waianukole and Launiupoko State Park in 1987 (*AECOS*, 1988; also see Brock & Guinther, 1987) included qualitative estimates of coral cover and diversity, abundance of fishes, and distributions of major biological elements. This information was then incorporated into a biotope map showing the approximate distribution of the various types of environments and biological communities that were present. The map covers the area just south of the proposed storm drain outlet, but very likely also applies to the area directly off the proposed drain. The shoreline here is a dark (terrigenous) sand and boulder beach. It is likely that the proportion of sand on any particular part of this beach changes from time to time. Directly off the shoreline there occurs a zone of mostly similar bottom type. Where rounded cobbles predominate, this is the "cobble biotope." In 1987, this biotope extended out to a depth of less than 1 m (1-2 ft) in most places. Although larger stones are sometimes coated with algae, movement of the sands, and the stones whenever larger waves impinge on the shore, makes this unstable bottom unsuitable for all but a few marine organisms. Where sand predominates, this becomes the "roiling sand biotope," a bottom type that extends some 200 m (650 ft) off the shore at the proposed drain outlet site. Here, where outcrops rise above the sand, many species of limu were note: *Codium arabicum, Dictyosphaeria cavernosa, Halimeda discoidea, Neomeris annulata, Dictyota acutiloba, D. bartayresii, D. sandwicensis, Padina japonica, Turbinaria ornata, Acanthophora spicifera, Ahnfeltia concinna, Coelothrix irregularis, Gelidiopsis scoparia*, ogo or *Gracilaria bursapastoris*, huluhuluwaena or *Grateloupia filicina, Jania* sp., *Laurencia obtusa Desmia hornemanni, Porolithon gardineri*, and *P. onkodes*. Because there was little bottom relief to provide shelter, few fishes or maroinvertebrates were present. Species noted were juvenile hinalea lauwili or *Thalassoma duperry*, kala or *Naso unicornis*, kumu or *Parupeneus porphyreus*, `omaka or *Stethojulis balteata*, the sea cucumber, *Holothuria atra*, and green sea urchin, *Echinometra mathaei*. (Brock & Guinther, 1987).

Further offshore, limestone bottom predominates. Water depth may range from 1.2 to 2.4 m (4 to 8 ft) and this biotope is subject to the forces of the impinging surf. Coral cover was sparse in 1987, with only scattered heads of *Porites lobata*, *P. evermanni*, *Pocillopora meandrina*, and *Poc. damicornis* noted in 1987. Other invertebrates were wana or *Echinothrix diadema*, soft coral or Palythoa tuberculosa, and the sea cucumber *H. atra*. Typical fishes included manini or *Acanthurus sandwicensis*, hinalea lauwili, ma`i`i`i or *Acanthurus nigrofuscus*, damselfishes (*Plectroglyphidodon johnstonianus* and *Chromis vanderbilti*), moa or *Ostracion meleagris*, `omaka, juvenile palani or *Acanthurus dussumieri*, na`ena`e or *A. olivaceus*, umaumalei or *Naso literatus*, toby or *Canthigaster jactator*, o`iliuwi`uwi or *Pervagor spilasoma*, and o`ililepa or *Cantherhines sandwicensis*. The bottom was here also dominated by many species of seaweeds, including *Prolithon gardineri*, *Sargassum echinocarpum*, *Halimeda opuntia*, *Neomeris annulata*, *Dictyota sandvicensis*, *Ralfsia pangoensis*, *Turbinaria ornata*, *Amansia glomerata*, ogo, huluhuluwaena, *Plocamium sandvicense*, and *Hypnea* sp. (Brock & Guinther, 1987).

The outer face of the limestone biotope shows a pattern of shallow grooves and channels oriented perpendicular to the shore. Further seaward, at depths exceeding 4.5 m (15 ft), the bottom is predominantly a fine, dark sand. Fishes noted in the grooved limestone biotope were moa, o`ililepa, toby, damselfishes (e.g., *Chromis vanderbilti*, *Stegastes fasciolatus*, and *Plectroglyphidodon johnstonianus*), hinalea lauwili, kikakapu (*Chaetodon lunula* and *C. ornatissimus*), `omaka, hinalea luahine or *Thalassoma ballieui*, kihikihi or *Zanclus cornutus*, hilu piliko`a or *Paracirrhites forsteri*, humuhumunukunuku apua`a or *Rhinecanthus rectangulus*, *Macro-pharyngodon geoffroy* (a wrasse), kala, palani, moana or *Parupeneus multifasciatus*, umaumalei, ma`i`i`i, maiko or *A. nigroris*, and na`ena`e. Algae were much less conspicuous than inshore, with the most conspicuous species being *Neomeris annulata*, *Halimeda discoidea*, *Amansia glomerata*, *Coelothrix irregularis*, huluhuluwaena, huna or *Hypnea cervicornis*, and *Laurencia obtusa*. (Brock & Guinther, 1987).

Table 6-1 provides a summary of quantitative data (by biotope) collected in 1987 from the nearshore marine environment south of the proposed drainage outlet. The data are based on 20 x 4 m quantitative surveys conducted at nine different stations.

Grigg (1983, 1986, 1991) undertook studies of the marine environment between Lahaina and Launiupoko specifically to look at issues of land drainage impacts from the Kauaula Stream watershed and to assess impacts to the nearshore biota from a diverted drainage outlet south of Puamana. In essence, this series of reports comprised initial and updated environmental assessments of the same basic project for which the present document is being prepared. The primary purpose of the present considerations is to bring those efforts up to date considering that a decade has transpired since the final report prepared by Grigg (1991).

Before relating results obtained by our August 2002 resurvey of Grigg's benthic coral transects (see below), it is worthwhile to summarize Grigg's findings and conclusions regarding the nearshore environment in the project area. Initially Grigg assessed alternative



outlet locations for combined Lahaina and Kauaula subwatersheds at Kauaula Stream (Makila Point; Site 'B') and Lahaina town 150 yds east of the harbor (Site 'A"; Grigg, 1983; see Figure 6-1). Considering that a well-developed, fringing reef lies off this shoreline extending from Mala Wharf (north of Lahaina town) to Puamana it quickly became clear that an acceptable discharge location might be difficult to validate biologically (see also Sea Engineering Inc. and *AECOS* Inc., 1994). However, given that this reef ends close to the mouth of Kauaula Stream and fewer species of corals and algae, and lower values of coral cover occur off Site 'B' as compared with Site 'A,' the former (Kauaula Stream mouth) was assessed to produce less impact from an increase in drainage discharge.

**Table 6-1. Summary of the Number of Fishes, Corals, Algae, and Macro-Invertebrate Species as well as the average number of individuals and mean coverage in the four biotopes surveyed in the 1987 study (from *AECOS*, 1988)**

| Group | BIOTOPES | | | |
|---|---|---|---|---|
| | Cobble | Roiling Sand | Flat Limestone | Spur & Groove |
| **Corals:** Mean coverage (%) / total species | 1.3 / 1 | 0 / 0 | 0.2 / 2 | 3.6 / 8 |
| **Algae:** Mean coverage (%) / total species | 6.4 / 11 | 16.7 / 10 | 2.4 / 10 | 10.6 / 10 |
| **Fish:** Mean No. ind.s. / total species | 205 / 9 | 1 / 3 | 9 / 19 | 54 / 22 |
| **Macroinvertebrates:** Mean No. ind.s. / total species | 1813 / 9 | 6 / 4 | 4 / 4 | 5 / 5 |

Grigg undertook another survey in 1986 (Grigg, 1986) following a decision to develop a second outlet along the coastline further south towards Launiopoko. This survey looked at a series of four transects to the south of Kauaula Stream. This study recommended that the secondary diversion be placed as far south as the limits of the study area (approximately 3600 ft or 1100 m south of the Kauaula Stream mouth), because this area was furthest from areas of generally better coral growth, furthest from recreational sites (especially at Puamana), and demonstrated somewhat better circulation (movement of nearshore waters offshore).

In 1991, Grigg (1991) prepared a reassessment of the proposed drainage system changes on the marine resources between Lahaina and the proposed second outlet. A resurvey of three of the previously surveyed locations was accomplished (off Lahaina, off Makila Point, and off the proposed second outlet). Grigg found that coral growth at Sites A and B remained as described in 1983, and Site B was more degraded than Site A. Further, Site D' (proposed new outlet location) was the most degraded of the three sites surveyed in 1991.

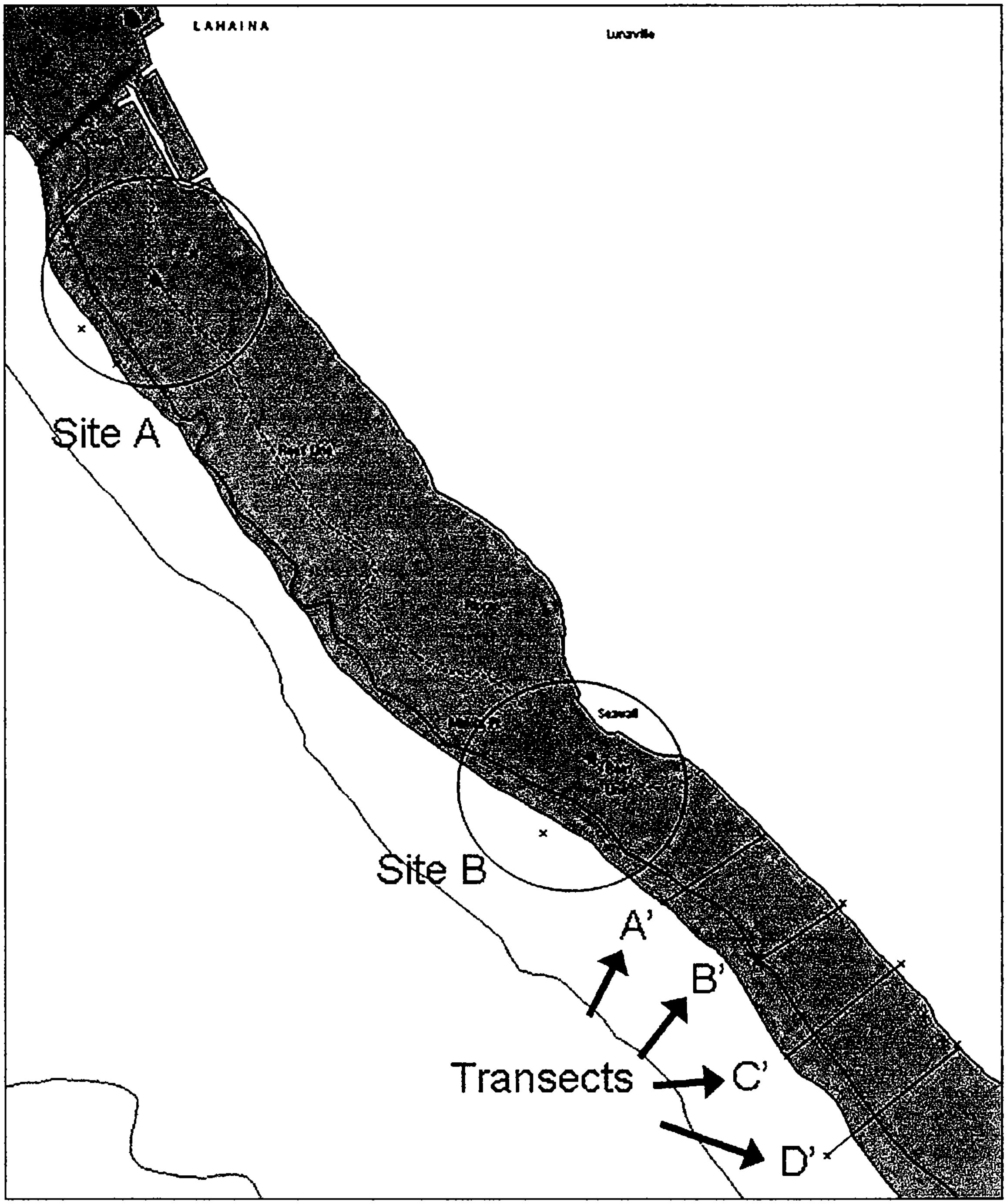



**Figure 6-1 West Maui study sites A & B and transects A'-D'. GPS endpoints are displayed by small x.**

## 6.2 Recent Surveys

An initial reconnaissance survey was conducted on March 29, 2002 using snorkeling gear. The survey area was located offshore from the northern culvert in Puamana Beach Park in water depths from 3 to 6 m (9-18 ft). We had intended to conduct snorkel tows over a larger area, but this was impractical because visibility under the water was so poor. It was noted that a flat limestone biotope similar to that described in 1987 (Brock & Guinther, 1987; *AECOS*, 1988) off Launiupoko, extends to the 5 m (15 ft) depth contour out from Puamana Beach Park. Some spur and groove development was seen. A brief snorkel off the drain outlet site on August 26, 2002 by SEI provided the observation that this area is still very dominated by sand and a diversity of limu.

The main effort at bringing previous surveys for the proposed new drainage system up to date was undertaken by Alyson Hodges (Pacific Rim Resources) and Eric Brown (Hawaii Institute of Marine Biology). Their report (Hodges & Brown, 2002) is largely reproduced in this section. However, the original report and compact disk (CD) should be consulted for raw data, statistical tables, and photographs. The scope of their study was to extend the efforts of the previous (Grigg) work by:

1. Re-surveying six sites using compatible methodology;
2. Evaluating any differences in coral reef communities among these sites;
3. Comparing the results over time to assess any changes in the coral reef communities;
4. Providing recommendations as to which of these six sites would be least affected by the discharge in terms the coral reef communities.

The study focused on coral cover rather than species richness, fishes or algae in concordance with Grigg's reports (1983, 1986, 1991) and utilized the methods employed therein. The six Grigg sites (A, B, A', B', C', and D'; Fig. 6-1) were relocated as accurately as practical from the descriptions provided by Grigg:

Site A — located approximately 150 yards (~ 150 m) south of the Lahaina Harbor break wall.
Site B — located at the mouth of Kauaula stream, which enters the ocean at Puamana through the gated residential community.
Site A' — located near the southern end of the Puamana subdivision.
Site B' — located on the northern boundary of Puamana Beach Park.
Site C' — located on the southern boundary of Puamana Beach Park.
Site D' — located along the rocky headland approximately 500 m south of the entrance to the Puamana Beach Park.

At Site A, four underwater transects were surveyed (Fig. 6-2). Transect I consisted of three 1 $m^2$ quadrats set 50 meters apart along the transect before terminating at the reef crest or surf break. Transects II-IV consisted of five quadrats spaced at 50 meter intervals. At Site B, three transects were surveyed, each with five quadrats spaced at 50 m intervals (Fig. 6-2). Digital photographs were taken at all quadrats. At each of the A', B', C', and D' sites, one transect with five to eight $1m^2$ quadrats placed at varying depths were surveyed (Fig 6-3). Digital photographs of the quadrats were taken at depths corresponding to the locations depicted in Grigg (1986). GPS waypoints for the start and end of each transect were recorded and are



provided here in Appendix A-1. At each quadrat, percent coral cover, number of coral species, number of algae genera, and number of fish species were recorded.

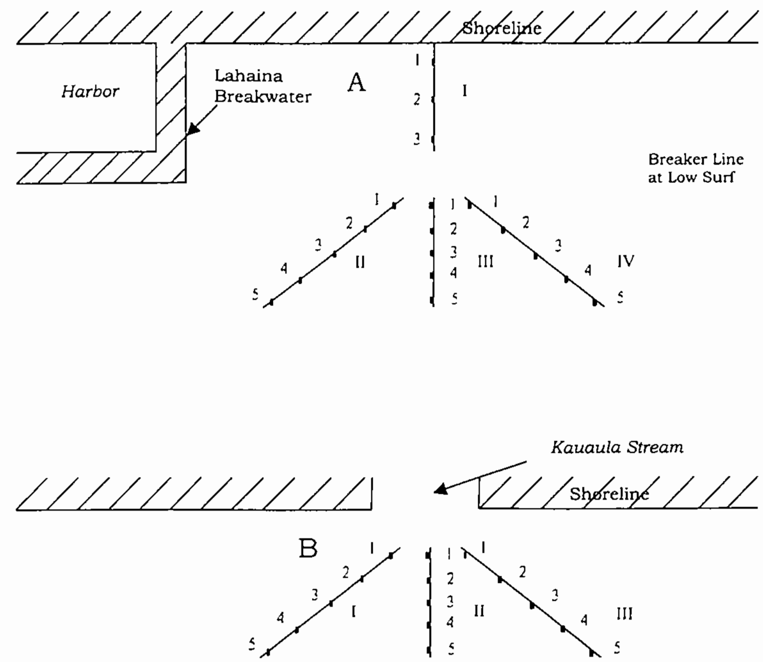



**Figure 6-2. Schematic diagram illustrating the transect (Roman numerals) and quadrat (black squares) layout for Sites A and B. The distance between each quadrat is 50 m. Angles are 45 degrees. Filled squares indicate quadrats at which a digital photograph was taken. Figure adapted from Grigg (1991).**

For statistical analysis, percent coral cover data were arcsine-square root transformed to meet the assumptions of normality and homogeneity of variances for the Analysis of Variance (ANOVA) test in the General Linear Model (GLM). Statistical procedures included the following:

1.) 2-way ANOVA for sites A and B with time and site as factors and coral cover as the dependent variable.

2.) 2-way ANOVA for sites A', B', C' and D' with time and site as factors and coral cover as the dependent variable.

3.) 1-way ANOVA for all sites surveyed in 2002 with site as the factor and coral cover as the dependent variable.

4.) A Tukey's pairwise comparison procedure was used to ascertain differences among sites in 2002.

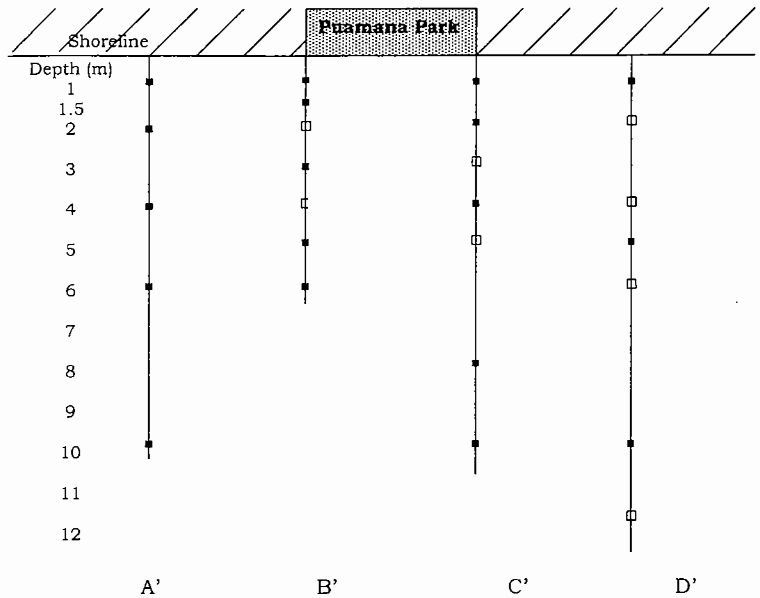



**Figure 6-3. Schematic diagram illustrating the transect and quadrat layout at Sites A'-D'. Filled squares indicate quadrats at which a digital photograph was taken.**

The adaptive rapid-survey methodology established by Grigg involved placing transects according to spatial and temporal planning targets. While cost-efficient, it produced data sets that required segmented analysis (Table 6-2). Consequently, the results are examined from several viewpoints rather than one comprehensive test. Sites are grouped for analysis so as to best utilize the available information. The groups used are: Sites A and B for years 1982, 1983, 1991, 2002; Sites A' through D' for years 1986 and 2002, and all sites for year 2002 only.

**Table 6-2. Site survey dates. P = previous surveys (Grigg 1983, 1986, and 1991). T = present study (2002).**

| Site | Year Surveyed | | | | |
|---|---|---|---|---|---|
| | 1982 | 1983 | 1986 | 1991 | 2002 |
| A | P | P | | P | T |
| B | P | P | | P | T |
| A' | | | P | | T |
| B' | | | P | | T |
| C' | | | P | | T |
| D' | | | P | P | T |



**<u>Sites A and B</u>** — The nearshore reef ecosystems at Sites A and B are comprised of similar faunal assemblages but different structural elements. Site A is characterized by a shallow reef flat with low coral cover from shore to the reef crest. Outside of the surf break, the reef is well developed out to a depth of approximately 10-12 meters. At Site B, waves break generally closer to shore due to the absence of a reef crest and flat. Low coral cover typifies the habitat close to shore. Outside of the breakers the reef is moderately well developed to a depth of approximately 12 meters.

The quadrat layout at Site A included a component (Transect I) on the reef flat which could not be included in the design of Site B. Therefore, to examine comparable depths and locations at both sites, the data from Transect I at Site A were omitted from the following statistical analyses but included in the raw percent coral cover values for Sites A and B (Appendix A-2).

Considering all surveys together over time, Site A had almost twice as much coral cover as Site B (mean Site A = 47.7 ± 6.5 SE), mean Site B = 27.8 ± 5.8 SE). A 2-way ANOVA indicated that this was significant ($F_{site}$ = 24.06, $df$ = 1,112, $p_{site}$ < 0.001) across the 2 sites (Fig. 6-4). Site A consistently had higher coral cover than Site B at the time of each survey ($F_{time*site}$ = 0.12, $df$ = 3,112, $p_{time*site}$ = 0.95; Fig. 6-5). No change in coral cover was detected at these sites over time when both sites were pooled together ($F_{time}$ = 2.11, $df$ = 3,112, $p_{time}$ = 0.103). The ANOVA table for Sites A and B is presented in Appendix A-3.

The number of coral species recorded at both sites remained fairly constant. Fish and algae appeared to increase in richness between Grigg's surveys and the present study (Table 6-3). Enumerated data for each species of algae, coral, and fish are presented in the Appendix A-4.

**<u>Sites A'-D'</u>** — The nearshore reef ecosystems at Sites A', B', C', and D' are very similar and consist of a gently sloping fringing reef tract grading into sand and eventually giving way to beds of *Halimeda incrassata*. Coral cover is very poor close to shore and becomes patchy until 3 meters depth. At approximately 3-6 meters depth there is a moderately well developed reef. From 6-10 meters, large sand patches form a belt between the fringing reef and the deeper *Halimeda incrassata* fields. Occasional patch reefs are found in the *Halimeda* beds whenever there is some form of substrate relief.

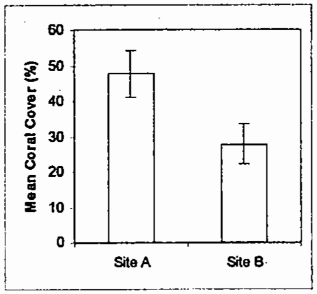



Figure 6-4. Mean percent coral cover and standard error at Sites A and B averaged for all years surveyed (1982, 1983, 1991 and 2002).

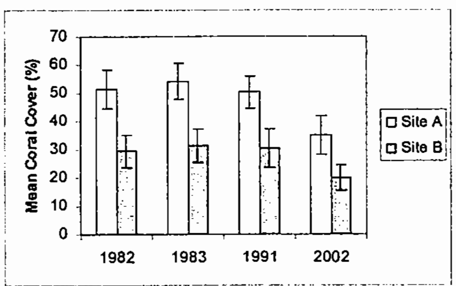



Figure 6-5. Mean percent coral cover and standard error for Sites A and B in 1982, 1983, 1991, and 2002.

Table 6-3. Numbers of species at Sites A and B in 1982, 1983, 1991, and 2002.

| GROUP | Site A | | | | Site B | | | |
|---|---|---|---|---|---|---|---|---|
| | 1982 | 1983 | 1991 | 2002 | 1982 | 1983 | 1991 | 2002 |
| Coral | 10 | 9 | 12 | 8 | 6 | 6 | 8 | 8 |
| Algae | 12 | 13 | 9 | 17 | 8 | 8 | 9 | 19 |
| Fish | 38 | 32 | --- | 50 | 38 | 30 | --- | 54 |

In order to compare coral cover across sites at comparable depths, quadrats 7 at Sites B', C' and D' and quadrat 8 at Site D' were omitted from the following analysis. Raw percent coral cover values for Sites A' through D' are presented in the Appendix A-5. Site A' had the highest overall cover (Mean 15.2% ± 7.0 SE) compared to site D' with the lowest overall coral cover (Mean 7.9% ± 2.9 SE).



A 2 way-ANOVA showed that there was no significant difference ($F_{Site}$ = 0.98, $df$ = 3,40, $p_{Site}$ = 0.414) in percent coral cover, however, among the four sites (Fig. 6-6). There was a significant difference in coral cover between the years 1986 and 2002 ($F_{Time}$ = 18.6, $df$ = 1,40, $p_{Time} < 0.001$). Overall coral cover was nearly 7 times lower in 2002 (mean 3.6 ± 1.5 SE) compared to 1986 (mean 24.8 ± 8.3 SE) (Fig. 6-7). There was no significant time*site interaction ($F_{Time*site}$ = 0.66, $df$ = 3,40, $p_{Time*site}$ = 0.58) for coral cover indicating that the relationship between sites was moderately consistent over time. The ANOVA table for Sites A'-D' is presented in the Appendix A-6.

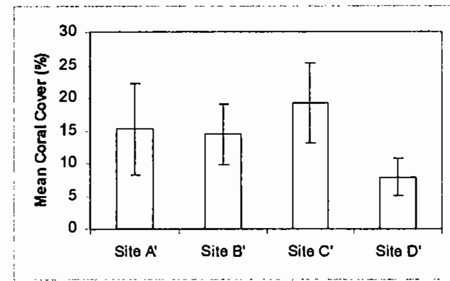



Figure 6-6. Mean percent coral cover and standard errors at Sites A', B', C', and D' in 1986 and 2002.

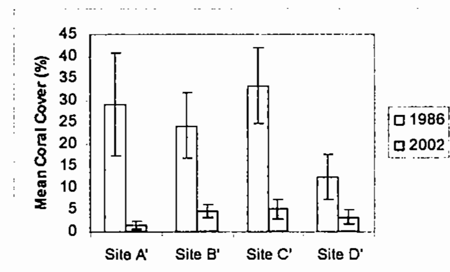



Figure 6-7. Mean percent coral cover and standard errors at Sites A', B', C', and D' in 1986 and 2002.

The number of coral and fish species recorded at all four sites remained relatively constant. However, the number of fish species appeared to be lower at Site D' in 1986. Algae species appeared to increase between Grigg's surveys and the present study except for Site D' (Table

6-4). Enumerated data for each species of algae, coral, and fish are presented in the Appendix A-7.

Table 6-4. Numbers of species at Sites A', B', C', and D' in 1986 and 2002. Note Site D' was also surveyed in 1991.

| GROUP | Site A' | | Site B' | | Site C' | | Site D' | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1986 | 2002 | 1986 | 2002 | 1986 | 2002 | 1986 | 1991 | 2002 |
| Coral | 6 | 3 | 5 | 3 | 7 | 4 | 3 | 3 | 3 |
| Algae | 9 | 20 | 9 | 22 | 9 | 17 | 12 | 11 | 12 |
| Fish | 25 | 23 | 22 | 23 | 16 | 29 | 10 | ... | 30 |

All Sites in 2002 — A spatial comparison was conducted among all sites in 2002 since this was the only year in which all sites were surveyed. In order to compare coral cover across sites at comparable depths, transects I, II, and IV at Site A and transects I and III at Site B were omitted from the following analysis. Site A had the highest mean coral cover at 43% ± 14.1 SE while site A' had the lowest mean coral cover at 1.3% ± 0.9 SE. Appendix A-8 shows the percent coral cover for each site.

A 1-way ANOVA resulted in a significant difference in percent coral cover among the six sites ($F$ = 8.909, $df$ = 5,32, $p < 0.001$). The ANOVA table for all sites is presented in the Appendix A-9. The Tukey pairwise comparisons indicated that A differed significantly from A' through D', and B differed significantly from A'. None of the other pairwise comparisons were significant at $p < 0.05$ (Table 6-5; Fig.6-8).

Table 6-5. $p$-values from Tukey's pairwise comparisons for 1-way ANOVA comparing mean coral cover (%) among all sites in 2002.

| Site | A | B | A' | B' | C' | D' |
|---|---|---|---|---|---|---|
| A | - | | | | | |
| B | 0.111 | - | | | | |
| A' | 0.000** | 0.045* | - | | | |
| B' | 0.000** | 0.293 | 0.881 | - | | |
| C' | 0.000** | 0.245 | 0.922 | 1.000 | - | |
| D' | 0.000** | 0.096 | 0.993 | 0.991 | 0.997 | - |

The number of coral and fish species at Sites A and B appear higher than at Sites A' through D' (see Table 6-6). The number of algae species appears to remain relatively constant at all sites except D', which suggests slightly lower numbers of algae.



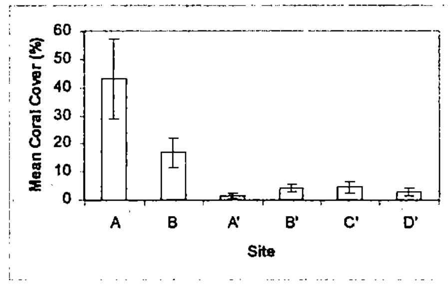



Figure 6-8. Mean percent coral cover and standard errors at Sites A, B, A', B', C', and D' in 2002.

Table 6-6. Numbers of species at Sites A, B, A', B', C', and D' in 2002.

| Group | Site A | Site B | Site A' | Site B' | Site C' | Site D' |
|---|---|---|---|---|---|---|
| Coral | 8 | 8 | 3 | 3 | 4 | 3 |
| Algae | 17 | 19 | 20 | 22 | 17 | 12 |
| Fish | 50 | 54 | 23 | 23 | 29 | 30 |

## 6.3 Discussion of Survey Results

Limitations and sources of error — It is important to recognize that the methodology established in the prior surveys was a rapid survey technique appropriate for coarse spatial comparisons. Detailed spatial/temporal comparisons are difficult to make with any degree of precision. This is primarily due to the difficulty in repositioning transects and quadrats across years and the small sample size using this rapid survey technique. These sources of error could also explain differences between Grigg's work and the results in the present study. In the case of coral cover, a few interesting observations can be made in regards to transect/quadrat repositioning and inter-observer differences.

For Sites A' through D', the observed differences between Grigg's work and the present study are not likely due to quadrat repositioning error alone. If they were, one would expect some of this study's percent coral cover values to be higher and some to be lower than Grigg's values due to chance alone. This is not the case. Instead, all of Grigg's values are consistently higher than the present study values. This suggests that the observed differences between surveys are either due to inter-observer error (overestimation by Grigg and/or underestimation by this study), or some real effect with the quadrats characterizing the habitat reasonably well, or some combination of both.

On the other hand, at Sites A and B, inter-observer error (overestimation by Grigg and/or underestimation by this study) may be ruled out as being the primary cause of observed differences. This is because if it were the cause, one would expect most or all of Grigg's observations to be higher than this study's. But they are not.

These observations, together with the assumption that each observer remained internally consistent throughout his/her respective observations, suggest that there is a real component of reef change.

**<u>Coral cover</u>** — Several interesting elements emerged from the data. First, from a spatial perspective, Site A has significantly better coral cover than the other sites. Site B has significantly less coral cover than Site A, but more than Site A'. The lower coral cover at Site B compared to A may be a result of the presence of Kauaula Stream discharge at this site. There is no statistical difference between Site B and Sites B', C', and D'. Generally, Sites A' through D' have low coral cover compared to Sites A and B, although they do not appear to differ from each other. These recent survey results are supported by the data from the Coral Reef Assessment and Monitoring Project (CRAMP) grid at Puamana that bisects Site A' and runs parallel to shore. The CRAMP methodology is designed to detect small spatial and temporal differences and reports similar (within 5%) coral cover values in the same area (Jokiel *et al.* 2001, 2002).

Second, from a temporal perspective, coral cover at Sites A and B, is roughly similar across the survey periods (1982 to 2002). However, coral cover has declined at Sites A' through D' from 1986 to 2002. This could be the result of differential impacts at a small spatial scale from Hurricane *Iniki*, which struck the region in September, 1992. Connell, *et. al.,* (1997) reported that areas on the Great Barrier Reef in close (100m) proximity had high spatial variability in coral cover in response to cyclonic disturbances. Even a year after *Iniki* came through the islands, there were sections of the reef that were wiped clean as a slate (Personal obs.). Hurricane *Iniki* would have 'reset' both reef areas to an earlier stage of development but slight differences in habitat quality (e.g. more relief at sites A and B) may account for the present day differences among sites. Figure 6-5 suggests steady coral cover at Sites A and B from 1982 to 1991 with a decline prior to 2002, while Figure 6-7 demonstrates an across-the-board decline from 1986 to 2002. With better habitat, sites A and B would have been less damaged by and/or rebounded quicker from *Iniki* than Sites A' through D'.

Regardless of the factors at work, it is apparent that Sites A and B offer better overall coral cover than Sites A' through D'. Coral cover at A is above the statewide average of 25% for all thirty CRAMP sites (Friedlander, *et al.*, in rev.). Site B is comparable to this average. Sites A' through C' were at or above this average in Grigg's surveys and now are well below it. Site D' has consistently been reported below this average.



The number of coral species appears relatively constant among the six sites and through time, with the suggestion that Sites A and B may have more than Sites A' through D'. The numbers are comparable to reefs statewide (Friedlander, et al., in rev.).

Overall, Sites A and B exhibit better percent coral cover than Sites A' through D'. Of these, D' generally offers the least. Grigg (1986) reports that the longshore current in the Puamana area trends northwards. As any discharge plume is likely to be fairly wide, a discharge point at A' would likely affect B and possibly A. From this perspective, and assuming quality coral does not occur to the immediate south of D', it would be better to situate the outlet closer to D' and thus away from Sites A and B.

## 7.0 POTENTIAL PROJECT IMPACTS

### 7.1 Coastal Water Quality Impacts

The Lahaina Watershed Flood Control Project is designed to eliminate non-point source runoff at Lahaina Town, reduce runoff and sediment discharge from Kauaula Stream at Makila Point, and introduce a new point-source discharge of runoff and sediment at a second outlet location at Waianukole. The reduced sediment and runoff discharge at Lahaina Town and Makila Point will enhance water quality conditions at these locations. High turbidity conditions such as "red water" episodes, should be reduced or eliminated, and the coral reef ecosystems should be invigorated. On the other hand, runoff and sediment loading will increase at the site of the second outlet. The environmental rationale for the second outlet is that the new site has less species diversity, is therefore less environmentally sensitive, and is less important economically than the shorefront at Lahaina Town (i.e. the Front Street beaches), or the Kauaula Stream outlet at Makila Point in the Puamana Subdivision.

Settling basins have been constructed in other West Maui watersheds: at Kaanapali, Kahana, and at Napili. Although turbid "red water" episodes still occur after rainstorm events, observers say that the intensity and duration of these episodes has diminished.

Water quality measurements showed nearshore waters to be distinctly different from offshore waters by having elevated values of turbidity and nutrients. Previous studies showed a rapid decline in concentrations of dissolved and particulate constituents both spatially and temporally from the mouth of an outlet stream. Constituents declined by one or two orders of magnitude within 1500 feet of the shoreline, and also laterally from the stream mouth. Within three days of a storm event, few concentration gradients were evident. This is in general agreement with the results of the plume modeling conducted in this study.

Section 5 of this report describes the behavior of the discharge plume that will be generated by the new outlet location. The plume will initially mix rapidly with the ambient water and flow directly offshore 500 to 1,000 feet. Beyond this, the plume forms a thin surface layer that is transported by ambient currents, mixes slowly, is attached to the shoreline, and spreads and thins due to buoyant forces. A plume concentration contour of 20% (meaning 80% dilution) was calculated to correspond to a salinity of 28 ppt, a conservative impact indicator. The area of biological impacts due to low salinity will be directly offshore of the outlet, where the low salinity plume directly contacts the seafloor. For example, during a 10-year event, the plume will be in contact with the seafloor for a distance of 550 feet offshore of the outlet.

The table below (same as Table 5-2) is a summary of modeling results. Beyond the area of direct seafloor contact, the plume forms a thin surface layer that should have little impact on the benthic (bottom dwelling) environment. The surface plumes are predicted to meet the State Department of Health water quality standards (HAR 11-54) for being within 10% of ambient salinity (31.5 ppt) within 17 to 21 hours after the discharge ends.



**Summary of Modeling Results**

| | 2-year storm | 5-year storm | 10-year storm |
|---|---|---|---|
| Peak discharge rate (cfs) | 765 | 1683 | 2478 |
| 6-hour average discharge rate (cfs) | 341 | 751 | 1106 |
| Area of seafloor impacted by plume with salinity less than 28 ppt (square ft) | 52,424 | 116,332 | 121,708 |
| Time for plume to meet salinity water quality standards (hours) | 17.3 | 19.7 | 20.7 |

### 7.2 Discharge Impact on Marine Flora and Fauna

The relationship between coral health and sedimentation on coral reefs is not well quantified, although some general principles are understood:

- Rapid sediment influx can bury and smother corals.
- Burial of hard bottom areas by mobile sediments can result in decreased recruitment, or establishment of juvenile colonies.
- Scouring of hard bottom areas by mobile sediments can result in mortality of juvenile colonies and decreased recruitment.
- Excess silt-sized sediment can blanket and destroy colonies.
- Excess turbidity from suspended sediments will reduce the amount of light available for photosynthesis.

Burial and scouring are effects produced predominately by sand and gravel sized sediments that quickly fall out of suspension and are moved on the bottom by wave motion. Water column turbidity and blanketing of corals is caused by finer grained sediments, such as silts and clays, that fall out of suspension slowly during periods of calm water. During active water motion conditions, such as occurs with the arrival of a southern swell, for example, the silts and clays can be re-suspended in the water column, leading to turbid conditions nearshore.

The watershed plan will eliminate freshwater runoff and sediment discharge at Lahaina and reduce them at Makila Point. Negative environmental effects due to both suspended silts and clays and sands and gravel will therefore be reduced at these locations. The presence of a new outlet at Waianukole will cause a negative impact over a generally small nearshore area where the freshwater plume may contact the bottom, and increased turbidity may degrade water quality in the vicinity of the outlet. However, modeling of the discharge plumes for 2-year, 5-year, and 10-year events shows that water quality should meet the State Department of Health water quality standard of being within 10% of ambient salinity about 17 to 21 hours after the discharge ceases.

Nutrients carried by runoff from the land have been cited as a potential cause of benthic algal blooms that sometimes plague the West Maui coastline. However, in a study seeking causes for algal blooms off West Maui, Dollar and Andrews (1997) concluded that agricultural leachate into the groundwater, and to a lesser extent cesspool inputs, were primarily responsible for nutrient enrichment of the nearshore zone, and this enrichment promoted algal growth. That is, "... groundwater, rather than surface water [discharge] is the most important vehicle for inputs of nutrients to the nearshore that can be utilized by algae." In their study, they found no substantial increases in nutrient concentrations in the nearshore zone following periods of rain.

Grigg (1991) concluded that the project would not "pose any significant negative impacts to endangered or threatened species in the area including the Hawaiian green sea turtle, Chelonia mydas." The shoreline in the area of the proposed new drainage outlet is mostly rocky, with only narrow deposits of sand and virtually no sand backshore where turtles might lay eggs. Inland from the shore deposits of mostly rounded stones and rocky outcrops, is an eroding embankment that rises steeply to the highway. Thus, turtles would utilize this area only for feeding on algae covered hard bottom off the shore. Changes in the abundance and types of algae due to the new outlet will likely occur only over a limited area that should not significantly impact the turtle population.

With respect to humpback whale (Megaptera novaeangliae), these animals would never inhabit the shallow nearshore waters directly off the proposed drainage outlet or the waters close in where turbidity, influenced by runoff, might be high. The purpose of the project is to reduce flooding and, through a series of detention structures, reduce the amount of sediment discharged from the watershed. Therefore, the impact on the waters offshore where whales seasonally occur should be one of no change or improved water quality.

### 7.3 Shoreline and Coastal Processes Impacts

The watershed plan incorporates sediment settling basins that are projected to reduce total annual sediment outflow by about 25%. Sediment outflow at Kauaula Stream will be reduced by about 52%, from 1850 tons per year, to 960 tons per year. The sediment basins will also be designed to capture all stones larger than 6 inches in diameter. Sediment discharge in the area between Lahaina Harbor and Kauaula Stream will change from about 3,400 tons to no sediment discharge with the diversion and sediment basins in place. Presently, about 310 tons of sediment are discharged near Puamana Park, this sediment will be diverted to the second outlet, where the discharge will increase to 3,280 tons.

The Front Street beaches were found to be composed of a high percentage (54%) of terrigenous sediment. Less terrigenous sand supply from Kauaula stream may eventually impact these beaches. However, the decrease in sediment discharge at Lahaina and Kauaula Stream may also invigorate the coral reef habitat in these areas, and lead to increased production of reef-derived marine sediments.

Shoreline problems are complex and difficult to predict. Mitigation measures may require a coastal management process that would include measurement of beach changes and institution of nourishment programs if necessary. If beach loss does becomes a problem over the long term, sand-sized sediment trapped in the project sediment basins can be placed on the beaches. This effort would be aided by designing the sediment basins to segregate the



sand-sized sediment from finer silts and clays. Slow changes may also occur at Makila Point as cobbles and boulders that form the point are transported by infrequent extreme events, while new material is retained in the sediment basins. As with the Front Street beaches, if changes at Makila Point become a problem over the long term, the system can be fed with cobbles and boulders trapped in the sediment basins.

At the second outlet site at Waianukole, most of the suspended sediment in the discharge will move offshore with the discharge plume, but a general increase in turbidity can be expected. However, high wave events should help to re-suspend and disperse turbidity-causing silts and clays. The shoreline at the site is rocky, with only scattered sand, so that beach loss at the site due to the project will not be a problem. However, over time, new beaches may form in the vicinity due to the influx of sandy sediment from the discharge.

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# Appendix A

**A-1. GPS waypoints for the start and end (E) of each transect.**

| Site | Latitude | | Longitude | |
|---|---|---|---|---|
| A1 | 20 52.13171 | N | 156 40.60843 | W |
| A1E | 20 52.10379 | N | 156 40.66362 | W |
| A2 | 20 52.07281 | N | 156 40.71083 | W |
| A2E | 20 52.01495 | N | 156 40.80337 | W |
| A3 | 20 52.07053 | N | 156 40.70818 | W |
| A3E | 20 51.97224 | N | 156 40.76020 | W |
| A4 | 20 52.07646 | N | 156 40.71410 | W |
| A4E | 20 52.11158 | N | 156 40.82309 | W |
| A' | 20 51.40865 | N | 156 39.94889 | W |
| A'E | 20 51.33192 | N | 156 40.07130 | W |
| B' | 20 51.33031 | N | 156 39.84594 | W |
| B'E | 20 51.26073 | N | 156 39.95425 | W |
| B1 | 20 51.50698 | N | 156 40.16479 | W |
| B1E | 20 51.48804 | N | 156 40.27863 | W |
| B2 | 20 51.50422 | N | 156 40.16227 | W |
| B2E | 20 51.41401 | N | 156 40.22417 | W |
| B3 | 20 51.50097 | N | 156 40.16178 | W |
| B3E | 20 51.39690 | N | 156 40.14223 | W |
| C' | 20 51.25811 | N | 156 39.77286 | W |
| C'E | 20 51.14766 | N | 156 39.91689 | W |
| D' | 20 51.16165 | N | 156 39.70213 | W |
| D'E | 21 51.02900 | N | 157 39.86700 | W |

**A-2. Percent coral cover at Sites A and B for years 1982, 1983, 1991, and 2002.**

| QUADRAT | SITE A | | | | QUADRAT | SITE B | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1982 | 1983 | 1991 | 2002 | | 1982 | 1983 | 1991 | 2002 |
| AI-1 | 0 | 0 | 0 | 0 | | | | | |
| AI-2 | 0 | 0 | 0 | 0 | | | | | |
| AI-3 | 5 | 9 | | 0 | | | | | |
| AI-4 | 10 | 10 | | | | | | | |
| AI-5 | 30 | 40 | | | | | | | |
| AII-1 | 20 | 25 | 20 | 10 | BI-1 | 0 | 15 | 0 | 4 |
| AII-2 | 25 | 30 | X | 67 | BI-2 | 30 | 40 | 20 | 5 |
| AII-3 | 50 | 60 | 30 | 61 | BI-3 | 40 | 35 | 40 | 26 |
| AII-4 | 60 | 70 | 70 | 61 | BI-4 | 60 | 50 | 50 | 37 |
| AII-5 | 90 | 90 | 80 | 7 | BI-5 | 70 | 70 | 75 | 60 |
| AIII-1 | 30 | 25 | 20 | 27 | BII-1 | 0 | 0 | 0 | 10 |
| AIII-2 | 25 | 30 | 40 | 43 | BII-2 | 15 | 20 | 15 | 30 |
| AIII-3 | 55 | 60 | 60 | 31 | BII-3 | 40 | 30 | 20 | 25 |
| AIII-4 | 60 | 70 | 70 | 97 | BII-4 | 50 | 75 | 65 | 19 |
| AIII-5 | 90 | 85 | 80 | 17 | BII-5 | 40 | 50 | 80 | 0 |
| AIV-1 | 25 | 30 | 20 | 5 | BIII-1 | 0 | 0 | 10 | 0 |
| AIV-2 | 20 | 25 | 30 | 23 | BIII-2 | 5 | 5 | 0 | 42 |
| AIV-3 | 60 | 60 | 50 | 25 | BIII-3 | 30 | 25 | X | 24 |
| AIV-4 | 70 | 60 | 70 | 30 | BIII-4 | 30 | 30 | 35 | 3 |
| AIV-5 | 90 | 90 | 65 | 21 | BIII-5 | 30 | 25 | 30 | 13 |

**A-3. 2-way ANOVA table of percent coral cover (arcsine-square root transformed) for Sites A and B for years 1982, 1983, 1991, and 2002.**

| Source of Variation | SS | df | MS | F | P-value | F crit |
|---|---|---|---|---|---|---|
| Time | 0.551 | 3 | 0.184 | 2.112 | 0.057 | 2.69 |
| Site | 2.094 | 1 | 2.094 | 24.057 | 0.000 | 3.93 |
| Time*Site | 0.031 | 3 | 0.010 | 0.120 | 0.926 | 2.69 |
| Within Error | 9.747 | 112 | 0.087 | | | |

**A-4. Algae, coral, and fish enumerated for Sites A and B in 2002.**

| | Site A | Site B |
|---|---|---|
| **A. ALGAE** | | |
| *Acanthophora* | X | |
| *Actinotrichia* | | |
| *Asparagopsis* | X | |
| *Blue-Green Unknown* | X | |
| *Brown Unknown* | X | |
| *Caulerpa* | | X |
| *Cladymenia* | | |
| *Codium* | | |
| *Corallina* | X | X |
| *Dasyopsis* | | X |
| *Dictiyota* | X | X |
| *Dictyopteris* | X | |
| *Dictyosphaeria* | | X |
| *Enteromorpha* | | |
| *Galaxaura* | | X |
| *Halimeda* | X | X |
| *Hypnea* | | |
| *Jania* | | X |
| *Liagora* | | X |
| *Lyngbia* | X | X |
| *Malaniamansia* | X | X |
| *Martensia* | X | |
| *Microdictyon* | | X |
| *Neomeris* | X | X |
| *Padina* | X | X |
| *Porolithon* | | X |
| *Portiera* | | X |
| *Red Unknown* | X | |
| *Sargassum* | | |
| *Tolypiocladia* | X | X |
| *Trichogloea* | | |
| *Turbinaria* | X | X |
| *Turf* | X | X |
| *Ulva* | | |
| Totals | 17 | 19 |
| **B. CORAL** | | |
| *Leptastria purpurea* | X | X |
| *Montipora capitata* | X | X |
| *Montipora patula* | X | X |
| *Pavona varians* | X | X |



| | Site A | Site B |
|---|---|---|
| *Pocillopora damicornis* | X | |
| *Pocillopora meandrina* | X | X |
| *Porites compressa* | X | X |
| *Porites evermani* | | X |
| *Porites lobata* | X | X |
| Totals | 8 | 8 |
| **C. FISH** | | |
| *Abudefduf abdominalis* | | X |
| *Acanthurus blochii* | X | X |
| *Acanthurus leucopareius* | | X |
| *Acanthurus nigrofuscus* | X | X |
| *Acanthurus nigroris* | X | X |
| *Acanthurus olivaceus* | X | X |
| *Acanthurus triostegus* | X | X |
| *Apogon kallopterus* | | |
| *Apogon maculiferus* | | |
| *Aulostomus chinensis* | X | |
| *Bodianus bilunulatus* | X | |
| *Canthigaster amboinensis* | | X |
| *Calotomus carolinus* | X | X |
| *Cantherhines dumerilii* | | X |
| *Canthigaster jactator* | X | X |
| *Caranx melampygus* | X | |
| *Cantherhines sandwichiensis* | | X |
| *Cephalopholis argus* | X | X |
| *Centropyge potteri* | X | |
| *Chromis agilis* | | X |
| *Chaetodon auriga* | | X |
| *Chromis hanui* | | X |
| *Cheilio inermis* | X | |
| *Chaetodon lunula* | X | |
| *Chaetodon miliaris* | | |
| *Chaetodon multicinctus* | X | |
| *Chaetodon ornatissimus* | X | X |
| *Chaetodon quadrimaculatus* | X | |
| *Chlorurus sordidus* | X | X |
| *Chromis vanderbilti* | X | X |
| *Cirrhitops fasciatus* | | X |
| *Cirripectes vanderbilti* | X | X |
| *Coris venusta* | | X |
| *Ctenochaetus strigosus* | X | X |
| *Dascyllus albisella* | X | |
| *Decapterus macarellus* | | X |
| *Diodon holocanthus* | | X |
| *Diodon hystrix* | | X |
| *Fistularia commersonii* | | X |
| *Gomphosus varius* | X | X |
| *Gymnothorax eurostus* | X | |
| *Gymnothorax meleagris* | X | |
| *Halichoeres ornatissimus* | X | X |
| *Kyphosus cinerascens* | | |
| *Labroides phthirophagus* | | X |

| | Site A | Site B |
|---|---|---|
| *Lutjanus kasmira* | | |
| *Macropharyngodon geoffroyi* | X | X |
| *Melichthys niger* | X | X |
| *Melichthys vidua* | X | X |
| *Naso brevirostris* | | X |
| *Naso hexacanthus* | | X |
| *Naso lituratus* | X | X |
| *Naso unicornis* | X | |
| *Ostracion meleagris* | X | |
| *Oxycheilinus bimaculatus* | | |
| *Paracirrhites arcatus* | X | X |
| *Parupeneus cyclostomus* | | X |
| *Paracirrhites forsteri* | | X |
| *Parupeneus multifasciatus* | X | X |
| *Plagiotremus ewaensis* | | X |
| *Plagiotremus goslinei* | X | X |
| *Plectroglyphidodon imparipennis* | X | X |
| *Plectroglyphidodon johnstonianus* | X | X |
| *Pseudojuloides cerasinus* | X | |
| *Pseudocheilinus octotaenia* | X | X |
| *Pseudocheilinus tetrataenia* | | X |
| *Rhinecanthus rectangulus* | X | X |
| *Scomberoides lysan* | | |
| *Scarus psittacus* | X | X |
| *Scarus rubroviolaceus* | X | |
| *Sebastapistes coniorta* | X | |
| *Stethojulis balteata* | X | X |
| *Stegastes fasciolatus* | X | X |
| *Sufflamen bursa* | X | X |
| *Synodus ulae* | | |
| *Thalassoma duperrey* | X | X |
| *Thalassoma purpureum* | X | |
| *Xyrichtys umbrilatus* | | X |
| *Zanclus cornutus* | X | |
| *Zebrasoma flavescens* | X | X |
| Totals | 50 | 54 |

**A-5. Percent coral cover at Sites A', B', C', and D' for the years 1986 and 2002. * represent quadrats where digital photographs were taken.**

| Site A' | | | | Site B' | | | |
|---|---|---|---|---|---|---|---|
| Station | Depth | 1986 | 2002 | Station | Depth | 1986 | 2002 |
| A'-1 | 1* | 0 | 0 | B'-1 | 1* | 0 | 0 |
| A'-2 | 2* | 50 | 0 | B'-2 | 1.5* | 5 | 1 |
| A'-3 | 4* | 70 | 5 | B'-3 | 2 | 25 | 9 |
| A'-4 | 6* | 40 | 3 | B'-4 | 3* | 45 | 6 |
| A'-5 | 8 | 15 | 0 | B'-5 | 4 | 40 | 6 |
| A'-6 | 10* | 0 | 0 | B'-6 | 5* | 30 | 6 |
| | | | | B'-7 | 6* | 0 | 0 |



| Site C' | | | | Site D' | | | | |
|---|---|---|---|---|---|---|---|---|
| Station | Depth | 1986 | 2002 | Station | Depth | 1986 | 1991 | 2002 |
| C'-1 | 1* | 0 | 0 | D'-1 | 1* | 0 | 0 | 0 |
| C'-2 | 2* | 25 | 2 | D'-2 | 2 | 0 | 0 | 5 |
| C'-3 | 3 | 40 | 6 | D'-3 | 3* | 10 | 5 | 9 |
| C'-4 | 4* | 60 | 11 | D'-4 | 4 | 10 | 20 | 0 |
| C'-5 | 5 | 50 | 12 | D'-5 | 5* | 30 | 0 | 6 |
| C'-6 | 8* | 25 | 0 | D'-6 | 6 | 25 | 20 | 0 |
| C'-7 | 10* | 10 | 0 | D'-7 | 10* | 10 | 5 | 0 |
| | | | | D'-8 | 12* | 0 | 0 | 2 |

**A-6. 2-way ANOVA table of raw percent coral cover for Sites A' to D' for years 1986 and 2002.**

| *Source of Variation* | *SS* | *Df* | *MS* | *F* | *P-value* | *F crit* |
|---|---|---|---|---|---|---|
| Time | 1.126 | 1 | 1.126 | 18.580 | 0.000 | 4.08 |
| Site | 0.177 | 3 | 0.059 | 0.976 | 0.414 | 2.84 |
| Time*Site | 0.119 | 3 | 0.040 | 0.656 | 0.584 | 2.84 |
| Within Error | 2.424 | 40 | 0.061 | | | |

**A-7. Algae, coral, and fish enumerated for Sites A', B', C', and D' in 1986 and 2002.**

| | 1986 | | | | 2002 | | | |
|---|---|---|---|---|---|---|---|---|
| Sites | A' | B' | C' | D' | A' | B' | C' | D' |
| **A. Algae** | | | | | | | | |
| *Acanthophora* | | | | | X | X | X | X |
| *Actinotrichia* | | | | | | X | X | |
| *Asparagopsis* | X | X | | | | | | X |
| *Blue-Green Unknown* | | | | | | | | |
| *Brown Unknown* | | | | | | X | X | X |
| *Caulerpa* | | | | | X | | | |
| *Cladophora* | X | X | X | X | | | | |
| *Cladymenia* | | | | | | | | |
| *Codium* | | | | | | X | X | |
| *Corallina* | | | | | | | | |
| *Dasyopsis* | | | | | X | | | |
| *Dictiyota* | | X | | X | | X | X | X |
| *Dictyopteris* | | | | | | X | | X |
| *Dictyosphaeria* | | | | | X | X | X | X |
| *Enteromorpha* | | | | | X | | | |
| *Galaxaura* | | | | X | X | X | X | X |
| *Halimeda* | X | X | X | X | X | X | X | |
| *Hypnea* | | | | X | X | X | X | X |
| *Jania* | | | | X | X | X | X | |
| *Liagora* | X | X | X | | X | X | | |
| *Lyngbia* | | | | | X | | | |
| *Melanamansia* | | | | | X | X | X | |
| *Martensia* | | | | | | X | | |
| *Microdictyon* | X | | X | X | | X | | X |
| *Neomeris* | X | X | X | X | X | X | X | X |
| *Padina* | X | X | X | X | X | X | X | |

| Sites | 1986 A' | 1986 B' | 1986 C' | 1986 D' | 2002 A' | 2002 B' | 2002 C' | 2002 D' |
|---|---|---|---|---|---|---|---|---|
| *Porolithon* | X | X | X | X | | | | |
| *Portiera* | | | | | X | X | X | |
| *Red Unknown* | | | | | X | X | | X |
| *Sargassum* | X | X | X | X | | X | X | |
| *Tolypiocladia* | | | | | | | | |
| *Trichogloea* | | | | | X | | | |
| *Turbinaria* | | | | | X | X | X | |
| *Turf* | | | | | X | X | X | X |
| *Ulva* | | | | | X | | | |
| Totals | 9 | 9 | 8 | 11 | 19 | 22 | 17 | 12 |
| **B. Coral** | | | | | | | | |
| *Leptastria purpurea* | X | X | X | | | | | |
| *Montipora capitata* | X | X | X | X | X | X | X | X |
| *Montipora patula* | X | | X | X | | | | |
| *Pavona varians* | | X | X | | | | X | |
| *Pocillopora damicornis* | | | | | | | | |
| *Pocillopora meandrina* | X | X | X | X | X | X | X | X |
| *Porites compressa* | X | | X | | | | | |
| *Porites evermani* | | | | | | | | |
| *Porites lobata* | X | X | X | X | X | X | X | X |
| Totals | 6 | 5 | 7 | 4 | 3 | 3 | 4 | 3 |
| **C. Fish** | | | | | | | | |
| *Abudefduf abdominalis* | | | | | | X | X | |
| *Acanthurus blochii* | | | | | X | X | | X |
| *Acanthurus dussumieri* | X | | X | | | | | |
| *Acanthurus leucopareius* | X | X | X | | | | X | |
| *Acanthurus nigrofuscus* | | | | | X | X | X | X |
| *Acanthurus nigroris* | X | X | X | | X | | X | |
| *Acanthurus olivaceus* | X | X | X | | X | | | X |
| *Acanthurus triostegus* | | | | | X | X | X | X |
| *Apogon kallopterus* | | | | | | | | X |
| *Apogon maculiferus* | | | | | | | | X |
| *Bodianus bilunulatus* | X | | X | | | | | X |
| *Calotomus carolinus* | | | | | | X | | |
| *Cantherhines sandwichiensis* | | | | | | | | X |
| *Canthigaster amboinensis* | | | | | | | X | X |
| *Canthigaster jactator* | X | X | X | | X | | X | |
| *Caranx ignobilis* | | X | | | | | | |
| *Cephalopholis argus* | | | | | | X | X | |
| *Chaetodon lunula* | X | X | | | | | | |
| *Chaetodon miliaris* | | | | | | | | X |
| *Chaetodon multicinctus* | | | | | | | | X |
| *Chaetodon ornatissimus* | X | X | | | | | | |
| *Chaetodon quadrimaculatus* | X | X | X | | | | | |
| *Chelinus bimaculatus* | | | | X | | | | |
| *Chlorurus sordidus* | | | | | X | | | |
| *Chromis ovalis* | X | | X | X | | | | |
| *Chromis vanderbilti* | | | | | X | X | X | X |
| *Cirrhitops fasciatus* | X | | | | | X | | X |
| *Cirripectes vanderbilti* | | | | | | X | | |
| *Coris gaimardi* | | | X | | | | | |



| Sites | 1986 A' | 1986 B' | 1986 C' | 1986 D' | 2002 A' | 2002 B' | 2002 C' | 2002 D' |
|---|---|---|---|---|---|---|---|---|
| *Coris venusta* | | | | | X | X | X | X |
| *Ctenochaetus strigosus* | X | X | X | | | | | X |
| *Dascyllus albisella* | X | X | | | X | | X | X |
| *Decapterus macarellus* | | | | | X | | X | |
| *Diodon holocanthus* | | | | | X | | | |
| *Gomphosus varius* | | | X | | | | | |
| *Gymnothorax meleagris* | | | | | X | | | |
| *Halichoeres ornatissimus* | | | | | | X | X | |
| *Labroides phthirophagus* | | | | | | | X | |
| *Lutjanus kasmira* | | | | | | | X | X |
| *Macropharyngodon geoffroyi* | | | | | | X | | |
| *Melichthys niger* | X | X | X | X | X | | X | X |
| *Naso brevirostris* | | | | | | | | X |
| *Naso unicornis* | X | X | X | X | | | | |
| *Ostracion meleagris* | | | | | | | | X |
| *Oxycheilinus bimaculatus* | | | | | X | | | X |
| *Paracirrhites arcatus* | X | | X | | X | X | X | X |
| *Paracirrhites forsteri* | | | | | | | X | |
| *Parupeneus multifasciatus* | X | X | X | X | | | X | X |
| *Pervagor spilosoma* | X | X | X | | | | | |
| *Plagiotremus goslinei* | | | | | X | X | X | |
| *Plectroglyphidodon imparipennis* | | | | | X | X | X | X |
| *Plectroglyphidodon johnstonianus* | | | | | X | X | X | |
| *Pseudocheilinus octotaenia* | | | | | | | X | |
| *Pseudojuloides cerasinus* | | | | | | | | X |
| *Rhinecanthus rectangulus* | X | X | X | X | X | X | X | X |
| *Scarus psittacus* | | | | | | X | X | |
| *Scomberoides sancti-petri* | | X | X | | | | | |
| *Sebastapistes coniorta* | | | | | | X | | X |
| *Stegastes fasciolatus* | X | X | X | X | X | X | X | |
| *Stethojulis balteata* | X | X | X | X | X | X | X | X |
| *Sufflamen bursa* | | | | X | | | | X |
| *Synodus ulae* | | | | | | | X | |
| *Thalassoma ballieui* | X | | | | | | | |
| *Thalassoma duperrey* | X | X | X | X | X | X | X | X |
| *Xyrichtys umbrilatus* | | | | | | X | | |
| *Zanclus canescens* | X | X | | | | | | |
| *Zanclus cornutus* | X | X | | | | | | |
| Totals | 25 | 21 | 21 | 10 | 23 | 23 | 29 | 30 |

**A-8. Mean percent coral cover at all sites surveyed in 2002.**

| Site | N | Mean | SE |
|---|---|---|---|
| A | 5 | 43.0 | 14.1 |
| B | 5 | 16.8 | 5.4 |
| A' | 6 | 1.3 | 0.9 |
| B' | 7 | 4.0 | 1.4 |
| C' | 7 | 4.4 | 2.0 |
| D' | 8 | 2.7 | 1.2 |

**A-9. 1-way ANOVA table of square-root transformed percent coral cover for all sites in 2002.**

| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
|---|---|---|---|---|---|---|
| Site | 1.713 | 5 | 0.342 | 8.909 | 0.000 | 2.51 |
| Within Gps | 1.230 | 32 | 0.038 | | | |

# Appendix B

## Archaeological Inventory Survey for the Lahaina Watershed Flood Control Project

# An Archaeological Inventory Survey Of the Lahaina Watershed Flood Control Project Area

## Lands of Polanui, Pahoa, Puehuehunui, Halaka`a, Waine`e, and Puako Lahaina District, Maui Island

**TMK: 4-6-13-16, 18, 26**
**TMK: 4-7-01, 02**

**Prepared for:**

**Munekiyo & Hiraga, Inc.**
**Kahului, Maui**

**Prepared by:**

**Erik M. Fredericksen**
**Demaris L. Fredericksen**

***Xamanek Researches***
***Pukalani, Maui***

**March 7, 2003**

## ABSTRACT

Xamanek Researches carried out an archaeological inventory survey of a portion of land in Lahaina, Maui in the summer of 2002. The inventory survey was conducted as part of the Environmental Impact Statement for the Lahaina Watershed Flood Control project. This flood control project has federal support from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), and local sponsor support provided by the West Maui Soil and Water Conservation District and the County of Maui. The overall scope of the inventory survey included a general survey corridor that was nearly 2 miles long and ranged from 150-250 feet in width.

The c. 10,500 foot (3,200 meter) long project corridor lies in portions of the lands of Polanui, Pahoa, Puehuehunui, Halaka`a, Waine`e in Lahaina District, on the leeward side of West Maui. One previously unidentified site—a probable precontact Native Hawaiian burial—was located during testing in the project area. This find was subsequently designated SIHP No. 50-50-03-5239. The Site 5239 burial retains its significance under both Criterion "d" and Criterion "e" of Federal and State historic preservation guidelines. Passive "as is" preservation is recommended for this burial site.

The elongated project corridor crosses some 41 Land Commission Awards, and an additional 20 LCAs lie in close proximity to the study area. Given the presence of the Site 5239 burial on LCA 5832, it remains possible that additional burials may be contained in this LCA as well as other LCAs that are crossed by the Lahaina Watershed Flood Control Project. Based on discussions with Dr. Melissa Kirkendall, SHPD Maui/Lana`i islands staff archaeologist, and members of the Maui/Lana`i Islands Burial Council, archaeological monitoring is recommended during construction of the Lahaina Watershed Flood Control Project. This step will help to mitigate adverse effects from construction activities to any significant material culture remains and/or human burials that may be contained in untested portions of the project corridor.

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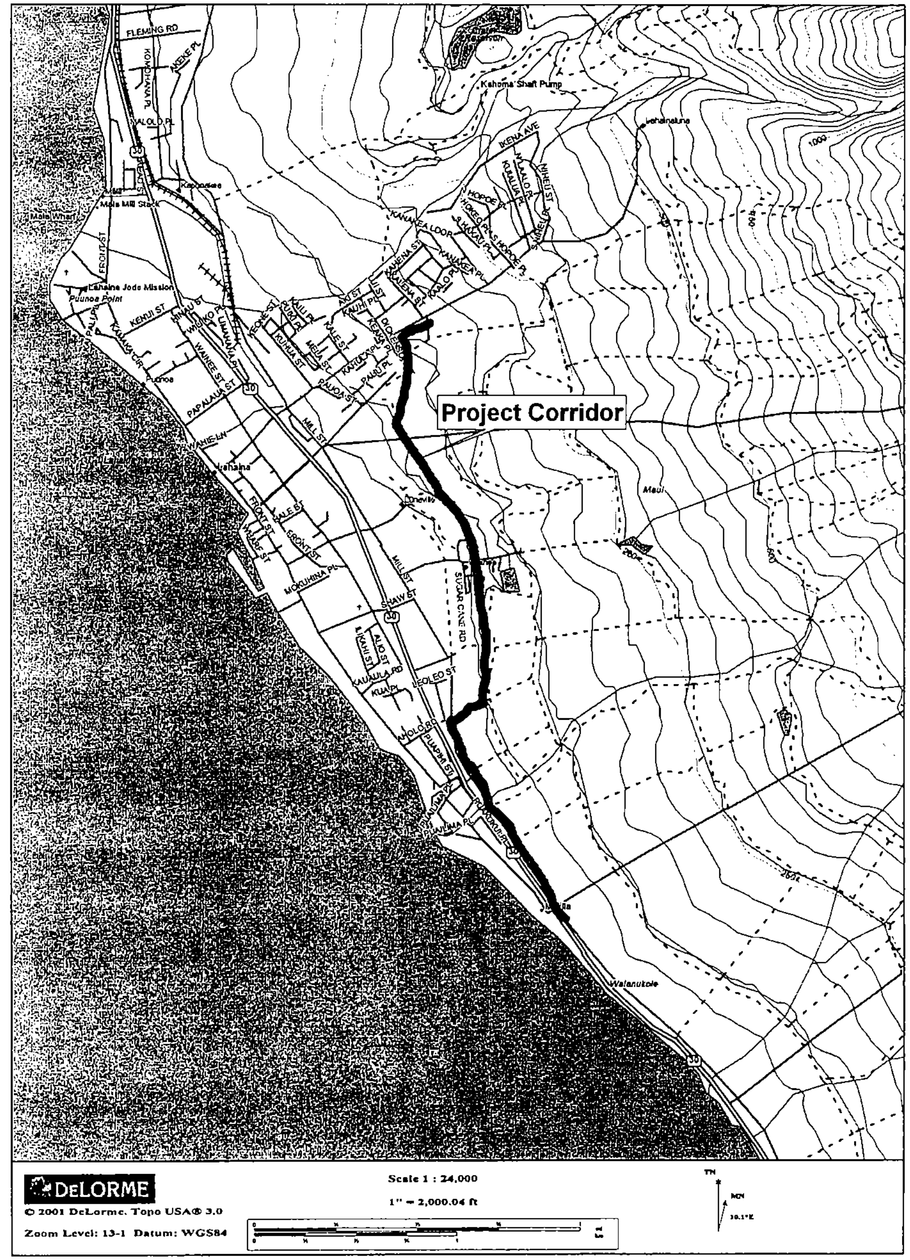
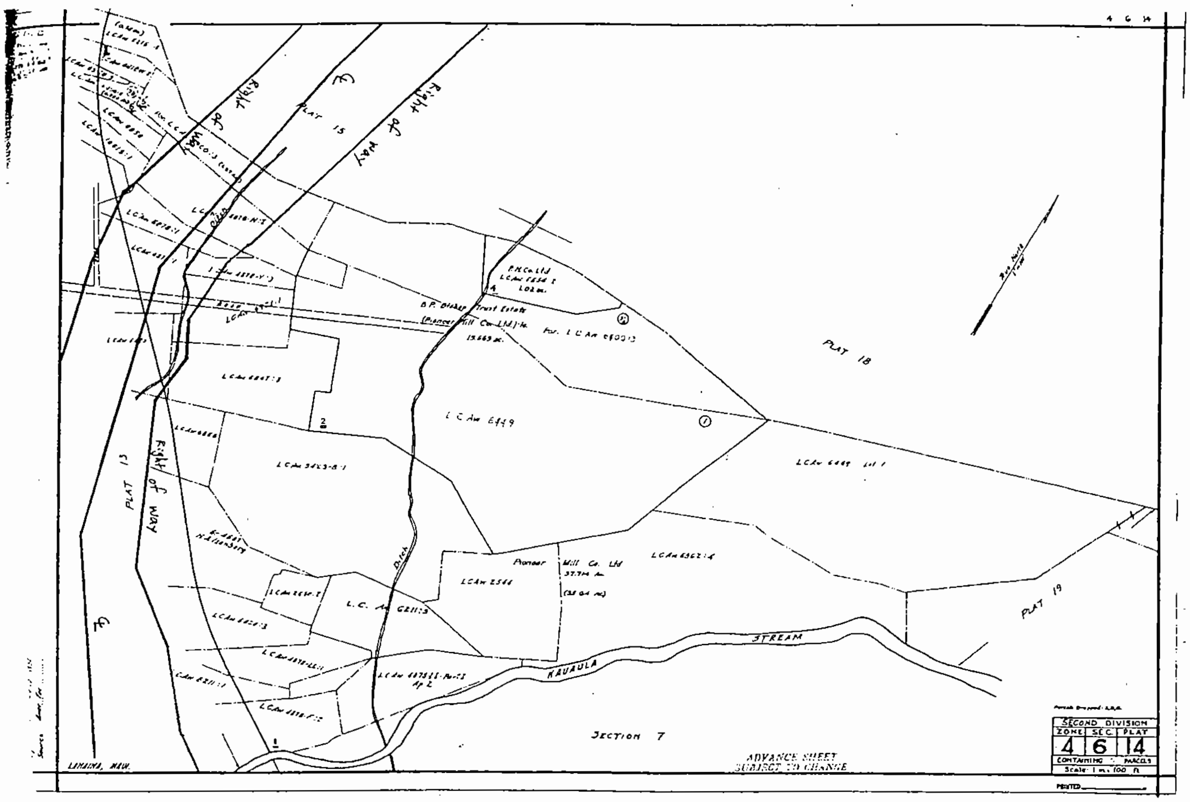
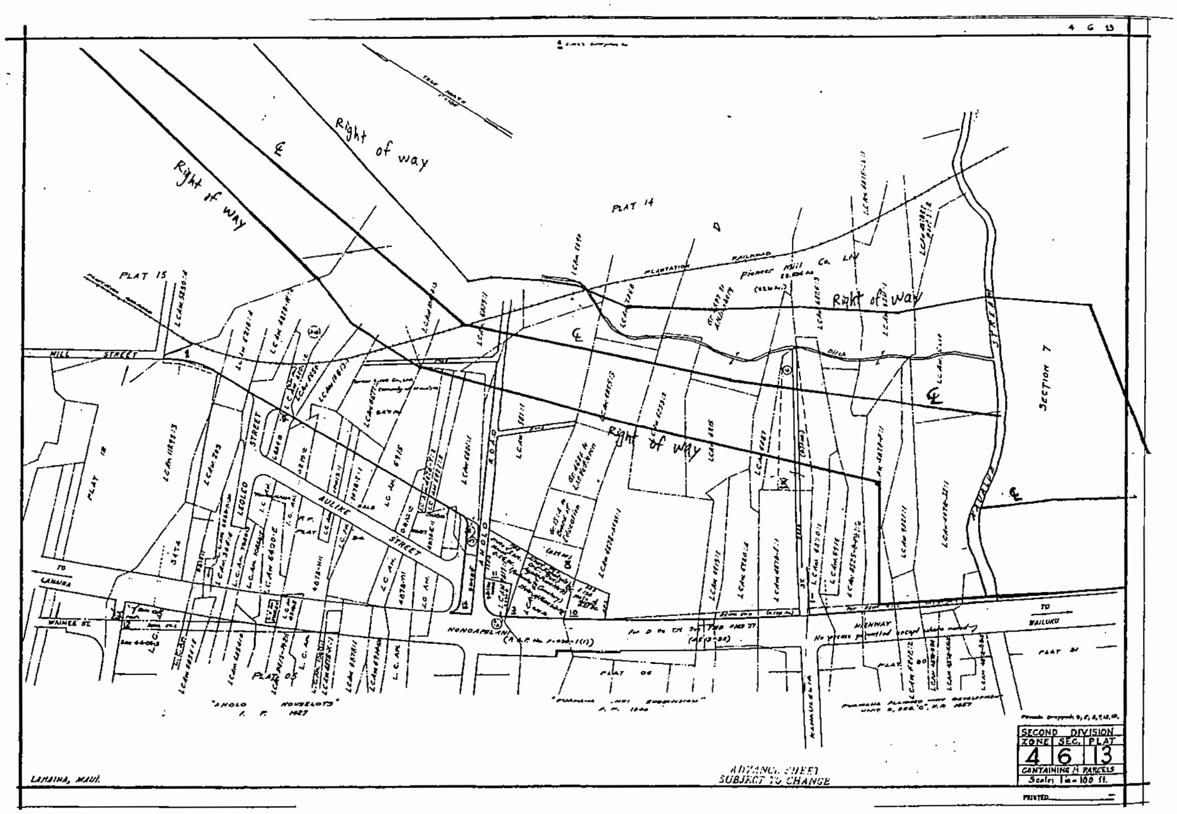
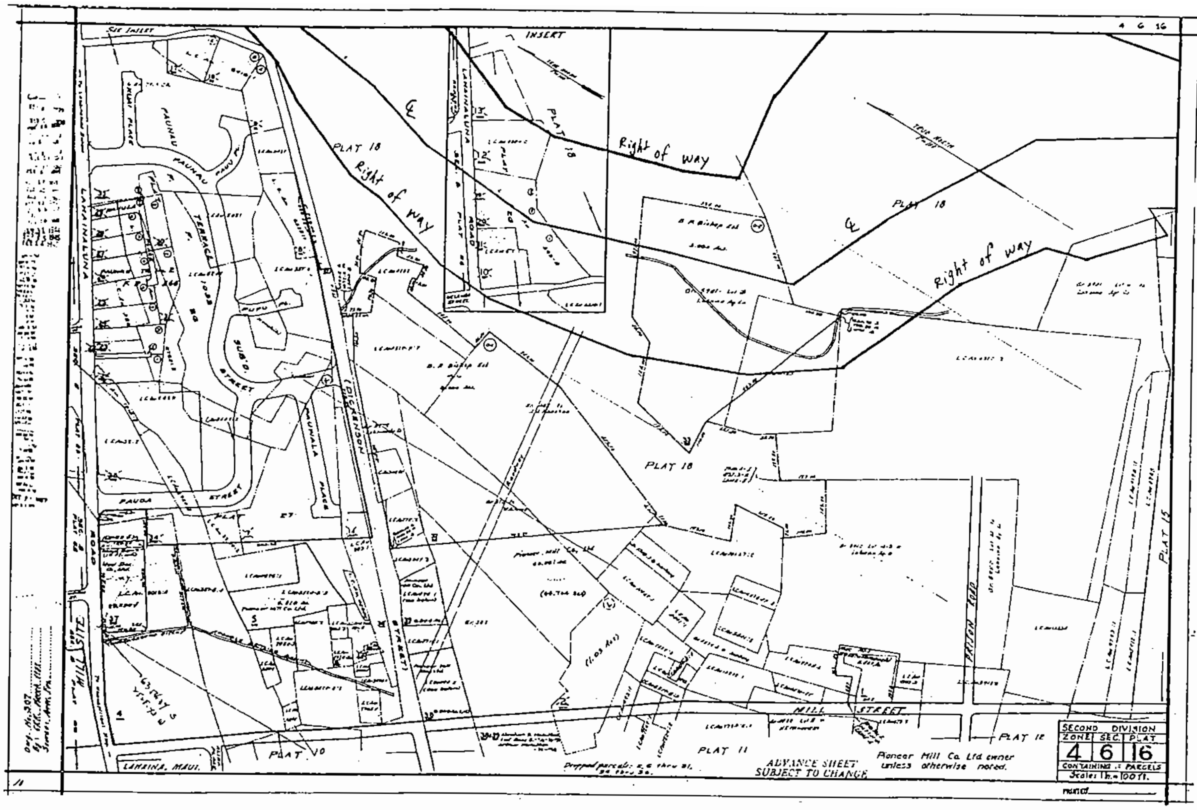





Map 5 – State of Hawaii Tax Map—Zone 4, Section 6, Plat 14.




Map 4 – State of Hawaii Tax Map—Zone 4, Section 6, Plat 13.




Map 7 – State of Hawaii Tax Map—Zone 4, Section 6, Plat 16.

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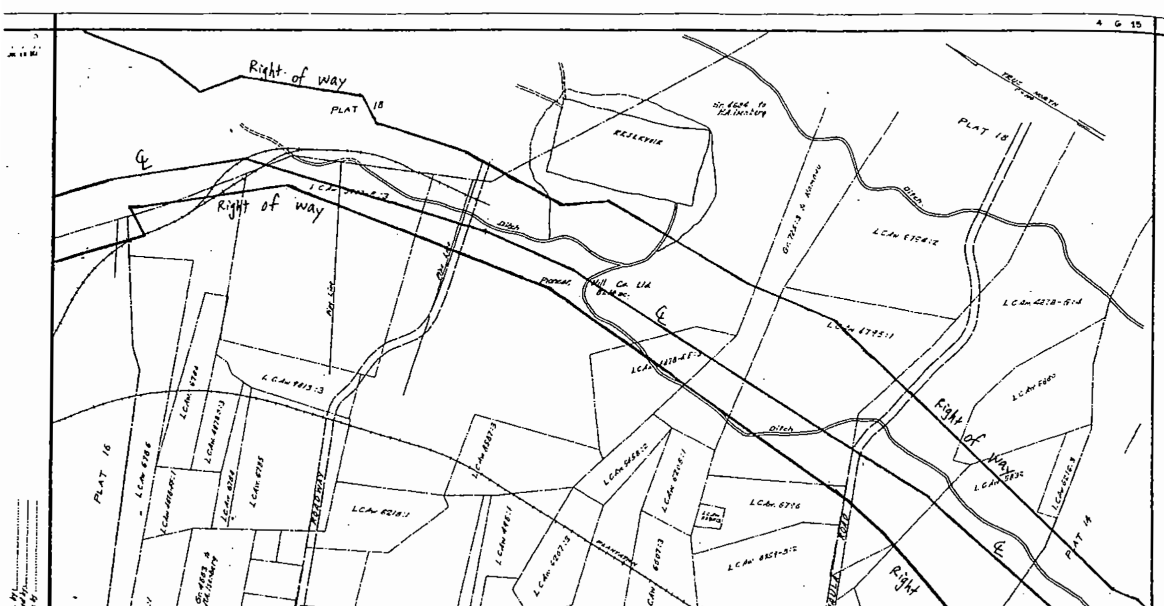


Map 6 – State of Hawaii Tax Map—Zone 4, Section 6, Plat 15.

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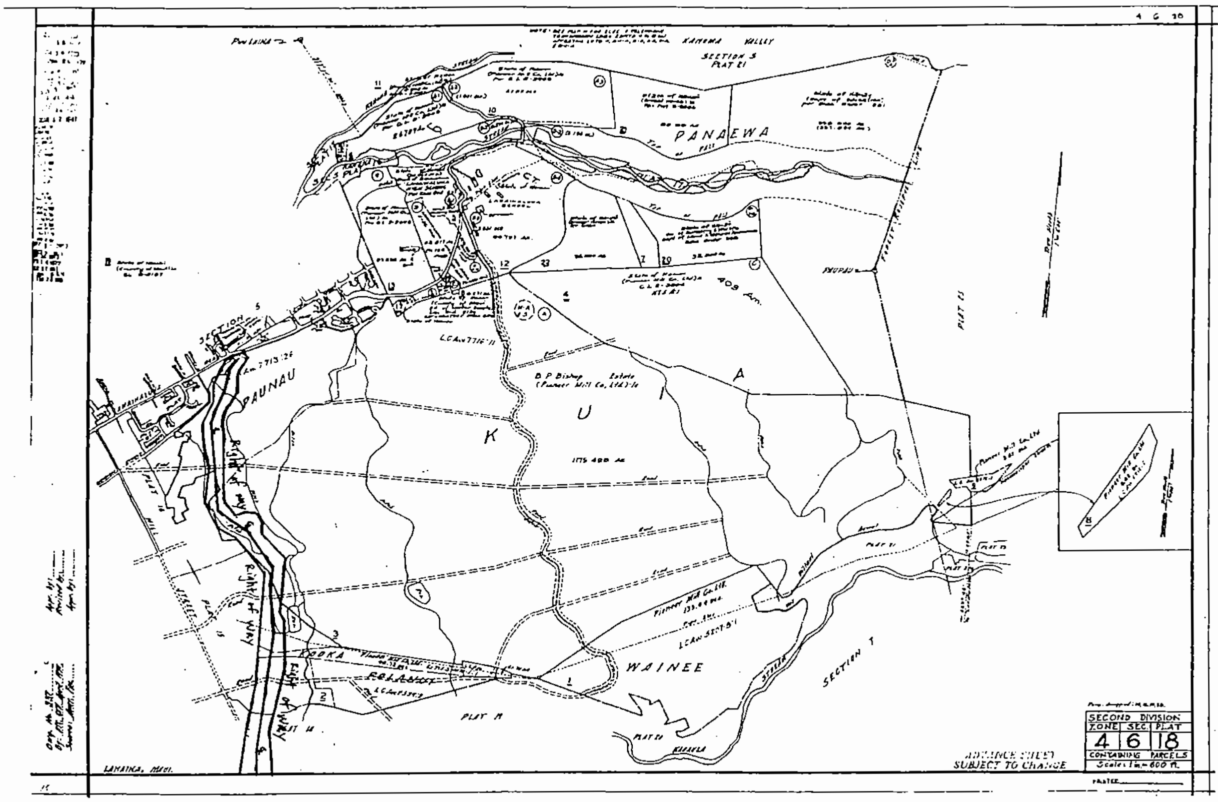
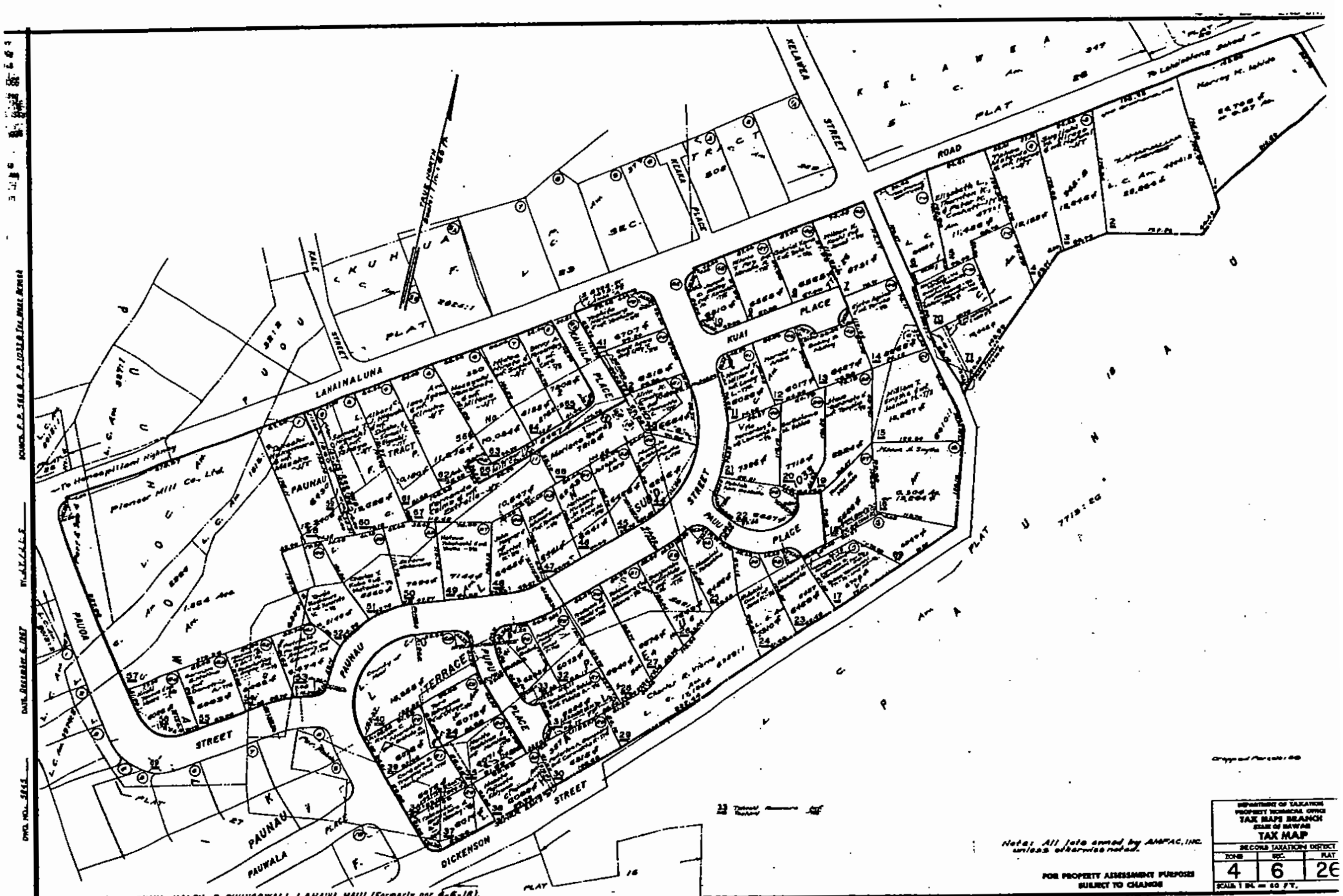
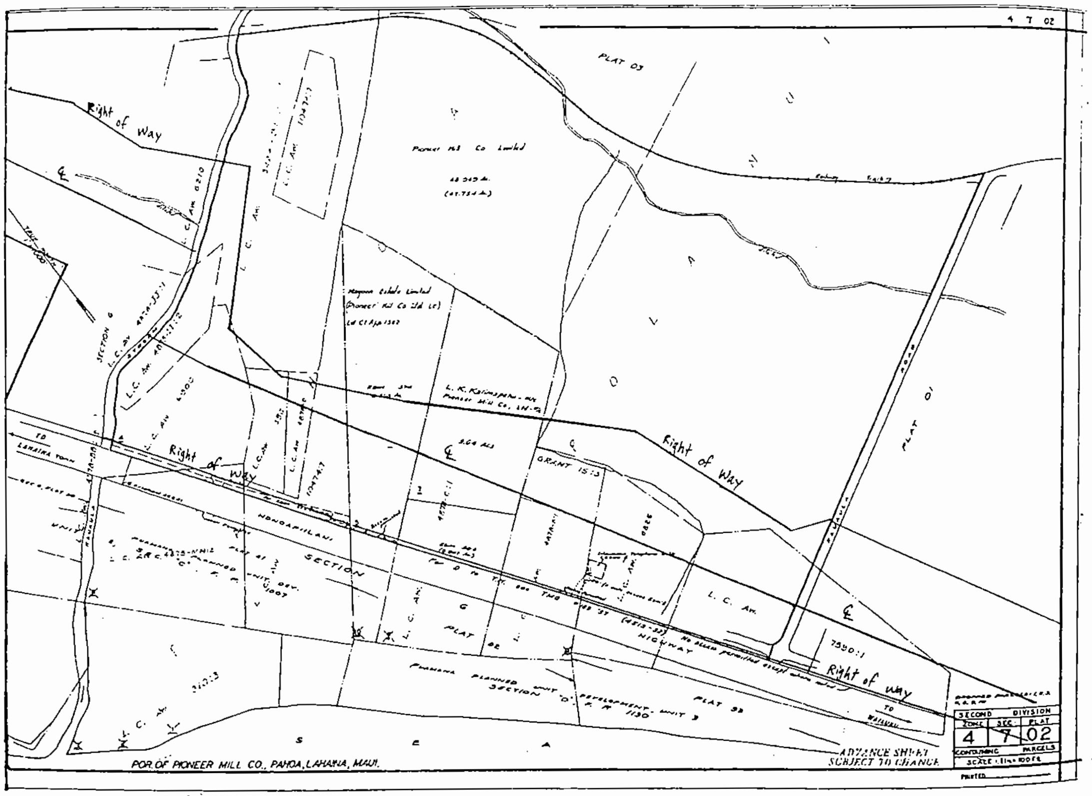



**Map 8 – State of Hawaii Tax Map—Zone 4, Section 6, Plat 18.**

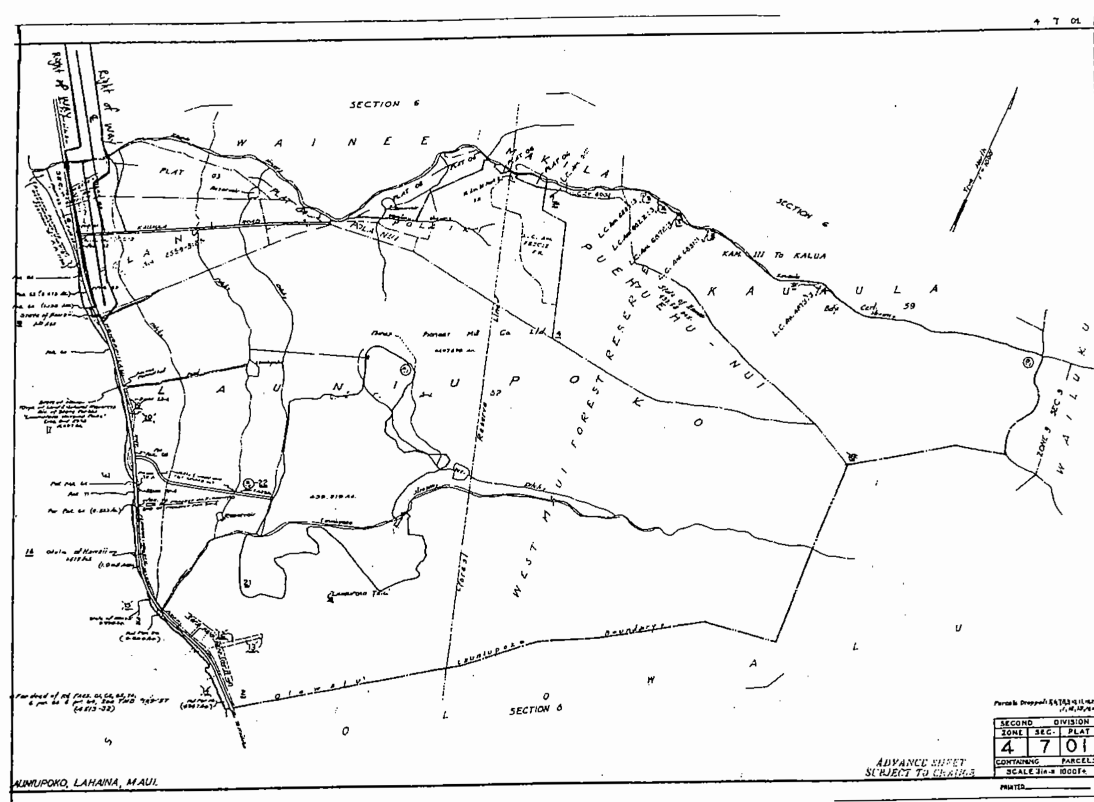




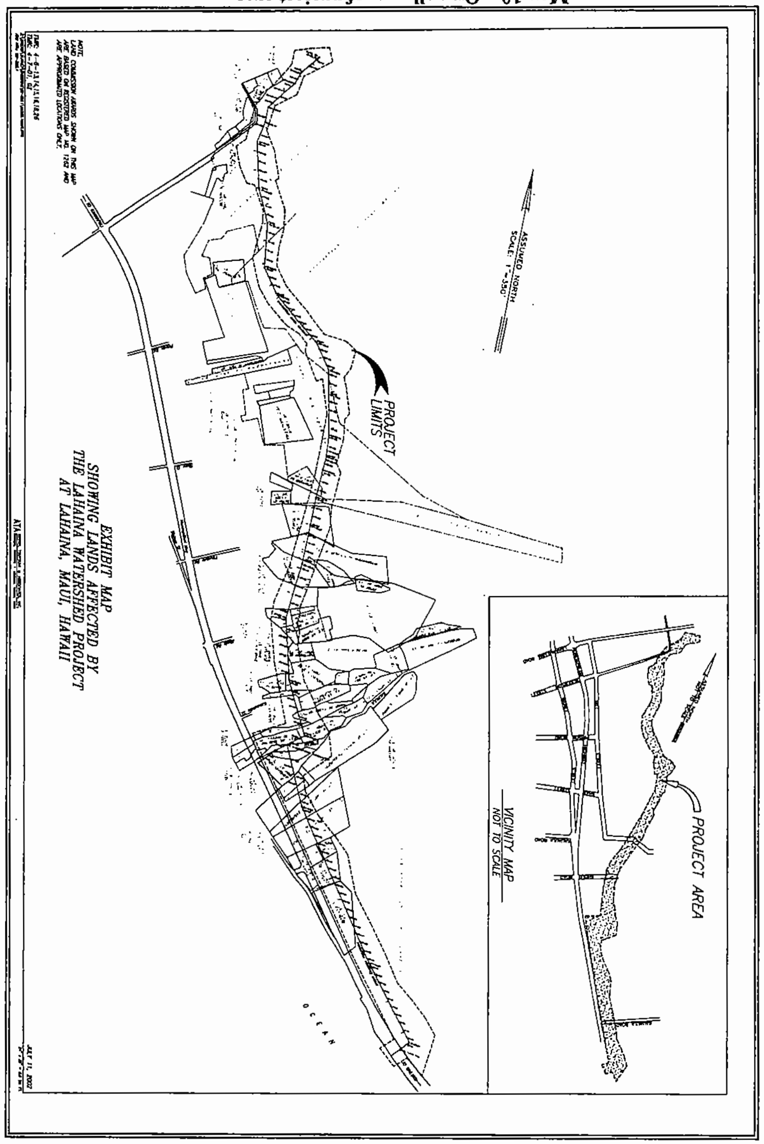

**Map 7 – State of Hawaii Tax Map—Zone 4, Section 6, Plat 26.**




Map 3 – State of Hawaii Tax Map—Zone 4, Section 7, Plat 02.




Map 2 – State of Hawaii Tax Map—Zone 4, Section7, Plat 01.




**Map 10 – Overall map of project area.**



# INTRODUCTION

Munekiyo & Hiraga, Inc. contacted Xamanek Researches during the fall of 2001 about an archaeological survey for the Lahaina Watershed Flood Control project area. The elongated project area was located *mauka* (east) of Honoapi`ilani Highway in Lahaina, Maui. This slender corridor would cross several TMKs, Land Commission Awards, and Kauaula Stream. This flood control project for the Lahaina area would be conducted with federal support from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), with local sponsor support provided by the West Maui Soil and Water Conservation District and the County of Maui. The overall scope of the project included a general corridor that was nearly 2 miles long and ranged from 150-250 feet in width. In addition, three settling basins were proposed for the flood control project as well.

We were asked to submit a proposal for the necessary work. Our proposal was subsequently accepted, and we were contracted to conduct the archaeological inventory survey. The field portion of this survey was carried out in the summer of 2002. The following report presents the results of this inventory survey.

# STUDY AREA

The c. 10,500 foot (3,200 meter) long project corridor lies in portions of the lands of Polanui, Pahoa, Puehuehunui, Halaka`a, Waine`e, and Puako in Lahaina District, on the leeward side of West Maui (TMKs 4-7-01, 4-6-13, 14, 15, 16, 18, 26). The entire corridor lies *mauka* (east) of Honoapi`ilani Highway and crosses former Pioneer Mill Company, Ltd. sugarcane land as well as Kauaula Stream. In addition, the project corridor passes to the east (*mauka*) of the general location of the former Waine`e Village (Site 50-50-03-5042).[1]

[1] This plantation camp was demolished in 2000 per SHPD Doc. No. 9906CO10.

**Natural History**

The soils in the general project area belong to the Pulehu-Ewa-Jaucas association. They are deep, nearly level to moderately sloping, well-drained and excessively drained soils that have a moderately fine textured to coarse-textured subsoil or underlying material. They are located on alluvial fans and in basins. They are further classified as Wainee extremely stony silty clay, 3 to 7 percent slopes (WxB) and Wainee very stony silty clay, 7 to 15 percent slope (WxC). On these soils the runoff is slow and the erosion hazard is slight. Stones cover as much as 3 percent of the surface. Bedrock occurs at a depth of about 36 inches. These soils are used mainly for sugarcane, and a small acreage is used for home sites (Foote, et al., p. 134).

The project area ranges in elevation from 1.5 feet AMSL at the outlet along the coastline at its southwestern end to 153 feet AMSL at the intake basin adjacent to Lahainaluna Road at the study area's northeastern end. Precipitation on this part of Maui is about 10 to 20 inches per year, and the rains generally occur during the winter months. The temperature ranges from the mid-seventies to the mid-eighties, and is relatively constant throughout much of the year round.

Vegetation noted in the flood control project corridor at the time of our survey was dominated by non-native plant species. Dominant vegetation throughout the bulk of the corridor consisted of *koa haole* shrubs (Leucaena leucocephala), rattoon sugarcane plants (Saccharum officinarum), various non-native grasses and succulent weeds. In addition, some mango (Mangifera indica), Java plum (Eugenia cuminii), monkeypod (Albizia saman), *kiawe* (Prosopis pallida), and *`opiuma* (Pithecellobium dulce) trees were noted in the vicinity of Kauaula Stream, the former location of Waine`e Village, and in the vicinity of Lahainaluna Road. The only native plant species noted during the survey consisted of *`uhaloa* (Waltheria americana), an indigenous shrub that is a pioneer species in disturbed landscapes.

# BACKGROUND INFORMATION

## Historical Background Research

Portions of the survey area lie a few hundred meters *mauka* of the present Lahaina National Historic Landmark. This region of Maui was associated with the former political and social center, which has been indicated by this recognition. In precontact times, Lahaina served as the residence of powerful chiefs—the most notable of whom was Kahekili. The Lahaina District was considered by high chiefs to be a desirable



location because of its abundant resources and climate, as well as its proximity to the islands of Lana`i and Moloka`i.

**Precontact**

The study area lies within the lands of Polanui, Waine`e, Puaanui, and Kooka, which lie to the east of Pakala. This latter area was the home of many high ranked chiefs and later on, members of the Royal family, and is sometimes referred to as Kalua`ehu (pit of the red one). This is in reference to the lizard goddess or *mo`o*, associated with the adjacent Loko o Mokuhinia that was traditionally connected with the Pi`ilani family of Maui through the *mo`o*, or lizard, a deity or *`aumakua* that traditionally took female form.

The *mo`o* of Loko o Mokuhinia were known by several names. One name is Kihawahine. This is also the name of the Maui chiefess who was a daughter of Pi`ilani. Here could be part of the connection that establishes the link to the Pi`ilani family. Kihawahine was the older sister of Kiha-a-Pi`ilani, a future king of Maui. Their sister Pi`ikea married Umi-a-Liloa, the descendents of whom formed the royal line on the island of Hawaii (Klieger et al., 1995, pp. 20-21). Kihawahine lived most likely in the latter part of the 16th century.[2]

Upon the death of Kihawahine, it is said that she was transformed into the *mo`o* named Mokuhinia. Kamakau (1991, p. 85) records that Chiefess Kihawahine was transformed into a *mo`o* named Kalanainu`u. Mary K. Pukui maintains that Kihawahine was deified and made a *mo`o* goddess after her death. This *mo`o* goddess became one of Kamehameha I's favorite goddesses, and served as a "land holder" deity (Klieger et al., 1995, p. 22). According to Kamakau (1991, P. 85) Kihawahine, as a *mo`o*, had the *kapu moe*, and was the *akua* of the high chiefesses of Maui during Kamehameha I's time.

A possible representation of Kihawahine was recovered from the Island of Hawaii in 1885[3]. It is reported that Kamehameha I carried this image around the islands on the Makahiki circuit. The female image had bleached hair and was once decorated with feathers. Its eyes were inlaid with pearl shell, and human teeth lined the mouth. It is also stated that the image was wrapped in a turmeric-dyed *tapa* cloth (Klieger et al., 1995, p. 26).

## Early post-contact: The Kamehamehas in Lahaina

In the latter part of the 18th century a series of battles intended to unify all of the islands ensued, seriously disrupting the landscape and lifestyle of many areas of the archipelago. Lahaina did not escape this destructive struggle. Klieger comments on the warfare (1995, et al., p. 14):

*"In the mid-eighteenth century, Alapa`i-nui of Hawaii went to war against the O`ahu Mo`i Peleioholani on Maui, and focused his energies on Lahaina. The tactics*

[2] Another factor linking the Pi`ilani family with Loko O Mokuhinia, is the location of Pi`ilani's residence, which lies directly *makai* (Klieger et al., 1995, p. 20-21)
[3] The image of Kihawahine was drawn by Robert C. Barnfield, and is shown in Klieger et al., 1995, p. 25.

*were somewhat unusual—Alapa`i dried up the streams of Kaua`ula, Kahana, and Kahoma (probably the sources of water for Mokuhinia), toppled the terraces and `auwai, and destroyed the productive capabilities of the lo`i system below (Kamakau 1992:74). It is not certain if Lahaina agriculture and aquaculture rebounded between the numerous battles for interisland supremacy. But years after Alapa`i's destructive path, Lahaina productivity still seemed marginal: Portlock confirmed in 1786 that western Maui had been devastated by the wars of unification (cited in Speakman 1978: 72-73). Lahaina then appears to have had little in the way of provisions to offer the passing explorers, perhaps much less to feed itself."*

In 1795, Kamehameha returned to Lahaina to provision his war fleet before continuing on to conquer the islands of Moloka`i and Oahu. Following the unification of those islands, between the years of 1798 and 1802, Kamehameha commissioned the construction of a "Brick Palace" which was built at Keawa`iki point in Lahaina. The building was reported to have been built by two foreigners—a "Mr. Miller" and a man named "Black Jack" Keaka. They had been living on Oahu prior to Kamehameha's invasion of that island in 1796, and following the battle of Nuuanu, they joined his side. The structure was two stories in height, and measured 41 by 15 feet[4] on the outside.

Kamehameha used the "Brick Palace" as his encampment headquarters during his residence on Maui in the year of 1802, while waiting for the assemblage of his fleet of war canoes to carry out the invasion of Kaua`i. Several historians suggest that the building was built as a residence for Queen Kaahumanu, but she apparently refused to live in it. She instead preferred to live in a traditional *hale pili* located a few feet to the south. A retinue of about 1,000 people accompanied the King and Queen during their stay. Their encampment probably extended southward to Loko o Mokuhinia.

By this time Lahaina had rebuilt most of its war-ravaged infrastructure, and was once again productive and prosperous. A large taro pondfield *mauka* (inland) of the "Brick Palace" produced this sacred food for the royalty, and is referred to as the Royal Taro Patch in several sources.[5]

After leaving Lahaina to wage an unsuccessful battle to gain control of Kaua`i, Kamehameha established his court in Honolulu. On several occasions he revisited Lahaina. In 1812, he stopped to collect tribute at the time of the Makahiki, and appoint his brother-in-law Kahekili Ke`eaumoku[6] as governor of Maui (Klieger et al., p. 17).

Captain Louis Claude Desaules de Freycinet visited the encampment at Keawa`iki in 1819, shortly after the death of Kamehameha. He observed the following (Klieger et al., p. 17):

[4] Several historians gave the measurements as 40 by 20 feet. The actual measurements were established during archaeological excavations undertaken in 1965 (Fredericksen and Fredericksen, 1965).
[5] Akoni Akana, President of the Friends of Moku`ula, and Hawaiian cultural specialist, says that the reference is because the King himself actually worked taro there, demonstrating to his people the value and sacredness of physical labor (personal communication, 1998).
[6] He was the brother of wives Ka`ahumanu and Kaheiheimalie (Barrere, 1975, p. 23).



*"We landed at Rahaina and immediately visited the water supply [probably Pahumanamana Stream] and chose a suitable place to set up our observatory. The governor, Keeaumoku, came with us, and allowed us to use the platform of a neighboring morai [heiau], and of a red brick house to set up our instruments. The red brick house was built by Tamehameha, who had originally wanted it to be a store, but the construction was so defective that, hardly finished, it began to sag in plain view. To the south was the habitation of the priests, and right next to it, a morai, constructed on a platform of stones, forming a sort of platform on the beach. The governor made our observatory taboo, so that we would not be bothered by curious onlookers. [Freycinet 1827-1839]".*

While Kamehameha I moved the center of government to Honolulu, other members of the royal family remained in Lahaina. Kamehameha I died in 1819, and his son, Liholiho was crowned Kamehameha II. Liholiho's mother, Keopuolani, the last of the female *ali`i* whose power was sacred, continued to reside in Lahaina. In 1823 she died at the age of 54. Prior to her death she had requested a Christian funeral—issuing the strongest prohibitions against all traditional funeral customs—save wailing (Klieger et al., p. 33). She was probably entombed at Halekamani, which was located near the beach in the royal compound of Pakala. The Reverend Hiram Bingham wrote that:

*"...her remains were deposited in a very tight stone and mud house. Around the house was built a stone wall from 6 to 12 feet thick, and from 4 to 10 feet high. This was a great work. The stones were all carried by hand, a distance of about a mile, and then laid in clay."*[Ibid., p. 36]

Other observers noted that mourners formed an encampment around the tomb, in an effort to remain close to the beloved queen. Kaumuali`i, the ruler of Kaua`i and husband of Kaahumanu, died in 1823, and had requested prior to his death that he be laid to rest beside his friend, Keopuolani. In 1825, when the bodies of Kamehameha II and his queen, Kamamalu, were returned to the islands following their deaths from measles in England, their coffins were taken ashore at Lahaina. Here they lay in state for a short time—next to the coffin containing the remains of the king's mother. The entourage was joined by Princess Nahi`ena`ena and Kauikeaouli, now King Kamehameha III, for the final funerary trip to Honolulu.

Princess Nahi`ena`ena lived near her mother's tomb, in Pa Halekamani, preferring Lahaina to the capitol in Honolulu. She was married at Waine`e Church in 1835 to her father's daughter's (Kiliwehi) son, a young Big Island chief named Leleiohoku. Following her marriage she then moved to Honolulu, and soon became pregnant. Some said that the child was fathered by Kauikeaouli, as their marriage would have been customary had the missionary influence not been so pervasive. Nahi`ena`ena gave birth to a child who died shortly afterward. She never recovered from the pregnancy, birth and death of her child, and died herself on December 30, 1836.

Her body was returned to Lahaina, and a stately funeral procession wound through the town ending at Halekamani. There her remains were deposited next to those of her mother (Klieger et al., p. 52).

Kamehameha III (Kauikeaouli) immediately began to construct a mausoleum for his beloved sister at Moku`ula, the royal island in Loko o Mokuhinia. When completed her remains and possibly those of her deceased child, along with the remains of Keopuolani and other *ali`i,* were relocated there. Kamehameha III lived on the island for the next eight years—distancing himself from the pressures of government that existed in Honolulu, and allowing others to attend to the affairs of state.

In 1837, a missionary wife named Andelsia Lee Conde wrote about the tomb at Moku`ula:

*"...The room was a large chamber elegantly furnished with chairs, tables and large mirrors set under them, beautiful china matting and a small organ upon which he played for our entertainment. Nearly in the center of the room was placed a bedstead nearly the magnitude of 3 common bedsteads. Upon which was a bed neatly spread, and upon this were placed the three coffins, side by side, most splendidly ornamented. Each of these corpses were enclosed in 3 coffins—the first zinc—the second lead and the third or outside one of wood. These were covered with scarlet silk velvet, put on with a multitude of brass nails—gilded plates, with their names & c. upon them, and various gilded ornaments, that gave us almost the impression but that of a tomb. ..."* [cited in Ibid., p. 55]

King Kamehameha III eventually married Kalama, who bore him two sons, both of whom died somewhere between 1839 and 1842.[7] The sister of his new *aikane* [Keoni Ana (a.k.a. John Young II)] bore Kamehameha III twin boys, although the two were not married in the Christian sense. One of the twins was Albert Kunuiakea Kuka`ilimoku (1851-1903), the only royal child that survived infancy. Although he was raised by Queen Kalama, the grandson of Kamehameha I was treated with scorn by the Calvinist Christians because of his birth out of wedlock, even though he served as a House representative in 1880 (Ibid., p. 65).

In 1840, Kamehameha III began building a western-style coral-block "palace" called Hale Pi`ula (House with the Iron Roof). A reference to the structure is found in Thrum's Almanac (1907, p. 173, in Fredericksen, et al., 1988):

*"There was an attempt at a building of a so-called palace which answered for a time as the show place, a name which should properly attach itself to royalty. It was also occupied part of the time by the court of the kingdom. It was more of a curiosity than an adornment. It seemed out of place amid all the tropical profusion and exuberance of natural life to see this building intruding into the atmosphere. With some idea of making the building larger, they undertook to double its length and made a still further blotch on the landscape. Fortunately so far as beauty was concerned it was partly dismantled and never finished and remained quite a conspicuous figure on the beach. However, in later years, they had to transport its stones to the premises of the old for where they now*

[7] Named Keaweawe`ulaokalani I and II, these were the last immediate family members of Kamehameha III to be placed in the tomb at Moku`ula (Klieger et al., p. 65)



*appear in the government building which is much more in harmony with the surroundings."*

The Polynesian, in a July 25, 1846 article, reports that:

*"Lahaina contains many excellent and unoccupied houses which would find ready tenants could they be transported to Honolulu. The palace, as a huge graceless, incomplete, two-story building, encircled by a wide verandah...is a monument of a waste of government means which do credit to some old and dissolute monarchy verging to its downfall. Its site is the sandy beach, instead of, as it might have been had taste been consulted, a quarter of a mile back, amid one of the many beautiful groves that give Lahaina so picturesque an appearance. Mr. Baldwin's church and the adjoining house are most delightfully situated in this respect and are quite unique in their tout ensemble, for Hawaiian scenery. The white turrets of the church peer through the trees most prettily. But this palace, on which work seems to be still going on, is on a scale to accommodate a population in itself, nearly as large of that of Lahaina. The interior is not only wretchedly arranged as to rooms, but positively mangled; special pains being manifest to prevent ventilation, and make as many ill-shaped and comfortless apartments as possible."*

Judging from these comments, few were impressed with the building. By 1848 it was being used as a courthouse—until it was severely damaged by *kauaula* winds in 1858. Some of the remaining stones and coral blocks were incorporated into the Lahaina Court House, which still stands in Lahaina overlooking the small boat harbor (Fredericksen et al., 1988). Other coral blocks found their way into various structures elsewhere in Lahaina.

In 1845 the royal court moved back to Honolulu. Kamehameha III took his trusted friend Keoni Ana and his wife, Julia Alapa`i[8] along with him. In that same year, upon the death of dowager Queen Kekauluohi--*hanai* mother of Queen Kalama and the last female *kuhina nui*[9]--Kamehameha III appointed Keoni Ana *kuhina nui (*Klieger et al., p. 69).

Keoni Ana became the Minister of Interior, and carried out the land reform known as the Mahele in 1848. King Kamehameha III died on December 16, 1854—leaving behind a constitutional government and a totally new land system (Klieger et al., p. 71).

## Discussion

The significance and sacredness Lahaina was established long before the unification of the islands by Kamehameha I. The Pi`ilani family lived in the Lahaina area, *makai* of Loko o Mokuhinia, probably near the location of Kamehameha III's Hale

[8] Julia Alapa`i is the granddaughter of Alapa`i-nui, the king of Hawaii who ravaged Lahaina in the mid-1700s.

[9] Kaahumanu was the first, followed by Kina`u. Kekauluohi was appointed *kuhina nui* after the death of Kina`u in 1838. Kekauluohi was the daughter of Kaheiheimalie, who was a sister of Kaahumanu. Kaheiheimalie was married to Ulumaheihei Hoapili, the governor of Maui. Kekauluohi's father was a half-brother of Kamehameha I (Kame`eleihiwa, 1992, p. 125).

Pi`ula. Another connection to Mokuhinia comes with the legendary transformation of Pi`ilani's daughter into the *mo`o*, Kihawahine. This deity became the *`aumakua* of Kamehameha the Great, who probably carried an image of her with him as he traveled around the island at Makahiki time. Prior to the arrival of Kamehameha, Kahekili had been ruler of all of the islands except for Hawaii. He maintained his home and royal court at Lahaina until his death in 1794.

After Kamehameha made Lahaina the capitol in 1802, the area between the point (Keawa`iki) on which he built the "Brick Palace", and Loko o Mokuhinia became the residences of chiefly families associated with the Kamehamehas.

The royal court moved to Honolulu, but Lahaina still remained an important place, especially after the succession of King Kamehameha III to the throne. During the tumultuous times following the deaths of Kamehameha I and II, Kamehameha III often retreated to Lahaina and Lake Mokuhinia and the royal island within the lake—Moku`ula. On this island he built a mausoleum for his mother, sister, and other *ali`i* connected with the royal family.

After the death of his sister, he remained in Lahaina until 1845, when the court was permanently moved to Honolulu. Lahaina continued to be the residence of important people throughout the 19th century. King David Kalakaua held title to property north of Loko o Mokuhinia, and his heirs kept title to the land for two decades into the 20th century. William Charles Lunalilo (later King Lunalilo) also held title to a property in this area as well as a LCA (8559-B).

In 1832, the missionaries conducted a census stating the population of Lahaina at the time was 4,028 (Schmitt, 1973).

By the mid-1800s, forces of Christianity and commercialism had transformed the Hawaiian system of social stratification. Social status began to be based on acquired wealth, rather than on birth and rank. Chinese and Japanese laborers were imported to work in the sugar industry, and these immigrant groups settled in ethnic clusters throughout Lahaina. The sacred Lake Mokuhinia dried up as water was diverted to irrigate sugarcane production in the fields to the east, as Lahaina shifted to more of a commercial center, rather than a governing center.

The name—Lahaina—is said to refer to the "cruel sun"—which is probably a reference to the droughts that affected the surrounding area from time to time (Pukui et al., 1974, p. 127). In precontact times, Lahaina itself was a garden-like area, with *lo`i*, ditches (*`auwai),* and their separating embankments, creating a verdant landscape. Brackish-water and fresh water ponds (*loko*), were also present. The largest and most significant of these fresh water ponds was Loko o Mokuhinia,[10] which lies about 0.5 kilometer to the west (*makai*)of the northern portion of the present project area. Given the limited rainfall on the leeward side of the island, the garden-like quality of Lahaina

[10] See Appendix A for more on the significance of this lake.



was a testament to the skill and ingenuity of Native Hawaiians farmers. Ocean resources were also abundant and harvested.

Early historic references to Lahaina District describe a rich agricultural oasis, with *taro*, breadfruit, coconut, and other food crops growing near the coast. *Taro* pondfields were interspersed with fishponds—all being watered from streams coming down from the mountains. Handy and Handy, 1972, p. 493) refer to the area as extending "about three leagues[11] in length and one in its greatest breadth. Beyond this all is dry and barren". The project corridor falls within that 3-league area, and the Land Commission Awards discussed later acknowledge that fact in their land use patterns.

These early visitors commented on the appearance of Lahaina. Archibald Menzies, a naturalist and surgeon on the Captain George Vancouver's vessel, HMS Discovery, reported during the 1793 voyage (Handy and Handy, 1972, p. 493):

*"March 17. On the forenoon of the 17th, I accompanied Captain Vancouver and a party of officers, with two Niihau women to see the village of Lahaina, which we found scattered along shore on a low tract of land that was neatly divided into little fields and laid out in the highest state of cultivation and improvement by being planted in the most regulated manner with different esculent roots and useful vegetables of the country, and watered at pleasure by aqueducts that ran here and there along the banks intersecting the fields, and in this manner branching through the greatest part of the plantation."*

[11] One league equals about 3 miles.

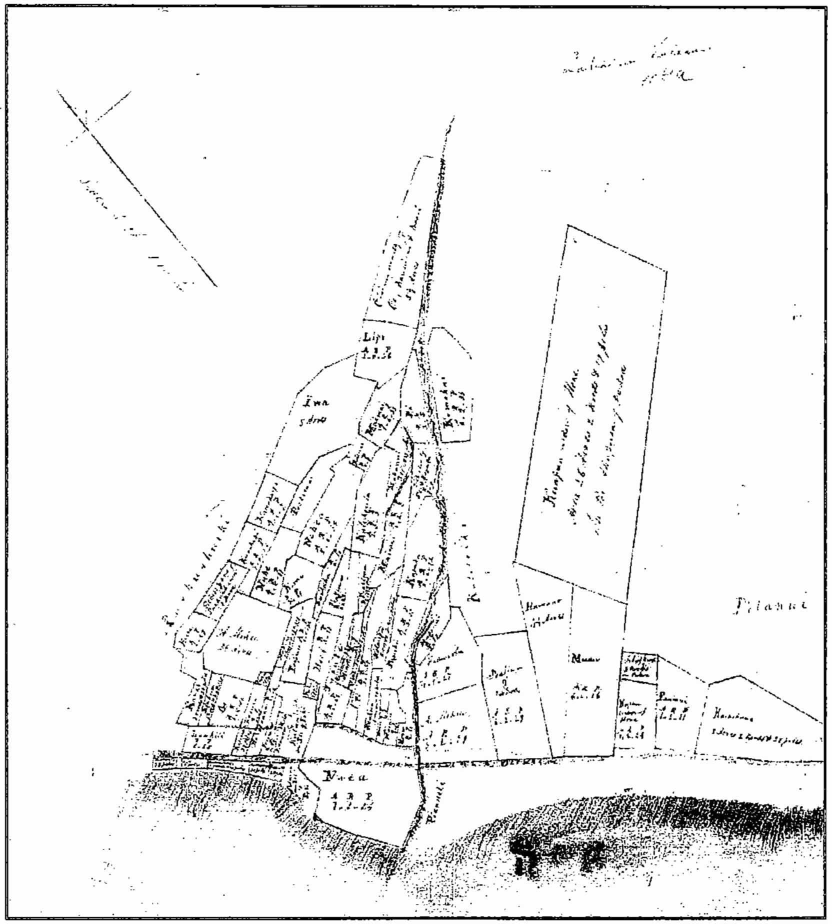



**Figure 1 – Alexander Map of Lahaina—1849 or 1850, showing relationship of *kuleana* in the densely cultivated region of Lahaina.**
**( from Moffat and Fitzpatrick 1995, p. 74)**



When Louis de Freycinet visited Lahaina in 1819, J. Arago also commented on the idyllic appearance of Lahaina (Handy and Handy, 1972, p. 493):

*"The environs of Lahaina are like a garden. It would be difficult to find a soil more fertile, or a people who can turn it to greater advantage; little pathways sufficiently raised, and kept in excellent condition, serve as communications between the different estates. These are frequently divided by trenches, through which a fresh and limpid stream flows tranquilly, giving life to the plantations, the sole riches of the country."*

Lahaina's main *taro* lands were watered by 2 large streams, Kanaha and Kahoma, which ran back into deep steep-sided valleys, the sides of which were "too precipitous for terracing" (Ibid., p. 492).

In the early 1840s, a local census indicated that there were 1,096 houses and 3,557 residents in Lahaina. Other details of the survey noted that there were 882 grass houses, 155 adobe structures, and 59 of stone or wood—and the town was home to 528 dogs (Moffat and Fitzpatrick, 1995, p. 75.

## Mahele

In 1848, during the reign of Kamehameha III, the traditional Hawaiian land ownership pattern was replaced with a more Western-style system. The Mahele, or division, separated lands into 3 major divisions—Crown lands (lands for the king), Government Lands, and Konohiki Lands. If common people, referred to as Native tenants, had lived on and gained subsistence from a parcel of land, they could claim these lands, which came to be known as *kuleana*.

### Land Commission Awards located in the study corridor

A total of 41 Land Commission Awards are represented in the project corridor. They are noted on the following table, and information pertaining to their size and land use is noted. Data was not found for some of these LCAs. An additional 20 are identified on the project map, but are located outside the project corridor. They are located in several *ahupua'a*, clustered along the coast—Polanui, Pahoa, Puehuehunui, Halakaa, Wainee, Paunau. This area was on the fringe of the center of governmental power and influence under Kamehameha III, which was concentrated around Loko o Mokuhinia.

## Table 1
### Land Commission Awards in Project Area

| LCA # | Apana | R.P | Awardee | Area | Ahupua`a | Remarks |
|---|---|---|---|---|---|---|
| | | | | | | |
| 345B | | 5633 | Kaawa | 1ac., 31 rods | Paunau | Fenced land; inherited from wife, Kekipa |
| 356 | | 8399 | Moehauna | | Pahoa | sweet-potato field** |
| 477[12] | | | Keakualele | | | |
| 2546 | | | Lipi | | | |
| 2650 | 2 | | Kekoalii | | Puehuehulki | 11 *loi*** |
| 3423B | | | Iwa | 9.99 acres | Pueheunui | |
| 3424B | 2 | 8251 | Kaleleiki | 8 ac., 30 rods | Pahoa | *Taro* land enclosed by stone wall built in 1844 |
| 4320 | 3 | | Kaua | | | |
| 4662 | | | Paaluhi | | | |
| 4787B | | | Kapua | | | WA—nd[13] |
| 4804 | 2 | 1683 | Hesetia Nui | 1.03 acres | Paunau | 17 *kalo* patches |
| 4878 | 2 & 3 | | Pi | | Pahoa | |
| 4878BB | | 3585 | Honu | 2 roods,23 rods | Makila | Houselot and *kula* |
| 4878C | | 1696 | Muaa | 6.0 ac.,26 rods | Pahoa | 17 *lois*, houselot and *kula* in 1 piece |
| 4878D | | 5692C | Kuapua | | Pahoa | ND** |
| 4878EE | 3 | | Makaiole | 2 ac.,2 roods, 9 rods | Wainee | 5 *loi* |
| 4878G | 4 | 1959 | Malaehakana | 8 ac., 49 rods | Polanui | Data not clear—of the 4 *apana*: 1 *kalo*,2 patches of *kula*, houselot |
| 4878II | 2 | | Pupuka | | | Not found in Index |
| 4878KK | | -- | Kelea | 12 rods | Polaiki | 2 *loi* |
| 4878LL | | 2709 | Makanui | | Pahoa | ND** |
| 4878O | | | Olala | | | |
| 4878Y | | 2718 | Mamaka no Muolo | 1.19 acres | Halakaa | *Kula* and *taro* lands |
| 5207B | | | Kalaipaihala | | Wainee | |
| 5458 | 2 | | Manu | | Kooka | |
| 5784 | 2 | | Naai | | | WA—nd |
| 5832 | | 1157 | Kaaumaiewe | 4.35 acres | Kamani | 1 *mo`o* and a *kula* |
| 6205 | 1 | | Olelo | | | |
| 6210 | | 2706 | Kapuka | 2 ac., 12 rods | Makila | Houselot and 1 *loi* |
| 6211 | 1 | 1202 | Maimai | 1.54 ac. | " | *Taro* land, enclosed with stone wall |
| 6212 | 2 | 1695 | Kekua | 1.35 ac. | " | *Kula* and *taro* lands |
| 6215 | | 1854 | Keani | .88 acres | Puehuehulki | 1 piece of *kula* land |
| 6389 | | | Kahalelole | | Wainee | |
| 6410 | | 1705 | Kaiki | 1.27 ac. | Paunau | 1 houselot and 14 loi in 1 piece |
| 6426 | 1 | | Kalehoula | | Lahaina | Not found in index |

[12] Shaded areas indicate LCAs which are shown on the ATA map (project map), but are located outside of the study corridor.
[13] Indicates that this could not be found in the Waihona `Aina Corp 2000 <Waihona.com> data base.



| | | | | | | |
|---|---|---|---|---|---|---|
| 6437 | | | Kaiwipalupalu | | Paunau | |
| 6449 | | | Kapu | | | WA—nd |
| 6495 | | | Kawahamano | 4.75 ac.,26 rod | Pahoa | 13 irrigated *loi*, 3 dry *loi*, 2 *mo`o kula* |
| 6784 | 1 & 2 | | Naai | | Wainee | |
| 6786 | | | Kamohomoko | | " | |
| 6788 | | | Kamauoha | | " | |
| 6795 | | ----- | Ukukua | 4 ac., 2 roods, 13 rods | Polanui | *Kula* land |
| 6821 | 1 | | Paikaualani | | | WA—nd |
| 6854 | | | Ohule | | Puunauiki | |
| 6860 | | | Nunea | | Polanui | |
| 6862 | | | Kaumiumi | | Pauhi | |
| 6867 | | 8284 | Poepoe | 1 ac.,18 rods | Kauaula | *Kula* land |
| 6868 | | 5582 | Hanakaipo | | Puehuehu Iki | Taro land? Houselot? ** |
| 6879 | 2 | 4556 | Kuhaulua | 1 ac., 1 rood, 33 rods | Paunauiki | *Kula* land with *mo`o* |
| 6886 | 1 | 8260 | Kamohai | | Pahoa | *Taro* land (N.Namuu)** |
| 6887 | | 5703 | Kuakaha | 2 roods, 14 rods | Kaulalo | 3 *taro loi* |
| 6890 | | ----- | Kaiwikokole | 1 rood, 34 rods | Halakaa | *Kula* land |
| 6900 | | 1198 | Keawealu | 2.42 acs. | Makila | *Taro* land–16 small *loi* |
| 6921 | 1 | 1711 | Paikaualani | 1.7 ac. | Halakaa | *Kalo* land with 2 *poalima lois* inside |
| 6948 | | | Kapu | | | WA—nd |
| 7590 | 1 | 1190 | Kainukane | | Pola Nui | Kula land and houselot on Govt. road** |
| 7713 | | | V. Kamamalu | | | Crown land |
| 7716 | | | R. Keelikolani | | | Crown land |
| 8559B | 25 | 8395 | W.C.Lunalilo | | Pola Nui | Crown land |
| 9821 | 1 | 3456 | Kaleiopu | 1.5 ac.,19 rods | Makila | *Kalo* and *kula* land |
| 9825 | | 1704 | Paniani | | Pola Nui | Houselot ** |
| 10785 | | | Paniani | | Paunau | |

** Data obtained from Haun, 1999.

A look at the U.S.G.S. topographic map of Lahaina shows a number of these *ahupua`a* as inland land blocks, which do not conform to the traditional *ahupua`a* pattern. These traditional land divisions consisted of a pie-shaped piece of land that stretched from the ocean inland to the forest zone in some cases. It covered several different ecological zones--thus insuring that the residents had access to a wide range of natural and cultivated resources. The *ahupua`a* of Makila probably once extended to the sea, but by the early 1800s, it was apparently subdivided into numerous named *ahupua`a* and probably *ili*-level divisions (Haun, p.18). However, on the topographic quad map it is shown as a relatively small area, approximately 1.5 kilometers inland in Kau`aula Stream. Other land-locked *ahupua`a* shown *mauka* of the project area are Puehuehuiki, Kooka, and Polaiki, which are found on the table above.

Please refer to Appendix A for Foreign and Native Testimonies concerning the LCAs listed on the Table 1. These are taken from the Wai`hona `Aina Corp. database at www.waihona.com.

## Post-1850s

### Plantation Era

Sugarcane cultivation began in West Maui in 1849 when Judge A.W. Parsons established and began operating a sugar mill in Lahaina. It was sold to J.T. Gower about 1850, and in 1852, was sold at auction to O.H. Gulick, along with 1,000 acres of land (HRHP, 1974).

In 1854, a whaling vessel stopped in Lahaina on a return voyage from Tahiti with 2 varieties of sugar cane. These were given to the U.S. Consul, who planted them in his garden. One variety proved to be hardy and productive in the harsh Lahaina climate, becoming known as "Lahaina" cane. It was the predominant variety for the next 50 years (Ibid.).

In 1859, Henry Dickinson, a Lahaina shopkeeper, formed the Lahaina Sugar Company, and a year or so later, Pioneer Mill Company was founded by three partners--James Campbell, Henry Turton, and James Dunbar, on land deeded to them by Benjamin Pittman. In 1863, Lahaina Sugar Company was sold to Pioneer Mill Company after going bankrupt. A third plantation was attempted by Lot Kamehameha and partners in 1870, but was also bought out by Pioneer Mill Company a couple of years later, following his death.[14] In 1877, a German ex-ship captain, H. Hackfield, took over as manager of the plantation, which represented assets of $500,000 in 1883 (Simpich, 1974, as cited in Graves, 1993, p. A-5).

Henry Turton, one of the originators of Pioneer Mill Company plantation, received permission from the Minister of the Interior of the Kingdom of Hawaii in May of 1882, to proceed with a railroad, intended to connect distant fields with the mill. It eventually extended north to Napili, and south to Ukumehame, probably crossing portions of the study corridor.

In the heyday of sugar production, the mill provided electricity, water, and medical care to not only its workers, but also the town of Lahaina. It ran the largest mercantile on Front Street, Lahaina Dry Goods. The building was said to have been built as a possible refuge for the Kaiser, prior to World War I. Because of the fact that it was controlled by German nationals in 1917--H. Hackfield and Company, the managing agent for Pioneer Mill—it was seized and by the government and sold to Americans as America entered World War I. Quickly, the company was renamed American Factors, and later became known as Amfac, Inc.

In the early part of the 20th century, Pioneer Mill controlled c. 12,500 acres of land on the west side of Maui—lands which were considered some of the rockiest of the plantation lands in Hawaii. This rockiness is commented upon in Gilmore's The Hawaii Sugar Manual:

[14] Lot Kamehameha (Kamehameha V) died in 1872, without naming an heir. His property was inherited by his half-sister Ruth Keelikolani—Princess Ruth.



*"Owing to the roughness of the terrain, very little cultivating is ever effected with implements drawn by either tractors or mules. Practically all is done with the hoe. Forty percent of the land is so completely covered with rocks that plowing is impossible, and preparing land for planting is done with pick and shovel.*

*In these fields the rocks are cleared away and built into a series of stone walls from 5 to 6 feet apart and often 3 feet high. These stone walls form the banks of the cane row; and between these walls the ground is softened up with pick and then planted. The soil in these areas, although extremely difficult to get at, is very fertile and yields as great as from 90 to 100 tons per acre can be secured off such fields (1936: 200, in Haun, 1999, p. 15).*

Obviously, such work was extremely labor-intensive, and a constant flow of immigrants was needed to provide this. The first group to come were the Chinese in the early sugar plantation years, followed a generation later by the Japanese, and finally in the 1920s and 1930s, by the Filipinos.

The plantation was basically a feudal system, which provided for all of the workers needs—from housing, to merchandise, to health care and social activity. In this environment, Waine`e Village was established in the early 1900s. The village contained up to 200 houses in its prime in the 1920s. It continued to house plantation employees throughout the pre- and post-World War II years, until it was slated for destruction. In March 1999, it was announced that Pioneer Mill would cease to plant sugarcane on its vast land holding on the west side of Maui. As each field ripened, it would be harvested, and when all harvest was complete, the mill would be closed down.

The Maui News devoted several pages to the history of Pioneer Mill in its August 29, 1999 issue. At that time, there were 36 homes left standing in Waine`e Village, which made up what was described as the last plantation camp on Maui. The article went on to state: "Until recently, nearly all of the homes were occupied, although...the structures, many of them built in the 1920s, were in poor condition". The site of this former village lies *makai* of the project corridor.[15]

[15] Waine`e Village was demolished in 2000.

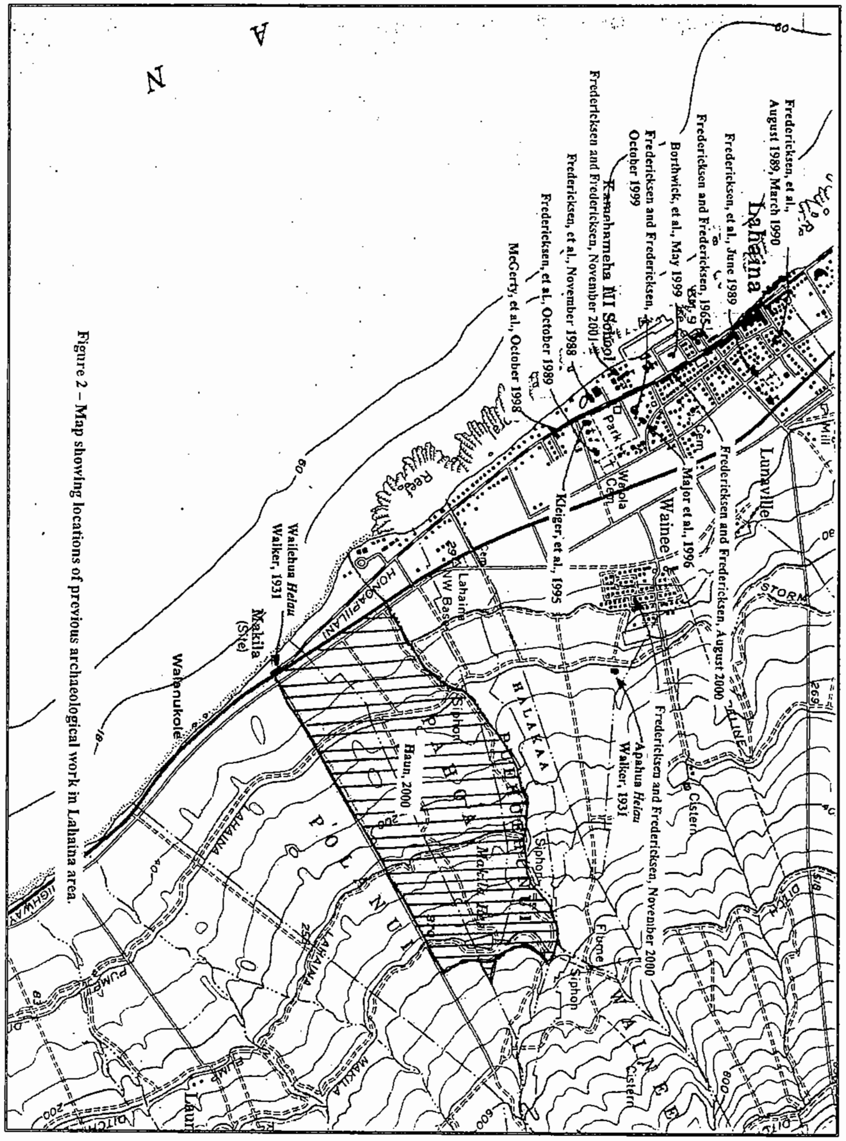



Figure 2 – Map showing locations of previous archaeological work in Lahaina area.

# PREVIOUS ARCHAEOLOGICAL STUDIES IN LAHAINA

The first archaeological work in the Lahaina area was the inventory of religious structures compiled by Winslow Walker in 1929 and 1930 (Walker, 1931). He listed 3 *heiau* in the Lahaina environs—Wailehua *heiau*, located at Makila Beach in southern Lahaina (Site 50-50-03-6), Halekumukalani *heiau*, located in the Puehuehunui cane fields above Lahaina (Site 50-50-03-7), and Apahua *heiau* (Site 50-50-03-08) located in the cane fields above Waine`e.

Wailehua *heiau* is the structure that was dismantled at the death of Queen Keopuolani (Majors et al., 1996, p. 13). The stones were carried from its location at the shoreline to the tomb, Halekamani, which held the remains of the queen until they were redeposited in the mausoleum on Moku`ula. Wailehua *heiau* is described as measuring 130 by 80 feet in Thrum (1909), and was said to have been built by Kauhi-ai-moku-kama, the son of Kekaulike, in or around 1738 (Walker, p. 109).

Halekumukalani *heiau* was a small sacrificial structure (*luakina*) in the cane fields above (*mauka)* of the Pioneer Mill Company railroad. It was totally destroyed at the time of Walker's survey (Ibid.). Apahua *heiau* is another structure that has been totally destroyed by cane cultivation. According to Thrum, it was built by "… Hua-nui, about 50 years later than Hua-a-Pohaku-kaina (Ibid.).

**Brick Palace of Kamehameha I**

In 1965, Xamanek Researches (Fredericksen and Fredericksen, 1965) undertook a project to determine the nature and location of the "Brick Palace" of King Kamehameha I on Keawa`iki point. This structure was built between 1798 and 1802, calling on the help of 2 foreigners who were in Kamehameha's entourage. With the aid of several historical documents, the location of the building was narrowed to an area immediately *makai* of the Lahaina Library. A *heiau* was said to have existed near the mouth of Pahumanamana Stream, and probably served as the location for the structure. Finds from subsurface testing included the foundation of the brick building. It measured 41 feet by 15 feet.

The remaining brick walls were 1 to 4 courses in height, and the bricks had been arranged in what was called "British bond". The bricks were not imported, but rather manufactured of local clays, probably from the nearby *taro* pondfield, sometimes identified as the "Royal Taro Patch". They were primitively fired, resulting in rather poor quality bricks—some under-fired and some over-fired. Shapes were not always consistent.

The structure was built on a stone platform, probably the unnamed *heiau*, which had been paved with small, waterworn pebbles. The bricks were bonded with a pinkish-colored, poor quality mortar, which was produced by burning coral to lime, and mixing that lime with beach sand and soil. Because of the lack of a solid foundation, the brick structure began to crack and sag, almost immediately after its completion. Consequently, to cover the cracks, the outside of the building was covered with a lime and sand plaster sometime in the 1820s or 1830s.

The archaeological findings corroborated historical observations in terms of the general location, and the nature of the construction. However, the true size of the building was somewhat different from historical records, as most described the structure as measuring 20 by 40 feet.

In 1969 Xamanek Researches re-excavated the "Brick Palace" walls to determine what portions, if any, were still in a state of preservation that was good enough for public display. Additional excavation was also undertaken in the interior of the structure, in order to obtain additional archaeological details and information. Portions of the walls that were still reasonably intact were prepared for display. In the northwest corner of the structure there were 3 to 4 courses of brick that were still *in situ*, and in a good state of preservation. These were exhibited within an enclosure, which was covered with plexiglass. Unfortunately, the prevailing public attitude at that time was not focused on history or preservation, and within a few months of completion of the exhibit, vandals had broken the plexiglass dome covers, exposing the contents. Subsequently, deterioration of the architectural remains of the palace within the display areas took place (Fredericksen and Fredericksen, February 1970).

**Hale Pi`ula**

In 1988, Xamanek Researches had the opportunity to conduct subsurface testing at Armory Park—the general location of Hale Pi`ula, the large stone and coral-block "palace". King Kamehameha III began construction of this structure in 1840. Portions of the park that were covered with paved parking and buildings could not be tested at the time. The foundation of the structure was not located, but a large cairn containing masses of burned coral was located on the *makai* portion of the study parcel. This probably represented a" lime kiln" which produced the lime that was used in the construction of the building. It was predicted that the foundation of the building lies somewhere under either the concrete slab on which the modern buildings are situated, or under the parking lot near Front Street (Fredericksen et al., November 1988).

**Other archaeological studies in Lahaina Town**

The Aus project (Site 1797) was primarily data recovery and the monitoring of a large excavation for the basement parking area of a business office building on TMK 4-6-09: 21. The finds were almost exclusively historic, and were analyzed and placed into 4 historic periods: Late $18^{th}$—Early $19^{th}$ Century; Mid-to-Late $19^{th}$ Century; Early $20^{th}$ Century; and Recent. The earliest artifacts consisted of a mix of historic and indigenous artifacts that would be expected at that transitional time period. The indigenous artifacts



include, *leho he`e* (octopus lures), a stone bowl probably used for preparing bait, and adze fragments. Mixed with these were fish debris, and 4 flared-lip case gin bottle portions. Also a hobnail-embossed ink well, typical of those used in the late-$18^{th}$ century, was recovered. It was in 2 pieces, each found in a different part of the study area. The other time periods were represented by bottles, porcelain and crockery, which were dated by style, trademarks and manufacture technique (Fredericksen et. al., June 1989).

Scientific Consulting Services carried out a monitoring program during the Front Street Renovation project that was undertaken in 1997 and 1998 (McGerty, Dunn and Spear, October 1998). The project involved placement of underground utilities, which required extensive subsurface disturbance. The entire project stretched from Lahainaluna Road to Shaw Street. Many precontact and historic sites, and several precontact burials were encountered during the project work. The findings document a subsurface cross section of Lahaina town.

In January 1999, during part of the restoration of the Lahaina Courthouse, an inventory survey was carried out by Cultural Surveys Hawaii. The Maui Cultural Resources Commission, and SHPD had requested an inventory survey, prior to any subsurface disturbance. However, the process was not followed, which resulted in monitoring being the original fieldwork at the site (Borthwick and Hammatt, May 1999 [Draft], p. 1).

A subsurface testing phase was worked out between SHPD and CSH, which consisted of the excavation of 4 backhoe trenches, sampling various areas of the Courthouse grounds. It had been assumed that the entire parcel consisted of historic fill. However, it was soon discovered that a precontact substratum was present, in which artifacts such as adzes, coral and urchin abraders, and volcanic glass were located. Radiometric dating placed this occupation at c. AD 1420 to 1660 (Ibid., p. 44). The site is designated as Site 4754.

**Moku`ula**

Extensive work was conducted in 1993, by Bishop Museum archaeologists Steve Clark and Paul Klieger. They initiated an archaeological inventory survey and test excavations at the site of King Kamehameha III's residence and family tomb on the island of Moku`ula (Klieger et al, 1995). The abstract (Ibid., p. xviii) states:

*"The site appears to have been very important to Kamehameha III, descended from both Maui and Hawai`i Island families. As few meters west of Moku`ula is the site of the Lahaina palace of the great Maui mo`i Pi`ilani of the sixteenth century, as well as the official palace of Kamehameha III, Hale Piula. Recent historical and archaeological inventory and survey research (Phase I) has rediscovered the location of Moku`ula under Malu `ulu o Lele Park. Archaeological excavations have shown that many architectural and other cultural features from the period of royal residence on Moku`ula are very well preserved. Data further indicate that although the fishpond of Mokuhinia is most likely natural, having been in existence for thousands of years, the island appears to have been largely man-made, probably in the early nineteenth century".*

Human remains were located in three test units. The remains of an articulated human right foot were identified in a location about 50 meters south of the Royal Tomb on Moku`ula. The presence of metal nails suggests that it was contained in a coffin. Another possible casket burial was located directly within the tomb location. It was not tested to determine whether human remains were still present (Klieger and Clark, 1995).

**Loko o Mokuhinia and environs**

In 1995, the Bishop Museum conducted an inventory survey on a parcel located *mauka* of Loko o Mokuhinia (TMK: 4-6-07: 13). Surface and subsurface investigations located two sites—the buried remains of a habitation area and possible pondfield (Site 4118), and a plantation-style house possibly dating to 1908 (Site 4119), which was still occupied at the time of the inventory survey (Major et al., 1996). The subsurface habitation area produced domestic artifacts such as bottles, ceramic sherds and metal consistent with a late 19th or early 20th century house site (Ibid., p. 57).

Another parcel, which lay on the northern shore of Loko o Mokuhinia, was inventoried by Xamanek Researches in October 1998 (Fredericksen and Fredericksen, October 1999). Subsurface testing located a precontact site remnant (Site 4690)—which yielded a radiometric date of occupation at between AD 1475 and 1665. An historic wall was also documented, that appears to have been an LCA boundary wall—one of the few remaining in Lahaina. Several coral blocks are incorporated into the structure, and may have originated from Hale Pi`ula.

An inventory survey of the Kaua`ula Development Parcel to the south of the study parcel, was conducted by PHRI in November 1999. A total of 15 backhoe trenches and one 50 by 50-cm. shovel test were used to test for the potential presence of buried prehistoric deposits on this 230-acre parcel (Haun, 1999, p. 6). Three agricultural sites were located. Two were interpreted as late precontact sites, which may have been continually used into the late 1800s, and the third was considered to be historic and associated with sugarcane activity.

The future site of the West Side Resource Center, the location of which lies directly *makai* of the project corridor was surveyed in mid-2000. The site was part of the last sugarcane village on Maui—Waine`e Camp, which was torn down in the late 1990s. Subsurface testing did not yield any evidence of significant cultural material. The area seems to have been impacted by past sugarcane cultivation, and by the construction and recent demolition of Waine`e Camp. One site, associated with the camp was identified—Site 5042 ( Fredericksen and Fredericksen, November 2000).

In July and August 2000, Xamanek Researches undertook a monitoring program at Kahmehameha III Elementary School grounds, situated just south of the courthouse on the coast. During the project, 10 *in situ* burials were located, along with numerous disturbed graves and a habitation site (Sites 4982, 4983, 4984). The burials were preserved in place, and the disturbed remains reinterred on the property. Radiometric



analysis dated the earliest finds from the 16th century (Fredericksen and Fredericksen, November 2001).

## Settlement Patterns and Expected Findings

The large number of radiocarbon precontact dates in Lahaina District occurring the in late 1600s (Borthwick, et. al., 1999; Fredericksen and Fredericksen, 1999; Haun, 1999; Kleiger, et al., 1995; Majors, et. al., 1996) indicate the increase of population and intensification of land use during that time. The settlement pattern included permanent habitation along the coast and inland within the main drainage areas. In these areas the valley floors were dotted with *lo`i* connected with *`auwai* systems, built and maintained for the production of *taro*. On the valley slopes, and in the areas at the lower reaches of the mountain slopes, dry land cultivation took place. Stream water was carried by *`auwai* to a broad band of pondfields near the permanent coastal habitation zone. Along the coast where settlements occurred, it appears that people also concentrated on exploitation of marine resources. In Lahaina, several fishponds existed as well. These inland ponds were possible because of the sand beach deposits that were formed parallel to the shore and kept the terrestrial run-off water from reaching the sea. Hawaiians took advantage of this natural feature, and utilized the ponds for the production of fish. Two of the prominent fishponds were Loko o Mokuhinia, and the smaller Loko Puako, around which intensive taro and breadfruit cultivation occurred. Dotted among the fishponds and *taro* pondfields, on higher ground, were the homes of the people who worked the land.

*Heiau* were situated along the coast and on ridge crests on the lower mountain slopes overlooking the coast. Burials occur in coastal sand dunes, in inland caves and hilltops, and in some habitation areas.

In an earlier study, Majors concludes:

*"We theorize that for most of Lahaina's past, the majority of habitation was along the beach, with secondary habitation/garden sites located inland along the shorelines of the fishponds. Intensive wetland taro production continued mauka of the coastline for about a kilometer or so (Klieger et al. 1995). Terraced fields continued up a few of the more prominent West Maui streams, and these lands probably included at least temporary habitation sites. Kula or open areas along the lower slopes of the mountains were probably ideal for raising dryland taro and sweet potato."* (Major et al., 1996, p. 17)

In early post-contact times, Lahaina became the center of the Hawaiian Monarchy. Kamehameha I spent time there, between battles of conquest. His son, Kamehameha III resided in Lahaina in preference to Honolulu. Kamehameha I's wife, the sacred Keopuolani, and his daughter, Nahi`ena`ena are buried there. Many high status individuals connected with the monarchy in one way or another lived in Lahaina, even after the official capitol of the kingdom was moved to Honolulu in 1845. King David Kalakaua and his heirs held title to a parcel, two decades into the 20th century.

In addition to the Royal presence, European interest in Lahaina increased, beginning with whalers and missionaries, and commercial enterprises. The traditional settlement and land use patterns were changed as people gravitated to Lahaina town. The Mahele altered the traditional land ownership patterns as well.

With the introduction of sugarcane cultivation in the 1850s, and the importation of foreign labor to work in the plantation, the character of Lahaina changed. The sugar plantations acquired either by purchase or lease, large amounts of land, further displacing the people. The acquisition of stream water for sugar cane production dried up any remaining taro fields by the end of the 19th century. Afterwards a pattern of dispersed villages and camps for plantation workers emerged. *Kuleana* land grants changed hands as plantation workers became affluent enough to purchase land from Hawaiians willing to sell. Commercial development became the driving force that would continue and intensify through the 20th century.

Based on our background research and the numbers of Land Commission Awards in the project corridor the expected findings in the study area could include possible precontact subsurface habitation site remnants, possibly containing associated human burials. It was expected that sugarcane cultivation over many decades would have impacted subsurface conditions to some extent. The extent of commercial agricultural surface disturbance connected with sugarcane cultivation would likely preclude any precontact surface finds. However, features such as walls, roads, irrigation ditches, and building foundations associated with former plantation activities could possibly still be visible.



## ARCHAEOLOGICAL METHODS

This archaeological inventory survey was conducted during the summer of 2002. The field team was made up of Mark Donham, Jennifer Frey and John Risedorf. Erik Fredericksen was the principal investigator and project coordinator. Demaris Fredericksen put together the background section for the report, and coordinated its editing and final production. Walter Fredericksen acted as a senior advisor. Mark Donham prepared the profile drawings for digital reproduction.

The survey of the study area was carried out in 2 phases—a pedestrian surface inspection, followed by subsurface investigation. This latter phase consisted of a series of 86 backhoe trenches. Some controlled excavation was also utilized to investigate Find 1, an *in situ* human burial. The walkover survey was completed using transect lines spaced c. 5 meters apart, and oriented roughly parallel to the staked center line. Potential areas of interest were marked with flagging tape for subsequent evaluation and testing. The second phase consisted of subsurface investigation throughout the Lahaina Watershed Flood Control project corridor.

A total of 86 backhoe trenches were placed on the project area (Map 11). Due to the number of Land Commission Awards (LCAs) on the project area, we tried to assess each LCA with at least one backhoe trench. In addition, three areas of low-density surface scatters of marine shellfish remains, coral and water worn stones were also tested. Finally, we utilized several backhoe trenches to randomly sample subsurface conditions in the corridor that did not contain LCAs. As previously mentioned, controlled manual excavation was utilized to investigate Find 1, a human burial. Backhoe trench profiles were drawn, and maps compiled using metric survey tapes and hand-bearing compasses. Written notes were kept in the field, and photographs were taken with color film and a digital camera. No material culture remains were transported off-island and standard laboratory procedures and methods were utilized.

# ARCHAEOLOGICAL RESULTS

A total of 86 backhoe trenches were excavated during the course of the archaeological inventory survey. One previously unrecorded site (Site 50-50-03-5239) was identified during the course of the inventory survey. This site consists of an *in situ* human burial that was located during subsurface testing. Backhoe test results and Site 5239 are discussed below.

## Backhoe Trench Results

As previously noted above, 86 backhoe trenches were utilized to sample the project area. These trenches ranged from 5.5 to 7.5 meters in length by 0.7 meter in width by a maximum of 1.6 meters in depth. All trenches were excavated to weathered bedrock or sterile alluvial deposits. Table 2 provides a summary of backhoe trench results for the overall project. Representative backhoe trenches are briefly discussed below.

### Backhoe Trenches 1 through 18

This first series of backhoe trenches was excavated on the southern portion of the project area in the vicinity of a planned siltation basin and to the south of Kaua`ula Stream. Several of the backhoe trenches were utilized to assess subsurface conditions of the bulk of the Land Commission Awards that lie within the study corridor in this portion of the project area. However, it was not possible to test LCA 6900 To Keaweolu, LCA 4878-D to Kuapua, and LCA 356 R. P. 6221 to Moehauna because these areas had been mass excavated, apparently for siltation basins for an unrelated project before we could sample them (Photos 7 & 8).[16] There were two general stratigraphic sequences encountered in this part of the Flood Control project area.

[16] There were numbers of marine shells, some coral and waterworn basalt pebbles, and pig bone that were noted in the visible backdirt of these basins. It was not possible to fully inspect a large push pile of excavated soil that was located outside of the corridor.



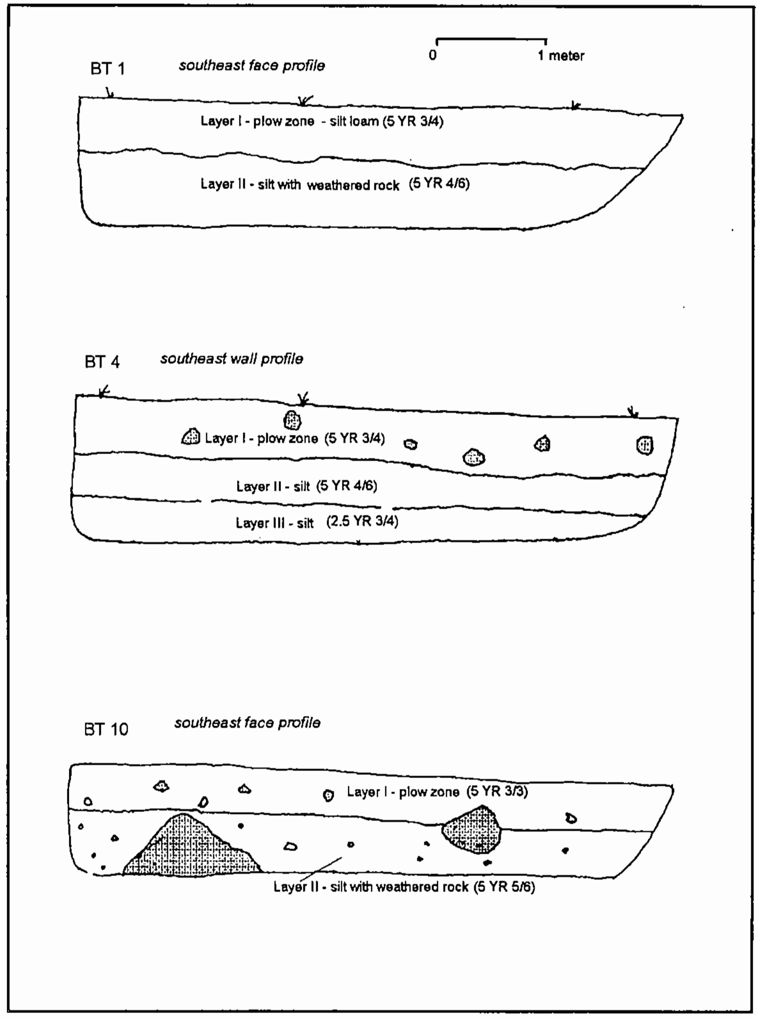



**Figure 3 - Representative profiles—BT 1, BT 4, and BT 10**

**Backhoe Trenches 1-3, 5, 7-12** (Figure 3)

These backhoe trenches contained two common soil layers, and Backhoe Trenches 1 and 10 are used as representative profiles. Several of the trenches were placed in surface locations that contained small amounts of weathered marine shellfish and coral, in an effort to assess whether any intact subsurface cultural layer(s) might exist.

Layer I consisted of dark reddish brown (5 YR 3/3 to 3/4) silty loam that was relatively rocky. This stratum is interpreted as the now former, commercial sugarcane plow zone and typically extended up to 60 cmbs in sampled locations. There was no evidence of an intact cultural layer encountered in any test instance. Modern material culture remains that were located included black plastic irrigation tubing, some pieces of concrete and broken bottle glass fragments.

Layer II was composed of reddish yellow (5 YR 6/6) to yellowish red (5 YR 4/6) silt with weathered bedrock. This rocky stratum extended to the bottoms of all of these backhoe trenches, which were abandoned due to very difficult digging conditions. There were no material culture remains noted in this layer.

**Backhoe Trenches 4 and 6** (Figure 3)

These two trenches contained the common Layers I and II that were present in the above group of trenches. However, it was possible to excavate through the Layer II yellowish red (5 YR 4/6) silt, because it contained little weathered rock. Layer III was made up of dark reddish brown (2.5 YR 3/4) silt with semi-rounded boulders and cobbles. This stratum was sterile, and excavation was halted because of very rocky subsurface conditions.

**Backhoe Trenches 13 through 18** (Figure 4)

These six trenches were placed in the vicinity of and south of Kauaula Stream and all yielded one or more water deposited layers. All of the trenches sampled Land Commission Awards that were partly contained in the corridor.[17] Most of these subsurface tests contained three soil layers.

Layer I was up to 70 cm thick in this area and is interpreted as the former commercial plow zone. There were no observed material culture remains noted in this previously disturbed dark reddish brown (5 YR 3/3 to 3/4) silty loam.

Layer II was up to 60 cm thick, and was composed of compact reddish yellow (7.5 YR 6/6) to strong brown (7.5 YR 4/6) silt. This compact stratum did not appear to contain any significant cultural materials.

[17] As noted earlier, it was not possible to test LCA 6900 to Keaweolu, LCA 4878-D to Kuapua, and LCA 356 R. P. 6221 to Moehauna because these areas were mass excavated for two siltation basins for an unrelated project before we could sample them.



Layer III consisted of alluvial deposits that ranged from terrestrial sand, silt and gravel to water worn pebbles and rocks. This loose layer did not appear to contain any material culture remains.

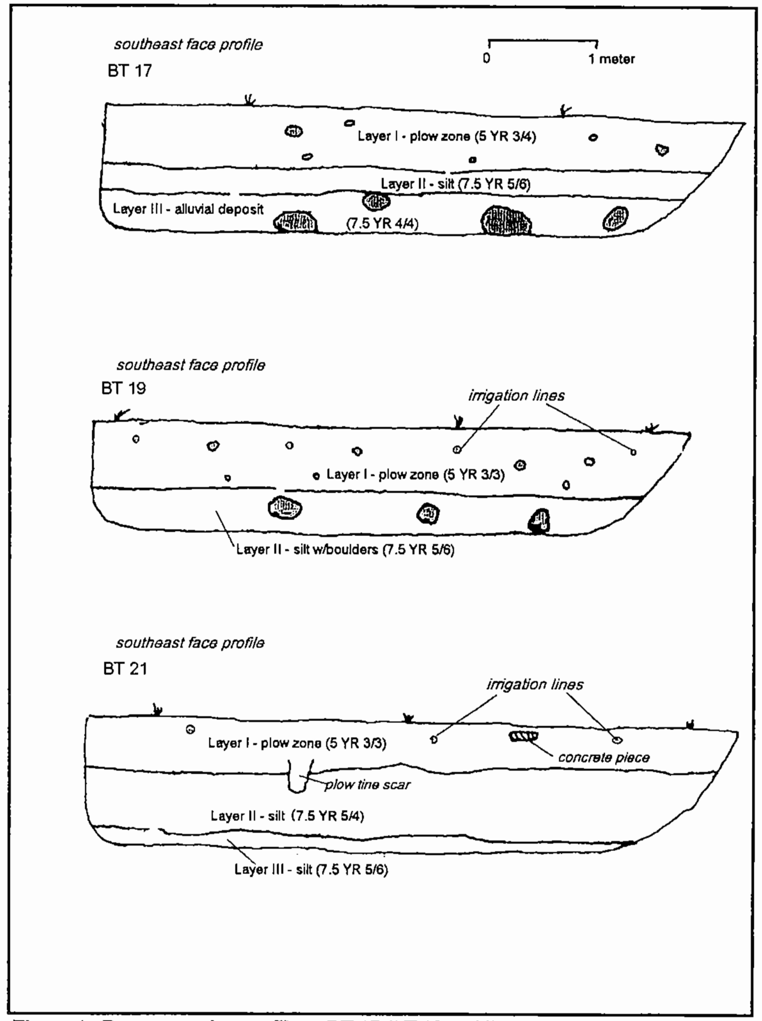



**Figure 4 - Representative profiles—BT 17, BT 19 and BT 21.**

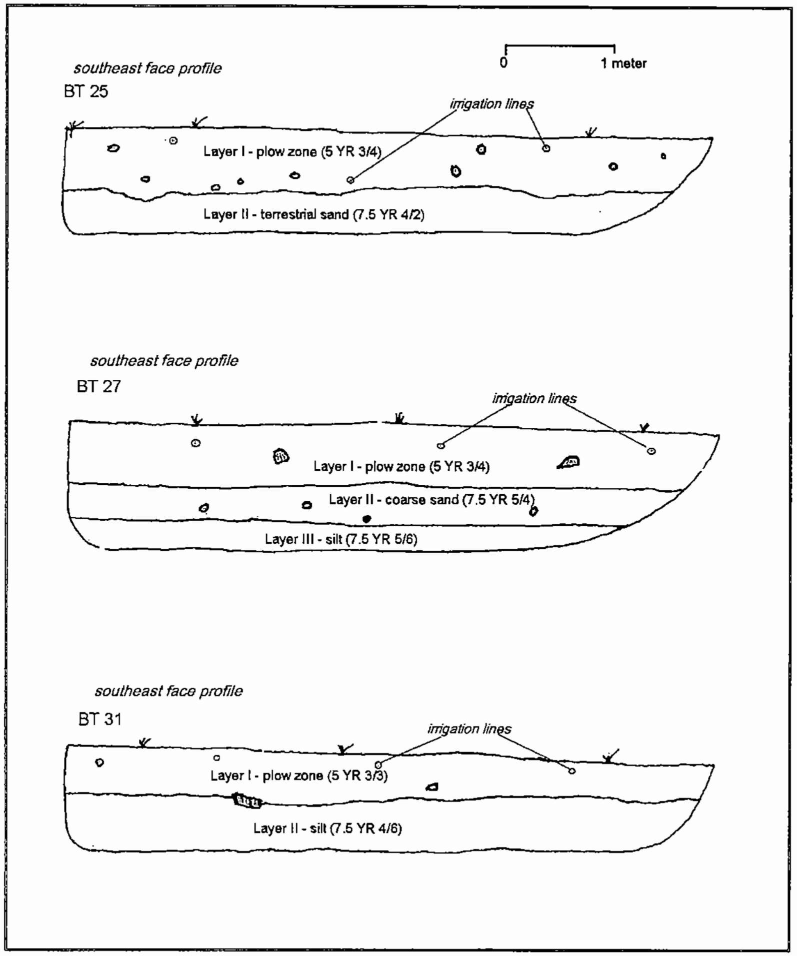



**Figure 5 - Representative profiles—BT 25, BT 27 and BT 31.**



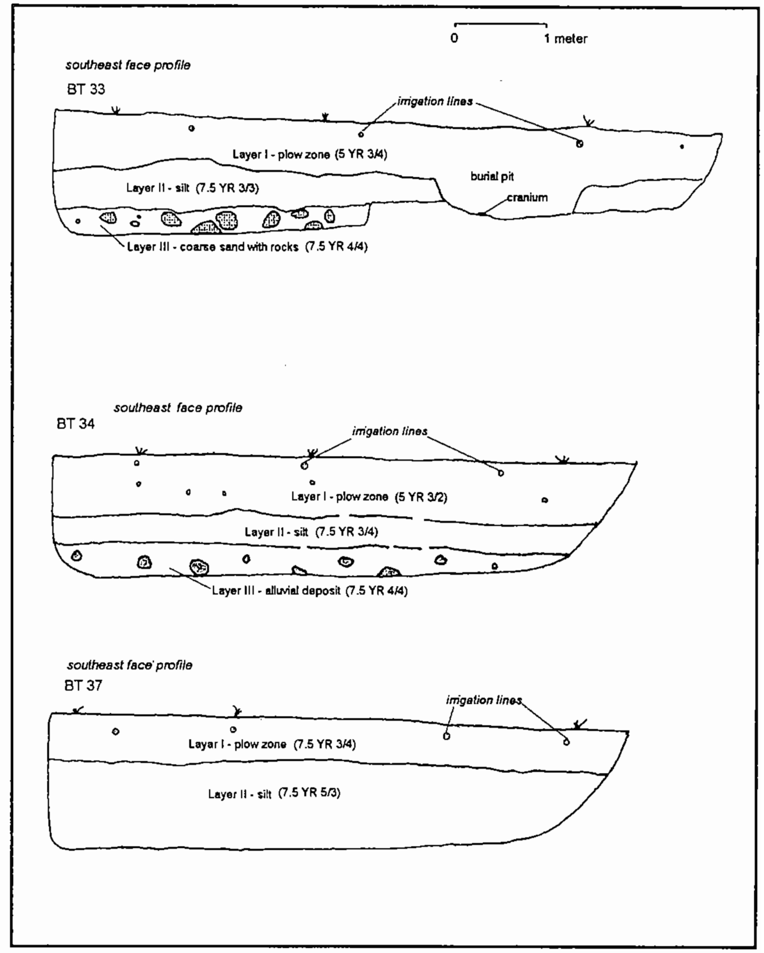



**Figure 6 - Representative profile of BT 33, BT 34 and BT 37.**

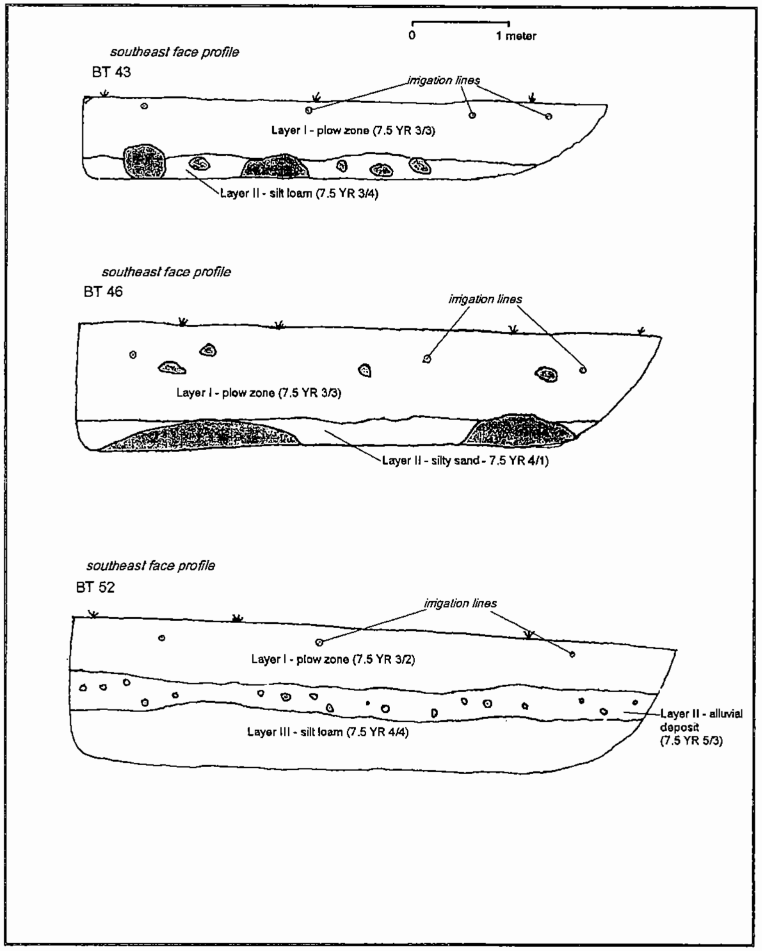



**Figure 7 - Representative profiles of BT 43, BT 46 and BT 52.**



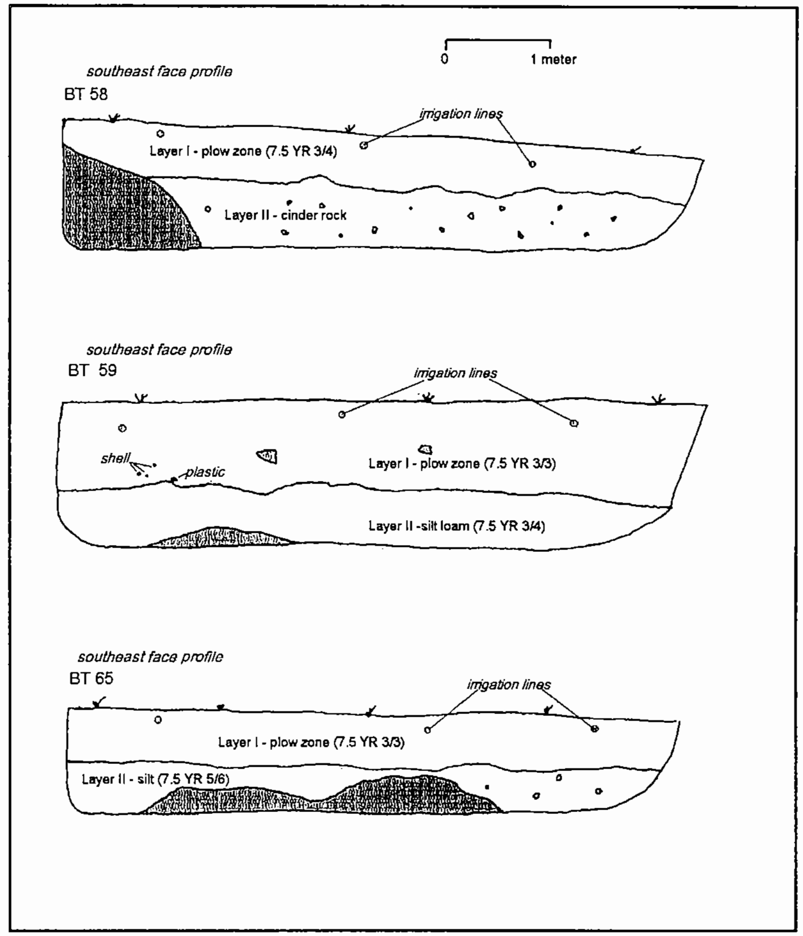



**Figure 8 - Representative profile of BT 58, BT 59 and BT 65.**

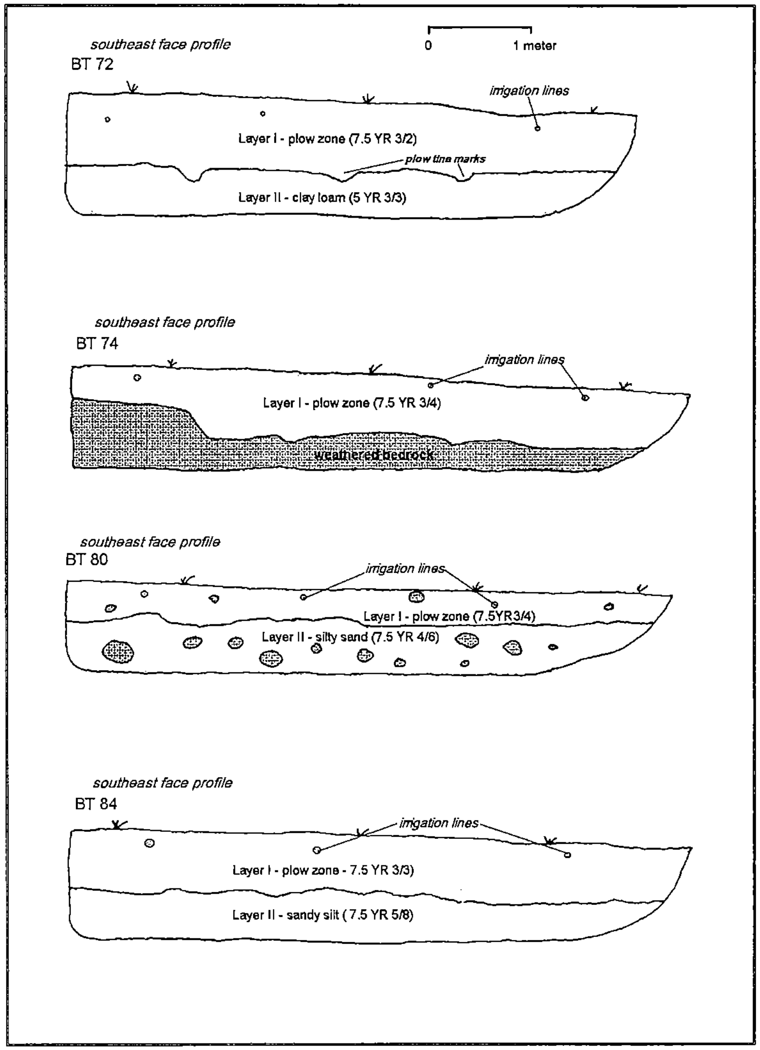



**Figure 9 - Representative profiles of BT 72, BT74, BT 80 and BT 84.**



## Backhoe Trenches 19-24, and 83-85[18] (Figures 4 & 9)

These nine trenches were used to test the area adjacent to and north of Kauaula Stream. In general, two types of stratigraphy were encountered in this series of trenches. Backhoe Trenches 19-22, 84 and 85 were composed of up to three soil layers, while BT 23-25 and 83 contained at least one alluvial layer.

### Backhoe Trenches 19-22, 84 and 85

All of these trenches contained the common plow zone soil—Layer I, which was made up of dark reddish brown (5 YR 3/3-3/4) silty loam. Black plastic irrigation lines were common in this slightly compact soil that was up to 70 cm thick. In addition, some broken pieces of concrete were noted in BT 21. Layer II was composed of strong brown (7.5 YR 4/6-5/6) silt that was very rocky. This stratum was up to 80 cm thick and did not appear to contain any material culture remains.[19] Layer III, when present, extended to the bottoms of BT 21 and 22. This strong brown (7.5 YR 4/6-5/6) silt overlaid weathered bedrock and also appeared to be sterile.

### Backhoe Trenches 23, 24 and 83

As previously noted, these trenches contained an alluvial deposit—in Layer II and/or Layer III. All of these trenches contained the plow zone—Layer I. Layer II (60-100 cmbs) of BT 23 was composed of brown (7.5 YR 5/3) coarse silty terrestrial sand, which did not appear to contain any cultural materials. Layer III consisted of brown (7.5 YR 5/3) to strong brown (7.5 YR 4/6) silty sand that extended to the bottom of the trenches. This loose stratum was sterile.

### Backhoe Trenches 25-51 and 77-82

This series of trenches tested the mid-portion of the project area, which also contains the most Land Commission Awards. Alluvial deposits were encountered in over 50% of these trenches, suggesting that this area to the north of Kauaula Stream was formerly well watered before the advent of sugarcane.

### Backhoe Trenches 26, 28, 29, 37, 39-42, 45, 47, 48-50, 79, 82 (Figures 6 & 7)

Common stratigraphy in these backhoe trenches without alluvial deposits consisted of—Layer I—dark reddish brown (5 YR 3/3) to brown (7.5 YR 5/3) silty loam. This stratum represents the plow zone, which was up to 80 cm thick in sampled locations.[20] Material culture remains noted in this disturbed layer consisted primarily of

[18] Breaks in the numerical sequence in this series and those that follow occur because some additional testing was undertaken near the end of the fieldwork phase of the inventory survey.
[19] Some slightly dark brown (7.5 YR 3/4) stained soil was located in Layer II of BT 21. This soil was screened through 1/8 inch hardware cloth in the field and did not yield any material culture remains. A bulk soil sample was recovered and subsequently floated in the lab, but did not yield charcoal.
[20] Layer I in Backhoe Trench 47 was 150 cm deep, but c. 100 cm of this appeared to have been pushed, possibly during previous field clearing activities.

black plastic irrigation tubing and some scattered pieces of concrete.[21] Layer II was composed of brown (7.5 YR 5/3) to strong brown (7.5 YR 4/4) silt. There were no cultural materials observed in this compact layer. Layer III, when present, was made up of reddish brown (5 YR 4/4) to brown (7.5 YR 5/4) silty loam. This compact stratum appeared to be sterile.

**Backhoe Trenches 25, 27, 30-36, 38, 43, 44, 46, 51, 52, 77, 78, 80 and 81** (Figures 5 & 7)

These trenches all yielded one or more alluvial layers. Layer I was composed of the common dark brown (7.5 YR 3/3-3/4) silty loam plow zone. Black plastic drip irrigation tubing was present in several trenches. This layer was up to 100 cm deep in sampled areas. Layer II was up to 60 cm deep and made up of brown (7.5 YR 5/3) to dark brown (7.5 YR 3/4) silt or silty sand that sometimes contained waterworn pebbles and cobbles. In all but one instance, this stratum was sterile. Layer III was composed of brown (7.5 YR 4/4) to strong brown (7.5 YR 5/6) alluvial gravel, waterworn pebbles and/or terrestrial sand. Backhoe Trench 33 located human remains and this site is discussed below.

## Site 50-50-03-5289 (Figure 10)

We located human remains during testing in Backhoe Trench 33 in the project corridor on the afternoon of 22 August 2002, in the vicinity of STA 32+00.[22] This portion of the project area was vegetated with young rattoon sugarcane, *koa haole*, and non-native weeds and grasses. Find # 1 was located during subsurface testing on LCA 5832 to Kaaumaiewa. This LCA consists of 4.35 acres, approximately half of which is contained in the project corridor. This particular LCA consisted of a *mo`o* and *kula* land.

The top portion of a human cranium was inadvertently disturbed during backhoe testing on this LCA. The cranium of an adult individual was found c. 90 cm below the existing surface of the abandoned sugarcane field. Several small waterworn cobbles were noted in what is interpreted as a burial pit.

### Evaluation of Find #1

The find was partially exposed by Backhoe Trench 33. Find #1 was manually cleared and all soil was screened through 1/8th inch hardware cloth. Three soil layers were present in this location.

Layer I (0-51 cmbs) consisted of dark reddish brown (5 YR 3/4) silty loam that contained 10% (by volume) semi-rounded pebbles and cobbles. This compact stratum represents the plow zone and contained plantation plastic irrigation line and some scattered pieces of concrete.

[21] One piece of coral water worn was found in Layer I of BT 26.
[22] STA stands for station, and each STA is equal to 100 feet. STA 32+00 lies 3,200 feet from the ocean outlet of the project corridor,



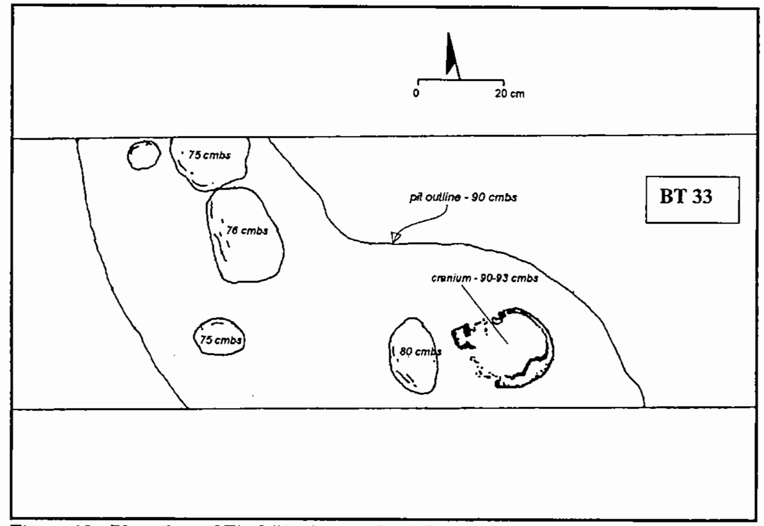



**Figure 10 - Plan view of Find #1—human burial.**

Layer II (51-100 cmbs) was composed of dark reddish brown (7.5 YR 3/3) silt. There were no cultural materials other than displaced human skeletal remains that were recovered from the screen in this stratum.

The Find #1 burial pit outline became noticeable at c. 51 cmbs and was up to 120 cm wide E-W (refer to Figure 6—BT 33). This pit was cleared to a maximum depth of 95 cmbs. One adult cranium with an articulated mandible was exposed, along with the outline of a pit and several waterworn cobbles. The cranium was lying on its right side, suggesting that this find is in flexed rather than an extended position. Further invasive excavation was not undertaken per the direction of the SHPD Maui office and the Maui/Lana`i Islands Burial Council.

Layer III (100-150 cmbs) was made up of coarse silty terrestrial sand with approximately 50% by volume of waterworn pebbles and cobbles. This stratum is interpreted as an alluvial deposit and did not yield any material culture remains.

### Discussion

This find is interpreted as an *in situ* burial. Given the location of this unmarked burial on LCA 5832 to Kaaumaiewa, and the lack of any recognizable post-contact trade goods in the pit, Find #1 is interpreted as a Native Hawaiian individual that was buried in this location over 50 years ago. The presence of this burial suggests that additional unmarked burials may be located in other LCAs in the Lahaina Watershed Flood Control project corridor as well as other LCAs in the general vicinity.

**Backhoe Trenches 53-76** (Figures 8 & 9)

These 24 trenches were excavated on the northern third of the study corridor. In general, trench stratigraphy tended to consist of two basic layers. Layer I, the disturbed plow zone, was up to 100 cm deep in sampled locations. This dark brown (7.5 YR 3/2-3/4) silty loam was relatively compact and often contained black plastic mulch and drip irrigation lines. Layer II, when present, was composed of brown (7.5 YR 4/4) to strong brown (7.5 YR 5/8) silt to silty loam with weathered rock and/or bedrock. This sterile stratum often overlaid bedrock. In Backhoe Trenches 57 and 60, a third stratum—Layer III was encountered. This sterile layer ended at bedrock and consisted of dark brown (7.5 YR 3/3) silty clay in BT 57 and dark brown (7.5 YR 3/4) clay in BT 60.

It is interesting to note that there was no subsurface evidence of alluvial deposits on this portion of the project area. The apparent lack of former surface water in this portion of the study area may explain why there are few Land Commission Awards located in this upper portion of the project corridor.

## Discussion of Backhoe Trench Testing Results

There was no evidence of an intact cultural layer encountered during subsurface investigation on any portion of the project area. It is estimated that nearly 100% of the study area has been heavily impacted by earth moving activities associated with commercial sugarcane cultivation. The plow zone in sampled areas typically ranged in depth from 50 to 100 cm. While there was no intact subsurface evidence of a precontact cultural layer located, several low density surface scatters of weathered marine shellfish remains and coral were noted in the area to the south of and just to the north of Kauaula Stream. While this surface evidence is somewhat circumstantial, it suggests that some of these areas may have formerly contained subsurface cultural deposits. However, it appears that commercial sugarcane cultivation has destroyed subsurface evidence of former occupation in Layer I in tested areas.

While sampled portions of Layer I did not contain any significant material culture remains, the presence of the Site 5239 burial on LCA 5832 to Kaaumaiewa in Layer II strongly suggests that some untested portions of the project area may contain partly intact cultural deposits and/or additional burials. It is important to reiterate that the plow zone ranged in depth from 50 to 100 cm in depth in tested portions of the project corridor, and Site 5239 was encountered at c. 90 cmbs.



# SUMMARY AND CONCLUSIONS

The pedestrian portion of the inventory survey did not locate any surface structural remains. Subsurface testing consisted of 86 backhoe trenches. Although the study corridor crossed numerous Land Commission Awards, the project area had been heavily impacted by land altering activities associated with commercial sugarcane cultivation, and no subsurface evidence was present.[23] Also, no recognizable precontact cultural layers were found during our testing.

One previously unidentified burial was located during testing in Backhoe Trench 33--located on LCA 5832 to Kaaumaiewa. While only a minimum amount of excavation was undertaken, the remains appeared to be a flexed burial, placed in a pit--suggesting a traditional Native Hawaiian burial. While the Land Commission Award data indicated that portions of the study parcel had contained taro *lo'i*, there was no subsurface evidence of taro cultivation identified. The lack of any intact precontact cultural layers, while not anticipated, is not surprising, since post-contact sugarcane cultivation altered both the surface and subsurface nature of the project area.

## Site Significance Evaluations

The following significance evaluations are based on the Rules Governing Procedures for Historic Preservation Review (DLNR 1996; Chapter 275). According to these rules, a site must possess integrity of location, design, setting, materials, workmanship, feeling and association and shall meet one or more of the following criteria:

**Criterion "a"**—Be associated with events that have made an important contribution to the broad patterns of our history;

**Criterion "b"**—Be associated with the lives of persons important in our past;

[23] The plow zone ranged in depth from 50 to 100 cm in depth in sampled portions of the project corridor

**Criterion "c"**—Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

**Criterion "d"**—Have yielded, or is likely to yield, important information for research on prehistory or history;

**Criterion "e"**—Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts.

Sites can be considered no longer significant when they qualify only under Criterion "d" and sufficient information has been collected from them during inventory survey level investigation.

Site 5239 qualifies for significance under Federal and State historic preservation guidelines Criterion "d" for its information content and Criterion "e" for its cultural value to the native Hawaiian people.

## Mitigation Recommendations

The Site 5239 burial retains its significance under both Criterion "d" and Criterion "e" of Federal and State historic preservation guidelines. Passive "as is" preservation is recommended for this burial site. At the writing of this report, it remains unclear whether this burial will be contained within the Lahaina Watershed Flood Control right-of-way. It appears that Site 5239 will be contained on County of Maui property if the final design for the project utilizes a grass-lined drainage swale. However, in the event that a concrete-lined drainage channel is chosen, the burial will likely lie *makai* (west) of the Flood Control Project easement, on private property.[24]

A conceptual preservation plan (E. Fredericksen, January 2003) was reviewed at the 30 January 2003 meeting of the Maui/Lana`i Islands Burial Council. At this time, the draft plan had been prepared with the understanding that the Site 5239 would be contained on the project area. However, a County of Maui Department of Public Works and Environmental Management representative indicated at the meeting that the final design for the project had not yet been worked out. Consequently, the Burial Council deferred action on formal acceptance of the plan. The conceptual plan, which calls for in-place preservation of the Site 5239 burial, was tentatively approved, assuming that the County of Maui chooses a grass-lined swale design (wider right-of-way) over the concrete-lined one. In the event that the concrete-lined design is chosen, this matter will need to be taken up again by the MLIBC and a new preservation plan will need to be prepared.

[24] This land (TMK 4-6-15: 01) is presently owned by Pioneer Mill Company, Ltd.



The elongated project corridor crosses some 41 Land Commission Awards. The presence of the Site 5239 burial on LCA 5832 strongly suggests that one or more additional burials may be contained in this LCA as well as other LCAs that will be crossed by the Lahaina Watershed Flood Control Project. Based on discussions with Dr. Melissa Kirkendall, SHPD Maui/Lana`i islands staff archaeologist, and members of the Maui/Lana`i Islands Burial Council, archaeological monitoring is recommended during construction of the Lahaina Watershed Flood Control Project. This step will help to mitigate adverse effects to any significant material culture remains and/or human burials that may be contained in untested portions of the project corridor.

## Table 2
## Summary of Backhoe Trench Results

| BT# | Dimensions L x D (m) | Stratigraphy | cmbs | Remarks |
|---|---|---|---|---|
| 1 | 5.50 x 1.20 | Layer I: dark reddish brown (5 YR 3/4) silt loam w/ 25% rock inclusion. | 0-50 | Layer I: sterile—plow zone |
| | | Layer II: yellowish red (5 YR 4/6) silt with weathered bedrock. | 50-120 | Layer II: sterile |
| 2 | 5.50 x 1.20 | Layer I: dark reddish brown (5 YR 3/4) silt loam w/ 30% rock inclusion. | 0-50 | Layer: sterile—plow zone |
| | | Layer II: yellowish red (5 YR 4/6) silt with weathered bedrock. | 50-110 | Layer II: sterile |
| 3 | 5.50 x 1.20 | Layer I: dark reddish brown (5 YR 3/4) silt loam w/ 30% rock inclusion. | 0-50 | Layer I: sterile plow zone |
| | | Layer II: yellowish red (5 YR 4/6) silt w/ weathered bedrock. | 50-120 | Layer II: sterile |
| 4 | 5.50 x 1.40 | Layer I: dark reddish brown (5 YR 3/4) silt loam w/ 20 % rock inclusion. | 0-60 | Layer I: sterile—plow zone |
| | | Layer II: yellowish red (5 YR 4/6) silt with weathered rock. | 60-90 | Layer II: sterile |
| | | Layer III: dark reddish brown (2.5 YR 3/4) silt. | 90-140 | Layer III: sterile |
| 5 | 5.50 x 1.30 | Layer I: dark reddish brown (5 YR 3/4) silt loam with 30% rock inclusion. | 0-60 | Layer I: sterile—plow zone |
| | | Layer II: reddish yellow (5 YR 6/6) silt with weathered bedrock. | 60-130 | Layer II : sterile |
| 6 | 5.50 x 1.10 | Layer I: dark reddish brown (5 YR 3/4) silt loam w/ 30% rock inclusion. | 0-40 | Layer I: sterile—plow zone |
| | | Layer II: yellowish red (5 YR 4/6) brown weathered rock. | 40-80 | Layer II: sterile |
| | | Layer III: dark reddish brown (2.5 YR 3/4) silt with semi-rounded boulders. | 80-110 | Layer III: sterile |
| 7 | 5.50 x 1.10 | Layer I: dark reddish brown (5 YR 3/4) silt loam w/ 20 % rock inclusion. | 0-50 | Layer I: sterile—plow zone |
| | | Layer II: yellowish red (5 YR 5/6) silt with weathered bedrock. | 50-110 | Layer II: sterile |
| 8 | 5.50 x 0.70 | Layer I: dark reddish brown (5 YR 3/4) silt loam. | 0-40 | Layer I: sterile—plow zone |
| | | Layer II: yellowish red (5 YR 4/6) silt with weathered bedrock. | 0-70 | Layer II: sterile |
| 9 | 5.50 x 1.00 | Layer I: dark reddish brown (5 YR 3/3) silt | 0-50 | Layer I: sterile—plow zone |

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| | | loam w/ 30% rock inclusion.<br>Layer II: yellowish red (5 YR 5/6) silt with weathered rock. | 50-100 | Layer II: sterile |
| 10 | 5.50 x 0.90 | Layer I: dark reddish brown (5 YR 3/3) silt loam w/ 30% rock inclusion.<br>Layer II: yellowish red (5 YR 5/6)silt with weathered rock and large boulders. | 0-50<br>50-90 | Layer I: plow zone—1 *Planaxis* shell—back dirt<br>Layer II: sterile |
| 11 | 5.50 x 1.00 | Layer I: dark reddish brown (5 YR 3/4) silt loam w/ 30% rock inclusion.<br>Layer II: reddish brown (5 YR 5/4) silt with weathered bedrock. | 0-50<br>50-100 | Layer I: plow zone, sterile<br>Layer II: sterile |
| 12 | 5.50 x 1.00 | Layer I: dark reddish brown (5 YR 3/3) silty loam.<br>Layer II: reddish brown (5 YR 4/4) silt with weathered bedrock. | 0-50<br>50-100 | Layer I: plow zone, sterile<br>Layer II: sterile |
| 13 | 5.50 x 1.40 | Layer I: dark reddish brown (5 YR 3/3) silty loam w/ 20% rock inclusion.<br>Layer II: compact reddish yellow (5 YR 6/6) silt w/ few rock inclusions.<br>Layer III: waterworn rock, coarse terrestrial sand and gravel (7.5 YR 4/4) . | 0-50<br>50-110<br>110-140 | Layer I: plow zone, sterile<br>Layer II: sterile<br>Layer III: sterile |
| 14 | 5.50 x 1.40 | Layer I: dark reddish brown (5 YR 3/3) silty loam.<br>Layer II: compact reddish yellow (7.5 YR 6/6) silt.<br>Layer III: waterworn material. | 0-70<br>70-110<br>110-140 | Layer I: plow zone, sterile<br>Layer II: sterile.<br>Layer III: sterile alluvial deposit. |
| 15 | 5.50 x 1.20 | Layer I: dark reddish brown (5 YR 3/3) silty loam.<br>Layer III: alluvial deposit (7.5 YR 4/2) | 0-50<br>50-120 | Layer I: plow zone, sterile<br>Layer II: sterile |
| 16 | 5.50 x 1.00 | Layer I: dark reddish brown (5 YR 3/3) silty loam.<br>Layer II: strong brown (7.5 YR 4/6) silt.<br>Layer III: alluvial deposit (7.5 YR 4/4) | 0-50<br>50-100<br>60-100 | Layer I: plow zone, sterile<br>Layer II: sterile<br>Layer III: waterworn deposit, sterile |
| 17 | 5.50 x 1.20 | Layer I: dark reddish brown (5 YR 3/4) silty loam w/ 50% rock inclusion.<br>Layer II: strong brown (7.5 YR 5/6) silt.<br>Layer III: waterworn material (7.5 YR 4/4). | 0-60<br>60-90<br>90-120 | Layer I: plow zone, sterile<br>Layer II: sterile<br>Layer III: sterile |
| 18 | 5.50 x 1.30 | Layer I: dark reddish brown (5 YR 3/3) silty loam w/ 30% rock inclusion.<br>Layer III: sandy silt w/ 50% rock (7.5 YR 4/4). | 0-40<br>40-130 | Layer I: plow zone, sterile<br>Layer II: sterile |
| 19 | 5.50 x 1.00 | Layer I: dark reddish brown (5 YR 3/3) silty loam w/ 30% rock inclusion.<br>Layer II: strong brown (7.5 YR 5/6) silt w/ 60% semi-rounded boulders. | 0-60<br>60-100 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 20 | 5.50 X 1.30 | Layer I: dark reddish brown (5 YR 3/4) silty loam w/ 15% rock inclusion.<br>Layer II: strong brown (7.5 YR 4/6) silt with sparse rock. | 0-50<br>50-130 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |
| 21 | 5.50 x 1.30 | Layer I: dark reddish brown (5 YR 3/3) silty loam.<br>Layer II: brown (7.5 YR 5/4) silt w/ sparse rock<br>Layer III: strong brown (7.5 YR 5/6) silt with sparse rock. | 0-50<br>50-100<br>100-130 | Layer I: plow zone w/ sparse concrete chunks and irrigation lines<br>Layers II and III: sterile |
| 22 | 5.50 x 1.20 | Layer I: dark reddish brown (5 YR 3/4) silty loam.<br>Layer II: brown (7.5 YR 5/4) silt with sparse rock. | 0-70<br>70-90 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |



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| | | Layer III: strong brown (7.5 YR 4/6) silt with sparse rock. | 90-120 | Layer III: sterile |
| 23 | 5.50 x 1.35 | Layer I: dark reddish brown (5 YR 3/3) silty loam w/ 10 % rock inclusion.<br>Layer II: brown (7.5 YR 5/3) silty coarse terrestrial sand.<br>Layer III: strong brown (7.5 YR 4/6) silt. | 0-60<br>60-100<br>100-135 | Layer I: plow zone w/ irrigation lines<br>Layers II and III: sterile |
| 24 | 5.50 x 0.70 | Layer I: dark reddish brown (5 YR 3/4) silty loam w/ 30% waterworn rock inclusion.<br>Layer II: brown (7.5 YR 5/3) sandy silt with 30% waterworn rock. | 0-40<br>40-70 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |
| 25 | 5.50 x 1.00 | Layer I: dark reddish brown (5 YR 3/4) silty loam w/ 30% waterworn rock.<br>Layer II: brown (7.5 YR 4/2) coarse terrestrial sand. | 0-60<br>60-100 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |
| 26 | 5.50 x 1.20 | Layer I: dark reddish brown (5 YR 3/4) silty loam w/ 30% rock inclusion.<br>Layer II: strong brown (7.5 YR 5/6) silt. | 0-50<br>50-120 | Layer I: plow zone w/ irrigation lines and 1 piece waterworn coral<br>Layer II: sterile |
| 27 | 5.50 x 1.30 | Layer I: dark reddish brown (5 YR 3/4) silty w/ 20% angular rock inclusion.<br>Layer II: brown (7.5 YR 5/4) terrestrial sand w/ water worn rock.<br>Layer III: strong brown (7.5 YR 5/6) silt. | 0-50<br>50-95<br>95-130 | Layer I: plow zone w/ irrigation lines and 3 pieces of coral<br>Layers II and III: sterile |
| 28 | 5.50 x 0.80 | Layer I: dark reddish brown (5 YR 3/3) silty loam w/ 70% semi-rounded rocks. | 0-80 | Layer I: plow zone w/ irrigation lines |
| 29 | 5.50 x 1.10 | Layer I: dark reddish brown (5 YR 3/3) silty loam w/ sparse rock inclusion.<br>Layer II: strong brown (7.5 YR 4/6) silt. | 0-50<br>50-110 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |
| 30 | 5.50 x 0.80 | Layer I: dark reddish brown (5 YR 3/4) silty loam w/ 50% sub-angular boulders.<br>Layer II: brown (7.5 YR 5/4) coarse terrestrial sand with boulders. | 0-60<br>60-80 | Layer I: plow zone w/ irrigation lines<br>Layer II sterile |
| 31 | 6.00 x 1.10 | Layer I: dark reddish brown (5 YR 3/3) silty loam w/ 10% semi-rounded and waterworn rock inclusion.<br>Layer II: brown (7.5 YR 5/4) silt. | 0-45<br>45-110 | Layer I: plow zone w/ irrigation lines<br>Layer II sterile |
| 32 | 5.50x 0.80 | Layer I: dark reddish brown (5 YR 3/4) silty loam w/ 30% rock inclusion.<br>Layer II: strong brown (7.5 YR 4/6) terrestrial sand w/ 70% waterworn boulders and cobbles. | 0-40<br>40-80 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |
| 33 | 7.50 x 1.30 | Layer I: dark reddish brown (5 YR 3/4) silty loam w/ 10% semi-rounded pebbles and cobbles.<br>Layer II: dark brown (7.5 YR 3/3) silt.<br>Layer III: coarse silty sand w/ 50% waterworn rock inclusion (7.5 YR 4/3). | 0-50<br>50-100<br>100-130 | Layer I: plow zone w/ irrigation lines<br>Layer II: human burial @ 90cmbs (Find #1).<br>Layer III: alluvial deposit, sterile. |
| 34 | 5.50x 1.20 | Layer I: dark reddish brown (5 YR 3/2) silt loam w/ 20% waterworn rock.<br>Layer II: dark reddish brown (7.5 YR 3/4) silt.<br>Layer III: alluvial deposit (7.5 YR 4/4). | 0-60<br>60-100<br>100-120 | Layer I: plow zone w/ irrigation lines<br>Layers II and III: sterile |
| 35 | 5.50 x 1.20 | Layer I: brown (7.5 YR 5/3) sandy silt w/ 40% waterworn cobbles and boulders.<br>Layer II: strong brown (7.5 YR 5/6) terrestrial sand. | 0-90<br>90-120 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |

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| 36 | 5.0 x 1.30 | Layer I: dark brown (7.5 YR 3/4) silt loam w/ sparse rock inclusion.<br>Layer II: brown (7.5 YR 5/4) sandy silt.<br>Layer III: brown (7.5 YR 4/4) silt with 20% semi-rounded cobbles. | 0-50<br>50-70<br>70-130 | Layer I: plow zone w/ irrigation lines<br>Layers II and III: sterile |
| 37 | 5.50 x 1.50 | Layer I: dark brown (7.5 YR 3/4) silt loam w/ sparse rock inclusion.<br>Layer II: brown (7.5 YR 5/3) silt w/ weathered rock. | 0-50<br>50-150 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |
| 38 | 5.50 x 1.20 | Layer I: dark brown (7.5 YR 3/4) silt loam w/ sparse rock inclusion.<br>Layer II: compact brown (7.5 YR 5/3) silt.<br>Layer III: brown (7.5 YR 5/4) fine silty sand. | 0-90<br>80-90<br>90-120 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile<br>Layer III: sterile |
| 39 | 5.50 x1.10 | Layer I: dark brown (7.5 YR 3/3) silt loam w/ sparse rock inclusion.<br>Layer II: compact, brown (7.5 YR 4/4) silt w/ semi-rounded boulders. | 0-50<br>50-110 | Layer I: plow zone w/ irrigation lines, one piece of concrete<br>Layer II: sterile |
| 40 | 5.50 x .90 | Layer I: dark brown (7.5 YR 3./3) silt loam with sparse rock inclusion.<br>Layer II: strong brown (7.5 YR 4/6) silt with 50% semi-rounded boulders. | 0-50<br>50-90 | Layer I: plow zone w/ irrigation lines and several concrete pipe fragments<br>Layer II: sterile |
| 41 | 5.50 x 1.20 | Layer I: dark brown (7.5 YR 3/4) silt loam.<br>Layer II: brown (7.5 YR 5/4) silt.<br>Layer III: reddish brown (5 YR 4/4) silt loam very rocky below 110cmbs. | 0-55<br>55-65<br>65-120 | Layer I: plow zone w/ irrigation lines, 1 piece of bottle glass<br>Layer II: sterile<br>Layer III: sterile |
| 42 | 5.50 x 1.50 | Layer I: dark brown (7.5 YR 3/2) silt loam.<br>Layer II: reddish brown (5 YR 4/4) silt loam w/ semi-rounded boulders, increasing w/ depth. | 0-70<br>70-150 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |
| 43 | 5.50 x 0.90 | Layer I: dark brown (7.5 YR 3/3) silt loam w/ semi-rounded rock.<br>Layer II: dark brown (7.5 YR 3/4) silt loam w/ 60-70% semi-rounded and waterworn rock. | 0-60<br>60-90 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |
| 44 | 5.50 x 1.40 | Layer I: dark brown (7.5 YR 3/4) silty loam w/ sparse rock inclusion.<br>Layer II: brown (7.5 YR 5/3) silty sand w/ 70% waterworn gravel and cobbles.<br>Layer III: brown (7.5 YR 4/3) silty loam w/ semi-rounded boulders at bottom. | 0-70<br>70-100<br>100-140 | Layer I: plow zone w/ irrigation lines.<br>Layer II: alluvial deposit, one faunal bone.<br>Layer III: sterile |
| 45 | 6.00 x1.30 | Layer I: dark brown (7.5 YR 3/4) silty loam w/ sparse rock inclusion.<br>Layer II: brown (7.5 YR 5/4) silt loam w/ 20% semi-rounded cobbles and boulders. | 0-80<br>80-130 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |
| 46 | 5.50 x 1.30 | Layer I: dark brown (7.5 YR 3/3) silty loam w/ 20% semi-rounded cobbles and boulders.<br>Layer II: dark gray (7.5 YR 4/1) silty sand w/ large boulders. | 0-100<br>100-130 | Layer I: plow zone w/ irrigation lines<br>Layer II: sterile |
| 47 | 5.50 x 1.50 | Layer I: dark brown (7.5 YR 3/4) silty loam w/ weathered rock. | 0-150 | Layer I: sterile plow zone w/ 1 meter cap of pushed soil |
| 48 | 5.50 x 1.10 | Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: brown (7.5 YR 5/4) silty gravel w/ weathered rock | 0-70<br>70-110 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 49 | 5.50 x 1.00 | Layer I: dark brown (7.5 YR 3/2) silty loam. | 0-60 | Layer I: plow zone with |



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| | | Layer II strong brown (7.5 YR 5/6) silty sand w/ weathered rock. | 60-100 | irrigation lines<br>Layer II: sterile |
| 50 | 5.50 x 0.90 | Layer I: dark brown (7.5 YR 3/4) silty loam w/ 20% sub-angular cobbles.<br>Layer II: strong brown (7.5 YR 5/6) silty gravel w/ decaying rock. Large boulders in base. | 0-50<br>50-90 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 51 | 5.50 x 1.00 | Layer I: dark brown (7.5 YR 3/3) silty loam w/ 10% sub-angular rock.<br>Layer II: strong brown (7.5 YR 5/6) silty gravel. | 0-55<br>55-100 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 52 | 5.50 x1.60 | Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: alluvial deposit (7.5 YR 5/3)<br>Layer III: brown (7.5 YR 4/4) silt | 0-70<br>70-100<br>100-160 | Layer I: plow zone with irrigation lines<br>Layers II and III: sterile |
| 53 | 5.50 x 1.00 | Layer I: dark brown (7.5 YR 3/3) silty loam.<br>Layer II: strong brown (7.5 YR 5/6) silt w/ weathered rock | 0-70<br>70-100 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 54 | 5.50 x 1.00 | Layer I: dark brown (7.5 YR 3/4) silty loam.<br>Layer II: brown (7.5 YR 4/4) silt w/ weathered rock. | 0-45<br>45-100 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 55 | 5.50 x 1.30 | Layer I: dark brown (7.5 YR 3/2) silty loam w/ sparse rock inclusion.<br>Layer II: strong brown (7.5 YR 5/8) weathered rock. | 0-100<br>100-130 | Layer I: sterile plow zone<br>Layer II: sterile |
| 56 | 5.50x 1.20 | Layer I: dark brown (7.5 YR 3/4) silty loam.<br>Layer II: brown (7.5 YR 4/4) clay loam. | 0-50<br>50-120 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 57 | 5.50 x 1.20 | Layer I: dark brown (7.5 YR 3/3) silty loam.<br>Layer II: brown (7.5 YR 5/3) silt with weathered rock.<br>Layer III: dark reddish brown (5 YR 3/3) silty clay w/ weathered bedrock. | 0-60<br>60-100<br>100-120 | Layer I: plow zone with irrigation lines<br>Layer II: sterile<br>Layer III: sterile |
| 58 | 5.50 x 1.10 | Layer I: dark brown (7.5 YR 3/4) silty loam.<br>Layer II: clinker rock | 0-60<br>60-110 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 59 | 5.50 x 1.40 | Layer I: dark brown (7.5 YR 3/3) silty loam (largely redeposited).<br>Layer II: compact, dark brown (7.5 YR 3/4) silty loam w/ large boulders in base. | 0-100<br>100-140 | Layer I: plow zone through recent refuse area w/ modern materials and shell<br>Layer II: sterile |
| 60 | 5.50 x 1.20 | Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: strong brown (7.5 YR 5/6) silt w/ weathered rock.<br>Layer III: dark brown (7.5 YR 3/4) clay. | 0-40<br>40-100<br>100-120 | Layer I: plow zone w/ irrigation lines<br>Layers II and III: sterile<br>Trench terminated at bedrock |
| 61 | 5.50 x 1.00 | Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: dark brown (7.5 YR 3/3) clay with weathered bedrock. | 0-60<br>60-100 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 62 | 5.50 x 1.00 | Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: strong brown (7.5 YR 5/6) weathered bedrock. | 0-40<br>40-100 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 63 | 5.50 x 1.10 | Layer I: Layer I: dark brown (7.5 YR 3/3) silty loam.<br>Layer II: strong brown (7.5 YR 4/6) silt w/ weathered rock. | 0-60<br>60-110 | Layer I: plow zone contains irrigation lines, few concrete pipe fragments<br>Layer II: sterile |
| 64 | 5.50 x 1.00 | Layer I: Layer I: dark brown (7.5 YR 3/2) silty loam. | 0-60 | Layer I: plow zone with irrigation lines |

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| | | Layer II: dark brown (7.5 YR 3/4) silt w/ weathered bedrock. | 60-100 | Layer II: sterile |
| 65 | 5.50 x 0.90 | Layer I: Layer I: dark brown (7.5 YR 3/3) silty loam.<br>Layer II: strong brown (7.5 YR 5/6) silt w/ weathered bedrock. | 0-60<br>60-90 | Layer I: plow zone with irrigation lines and a few pieces of conerete<br>Layer II: sterile |
| 66 | 5.50 x 1.20 | Layer I: Layer I: dark brown (7.5 YR 3/4) silty loam.<br>Layer II: weathered bedrock. | 0-90<br>90-120 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 67 | 5.50 x 0.90 | Layer I: Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: weathered bedrock. | 0-60<br>60-90 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 68 | 5.50 x 1.20 | Layer I: Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: weathered bedrock. | 0-70<br>70-120 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 69 | 5.50 x 1.00 | Layer I: Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: weathered bedrock. | 0-80<br>80-100 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 70 | 5.50 x 1.30 | Layer I: Layer I: dark brown (7.5 YR 3/4) silty loam.<br>Layer II: strong brown (7.5 YR 5/6) silt w/ weathered bedrock. | 0-70<br>70-130 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 71 | 5.50 x 1.10 | Layer I: Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: strong brown (7.5 YR 4/6) silt w/ weathered bedrock. | 0-50<br>50-110 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 72 | 5.50 x 1.20 | Layer I: Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: dark reddish brown (5 YR 3/3) clay loam weathered bedrock. | 0-80<br>80-120 | Layer I: plow zone with irrigation lines.<br>Layer II: sterile. |
| 73 | 5.50 x 1.25 | Layer I: Layer I: dark brown (7.5 YR 3/4) silty loam.<br>Layer II: reddish (5 YR 4/3) brown clay in weathered bedrock. | 0-80<br>80-125 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 74 | 5.50 x 0.70 | Layer I: Layer I: dark brown (7.5 YR 3/4) silty loam, terminates at bedrock. | 0-70 | Layer I: plow zone with irrigation lines |
| 75 | 5.50 x 0.50 | Layer I: Layer I: dark brown (7.5 YR 3/3) silty loam, terminates at bedrock. | 0-50 | Layer I: sterile plow zone |
| 76 | 5.50 x 0.80 | Layer I: Layer I: dark brown (7.5 YR 3/4) silty loam.<br>Layer II: weathered bedrock. | 0-45<br>45-80 | Layer I: sterile plow zone<br>Layer II: sterile |
| 77 | 5.50 x 0.90 | Layer I: Layer I: dark brown (7.5 YR 3/4) silty loam w/ 10% semi-rounded cobbles.<br>Layer II: brown (7.5 YR 4/4) silty terrestrial sand w/ 50% semi-rounded boulders. | 0-50<br>50-90 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 78 | 5.50 x 1.00 | Layer I: Layer I: dark brown (7.5 YR 3/3) silty loam.<br>Layer II: dark brown (7.5 YR 3/4) sandy silt w/ 50% waterworn rock. | 0-60<br>60-100 | Layer I: plow zone with irrigation lines.<br>Layer II: sterile. |
| 79 | 5.50 x 1.10 | Layer I: Layer I: dark brown (7.5 YR 3/2) silty loam.<br>Layer II: strong brown (7.5 YR 5/6) silt w/ 50% semi-rounded rock in base. | 0-70<br>70-110 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 80 | 5.50 x 0.80 | Layer I: Layer I: dark brown (7.5 YR 3/4) silty loam w/ 30% semi-rounded rock.<br>Layer II: strong brown (7.5 YR 4/6) silty sand w/ 60% waterworn rock. | 0-40<br>40-80 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 81 | 5.50 x 1.30 | Layer I: Layer I: dark brown (7.5 YR 3/4) silty loam w/ 30% semi-rounded rock.<br>Layer II: brown (7.5 YR 4/4) sandy silt.<br>Layer III: brown (7.5 YR 5/3) silty sand w/ | 0-60<br>60-100<br>100-130 | Layer I: plow zone with irrigation lines<br>Layer II: sterile<br>Layer III: sterile |



| | | | | |
|---|---|---|---|---|
| | | 30% semi-rounded rock. | | |
| 82 | 5.50 x 1.10 | Layer I: Layer I: dark brown (7.5 YR 3/4) silty loam w/ 20% semi-rounded rock.<br>Layer II: brown (7.5 YR 5/3) silt w/ 50% semi-rounded rock. | 0-60<br>60-110 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 83 | 5.50 x 1.30 | Layer I: Layer I: dark brown (7.5 YR 3/3) silty loam.<br>Layer II: grayish brown (10 YR 5/2) coarse silty sand.<br>Layer III: brown (10 YR 5/3) sandy silt. | 0-60<br>60-100<br>100-130 | Layer I: plow zone with irrigation lines, one pig phalanx<br>Layers II and III: sterile |
| 84 | 5.50 x 1.10 | Layer I: dark brown (7.5 YR 3/3) silty loam.<br>Layer II: strong brown (7.5 YR 5/8) sandy silt. | 0-70<br>70-110 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 85 | 5.50 x 1.00 | Layer I: dark brown (7.5 YR 3/3) silty loam.<br>Layer II: compact dark brown (7.5 YR 3/4) silty loam with semi-rounded boulders. | 0-60<br>60-100 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |
| 86 | 5.50 x 0.80 | Layer I: dark brown (7.5 YR 3/3) silty loam w/ 20% semi-rounded boulders.<br>Layer II: coarse brown (7.5 YR 4/4) silty sand with 60% waterworn rock. | 0-40<br>40-80 | Layer I: plow zone with irrigation lines<br>Layer II: sterile |

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## Photographs of project area

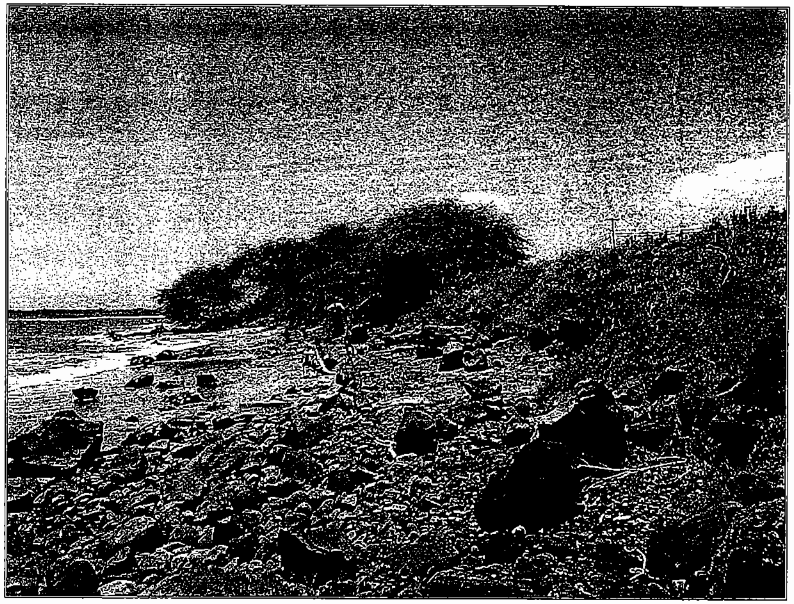


Photo 1 – General view of coastline—just *makai* of Honoapi`ilani Highway at southern extent of project area. View to the north.



Photo 2 – Project area looking to the north—*mauka* of highway.

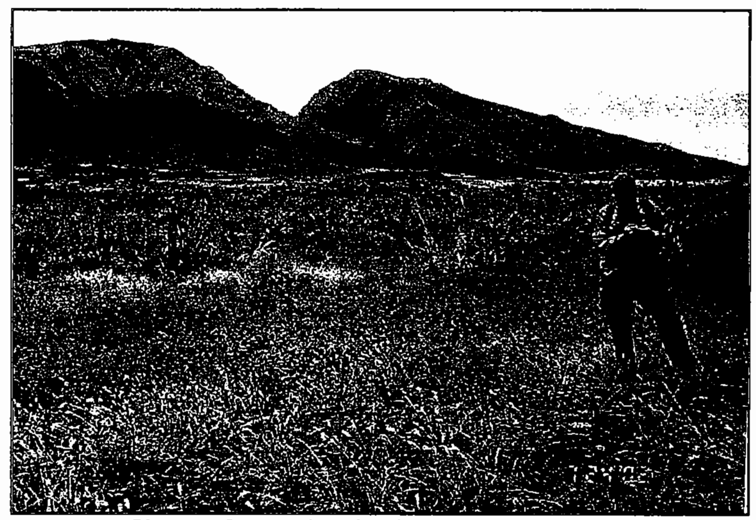


Photo 3 – General view of project area—looking east.

Photo 4 – Recording backhoe trench—view to the west.

Photo 5 – Two views of old Portuguese oven in vicinity of former Waine'e Camp—which lies outside project boundary.



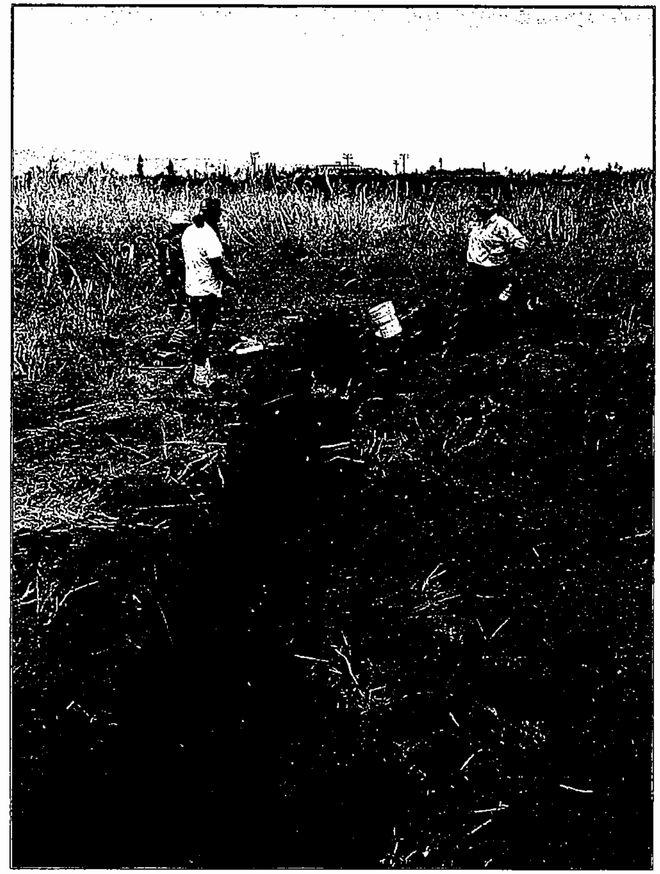


Photo 6 – Backhoe Trench 33—in which a human burial was found. (l. to r.—Mark Donham, William Waiohu, member of the Maui and Lanai Islands Burial Council, and Jennifer Frey).

**Photo 7 – Mr. Waiohu examining 1 of 2 large siltation basins which bifurcated the watershed corridor in vicinity of Kauaula Stream.**

**Photo 8 – Mr. Waiohu pointing out material moved by bulldozer activity. Note second drainage basin in background.**



# Appendix A

## Exerpts from Testimonies[25]

### 345B, Kaawa, Lahaina, Maui, December 28th

N.R. 96v2
Greetings to the Land Comissioners:
Here is my little thought to your. My little lot is southeast of Kapoulu. I want it to be entered and worked on by the government. I am, with thanks to you all,
S.S. Kaawa

N.T. 111v2
Kanae, sworn, Paunau's property is toward the mountain just seaward of Kaleikini's property. He had received it from his wife who had obtained it from her first husband. Kekipa had received it from Maluo (he is the first husband of the wife of Kaawa). When Kekipa had it in the year 1839 it had been fenced by kaawa in the year 1838, but the original fence was a poor one.

Kaawa'a brother-in-law (Nui) had objected so the officers of the law passed that it (land) was for the two of them, (however) should one of then err in the future the other would get the entire property and when Kaawa had put up a fence his brother-in-law did not do this, too.

Kahula, sworn, What that person there just said is what I have know. How bad these two people were is what I have seen, but the property belongs to only one person—Kaawa. When Kekipa died, it was willed to Kaawa. Kaawa enclosed the property. I did not see them (two) working together. Afterwards and recently the lot was divided and it was Kaawa's own means which were spent for the lot and with his own hands he had worked on the land.

N.T 192v2, p. 111

[25] Source of data is Waihona Aina Corp. (www.waihona.com).

Kanae, sworn by the Word of God, I know about the time we were living together there. Kaawa had received his interest from Kekipa and Kekipa received this interst from Maluo. Kaawa's wife had received that place just prior to Nahienaena's death. That is her interest which he is claiming. The fater of Kapihe had fenced this place and Kaawa again had put up a high fence withle his brother-in-law demanded to cut the fence. Kaawa's claim was filed while in the meantime objections were raised; therefore, it (case) was left for the judge to decide, after which the officers who quiet land titles may again file for a claim.

**[Award 345B; R.P. 5633. Paunau Lahaina; 1 ap.; 1 Ac. 32 rods]**

## 3424B, Kaleleiki

F.T. 13v15
Nalimanui, sworn, says she knows the House Lot of Claimant in Waianaeiki, Lahaina. Claimant got this place from his sister before the death of Kinau. His title to it has never been disputed. It is enclosed and the fence is the proper boundary.

It is bounded:
Mauka by Kahikona's land
Olowalu by Kalua's land
Makai by Keawe's land
Kaanapali by School House & Ninia's land.

Pahia, sworn, says he knows Claimant's lot in Waianaeiki. It is a House Lot. He confirms in full the testimony of the last witness. See p. 31

F.T. 31v15
No. 3424B, Keleleiki, from page 13

Claimant appeared in person and stated that his claim for land in "Aki" and "Waianaeiki" and "Pahoa," Lahaina, was heard by Mr. Richards and subsequently surveyed by Mr. Alexander. He says also that the widow of Namaau, deceased or Mr. Kekuanaoa, have set up a counter claim to the land in Pahoa, and Claimant objects to their getting an award until he has opportunity to be heard. He has a claim also in Ukumehame.

F.T. 53-54v15
No. 3424B, Keleleiki, (from p. 31)

Upai, sworn, says he knows the piece of land in "Pahoa," Lahaina, claimed by Kaleleiki and disputed by Kekuanaoa. It is a large piece and is enclosed by a stone wall built by the father-in-law of claimant in the year 1844. She received this lot from Pawaa, her father, who got it from Nalehu, the former Konohiki, under Namauu, in 1844. Pawaa died in 1847 and left this place to claimant's wife, who has always cultivated it. There is a poalima patch in this lot belonging to the Konohiki.



(The Konohiki's Agent says he does not dispute the right of claimant, but wishes to have the Konohikis' portion distinctly marked out)

**[Award 3424B; R.P. 8251; Aki Lahaina; 1 ap.; 12 roods; Pahoa Lahaina; 1 ap.; 8 Acs 30 rods; Waianae Lahaina 1 ap.; 2 roods 27 rods; Waianae iki Lahaina; 1 ap.; 2 roods 38 rods]**

## 4804, Hesetia Nui, January 18/48

N.R. 202-203v6
Greeting to the Land Commissioners of the Hawaiian Kingdom: I hereby state my claim for land at Paunau, Island of Maui.

There are 15 lo`I, also a kula in this same Pauku. It has been held peacefully, with no opposition, and I am under the konohiki, until this time. There are two lo`I Makai of Paunau, which have never been disputed.
I am, your obedient servent;
H.NUI

F.T. 13-14v7
17 kalo patches, Lahaina mauka and 1 house lot makai Lahaina.

Nana, sworn, I know these lands, the house lot is at Paunau Lahainawaena.

Mauka is yard of Umiumi
Olowalu is a dry creek
Makai is Kaawa
Kaanapali is Lahainaluna road.
It has a fence which is the true boundary.

Claimant had this land from his father, who, together, have held it undisputed from Kamehameha I's time.

Claimant has 17 kalo patches, 15 of them lie in the velley above Lahainaluna and are in one lot.
Mauka are the lois of Umiumi
Olowalu is the creek and Makai
Kaanapali is the precipice.
Kekuanaoa has 1 loi within these bounds.

The other 2 lois are at Lahainalalo
Mauka are Kanaina's lois
Olowalu is Paunau water course
Makai is yar of Aki
Kaanapali is "Kapawakua" of Beke.

These kalo lands he had from his parents, and they have been in the undisturbed possession of his family from the time of Kamehameha I.

Poalima is Victoria's.

**[Award 4804; R.P.1683; Paunau Lahaina; 3 ap.; 1.03 Acs]**

## 4878BB, Honu, Part 24, June 1, 1849

F.T. 39v7
Kauhikapa, sworn, I know the land of the claimant. They are in "Makila", Lahaina and consist of 2 pieces. In one is a house lot and kula. The other is not in "Makila" but is in Alio and is kalo land.

The kalo land which is one loi I gave to the claimant in 1837 and he has occupied it in peace ever since. The house lot and kula he received from Makaena in 1837 and he has not been disputed in his title to this piece.

The house lot and kula are bounded:
Mauka aby the land of Pupuka
Olowalu by the dry creek bed
Makai by the main rod of Lahaina
Kaanapali by thi land of Kekua.

The kalo land is bounded:
Mauka and Olowalu sides by my lois
Makai by the poalima lois of Serang or Victoria
Kaanapali by Kainaiki

**[Award 4878BB; R.P. 4506 & 3585; Makila, Lahaina; 1 ap.; 1 rood 9 rods; Makila Lahaina; 1 ap.; 2 roods 23 rods]**

## 4878C, Muaa

F.T. 27v7
Nalehu, sworn, I know these lands, being 17 lois, a house lot and kula in 1 piece. The lois are scattered all in "Pahoa," Lahaina. Claimant had these lands from Maele in 1839 and ever since held them in peace.

The piece containing the house lot & most of the kula is bounded:
Mauka by waste kula of Pahoa
Olowalu by Kapua's land
Makai by Olowalu main road
N.(Kaanapali) by the kula of Kauahamano.

Claimant has another kula farther Mauka:
Mauka is the pali
Olowalu is kula of Polanui
Makai by land of Hone
N.(Kaanapali) by Pikanele.



Two of his lois are in one piece:
Mauka is Upai's lois
Olowalu and Makai and Kaanapali by my lois.

Another piece further makai in the creek contains 15 lois:
Mauka is Kawahamano's lois
Olowalu is baren pali
Makai is Hone's lois
Kaamapali by pali & creek.

**[Award 4878C; P.R. 1696; Pahoa Lahaina; 1 ap.; 6 Ac 26 rods; Anapenape Pahoa Lahaina; 1 ap.; 2 roods 28 rods]**

## 4878EE, Makaiole, wahine

F.T. 167-168v7
Manae Wahine, sworn, I know the lands of the claimant in Puaanui, Lahaina. They consist of 6 pieces: One Pahale, two pieces of Kula, 5 moos of kula, suparated in two pieces, one pieces of 1 moo, and the other 4 moos, and the other two in Waineenui, one piece of 5 lois and the other piece of one loi and kula.

The claimant received the first six pieces from Kakelihi in 1851 and the two pieces in Waineenui in 1831 and her title has never been disputed up to the present time. Exect for the 5th piece, which was disputed, and taken away by Kahue in 1848, at the first she had 5 moos in this piece, but in 1838 she gave it to the king, and in 1848 Kalua, the konohiki, took away the 4 remaining.

The first piece in Puaanui of Pahale is bounded:
Mauka by Kooka
Olowalu by Kaakanauna
Makai by Pahine
Kaanapali by Kaeo's land.

The 2nd piece of kula is bounded:
Mauka by Kalaoa's land
Olowalu and Makai by the same
Kaanapali by Kaha's land.

The 3rd piece of one moo of kula is bounded:
Mauka by Niiki'a lot
Olowalu by Kalaoa's lot
Makai by the same
Kaanapali by Kaha's lot.

The 4th piece of kula is bounded:
Mauka and Olowalu sides by Kaha's lot

Makai by another person not know
Kaanapali by Kaeo land.

The 5th piece of 4 moos of kula [pasture] is bounded:
Mauka by Kaha's lot
Olowalu by Kuahamauna
Makaia by the Government road
Kaanapali by Kaeo's land.

The 6th piece of kalo and kula land is bounded:
Mauka by Haualolua [?]
Olowalu by Kalaoa
Makai and Kaanapali by "Puehuehunui".

The first piece in Wainee, of kalo of 5 lois, is bounded:
Mauka by Laahili's land
Olowalu by "Kooka"
Makai by Kalaipahala
Kaanapali by Namaka's land.

The last piece of one loi and kula is bounded:
Mauka by Naai
Olowalu by Polanui
Makai and Kaanapali by Naai.
**[Award 4878EE; R.P. 2737; Puaa Lahaina; 3 ap.: 5 Acs 1 rood 9 rods; Pukalale Puaa Lahaina; 1 ap.; 1 Ac. 2 roods; Waianae Lahaina; 1 ap.l 25 rods; Wainee Lahaina; 1 ap.l 2 Acs 2 roods 9 rods]**

### 4878G, Malaekahana, part 6

F.T. 29v7
Mahaulea, sworn, I know the land of claimant. They are in Polanui, Lahaina, and consist of three distinct pieces. One kalo land and two patches of kula. There is a house lot beside this.

Claimant has these lands from a woman, Kamane's wife. This was in 1835, I think, and he has never been disputed in his title to the present time. I am the head man of Polanui under Kanaina.

One piece of kula containing two moos is makai and is bounded:
Mauka by Kanaina poalima lois
Olowalu by the land of Makuwahine
makai by the yard of Kaoo
On the other side by the same.

The mauka piece of kula is fenced, and the fence is the correct boundary
Mauka of it is the kula of mine
Olowalu is Puunoa



Makai is Polaiki's land
on the other side is the land of Koalakai.

The house lot has two houses on it and is bounded:
Mauka by the land of Makuwahine's land
Olowalu by John White's land
Makai the road to Olewalu
On the other side by the land of Kapuwanui.

The kalo land contains 10 lois and it is bounded:
Mauka by Alio
Olowalu by the same
Makai by the poalima lois of Kanaina
Kaanapali by Kaiwi.

**[Award 4878G; R.P. 1959; Polanui Lahaina; 3 ap.; 8 Acs 49 rods; R.P. 2742; Polanui Lahaina; 1 ap.; 13 rods; See 4878 for Native Register document; (Awardee index lists R.P. 1959 as 2 Acs 49 rods?)]**

### 4878KK, Kelea, Part 32, June 1, 1849

F.T. 43v7
Pupuka, sworn, I know the lands of the claimant. They consist of [a] section of kalo patches on "Puehuehueiki" and a house lot and kula and loi on "Makila".

The claimant obtained these lands in the days of King Liholiho from Kalekana [?], and has possession [of] them in peace ever since.

The piece on "Makila" is bounded:
Mauka by my land
Olowalu by the creek
Makai by the main road of Lahaina
Kaanapali by the land of Kanehiwa.

The piece of kalo land is bounded:
Mauka by the land of Laahili
Olowalu by the same
Makai by the lois of Haukolea [?]
Kaanapali by the lois of Keawekane.

**[Award 4878KK; R.P. 4429; Makila Lahaina; 1 ap.; 1 rood 78 rods; no R.P.; Polaiki Lahaina; 1 ap.; 12 rods]**

### 4878Y, Mamaka, Part 22, June 1, 1849

F.T. 38v7
Waihoioaku, sworn, I know the lands of the claimant. They consist of 2 pieces of kula and one piece of both kula and kalo land. They are all in "Halakaa."

Claimant received these lands from Unele in 1845 and he has been [in] undisturbed possession ever since. The Lord of this land is Kaeo.

The makai kula is bounded:
Mauka by the yard of Kapu
Olowalu by the land of Paikaualani
Makai by the land of Hulu
Kaanapali by Paunau ekolu.

The next piece is bounded:
Mauka by the land of Kaiwikaola
Olowalu by the land of Kupalii
Makai by the lois of Paikaualani
Kaanapali by the creek.

See page 77 V. 15

F.T. 77v15
No. 4878Y, Mamaka, Lahaina, 24th August 1853, from page 38v7

Unele, sworn, says he knows the three first pieces set forth in the survey of this claim made by W.P. Alexander. The claimant received these pieces of land from the witness who is Luna of "Halakaa," under Kaeo, in the year 1844 and no one disputes the claim.

Witness as Luna objects to apana 4 situated in "Kauaula."

(Muolo, the widow and heir of claimant withdraws all claim to Apana 4)

**[Award 4878Y; R.P. 2718; Halakaa Lahaina; 3 ap.; 1.19 Acs; Mamaka for Muolu; See 4878 for Native Register document]**

### 5832, Kaaumaiewa, 22 January 1848

N.R. 334v6
To the Land Commissioners, Greetings: I, Kaaumaiewa am a petitioner for my land claim. It is a pauku of land, one mo`o, and a kula. It is finished, except for a portion in another place. That is my land claim which is stated to you. The name /of the land/ is Kamani. It is in Lahaina waena, adjoining Polanui.
KAAUMAIEWA

F.T. 5v7
Cl. 5832, Kaaumaiewa

Claimant said his only proper witness was Kaniau now in Hamakua from whom he has the land.



Moku, sworn, I am luna ahau of Lahaina. I know claimant's land. It is in one piece and a section in the ahupuaa of Kamani.

Bounded:
Mauka by Kanaina's Polanui
Olowalu by Punau
Makai by Kanaian's
Kaanapali by Polanui.

**[Award 5832; R.P. 1157; Kamani Lahaina; 1 ap.; 4.35 Acs]**

### 6210, Kapuka

F.T. 103-104v7
Pupule, sworn, the land of the claimant is in "Makila," Lahaina. It is a house lot and one loi.

The claimant received it from Pupuka, in the days of Hoapili and his title has never been disputed.

It is bounded:
Mauka by Pupuka's land
Olowalu by the creek of Makila
Makai by Pupuka's land
Kaanapali by Maimai's land.

**[Award 6210; R.P. 2706; Makila Lahaina; 1 ap.; 2 Acs 12 rods; See 6203, N.R. 555v6 for Native Register document]**

### 6211, Maimai, a blind man

F.T. 104v7
H. Maka[?], sworn, the claimant's land is in "Makila," Lahaina. It is an one-piece patch and loi of kalo [?] of the kula is joined to one of its kalo lands. I know there are only 3 distinct pieces.

The claimant received them from Kaulunae in the year 1841 and has held them in peace ever since.

The first piece makai is bounded:
Mauka by the poalima
Olowalu by Kaapuiki's land
Makai by Paele's land
Kaanapali by Kalehuula's land.

The 2d piece is bounded:
Mauka by Pii's land

Olowalu by the the pali of Makila
Makai by poalima land
Kaanapali by the pali of Makila.

The 3d piece is bounded:
Mauka by Pupuka's land
Olowalu by Kamehai's land
Makai by Pii's land
Kaanapali by the pali of Makila.

See page 6, volume 15

N.T. 6-7v15
No. 6211, Maimai, from 104v7

Kauhi, sworn, says she knows the House Lot claimed by Maimai in Puehuehunui, and disputed by the King's Luna. Kaihee got this lot from my husband Oo and myself when Kaenaena was Luna Auhau, about 1840. It is enclosed by a stone wall which was built by Kaihee, who left this place some years ago and went to live in Honuaula, and the lot is now occupied by Maimai.

Halama, sworn, says the Lot is dispute is enclosed but not occupied. Maimai has possession of it. He got it from Oo before the death of Kinau.

Z. P. Kaamaea, sworn, says he knows the Lot in dispute. It is enclosed with a stone wall built by Kaaihee, a former occupant, who now lives at Honuaula. He left the lot in dispute in 1847. After he left it, then Mahiai occupied it until 1848, when he went to live at Honuaula with Kaaihee. Kaaihee lived under Kalaimoku Hanapilo, at whose expands the stone wall was built. When Mahiai left the Lot, Kaaihee restored it to Kalaimoku. It was unoccupied up to 1850, when Maimai commenced to cultivate in it.

I understand that the King is Kalaimoku's Heir. I have heard that kaaihee did not put in a claim for this lot, because it belonged to Kalaimoku.

Luikua, sworn says he knows the lot in dispute. Kaaihee occupied it till he went to live at Honuaula. I recollect asking Kaaihee at one time who gave him the Lot in question. He told me he got it from Piapia. When the wall was built round it it was at Kalaimoku's expense to whom Kaaihee gave up the Lot when he left it. The Lot is at present unoccupied. There is no house in it. Maimai plants on it.

Pi, sworn, says he knows the Lot in dispute. Kaaihee got it from Oo. The fence was built by Kaaihee. When he left it then Mahiai held it, and after he went away then Maimai began to cultivate there.

(Claimant says that at the time the Kuleanas were being sent in to the Commission, the lot in dispute was not occupied by anyone)



(Decided to belong to the heir of Kalanimoku)

**[Award 6211; R.P. 1202; Makila Lahaina; 1 ap.; 1.54 Acs; R.P. 1847; Makila Lahaina; 1 ap.; 1 Ac.; See 6203 for Native Register document]**

### 6212, Kekua

F.T. 104v7
Maimai, sworn, The lands of the claimant is [are] in "Makila," Lahaina and consists of one kalo land a kula and one kula by itself. The claimant received them from Kaulunae in the year 1823 and has had quiet possession ever since, the konohiki has 4 lois of kalo, however, in the midst of the kalo land.

The first piece is bounded:
Mauka by Pi's land
Olowalu by the pali of Makila
Makai by Kamakakapu's land
Kaanapali by the pali of Makila.

The kula piece is bounded:
Mauka by Kaainopu's land
Olowlau by Honu's land
Makai by the Government fence
Kaanapali by the land of Pi.

**[Award 6212; R.P. 1695; Waikapu Makila Lahaina; 2 ap.; 1.35 Acs; See 6203, N.R. 555v6 for Native Register document; List of Namauu ma]**

### 6215, Keani

F.T. 105v7
A. Moku, sworn, I know the land of the claimant is in Puehuehunui, Lahaina and is in one piece of kula land.

The claimant had this land from Mimai, the blind man in 1847. Maimai had it from Maimai in 1845 and these titles have never been disputed.

It is bounded:
Mauka by the land of Kaleimikio[?]
Olowalu by Kaalalo
Makai by my land
Kaanapali by the poalima land.

The claimant has gone to California.

**[Award 6215; R.P. 1854; Puehuehunui Lahaina; 1 ap.; .88 Ac.; See 6203, N.R. 555v6 for Native Register document]**

## 6215, Keani

F.T. 105v7
A. Moku, sworn, I know the land of the claimant is in Puehuehunui, Lahaina and is in one piece of kula land.

The claimant had this land from Mimai, the blind man in 1847. Maimai had it from Maimai in 1845 and these titles have never been disputed.

It is bounded:
Mauka by the land of Kaleimikio[?]
Olowalu by Kaalalo
Makai by my land
Kaanapali by the poalima land.

The claimant has gone to California.

**[Award 6215; R.P. 1854; Puehuehunui Lahaina; 1 ap.; .88 Ac.; See 6203, N.R. 555v6 for Native Register document]**

## 6410, B. Kaiki

N.R. 368v6
Greetings to the Commissioners for title to house lots and land: I, Balenaba Kaiki, hereby enter my claim for a house lot in Lahaina, Island of Maui. My lot was from my kaiko`eke, Una.

Furthermore, I also have a land claim, there are 14 lo`i - that is the total of the lo`is, and there are many scattered lo`i, I have half of the `ili, which is Paunau.
B. KAIKI

F.T. 12-13v7
Cl. 6410, Kaiki

Land in Panau, Lahaina, consisting of 1 house lot and 14 kalo patches.

Nui, sworn, I know these lands of 1 house lot and lois 14 lying in one piece. The house lot is between Lahaina & Lahainaluna

Bounded:
Mauka by road to Kapoula
Olowalu by Lahainaluna road
Makai by yard claimed by Kawipaupalu
Kaanapali by Kapena's yard.

It has a fence which is its true boundary. Claimant had this from Malu about 1837 and has ever since held it in peace.



The kalo land is bounded:
Mauka by kalo land of Kekahuna
Kaanapali by precipice bounding the creek
Makai and Olowalu by the creek

Some of these lois are very small, lying in the bed of the creek above Lahainaluna.

Claimant's title to this kalo land is the same as to his house lot and to my knowledge has never been disputed. The poalima belongs to Victoria.

**[Award 6410; R.P. 1705; Paunau Lahaina; 2 ap.; 1.27 Acs]**

## 6495, Kawahamano, Lahaina, 27 January [1848]

N.R. 394v6
Hear ye, ye Land Commissioners: I hereby state my claim which was from Namauu. There are 13 irrigated lo`i and 3 dry lo`i. 2 mo`o kula are at Pahaa. However, the house claim is in Mauuoku, in Kooka.
KAWAHAMANO

F.T. 127v7
Cl. 6495, Kawahamano

Mua, sworn, I know the lands of the claimant. It is in two pieces, one of kalo and the other of kula land in Pahoa, Lahaina.

The claimant received it from Namauu, now dead, in the year 1844 and has possessed it in peace up to the present time.

The kula piece is bounded:
Mauka by the kula of Kuopua
Olowalu by my land
Makai by the Government road
Kaanapali by the poalima of Namauu's heirs.

The other piece is kula land kalo land.

It is bounded:
Mauka my Piikoi's land
Olowalu by the pali
Makai by my land
Kaanapali by the creek of Pahoa.

**[Award 6495; R.P. 6804; Pahoa Lahaina; 2 ap.; 4.75 Acs 26 rods]**

## 6795, Ukukua

F.T. 59v7
Makaulia. sworn, I know the lands of the claimant. it is in "Polanui," Lahaina. It consists of two pieces, one a kula land and the other a kalo land.

The claimant received these lands from me about the year 1840 and he has enjoyed them in peace ever since.

The kula land is bounded:
Mauka by the land of a Koolakai
Olowalu by the Malaekahana[26]
Makai by the land of Malaekahana and Kua
Kaanapali by "Kooka."

The kalo land is bounded:
Mauka by my lois
Olowalu by the same
Makai by the land of Kekaawi
Kaanapali by the stream of "Polanui."

**[Award 6795; 2 ap.; 4 Acs 2 roods 13 rods; See No. 6781 for Native Register with multiple claims (Hihio ma with dozen other claimants named) and 6654 for claim with wrong number in Keokea]**

## 6867, Poepoe

F.T. 68v7
Kauana, sworn, I know the kalo land of the claimant. It is 35 lois in one piece and 3 pieces of kula in "Kaeaula," Lahaina. The claimant received this from Keawe, the luna, in the olden days of Hoapili, and his enjoyed them in peace ever since.

The kalo land is bounded:
Mauka by the land of Kalua
Olowalu by the land of Kaheananaui
Makai by the land of Kalua
Kaanapali by the high pali.

The first piece of kula is bounded:
Mauka by the land of Kalua
Olowalu by the same
On the other two sides by the high pali.

The second piece of kula is bounded:
On three sides by the high pali
Makai by the land of Kanihou.

[26] LCA 4878G



The third piece is bounded:
On the Mauka and Olowalu and Makai sides by the creek of Kanaula
and Kaanapali side by the high pali.

Moku, sworn, I know the house lot of Poepoe. He received it from Moi in 1839 or 1840, and his title has never been disputed.

F.T. 13v16
No. 6867, Poepoe, Lahaina, 25 November 1854, Disputed by Kaiwikokoole.

Hanakaipo, sworn, Knows the piece of land claimed by Poepoe. It is situated in the Ahupuaa of Halakaa, Lahaina and is bounded:

Mauka by Kapu's land
Kaanapali by Kapu, Paikanalani's & Waimanalo's land.
Makai by Kane's land
Olowalu by Witness' land.
**[Award 6867; R.P. 8284; Alamihi Kauaula Lahaina; 1 ap.; 1 Ac. 2 roods 18 rods; Halakaa Lahaina; 1 ap.; 1 Ac 2 roods 18 rods; Wanapa Kauaula Lahaina; 1 ap.; 24 rods; See No. 6851 Kahula ma for Native Register document (Kahula ma with 85 other people named)]**

## 6879, Kuhaulua [Kauhielua]

F.T. 78v7
Kua, sworn, I know the lands of the claimant. They are in "Paunauiki," Lahaina. They consist of 2 pieces of kula land, one containing 7 moo, the oher 2 moo. The claimant received these lands in the days of King Kamehameha [II] in 1844 from me as luna and he possessed them in peace ever since.

The first piece contains of 7 moos is bounded:
Mauka by "Halakaa"
Olowalu by the same
Makai by the same and Haliili's land
Kaanapali by Hekona's land.

The other piece is bounded:
Mauka by the creek of Paunau
Olowalu by Haupu's land
Makai by the Government road leading to Olowalu
Kaanapali by Kauhiheha's land.

**[Award 6879; R.P. 4556; Paunauiki Lahaina; 2 ap.; 1 Ac. 1 rood 33 rods; See No. 6851 Kahula ma for Native Register document]**

## 6887, Kuakaha, June 4, 1849

F.T. 82v7

Kamohai, sworn, I know the land of the claimant; [It] is in "Kaulalo," Lahaina and consists of 3 lois in one piece. The claimant received it from Pinauea in the days of Namakeha, and his title has never been disputed.

It is bounded:
Mauka by Pinauea's land
Olowalu by Poopuu's land
Makai by Makakuia's land
Kaanapali by the high pali.

**[Award 6887; R.P. 5703; Kauaula Lahaina; 1 ap.; 2 roods 14 rods; See No. 6851 Kahula ma for Native Register document]**

## 6890, Kaiwikokoole

F.T. 86v7
Poepoe wahine, sworn, I know the lands of the claimant. They are in "Halakaa," Lahaina. They are in all four pieces, one of kula and kalo land mauka.

He received these from Colonel Moa in the days of Hoapili, and there has been no dispute ever since about his title.

The mauka piece is bounded:
Mauka by Kaoemos land
Olowalu by the high pali
Makai by Kupihea's land
Kaanapali by the creek of "Haleu."

There are also 3 moos of kula makai.

One moo is bounded:
Mauka by Opunui's land
Olowalu by "Puehuehu iki"
Makai by the poalima[?] land
Kaanapali by Kaemo's[?] land.

One moo is bounded:
Mauka by Painaiwaa's land
Olowalu by Puehuehu
Makai by the poalima[?] land
Kaanapali by Kuemo's land.

The remaining moo is bounded:
Mauka by Kau's lot
Olowalu by my lot
Makai by "Puehuehuiki"
Kaanapali by Pukanalani's land.



F.T. 13v16
No. 6890, Kaiwikokoole, Lahaina, 24 November 1853, Disputed by Poepoe

Kaailau, sworn, Knows the piece of land claimed by Kaiwikokoole. It is kalo land situated in the Ahupuaa of Halakaa in the District of Lahaina and bounded as follows:

Mauka by Poepoe's and Paikaualani's land
Kaanapali by the new road
Makai by Keawekane's land
Olowalu by Hanakaipo's land.

Claimant received this land from his brother (Kawaihae) in the year 1837 and held it without dispute up to the time of his death (in the year 1851) at which time he returned it to his brother (Kawaihae) who has held it up to the present time.

Kawaihae, sworn, Witness was Luna under the Konohiki of the land in dispute in the year 1837, and in the same year gave it to his brother (Kaiwikokoole) who held it without dispute up to the time of his death (in the year 1851) when witness took possession of the piece of land and held it up to the present time. Kawaa has cultivated it for witness and built a house on it.

Poepoe (Wahine), sworn, confirms in full the testimony of the former witness.

F.T. 70-71v16
No. 6890, Kaiuikokoole VS Poepoe

Kaailau, sworn, I have seen the land section of Kaiuikokoole in Halakaa, Lahaina, Maui.
Mauka by Paikanalani and Poepoe's land
Kaanapali by Government road
Makai by Keawekane's land
Olowalu by Hanakaipo's land.

Land from his older brother Kawaihae in 1837, no disputes until his death in 1851, then his brother received it and lived on in until it was surveyed by W.P. Alexander. Poepoe disputed it at this time, the reason for which was not known.

Lahaina 26 November 1854
Kawaihae, sworn, I am an overseeing konohiki in the past for Halakaa and in 1837, I gave this land section to Kaiuikokoole just as Kaailau has mentioned above and he continued to live there peacefully until his death in 1851. I have inherited this land where I have cultivated to this time. Kawaa built the house under Kaiuikokoole and it is still standing here. I do not know the reason for Poepoe's dispute about it.

Poepoe (wahine), sworn, I have known in the same way as the witnesses have related here.

Hanakaipo (for Poepoe), sworn, I have seen his land section in Haleakaa of Lahaina, Maui.
Mauka by Kapu's land
Kaanapali by Paikanalani and Kapu's land, Waimanalo's land
Makai by Keawekane's land
Olowalu by Hanakaipo's land.

Land from Kauliokamoa as heresay, but the time it was received is not known to witness. Witness have never seen Kaiuikokoole working on this place to the present.

Witness have seen Kawaa living here, it was Poepoe who had asked him to live here. Kawaa have built a house and has cultivated the land since 1851.

Lahaina 26 November 1853
Kanawaliwali, sworn (for Poepoe), I have seen this place over which here is a dispute between Kaiuikokoole and Poepoe. This pasture lot is in Halakaa of Lahaina, Maui and I have known the boundaries just as Hanakaipo has related. Land received from Kauliokamoa in 1837 at the time Nahienaena's corpse was brought back to Lahaina here. I do not know the reason for which he had received this land, but Kawaa's house was there because he was invited to live there by Poepoe.

Nakaikuaana, sworn, in 1837, Nahienaena's corpse was brought back here to maui and at that time I had seen Poepoe living on this place. This place was sold to Kauliokamoa. Poepoe's house lot makai was given to Kauliokamoa then Kauliokamoa gives to Poepoe this place where on he is living at present. I do not know Kaiuikokoole's interest, he has a separate kuleana. Kawaa lives under Poepoe, but I am Poepoe's wife's own older sister.

Manamana, sworn (for Kaiuikokoole), I have seen this place of Kaiuikokoole, that was in the year 1837 probably. It was Kauliokamoa himself who gave it that was in the year 1837 probably. It was Kauliokamoa himself who gave it to Kawaihae, who was kauliokamoa's land lord, then it was Kawaihae who gives it to Kauiuikokoole. I lived there and raised squash under Kaiuikokoole, but the lot by the beach was for Poepoe himself. When he started; however, he had compassion for Poepoe and let him have the house site only without a place to farm. Kawaa lived under Kaiuikokoole and not under Poepoe. The enclosure is new and was built in 1851. This is that which I have known.

F.T. 70-71v16
No. 6890, Kaiwikokoole, Lahaina, Nov. 24, 1853

kue 6867, Poepoe

Kaailau, hoohikiia, Ua ike au i ka apana aina o Kaiwikokoole e waiho ana ma Halakaa, Lahaina, Maui.

Penei na palena
Mauka, aina o Poepoe me Paikaualani
Kaanapali, alanui Aupuni



Makai, aina o Keawikane
Olowalu, aina o Hanakaipo

Ua loaa ia ia keia apana aina no Kawaihae kona kaikuaana mai i ka M.H.1837. a ua noho oluolu oia a hiki i kona make ana i ka M.H.1851. hooili oia i keia wahi no Kawaihae kona kaikuaana, a ua mau kona noho ana a hiki i ka wa o ka ana ana a W.P. Alexander, kue o Poepoe, aole maopopo ke kumu.

Lahaina, Nov. 25, 1854.

Kawaihae, hoohikiia. He Luna Konohiki au mamua no Kalakaa, a i ka M.H.1837, haawi au i keia apana aina no Kaailau i hai ae nei maluna ia Kaiwikokoole. a ua mau kona noho ana malaila a hiki i kona make ana i ka M.H.1851 me ka oluolu. a hooili mai ia`u a hiki i keia wa, a ua malu no, a na Kawaa i hana i ka hale malalo no o Kaiwikokoole a ke ku nei no a keia wa, a o ke keakea ana a Poepoe, aole maopopo ia`u ke kumu.

Poepoe (Wahine), hoohikiia, Ua like pu ko`u ike me ka na hoike i hai ae nei maluna, pela no ko`u ike.

Hanakaipo, hoohikiia (no Poepoe), Ua ike au i kona apana aina ma Halakaa, Lahaina, Maui.

Penei na palena.
Mauka, aina o Kapii
Kaanapali, aina o Kapu me Paikaualani me Waimanalo.
Makai, aina o Keawekane
Olowalu, ko`u aina

Ua loaa ia ia keia apana aina no Kauliokamoa mai, pela ko`u lohe, aole nae maopopo ia`u ka manawa o ka haawi ana, aole au i ike i ke Kaiwikokoole hana ana ma keia wahi a hiki i keia wa, a ua ike au i ko Kawaa noho ana malaila na Poepoe i ku aku e hoi malaila e noho ai, a ua kukulu oia i ka hale a ua mahi mai ka M.H.1851, mai.

Lahaina, Nov. 26, 1853
Kanawaliwali, hoohikiia (no Poepoe), Ua ike au i keia wahi e hoopaapaa ia nei mawaena o Kaiwikokoole a me Poepoe, aia ma Halakaa, Lahaina, Maui. he pa kula ua like ko`u ike i na palena me ka Hanakaipo i hai ai.

Ua loaa ia ia keia apana aina no Kauliokamoa mai i ka M.H.1837. oia ka wa i hoihoiia mai ai ke kupapau o Nahienaena i Lahaina nei, aole maopopo ia`u ke kumu o ko Kaiwikokoole kuleana ma keia wahi. ua ike au i ka hale o Kawaa e ku ana ,alaila mamuli o Poepoe kona noho ana.

Nakaikuaana, hoohikiia, I ka M.H.1837. hoihoiia mai ke kupapau o Nahienaena i Maui nei, ike au ia Poepoe e noho ana ma keia wahi, he wahi keia i kuaiia me Kauliokamoa, he pahale ko Poepoe makai a lilo ia Kauliokamoa, a haawi o Kauliokamoa i keia wahi no Poepoe, a ke noho nei no oia a hiki i keia wa, aole maopopo ia`u ko Kaiwikokoole kuleana, he wahi okoa no kona, a o ko Kawaa noho ana mamuli no o Poepoe, aka; o wau ke kaikuaana ponoi o ka wahine a Poepoe.

Nanamana, hoohikii (no Kaiwikokoole), Ua ike au i keia wahi o Kaiwikokoole oia paha ka M.H.1837 na Kauliokamoa ponoi no i haawi mai ia Kawaihae, oia ka luna aina a Kauliokamoa, a na Kawaihae i haawi ia Kaiwikokoole, a ua noho au malaila, a ua mahi i ka ipu, malalo o Kaiwikokoole, aka; o ka pa ma kahakai no Poepoe ponoi no ia, a hoomaka o Poepoe e kukulu i hale, hooku keia e Kauliokamoa. a no ke aloha o Kauliokamoa ua haawiia, he kahuahale wale no, aole wahi mahi, a o ka Kawaa noho ana malalo no o Kaiwikokoole, aole malalo o Poepoe, pela ko`u ike, a o ka pa i hanaia he pa hou wale no i ka M.H.1851.

F.T. 70-71v16 Translation
No. 6890, Kaiwikokoole, Lahaina, November 24, 1853
Counter No. 6867, Poepoe

Kaailau, sworn, I know the parcel of land of Kaiwikokoole, situate at Halakaa, Lahaina, Maui.

It is bounded as follows:
Mauka by land of Poepoe and Paikaualani
Kaanapali by a Government road
Makai by land of Keawekane
Olowalu by land of Hanakaipo.

He received this parcel from Kawaihae, his kaikua`ana, in 1837, and had quiet possession until his death in 1851 when this place was bequeathed to Kawaihae, his kaikua`na. His occupancy has been continuous until the time of the survey by W. P. Alexander, when it was disputed by Poepoe, for what reason I do not know.

Lahaina, Nov. 25, 1854
Kawaihae, sworn, I was formerly a Luna Konohiki for Halakaa. In 1837 I gave this parcel of land which Kaailau has spoken of above, to Kaiwikokoole, and he occupied it continuously until his death in 1851, without dispute, and it was bequeathed to me, until this time, and it has been cultivated. Kawaa made the house, under Kaiwikokoole, and it stands there at this time. I do not know the reason for the objections by Poepoe.

Poepoe (Wahine), sworn, My knowledge is the same as the foregoing testimony.

Hanakaipo, sworn (for Poepoe), I know his parcel of land at "Halakaa", Lahaina, Maui.

It is bounded as follows:
Mauka by land of Kapu
Kaanapali by land of Kapu and Paikaualani and Waimanalo
Makai by land of Keawekane
Olowalu by my land.



He received this parcel from Kauliokamoa, so I heard, however I do not recall the time it was given. I have never seen Kaiwikokoole working at this place until this time. I saw Kawaa's occupancy there. It was Poepoe who sent for him to return there to live and he built the house and cultivated the land from 1851.

Lahaina, November 26, 1853
Kanawaliwali, sworn (for Poepoe), I know this place which is disputed between Kaiwikokoole and Poepoe. It is at Halakaa, Lahaina, Maui and is a kula lot. My knowledge of the boundaries is as Hanakaipo has stated.

He received this parcel from Kauliokamoa in 1837. This was the time when the body of Nahienaena was returned here to Lahaina. I do not know the basis of Kaiwikokoole's claim at this place. I saw the house of Kawaa standing there, his occupancy of it was from Poepoe.

Nakaikuaana, sworn, In 1837 when the body of Nahienaena was returned to Maui, I saw Poepoe living at this place. This place was bartered between Kauliokamoa and Poepoe. Poepoe had a house lot makai, which was conveyed to Kauliokamoa, and Kauliokamoa gave this place to Poepoe, and he occupies it until this time. I do not understand Kaiwikokoole's claim, he has another place, and Kawaa's occupancy was because of Poepoe, but /sic/, I am the own kaikua`ana of the wife of Poepoe.

Manamana, sworn (for Kaiwikokoole), I know this place of Kaiwikokoole, it was perhaps 1837 /when/ Kauliokamoa himself gave it to Kawaihae, he was the luna of the land of Kauliokamoa, and Kawaihae gave it to Kaiwikokoole. I lived there and planted gourds, under Kaiwikokoole. However, the lot at the seashore was Poepoe's own. Poepoe began to build a house, and because of the friendship of Kauliokamoa, a house site only was given, not a place to cultivate. Kawaa's occupancy was under Kaiwikokoole, not under Poepoe, that is my knowledge of it. The fence which was made was a new one, in 1851.

**[Award 6890; Halakaa Lahaina; 1 ap.; 1 rood 34 rods; See No. 6851 Kahula ma for Native Register document]**

### 6900, Keawealu

F.T. 84-85v7
Aloha, sworn, I know the lands of the claimant. They are in "Pahoa," Lahaina. They are [sic] consist of 2 pieces, one a kalo land, the other a kula.

The claimant received these lands from Kalehu in 1835, and he has held them without dispute ever since.

The kula land is bounded:
Mauka by Kalaiki's land
Olowalu by the lands belonging to the heir of Namauu
Makai by Kalehouka's land

Kaanapali by the creek of Pahoa.

The kalo land consists of 16 small lois and is bounded:
Mauka by the pali
Olowalu by the same
Makai by the creek of Pahoa
Kaanapali by "Kooka."

**[Award 6900; R.P. 1198; Pahoa Lahaina; 1 ap.; 1 rood 3 rods; Makila Lahaina; 1 ap.; 2.42 Acs; See No. 6851 Kahula awarded; See No. 6851 Kahula ma for Native Register document]**

### 6921, Paikaualani

F.T. 86v7
Kaiwikuheole, sworn, I know the land of the claimant. They are in "Halakaa," Lahaina. They consist of 2 pieces, one piece of kalo land with two poalima lois inside and one piece of kula makai consisting of 2 moos. There is a house on this last piece.

The claimant received it from Naea, in 1844 and has held quiet possession ever since.

The kalo land is bounded:
Mauka by Kamaka's land
Olowalu bh the high pali
Makai by Punaiwaa's land
Kaanapali by "Haleu.

The other piece is bounded:
Mauka by Kapeke's land
Olowalu by the pali
Makai by Punaiwaa's land
Kaanapali by "Halei."

See page 14 v15

N.T. 14v15
No. 6921, Paikaualani, from Page 86v7

Kaanaana, sworn, says he knows the House Lot of claimant in Lahaina. He is without dispute.

The Lot is bounded:
Mauka by Kukahiko's land
Olowalu by the land called "Alio"
Makai by the public land
Kaanapali by Kaanaana's land.

Kapule, sworn, confirmed the testimony of Kaanaana.



**[Award 6921; R.P. 1711; Halakaa Lahaina; 3 ap.; 1.7 Acs; R.P. 2717, Lahaina; See No. 6851 Kahula ma for Native Register document]**

### 9821, Kaleiopu, Olowalu

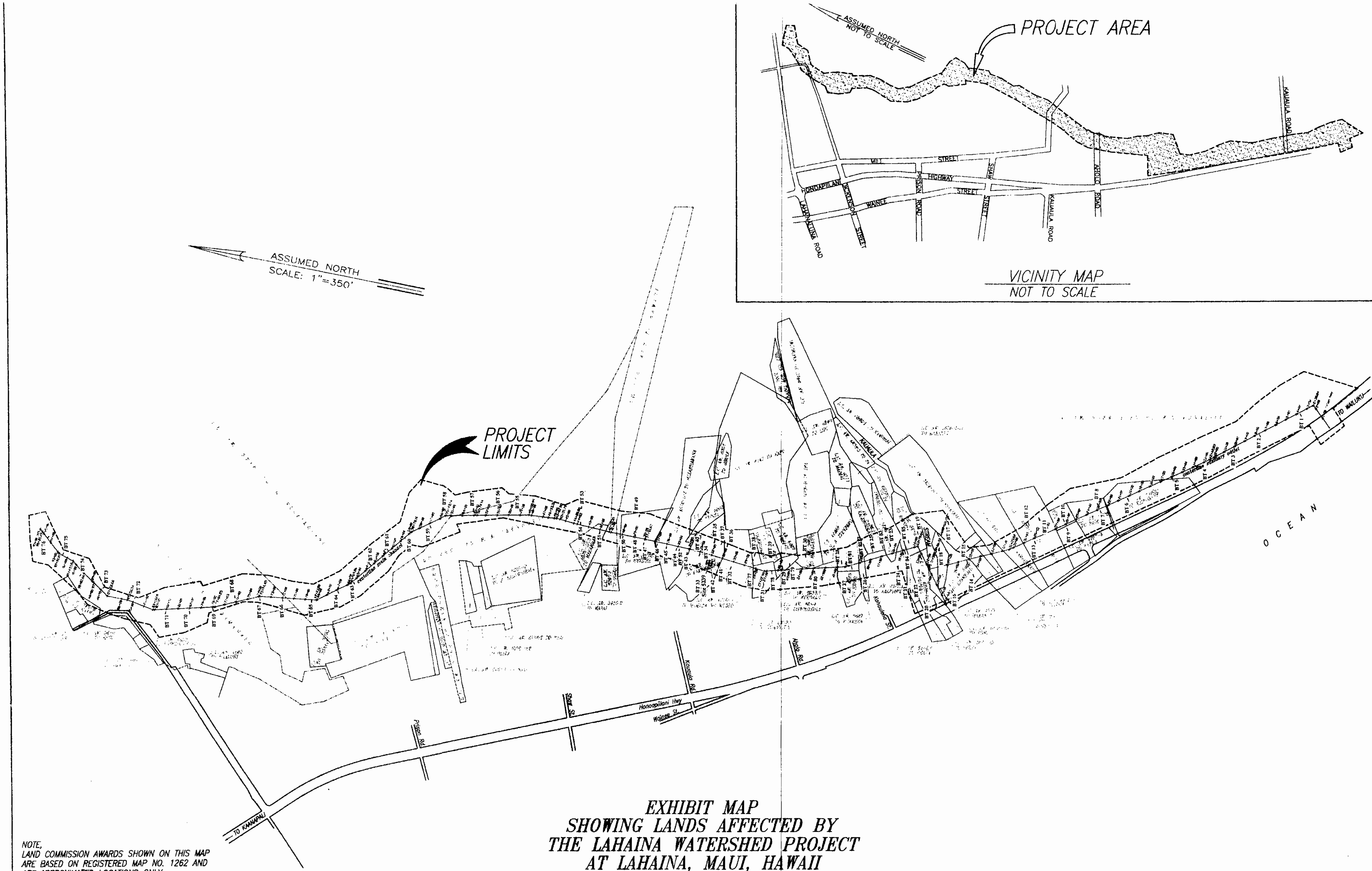
F.T. 100-101v7
Maunai, sworn, I know the lands of the claimant. They are in "Makila" Lahaina. They consist of one kalo and one kula land. The claimant received these lands from Kaulunae, the luna, in the days of John Young's Governorship, and has held them in peace ever since.

The kula piece is bounded:
Mauka by my land
Olowalu by Papaha's
Makai by Kamaka's
Kaanapali by Pi's land.

The kalo is bounded:
Mauka by Makanui's
Olowalu by Uilama's
Makai by Pupaki's
Kaanapali by the high pali.

There are 2 lois inside this last piece belonging to the poalima of Kaulunae.

**[Award 9821; R.P. 3456; Makila & Kauaula Lahaina; 2 ap.; 1.5 Acs 19 rods; See 9811 for Native Register document, Makaula ma]**




**Map 11 – Project map showing location of Backhoe tests and Site 5239.**

# Appendix C

## Lahaina Watershed Hydrology Reevaluation, U.S. Department of Agriculture, Natural Resources Conservation Service, October 4, 2002 (Updated March 10, 2003)

Lahaina Watershed Hydrology Reevaluation
October 4, 2002

The Lahaina Watershed Plan and Environmental Assessment was completed in August 1992. Issues of Maui County capital improvement priorities delayed implementation of the flood control project. Recent resolve by the County to install the project has led to the upgrading of the ten-year old Environmental Assessment to an Environmental Impact Statement. The preparation of the EIS requires the revision of the storm runoff analyses to account for the changes in landuse due to the closure of Pioneer Mill and the cessation of sugarcane cultivation in the Lahaina Watershed.

The current hydrology reevaluation resulted in increased peak discharge in the Lahaina Subwatershed while peak discharge in the Kauaula Subwatershed remained generally unchanged from the 1992 Watershed Plan.

Stormwater Discharge

The estimates of storm runoff for the Lahaina Watershed are derived from the NRCS (formerly SCS) hydrologic method which estimates direct runoff from storm rainfall. The NRCS method uses synthetic unit hydrographs compiled from watershed runoff data for various climatic regions in the United States. Two versions of the computerized hydrologic model, TR-20 Computer Program for Project Formulation Hydrology, was used for the earlier and current analyses.

Modeling for the Lahaina Watershed used a 24-hour storm with a Type I rainfall distribution. The Type I storm distribution is typical of maritime climates in the western United States. Twenty-four hour rainfall for storm events ranging from 2-year to 500-year recurrence intervals for the Lahaina and Kauaula Subwatersheds were determined using the U.S. Weather Bureau's Rainfall Frequency Atlas (1962).

The hydrologic analyses uses a Runoff Curve Number (CN) which provides the fraction of rainfall that contributes to direct runoff. The CN includes consideration of soil characteristics for runoff potential, land cover, conservation treatment, and hydrologic condition. The major change in the Lahaina Subwatershed has been the conversion of approximately 1,300 acres of irrigated sugarcane to other uses. The land is characterized as brushland in the current analyses. The present condition for the converted acres increased the CN by about five points over sugarcane cropland, increasing direct runoff rates.

In addition to the landuse change, improvements in the hydrologic model, TR-20, and computer processing capability resulted in increased runoff rates in the current analyses. The 1992 Watershed Plan hydrologic analysis was conducted using the 1980 version of TR-20. The input files were transmitted to a mainframe computer at a remote location for processing. The 1992 version of TR-20, used for this reevaluation, is PC-based and incorporates changes that required modification of the input file in order to process.

It appears that in a move to reduce processing time, the relatively gross Time Increment of 0.5 hours was employed in the earlier effort. When the same input data is processed using a smaller Time Increment of 0.1 hours, the peak discharge from the sub areas increases by 10 to 20 percent. An explanation is that because of the small sizes of the subareas in the Lahaina Watershed and the short Times of Concentration (Tc) that are often shorter than the 0.5 hours Time Increment, the hydrograph definition was degraded. It is recommended that the time increment be 0.1 to 0.2 of the shortest watershed Tc. Therefore, the output resulting from using the 0.1 hr time increment is more credible.

Several other modifications to the earlier hydrologic analyses were made. First, the process of combining the Kauaula Subwatershed and Lahaina Subwatershed hydrographs at the debris basin was faulty in the earlier model and was corrected. Also, the 100-yr rainfall for the Kauaula Watershed was reduced from 15.5 in. to 14 in. through reexamination of the subwatershed centroid and was checked using log-probability graphing.

The results of the reevaluation of storm runoff are displayed in Table 1.

Table 1
Lahaina Watershed Reevaluation
Peak Storm Discharges
(Cubic Feet/Second)

| | 2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | 500-yr |
|---|---|---|---|---|---|---|---|
| Kauaula Stream above Debris Basin | 1,281 | 2,669 | 3,839 | 5,504 | 6,809 | 8,144 | 11,067 |
| Upper Lahaina Diversion (Sta 75+00) | 171 | 442 | 691 | 1,060 | 1,357 | 1,667 | 2,357 |
| Lower Lahaina Diversion (Sta 15+00) | 264 | 678 | 413 | 1,636 | 2,097 | 2,574 | 3,653 |
| Debris Basin | 1,438 | 3,169 | 4,661 | 6,816 | 8,520 | 10,272 | 14,130 |
| Debris Basin outlet to Puamana Channel | 456 | 1,299 | 2,049 | 3,152 | 4,033 /1 | 4,943 | 7,432 |
| Debris Basin outlet to Second Outlet | 982 | 1,870 | 2,612 | 3,664 | 4,487 | 5,329 | 6,698 |
| Ocean Discharge at Puamana | 459 | 1,304 | 2,056 | 3,162 | 4,045 | 4,957 | 7,450 /2 |
| Ocean Discharge at Second Outlet | 1,027 | 1,969 | 2,759 | 3,872 | 4,744 | 5,640 | 7,275 |
| Ocean Discharge at Single Puamana Outlet 3/ | 1,450 | 3,200 | 4,668 | 6,850 | 8,550 | 10,286 | 14,200 |

Notes:
1/ Maintains flow in Puamana channel to its design capacity of 4050 cfs for 50-yr storm.
2/ Flows exceeding ~5000 cfs are overland flow from emergency spillways.
3/ Project alternative with single outlet. From graph using 10-yr and 100-yr values
(Revised 6/12/02, 4/10/03)

## Sediment Discharge

A updated quantification of streamflow and runoff is needed for the hydraulic and structural design of the works of improvement. A 10 or 20 percent increase can significantly change the dimensions of the structures. An update of sediment discharge that is correlated to the increase in runoff, however, does not necessarily provide more significant information due to the imprecise nature of sediment discharge forecasting.

After completion of the analyses using the increased streamflow values it was decided that the effect on bedload discharge was insignificant when compared to the margins of confidence provided by the several sediment discharge methodologies used. Therefore the sediment discharge figures for Kauaula stream will remain unchanged.

Sediment discharge from the former sugar fields in the Lahaina Subwatershed may increase because of the changes in land use and runoff volume. The model used in the 1992 analyses of sheet and rill erosion is no longer in use. The earlier estimated quantities of sediment yield from the Lahaina Subwatershed will be proportioned upward with the increased runoff quantities. As the sediment basins along the diversions are designed to limit flow velocity, the sizes of the basins will be enlarged accordingly with the increased storm discharge during design.

Prepared by: Dudley Kubo, Planning Engineer, NRCS (Updated 3/10/2003)

# Appendix D

## Letter from Department of the Army Dated January 21, 2003

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

REPLY TO
ATTENTION OF

January 21, 2003

Regulatory Branch

Mr. Mich Hirano, AICP
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Hirano:

This letter responds to your request for a jurisdictional determination for the second outlet location of the Lahaina Flood Control Project, dated January 13, 2003. Based on the information you provided, which shows the outlet landward of the mean higher high water line, I have determined that this portion of the project is not in jurisdictional waters of the United States and therefore a Department of the Army (DA) permit will not be required.

If you have any questions concerning this determination, please contact William Lennan of my staff at 438-6986 or FAX 438-4060, and reference File No. 200200337.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

# Appendix E

## Transcript of the Public Information Meeting to Present the Draft Environmental Impact Statement and to Receive Public Comments Held on June 17, 2003

LAHAINA WATERSHED FLOOD CONTROL PROJECT

PUBLIC INFORMATION MEETING

ORIGINAL

Held at Lahainaluna Intermediate School, Lahaina, Maui, Hawaii, commencing at 6:00 p.m. on June 17, 2003.

REPORTED BY: LYNANN NICELY, RPR/RMR/CSR #354





MR. NOHARA: Good evening. My name is Wes Nohara. I'm the vice chairman of the West Maui Soil and Water Conservation District and we're the host agency for this project. And on behalf of the District, I would like to welcome each and every one of you to our public meeting. It's so good to see all of you here showing interest in this project and good to see all of you. I recognize probably three-quarters of you in this room. And again, it's good to know that each and every one of you have a personal interest in this project.

It is a very important project and it's been around a long time and I know that there are concerns, but overall I believe much of Lahaina supports this project because of its importance for public safety and protection of personal property.

We have an agenda to follow and before we do so, I would like to recognize a few important people here tonight. On behalf of the County, we have Joe Krueger. It's also good to see Joanne Johnson representing our district and the county council. Welcome, Joanne. Are there any other visitors that -- I again welcome each and every one of you.

Without further ado, I believe our meeting format will be explained by Mich Hirano.

MR. HIRANO: Thank you, Wes, and good evening, ladies and gentlemen, and welcome to the public information meeting. I'm pleased to see you all here tonight. As Wes said, this is a very important project for the county.

Tonight is really a time to I guess provide information on the Draft Environmental Impact Statement that was published in the Environmental Bulletin on June 8th. I'm sorry, was it June 8th? Sorry, May 8th. And the 45-day comment period is expiring on June 23rd. And so we wanted the opportunity to provide a public information meeting during that 45-day comment period to give a report on the findings of the Draft EIS and also to receive comments from the public regarding some of the aspects of the project or comments on the Draft Environmental Impact Statement itself.

So tonight the format will be we would like to provide some background information. Dudley Kubo of the Natural Resources Conservation Service will be providing some of that background information.

I'll be presenting an overview of the findings of the Draft Environmental Impact Statement. That will be a power point presentation. And then we have a sign-up sheet which we would like people who are





interested in providing comments to the Draft EIS to put your name down on the sign-up sheet. We can pass that around while we're making our presentation. And then we have a court reporter here tonight, Lynann from Iwado Services, and she will be recording the dialogue of the meeting tonight and the comments that are provided by yourselves and this transcript will be included in the Draft Environmental Impact Statement, the final Draft Environmental Impact Statement. And we will also, during our work in finalizing the Draft Environmental Impact Statement, be responding to those issues that are raised this evening.

So we don't want the dialogue really about the project. We are here to receive comments and receive public input into the Environmental Impact Statement.

So with that sort of background and how this meeting will be conducted this evening, I would like to just turn now the floor over to Dudley Kubo, planning engineer for the Natural Resources Conservation Service.

MR. KUBO: Hi, good evening, thanks to all of you for showing up tonight.

I would like to provide a little background for this project which, like Wes has said, has been going on for a long time and I've been involved with the planning of this project since about 1985 so if anyone is to blame, it's probably me.

This project is a flood control project to provide flood protection to the southern part of Lahaina Town. And it's a partnership project which involves the County of Maui, the West Maui Soil and Water Conservation District, and the federal government through the USDA Natural Resources Conservation Service.

We in the Natural Resources Conservation Service administer a water resources program called the Small Watershed Act which provides federal assistance to communities to solve water resource problems that they have. For this particular type of project, the federal government will be able to pay the construction costs of the flood improvements, flood control improvements, and also a lot of the planning and technical assistance that's required in order to put the plan and the designs together.

Back in about 1960, I think, there was quite a bit of discussion starting about the need for flood control in Lahaina. And in 1980, the West Maui Soil and Water Conservation provided -- well, it was the Soil Conservation Service at that time -- an application to request federal assistance for this





project. So this project actually started off officially in about 1980. In 1981, we began the preliminary planning for this project and in 1985 we received money from the federal government to actually start putting together the plan.

Some of you may remember a series of meetings out here, they were held at Kam III School, they were held at Pacific Center, they would held down at the Puamana Community facilities, and we went through like different types of alternatives. And in 1992, we came up with a watershed plan which is a plan that we're presenting again tonight which basically takes a diversion across from Lahainaluna Road to Kauaula Stream, into a debris basin there. At that debris basin, which essentially is there to collect rocks, the big boulders and such that come down the stream from going into any of the downstream improvements and out into the ocean. We split the flows at that point with most of the flow going toward a second created outlet about 3,000 feet south of Kauaula Stream and the flow that goes through Puamana subdivision would be limited to its original flow. And that was the plan that was -- that we developed in 1992.

The plan provides for a 100-year flood protection, meaning that we would provide the protection that would be required to handle the water from a rainstorm which can be expected once in a hundred years. We know that like in Hilo we've had 300-year storms in a period of about 15 years, so, you know, this is an area that I guess we really need to look at.

We also intend to provide protection to the reef that's fronting Lahaina Town, trying to keep the sediment that normally like passes with the flood waters into the ocean area in front of Lahaina Town from occurring.

After 1992, there were a number of things that kept this project from moving along quickly. One was funding both by the federal government and the county governments. We also had in 1992 only backed this environmental -- the environmental documentation for this project was only an environment assessment and times have changed, we need an Environmental Impact Statement for a project such as this in today's planning environment.

So probably the 1996-2001 period, there were a number of rainstorms that brought damaging floods into Lahaina area. The county became much more interested in pursuing this project. We got together and decided that the Environmental Impact Statement was





appropriate for this project. The federal government and the county went in together and contracted with Munekiyo & Hiraga, and that's Mitch's firm, to provide that Environmental Impact Statement. And they have been working hard with us and with the county and with the community to pull the Environmental Impact Statement which identifies and discloses the effects of this project in the Draft Environmental Impact Statement and you'll see the fruits of their labor tonight.

Some of the new issues that arose in 2002 was that, one, Pioneer Mill had gone out of operation, meaning a lot of the land treatment activities that we had worked with the mill on in protecting the upper agricultural area to slow water down, to capture sediment and such, weren't in effect any more. So we're continuing to work with the land owners up there to make sure that those land treatment practices that control soil erosion and control water up in the upper part of the watershed are kept in operation.

Another issue was the high maintenance costs of a grass-lined channel that we were proposing. We wanted to get away from concrete types of channels and our proposal was to have a grass-lined channel.

We also revised some of the amounts of water and sediment that come off the landscape, primarily because of the closure of Pioneer Mill and their operations.

We also did a reassessment of the ocean outlets and did a much more thorough archeological assessment in the project area. So that's where we are tonight.

Mitch is going to present the EIS and we're hoping that without any substantive issues that come up that will stop the EIS from proceeding farther, that we can resolve it -- the issues that are brought up and issue a final EIS in several months.

At that time we're going to finalize some of the designs on some of the outlet works. The county will also be scrambling to get the land rights for the installation of these measures and also the permits that are required to install the measures.

We've already started working with our national people to secure the funding in subsequent years for installation of this project.

I can't stress the amount of input that the community can have, especially on the funding project, through your elected representatives.

So with that bit of background, I think I would like to turn it back to Mitch.





MR. HIRANO: Thank you, Dudley.

I think it was last February we had the initial public meeting that started off the -- I guess the environmental review process and it's been a little over a year and tonight we've published the Draft Environmental Impact Statement and wanted to review the findings of that report with you tonight.

The Lahaina Watershed Flood Control Project, as mentioned earlier, the project sponsors are the County of Maui, Department of Public Works and Environmental Management, the West Maui Soil and Water Conservation District, and the U.S. Department of Agriculture, Natural Resources Conservation Service. These three parties are involved in watershed management in the locale and have sponsored this particular project.

The Environmental Impact Statement consultant team is made up of the following companies. Munekiyo & Hiraga, Incorporated, is responsible for the preparation of the EIS and the project permitting. And with me tonight is Mike Munekiyo, the principal of Munekiyo & Hiraga.

Sea Engineering Incorporated, a company out of Honolulu, did the coastal process evaluation as well as the marine water quality assessment and the marine biology, and we will get into the findings of their report and their work later on in the presentation.

Xamanek Researches -- and Eric Frederickson is with me tonight. Xamanek Researches did the archeological inventory survey for me along the project alignment.

Austin, Tsutsumi & Associates, our surveying engineering company, and that company, ATA, did the alignment staking and mapping for the archeological inventory survey as well as they did the certified shoreline map for the location of the second outlet.

In terms of project need, I guess it goes without saying that there has been a problem with the watershed management, with runoff, storm water runoff into the Lahaina area, and this picture was taken from the front page of the Maui News last year, January 29th, just before we started to get involved in the Environmental Impact Statement of the project. And in this particular area -- this is just along Wainee Street in Lahaina. And as you can see, there is about three feet of water or two and a half feet of water in Mr. Mano's front yard. And so there is a need for the project.

The project objectives are threefold. We're trying to reduce the flooding and the erosion problems





on the land by diverting runoff into a diversion channel with a safe outlet, ocean outlet. Another objective is to relieve the effects of excess sedimentation on the nearshore coral reefs fronting Lahaina Town. And to provide a 100-year flood level protecting the benefiting area including the Lahaina Historic District No. 1.

And I think last time we had the meeting, we had representation from a gentleman who survived three 100-year floods in his lifetime and so these floods occur more frequently than a hundred years, as he can tell you. But it is a design criteria that is used in flood prevention.

As you can possibly make out in this next slide, the Lahaina watershed is made up of three watersheds, basically. It's the Lahaina Subwatershed which covers an area of approximately 2,140 acres, there is the Kauaula Watershed which covers an area of approximately 2,780 acres, and there is a small subwatershed south of Kauaula Stream which covers an area of 330 acres. This project is designed to capture storm water runoff from that area and divert it into the safe ocean outlet at the bottom of the stream.

So the Lahaina -- as I mentioned, the Lahaina

Subwatershed is 2,140 acres. The Kauaula Watershed is 2,780 acres. The outlet subwatershed south of Kauaula Stream is 330 acres. And this whole watershed area is 5,250 acres.

The project is designed to take water from -- and it starts at approximately at the top left-hand side of the screen, about at the 153-foot elevation. There is an inlet basin just alongside Lahainaluna Road. It goes into a concrete section of reinforced concrete channel, into a sediment basin, and then from there is transported through a grass-lined diversion channel into another sediment basin just above Wainee Reservoir, and then at this time it gets transferred back into a concrete channel section through what was formerly Wainee Village. And from there, it transitions back into a grass-lined channel south-southwest to Kauaula Stream and there is a sediment basin at Kauaula Stream before it enters into a debris basin.

The sediment basin is designed to take the fine silt and sand material out of the water and deposit it at the bottom of the sediment basin and the debris basin is designed to take the larger boulders that come down Kaukaula Stream during a high flood event where fairly large boulders are transported by





the swift waters through Kauaula Stream and into a debris basin.

From the debris basin, there are two outlets; one moving on further south to the grass-lined channel to a second ocean outlet which is out by Waianukole and the other flows go down into the improved channel of Puamana Channel and out at Makila Point.

If we look at the cross sections of each of these channels and basins, if I could just go over with you sort of the composition and the makeup of these channel sections to give you an idea of how they will be designed.

On the top of your screen is the concrete channel just below the inlet basin. And this concrete channel is approximately 10 feet wide and 5 feet deep. That channel section is approximately 1,000 feet long. And then it transitions into a grass-lined diversion channel which will be approximately 20 to 25 feet across the bottom. It has a 1-to-3 slope on the side channel and its depth is about 9 feet. There is a top berm on the makai side of the basin which is approximately 15 feet wide. And this berm will also be a maintenance road that will allow the maintenance of the channel and so it would have a dual purpose.

Section C is the concrete channel along Wainee

Reservoir and the former Wainee Village. This section of channel is 10 feet deep and approximately 15 feet wide and it's approximately 500 feet long at that particular section.

The debris basin at Kauaula Stream is a large horseshoe shaped basin with a bottom dimension of a span of 250 feet. It has a depth of approximately 27 feet. And there is an outlet that will outlet the water into the southern diversion channel as well as down the Puamana section of Puamana Channel. At the 100-year flood event level, the debris basin designed to split the flows evenly between the southern outlet and the existing Puamana Channel.

The grass-lined section on there is about 65 feet long and that is the section that goes from Puamana Channel to the second outlet. It's 65 feet wide at the bottom and it's about 10 feet deep and it has a slope of 3-to-1. And this one is designed as well to be a grass-lined diversion channel.

This is a plan view of the second outlet. In the middle there is -- this outlet -- the grass-lined channel goes into a sediment basin at the top of the screen, which is mauka of the Honoapiilani Highway, and then it goes through a box culvert. There will be four bay box culverts approximately 8 feet wide each





and about 11 feet high. And that will flow through the -- under Honoapiilani Highway and then it will spill out into an apron and out into the marine outlet.

The bold line that sort of squiggles across the screen around the mid point of the screen is the survey line of the certified shoreline. That was the certified shoreline as of January 2003. The thinner line which is at the bottom part of the -- below that darker line is the mean higher high water line and that is a significant line in that anything mauka of that line is out of the jurisdiction of the Department of Army and anything makai of that line would require a Department of Army permit. And the spillway is just mauka of that line and we have processed this through the Department of Army Corp of Engineers and they have said that it is not within their jurisdiction.

At that point I would just like to show the next slide which is -- this is a photograph that was taken in April of the shoreline right at the second outlet. As you can see, it's a rocky shoreline with embedded sand pockets. It's a steep bank at that point. The edge of the highway is basically right at the bank and there were comments with respect to the size of the second outlet.

There are some design things that can be done with the second outlet to mitigate visual impacts of the outlet by incorporating more boulders and texturing the outlet structure -- the base of the outlet. But as you can see from the next slide, part of that structure is required to retain the bank and the highway. Right now the bank is eroding and moving on just at the edge of the pavement at the highway. There is a guardrail right up where the truck is and then the bike lane and the pavement starts right on the other side of that truck. There is severe erosion problems at that particular location and the second outlet is basically -- part of its structure is part of a retaining wall for the highway.

The Lahaina Watershed Flood Control Project's costs -- these are some of the details that the county will be concerned with. The cost is between 12 to 14 million dollars to build. The operation, maintenance and replacement costs are $260,000 per annum. That's to maintain the structure.

The funding for the costs for the project is coming from the federal government through NRCS, grants, and through the County of Maui.

Construction of the project will probably be phased over two to three fiscal years and so we see a





construction period of about 24 to 36 months and that would depend on availability of funding for the project as it moves along.

The Environmental Impact Statement was prepared in accordance with Chapter 343 of the Hawaii Revised Statutes. That was because it involves county funds, it involves some county lands. As well the Environmental Impact Statement was prepared in accordance with the Federal National Environmental Policy Act. Because federal funds will be involved with the project, Environmental Impact Statement was processed through the NEPA process as well. So we did this on a coordinated basis as we published Chapter 343 in the Environmental Notice of Office of Environmental Quality Control. We also notified through the notice of the NEPA preparation and then NRCS as well published the availability of the Environmental Impact Statement through the NEPA federal bulletin and as well advertised the availability of it -- of the environmental impact preparation notice through the local media.

So the Draft Environmental Impact Statement in terms of just its summary, tonight I would just like to touch upon the potential impacts that were identified, the unresolved issues with regard to the project. I'll give you the outline of the alternatives that were considered with the project and then the permitting considerations that are required for the project.

With respect to potential impacts, we looked at, through Sea Engineering, the environmental marine consultant, identified that there will be localized impacts. There will be a discharge plume at the second outlet. There will be some impacts regarding shoreline and coastal processes which they have outlined and have as well identified mitigation that will be necessary or that may be necessary. Marine resources -- looked at the cultural gathering practices of limu and the fishing practices with respect to potential impacts on those activities. And we did cultural impact assessments to identify other significant cultural impact considerations that must be incorporated into the design of the project or at least be considered in the implementation.

With respect to the impact plume, this graph shows you sort of the characteristic of the water movement during a -- this is a two-year storm. And the storm -- this is over a period of 26 hours. And at about five -- at about five hours after the storm, the water starts becoming evident, the runoff, and it





moves up to approximately where you see 10 -- after 10 hours, the water is moving at approximately 200 cubic feet per second. At the peak of a two-year storm, the water is generating approximately 800 cubic feet per second at about the hour of 15. That's where it peaks and then it slows down. And after 26 hours, it's back to normal. So this is a peak graph of a characteristic storm in terms of water.

The significance of this is that the area of concentration of the second outlet -- this is where we have the second outlet. The circle is the location of the second outlet. On the top of the screen is Puamana Channel, Makila Point. So what is being introduced is a point source of discharge at the second outlet and the characteristic of the water moving through that is sort of displayed in the next table.

In terms of the summary of characteristics of the water movements and volumes, Sea Engineering did a modeling of the water flows through a computer-generated simulation model and determined these characteristics of the flows. During a 2-hour storm, the peak discharge rate is approximately approximate 765 cubic feet per second. At the six-hour average storm period, the discharge rate is approximately 341 cubic feet per second. The area of seafloor that's impacted by the plume with salinity with less than 228 parts per thousand is approximately 52,000 square feet. That's what the modeling result indicated would be the -- some sedimentation along the seafloor in the area moving out from the second plume.

The time that that plume meets the Department of Health salinity water quality standards in terms of hours is 17.3 hours. So after 17.3 hours, the salinity in the water in front of that second outlet returns to within Department of Health standards. So 17 hours after the storm.

During a 5-year storm, the peak discharge rate is 1,683 cubic feet per second. The average discharge rate at 6 hours is 751 cubic feet per second. The area of seafloor impacted by the plume with salinity with less than 228 parts per thousand is approximately 116,332 square feet. The time for the plume to meet DOH salinity water quality standards is about 19.7 hours after the storm.

A 10-year storm, again, a little larger. Peak discharge rate of 2,478 cubic feet per second. At the 6-hour storm period, the discharge rate is 1,106 cubic feet per second. The area of seafloor impacted by the plume with salinity with less than 228 parts per





thousand is 121,708 square feet. And the time for the plume to meet DOH salinity water quality standards is 20 hours after the storm, the water in front of the plume -- in front of the second outlet should be back to DOH standards.

The reason that the 2-, the 5-, and the 10-year storms were used to model the impact of the plume and of the second outlet is because impacts are probably cumulative after a small series of events and that's what the consultants were modeling. The 100-year event is rare and happens so infrequently that the more -- I think the more telling impact would be the shorter duration storms which happen more frequently.

With respect to impacts to coastal processes, consultants found that the Front Street beaches may have less terrigenous sediment to provide sands to build up beaches. That's because the movement of sand through Kauaula Stream and the Puamana Channel has been reduced by the sediment basins. And the mitigation that was identified for that would be to monitor the beaches along Front Street in Lahaina Town and there may be beach nourishment programs that would be required to mitigate the impact of the loss of terrigenous sediment.

Makila Point has slowly been built up over the years by the cobbles and boulders that have been coming down Kauaula Stream and because of the debris basins have been designed to capture those cobbles and boulders during the high storm frequency events, there may be a requirement to artificially build up the Makila Point over time by taking the boulders and cobbles out of the debris basin and placing them and keeping Makila Point at its present state of I guess development.

There will be increased turbidity in water quality from suspended sediment in discharge in the vicinity of the second outlet. As I said, we've looked at that plume. It's a localized area. During a 10-year storm, about 120,000 square feet. However, the -- after 20 hours, that sediment should be back to normal, water quality in that area should be back to normal. Sediments and currents in that particular area take and move and disperse the sand fairly quickly at that particular location. And a result of that is that new beaches may form to the south of the second outlet and that is considered a beneficial impact.

In terms of environmental effects which cannot be avoided, as we mentioned in the report through Sea





Engineering's work, there will be a localized area in front of the second outlet of approximately 121,000 square feet based on a 10-year flood that would have sedimentation for a limited period of time which will then be moved offshore by the currents.

Impacts to two species of limu may result as a result of increased turbidity at that particular location. However, overall we think that the limu would be redistributed. And although there may be some limited impacts in the area of the second outlet by an overall decrease of approximately 25 percent of the sediment discharge throughout the study area, we feel that there will be a net benefit to the marine resources fronting Lahaina Town as a result of removing sediment that flows through the reefs fronting Lahaina Town from nonpoint source pollution during storm events.

With respect to other cultural impact considerations based on cultural informant interviews, six items were identified. Maintenance of public and non-public agricultural access. As you know, the flood control channel moves across the landscape, whereas most of the agricultural roads and access is from makai to mauka and so provisions need to be provided for maintaining agricultural access or makai/mauka access over the channel.

Maintenance of access to Kauaula Valley.

Presence of cultural resources in the vicinity of Kauaula Stream. We understand that, you know, that Kauaula Stream played a very important role in the pre-contact period and could be a source of cultural resources that need to be respected and protected.

Marine resources were identified as a consideration that needed to be brought into focus during the EIS.

Land management practices were also identified. Many people felt that really the importance of land management practices could not be understated, that during the agricultural period and during the traditional land management and stewardship pre-contact, that the waters were well maintained and managed by terracing and agricultural practices that helped retain erosion and flood water. So there was an emphasis put on developing again more traditional land management practices in the upland that would reduce sedimentation and erosion and runoff.

Impacts to surrounding residences were identified as a concern during the construction period. There would be localized short-term impacts with construction and that was identified as something





that needed to be considered.

This is just -- this particular slide just shows where the agricultural accesses will be maintained in the design of the project. There is a crossing -- and they're pretty much along the old traditional agricultural routes and roads during the sugar cane period. There are six -- sorry, five agricultural crossings. Just to the north of the sediment basin. Another one to the south at Wainee near the reservoir, there is a crossing that will be designed. There is another crossing at one of the streets there, the agricultural roads. And south of Kauaula Stream is another crossing for an agricultural access.

In terms of just a summary of our Environmental Impact Statement on marine resources, overall there will be a net benefit to marine resources resulting from the reduction of approximately 25 percent of the sediment discharge in the study area.

In terms of mitigation for cultural impact or potential cultural impacts, archeological monitoring is recommended and will be incorporated in the design and construction of the building of the project.

Archeological monitoring will be carried out during construction activities to mitigate adverse effects to cultural and historic resources.

Unresolved issues that have come up with project design and project assessment is the Lahaina Bypass. Both projects at this point are very conceptual in nature. In terms of the Lahaina Bypass, they just underwent a final environmental -- federal Environmental Impact Statement which was accepted by the state under Section 343, by the governor and it is under consideration right now under the federal process to be finalized in the near future. However, as you saw from the earlier slide in the first frame, the Lahaina Bypass parallels the Flood Control Project but mauka of the flood control alignment ranging from about 500 feet to 1,000 feet up slope from the project.

There is concern that has been raised, you know, that that would act as a higher sort of level of retention and what needs to be sort of coordinated with the design of the highway and the final design of the flood water control channel is that how the flows of water will pass through and under the Lahaina Bypass alignment and highway and into the diversion channel. And those items have to be finalized in the design of both projects so that the integrity of the





flood control project will be intact and not impacted by the Lahaina Bypass alignment and route.

In terms of alternatives considered, the alternative that we just assessed is the preferred alternative. Another alternative that was considered was shotcrete banks and earth bottom channel alternative.

The third was Lahaina Town flood control outlet, to have a flood outlet through Lahaina Town. I get on to item B in the next slide, but I would just like to touch on the other alternatives. The Lahaina Town flood control alternative didn't prove to be very I guess workable, that there isn't a very well defined outlet and course presently that exists through Lahaina Town to carry the volumes of water that's anticipated from the flood control project. There are some limited outlets at this point in time that have been implemented and the county is right now reviewing a comprehensive flood control project makai of the existing alignment of the flood control channel. But not having a well-defined natural outlets and courses through Lahaina Town at this point in time sort of put this alternative at a lower priority.

The Kauaula Stream single outlet alternative was considered. However, concerns were raised by residents in the local area regarding the high volumes that may be coming down Kauaula Stream and the Puamana Channel and so that alternative was placed at a lower priority.

The no action alternative action is one that can be considered. However, as you can see, the need is present and it isn't a very prudent alternative to follow. And as well, the deferred action alternative is similar to the no action alternative, resulting in current flooding problems, persisting and higher costs for future implementation.

The shotcrete alternative was considered with respect to the alignment. It would reduce the maintenance costs of the channel from the grass-lined alternative to shotcrete side banks, grass-lined bottom. It would reduce maintenance costs and it would also reduce right-of-way requirements because with the shotcrete banks, you could increase the slope to 1-and-1 and reduce the right-of-way that may be required for the channel.

Those are the alternatives that were considered. Comments will be received on those alternatives as well.

Permitting that will be required for the project. The county -- there will be a Special





Management Area Use Permit required for the improvements that are probably south of Kauaula Stream. They're within the special management area of the County of Maui.

There will be a Shoreline Setback Variance requirement for the second outlet. Although it is mauka of the high water -- the mean higher high water line, it is shoreward of the certified shoreline and within the setback of the County of Maui so a Shoreline Setback Variance will be required. These permits have been applied for as well concurrently with the EIS review, the review of the Special Management Area Use Permit and Shoreline Setback Variance have been and will be carried out concurrently.

With respect to the State of Hawaii permits, Section 401, water quality control permit will be required through the Department of Health. Coastal zone management consistency approval will be required through the Office of Planning. A conservation district use permit will be required through the Department of Land and Natural Resources and that's for the area of the second outlet that is shoreward of the Honoapiilani Highway right-of-way. And the stream channel alteration permit will be required from the

Commission on Water Resources Management for the works contemplated for Kauaula Stream, the debris basin, and Kauaula Stream.

Under the federal jurisdiction, Department of Army Section 404 permit may be required for Kauaula Stream debris basin as well.

That is the sort of a very quick summary of the Draft Environmental Impact Statement findings. What we would like to do now is to have I guess public comment and input into the Draft Environmental Impact Statement. We've set up a microphone for this and we would ask that people sign in -- if you want to speak on the project, to sign in and then make your comments heard to us. We are going to be recording this as well. As I said, a court reporter will be taking a verbatim transcript of public testimony. And then after this period, project sponsors Mike and myself and Eric will be available to just informally answer questions that you may have, provide further detail on the project, but it would be on a more informal basis. And as I said, we will stay about 15 or 20 minutes or however long it's required to just answer some questions that people may have but may not necessarily feel that public testimony for the project is warranted for their particular comments.





So at this point in time we can just go to the sign-up sheet. I would like to mention as well that there are some green sheets that are available and if you want to write your comments as well, you can, and hand them in. We have a sign-up or sign-in sheet for people attending the meeting tonight and if you haven't signed that, I would appreciate it if you would be able to just put your name and address down so that we could -- for the Environmental Impact Statement review we could include the public meeting and the attendees of the public meeting.

MR. NOHARA: First testifier is Ed Lindsey.

MR. LINDSEY: Hello, my name is Ed Lindsey, born and raised in Lahaina. And during our formative years, my dad who has had relations in every one of these mountain valleys and I'm here to help the process along rather than being a hindrance as I can see that Lahaina needs a flood control system, just that we want to be sure that it's the correct one and it will last for the next hundred years or more. Because once this thing get installed and with the building that's going to be occurring, there is going to be little room for changing unless the state or county secure these lands for future development in as far as flood controls are concerned.

I appreciate the work that has gone into the EIS and I haven't had a chance to go through it thoroughly. I just received a copy of the EIS on Thursday and haven't had the time -- adequate time to go through it in a manner that it should be done. However, from my perusal, I have some suggestions and then some concerns.

The suggestion I had is to have a variety of alternatives. I believe a variety of alternatives would be best needed for this kind of flood control system. And you mentioned it in your booklet here, I mean your book, the contours, berms, walls, ag nets, native plants. Look at the plantation infrastructure, what can be used, how it can be used, and incorporate that; it's already there.

Alternative ag uses. You know, I've seen a section about native plants and how to use them and so on. But if we take the water from the top side and actually use it properly for agricultural uses or any other method that we can so that the water aquifer system is recharged rather than going out into the ocean to me makes more sense.

Now, I know Kamehameha schools have a large section of the lands above Lahaina Town and they have been interested in trying to get it into ag use, but





there is problems about getting water to the section above Lahaina. And I think as part of the system for this control should be getting agricultural water across wherever the resources are so that you can have alternative agricultures, multiple types of agricultures going on here. This will take a lot of the flood water problems out because as we all know, sugar did the job and I don't see too much differences in this occurring.

We also need basins and we also need ponds and that kind of thing. That should be entirely incorporated. Another suggestion would be to maybe if you rip it down a little further than four inches so that water can soak in rather than run off.

A concern as was mentioned before is our ocean resources. As a practitioner and as a person who has lived in Lahaina and used the ocean as our refrigerator to supplement our diet, the limu situation was sort of given just a cursory mention. You know, lipoa out there where you plan to have the water dump is really important and we miss the smell of the lipoa as we driving to Lahaina from outside of Puamana park area. And there are chants that mention about it. Also, this limu called pakelepa [phonetic] Used to out there. That's chop-chop limu, for those of you who don't know. And that used to be over on the corals.

Now, recently -- not recently, but a while ago when I went back out there in diving in the last big flood we had, I never seen the ocean in front of Puamana as chocolate as chocolate can be. And the residue of that dirt in the ocean still pops up from Launiupoko down to Puamana whenever you have storm waves. And another section -- this is a little bit off the topic -- is right off the pali road. You know, the same situation has happened. That pali road, water in the pali road area outside Ukumehame used to be crystal clear and the same thing has happened there. It's sediments and human damage.

With that, I would urge you to continue on. Mahalo.

MR. NOHARA: Thank you, Ed. Next speaker is Brian Pellin.

MR. PELLIN: I work on several different projects. One of them is with the West Maui Mountains Watershed Partnership. The other one is with the state Department of Health Clean Water Branch, a statewide watershed project. But I'm actually here speaking on behalf of myself rather than the agencies. Since there is a diverse group of state [inaudible], I





can't represent all their points of view.

So basically a lot of my opinions were basically based on notes from the West Maui Water Advisory Committee. They mentioned that increased storage would be ideal, the existing ditches [inaudible]. There is a need to catch [inaudible] and distribute them better. Basically they also recommended improved water recharge through revegetation.

Basically it seems like the project is creating -- is more treating the symptoms rather than the cause. You know, it's basically they want to do another Kahoma Channel but facing the other direction, so I think it would be beneficial to increase storage capacity to promote the agricultural uses rather than just push everything out into the ocean farther down.

There is a lot of issues going on in this area that everyone is aware of with land owners, development, Kamehameha schools, and other land owners, and I think we should try to use this opportunity to find a win-win situation where everyone benefits. And I think this is a great opportunity, I think that the money would be well spent to restore the entire stream corridor with native plants, use the increased storage capacity to irrigate the fields, and solve a lot of those issues rather than putting the sedimentation basin right at the mouth here.

I notice that with Iao Stream channel, now they are going back several years later and trying to put in a low-flow channel so that the old [inaudible] can get back up there. So I think they should look at the cumulative impacts more. Also, when the bypass road goes in, it wasn't mentioned that all that pollution is going to end up there and eventually in the ocean. They're having a problem on Oahu in Ala Wai Canal where the sediment is so contaminated with lead from brake pads and motor oils that they can't even dispose of it in the ocean, they have to dispose of it on land. So I think that issue needs to be addressed with all the toxic sediment eventually reaching its way in there.

So I think a lot of the money should be used for stream corridor restoration rather than creating a new stream, fix up the other ones, use the infrastructure that's existing for more storage capacity, for more agricultural use, which is what everyone wants. Thank you.

MR. NOHARA: Thanks, Brian. Next speaker is Lucienne deNaie.

MS. DENAIE: Thank you very much for this





chance to make a few comments. My name is Lucienne deNaie. I'm speaking today for the Sierra Club Maui group. We've had a little bit of chance to review some of the proposal and I have to say I echo many of the things that previous speakers have said, that the surface in the stream water is very essential for the survival of our endemic and indigenous species of stream life. And when we channelize these waters, it can have very adverse impacts on the viability of the of these life forms.

So it seems like although some of our streams here do have those kind of channels, that what we want to look for in our future is ways to control the amount of water that comes during extreme storm events in a way where it can be productively used. And the intention of this project is very good. I have been here when there have been big storms and it's scary, there is a lot of water coming at once. But it is true we have the same problem on our road where I live in Huelo and of course we can really get rain over there. And somebody came up with a solution that we do the same thing, we channelize it through a little cement sort of riprap thing and we have nothing but problems because when we get a lot of rain, it just cuts away, gradually, because the water has such a volume because it's been concentrated. And it seems to me -- I'm not an engineer or anything -- that what this is going to do is take a great deal of water coming from a large area of land, channelize it into a very narrow area, take it steeply downhill, thereby kind of increasing the impacts it has. Even though there are the basins to try to interfere with the boulders and sediments and there is some absorption through the grassy area, still whenever you take something and make it smaller or narrower, our particular channel passes across grassy areas, too. But when I asked the old timers, you know, did you used to have this problem like we have now where we have this river crossing our road, they go, "Oh, no." And I said, "Well, why not?" They said well, because it was all gradually absorbed along the road. When they took it and made it all one place and took it downhill and put it in this one little crossing, it became a big problem because it's like the whole problem was compounded.

So if there was a possibility to look at more options in the design -- and I don't know if that's possible through the review process -- and create a solution similar to what the last speaker described where you create riparian areas along the stream that





could absorb some of the water at different elevations and utilize the existing ditches which appear to be kind of empty up there to carry some of the water to reservoirs where it could either be let back into the aquifer or utilized for the agricultural purposes that, you know, is going to be going on both to the south and the north of Kauaula Stream, that would seem just a more -- far more productive.

It would also promote, I think, the health of the Kauaula Stream which eventually if flows can be restored, there is the habitat that surrounds it so that it's not a destructive thing.

So I know a lot of folks want to speak and that's our two cents worth that we really want to see a plan and we support a plan that can recharge the aquifer, can minimize the impacts to having a high volume amount of water just shooting out into the ocean somewhere, and can work with the natural processes to the best of our ability as humans. Thank you.

MR. NOHARA: Thank you, Lucienne. Next speaker is Isaac Harp.

MR. HARP: Aloha. My name is Isaac. I live right down here by the mill, down the Mill Street, and I have a copy of the Draft Environmental Impact

Statement. Probably most of you never got this or you probably wouldn't have a chance to review this to provide comments or just comment on what you hear from the people today I guess here. I would like to just breeze through this real quick and point out a few notes.

What I usually do on this type of thing is look to the findings and conclusions section and I'll get to that in a little bit. I want to bring some concerns forward before I get to that. I kind of dog-eared these pages so I can get to them a little faster.

It states here that the sedimentation is going to be reduced by 25 percent and I was wondering exactly where that 25 percent is. Is that only in front of Lahaina Town? From what I understand from reading through this, at the second outlet the sedimentation discharge is going to increase to over 3,000 tons annually. And a lot of that it has been suggested to use for -- to nourish I guess the beaches where the former sediment used to go to. I think that's totally unacceptable to have discharge that puts over 3,000 additional tons of sediment into the water in one location to try and protect another location. It's like cleaning your yard and throwing





the rubbish in the neighbor's yard. I think I would either focus on taking care of the local community more than just focusing on keeping the water pretty in front of Lahaina for the tourists.

A lot of the local community collect food out there. In this EIS, there is only mention of a few seaweeds out there. There is also several urchins, fin fishes, crustaceans and things down there that depend on the seaweed down there. Not just the two seaweeds that we depend on out in that area. I think you guys need to dig a little bit deeper in that area.

But rather than continue with the going bit by bit through here, I just drop to the conclusions and findings and I'm sending my comments in writing. You have thirteen points in your findings and conclusions. Number one is no irrevocable commitment to loss or defect of any natural or cultural resource would occur as a result of the proposed project. We're going to lose the seaweed I think from that second outlet, so under number one you failed there.

Number two, the proposed action would not curtail the range of beneficial uses of the environment. Again, you're going to destroy the marine environment at the second discharge, so you also fail on that point.

Number three, the proposed action does not conflict with the state's long-term environmental policies or goals or guidelines as expressed in Chapter 344, Hawaii Revised Statutes. I don't think the environmental policies or goals or guidelines of the state is to discharge sediment directly into the ocean, so I also believe you fail on that point.

Number four, the economic or social welfare of the community or state would not be substantially affected. I believe you failed that because you will substantially affect a local community that utilizes the marine resources in that area. So far we're at four out of four and you're failing.

The proposed action does not affect public health. Well, a lot of people depend on marine resources as our diet. As you probably know, a lot of Hawaiians are not too healthy because of poor diet and a lot of people are moving more towards fish, so I believe you do affect the public health by eliminating this area for food collection. So you fail number five.

Some good news here, I think you pass on the next one. No substantial secondary impact such as population changes or effects on public facilities are anticipated. I don't think the project affects that,





so I believe you pass that one.

Number seven, no substantial degradation of environmental quality is anticipated. In this document itself says that over 3,000 tons annually are going to be discharged from the discharge number two, so I believe you are substantially going to degrade the environmental quality. So that's another failure.

Number eight, the proposed action does not involve a commitment to larger actions nor a cumulative impact resulting in considerable effect on environment. Again, I've got to point to that number two, over 3,000 tons annually coming out at siltation, that's another failure.

No rare or endangered species or their habitat would be adversely affected by the proposed action. That's number nine. The area supports feeding grounds for the protected green sea turtle or threatened sea turtle and there has also been sightings of Hawaiian monk seals hauling out on those beaches which is rock now and if the sediment comes down, it might change to sediment beaches and monk seal might not like that habitat. So I believe you failed on that one again.

Number 10, air quality, water quality, or ambient noise levels would not be detrimentally affected by the proposed project. I believe the water quality will be definitely impacted detrimentally in discharge area number two, so you fail on that one again.

Number 11, the proposed project would not affect environmentally sensitive areas such as flood plains, tsunami zones, erosion prone areas, geologically hazardous lands, estuaries, fresh waters, or coastal waters. Again we're going to affect the coastal waters, so that's a failure.

Number 12, the proposed project will not substantially affect the [inaudible] vistas and view planes identified in county or state plans or studies. I believe you pass on that one.

And last but not least, number 13, the project will not require substantial energy consumption. I believe that you also pass on that one. So out of the 13 points there, I believe you pass three of the 13, so for that score I have to give you an F and [inaudible] get back to the drawing board.

But I'm really interested in what I heard tonight that there's been some discussion with the land owners in the upper areas on utilizing some best management practices up there and I would really like to see what those practices are going to be. I understand that Kamehameha schools is working on





terracing some of the lands to help retain some of the water. I believe that's where we should focus, start at the top and see how we keep the water on the land. If we install best management practices, terraces and things, rip the fields like I mentioned a few times before to a deep rip like six feet down to break that hard pan that was been subcompacted by the heavy equipment over all these decades of commercial growing with all of the heavy machinery and everything, see if we can get the water to percolate back down and help recharge it. If it does get out into the ocean, it's going to be filtered through the ground and will come up clean instead of with the silt. Keep all this silt on the land itself.

Go back to the drawing board. I'm in full support of the intent of the project, but I cannot at all support the project as it's currently drawn. And I appreciate all the work and I hope you reconsider this design. Mahalo.

MR. NOHARA: Thanks, Isaac. Next speaker, Hans Michel.

MR. MICHEL: Thank you very much. My name is Hans Michel, a resident in Lahaina for 40 years, working for Pioneer Mill for 32 years. I have seen a lot of floods, a lot of garbage, and a lot of mud.

What I like to have question you, you told us you're going to have a service road along the flat channel. Where is the flood -- the service road, on the mauka side or on the makai side? You did not specify that.

A VOICE: On both sides.

MR. MICHEL: On both sides. That seems to be pretty good. Because when we have a heavy rain, it's not a trickle, it's really rain. In Lahaina, either you get plenty or you get nothing and that you have to get used to it. The problem is when the water comes from the mountain, he brings out a lot of silt, storms, debris, and he will might clog up your flood channel if it's not deep enough at the present place where the water comes into the system. So since the whole thing or many of the other section is grass-lined, it might erode a lot of that thing. We shall not too sure. But anyway, make sure whatever you do, you do it right because I don't think you have any more extra money for do something. And I don't grumbling what you have do -- what you have done the last 25 years. That's about the best we have today. And if you can get something going and we take it little by little, everybody will profit because I know we're not going to keep everybody happy. And I'll be





glad -- [inaudible] speak about what he likes to plant, that's good, but for all the planting we need to have water. And I don't think we should use fresh water, we should use all the water from Kaanapali after bringing them over this way what you call these -- Wes, you can help me on that. It is irrigation water from the shoreline from that treatment plant.

MR. NOHARA: Reclaimed water.

MR. MICHEL: Reclaimed water. Yeah. If you want to do something, you better have the plan on recycled water from the Honokowai treatment plant has to come in conjunction with the bypass on the shoulder, come in all the way this way so you people can keep everything green without fresh water from the mountain which is supposed to drink. And that's all I have to say.

MR. NOHARA: Thank, Hans. Next speaker, Tammy Harp.

MS. HARP: Aloha. I'm Tammy Harp. I do have some concerns, but I won't chop the thing apart because I don't have all the -- I cannot -- I have to find reasoning in order to support why I like kill something. But anyway, I've noticed that there hasn't been any mention about any negative impacts at the inlet basin, the first one, and the reinforced concrete channel, and coming out into the sediment basin. Worst case scenario, what would happen to the residents within that lining area that's makai of them? There is nothing. You know, I never see anything about any impacts upon the people that live right there at the beginning.

Also to my concern is that instead of going from cutting this way like this, isn't there a way we can stop them from the top because if you look at them like in the draft said gullies and, you know, a potential flood plain gatherers, yeah, and one is right here above -- by the school on the right side of Puupaopao [phonetic]. There's a mean one right there. And then as you go along into that way, you'll see that there are fingers. Now, that's mother nature's way of flowing in maximum bad weather type. You know, that's just how it is. And, you know, if we can catch 'em at the beginning and start working them, you know, I think -- well, I mean, I think that knowledge today is far greater than 10, 20, 30 years ago, 50, whatever it was. The storm is still going to be the same no matter what we do. And if we alter on the land, we just making more problems for ourselves because we cannot control Mother Nature.

And my other concern besides the residents





that's near the inlet at the first inlet basin and the sediment basin is that makai of it, yeah -- before I get into makai side, I just wanted to ask -- good question, but you know like what is our drainage system of Lahaina? What is it? You know. And on page 55, it says the storm drainage system within Lahaina Town consists of short limited capacity culverts which outlet to the ocean. And what about the outlying areas? You know, how many of them within the system are still in service, are operable? You know. And are they being maintained? You know what I mean? Is it still in effect -- I mean in a working condition?

And another thing is about the, you know, some of these ditches are along homes. And has the county or the state made any effort to go on a shoreline and look at the condition of these outlets that are other potential, you know, damage the property owners? We don't know, you know. But from what I suspect, nothing has been looked into in that sense where you walk 'em and you go okay, this is a drain, this is one drain, this is one drain, all along Front Street going that way.

Okay. And then also, too, you know, is there funding available to upgrade the existing system? You know, is there? I mean, sure we got funding for this, but what about getting what is already there and to upgrade it to make it in a better condition. More appropriate, that is. And also, this is a lot of questions. Because we're talking about flood and stuff.

You know, we would like to know where is the origin of that sitting water in the ditch at Malulele [phonetic] park? I mean, where does it come from? It's just sitting there. A lot of times from small kid time, the thing would dry up. Now it just stays there. Why?

Okay. And then another thing is you know as being residents and sometimes we feel like we're being forced to expose our traditional and cultural knowledge, yeah, just to protect our resources. And you know, sometimes I feel that naming species are sometimes inappropriate and invasive because we know better not to tell because then we open the doors to depletion. And you know being that we live on an island, we actually utilize the whole shoreline. It doesn't matter if A, A B, you know, A with a thing on top, it doesn't matter. The whole shoreline is being utilized. Not necessarily going to see us every day because that's not how it's supposed to be. But we do





utilize the whole shoreline on both sides of the impact area and the impact area itself. So, you know, especially at the second outlet if there is contradiction with what was engineering, who is that, Dr. [Inaudible] who used to speak, anyway, with them describing what is outside the reef and everything and how well defined and la la la, and yet they okaying that we can discharge the sediment out of that second one just to enhance 25 percent towards Lahaina Town when 75 percent will be destroyed at the mouth. And besides that when you look like the limus that said that oh, I'm going to name some at the mouth of like Kauaula, that guy says there is these limus don't exist. Of course you go to other rivers, they ain't going to exist there because that's not their environment. But you go adjacent to that, boom, they're there. So impacts will actually be like dominos. And, you know, like was said oh, move down, grow some place else. We hope. Because we don't know what the actual negative impact going to be because we cannot judge it. Just like the weather man, I don't trust it. So you know, I mean, we can say things on paper and actually we could bring more destruction to something we want to protect. So in order for -- you know, I cannot agree with what was presented as the for the marine section, the ocean, because you're going to destroy 75 percent of one area that is harvestable or can still be -- I mean -- and just to enhance 25 percent of one town that it could have been like that historically and why we going to alter it now. Why we going to create beaches for more people to come on top and trample everything again. No, we got what we got. We got to just make use of what we have and just that people got to realize that you cannot go to the beach every day just to take the same thing every day because you going to wipe them out and you take it, that's being selfish because that's how the mentality of today is. You know, you don't go every day. You go some place else. Think about other families. If you're going to go -- that's why like Isaac, you guys don't know this, but he always mentions about the commercial factor of taking from the nearshore waters. And you know, slowly I'm beginning to believe that we are going to have to go that route in order to preserve. Because people got to realize if something drastic happens, we got to rely on our own resource to feed ourselves. And if we allow people to harvest uncontrollably, we no can go to the icebox and get food. We got to go borrow from somebody else's freezer. But it's just that we can do





more harm than good if this is not planned well.

But for me I feel we got to hit the main entry of all of it. Because you guys do say where this the inlet basin is collecting water from where? Is it this development here? And also, too, what about the developments coming up by Akila all the way to Launiupoko? What is those homeowner, the resident agricultural homeowners up there, what is their kuleana to not get their opala down into the waters below? Are they going to tap their gutter system into this flood control project? I mean, what? Going to be like Launiupoko where the ditch comes right down on the side of the park? So there is -- well, I'll write the rest, but I just wanted -- and also for the record I wanted to state that in my portion I did mention that I didn't know about any cultural, you know, things going on, but it said in recent years which I didn't comprehend in the beginning. But yes, in recent years and for sometime before that, there have been cultural practices going on and that has been with the families of Kauaula. You know, they live off the land. Sure, they got to work, come out for subsistence, part of the subsistence cycle, but still they live off of the land. And culturally I feel the families of Kauaula have maintained the cultural part exercising the practices. But anyway, I should have done better than this, but sorry for the rambling, but I didn't see nothing that would -- for the -- especially for the residents that would be affected by the first inlet and the second sediment basin, there is nothing that says that there won't be any impacts upon them. Mahalo.

MR. NOHARA: Next speaker is Pete McKenny.

MR. McKENNY: I've got to tell you, when I came to this meeting I was pretty sure what I was going to say. And listening to all the comments and all the people that I've talked to over the past 30 days, I realized what a complex situation this is. I've spent a good part of the day on the phone with Don Malcolm that's familiar with these projects and somebody whose wisdom I admire, and it's kind of -- Wes gave me some thoughts to consider. And I think what I would like to say -- and this was Don's concern -- is that we don't get too carried away with negative criticism on this for fear that it will kill the project. And in favor, if this project -- it's needed and it's a question of how we're going to do it.

And I think most of the concerns that I've heard tonight are concerns about treating the mauka situation. We have people working on it, the NRCS and





the West Maui Soil and Water Conservation District that are working with the land owners on this now. I think part of the problem is that their recommendations, suggestions from Brian and Lucienne haven't found their way yet into this EIS. And as this is expanded and our comments are heard, I think a lot of these concerns will be taken care of. And I hope that's the case and I hope we all work toward that end.

One thing that particularly in this EIS that I didn't feel inspired much confidence in me any way was the EIS on the highway bypass which runs mauka of this flood control project. And I think the question needs to be asked if the flood control project is necessary in the first place, why isn't the flooding danger more fully dealt with in the EIS on the highway which has already been accepted? When you -- in the design section, what I found out they want to do culverts underneath the highway. Well, if you back up a lot of this water and shoot it through culverts, you're going to have some problems mauka. So there will be some impact from the highway on to this flood control project and I think that needs to be fully explored and developed.

Those are my thoughts. I hope we all work together as a community for a constructive solution to this.

My other feeling is that 25 percent reduction in silt -- we can do a lot better by doing a better job mauka and hopefully this will happen as we all work together. Mahalo.

MR. MICHEL: To answer your question, you said how come we don't make the flood channel mauka the bypass. [Inaudible] a long time. But I found out from the government sources that two different governments don't can get along together for plan something. Otherwise everything would have been mauka the bypass, one flood channel, and aloha, we all done.

MR. McKENNY: Sounds good to me. Thank you very much.

MR. NOHARA: Thanks, Peter. Next speaker is Jacob Kapu.

MR. KAPU: Aloha. I'm Jacob Kapu from Kauaula. I go to Lahainaluna High School. And on the bottom of like the high school, there is a canal, I think we should -- or you guys should restore that. It would bring more agriculture and then you can restore like water to make like agriculture what he said, agriculture lands, you can sell for make like agriculture plants. I think you should restore the





old canal before you can make a new one. That's all.

MR. NOHARA: Thanks, Jacob. Our last speaker is Ke'eaumoku Kapu.

MR. KAPU: Mahalo. Ke'eaumoku Kapu, Kauaula. First I would like to say there's an old saying, liquor is for drinking and water is for fighting. But we throwing all the water away. Yeah. This diversion to divert water away from town in these culverts, who does it benefit? We're getting rid of natural resources to provide for our future.

Then the second question is pertaining to what we're going to do about the land after the water has been taken away from the place? That aina up there I know about 'em because I drive every day, yeah, every day I drive that land. I go through the dust. I go through the hard times pertaining to when it rains. I rather be stuck up there than down here. Yeah? So that's pertaining to a cultural assessment or inventory survey that needs to be done. We tried to share pertaining to what basically our input or how we could benefit in this factor, but we got to remember people, this is a federal grant. Bottom line means the comments will be taken into consideration, but the project shall continue. Okay.

We're talking indigenous, endemic species and it's always the cultural aspects of any project is the first priority on the list, but it's the last to be addressed when the project is finalized to be completed. Okay? So how we going to solve our solutions for the future when we getting rid of all this precious resources, these precious commodities that we need to be basically dependent on? You know, we been through many litigations in the past, yeah, and for our family, we know what it is to be oppressed. We know how it is to basically be faced against the wall, yeah, by being put down by so many entities, okay. Historic preservation is the recommendation, that's all. Yeah? State land use commission, what do they do? Nothing. County? I still waiting for them to do their fiduciary duties pertaining to what our plight has been from the beginning. Now we need to look at this project -- not just this one project, yeah, but how all these projects going to coincide with the next. You got the bypass. Good comment you brought up, Mr. McKenny. Why put the so-called trench below the freeway when it should be above? It does make sense. So who actually -- is this a time factor to put in the bypass before the so-called canal or is it the canal permit was put in before the bypass? Then we get the low income





homes coming up after the new park was put in. Then what else kind potential development we get in the area? Yeah. You guys going to have to figure that out. We already figured out the mess, okay? We already tried to go out there and explain to you people what was going on. But hey, everybody like reading the newspaper and making determinations for themselves as pertaining to our plight in Kauaula.

And as pertaining to a compromise or an agreement, come on. Hawaiians love to love and they love to fight and that's all they like to do. When it comes to doing something pono, yeah, we here for the long haul. I hope you all with us. Other than that, mahalo.

MR. NOHARA: Thanks, Ke'eaumoku. There is two more speakers. J.J. Elkin.

MR. ELKIN: Thank you. J.J. Elkin from 505 Front Street.

I've been to several of these meetings and I'm struck by the following. When you look at this entire problem, we all know it's a problem, we know it has to be fixed. There are two completely different concepts of how to solve this problem. What we have heard tonight, this presentation, the formal presentation, is one type of solution. It's what I would call the engineering solution. And I'm not going to ask questions about the engineering solution, whether they figured the maximum water flow for a hundred years and such questions. But the idea there is how can we control the water so that it doesn't come down on the houses in Lahaina.

But there is another concept that has been pointed out and it's been brought up in other meetings and it's a completely different concept. It's been touched upon by several speakers tonight. And frankly, I think has not been properly examined and I think we have to get an answer and it has to be properly examined. And the question is basically instead of the, quote, engineering conquering type of solution which is traditional all over the world, is there another solution which is more in keeping with the -- to put a general name on it, with nature. In other words, just to give you several examples that have already been pointed out with the concrete type of a situation. Number one, it reduces the negative impact, but it doesn't eliminate it. And that's a problem for those people who are concerned about preserving the environment.

The second thing, I am very worried about this bypass situation. The reality is we need help here in





Lahaina and when you superimpose the problems of the bypass, I can see that this thing is going to be 20 years down the road. In other words, there are all types of things, some of which have been touched upon today, but introducing another problem in the, quote, concrete solution is going to cause a lot of problems.

Therefore, I would like to suggest that we need to have an examination of -- a study such has been done for the, quote, concrete study, of is there another type of way of doing it? Can we have the water, as has been pointed out, the sources up above, can we have them dispersed in various areas in a more natural way so that we don't need the, quote, concrete type of solution? And I think we need to have that type of study, we have not had that type of study, and let's have that type of study.

So, my conclusion is as follows: Number one, we've been talking about this forever and I see the, quote, concrete solution has big, big problems in terms of delay, in terms of cost. In terms of cost, just to give you an example, you would say well, we have a 12 to 14 million dollar estimate, but we might have to do something to restore part of the shore. How much is this going to cost? How much silt is going to come out? What are the other effects we're going to have to mitigate? Isn't it better to look at the solution which is more in keeping with nature to try to deal with the problem up above rather than down below. And we haven't had that study.

So what I'm saying to you is we have had one study tonight. How about getting another study? How about getting a study using the natural flows of water and trying to preserve the environment and not have the, quote, concrete type of solution?

So my question to the committee, I guess, is can we get such a study? Maybe it's not practical. Maybe we should go back to the concrete solution. But we haven't had the study yet, so how can we make a decision? So could we please get that type of study?

MR. NOHARA: Okay. Thanks, J.J.. Next speaker, Mary Helen Lindsey.

MS. LINDSEY: As I heard all the speakers, I needed to write down on my own, especially hearing Hans because Hans and I go back a long time, especially when it's including the floods we have gone through so we know what it is to live through floods.

Born and raised in Lahaina, 393 Front Street, ocean. Kauaula Road went all the way from Kauaula down right where we live. There has always been flooding. Always been flooding. And I don't want to





be caught in a flood. The damage that's going to be done is going to be horrendous. Every year we go through this with the houses that's below just before Wainee Waiola church. The hardship that's gone through. Something has to be done, definitely. And I appreciate -- reading through the book and not putting the time in, but going from one area to the other, I have some questions that I hope can be answered.

In the book it says there is two land owners that do not agree and you said you folks will deal with them. Is it going to come to condemnation of the land to get it? Or you think those two land owners will change their minds? If it's condemnation, that's going to take forever. So I see another holdup.

You know, I want to look at the big picture. Is this going to be done? Because when the very beginning of it over at Puamana where Kauaula Stream goes through, the engineers have painted the rocks and they said you watch the rocks where different areas come from, then we'll know how strong the force is. So that was done. And that was done over 20 years ago. And if we're going to be grumbling or arguing or saying, you know, what's best, there is no doubt about Pioneer Mill knew what they were doing about controlling flood. They knew. The ditch at

Lahainaluna is full. If that ditch was emptied and maintained when Pioneer Mill used it, that's going to help some flooding. But it's not maintained. Nobody is going to maintain.

It went into reservoirs. No doubt about that. That helped. So if ditches could be re-maintained and if reservoirs that they have could be maintained, too, then it could go catch it, there is no doubt that some of the force will stop, but it will not stop it. There is no doubt it's not going to stop it. But it will keep the water up there.

Let's face it, agriculture is not in. You can't make a living out of agriculture. Water is too high. Land is too high. I'm a farmer, too. We have only one place that we can send our produce to. So let's be real, guys. Agriculture, unless you can -- go talk to all the different people who are in agriculture. It's rough. Corn is all over the place. What happens? Everybody has it, price goes down. So reality is -- agriculture, very questionable.

So another question that I have over here is the Kanaha flood that we had. And one of the questions brought in is why don't we hook up also to Kahomo. Because they have fantastic system now. We don't know. Rain sometimes over here rains and over





that side it's not raining. It rains longer certain sides and it doesn't rain on our side. But when the rain comes, when the rain comes, it will come. And we want to be prepared. I want to be prepared. I don't want to be walking in mud and trying to find a safe place.

Pioneer Mill. Reality, guys. Pioneer Mill used to send their dirty water right down. And what's happened? The reef survived. All that dirty water went down. And we used to swim in it, too. We didn't die. We're pretty healthy, as you can see, my brother and I. I guess we have seen the changes. However, I don't want to see another change when we get inundated because many things -- the weather forecast has been very, very difficult to protect -- to dictate, rather -- or to -- what is the right word? Anyway, to save. Because look in the Mainland how many floods they have. And the so-called 100-year flood came to 1,000-year flood. You can see the trucks floating down. Are we going to sit around and say more tests, let's do more things, let's wait. And then when it does come, oh, it came and we're stuck. That's not the answer, guys.

I applaud you for all the work you folks have done and I wish there were some easier and fast, quick things that you folks could put together to do. But the picture -- the picture is a bright picture. It's not a rain picture. It's a bright picture. We got to give it chance. We have to work -- clean out the Pioneer Mill system, put in what you got, and then if we get the bypass at all because this bypass has been forever, and we don't want this flood system to be forever. I want it to be in my lifetime. And I do not want to face inundation by rain and be in mud. Thank you.

MR. NOHARA: Thank you, Mary Helen. Our last speaker is Yolanda Dizu.

MS. DIZU: Aloha. My name is Yolanda Dizu from Kauaula. After listening to everyone's testimony, some pretty good ones out there and it sounds like what everybody's thinking is if we destroy our resources and/or use diversions over diversions over diversions, the waters will not be able to flow the way it should flow. And it sounds like that's what's causing a lot of our floods. Yes, agricultural is -- you can't make money off of agriculture. But you can off of smart agriculture. I mean, look at Oahu, there is no more poi, no more taro. You know? Self sustainability. And you heard mauka -- makai going to suffer, too. So because of the bypass and





what's coming in, I don't think this is going to go through anyway for a while anyway. And go back to study again, I guess, and see what happens. But we cannot have one band-aid fix that only going to work for 20 years. With the bypass coming in, with the developments that are coming in, it going to happen. It going to be band-aid and going to have to do them all over again and waste all that money, tax payers' money. So that's, you know, try the best you can to come to another solution. I mean we need, we need this, but -- we need. I mean, I know people, I have families that their house gets flooded out. And no insurance. You know? And they suffer. In the meantime, if the county can help, you know, all you guys who do this research, help the families now because we're going to have big rainstorm. It's coming. You can feel it in the air. Mahalo.

MR. NOHARA: Thanks, Yolanda. I believe that's all the speakers that signed up. We do have written testimony from Joanne Johnson who couldn't stay.

In closing, I would like to thank each and every one of you for coming out tonight and sharing your perspectives and concerns on this project and on behalf of the County of Maui and NRCS, Michael

Munekiyo and Mich Hirano, the West Maui Soil and Water Conservation District, we want to thank you and we will take your comments into consideration.

I really believe that something needs to be done. I think this is an important project. There is always going to be some concerns. As a community, we need to pull together and work together to resolve this. And with that, I want to thank each and every one of you.

Are there any other closing comments from anyone?

MR. MICHEL: Wes, please tell the people the water channels you have built from Honokowai -- I mean Honolua all the way to the Kahoma Channel are actually practically working good or correct. Please explain it to the people. So I don't think the project designed. To me it looks fairly good. I have no comments on that. But let them know what you done soil conservation [inaudible].

MR. NOHARA: Hans Michel says he wants me to explain about the types of projects we have done on the north side of Honokowai, from Honokowai north of Kapalua. And we've brought in probably about $15 million of the same type of federal funds for basins and flood control projects from Napili to Three





Gulch which enters into Napili Bay all the way to Honokowai. And yes, those projects have prevented huge floods that I remember as a little boy in Kahana area and devastated some of my classmates' homes there. So it's no doubt that these projects do work.

But I also have to say that I'm a firm believer that BMPs, best management practices, need to be installed from the mauka to the makai. These basins are a last stop measure to protect people's homes. But you cannot use that alone. You need to protect from the top of the mountain, which we do have I believe people who said they represent the West Maui Mountain Partnership people, and they're fighting pigs and our latest challenge will be deer, protecting the native plants, protecting the watershed, our drinking water, forestry lands, ag lands, putting in terraces and those kinds of stuff. I'm a believer in keeping [inaudible] where possible. It's hard to make a living in agriculture. Without water, it's almost impossible. But it is a system and I know that our Hawaiian friends understand that well. And I still support this project, I think it's important. We should not lose sight of the importance of the management of soil and water from mauka to the ocean. So that's my perspective.

A VOICE: I have one comment. If the county stops giving out permits to purchase a property before you folks do your work, then it will be easier than having to go out and buy the property back. It should go to the county first and the county should stop selling lands before we get everything finalized. This has been in process for many years and should have went directly to the county. But the county decided to sell it off to new development and now they're stuck trying to buy back property which is going to prolong this project.

MR. NOHARA: Thank you. With that, again, thank you.

A VOICE: Just one thing. What you said about the limu, the one called chop-chop, the common name is [inaudible]. Not everybody know it as chop-chop limu.

MR. NOHARA: Okay. Thanks, Tammy. Again, thank you and drive safe. Good night.

(WHEREUPON, the meeting was concluded at 8:10 p.m.)





C E R T I F I C A T E

STATE OF HAWAII )
) SS.
County of Maui )

I, LYNANN NICELY, RPR, Notary Public for the State of Hawaii, certify:

That on the 17th day of June, 2003, the meeting minutes were taken by me in machine shorthand and were thereafter reduced to print under my supervision by means of computer-assisted transcription; that the foregoing represents, to my best ability, a true and accurate transcript of the proceedings had in the foregoing matter.

I further certify that I am not attorney for any of the parties hereto, nor in any way interested in the outcome of the cause named in the caption. Dated this 9th day of July, 2003, 2003.

Lynann Nicely

NOTARY PUBLIC, State of Hawaii

My commission expires: 1/24/2006

# COMMENT CARD
## LAHAINA WATERSHED FLOOD CONTROL PROJECT
## PUBLIC INFORMATION MEETING

Comments are due by June 23, 2003 and may be turned-in at the public information meeting or mailed to: Mr. Gilbert Coloma-Agaran, Director, Department of Public Works and Environmental Management, 200 S. High Street, Wailuku, Hawaii 96793.

**PLEASE PRINT**

Name: Jo Anne Johnson

Address: 200 S. High Street Rm. #813, Wailuku, Hi 96793

Phone: Home 661-3237 Business County Councilmember (270-5504)

Representing: As County Official

Comments: Questions: 1) What is the cost reduction by using the shot-crete alternative? Current projections for annual maintenance costs are $260,000 and while I know there is general support for Lahaina's flooding problems by the County Council, is the Budget chair and Council aware of this added annual cost?

2) Has any effort been made to coordinate this project with the homeless Resource Center now being constructed or with the Maui County Parks Department.

(The other side of this card may be used if more space is required)

3) What is the impact, if any, on the Ikena Street portion of the Bypass which will now connect to Keawe St. (over Kahoma) (over)

atapiirpad/card.001

Rather than with Dickenson Street (which has now been scrapped on the S.T.I.P. schedule)?

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**PLEASE PRINT**

Name: Paulo Kanakakehau Fujishiro

Address: Box 1967, Wailuku, Hi 96793

Phone: Home 781-0242 Business SAME

Representing: IKE AINA - Hawn Land Trust

Comments: Needs more community input! Especially the Kupuna who can recollect some of their experiences. as to how the project can succeed! Look on the back!

(The other side of this card may be used if more space is required)

ata/hpiiroad/card.001

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**PLEASE PRINT**

Name: ORAL R.K. ABIHAI

Address: P.O. BOX # 494 LAHAINA, HI 96761 MAUI

Phone: Home 661-0238 Business O.G.S. INC

Representing: LAHAINA HISTORIC CENTER

Comments: AT CERTAIN POINTS ON THE REINFORCED CHANNEL BEFORE OR AFTER THE SEDIMENT BASIN'S COULD THEIR BE A WAY TO STORE THE STORM WATER IN LARGE TANKS BEFORE IT EMPTIES OUT N THE OCEAN, LIKE A NEW WATER SYSTEM FOR FUTURE USE!!

(The other side of this card may be used if more space is required)

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**PLEASE PRINT**

**Name:** LUCIENNE de NAIE

**Address:** SR1 BOX 47 HAIKU, HI 96708

**Phone: Home** 572-8331 **Business** SAME

**Representing:** SIERRA CLUB MAUI

**Comments:** A MORE NATURAL SOLUTION IS NEEDED. SPECIFIC COMMENTS WILL BE SUBMITTED

(The other side of this card may be used if more space is required)

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**PLEASE PRINT**

**Name:** BOB SULLIVAN

**Address:** 550 WAINEE ST. LAHAINA

**Phone: Home** 6613585 **Business** 6690423

**Representing:** SELF

**Comments:** THE POSITIVES OUTWEIGH THE NEGATIVES FOR THE PROTECTION OF LAHAINA TOWN —

(The other side of this card may be used if more space is required)

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## COMMENT CARD
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**PLEASE PRINT**

Name: Pat Sullivan

Address: 309 S. Ulu Koa Pl.

Phone: Home 6675932 Business 6690423

Representing: Self

Comments: The benefits of this project are essential to the prevention of flooding in Lahaina town. Press on with the project as proposed. Public Safety + Protection of Personal Property.

(The other side of this card may be used if more space is required)

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* Flood system should be above bypass.

## COMMENT CARD
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**PLEASE PRINT**

Name: Robin Ritchie

Address: 3975 L. Honoapiilani Lahaina HI 96761

Phone: Home 669399 Business

Representing: the public

Comments: How will road traffic be diverted during construction. We only have one highway + you will be reconstructing under it in two locations? And why hasn't Pioneer Mill been required to plant foliage to avoid wind + water erosion.

(The other side of this card may be used if more space is required)

ata/hpiiroad/card.001

## LAHAINA WATERSHED FLOOD CONTROL PROJECT

**Public Information Meeting**
**Attendance Sheet**
**June 17, 2003**

**PLEASE PRINT**

| | Name | Organization | Address | Telephone |
|---|---|---|---|---|
| 1 | John Kostrick | COM | 1582 Kuuipo St Lahaina 96761 | 661 5749 |
| 2 | Jo Anne Johnson | County Council | 200 S. High st. #813 | 270-5504 |
| 3 | Jacob [illegible] | KCELC | Box 1967 Wailuku | 281-0242 |
| 4 | MAGGIE KRAMP | MAUI SWCD | 210 IMI KALA #209, WAILUKU | 244.3100 ext 101 |
| 5 | Hans Michel | | 1404 Olona | 667-7693 |
| 6 | JOE KRUEGER | PUBLIC WORKS | 200 S. HIGH ST. WAILUKU | 270-7745 |
| 7 | Lillian Agawa | | 442 Lahainaluna Rd | 661-3987 |
| 8 | Matsuko Kubo | | 757 Paunau St. | 661-0434 |
| 9 | Kathleen Aoki | resident & PLANNING | 761 Paunau St | 661-4248 |
| 10 | Jim Riley | West Maui Land | 33 Lono Suite 450 | 877-4202 |
| 11 | BOB COLLINS | Maui Cty Civil DEFENSE | 200 High St Wailuku | 270-8755 |
| 12 | Jana R Baricuatro-Kahalsanu | | 414 Lahainaluna Rd | 662 0050/3768 |
| 13 | Robert Sullivan | | 550 Wainee St | 6613585 |
| 14 | Pat Sullivan | | 309 S. Uluhoa Pl | 6675932 |
| 15 | Peter McKenney | — | BOX 519 LAHAINA, 96767 | 667-2953 |

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| | Name | Organization | Address | Telephone |
|---|---|---|---|---|
| 16 | Mary Helen Lindsey | Self | 393 Front St | |
| 17 | Edwin Lindsey | Self | 1087-A Pookela Rd Makawao | |
| 18 | Donna Brown | Self | 19 Hale Malia Pl. Lahaina | 669-7580 |
| 19 | Watt Miles | Maui Planning Department | | 270-7735 |
| 20 | Daniel Kahaialii | Self | 217 Akeke pl. Lahaina | 661-1711 |
| 21 | Yolanda Dizon | Self & Kuleana Ku Ikahi | PO Box 792 Lahaina | 385-3124 |
| 22 | Albert-Allen Ogan | Self Kuleana Ku Ikahi | " " " | 661-8489 |
| 23 | EZEKIELA I. KALUA | W.M.T.A. | PO BOX 10338 LAHAINA HI. 96761 | 280-9682 |
| 24 | Roz Baker | State Senate 5th Dist. | PO Box 10394, Lahaina 96761 | 665-0930 |
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| Name | Organization | Address | Telephone |
|---|---|---|---|
| 100 ORAL A BIHAI | LAHAINA HISTORIC CENTER | P.O. BOX #494 LAH, | 661-0238 |
| 101 Tammy A. Harp | LAHAINA OPEN SPACE SOCIETY (LOSS) | PMB 191, 843 WAINE'E ST. F-5 | 661-4527 |
| 102 Anita Yamafuji | | 601 S. Hopoe Place Lah | 667-5763 |
| 103 Pet | | | |
| 104 CAROL TAKASHIMA | | 466 Pauea PL | 661-0201 |
| 105 Robin Ritchie | not organized | 3975 L. Honoapiilani Lahain | 669-3195 |
| 106 Isaac D. Harp | 'Ilio'ulaokalani; Lahaina Open Space Society | PMB 791, 843 Wainee St., F5 Lahaina, Hawaiian Islands 96761 | 661-4527 |
| 107 Mr & Mrs Ke'eaumoku Kapu | Kuleana Kuikahi LLC | PoBox 11524 Lahaina Hi 96761 | 276-5933 |
| 108 June Kaaihue | | P.O.Box 12544 96761 | 6695033 |
| 109 May Fujiwara | Lahaina-Honolua Sr. Ct Club | PO Box 1086 Lahaina 96767 | 661-4208 |
| 110 George Fujiwara | Lah. Hono. Sr. citizen club | Po. Box 1086 Lah. 96767 | 661-4284 |
| 111 Joe Kaaue | " " " " " | Shaki St. Lahaina, Hi | 661-4322 |
| 112 William SOARES | RESIDENT | 37 KUA PL. LAHAINA | 6673776 |
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LAHAINA WATERSHED PUBLIC MEETING -- June ~~18~~ 17, 2003, Lahaina Intermediate School

| NAME | AFFILIATION | ADDRESS | PHONE | EMAIL |
|---|---|---|---|---|
| Buck Buchanan | Self | 416 ACIO ST | 661-9044 | |
| J. J. ELKIN | | | | |
| LUCIENNE deNAIE | SIERRA CLUB MAUI | SR1 BOX 47 HAIKU | 572-8331 | |
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