# DRAFT
# DETAILED PROJECT REPORT
# and
# ENVIRONMENTAL STATEMENT

# KAULANA BAY
## NAVIGATION IMPROVEMENTS
## South Point, Island of Hawaii



US Army Corps
of Engineers
Honolulu District

JUNE 1981

DRAFT

# DETAILED PROJECT REPORT

# AND

# ENVIRONMENTAL STATEMENT

## KAULANA BAY
## NAVIGATION IMPROVEMENTS

SOUTH POINT, ISLAND OF HAWAII, STATE OF HAWAII

US Army Engineer District
Honolulu

Building 230
Fort Shafter, Hawaii 96858

JUNE 1981

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DETAILED PROJECT REPORT
AND
ENVIRONMENTAL STATEMENT
SOUTH POINT, ISLAND OF HAWAII, STATE OF HAWAII

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# KAULANA BAY

# NAVIGATION IMPROVEMENTS

## MAIN REPORT

# I. INTRODUCTION

## 1. PURPOSE

The purposes of this study were to determine the need for and feasibility of providing light-draft navigational improvements on the Island of Hawaii.

## 2. STUDY AUTHORITY

This study and report were accomplished under the authority provided by Section 107 of the River and Harbor Act of 1960 (Public Law 84-645), as amended. Pertinent paragraphs of the authority are included in Appendix A.

The Kaulana Bay Navigation Improvement Study was initiated following a written request from the State of Hawaii, dated 23 August 1979. Based upon this request, a reconnaissance report was completed by the US Army Corps of Engineers, Honolulu District on 8 January 1980 and approved for detailed project studies by the Chief of Engineers in June 1980.

## 3. STUDY AREA

The Island of Hawaii (Figure 1), the largest of the Hawaiian Islands, encompasses 4038 square miles of land area and 305 miles of coastline. This island has two main population centers, Kailua-Kona on the west coast and Hilo on the east coast. The town of Hilo is the economic and political center of the island and the main port.

The Ka'u Judicial District encompasses most of the south-southeast portion of the island. The surrounding lands consist of treeless plains covered by grass and low shrubs, and volcanic basalt partially overlain by sand dunes. The shoreline in the area is rough and rugged, characterized by historic lava flows, and offering little natural protection or safe mooring.

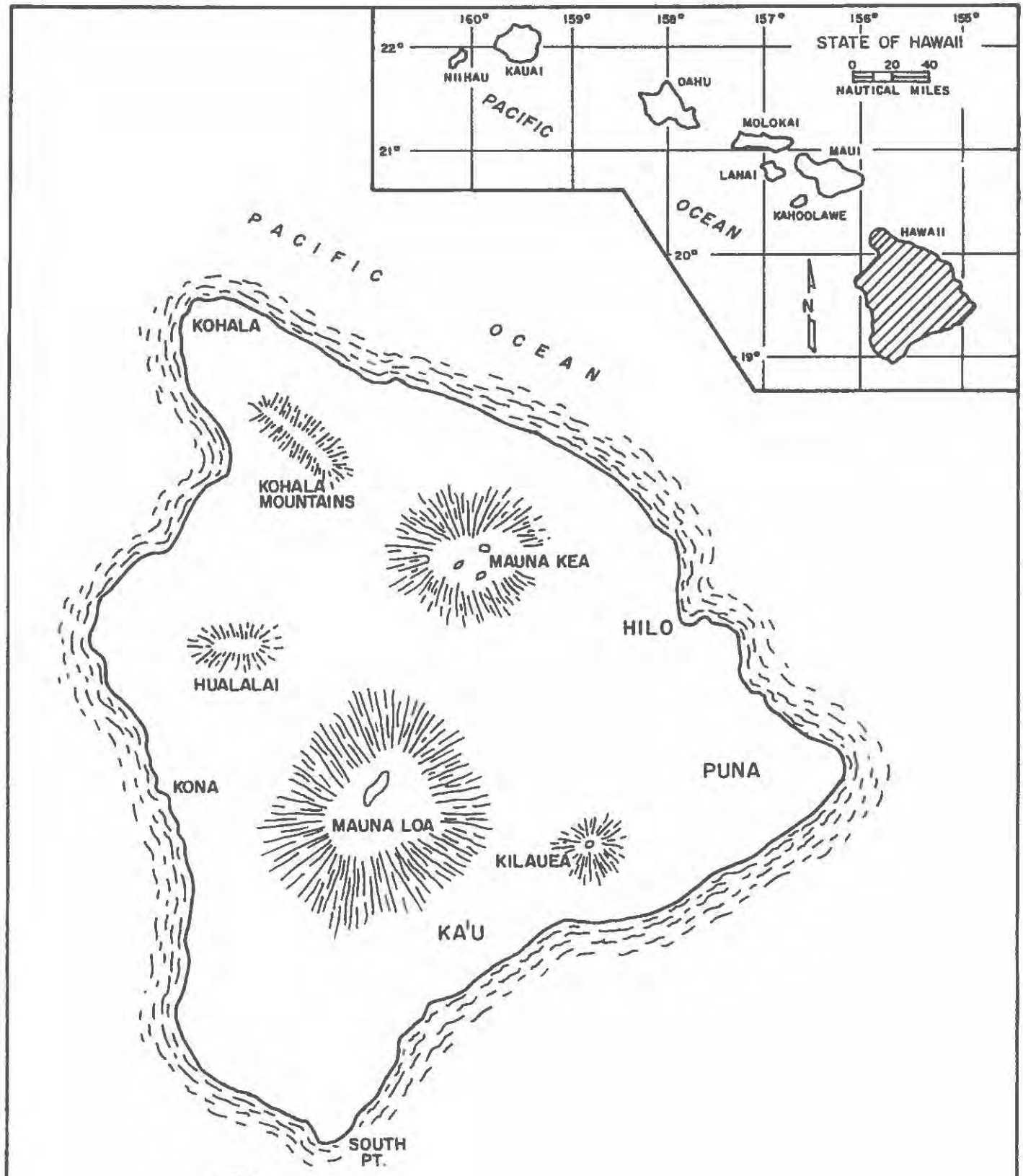
The boating facility at Kaulana Bay, consisting of a 20-foot wide, single-lane concrete ramp is the only facility in the Ka'u District constructed and administered by the State Department of Transportation. The ramp was built in 1963 and improved in 1972.

## 4. SCOPE OF THE STUDY

This study identified and evaluated the problems and needs associated with providing light-draft navigational improvements on Hawaii and the impacts upon the overall environmental, economic, social, cultural, and recreational resources of the area. The development of alternative sites and design lay-outs, and the costs and benefits associated with implementing these measures were evaluated.

Studies conducted included site investigations, archaeological-cultural studies, hydrographic and topographic surveys, geologic, foundations and materials investigations, fish and wildlife studies, oceanographic and meteorological studies, engineering designs, economic evaluations and environmental assessment.

The objective of this study is to provide a planning process based on increasingly specific stages of investigation. At the conclusion of each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KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII
LOCATION MAP
US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 1

stage, the range of possible alternatives was assessed and evaluated. Elimination of infeasible or undesirable measures narrowed the field of potential alternatives until an acceptable alternative or plan was developed.

The Detailed Project Report (DPR) constitutes the authorizing document for construction for the US Army Corps of Engineers small projects or continuing authorities program. Construction plans and specifications can be initiated after subsequent approval of the DPR by the Chief of Engineers and receipt of local assurances from the State of Hawaii.

## 5. STUDY PARTICIPANTS AND COORDINATION

The US Army Corps of Engineers, Honolulu District was responsible for conducting and coordinating the overall study and preparing the study report. Studies and investigations were performed with the assistance of governmental agencies (Federal, State, and local). Community groups and private interests were contacted during the study to help identify study concerns, to obtain pertinent study information, and to develop and evaluate alternative plans. A list of those contacted and the Public Involvement program are presented in Appendix B.

## 6. REPORT PREPARATION

This document consists of a main report and a series of appendices. The main report is a self-contained document which describes the planning process and includes the environmental impact statement. The appendices contain technical and detailed information and background data to support the information contained in the main report.

Appendix A, Plan Formulation Criteria and Compliance Reports, contains specific information regarding the study authority, legislative requirements, planning criteria and constraints, and local cooperation requirements that contribute to the plan formulation process of the study. Also included in this appendix are the evaluation reports required by Executive Order 11988, Section 404 of the Clean Water Act, and the Coastal Zone Management Act.

Appendix B, Public Involvement Program, describes the public involvement program and contains pertinent correspondence received during the study and evaluation period.

Appendix C, Engineering Investigations and Design Analysis, contains the engineering analyses and data relevant to the design of the proposed general navigation improvements. This appendix also provides information concerning geology, foundations and materials investigations and cost estimates.

Appendix D, Cultural and Social Resources, contains information on the cultural-archaeological and social resources within the affected study area.

Appendix E, Natural Resources and Fish and Wildlife Coordination, contains information on natural resources within the study area and the US Fish and Wildlife Service report prepared in accordance with the Fish and Wildlife Coordination Act of 1958 (Public Law 85-624).

Appendix F, Economic Analysis, contains the economic background, data, and analyses for determining the benefits and costs associated with each alternative plan.

7. PRIOR STUDIES

a. The US Army Corps of Engineers, Honolulu District completed a Reconnaissance Report on possible light-draft navigation improvements for the Island of Hawaii on 8 January 1980. This report established Federal interest in providing possible navigational improvements in Hawaii under Section 107 of the River and Harbor Act of 1960, as amended.

b. The County of Hawaii completed a General Plan through an urban planning grant from the Department of Housing and Urban Development, under the provision of Section 701 of the Housing Act of 1954, as amended, and the State of Hawaii. The general plan revision program, completed in April 1978 outlines general guidelines concerning socioeconomic, physical, and institutional planning. This plan also outlined desired navigational improvements for Hawaii.

## II. PROBLEM IDENTIFICATION

1. PURPOSE

The purpose of this section is to define the study area and the problems to be addressed in the study. This includes describing the base conditions, identifying public concerns, establishing planning criteria, and analyzing the problems. Public concerns which relate to water and related land resource problems are identified and then refined based on national and local policies.

National planning policies are prescribed by the Water Resources Council's Principles and Standards (38 FR 24778-24 869), the National Environmental Policy Act of 1969 (PL 91-190), Section 122 of the River and Harbor and Flood Control Act of 1970 (PL 91-611), the Water Resources Development Act of 1974 (PL 93-251), the Clean Water Act of 1977 (PL 95-217), and the Corps of Engineers' policy guidelines (ER's).

To help determine the resource management[1/] problems, the base condition of the study area is first defined. The base condition is the existing economic, social, and environmental characteristics of the area. Future conditions are then projected and analyzed to determine the "most probable future"[2/] which would prevail over the area without any changes to existing resource management plans. This analysis describes the "without condition" criterion. Planning objectives[3/] are then formulated based on the problems and needs of the area related to the "without condition" criterion.

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1/ "Resource management" involves the development, conservation, enhancement, preservation and maintenance of water and related land resources to achieve the goals of society expressed nationally and locally.

2/ "Most probable future" is the projection of basic demographic, economic, social, and environmental parameters, which is used as the basis for defining the "without condition" and the planning objectives for a particular study.

3/ "Planning objectives" are the national, state, and local water and related land resource management needs (opportunities and problems) specific to a given study area that can be addressed to enhance National Economic Development or Environmental Quality.

## 2. NATIONAL OBJECTIVES

The Principles and Standards (P&S) for planning water and related land resources define the national objectives of national economic development and environmental quality. National objectives are a means of measuring the effectiveness of possible solutions. The national economic development (NED) objective is achieved by increasing the value of the nation's output of goods and services and improving national economic efficiency. The environmental quality (EQ) objective provides for the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems in the study area.

During the formulation of alternative plans, the NED and EQ contributions are evaluated on an equal basis. For any plan to be considered for implementation, the total beneficial contributions accruing from the project must exceed the total adverse impacts of the project. P&S also requires that the impacts of a proposed action be measured in terms of Regional Development (RD) and Social Well Being (SWB). Contributions to the RD account are determined by establishing a proposal's effects on a region's income, employment, population, economic base, environment, and social development. Contributions to the SWB account are determined by establishing a proposal's effects on real income, security of life, health and safety, education, cultural and recreational opportunities, and emergency preparedness.

## 3. PROFILE OF EXISTING BASE CONDITIONS

The cultural, physical, environmental, and economic characteristics of Kaulana are briefly described. The appendices contain more detailed descriptions relevant to the planning and design of general navigation improvements.

a. History and Culture. The Ka'u District on the island of Hawaii has historically been a relatively independent Kingdom isolated from the rest of the island. Historical and archaeological records have revealed that Polynesian voyagers who settled in the Hawaiian Islands may have first landed and settled at Ka Lae, South Point, Hawaii. As the population expanded, other parts of the island became inhabited. Most of the early settlements consisted of small fishing villages.

In 1791, Kamehameha became ruler of the entire island by gaining the Ka'u District when its chief Keoua was killed at the dedication of Pu'ukohola Heiau at Kawaihae.

The Ka'u area later became a stopping point for seagoing travelers on their way to Hilo. In the 1860's, Mark Twain lived in Waiohinu and wrote extensively about his experience in the islands.

b. Physical and Environmental Setting.

(1) Physical features. Being of volcanic origin, the dominant topographic feature on the southeastern portion of the island (Ka'u District) are the large expanses of lava fields. Two of the island's most active volcanoes, Mauna Loa (13,796 MSL) and Kilauea are located in this area. Mauna Loa (Big Mountain), the largest single mountain on earth, provides a dramatic backdrop for the Kaulana Bay area. The Ka'u landscape is characterized by historic as well as young lava flows, moderate slopes with little or no established surface drainage, and a rugged coastline consisting of low and extremely steep sea cliffs.

(2) Climate. The Island of Hawaii has a semi-tropical climate, but has wide variations across the island in temperature and rainfall. Temperatures range from 58 to 90 degrees (minimum-maximum) along the coastal plain to sub-freezing minimums in the mountains. Mauna Kea and Mauna Loa often have a mantle of snow during the winter months. Rainfall in the southwestern region of the Ka'u District which includes the South Point area varies from less than 20 inches at South Point to 75 inches at the 5,000-foot elevation. Relatively uniform tradewinds prevail offshore, but disruption by the high land masses make inland winds very complex.

(3) Astronomical tides. The nearest tidal benchmark to Kaulana Bay is at Honuapo approximately 15 miles to the northeast. Tidal measurements taken at this location by the US Coast and Geodetic Survey in 1929 are as follows:

| | Feet |
|---|---|
| Highest tide (estimated) | 4.00 |
| Mean higher high water | 2.50 |
| Mean high water | 2.00 |
| Half tide level | 1.15 |
| Mean low water | 0.30 |
| Mean lower low water | 0.00 |
| Lowest tide (estimated) | -1.50 |

All elevations in this report are referenced to mean lower low water (MLLW) datum.

(4) Terrestrial biota. The coastal area of the Ka'u District is characterized by sparse vegetation consisting primarily of indigenous strand plants such as ilima, Pa'u-o-Hiiaka and beach morning glory with patches of Bermuda grass occurring in backshore areas.

Terrestrial fauna in the Ka'u District are also limited in abundance and diversity. Shorebirds including the golden plover, wandering tattler and ruddy turnstone probably utilize available shallow feeding habitat in the area. Passerine birds, field mice, and rats are also found in this area.

(5) Marine biota. The substratum throughout most of Ka'u coastline consists of hard lava rock covered in places by accumulation of silt and coral rubble. A number of bays along this coastline contain scattered massive heads of Porites coral. Coral growth elsewhere in these bays are limited to scattered Pocillopora colonies possibly a consequence of the constant wave action occurring in these areas. A variety of common reef fish and marine benthic invertebrates including gastropod mollusks, sea urchins, sea cucumbers and crabs are present along the coastline. Green sea turtles are occasionally observed offshore but no known nesting beaches are located in the Ka'u area. The endangered humpback whale has also been observed along the Ka'u coast in transit to or from the shallow shoals that comprise their preferred wintering habitat, primarily Penguin Banks and the area between Maui, Lanai and Molokai.

(6) Geology. The Island of Hawaii is the youngest of the Hawaiian island archipelago and is the result of the coalescence of the lava flows of five volcanoes. The volcanoes, Mauna Loa and Kilauea, are still very active. The base rock in the area is massive basalt. This is overlain by soil consisting of weathered base rock. The soils are very shallow, covering rough lava flows that are extremely permeable.

(7) Seismicity. The Island of Hawaii is situated within a seismically active zone and is classified as seismic zone 3. Many earthquakes of low and moderate magnitudes occur throughout the year. Most earthquakes that do occur are related to the volcanic activity of Kilauea and Mauna Loa.

c. Economic Characteristics.

(1) Development and economy. The State of Hawaii is prosperous with a growing population and economy. Between 1958 and 1980, the total resident population increased from 611,800 to 963,617 (preliminary census). During the period 1958 to 1977, the gross State product more than quintupled, from $1.4 billion to $8.0 billion. The three largest contributors to the State economy are tourism, defense expenditures, and agriculture, the bulk of the last activity being in the production of sugar and pineapple. The most rapid growth during the last several years has been in the tourist industry. Tourists' arrivals totaled 171,500 in 1958 and 3,960,000 in 1979. Tourist expenditures were $83 million in 1958. The expenditures were $440 million in 1968 and $2.6 billion in 1979, an increase of 495 percent. This compares to an increase of 175 percent for defense spending. It is expected that the growth trend in tourism will continue although at a slower pace together with the State economy in general.

Sugar and tourism dominate the economy of the Island of Hawaii. There are 469 sugarcane farms in Hawaii County cultivating 92,829 acres of caneland. Production of raw sugar was 3.9 million tons, 42.5 percent of the State's total in 1978 with a value of $68.6 million. Currently, the State of Hawaii supplies about 10 percent of the nations 11-1/2 million tons of annual sugar consumption.

The visitor industry on the Island of Hawaii grew rapidly in the past 15 years. Hotel construction increased so fast during this period that capacity exceeded the need for rooms. The increase in hotel units has been greatest along the Kona coast. Of the 6,093 units on the island in 1979, there were 3,637 units in Kona area, 1,954 units in Hilo and 502 units in other areas of the county. Total visitor expenditure on the island in 1978 was $158 million. Two-thirds of the State's beef and one-half of the diversified agriculture crops are produced on the Island of Hawaii. Commercially caught fish previously sold only to local markets or shipped to Honolulu are now being shipped freshly iced to the mainland.

Ka'u, South Kona, and the North Kona Districts would be serviced by Kaulana Bay. The major economy in the area includes livestock, sugar, coffee farming, and the visitor industry. The visitor industry is the fastest growing industry and will have the greatest influence in the future. An additional 2,150 hotel units are planned for the Kona area within the next several years.

Commercial fishing has always been popular in the Kaulana area. Available records indicate over 588,000 pounds of fish caught in 1980. This is expected to grow since Kaulana fronts one of the best fishing grounds in the islands.

(2) Population and labor force. Hawaii County's population decreased between 1930 and 1960. The 1970 census marked the first time since 1930 that the population had shown an increase over the previous decade. The population has continued to increase at a steady rate up through 1980.

Mechanization led to the decline in sugar employment and out migration of the population. With the advent of tourism in the 1960's, the population began to increase. Hawaii County population increased 3 percent from 61,332 in 1960 to 63,468 in 1970 and then 45 percent the next decade to 92,206 in 1980. For the same decades the Ka'u and Kona districts had increases of 1 percent to 1970 and 91 percent to 1980. The Ka'u District by itself had increases of 0.9 percent to 1970 and 8.9 percent to 1980.

TABLE 1. HISTORICAL POPULATION OF HAWAII COUNTY AND KA'U, SOUTH KONA, NORTH KONA

| | Hawaii County | | Ka'u, South Kona, North Kona | | Ka'u | |
|---|---|---|---|---|---|---|
| Year | Population | Percent Growth | Population | Percent Growth | Population | Percent Growth |
| 1910 | 55,382 | | | | | |
| 1920 | 64,895 | 1.6 | 11,440 | | | |
| 1930 | 73,325 | 1.2 | 14,156 | 23.7 | | |
| 1940 | 73,276 | -.1 | 13,529 | -4.4 | | |
| 1950 | 68,350 | -.7 | 11,633 | -14.0 | 4,303 | |
| 1960 | 61,332 | -1.1 | 12,111 | 4.1 | 3,368 | -21.7 |
| 1970 | 63,468 | 3.5 | 12,234 | 1.0 | 3,398 | 0.9 |
| 1980 | 92,206 | 45.3 | 23,411 | 91.3 | 3,699 | 8.9 |

Despite the rapid population growth in recent years, the county remains relatively uncrowded with a density of 23 person per square mile, as compared with over 1,000 person per square mile on Oahu.

The civilian labor force within the county increased 25 percent from 28,300 in 1970 to 35,400 in 1980. The greatest increase was hotel employment, followed by retail trade. The largest decrease was in the sugar industry where labor needs in harvesting and processing were reduced by mechanization. A slump in the tourist trade during the late 1970's in conjunction with the rising population caused unemployment to rise to its highest levels in the past two decades. The medium family income among Ka'u, South Kona, North Kona Districts residents was $8,478 in 1970 compared with $9,750 for Hawaii County and $11,554 for the State. The most recent income figures available show household income of $10,293 in Puna-Kona and $12,165 for Kona in 1975.

4. "WITHOUT" CONDITION PROFILE

If no federal action is taken to provide navigation improvements, the lack of an adequate boating facility will continue to constrain full use of the ocean's resources in the study area for commercial fishing. In addition, the lack of an adequate facility may stifle economic growth in the area through reduced boating related commercial enterprise and employment opportunities. Ka'u fishermen and other Big Island residents will continue to utilize the Kaulana Bay launch ramp, the only publicly owned and operated ramp in the entire Ka'u District.

The resident population and small business activity will continue to grow in the study area. With the ever increasing number of commercial fishermen, greater demands are being placed for an additional or improved boating facility. In recent years the export of fresh fish to local and mainland markets have been making increasing contributions to the gross economic output of the area. Commercial fishing is fast becoming an important economic mainstay of the Ka'u District.

## 5. NAVIGATION PROBLEM AND NEEDS

The existing Kaulana boat ramp is directly exposed to deepwater swells from the east clockwise to the southwest. Two large mountains, Mauna Loa and Mauna Kea, cause the prevailing tradewinds and waves in the Kaulana area to be easterly. These waves refract and diffract into the unprotected launch ramp resulting in considerable danger and difficulty during launching and recovery operations. During Kona winds the ramp is not usable at all. Because of these difficulties, launch and recovery operations take 3-4 persons, and the local boaters estimate that boats or trailers are damaged about 20 percent of the time the ramp is used. Based on available data and discussions with local boaters, it is estimated that launch and recovery at the existing ramp is only possible about 60 percent of the time.

At present, fishermen caught in sudden storms cannot safely land and recover their boats. This is a serious hazard for fishermen at night, when very profitable bottom fishing is done. If the winds and seas start to build, the boater must wait until daylight to use the ramp and by then the seas have often created a very hazardous condition. In addition, if sufficient people are not available to help, the boat is often damaged during the recovery operation.

The current practice for Ka'u fishermen is to launch their boat at Kaulana and then moor it in lee of the cliffs on the west coast of South Point. At the mooring area, they unload their catch and load fuel and ice as long as the wind and seas permit. Fish and supplies are brought up and down the cliff face by rope and pulley. During the times of the year when the fishing is exceptionally good, the boats are often moored overnight to reduce the number of hazardous launch and recovery operations. However, this practice is very risky also, particularly during the winter months when the wind and seas often change direction quickly. One boater reported having lost 7 boats in the last 20 years because he could not get his boat out when the wind and seas came up unexpectedly. A protected basin would permit fishermen to return to the ramp and safely unload their catch and return to the fishing grounds.

The relatively small, 18 to 27-foot fishing boats have no refrigeration or room for large amounts of ice. This limits their catch to what can be kept chilled, and often necessitates frequent trips to shore to unload their catch. With safer launch and recovery conditions, several of the boaters have stated that they would purchase larger craft to increase their fishing capability.

In spite of the hazardous conditions, the fishermen will continue to use the Kaulana ramp because of its proximity to excellent fishing grounds. The next closest, protected, public launch ramp is located at Pohoiki Bay on the east coast and Honaunau on the west coast, approximately 58 and 40 nautical miles away, respectively. These ramps are too far away for the Ka'u boaters to safely reach their fishing grounds and return. Consequently, Kaulana Bay as well as other potential sites along the Ka'u coast were investigated for

possible navigation improvements or construction of a new facility in a more sheltered location.

6. RELATED PROBLEMS AND NEEDS

a. Environmental Resources. Maintaining the district's natural environmental quality is important to the Ka'u community as well as to visitors to the Ka'u coast. Any navigation improvements should be designed to complement existing uses of the area's natural resource and should have as little adverse effect on the coastal and marine environment as possible. Marine life is relatively diverse and abundant along this coastline.

The Ka'u coast is rich in Hawaiian historical and cultural resources. Local residents have indicated an awareness and concern for protecting these resources and the need to coordinate improvements in the Ka'u area so as to not adversely impact on important cultural and historic resources as well as local lifestyles. The South Point area of the Ka'u District is on the register of National Historic Landmarks.

b. Human Resources.

(1) The Ka'u coastline provides recreational opportunities for southeast Hawaii residents and is actively utilized by swimmers, fishermen, and surfers as well as mainland visitors attracted simply for its scenic beauty. The effect of navigation improvements on these activities and the possible secondary effects on the use of adjacent land areas must be assessed and evaluated. If future shoreside facilities are provided, major utilities including electricity and water must be made available.

7. DESIRED IMPROVEMENTS

The State of Hawaii, Department of Transportation, has requested Corps of Engineers assistance with navigation improvements at Kaulana Bay, including the construction of a breakwater and protected basin. This request was based on the expressed desires of the local Ka'u Fishermen Association to improve the usability and safety of the launch facilities used by the South Point commercial fishermen.

At a recent public workshop (9 July 1980) held on the Big Island, the consensus of those attending (local governmental agencies, residents, and fishermen) favored Kaulana Bay as the site for navigation improvements. However, the possibility of improving existing facilities at other sites or the construction of new facilities in a more sheltered location are being considered. The alternative sites discussed at the public workshop were Punaluu, Honuapo Bay, Kaalualu Bay, Kaulana Bay, and Pohue Bay.

8. PLANNING OBJECTIVES

The formulation of planning objectives for the study was completed in two stages. First, preliminary analyses of social, economic, and environmental resources were performed in conjunction with the identification of the problems and needs related to light-draft navigation. Based on the analyses and the stated views of the County, the most immediate navigation needs are focused on commercial fishing.

Next, planning objectives were formulated to satisfy the specific light-draft navigational needs of commercial fishing. The following planning objectives served as guides in the formulation and evaluation of alternative plans for navigational improvements on the Big Island.

a. Improve commercial fishing opportunities on the Big Island during the 1985-2035 period of analysis.

b. Improve the socioeconomic opportunities for the people of the Ka'u District.

c. Avoid alteration to historical and cultural resources of the area.

d. Minimize alteration to bay marine environment.

e. Maximize net benefits.

## III. FORMULATION OF PRELIMINARY PLANS

### 1. RATIONALE

This section of the report is directed towards the development and evaluation of alternative measures to resolve the problems and needs of the study area and to fulfill the planning objectives defined in the previous section. Possible measures do not necessarily have to be within the Corps of Engineers' authority or capabilities. If favorable or superior measures are available outside the Corps of Engineers authorities, the final recommendations will also indicate these alternative measures. The initial step in the formulation process is the identification of broad measures (nonstructural or structural) available to resolve the problems. If structural measures are considered to be the best solution to meet the planning objectives, the second step is to identify and evaluate potential sites where structural solutions can be constructed with minimal adverse impacts. After the selection of a suitable project site or sites, specific design layouts can be formulated and evaluated. Those plans that meet the planning objectives and local desires can then be identified.

### 2. PRELIMINARY SCREENING OF ALTERNATIVE MEASURES

a. Nonstructural Alternatives. Nonstructural alternatives or measures are those actions that can meet the planning objectives without constructing new facilities. Typical measures include improving the efficiency of existing facilities or the conversion of other existing facilities. These measures have usually been identified as management alternatives.

b. The general lack of any public waterfront, harbor or protected boating facility in the Ka'u area makes it difficult to apply nonstructural alternatives as a management option. There are only two boating facilities along the entire Ka'u coastline both of which are launch ramps. Both facilities, however, cannot meet the planning objectives without extensive modifications. Although not intended to provide all-weather navigation protection, improving the navigation conditions for fair through marginal weather would greatly enhance fishing opportunities by increasing the percentage of time a vessel can use the launch facility. To meet the needs of these vessels, a protected basin is considered necessary for the safety and well-being of Ka'u fishermen.

c. Structural Alternative. The State of Hawaii Department of Transportation has identified specific criteria they feel would minimally meet the needs of Ka'u fishermen. Because little is known about the specific life requirements for many reef and marine organisms, precaution must also be exercised in evaluating possible disruption or destruction of these ecosystems by any structural proposal. Consequently, certain planning concepts should also be applied in evaluting these ecosystems and in selecting possible sites and/or designs for structural alternatives. Planning criteria for the formulation of preliminary plans would include at this stage:

(1) Providing a protected basin that can accommodate a typical fishing vessel of 27-foot length, 7-foot beam width and 2.5-foot draft.

(2) Minimizing conflicts with local land-use policy and physical community disruption.

(3) Enhancing, preserving, or minimizing adverse effects on marine and terrestrial flora and fauna resources.

(4) Preserve archaeological and historical resources.

(5) Maximization of net benefits.

3. IDENTIFICATION OF POTENTIAL SITES

a. This section of the report is directed towards the development and evaluation of alternative sites for light-draft navigation improvements. As expressed in the problems and needs section of this study, the construction of a protected basin was considered essential to commercial fishermen. A protected basin would permit safe passage of fishing boats during sudden storm conditions and provide safe launch and recovery operations. With improved conditions increased fishing capabilities of existing boaters are anticipated. The initial step is to identify potential sites. The number of potential sites can then be reduced by eliminating areas that would not meet our preliminary environmental, economic and land-use concerns. A solution of no development was not considered because it would not meet the expressed desire for improvement which is the basic objective of this study.

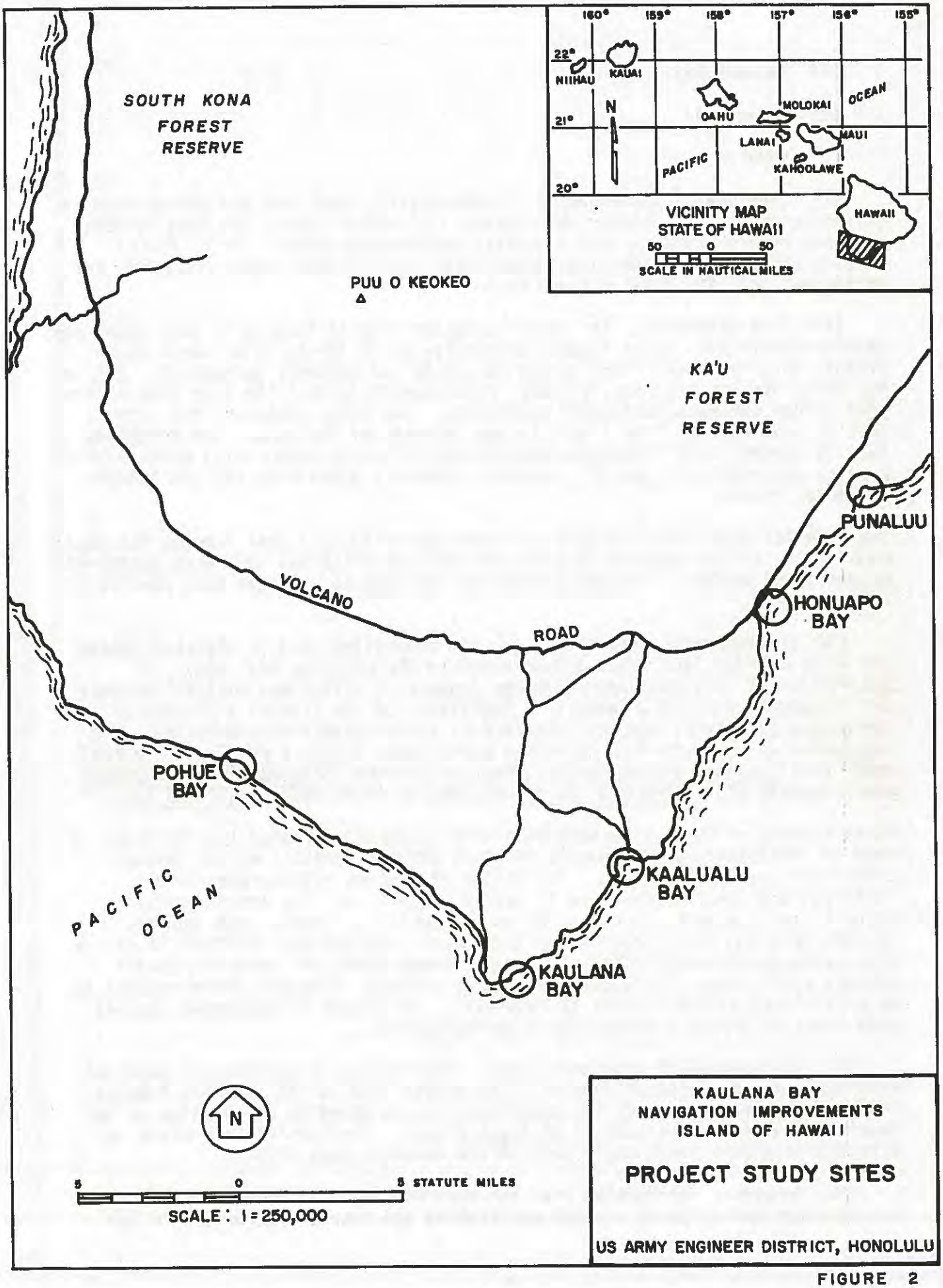
b. Potential sites were restricted to the Ka'u District coastline of the Big Island. Areas along the remaining coastline were considered too far from prime fishing grounds in the south and southeast coastal waters.

Five sites were initially considered as possible areas for light-draft navigation improvements (see Figure 2). The major considerations in selecting a possible site were: (1) sea conditions, (2) access, (3) distance to best fishing grounds, (4) land availability, (5) historical sites, (6) endangered species, (7) utilities, and (8) existing and proposed land use and zoning. No other location was identified by Hawaii County or the general public at a 9 July 1980 public workshop held on the Big Island. The possible alternative sites for navigation improvements include:

(1) Punaluu.

(2) Honuapo Bay.

(3) Kaalualu Bay.


SOUTH KONA
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KA'U
FOREST
RESERVE
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BAY
KAALUALU
BAY
KAULANA
BAY
PACIFIC
OCEAN
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KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII
PROJECT STUDY SITES
US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 2

(4) Kaulana Bay.

(5) Pohue Bay.

c. Punaluu.

(1) Land use. Land adjacent to the existing boat ramp and access road is privately owned by C. Brewer and Company. In recent years, the Punaluu Beach area has been developing into a tourist destination point. The C. Brewer Company maintains a condominium development, golf course, meeting center, and restaurant near the Punaluu Beach Park.

(2) Site condition. The existing launch ramp at Punaluu is very steep and in poor condition. It is aligned perpendicular to the incoming waves which creates hazardous conditions during launching and recovery operations. Only a few boats utilize the ramp, however, fishermen claim that the ramp area offers good refuge during sudden storm conditions. The water depth at this site is shallow ranging from 1 to 3 feet in the vicinity of the ramp. The bottom surface is covered with a heterogeneous mixture of black sand, silt, coral rubble, exposed pahoehoe rock, basalt, boulders, concrete slabs from the old landing and metal debris.

The existing ramp lies on a point of lava once used as a boat landing for sugar companies. An old concrete landing and adjacent buildings have been destroyed by waves and neglect. The access road to the ramp is a single lane converted railroad bed.

(3) Environmental considerations. An anchialine pond is situated behind the Punaluu Black Sand Beach and adjacent to the existing boat ramp. A description of this pond and its fauna appears in Elliot and Hall's "Wetlands and Wetland Vegetation of Hawaii." Vegetation at the site is a mixture of indigenous and exotic species. No rare or unique plants were observed. The vegetation was dominated by Christmas berry trees (Schinus terebinthe folius), haole koa (Leucaena leucocephala), beach heliotrope (Messerschmidia argentea), beach morning glory (Ipomoea spp.), and passion fruit vine (Pasiflora sp.).

Water clarity at Punaluu is excellent with visibility greater than 80 feet. A lens of freshwater, approximately 2-3 feet thick is visible on the surface within the bay near the ramp. Salinities of surface waters range from 19-29 ppt and water temperature is near 22 degrees C. The underlying salt water is substantially warmer at 25 to 27 degrees C. State water quality records obtained for Punaluu Black Sand Beach revealed that coliform levels do not exceed established limits. Like many areas along the south and southeastern coast, very little coral growth is evident. However, there appears to be a diversity of marine life at this site. No unique or endangered species were observed during a recent field investigation.

(4) Archaeological considerations. The remains of prehistoric Hawaiian structures can be found at Punaluu. The access road to the existing Punaluu ramp and the foundations of the sugar dock may be eligible for listing on the Hawaii and National Register of Historic Places. The Kane'ele'ele Heiau is situated on a hill immediately east of the existing boat ramp.

(5) Summary. The Punaluu area has been developed in recent years as a tourist destination point. Based on existing and future development in the

area, availability of land for potential sites for a harbor and shoreside facilities are limited. Several sites within the Punaluu area may be eligible for listing on the Hawaii and National Register of Historic Places (access road to ramp and old sugar dock). Because of problems associated with the acquisition of private shoreline land for navigational improvements, provisions for public vehicular access, and archaeological considerations, this site was consequently eliminated in favor of a more desirable location. Also, a master plan for statewide boat launching facilities completed in 1972 for the State of Hawaii Department of Transportation recommended that no further consideration is warranted for this site prior to 1990 because of the cost to protect the ramp.

d. Honuapo Bay.

(1) Land use. A county park (Whittington Beach Park) is situated along Honuapo Bay with access for vehicular traffic. In 1975, a tsunami severely damaged an old sugar dock and beach park facilities. Park facilities including three small pavilions and a restroom facility have recently been built by the County. Future plans for this area call for a resort development consisting of a 200-unit hotel and a golf course to be developed by C. Brewer Company.

(2) Site condition. Honuapo Bay is a shallow crescent shaped embayment situated about 5 miles southwest of Punaluu Harbor. A prominent feature of the coastline are the high cliffs along the southern coastal area. The offshore areas consist of a series of exposed pahoehoe domes as well as a fringing basalt shelf along the seaward edge of the inner bay. The Honuapo site is directly exposed to tradewind conditions, resulting in waves in excess of 2 feet almost 100 percent of the time. Waves in excess of 6 feet occur on an average of 80 days per year. The configuration of the bay offers limited natural protection from wave attack resulting in generally poor navigation conditions.

(3) Environmental considerations. A small coastal wetland can be found along the northern shoreline of Honuapo Bay. During a recent field trip, approximately 8 sea turtles (Chelonia mydas), an endangered species, were observed feeding nearshore. The largest of these turtles had an estimated carapace length of 36 inches or more.

(4) Archaeological considerations. The Honuapo Landing site, located just south of Whittington Park, was recommended by the Ka'u Historical Society as a reserve because of its historical relationship to Ka'u and its economic history and to inter-island shipping generally. Archaeological sites of importance in this area include house sites, platforms, walled structures (east of Laeokamilo Point), and the Honuapo Ponds.

(5) Summary. Whittington Beach Park (County), located along the shoreline of Honuapo Bay, provides shoreline recreational opportunities for the people of Hawaii County. The construction of navigational improvements for commercial fishing at this site is not considered to be compatible with the context of this theme. Although this site is easily accessible from the main highway, the entire area is privately owned and launching is very difficult because of the shallow reef and wave exposure. A master plan for state boat launching facilities, completed in 1972, recommended that no further consideration of this site is warranted because of the expense involved.

e. Kaalualu Bay.

(1) Land use. The County of Hawaii Recreation Plan (1974) is proposing to develop a regional beach park at Kaalualu Bay. C. Brewer's long-range plan for this area consists of several resorts and multiple family dwellings and single family residences, the majority of which are along the shoreline.

(2) Site condition. The configuration of adjacent land features affords good shelter for small craft during tradewind weather, but is exposed during Kona weather. Kaalualu Bay is very shallow and extensive dredging of hard bottom substrate would be required to provide a channel. Most of the bottom surface is composed of firmly attached basaltic material although loose boulders are also present. Access to this site is impossible without a four wheel drive vehicle.

(3) Environmental considerations. With the possible exception of the endemic sponges, the dominant and conspicuous macrofauna and macroflora of the bay are not unusual. Differences in depth and salinity from the head of the bay to its seaward extreme has made it possible to detect differences in the fish and invertebrates fauna indicative of the physical changes. Considerable seepage of brackish water occurs at the head of the bay, resulting in lowered temperatures in this region.

Approximately 80 percent of the vegetation at the site are non-native consisting mostly of weedy species. The vegetation around the bay may be divided into four communities: (a) Scaevola Thicket, (b) Prosopis Forest, (c) Sesuvium Marsh and (d) Lantana Bushland. No endangered or threatened species exist at this site.

(4) Archaeological considerations. An archaeological reconnaissance of the surrounding area completed in 1972 discovered 91 archaeological sites. The sites discovered in the bay area represent prehistoric Hawaiian utilization of the area--the most significant sites are the clusters of bait cups which are situated along the eastern edge of the bay. Other prehistoric sites include the Kapenako Waterhole which is adjacent to the east side of the bay and scattered house sites around nearby Paiahaa Bay.

(5) Summary. A regional beach park being proposed for Kaalualu Bay would provide shoreline recreational opportunities. Long range plans by C. Brewer include a resort/subdivision development. Based on these plans, construction of a harbor for commercial fishing is not considered to be compatible with the context of this theme. On a recent field trip, a species of endemic sponges was identified at this site. In addition, an archaeological reconnaissance conducted in 1972 revealed a total of 91 archaeological sites. Because of the environmental and archaeological considerations and land-use plans associated with this site, this location was no longer considered.

This site was selected for navigation improvements and funds were appropriated by the 1971 State Legislature, however, because of subsequent environmental conflicts this site was no longer considered.

f. Pohue Bay.

(1) Land use. Additional development of the existing subdivision directly across Pohue Bay is likely to occur if land access over the existing private

road system, as well as power supply, is obtained for the site in the future. This site is located on private ranch land. The 1971 General Plan for the County of Hawaii proposes to establish the Pohue Bay area as a shoreline reserve.

(2) Site condition. A small, sandy beach characterizes the edge of the central portion of the bay. Since the area is sheltered from tradewind conditions, Pohue Bay has considerable natural protection. Waves in excess of 2 feet approach the area 200 days a year while waves over 6 feet are estimated to occur only about 5 days per year.

(3) Environmental considerations. Bats, sited in this area, are listed on the endangered species list.

(4) Archaeological considerations. Directly across the shoreline are a number of archaeological sites which include the Kanonone Waterhole, house sites, petroglyphs, konani boards, and burials. Many other existing sites were not surveyed at the time of this reconnaissance.

(5) Summary. Additional development of the existing subdivision in the Pohue Bay area is anticipated with improved vehicular access and installment of major utilities. Along and adjacent to the shoreline area are a number of archaeological sites which have not yet been evaluated by the State Archaeologist. With additional development and archaeological sites scattered throughout the area, a potential location for a harbor and shoreside facilities will be limited. Because of site limitations and environmental and archaeological considerations, no further studies were conducted.

g. Kaulana Bay.

(1) Land use. Land availability is unlimited but the land is under the jurisdiction of Hawaiian Homes Commission. An arrangement would have to be made with Hawaiian Homes Land for access and shoreside space. The 1971 General Plan for the County of Hawaii proposes to establish the Kaulana Bay area as a shoreline reserve.

(2) Site condition. The shoreline of Kaulana Bay is scattered with rocks, cobbles and boulders with some sand and terrestrial sediments. The bottom of the bay is primarily solid rock substrate overlain with sand and rock up to about 1-foot in diameter. Depths vary from about 1-foot near the ramp area to about 6-8 feet in the bay. Wave energy within Kaulana Bay is usually generated by the northeast trades; however, when Kona storm conditions are present, southerly waves are focused directly into the bay causing hazardous conditions.

A partially paved and dirt road branching from the main highway provides access into this area.

(3) Environmental considerations. A recent study of coastal vegetation did not reveal the possible presence of Portulaca hawaiiensis (a rare species proposed for listing as endangered in 1976) or Sesbania tomentosa plants (ohai). Vegetation consisted principally of indigenous strand plants such as ilima (Sida fallax), Pa'u-o-Hiiiaka (Jacquemontia sandivicensis) and beach morning glory (Ipomoea pes-caprae). Open spaces at Kaulana are covered with Bermuda grass (Cynodon dactylon).

Water clarity at Kaulana is approximately 50 to 75 feet. Wave wash over a sand shoal is responsible for some localized turbidity. Surface salinities, ranging from 33.5 ppt to 32.5 ppt, suggested the presence of some fresh-water seepage. Scattered massive coral heads are found along the western portion of the bay. Presumably, because the bay is subjected to substantial wave action, there is little other hard coral growth. No unique or endangered marine species were observed during a recent field trip.

(4) Archaeological Considerations. Kaulana Bay is within the South Point National Historic District and is designated a National Landmark. A survey conducted in 1969 by the National Park Service identified Kaulana Bay point on the east side of the bay as a kapu area having numerous archaeological sites.

(5) Summary. Kaulana Bay is the nearest site to prime fishing grounds off the southern coast of the Big Island. A representative of the Hawaiian Homes Land acknowledged that he foresees no problems in the State obtaining the necessary permits for navigation and shoreside improvements.

There are no endangered species or species eligible for listing in the Kaulana Bay area. However, Kaulana Bay is located within a National Historic Landmark and District and archaeological sites are known to exist on the east side of the existing boat launching ramp. Navigational improvements at this location would require minimal channel dredging because existing depths are adequate for small craft navigation. Water clarity would be temporarily reduced because of dredging activities.

The loss of surface substrate is not expected to eliminate the habitat or fish resources of the area. Breakwaters have the potential of enhancing marine resources by providing habitat diversity and possibly increasing species diversity and abundance. Advantages arising from this site include minimal environmental and archaeological damage in comparison with the other potential sites. Consequently, further detailed studies were conducted for this site.

A master plan of statewide boat launching facilities, completed in 1972 for the State of Hawaii Department of Transportation, recommended that the ideal solution at Kaulana Bay appeared to be the relocation of the existing ramp to the Kona side of the cove and to construct a small stub breakwater to reduce both shoaling and wave action. The use of the site at that time was not considered extensive enough to justify such an expense, however, within recent years the Kaulana ramp has been heavily used by commercial fishermen from all parts of the island.

h. Summary of Potential Sites. Tables 2 and 3 give an overview of the various items considered in the selection of a site for possible navigation improvements. An inventory of existing facilities and resources within each alternative site was considered as well as various land-use designations within the Conservation District. All potential sites investigated in this study are located within the boundaries of the State of Hawaii Conservation District. This district is one of four districts into which the State has been zoned by the Land Use Commission. Major concerns and impacts resulting from existing and future conditions and developments were considered in the selection process. Based on the overall comparison of sites as depicted in Tables 2 and 3 and the desires of State and local concerns, Kaulana Bay was selected for further detailed studies.

TABLE 2. SUMMARY OF POTENTIAL SITES

| Site | Existing Facilities and Resources | Proposed[1] Developments | Hawaii County Conservation[2] District Inventory | Major Concerns and Planning Conflicts or Determination of Impacts |
|---|---|---|---|---|
| Punaluu | -Condominium development (multifamily units)<br>-Golf course, meeting center, restaurant<br>-Punaluu Beach Park<br>-Launch ramp<br>-Limited parking area<br>-Existing depths of -1 to -3 feet MLLW<br>-Prehistoric Hawaiian structures | -"Longhouse" pavilion to hold approximately 500 people<br>-Hiking trail: Punaluu to Kawaa<br>-Resort development<br>-Improvements to parking area<br>-Additional restroom facilities<br>-Landscaping and additional smaller pavilions<br>-Beach park acquisition and expansion | Hazard<br>-Tsunami inundation, floodplain, volcanic<br>Recreation<br>- Wild shoreline, board surfing, county park, archaeological site<br>Conservation District<br>Vegetation<br>-Scrubland, grassland<br>Fish and Wildlife<br>-Game bird range<br>Land Use<br>-Other urban<br>Private Land | -Limited land area for harbor and shoreside facilities<br>-Potential historic significance of access road and foundations of sugar dock<br>-No public land<br>-Possible disturbance of wetland area (anchialine pond) |
| Honuapo Bay | -Pavilions rest room facility<br>-Whittington Beach Park<br>-Existing natural channel 100 feet wide at -28 feet MLLW<br>-Sea turtles (Chelonia mydas) observed<br>-Honuapo Landing site (historical) | -Expansion of park/facilities<br>-Clearing and additional landscaping<br>-Resort development<br>-Golf course<br>-Reserve as a natural, scenic, preservation area through legislation | Hazard<br>-Tsunami Inundation, floodplain<br>Recreation<br>-Wild shoreline, board surfing, county park<br>Conservation District<br>Vegetation<br>-Grassland<br>Fish and Wildlife<br>-Game bird range<br>Private Land/State<br>-Land (County park)<br>Water Resources<br>-Irrigation water system and well | -Theme of county park for recreation/conservation in conflict with commercial fishing and ancillary facilities<br>-Possible adverse affect on sea turtles (endangered species)<br>-Possible disturbance of coastal wetland area |
| Kaalualu Bay | -Very shallow bay<br>-Numerous archaeological sites<br>-Endemic sponges | -Regional beach park<br>-Investigation of access and land acquisition<br>-Resort area<br>-Multifamily/single family dwellings | Recreation<br>-Wild shoreline<br>Conservation District<br>Fish and Wildlife<br>-Game mammal range<br>State Land | -Theme of proposed park for recreation/conservation in conflict with commercial fishing and ancillary facilities<br>-Extensive dredging because of shallow bay<br>-Potential loss of endemic sponges<br>-Potential circulation problem because of seepage of brackish water into bay<br>-Protect numerous archaeological sites (91)<br>-Poor access road |
| Pohue Bay | -Subdivision<br>-Good sand beach<br>-Hawaiian bat<br>-Numerous archaeological sites | -Provide public access and establish as shoreline reserve<br>-Investigate feasibility of acquisition and/or alternative means of open space preservation<br>-Evaluate historical significance | Recreation<br>-Wild shoreline<br>Conservation District<br>Fish and Wildlife<br>-Game mammal range<br>Private Land | -Limited land area for harbor and shoreside facilities<br>-Protect numerous archaeological sites<br>-Protect bat (endangered species)<br>-Poor access road |
| Kaulana Bay | -Launch ramp<br>-Existing depths of -1 to -(6-6) feet MLLW<br>-Scattered coral growth<br>-Unlimited parking area<br>-Scattered archaeolegical sites. National Register of Historic Places and National Landmark | -Provide public access and establish as shoreline reserve<br>-Investigate feasibility of acquisition and/or alternative means of open space preservation<br>-Evaluate historical significance | Hazard<br>-Volcanic<br>Conservation District<br>Vegetation<br>-Grassland<br>Fish and Wildlife<br>-Game mammal range<br>Private Land<br>Water Resources<br>-Domestic water system nearby (2-1/2 miles) | -Land under jurisdiction of Hawaiian Homes Commission<br>-Protect archaeological sites adjacent to existing ramp area; historic coordination required<br>-No readily available utilities if needed |

1/ Source: 1974 County of Hawaii Recreation Plan
2/ Source: Conservation district inventory maps, State of Hawaii, Department of Land and Natural Resources, July 1977.

TABLE 3. SUMMARY OF POTENTIAL IMPACTS AND MAJOR CONCERNS

● - Major Concern
◒ - Moderate Concern
○ - Minimal or No Concern

| Criteria | Punaluu | Honuapo Bay | Kaalualu Bay | Kaulana Bay | Pohue Bay |
|---|---|---|---|---|---|
| 1. PHYSICAL CRITERIA | | | | | |
| a. Access of site by the design vessel | ● Extensive dredging required | ◒ Moderate dredging required | ● Extensive dredging required | ◒ Moderate dredging required | |
| b. Area to accommodate harbor | ○ Adequate | ○ Adequate | ○ Adequate | ○ Adequate | ○ Adequate |
| c. Public land to accommodate harbor shoreside facilities | ● No public land available; requires purchasing or leasing of private lands | ◒ Public land available; however, used for County beach park | ○ Adequate public land available | ◒ No public land available; however, no major conflict anticipated with leasing of Hawaiian Homes land | ● No public land available; requires purchasing or leasing of private land |
| d. Vehicular access to site | ○ Adquate | ○ Adequate | ● Poor | ◒ Fair | ◒ Fair |
| 2. LAND USE POLICY | | | | | |
| a. Compatible with local land use planning | ◒ Site designation for other urban uses. (Recreational uses, coastal works, etc.) | ◒ Possible conflict with County beach park | ◒ Possible conflict with proposed County park | ○ Site designated as public boat launching area | ◒ Possible conflict with existing/proposed subdivision development |
| b. Possible community impacts | ◒ Commercial/resort; recreational mix may be incompatible | ◒ Commercial/recreational mix may be incompatible | ◒ Commercial/recreational mix may be incompatible | ○ No impacts anticipated | ◒ Commercial/residential mix may be incompatible (Odor/traffic) |
| 3. Environmental/significant adverse effects on terrestrial and/or marine resources | ○ No significant impact anticipated | ◒ Possible adverse impact on sea turtles (Chelonia Mydas), endangered species | ◒ Possible adverse impact on endemic sponges | ○ No significant impact anticipated | ◒ Possible adverse impact on bat habitat endangered species) |
| 4. Archaeological/ historical resources | ◒ Access road to the existing Punaluu ramp & foundation of sugar dock elegible for listings on the Hawaii & National Register of Historic Places | ○ No significant archaeological/ historical sites | ● Numerous archaeological sites in area | ● Located within highly significant National Landmark | ● Numerous archaeological sites in area |

i. Public Workshop. A public workshop (see Appendix B) was held on 9 July 1980 at the Naalehu Youth Center on the Big Island to obtain information on the suitability of these sites as well as any other sites that may be recommended or identified by the public. Only one other site, Pohue Bay, was identified as a possible or desirable location for navigation improvements. Reference for protection of the existing ramp at Kaulana was expressed. Because of a lack of available public lands, an arrangement would have to be made with Hawaiian Homes Land for access and shoreside space.

j. Governmental Planning. The County of Hawaii indicated preference for navigational improvements to be located at Kaulana Bay. A launch ramp at Kaulana, built by the State of Hawaii, Department of Transportation in 1963, is the only public boating facility along the entire Ka'u District coastline.

Basic public facilities, services and amenities are not available at Kaulana Bay. According to officials with the State of Hawaii Department of Transportation there are no immediate or future plans to develop water and electric utilities and shoreside facilities.

4. DEVELOPMENT OF DETAILED PLANS

a. General. This section of the report is directed towards the development of design and evaluation criteria for analyzing specific harbor configuration plans at Kaulana Bay. The formulation of design plans were guided by the specific technical, economic and environmental criteria which are described in the following sections.

b. General Technical Criteria.

(1) The design of the protective structure allows for a minor overtopping criteria by a design wave which may be expected from a severe combination of meteorological and hydrological conditions that are reasonably characteristic of the area.

(2) The entrance channel is to be of adequate depth and width to safely accommodate one-way traffic by the design vessel and the turning basin is to provide a safe maneuvering area. The prevailing wind and wave approach directions are to be evaluated to determine safe channel alignments for navigation. To insure navigational safety, the severity of turns (dog legs) of the entrance channel should be minimized and the widening (flaring) of the channel at the turns are to be provided. The protected basin is to have a maximum wave amplitude of 3 feet to insure minimal damage to vessels.

(3) Navigation improvements shall be designed to accommodate a design vessel of 27-foot length, 7-foot beam, and a 2.5-foot draft. The proposed project is to provide safe navigation and protection during all weather and sea conditions except severe storms.

(4) Each alternative is to be evaluated for shoaling characteristics to determine its effects on the stability of a dredged channel.

(5) Structural and foundation criteria should be applicable for an earthquake zone 3 area.

c. General Economic Criteria.

(1) The benefits should exceed the costs and the net benefits, as far as practicable, should be maximized.

(2) The costs for alternative plans of improvement are to be based on the latest unit prices and assumptions based on the prevailing conditions. The benefits and costs are to be expressed in comparable quantitative economic terms to the fullest extent possible. Annual costs are to be based on a 50-year amortization period and a 7-3/8 percent interest rate[1/]. The annual charges include the expected annual maintenance cost.

d. General Environmental Criteria.

(1) Minimize the physical destruction of scattered coral heads and seagrass resources within Kaulana Bay during harbor construction.

(2) Minimize long-term disturbances to the physical environment (e.g., water circulation, water quality, and sediment transport) which may have secondary impacts on the living resources that inhabit the bay.

(3) Avoid during design and construction phase highly significant archaeological features located on the east bank of Kaulana Bay.

e. The following general concepts were also used to guide the formulation, assessment, and evaluation of alternative harbor plans:

(1) Both adverse and beneficial impacts of alternative plans are to be identified and measured, and the beneficial or adverse contributions of each plan evaluated.

(2) Alternative plans which maximize net economic benefits (National Economic Development--NED plan) and those which are likely to make positive contributions to preserving, maintaining, restoring, or enhancing cultural and natural resources (Environmental Quality--EQ plan) are to be designated.

5. DESCRIPTION OF DETAILED PLANS

a. Kaulana Bay. Further investigations were conducted in order to better evaluate the existing conditions of the potential site and to prepare more detailed analysis and design.

(1) Hydrographic and topographic surveys were conducted at Kaulana Bay.

(2) Geotechnical investigations were completed by the Corps of Engineers for the Kaulana Bay area. Investigations were limited to the vicinity of the bay and adjacent land areas. Preliminary foundation criteria were based on visual underwater inspections and their limitations are recognized. It would not be justified at this time to obtain costly offshore borings of the Kaulana site which is ultimately deemed infeasible for other reasons. A conservative design can first be implemented based on the geotechnical data gathered from these investigations for the purposes of initial design and cost estimates. Reasonable ranges in design and cost reduction can be incorporated to determine if a less conservative design which can later be substantiated by more detailed subsurface investigations would reduce the overall costs (see Appendix C for the foundations investigation analysis and program). Detailed subsurface investigations will be conducted when a site and a general plan has been selected.

1/ As established by the US Water Resources Council.

(3) Archaeological/cultural reconnaissance. An archaeological reconnaissance was conducted to determine the location of prehistoric sites and features. Of particular importance was the determination of potential historical values of Hawaiian artifacts and structures known to be in the area before possible alterations, removal, or destruction.

b. Alternative Design Plans at Kaulana Bay.

Based on the identified problems and needs, the planning objectives, and the formulation and evaluation concepts, three alternative design plans for Kaulana Bay were developed in detail and evaluated with respect to their contributions to navigation improvements, their beneficial and adverse impacts and their benefits and costs. Two of the alternative plans would involve constructing and providing protection for a new launch ramp while the other plan would provide protection for the existing ramp. A protected basin would provide adequate safety for launching and retrieval operations. Ample parking for car/trailer vehicles is available in areas adjacent to the existing and proposed ramp. All future shoreside or parking facilities would be developed by local interests if needed.

(1) Plan 1. Plan 1 consists of dredging a 245-foot-long, 80-foot-wide, and 8.5-foot-deep entrance channel; a 220-foot-long by 100-foot-wide, and 6.5-foot-deep turning basin, and constructing a 160-foot-long main breakwater with a +11.5-foot crest elevation. The offshore breakwater would provide protection for the existing launch ramp. This plan utilizes the existing reef flat as the entrance channel and the single-lane launch ramp.

(2) Plan 2. Plan 2 consists of dredging a 135-foot-long, 100-foot to 80-foot-wide tapered, and 8.5-foot-deep entrance channel; a 200-foot-long by 100-foot-wide, and 6.5-foot-deep turning basin, and constructing a 135-foot-long main breakwater with a +8.0-foot crest elevation. The breakwater would provide protection for the new launch ramp. This plan utilizes the existing natural channel and a new single-lane launch ramp.

(3) Plan 3. Plan 3 consists of dredging a 135-foot-long, 80-foot to 60-foot-wide tapered, and 8.5-foot-deep entrance channel; a 200-foot-long by 100-foot-wide, and 6.5-foot-deep turning basin, and constructing a 155-foot-long main breakwater with a +11.5-foot crest elevation at the head and a +8.0-foot crest elevation at the trunk. The breakwater would provide protection for the new launch ramp. This plan utilizes the existing natural channel and a new single-lane launch ramp.

c. Other Planning Considerations.

(1) Aids to Navigation. The U.S. Coast Guard will provide the necessary aids to navigation for the selected site and plan. Details will be coordinated and presented in the final report. These aids are a federal cost and are not included in the maximum Corps of Engineers monetary limitation under the authorizing authority.

(2) Disposal Areas. A disposal area will be needed for dredged spoil material. Land disposal is considered to be environmentally superior to ocean dumping. A disposal site was assumed to be within 5 miles of the project site. The exact location will be determined in the final report.

The estimated quantity of dredged material for each plan is 11,700 CY, 5,300 CY and 3,200 CY for plans 1, 2, and 3 respectively.

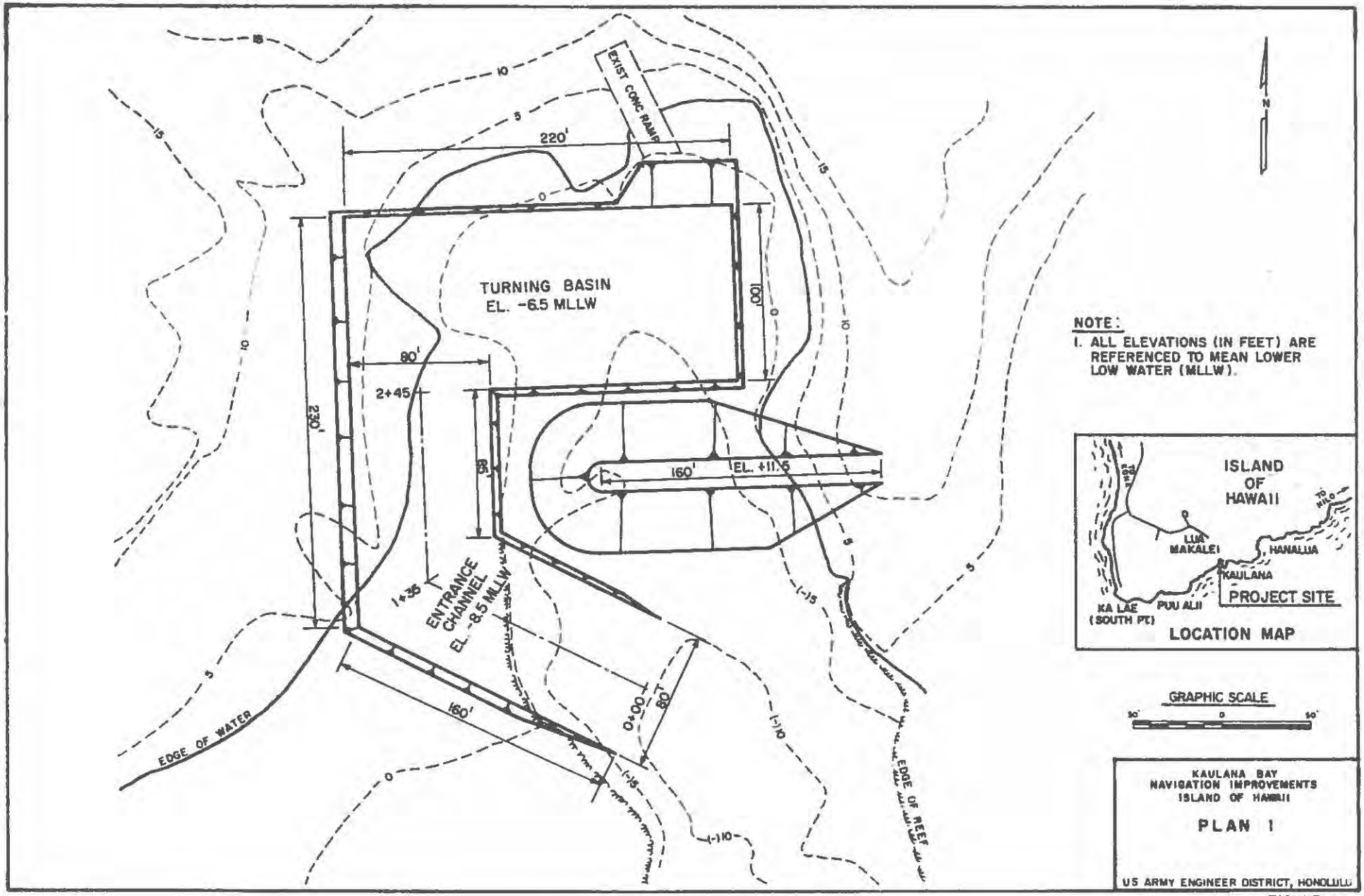
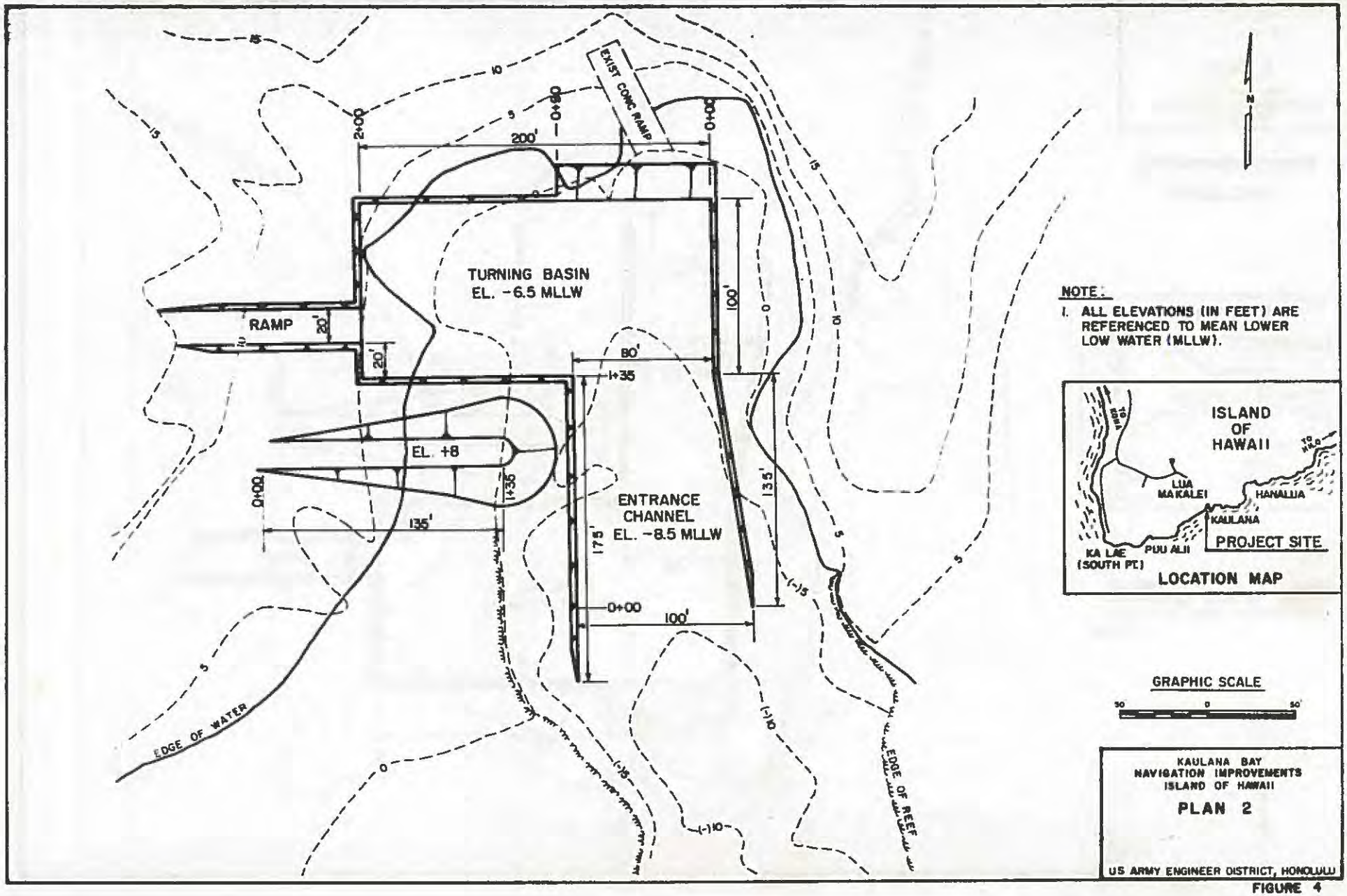

EXIST CONC RAMP
220'
TURNING BASIN
EL. -6.5 MLLW
100'
80'
2+45
230'
160'
EL. +11.5
1+35
ENTRANCE CHANNEL
EL. -8.5 MLLW
0+00
80'
160'
EDGE OF WATER
EDGE OF REEF
N
NOTE:
1. ALL ELEVATIONS (IN FEET) ARE REFERENCED TO MEAN LOWER LOW WATER (MLLW).
ISLAND OF HAWAII
HILO
LUA MAKALEI
HANALUA
KAULANA
PROJECT SITE
KA LAE (SOUTH PT)
PUU ALII
LOCATION MAP
GRAPHIC SCALE
50' 0 50'
KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII
PLAN 1
US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 3


EXIST CONC RAMP
2+00
0+00
200'
TURNING BASIN
EL. -6.5 MLLW
RAMP
20'
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100'
EL. +8
0+00
1+35
135'
ENTRANCE
CHANNEL
EL. -8.5 MLLW
175'
135'
0+00
100'
EDGE OF WATER
EDGE OF REEF
NOTE:
1. ALL ELEVATIONS (IN FEET) ARE REFERENCED TO MEAN LOWER LOW WATER (MLLW).
ISLAND OF HAWAII
TO HILO
LUA MAKALEI
HANALUA
KAULANA
PROJECT SITE
KA LAE (SOUTH PT.)
PUU ALII
LOCATION MAP
GRAPHIC SCALE
50
0
50'
KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII
PLAN 2
US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 4

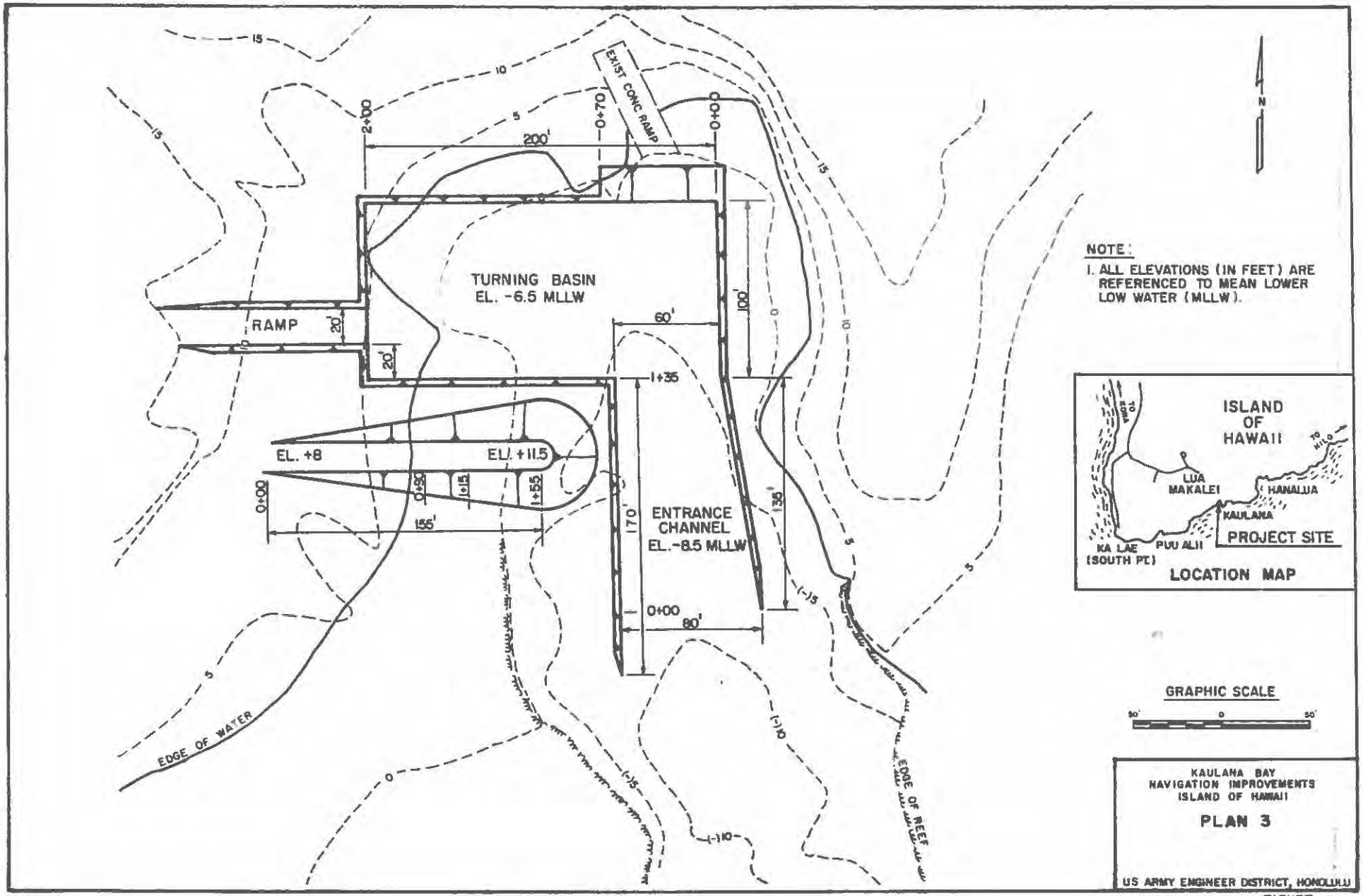
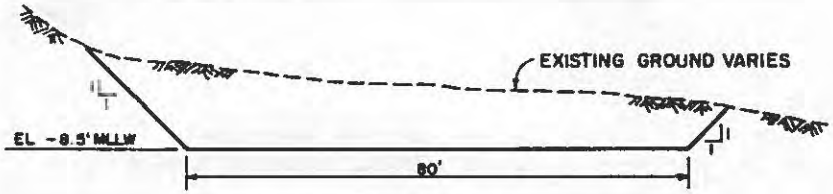
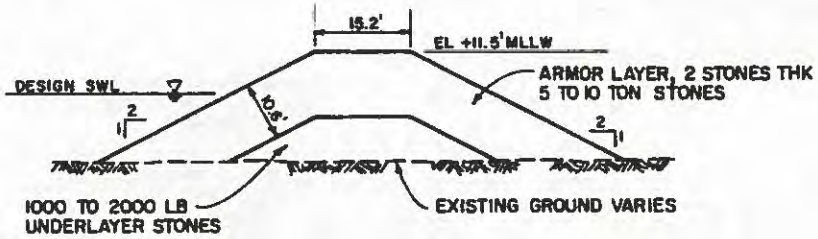

EXIST CONC RAMP
TURNING BASIN
EL. -6.5 MLLW
RAMP
20'
EL. +8
EL. +11.5
ENTRANCE
CHANNEL
EL. -8.5 MLLW
EDGE OF WATER
EDGE OF REEF
200'
100'
60'
155'
80'
170'
135'
NOTE:
1. ALL ELEVATIONS (IN FEET) ARE REFERENCED TO MEAN LOWER LOW WATER (MLLW).
ISLAND OF HAWAII
LUA MAKALEI
HANALUA
KAULANA
PROJECT SITE
KA LAE (SOUTH PT.)
PUU ALII
LOCATION MAP
GRAPHIC SCALE
KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII
PLAN 3
US ARMY ENGINEER DISTRICT, HONOLULU

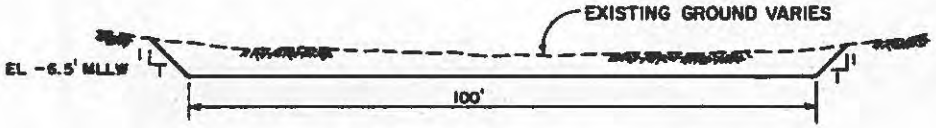
FIGURE 5




TYPICAL ENTRANCE CHANNEL




TYPICAL BREAKWATER SECTION




TYPICAL TURNING BASIN

NOTE :

THE CUT SLOPES IN THE AREA OF THE RAMP WILL BE FLATTEN TO CONFORM WITH THE STATE BOAT RAMP REQUIREMENTS

GRAPHIC SCALE

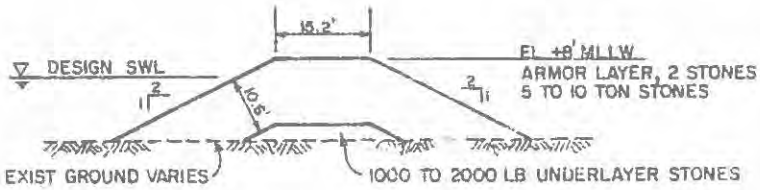
20' 15' 10' 5' 0 20' 40'

KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII

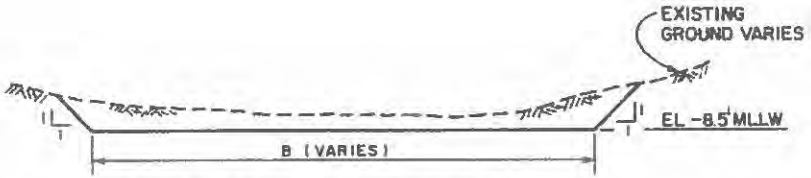
TYPICAL SECTIONS
PLAN I

US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 6

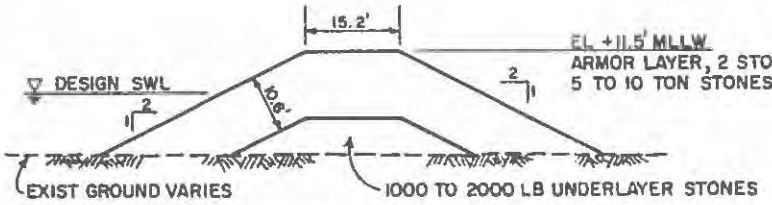



TYPICAL BREAKWATER SECTION, PLAN 2
TYPICAL TRUNK SECTION, PLAN 3
STA 0+00 TO STA 0+90

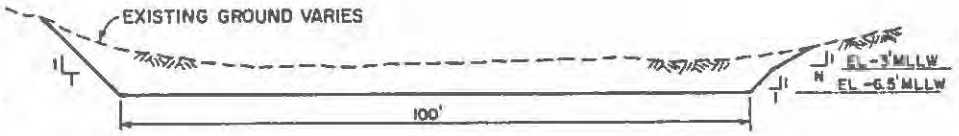



TYPICAL ENTRANCE CHANNEL

| STATION | B (FT) | REMARK |
|---|---|---|
| PLAN 2 | | |
| STA 0+00 TO 1+35 | 100 – 80 | TRANSITION |
| PLAN 3 | | |
| STA 0+00 TO 1+35 | 80 – 60 | TRANSITION |




TYPICAL HEAD SECTION, PLAN 3
STA 1+15 TO STA 1+55




TYPICAL TURNING BASIN

| STATION | N |
|---|---|
| PLAN 2 | |
| STA 0+00 TO 0+90 | 5 |
| STA 0+90 TO 2+00 | 1 |
| PLAN 3 | |
| STA 0+00 TO 0+70 | 5 |
| STA 0+70 TO 2+00 | 1 |

NOTE:
STA 0+90 TO STA 1+15 PLAN 3 BREAKWATER TRANSITION
FROM CREST ELEV. +8 TO CREST ELEV +11.5

GRAPHIC SCALE


KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII
TYPICAL SECTIONS
PLAN 2
PLAN 3
US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 7

(3) Construction Material Sources. Armor and underlayer stones are available at existing commercial quarry operations at Hilo or at the stockpile area at Honokahau Harbor. Armor stone sizes of 5 to 10 tons will be required.

G. ESTIMATED BENEFITS AND COSTS

a. Benefits. Benefits accruing from each plan were derived from navigation benefits and expected improvements in commercial fishing. Economic evaluations were conducted in accordance with procedures and standards prescribed by the Water Resources Council and Corps of Engineers' policy. Detailed analyses are presented in Appendix F.

b. Costs. Estimated project first costs were developed from projected May 1981 price levels and assumptions based on the prevailing physical conditions and construction methods suitable to the project area. The average annual cost for the purposes of the benefits to cost comparisons include interest (7-3/8%) and amortization (50-years) of the project first cost and the estimated annual maintenance costs associated with maintenance dredging, repairs to the breakwater structure, and maintenance for aids to navigation. Cost breakdowns and estimating assumptions are provided in Appendix C (Cost Estimation Section of the Engineering Investigations and Design Analysis Appendix).

c. Benefit to Cost Comparison. Table 4 presents a summary of the estimated average annual benefits to average annual costs associated with each plan. This comparison represents the degree of tangible economic justification for each plan.

TABLE 4. COST AND BENEFIT SUMMARY
(May 81 Price Levels)

| Item | PLANS 1 | 2 | 3 |
|---|---|---|---|
| Total Estimated First Cost 1/ | $2,654,000 | $1,068,000 | $1,243,000 |
| Estimated Average Annual Cost | 208,000 | 81,000 | 96,000 |
| Estimated Average Annual Benefit | 291,000 | 291,000 | 291,000 |
| Estimated Benefit to Cost Ratio | 1.4 | 3.6 | 3.0 |

d. Apportionment of Costs. The apportionment of costs between Federal and non-Federal interests corresponds to Section 107 of the River and Harbor Act of 1960, as amended, which prescribes the cost of sharing. This law limits Federal participation to a monetary maximum of $2.0 million (excluding the cost of aids to navigation).

1/ The apportionment of costs does not include other non-Federal costs (self-liquidating) associated with the assurances of local cooperation as required in Section 221 of the River and Harbor Act of 1970. Provisions required in the local cooperation agreement are detailed in Appendix A. Cost estimates are detailed in Appendix C.

TABLE 5. APPORTIONMENT OF COSTS

| Item | PLANS 1 | 2 | 3 |
|---|---|---|---|
| Total Project First Cost | $ 2,654,000 | $ 1,068,000 | $1,243,000 |
| Corps of Engineers First Cost Share 1/ | 2,000,000 | 957,000 | 1,132,000 |
| US Coast Guard First Cost Share 2/ | 10,000 | 10,000 | 10,000 |
| Non-Federal First Cost Share | 644,000 3/ | 101,000 4/ | 101,000 4/ |

1/ All future maintenance dredging and breakwater repairs are a Federal cost.

2/ All future maintenance for aids to navigation is a Federal cost.

3/ Includes cost for lands, easements and rights of way.

4/ Includes cost for new ramp and lands, easements and rights of way.

7. ASSESSMENT AND EVALUATION OF ALTERNATIVE PLANS

a. Light-Draft Navigational Needs. The purposes of this report were to identify light-draft navigational users, problems, and needs. Based upon the projected increased fish catch and reduction of damages to small-craft vessels under the 'with' project condition, local financial constraints and economic priorities of the State and County of Hawaii, it was felt that navigational improvements oriented around commercial fishing would satisfy the immediate primary socioeconomic needs. A protected basin and wider entrance channel was determined to best satisfy their needs, priorities, and constraints.

b. The evaluation of the economic, social, and environmental effects of the alternative plans is displayed in Table G (Summary Comparison of Alternative Plans and Systems of Accounts). This table displays the significant contributions, the beneficial and adverse effects, and the extent to which various planning objectives and evaluation criteria are met by each plan. This table will be revised and refined when comments on the plans are received during the review of the draft detailed project report (DPR) and in the public meeting.

TABLE 6. COMPARISON OF ALTERNATIVE PLANS AND SYSTEMS OF ACCOUNTS

| | NO IMPROVEMENT 'WITHOUT CONDITION' | PLAN 1 | PLAN 2 | PLAN 3 |
|---|---|---|---|---|
| A. PLAN DESCRIPTION | Use of existing facility at Kaulana Bay. Closest publicly owned and operated facility is at Pohoiki Bay, approximately 58 miles to the northeast. | Construction of a 160-foot breakwater, dredging of a 245-foot long entrance channel and turning basin. | Construction of a 135-foot breakwater and a new single lane launch ramp, dredging of a 135-foot long entrance channel and turning basin. | Construction of a 155-foot breakwater and a new single lane launch ramp, dredging of a 135-foot long entrance channel and turning basin. |
| B. SIGNIFICANT IMPACTS | | | | |
| 1. Economic | | | | |
| Local Government Finance* | None. | Requires approximately $644,000 local contribution not including costs for local assurances and cooperation. | Requires approximately $101,000 local contribution not including costs for local assurances and cooperation. | Requires approximately $101,000 local contribution not including costs for local assurances and cooperation. |
| Land Use | Land utilized in coastal area. Grazing on Hawaiian Homes Land inland by short-term lease. | No change to local land use policy, surrounding area is barren except for a few temporary shelters. | Same as Plan 1. | Same as Plan 1. |
| Public Facilities and Services | Existing Ramp. No shoreside facilities or major utilities. | Would provide for safe navigation and launch/recovery of boats and could promote the growth of related public facilities and services. | Same as Plan 1. | Same as Plan 1. |
| Regional Growth* | No significant impact. Stable growth will occur with or without navigation improvements. | No significant impact. Stable growth will occur with or without navigation improvements. | Same as Plan 1. | Same as Plan 1. |
| Employment* | Existing condition. | Would increase employment opportunities in commercial and general boating related services. | Same as Plan 1. | Same as Plan 1. |
| Damages to Boats and Related Equipment | Numerous damages during launch and recovery operations. Sixty percent use factor. | Marked decrease in damages during launch and recovery operations. | Same as Plan 1. | Same as Plan 1. |
| Increased Fish Catch for Commercial Fishermen | Current catch: 465,000 pounds per year. | 203,000 pound increase per year. | Same as Plan 1. | Same as Plan 1. |
| Commitment of Economic Resources | Not applicable. | Commitment of 9,400 tons of stone and fill, time, man-power and energy resources. | Commitment of 1,800 tons of stone and fill, time, man-power, and energy resources. | Commitment of 3,000 tons of stone and fill, time, man-power and energy resources. |

| | NO IMPROVEMENT 'WITHOUT' CONDITION | PLAN 1 | PLAN 2 | PLAN 3 |
|---|---|---|---|---|
| **2. Environmental** | | | | |
| **a. General** | | | | |
| Marine Environment | No change. | 1.16 acres dredged or covered. (1, 6, 9) | 0.85 acres dredged or covered. (1, 6, 9) | 0.91 acres dredged or covered. (1, 6, 9) |
| Terrestrial Environment | No change. | 0.24 acres modified. (1, 5, 9) | 0.19 acres modified. (1, 5, 9) | 0.22 acres modified. (1, 5, 9) |
| Fish and Wildlife | No change to existing conditions. Scattered coral growth within Kaulana Bay. | Loss of some coral and sessile organisms. Temporary displacement of motile organisms during construction. Rapid recovery anticipated. (1, 6, 9) | Same as Plan 1. | Same as Plan 1. |
| Water Quality* | | | | |
| Temporary Increase in Water Turbidity Anticipated During Construction; Grossly Estimated by Length of Construction Time and Quantity of Material Removed | Not applicable. | 12 months<br>11,700 Cubic Yards<br>(1, 6, 9) | 6 months<br>5,300 Cubic Yards<br>(1, 6, 9) | 6 months<br>5,200 Cubic Yards<br>(1, 6, 9) |
| Long-Term Alterations to Water Quality | Not applicable. | No significant long-term effect except for impacts associated with boat operation. (1, 6, 9) | Same as Plan 1. | Same as Plan 1. |
| Circulation & Flushing | | | | |
| Increase in Water Residence Time | No | Yes (1, 6, 9) | Yes (1, 6, 9) | Yes (1, 6, 9) |
| Air Quality* | | | | |
| Dust Nuisance Estimated by Length of Construction Period | Not applicable. | 12 months | 6 months | 6 months |
| Natural Resources* | Natural, unaltered shoreline except for existing ramp and natural bay area. | Would commit approximately 1.16 acres of natural marine environment to navigation improvements and 9,400 tons of quarried stone for protective structure. (1, 6, 9) | Would commit approximately 0.85 acres of natural marine environment to navigation improvements and 1,800 tons of quarried stone for protective structure. (1, 6, 9) | Would commit approximately 0.91 acres of natural marine environment to navigation improvements and 3,000 tons of quarried stone for protective structure. (1, 6, 9) |
| Man-Made Resources* | Continued demand for safe boating facility. | Completes boating facility for safe navigation. (1, 6, 9) | Same as Plan 1. | Same as Plan 1. |

| | NO IMPROVEMENT 'WITHOUT' CONDITION | PLAN 1 | PLAN 2 | PLAN 3 |
|---|---|---|---|---|
| b. Environmental Quality Destroyed | | | | |
| Marine Environment | | | | |
| Amount of Bay Area Disturbed | Approximately 1.5 acres available. | 1.16 acres. (1, 6, 9) | 0.85 acres. (1, 6, 9) | 0.91 acres. (1, 6, 9) |
| Amount of Live Coral Lost | None. | Minimal loss. (1, 6, 9) | Same as Plan 1. | Same as Plan 1. |
| c. Environmental Quality Enhanced | | | | |
| Amount of New Intertidal and Rocky Interstitial Marine Habitat Created | None. | 0.09 acres. (1, 2, 6, 9) | 0.05 acres. (1, 2, 6, 9) | 0.06 acres. (1, 2, 6, 9) |
| Species Diversity | None. | Localized Increase. (2, 6, 9) | Localized Increase. (2, 6, 9) | Localized Increase. (2, 6, 9) |
| 3. Social | | | | |
| Noise* | No change from existing condition. | Temporary increase during construction - 12 months; no long-term change. (1, 2, 5, 10) | Temporary increase during construction - 6 months; no long-term change. (1, 2, 5, 10) | Same as Plan 2. |
| Population* | No impact. | No significant effect on population growth and no displacement of people. (1, 2, 6, 9) | Same as Plan 1. | Same as Plan 1. |
| Aesthetic Values* | No change. | Visual intrusion from breakwater. (1, 6, 9) | Same as Plan 1. | Same as Plan 1. |
| Historic, Cultural, and Archaeological Resources | National Landmark District. | Probable destruction of two prehistoric features on east side of bay during construction. (1, 4, 9) | Possible effect on prehistoric features on east side of bay. (1, 5, 10) | Same as Plan 2. |
| Recreational Opportunities | No change. | Increase access for sports fishing. (1, 5, 10) | Same as Plan 1. | Same as Plan 1. |
| Health, Safety, and Community Well-Being | Hazardous navigation conditions at Kaulana Bay. | Would enhance health, safety and community well-being by providing a protective basin for boating operations. Also decreased accidents at sea. (2, 6, 8, 10) | Same as Plan 1. | Same as Plan 1. |
| Community Growth and Cohesion* | No change. | No significant change. | Same as Plan 1. | Same as Plan 1. |

| | NO IMPROVEMENT 'WITHOUT' CONDITION | PLAN 1 | PLAN 2 | PLAN 3 |
|---|---|---|---|---|
| **C. PLAN EVALUATION** | | | | |
| **1. Contributions to the Planning Objectives** | | | | |
| Improve Commercial Fishing Opportunities on the Big Island for the Period 1985-2035 | Restricts commercial fishing opportunities. | Provides protected basin for operation of trailer boats, contributes to development of commercial fishing, increases efficancy and opportunities for existing fishing operations, provides a social and economic commitment on the importance of fishing. | Same as Plan 1. | Same as Plan 1. |
| Improve the Socio-Economic Opportunities for the People of the Ka'u District | Contributes to socio-economic opportunities. | Provides employment opportunities, provides diversity of Big Island's tax revenue base, provides stability of fish supply and prices. | Same as Plan 1. | Same as Plan 1. |
| Minimize Alteration to Historical and Cultural Resources of the Area | No modifications. | Minimal impact. | No modifications. | No modifications. |
| Minimize Alteration to Bay Marine Environment | No modifications. | 1.16 acres modified. | 0.85 acres modified. | 0.91 acres modified. |
| **2. Response to Specified Criteria** | | | | |
| Providing a Protected Basin That can Accommodate a Typical Fishing Vessel of 27-Foot Length, 7-Foot Beam Width and 2.5-Foot Draft. | No | Yes | Yes | Yes |
| Providing Ancillary Land Area that can Accommodate Parking | Yes | Yes | Yes | Yes |
| Minimize Conflicts with Local Land-Use Policy and Physical Community Disruption | Unchanged. | Yes | Yes | Yes |
| Enhancing, Preserving, or Minimizing Effects on Marine and Terrestrial Flora and Fauna Resources | Unchanged. | Minimal effects. | Minimal effects. | Minimal effects. |
| Preserving Archaeological and Historical Resources | Unchanged. | Significant adverse effects. | Possible adverse effects which can be avoided. | Same as Plan 2. |

| | NO IMPROVEMENT 'WITHOUT' CONDITION | PLAN 1 | PLAN 2 | PLAN 3 |
|---|---|---|---|---|
| 3. Relationship to National Accounts | | | | |
| National Economic Development (NED) | | | | |
| Average Annual Benefits | N/A | $291,000 | $291,000 | $291,000 |
| Average Annual Costs | N/A | 208,000 | 81,000 | 96,000 |
| Net Annual Benefits | N/A | 83,000 | 210,000 | 195,000 |
| Benefit-to-Cost Ratio (B/C) | N/A | 1.4 | 3.6 | 3.0 |
| Environmental Quality | SEE ITEM B.2 ON THIS TABLE. | | | |
| Social Well-Being | SEE ITEM B.3 ON THIS TABLE. | | | |
| Regional Development | SEE ITEM B.1 ON THIS TABLE. | | | |
| 4. Response to Associated Evaluation Criteria | | | | |
| Acceptability | Not acceptable. | TO BE COMPLETED FOLLOWING PUBLIC MEETING AND REVIEW OF THE DRAFT REPORT BY THE PUBLIC. | | |
| Completeness | Not applicable. | COMPLETE AS DESCRIBED, EXCEPT FOR PERIODIC MAINTENANCE DREDGING. | | |
| Effectiveness | Not applicable. | Marginally effective. | Highly effective. | Effective. |
| Efficiency | Not applicable. | Marginally efficient. | Highly efficient. | Efficient. |
| Reversibility | Not applicable. | Irreversible commitment of resources. | Same as Plan 1. | Same as Plan 1. |
| Stability | Not applicable. | High | High | High |
| D. IMPLEMENTATION RESPONSIBILITIES | | | | |
| 1. Corps of Engineers | Not applicable. | Provide estimated project first cost share of $2 mil.; design and construction of the breakwater, entrance channel and turning basin. | Provide estimated project first cost share of $957,000 design and construction of the breakwater, entrance channel and turning basin. | Provide estimated project first cost share of $1.1 mil.; design and construction of the breakwater, entrance channel and turning basin. |
| 2. State of Hawaii | Not applicable. | Provide estimated local first cost share of $644,000 provide local assurances and cooperation. | Provide estimated local first cost share of $101,000 provide local assurances and cooperation. | Provide estimated local first cost share of $101,000 provide local assurances and cooperation. |
| 3. US Coast Guard | Not applicable. | Provide navigational aids. | Provide navigational aids. | Provide navigational aids. |

(*) Item specifically required in Section 122, Public Law 91-611 and ER 1105-2-240.

INDEX OF FOOTNOTES

TIMING

1. Impact is expected to occur prior to or during implementation of the plan.
2. Impact is expected within 15 years following plan implementation.
3. Impact is expected in a longer time frame (15 or more years following implementation).

UNCERTAINTY

4. The uncertainty associated with impact is 50% or more.
5. The uncertainty is between 10% and 50%.
6. The uncertainty is less than 10%.

EXCLUSIVITY

7. Overlapping entry: Fully monetized in NED account.
8. Overlapping entry: Not fully monetized in NED account.

ACTUALITY

9. Impact will occur with implementation.
10. Impact will occur only when specific additional actions are carried out during implementation.
11. Impact will not occur because necessary additional actions are lacking.

c. The Draft Environmental Impact Statement will be filed with the US Environmental Protection Agency. In accordance with the Council on Environmental Quality Regulation and Procedures, a minimum comment period of 45 days from the date of the notice of availability published in the Federal Register will be established. In addition, no administrative action will be taken regarding the proposed action for at least 90 days.

d. In accordance with Section 404 of the Clean Water Act of 1977 and Executive Order 11988 (Flood Plain Management, dated 24 May 1977), the public will have the opportunity at a public meeting to address the effects of "discharge of fill material within the navigable waters of the US" and "the development of Federal activities within the base flood plain." Evaluation reports concerning these two acts are provided in Appendix A.

e. In accordance with the Fish and Wildlife Coordination Act of 1946, as amended, the US Fish and Wildlife Service will provide a Section 2(b) report containing their assessment and evaluation of the impacts upon fish and wildlife resources associated with the recommended plan.

8. THE RECOMMENDED PLAN

a. National Economic Development (NED) Plan. Plan 2 at Kaulana Bay maximizes economic development based upon its least cost and greatest benefit to cost comparison. Consequently, Plan 2 is designated as the NED Plan.

b. EQ Plan. None of the plans make net positive contributions to the environmental resources of the study area. Plan 2 is considered to be the least environmentally damaging plan because it involves the least modifications to the marine environment, minimizes destruction of marine habitat, and creates new habitat.

c. The recommended and final plan selection will follow a review of this draft DPR and the draft environmental statement, and a formal public meeting to be held on the Big Island on 14 July 1981. All public input will be considered in the plan selection and will be documented in the final DPR. The following sections of this report will be completed after the public meeting and incorporated into the final report:

THE SELECTED PLAN

CONCLUSIONS AND RECOMMENDATIONS

# IV. ENVIRONMENTAL STATEMENT

DRAFT ENVIRONMENTAL STATEMENT
KAULANA BAY NAVIGATION IMPROVEMENTS
SOUTH POINT, ISLAND OF HAWAII

The responsible lead agency is the U.S. Army Corps of Engineers, Honolulu District. The responsible cooperating agency is the U.S. Fish and Wildlife Service, Pacific Islands Office.

Abstract:

Kaulana Bay is located in the Ka'u District of the Island of Hawaii approximately 80 road miles southwest of Hilo. The bay is situated about a mile east of South Point within land administered by the Hawaiian Homes Commission. The Honolulu District, U.S. Army Corps of Engineers, has investigated public concerns and needs associated with providing light draft navigation improvements for this region of the island, and impacts upon the environmental, social, cultural, recreational and economic resources of the area. Five sites were initially evaluated; the Kaulana Bay site was selected for further detailed studies. Three plans of improvement have been developed for the Kaulana site to meet navigation needs and design criteria. Plan 1 would require extensive dredging along the western side of the bay, creating a new entrance channel. A protective rock structure would also be constructed across the eastern portion of the bay. Plans 2 and 3 differ only in the width of the entrance channel. Plan 2, with the wider channel, would require additional dredging. Both plans require construction of a protective rock structure and new launch ramp and dredging of a turning basin. None of the plans would have significant adverse effects on important environmental or social resources, but all three plans could adversely affect significant archaeological (cultural) resources. These adverse effects can be avoided under Plans 2 and 3.

Further technical information concerning the statement may be obtained from:

Dr. James E. Maragos
U.S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858
Telephone (808) 438-2263/64

Note: Information, displays, maps, etc., discussed in the main report are incorporated by reference in the EIS.

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

## TABLE OF CONTENTS

LIST OF TABLES

THE FOLLOWING PEOPLE WERE PRIMARILY RESPONSIBLE FOR PREPAIRNG THIS ENVIRONMENTAL IMPACT STATEMENT:

## LIST OF PREPARERS

| NAME | DISCIPLINE/EXPERTISE | EXPERIENCE | ROLE IN PREPARING EIS |
|---|---|---|---|
| Timothy Young | Hydraulic Engineer/Civil Engineering and Water Resource Planning | BS, Civil Engineering<br>4 years Civil/Hydraulic Engineering with the US Army Corps of Engineers | Study Manager |
| James E. Maragos | Supervisory Environmental Biologist/Marine Ecology | BS, Zoology, Ph D, Oceanography<br>2 years Post-Doctoral Research<br>9 years Environmental Consultant<br>6 years EIS studies with the US Army Corps of Engineers | EIS Coordinator |
| Robert Moncrief | Ecologist/Marine Biology | BA, Zoology<br>7 years Biologist with the US National Marine Fisheries Service<br>4 years Biologist with the US Navy<br>3 years EIS studies with the US Army Corps of Engineers | EIS Preparer |
| David G. Sox | Social Environmental Specialist/ Historical and Cultural Geography | BA, MA, Geography<br>6 years research<br>6 years EIS studies with the US Army Corps of Engineers | Social and Cultural Resource Assessment |
| William Lennan | Fish and Wildlife Biologist | BA, Zoology<br>BS, Political Science<br>2 years Post Graduate Studies in Zoology<br>2 years Biologist with the US Fish and Wildlife Service | Fish and Wildlife Assessment |

1. SUMMARY

a. Major Conclusion and Findings. The alternative plans are described in detail in Section III of the Detailed Project Report. All three plans meet the primary objectives of improving commercial fishing opportunities on the Island of Hawaii and improving socioeconomic opportunities for the people of the Ka'u District. Based on a maximization of net benefits, Plan 2 was designated as the National Economic Development (NED) plan. None of the plans result in net positive contributions to the environmental resources of the study area which is the criteria for designation of an Environmental Quality (EQ) Plan. Plan 2 is considered to be the least environmentally damaging plan because it involves the least modification of the bay's marine environment. It also would minimize alteration to historical and cultural resources of the area. An evaluation of the discharge of fill material under Section 404 of the Clean Water Act of 1977 indicates that the site and fill material are suitable for this purpose. No threatened or endangered species or their critical habitat would be affected by any of the proposed alternative plans. The project area is located within the South Point National Historic District which is listed on the National Register of Historic Places and is also designated a National Landmark. Archaeological sites within the South Point complex are located on the east side of Kaulana Bay. Construction of all three plans could have adverse effects on archeological sites east of the bay, but construction of Plan 2 and 3 can be planned to avoid any impact.

b. Areas of Controversy. None.

c. Unresolved Issues. Coordination with the State Historic Preservation Officer and Advisory Council on Historical Preservation remains to be completed.

d. Relationship to Environmental Requirements.

The relationship of alternative plans to federal and state environmental requirements is presented in Table 1.

Table 1
Relationship of Plans to Environmental Requirements

| Federal Statutes | |
|---|---|
| National Environmental Policy Act (NEPA) | In full compliance |
| Prime Agricultural Lands | Not applicable |
| Preservation of Historic and Archaeological Data Act | In partial compliance |
| National Historic Preservation Act | In partial compliance - cultural reconnaissance in progress |
| National Landmarks | In partial compliance - cultural reconnaissance in progress |

Table 1 (Continued)
Relationship of Plans to Environmental Requirements

| | |
|---|---|
| Fish and Wildlife Coordination Act of 1958 | In partial compliance. Coordination with USFWS in progress |
| Estuary Protection Act | Not applicable |
| Endangered Species Act of 1973, as amended | In full compliance |
| Migratory Bird Treaty Act of 1918 | Not applicable |
| Marine Mammal Protection Act of 1972 | Not applicable |
| Marine Protection, Research and Sanctuaries Act | Not applicable |
| Federal Water Project Recreation Act of 1965 | Not applicable |
| Land and Water Conservation Fund Act | In full compliance |
| Coastal Zone Management Act | In full compliance |
| Watershed Protection and Flood Prevention Act | Not applicable |
| Scenic and Wild River Act | Not applicable |
| Water Resources Planning Act | In full compliance |
| Rivers and Harbors Act of 1899 | Not applicable |
| Clean Water Act | Partial compliance |
| Clean Air Act | In full compliance |
| Executive Orders, Memoranda, Etc. | |
| E.O. 11593 - Protection and Enhancement of of the Cultural Environment | Partial compliance |
| E.O. 11990 - Protection of Wetlands | Not applicable |
| E.O. 11987 - Exotic Organisms | Not applicable |
| E.O. 11988 - Flood Plain Management | Not applicable |
| State and Local Laws | |
| Chapter 343, HRS: State EIS Law, State CZMA Rev. 26 Sep 80 | Partial compliance |

2. NEED FOR AND OBJECTIVES OF THE ACTION

a. Study Authority. The study and report were performed under the authority of Section 107 of the River and Harbor Act of 1960, as amended (Public Law 84-645). The authority permits federal participation in the construction of small boat harb rs on a cost sharing basis up to $2,000,000. The local government must provide lands, easements, right-of-way and monies for non-federal costs.

b. Public Concerns. The Kaulana Bay Navigation Improvements Study was initiated following a written request from the State of Hawaii in August 1979. The request was based on the expressed desires of the local Ka'u Fishermen Association to improve the usability and safety of boating facilities used by the South Point commercial fishermen. The existing Kaulana boat ramp is the only publicly owned and operated boating facility along the Ka'u coastline, providing ready access to rich fishing grounds off South Point less than a mile away. The launch ramp is unprotected and directly exposed to deep water swell and trade wind generated waves from the east through southwest direction. This makes launching operations difficult and dangerous, requiring at least 3-4 persons to accomplish. Local boaters estimate that boats and trailers are damaged about 20 percent of the time the ramp is in use. Presently, launch and recovery operations are possible an estimated 60 percent of the time. The occurrence of sudden storms preventing fishermen from safely landing and recovering their boats is another serious problem at Kaulana. Such events occur frequently in the winter and are especially hazardous at night when fishermen are engaged in bottom fishing or moor their boats overnight in the lee of the cliffs on the west coast of South Point. A protected basin, allowing fishermen to launch, recover, off-load their catch and return to the fishing grounds would greatly decrease the damages to boats and equipment and risk of bodily injury and contribute to the increased productivity of the local fishing industry which has been expanding in size and economic importance in recent years.

c. Planning Objectives. The planning objectives which guided the formulation and evaluation of alternative navigation improvement plans are provided below:

(1) Economic Objectives.

(a) Improve commercial fishing opportunities on the Big Island during the 1985-2035 period of analysis.

(b) Improve the socioeconomic opportunities for the people of Ka'u district.

(c) Maximize net benefits.

(2) Environmental Objectives.

(a) Minimize alteration of marine environment within Kaulana Bay.

(b) Avoid alteration of historical and cultural resources of the area.

3. ALTERNATIVES INCLUDING THE PROPOSED ACTION

a. Plans Eliminated From Further Study.

(1) Non-structural Alternatives. Non-structural alternatives or measures are those actions that can meet the planning objectives without constructing new facilities. Typical measures include improving the efficiency of existing facilities or the conversion of other existing facilities. These measures have usually been identified as management alternatives.

The lack of waterfront harbor or protected boating facilities in the Ka'u region made it infeasible to apply non-structural alternatives as a management option. The two boating facilities that do exist here, both launch ramps, cannot meet the planning objectives without extensive modification. Although not intended to provide all-weather navigation protection, a harbor project improving the navigation conditions for fair to marginal conditions would greatly enhance fishing opportunities by increasing the percentage of time in which launch and recovery operations can be conducted at Kaulana ramp. To meet the needs of the local fishing fleet and contribute to the overall economic development of the Ka'u area, protection of the existing ramp is considered essential.

(2) Alternative Project Sites. Potential harbor sites were limited to the Ka'u District coastline. Areas outside of the Ka'u District were not considered due to their distance from prime fishing grounds in the south and southeast coastal waters. Five sites were initially considered as possible locations for light-draft navigation improvements. These were Punaluu, Honuapo Bay, Kaalualu Bay, Kaulana Bay and Pohue Bay (Figure 2). The major considerations in selecting a possible site were: (1) sea conditions (2) access (3) distance to prime fishing grounds (4) land availability (5) historic sites (6) endangered species (7) utilities and (8) existing and proposed land use and zoning (Tables 2 & 3). Based on the above criteria the following alternative sites were dropped from further consideration:

(a) Punaluu. Land adjacent to the existing boat ramp and access road at Punaluu is privately owned by C. Brewer and Company. The Punaluu area has been developed by Brewer in recent years as a tourist destination point. Based on existing and future development in the area, availability of land for potential sites for a harbor and shoreside facilities are limited. Several sites within the Punaluu area may be eligible for listing on the Hawaii and National Register of Historic Places (access road to ramp and old sugar dock). Because of problems associated with the acquisition of private shoreline land for navigational improvements, provisions for public vehicular access, and archeological considerations, this site was consequently eliminated in favor of a more desirable location.

(b) Honuapo Bay. Hanuapo Bay is a shallow cresent-shaped embayment located about 5 miles southwest of Punaluu Harbor. The offshore area consists of a series of exposed pahoehoe domes and a fringing basalt shelf along the seaward edge of the inner bay. The bay is directly exposed to tradewinds, resulting in waves in excess of 2 feet almost continously. Waves in excess of 6 feet occur on an average of 80 days per year.

Whittington Beach Park (County), located along the shoreline of Honuapo Bay, provides shoreline recreational opportunities for the people of Hawaii County. The construction of navigational improvements for commercial fishing at this site is not considered to be compatible with this use.

Although this site is easily accessible from the main highway, the entire area is privately owned and launching is very difficult because of the shallow reef and wave exposure.

(c) Kaalualu Bay. Kaalualu Bay is located approximately 5 miles northeast of South Point. The bay affords good shelter for small craft during tradewind weather but is exposed during Kona weather. The bay is very shallow and would require extensive dredging of hard bottom material to provide a channel and turning basin. Vehicular access to the site is impossible without a four wheel drive.

A regional beach park is proposed for Kaalaulu Bay which would provide shoreline recreational opportunities. Long range plans by C. Brewer include a resort/subdivision development. Construction of a harbor for commercial fishing is not considered to be compatible with these plans.

On a recent field trip, a species of endemic sponge was identified at this site. In addition, an archeological reconnaissance conducted in 1972 revealed a total of 91 archeological sites. Because of environmental and archeological issues and land-use plans associated with this site, this location was no longer considered.

(d) Pohue Bay. Pohue Bay is located on the southwest coast of the island approximately ten miles from South Point. A small sandy beach characterizes the edge of the central portion of the bay. Because the area is sheltered from tradewind conditions, Pohue Bay has considerable natural protection. Waves in excess of 2 feet approach the area 200 days a year while waves over 6 feet are estimated to occur only about 5 days per year.

Additional development of an existing subdivision in the Pohue Bay area is anticipated with improved vehicular access and installment of major utilities. Directly across the shoreline area are a number of archeological sites which have not yet been evaluated by the State Archeologist. With additional development and the occurence of numerous archeological sites scattered throughout the area, the bay as a potential location for a harbor and shoreside facilities will be limited. Because of site limitations and environmental and archeological issues, no further studies were conducted.

b. Without Condition (No Action). Without Federal implementation of planned navigation improvements at Kaulana Bay, boat launching and recovery operations will continue to be hazardous and difficult during strong trade winds and not possible during Kona wind conditions. Boats and trailers will be subject to damage as is presently the case. Fishing will be restricted by sea conditions rendering the ramp inoperable approximately 40 percent of the time. The developing local yellow fin tuna fishery will be restricted by adverse weather conditions affecting boat launching and recovery at Kaulana. Without an improved or additional boating facility, fishery related economic growth in the Ka'u District will be limited. There are no plans at this time for navigation improvements by local interests at Kaulana Bay or other alternative sites along the Ka'u coast.

c. Plans Considered in Detail. Based on the identified problems and needs, the planning objectives, and the formulation and evaluation concepts, three alternative design plans for Kaulana Bay were developed in detail and evaluated with respect to their contributions to navigation improvements, their beneficial and adverse impacts, and their benefits and costs. Two of

the alternative plans would involve constructing and providing protection for a new launch ramp while the other plan would provide protection for the existing ramp. All of the plans incorporate space for a single-lane launch ramp. Because of the confined nature of the bay, no mooring areas for small-craft vessels were designated. Adequate parking for car/trailer vehicles is available in areas adjacent to the existing ramp. Parking areas and harbor-related facilities would be developed by local interests.

(1) Plan 1. Plan 1 consists of dredging a 245-foot-long, 80-foot-wide, and 8.5-foot-deep entrance channel; a 220-foot-long by 100-foot-wide, and 6.5-foot-deep turning basin, and constructing a 160-foot-long main breakwater with a +11.5-foot crest elevation. The offshore breakwater would provide protection for the existing launch ramp. This plan utilizes the existing reef flat as the entrance channel and the single-lane launch ramp. The breakwater will require approximately 9,400 tons of quarried rock covering 0.26 acres. The dredging of the entrance channel and turning basin will affect 1.1 acres generating about 11,700 cy of basalt material. When completed, the navigation improvement would inclose a total water area of about 1 acre. Total project first cost is $2,654,000 cost-shared at $2,010,000 in federal funds and $644,000 in local funds.

(2) Plan 2. Plan 2 consists of dredging a 135-foot-long, 100-foot to 80-foot-wide tapered, and 8.5-foot-deep entrance channel; a 200-foot-long by 100-foot-wide, and 6.5-foot-deept turning basin, and constructing a 135-foot-long main breakwater with a +8.0-foot crest elevation. The breakwater would provide protection for the new launch ramp. This plan utilizes the existing natural channel and a new single-lane launch ramp. The breakwater will require approximately 1,800 tons of quarried rock covering 0.10 acres. The dredging of the entrance channel and turning basin will affect 0.82 acres generating about 5,300 cy of basalt material. When completed, the navigation improvement would inclose a total water area of about 1 acre. Plan 2 is considered the least environmentally damaging plan because it entails the least modification to the bay's marine environment. Total project first cost is $1,068,000 cost-shared at $967,000 is federal funds and $101,000 in local funds. Based on a maximization of net benefits this plan was designated as the National Economic Development (NED) Plan.

(3) Plan 3. Plan 3 consists of dredging a 135-foot-long, 80-foot to 60-foot-wide tapered, and 8.5-foot-deep entrance channel; a 200-foot-long by 100-foot-wide, and 6.5-foot-deep turning basin, and constructing a 155-foot-long main breakwater with a +11.5-foot crest elevation. The breakwater would provide protection for a new single-lane launch ramp. The breakwater will require approximately 3,000 tons of quarried rock covering 0.12 acres. The dredging of the entrance channel and turning basin will affect 0.88 acres generating about 5,200 cy of basalt material. When completed, the navigation improvement would inclose a total water area of about 1 acre. Total project first cost is $1,243,000 cost-shared at $1,142,000 in federal funds and $101,000 in local funds.

d. Comparative Impacts of Alternatives. Comparative impacts of the three alternative plans on significant resources are presented in Table 2. Additional comparison of alternate plans are contained in Table 3.

Table 2 . Comparative Impacts of Alternatives on Significant Resources

| Base Condition and Alteratives | South Point National Land Marks District | Coastal Water Quality | Plan Economics |
|---|---|---|---|
| Base Condition | Within the South Point complex of archeological sites, remains of the prehistoric and early historic Kapalaoa Village site are located inland and immediately east of the bay extending out to the end of Kaulana Point. | Relatively pristine open coastal waters w/few pollutant sources. | Not applicable |
| Without Condition | No change anticipated. | No change anticipated | Not applicable |
| Plan 1 | Breakwater structure would have direct adverse effect on surface archaeological sites on east side of the bay, possibly concerning one or more of the rock structures located there. Related construction activities would further disturb and possibly destroy other sites and cultural material in the area. | Temporary increase in water turbidity | Average Annual Cost: $208,000<br>Annual Benefit: $291,000<br>B:C Ratio: 1.4 |
| Plan 2 | No impacts provided that construction activities and equipment are confined to the central and western regions of the bay and shoreline. Construction activities related to dredging the entrance channel and turning basin, if conducted along the eastern side of the bay would damage or destroy surface archaeological sites and possibly subsurface cultural material. | During construction less than 1 year duration | Average Annual Cost: $81,000<br>Annual Benefit: $291,000<br>B:C Ratio: 3.6 |
| Plan 3 | Sames as Plan 2 | | Average Annual Cost: $96,000<br>Annual Benefit: $291,000<br>B:C Ratio: 3.0 |

## 4. AFFECTED ENVIRONMENT

### A. Environmental Conditions.

(1) Physical features. The island of Hawaii is the largest of the Hawaiian islands consisting of about 4,038 square miles of land area and 305 miles of coastline. Being of volcanic origin, the dominant topographic feature on the southeastern portion of the island (Ka'u District) are the large expanses of lava fields. Two of the island's most active volcanoes, Mauna Loa (13,796 MSL) and Kilauea are located in this area. Mauna Loa (Big Mountain), the largest single mountain on earth, provides a dramatic backdrop for the Kaulana Bay area. The Ka'u landscape is characterized by historic as well as young lava flows, moderate slopes with little or no established surface drainage, and a rugged coastline consisting of low and extremely steep sea cliffs.

(2) Climate. The island of Hawaii has a semi-tropical climate, but has wide variations across the island in temperature and rainfall. Temperatures range from 58 to 90 degrees (minimum-maximum) along the coastal plain to sub-freezing minimums in the mountains. Mauna Kea and Mauna Loa often have a mantle of snow during the winter months. Rainfall in the southwestern region of the Ka'u District which includes the South Point area varies from less than 20 inches at South Point to 75 inches at the 5,000-foot elevation. Relatively uniform tradewinds prevail offshore, but disruption by the high land masses make inland winds very complex.

(3) Terrestrial biota. The coastal area of the Ka'u District is characterized by sparse vegetation consisting primarily of indigenous strand plants such as ilima, Pa'u-o-Hiiaka and beach morning glory with patches of Bermuda grass occurring in backshore areas.

Terrestrial fauna in the Ka'u District are also limited in abundance and diversity. Shorebirds including the golden plover, wandering tattler and ruddy turnstone probably utilize available shallow feeding habitat in the area. Passerine birds, field mice, and rats are also found in this area.

(4) Marine biota. The substratum throughout most of Ka'u coastline consists of hard lava rock covered in places by accumulation of silt and coral rubble. A number of bays along this coastline contain scattered massive heads of Porites coral. Coral growth elsewhere in these bays are limited to scattered Pocillopora colonies possibly a consequence of the constant wave action occurring in these areas. A variety of common reef fish and marine benthic invertebrates including gastropod mollusks, sea urchins, sea cucumbers and crabs are present along the coastline. A table listing fish and invertebrate species observed in Kaulana Bay is provided in Appendix E of the Detailed Project Report. Green sea turtles are occasionally observed offshore but no known nesting beaches are located in the Ka'u area. The endangered humpback whale has also been observed along the Ka'u coast in transit to or from the shallow shoals that comprise their preferred wintering habitat, primarily Penguin Banks and the area between Maui, Lanai and Molokai.

(5) Geology. The island of Hawaii is the youngest of the Hawaiian island archipelago and is the result of the coalescence of the lava flows of five volcanoes. The volcanoes, Mauna Loa and Kilauea, are still very active. The base rock in the area is massive basalt. This is overlain by soil consisting of weathered base rock. The soils are very shallow, covering rough lava flows that are extremely permeable.

(6) Development and economy. The State of Hawaii is prosperous with a growing population and economy. Between 1958 and 1980, the total resident population increased from 611,800 to 963,617 (preliminary census). During the period 1958 to 1977, the gross State product more than quintupled, from $1.4 billion to $8.0 billion. The three largest contributors to the State economy are tourism, defense expenditures, and agriculture, the bulk of the last activity being in the production of sugar and pineapple. The most rapid growth during the last several years has been in the tourist industry. Tourists arrivals totaled 171,500 in 1958 and 3,960,000 in 1979. Tourist expenditures were $83 million in 1958. The expenditures were $440 million in 1968 and $2.6 billion in 1979, an increase of 495 percent. This compares to an increase of 175 percent for defense spending. It is expected that the growth trend in tourism will continue although at a slower pace together with the State economy in general.

Sugar and tourism dominate the economy of the island of Hawaii. There are 469 sugarcane farms in Hawaii County cultivating 92,829 acres in caneland. Production of raw sugar was 3.9 million tons, 42.5 percent of the States total in 1978 with a value of $68.6 million. Currently, the State of Hawaii supplies about 10 percent of the nations 11-1/2 million tons of annual sugar consumption.

The visitor industry on the island of Hawaii grew rapidly in the past 15 years. Hotel construction increased so fast during this period that capacity exceeded the need for rooms. The increase in hotel units has been greatest along the Kona coast. Of the 6,093 units on the island in 1979, there were 3,637 units in Kona area, 1,954 units in Hilo and 502 units in other areas of the county. Total visitor expenditure on the island in 1978 was $158 million. Two-thirds of the State's beef and one-half of the diversified agriculture crops are produced on the island of Hawaii. Commercially caught fish previously sold only to local markets or shipped to Honolulu are now also being shipped fresh-iced to the mainland.

Ka'u, South Kona, and North Kona Districts would be serviced by Kaulana Bay. The major economy in the area includes sugar, livestock, coffee farming, and visitor industry. The visitor industry is the fastest growing industry and will have the greatest influence in the future. An additional 2,150 hotel units are planned for Kona area within the next several years.

Commercial fishing has always been popular in the Kaulana area. Available records indicate over 588,000 pounds of fish were caught in 1980. This is expected to grow since Kaulana fronts one of the best fishing grounds in the islands.

b. Significant Resources.

(1) SOUTH POINT NATIONAL HISTORIC DISTRICT. Kaulana Bay is located within the South Point National Historic District which is listed on the National Register of Historic Places and is also designated a National Landmark. Originally, the South Point complex of sites was believed to have been the first area occupied by Hawaiians in 124 B.C. ± 60 A.D. and continuously occupied until about 1730. The national significance of the complex lay in the belief that "this area contains a group of sites which document the largest and most complete record of human occupation in the Hawaiian Islands." More recent radiocarbon dating studies show however that South Point fishermen established their living areas no earlier than 1,000 A.D. and continually occupied the region to about 1250 A.D. None of the individual archeological features which made up the original district nomination in 1962 as a National Landmark were found near Kaulana Bay, but subsequent investigations in 1969 identified the remains of the prehistoric and nearly historic Kapalaoa Village site upland and immediately east of the bay. This survey quoted a local Hawaiian informant as saying that Kaulana Point (east of the bay) as a kapu or forbidden area based on a number of rock structures found there (see map in Appendix D). A recent survey conducted in 1981 by Paul Rosendahl found additional structures out to the end of the point. An undisturbed subsurface cultural site with remains of hearths and fire pits was revealed in the compacted sand embankment immediately adjacent to and east of the boat launch ramp. No cultural materials were found in the area west of the present boat ramp.

(2) COASTAL WATER QUALITY: Coastal waters within and adjacent to Kaulana Bay are considered perennially dry open coastal waters receiving very little influence from terrestrial sources and are characteristic of the oceanic water mass surrounding the island. However, during trade wind and Kona storm conditions, near shore waters within Kaulana Bay and adjacent coastal areas are generally turbid, resulting from suspended particulate matter. Periodic operation of boat motors at the launch ramp and infrequent sheet flow runoff constitute the major sources of pollution.

(3) RESOURCES AND VALUES IDENTIFIED IN SECTION 122 OF PUBLIC LAW 91-611, HARBOR AND RIVER ACT OF 1970. The following resources and environmental values have been fully considered with respect to possible adverse economic social and environmental effects resulting from implementation of the proposed project (Table 6 of the DPR and Table 3 of the DEIS):

(a) Air, Noise and Water Pollution.

(b) Man-made or natural resources, esthetic values, community cohesion and availability of public facilities and services.

(c) Employment effects and tax and property value.

(d) Displacement of people, businesses and farms.

5. ENVIRONMENTAL EFFECTS

a. South Point National Historic District. Construction of the breakwater in Plan 1 would have direct adverse effects upon the surface archaeological sites on the east side of the bay, possibly covering one or more of the rock structures located there. Related construction activities such as the

movement of heavy equipment through the area containing archeological sites could cause additional damage to surface and subsurface cultural materials. Plans 2 and 3 should not affect the archeological sites provided construction activities related to dredging the entrance channel and turning basin are confined to the western and central regions of the bay and shoreline. This determination of effect and adverse effect as required by 36 CFR 800.4 is augmented by Paragraphs 3 to 7 and 20 to 21, Appendix E, and serves as a request for comments from the Advisory Council in Historic Preservation in accordance with 36 CFR 800.4(d)(1).

b. Coastal Water Quality: A temporary increase in water turbidity during construction is anticipated. The dredged basin and protective structure will result in a slight increase in water residence time within the bay. Projected increased boat usage will contribute to impacts associated with boat operations. The impacts within the bay are expected to be minimal as the facility does not provide for mooring of boats. No significant long-term effects on coastal water quality are anticipated.

c. Resources and Values Identified in Section 122 of Public Law 91-611: Project related impacts on the environmental resources and values identified in Section 122 of P.L. 91-611 have been fully considered (see Table 3). Potential adverse impacts upon these resources resulting from project implementation are not significant:

(1) Air, Noise and Water Pollution. Adverse impacts related to air, noise and water would be temporary impacts during construction of harbor improvememts. Minimization of these impacts would be effected by employment of construction methods that do not cause excessive or unnecessary turbidity, dust, hydrocarbon emmission or noise.

(2) Man-made or natural resources, esthetic values, community cohesion and availability of public facilities and service: destruction or disruption of the above resources as a result of project implementation would be minimal and are not considered significant. Adverse impacts to nearshore marine communities attributed to dredging and placement of rock for protective structures will occur. Loss or damage to habitat will vary between 0.9 and 1.3 acres depending on the plan. Some beneficial impacts are expected when marine life colonize and occupy protective structures.

(3) Employment effects and tax and property value: adverse employment effects and/or tax and property value losses would not result from project implementation.

(4) Displacement of people, businesses and farms: no injurious displacement of people, businesses and farms would result from project implementation.

6. PUBLIC INVOLVEMENT

a. Public Involvement Program. Government officials and agencies were notified by letter in June 1980 of the initiation of detailed studies for possible light-draft navigational improvements. A notice of intent to prepare a Draft Environmental Impact Statement (DEIS) for the Kaulana Bay Harbor was published in the Federal Register to notify those interested in contributing to the preparation of the DEIS.

TABLE 3. ANALYSIS OF IMPACTS ON RESOURCES AND VALUES IDENTIFIED IN SECTION 122 OF PUBLIC LAW 91-611 AND OTHER RESOURCES IN THE PROJECT AREA

| | NO IMPROVEMENT 'WITHOUT CONDITION' | PLAN 1 | PLAN 2 | PLAN 3 |
|---|---|---|---|---|
| A. PLAN DESCRIPTION | Use of existing facility at Kaulana Bay. Closest publicly-owned and operated facility is at Pohoiki Bay, approximately 58 miles to the northeast. | Construction of a 160-foot breakwater, dredging of a 245-foot long entrance channel and turning basin. | Construction of a 135-foot breakwater and a new single lane launch ramp, dredging of a 135-foot long entrance channel and turning basin. | Construction of a 155-foot breakwater and a new single lane launch ramp, dredging of a 135-foot long entrance channel and turning basin. |
| B. PROJECT IMPACTS | | | | |
| 1. Economic | | | | |
| Local Government Finance* | None. | Requires approximately $637,000 local contribution not including costs for local assurances and cooperation. | Requires approximately $93,000 local contribution not including costs for local assurances and cooperation. | Requires approximately $93,000 local contribution not including costs for local assurances and cooperation. |
| Land Use | Land utilized in coastal area. Grazing on Hawaiian Homes Land inland by short-term lease. | No change to local land use policy; surrounding area is barren except for a few temporary shelters. | Same as Plan 1. | Same as Plan 1. |
| Public Facilities and Services | Existing Ramp. No shoreside facilities or major utilities. | Would provide for safe navigation and launch/recovery of boats and would promote the growth of related public facilities and services. | Same as Plan 1. | Same as Plan 1. |
| Regional Growth* | No significant impact. Stable growth will occur with or without navigation improvements. | No significant impact. Stable growth will occur with or without navigation improvements. | Same as Plan 1. | Same as Plan 1. |
| Employment* | Existing condition. | Would increase employment opportunities in commercial and general boating related services. | Same as Plan 1. | Same as Plan 1. |

| | NO IMPROVEMENT 'WITHOUT CONDITION' | PLAN 1 | PLAN 2 | PLAN 3 |
|---|---|---|---|---|
| 1. Economic (continued) | | | | |
| Damages to Boats and Related Equipment | Numerous damages during launch and recovery operations. Sixty percent use factor. | Marked decrease in damages during launch and recovery operations. | Same as Plan 1. | Same as Plan 1. |
| Increased Fish Catch for Commercial Fishermen | Current catch: 465,000 pounds per year. | 203,000 pound increase per year. | Same as Plan 1. | Same as Plan 1. |
| Commitment of Economic Resources | Not applicable. | Commitment of 9,400 tons of stone and fill, time, manpower and energy resources. | Commitment of 1,800 tons of stone and fill, time, manpower, and energy resources. | Commitment of 3,000 tons of stone and fill, time, manpower and energy resources. |
| 2. Environmental | | | | |
| Marine Environment | No change. | 1.16 acres dredged or covered. | 0.85 acres dredged or covered. | 0.91 acres dredged or covered. |
| Terrestrial Environment | No change. | 0.24 acres modified. | 0.19 acres modified. | 0.22 acres modified. |
| Fish and Wildlife | No change to existing conditions. Scattered coral growth within Kaulana Bay. | Loss of some coral and sessile organisms. Temporary displacement of motile organisms during construction. Rapid recovery anticipated. Possible long term increase in species diversity and numbers. | Same as Plan 1. | Same as Plan 1. |
| Water Quality* Temporary increase in water turbidity anticipated during construction; grossly estimated by length of construction, time and quantity of material removed. | Not applicable. | 12 months<br>11,700 Cubic Yards | 6 months<br>5,300 Cubic Yards | 6 months<br>5,200 Cubic Yards |

| | NO IMPROVEMENT 'WITHOUT CONDITION' | PLAN 1 | PLAN 2 | PLAN 3 |
|---|---|---|---|---|
| 2. Environmental (continued) | | | | |
| Water Quality* | | | | |
| Long-Term Alterations to water quality. | Not applicable. | No significant long-term effect except for impacts associated with increased boat operation. | Same as Plan 1. | Same as Plan 1. |
| Circulation & Flushing | | | | |
| Increase in Water Residence Time. | No | Slight increase anticipated. Will not result in degradation of water quality. | Same as Plan 1. | Same as Plan 1. |
| Air Quality* | | | | |
| Temporary dust nuisance estimated by length of construction period. | Not applicable. | 12 months | 6 months | 6 months |
| Natural Resources* | Natural, unaltered shoreline except for existing ramp and natural bay area. | Would commit approximately 1.16 acres of natural marine environment to navigation improvements and 9,400 tons of quarried stone for protective structure. | Would commit approximately 0.85 acres of natural marine environment to navigation improvements and 1,800 tons of quarried stone for protective structure. | Would commit approximately 0.91 acres of natural marine environment to navigation improvements and 3,000 tons of quarried stone for protective structure. |
| Man-Made Resources* | Continued derane for safe boating facility. | Completes boating facility for safe navigation. | Same as Plan 1. | Same as Plan 1. |
| 3. Social | | | | |
| Noise* | No change from existing condition. | Temporary increase during construction - 12 months; no long-term change. | Temporary increase during construction - 6 months; no long-term change. | Same as Plan 2. |
| Population* | No impact. | No significant effect on population growth and no displacement of people. | Same as Plan 1. | Same as Plan 1. |

| | NO IMPROVEMENT 'WITHOUT CONDITION' | PLAN 1 | PLAN 2 | PLAN 3 |
|---|---|---|---|---|
| 3. Social (continued) | | | | |
| Aesthetic Values* | No change. | Breakwater structure would create unusual impact. Stone breakwater not out of character with adjacent rocky coastline. | Same as Plan 1. | Same as Plan 1. |
| Historic, Cultural, and Archaeological Resources. | National Landmark District. | Probable destruction of two prehistoric features on east side of bay during construction. | Possible effect on prehistoric features on east side of bay. May be avoided by suitable construction methods. | Same as Plan 2. |
| Recreational Opportunities | No change | Increase access for sports fishing. | Same as Plan 1. | Same as Plan 1. |
| Health, Safety, and Community Well-being. | Hazardous navigation | Would enhance health, safety and community well-being by providing a protective basin for boating operations. Also decreased accidents at sea. | Same as Plan 1 | Same as Plan 1. |
| Community Growth and Cohesion* | No change | No significant change | Same as Plan 1. | Same as Plan 1. |

* Resources and values identified in Section 122 of Public Law 91-611.

An informal workshop was conducted on 9 July 1980 in the South Point area of the Big Island to obtain public input on the desires and needs of providing possible light-draft navigational improvements. Details of this workshop are provided in Appendix B of the Detailed Project Report.

After the draft report and EIS are circulated to Federal and local governmental agencies and interested citizens, a public meeting will be held to obtain the public's view on the alternative plans. Public views and concerns expressed at that meeting will be a major factor in the final selected plan. All public comments will be documented in the final report. A final public meeting, if necessary, will be held to present the final selected plan.

This draft report will be filed with the US Environmental Protection Agency and a notice of availability will be published in the Federal Register in accordance with current environmental quality policy and procedure guidelines (44 FR 127). A 45-day comment period from the date of publication in the Federal Register will be available for those who wish to review and make comments to the DEIS. In addition, no administrative action on this study will be taken for a minimum of 90 days.

b. Required Coordination

(1) Coordination was initiated with the U.S. Fish and Wildlife Service at the inception of the study in to fulfill the requirements of the Fish and Wildlife Coordination Act. A preliminary report was submitted by FWS on 29 January 1981 describing fish and wildlife resources in the project area, and was utilized as a planning aid during the study. The final FWCA report will be provided subsequent to the selection of a recommended plan, addressing potential project impacts and appropriate mitigation measures.

(2) Endangered species coordination with the FWS Endangered Species Office was completed on 20 January 1981.

(3) Coordination with the State Historic Preservation Officer (SHPO) has been initiated. A cultural reconnaissance survey was conducted and a Determination of Effect based on survey findings will be forwarded to SHPO for review and concurrence.

(4) A coastal zone consistency determination report is provided in Appendix A of the Detailed Project Report for review by the State Coastal Zone Management Office. The consistency evaluation summarizes the project's conformance with the policies of the Hawaii State Coastal Zone Management Program.

(5) The U.S. Environmental Protection Agency and the State Department of Health will have the opportunity to review and comment on the Detailed Project Report and Draft Environmental Impact Statement (DEIS) to evaluate the effects of the project on water, air and noise quality. The State Department of Health will be requested to provide a water quality certification in accordance with Section 404(r) of the Clean Water Act of 1977.

c. Statement Recipients. A list of agencies, groups and individuals who will receive copies of the combined Draft Environmental Impact Statement and Detailed Project Report for reveiw is provided in Appendix B of the report.

d. Public Views and Responses. The State of Hawaii, Department of Transportation, has requested Corps of Engineers assistance with navigation improvements at Kaulana Bay, including the construction of a breakwater and protected basin. This request was based on the expressed desires of the local Ka'u Fishermen Association to improve the usability and safety of the launch facilities used by the South Point commercial fishermen.

At a public workshop (9 July 1980) held on the Big Island the consensus of those attending (local government agencies, residents and fishermen) favored Kaulana Bay as the site for navigation improvements. After the draft report is circulated to Federal and local government agencies and interested citizens, a public meeting will be held to obtain the public's views on the alternative plans. Views and concerns expressed at that meeting will be a major factor in the final selected plan.

TABLE 4
INDEX, REFERENCES AND APPENDICES
KAULANA BAY HARBOR
KAU, HAWAII

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| Affected Environment | pp. EIS-12-13 | pp. 5-9 |
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| Areas of Controversy | pp. EIS-5 | -- |
| Comparative Impacts of Alternatives | pp. EIS-10-11 | pp. 31-37 |
| Cover Sheet | pp. EIS-1 | Not applicable |
| Environmental Conditions | pp. EIS-12-13 | pp. 5-9 |
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# KAULANA BAY

# NAVIGATION IMPROVEMENTS

# SOUTH POINT, ISLAND OF HAWAII

## PLAN FORMULATION CRITERIA

## AND

## COMPLIANCE REPORTS

APPENDIX A

# APPENDIX A

## PLAN FORMULATION CRITERIA AND COMPLIANCE REPORTS

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# I. STUDY AUTHORITY

## SMALL NAVIGATION PROJECT AUTHORITY

a. Legislative Authority.

Section 107 of the River and Harbor Act of 1960, as amended by Section 310 of the River and Harbor Act of 1965, Section 112 of the River and Harbor Act of 1970, and Section 133(a) of the Water Resources Development Act, approved 22 October 1976, states:

(a) The Secretary of the Army is authorized to allot from any appropriations hereafter made for rivers and harbors not to exceed $25,000,000 for any one fiscal year for the construction of small river and harbor improvement projects not specifically authorized by Congress which will result in substantial benefits to navigation and which can be operated consistently with appropriate and economic use of the waters of the nation for other purposes, when in the opinion of the Chief of Engineers such work is advisable, if benefits are in excess of the costs.

(b) Not more than $2,000,000 shall be allotted for the construction of a project under this section at any single locality and the amount allotted shall be sufficient to complete the Federal participation in the project under this section.

(c) Local interests shall provide without cost to the United States all necessary lands, easements, and rights-of-way for all projects to be constructed under the authority of this section. In addition, local interests may be required to hold and save the United States free from damages that may result from the construction and maintenance of the project, and may be required to provide such additional local cooperation as the Chief of Engineers deems appropriate. A state, county, municipality or other responsible local entity shall give assurance satisfactory to the Chief of Engineers that such conditions of cooperation as are required will be accomplished.

(d) Non-federal interests may be required to share in the cost of the project to the extent that the Chief of Engineers deems that such cost should not be borne by the Federal Government in view of the recreational or otherwise special or local nature of the project benefits.

(e) Each project for which money is allotted under this section shall be complete in itself and not commit the United States to any additional improvement to insure its successful operation other than routine maintenance, and except as may result from the normal procedure applying to projects authorized after submission of survey reports and projects constructed under the authority of this section shall be considered as authorized projects.

## II. ASSURANCE OF LOCAL COOPERATION

Federal participation in the proposed project is subject to the condition that local interests would:

a. Provide without cost to the United Sta*es all lands, easements, and rights-of-way required for construction of the project.

b. Provide without cost to the United States an area suitable to the Chief of Engineers for the disposal of spoils and if necessary, retaining dikes, bulkheads, and embankments or the cost of such work.

c. Provide and maintain without cost to the United States the necessary mooring facilities, as well as all appropriate onshore structures, access roadways, utilities, parking areas and restrooms to insure a complete and adequate project. These facilities must be open to all on equal terms.

d. Accomplish without cost to the United States the necessary alterations and relocations of all utilities as necessary for project purposes.

e. Hold and save the United States free from claims for damages due to the construction work and subsequent maintenance of the project, excluding damages due to fault or negligence of the United States or its contractor.

f. Provide a cash contribution based on a percentage to be determined by final benefit and cost allocation analysis of the total Corps of Engineers first cost of project before apportionment. In addition, local interest must provide all cost in excess of the $2 million statutory Federal limitation under Section 107 of the River and Harbor Act of 1960, as amended.

## III. PLANNING CRITERIA AND CONSTRAINTS

Institutional Policies. Several institutional policies of the Federal Government affect the design and decisions for local and Federal participation. Executive policies are issued through the Office of Management and Budget (OMB), the Water Resources Council (WRC) and the Council of Environmental Quality (CEQ). Legislative policies are expressed by various legislative enactments of Congress which has developed a body of laws establishing national concerns regarding the nation's natural resources.

Design/Benefit Criteria. In developing justification for Federal participation, technical and economic evaluation policies, standards, principles, and procedures are established in determining a benefit to cost comparison. All projects must have a benefit to cost comparison. Projects must usually have a benefit to cost comparison of one or greater to be eligible for Federal participation.

Regulatory/Environmental Requirements. A number of statutory and regulatory requirements of the Federal Government must be complied with during the planning process. These requirements largely relate to the assessment and evaluation of possible impacts on the environment resources of the project area.

Archaeological and Historic Preservation Act of 1974 (Public Law 93-291) as amended. This act, also known as the Reservoir Salvage Act, provides for the preservation of historical and archaeological data which might be otherwise destroyed by flooding or other alteration of the terrain and authorizes up to one percent of the total amount authorized for appropriation for the project to be spent on recovery, protection and preservation of data. This act will be utilized only for sites eligible for or listed on the National Register of Historic Places. Applicability of this act to the project will be assessed in Appendix C and the EIS.

Clean Air Act, as amended (42 USC 7401 et seq.). As it applies to Corps studies and construction projects, this act requires that all Federal projects must conform to EPA-approved or promulgated state implementation plans. Compliance with this act will be addressed in the EIS.

Estuary Protection Act (Public Law 90-454). The act requires that Federal agencies in planning for use or development of water and land resources, give consideration to estuaries and their natural resources and that if estuaries may be affected, the Secretary of the Interior shall be given an opportunity to evaluate the effects of the project on the estuary. There are no estuaries in the study area.

Federal Water Project Recreation Act (Public Law 89-72, as amended). This act requires that full consideration be given to project opportunities for outdoor recreation and fish and wildlife enhancement; that planning based on coordination for use with existing and planned Federal and local public recreation developments; that the views of governmental agencies concerned with recreation and wildlife, including the USFWS and Heritage Conservation and Recreation Service (HCRS) be included in the report.

Land Water Conservation Fund Act of 1965 (16 USC 4601-4 et seq). As it applies to Corps studies and project, this act requires that Corps recreation planning be coordinated with the State plan developed pursuant to the Act. For Guam this is the Guam Comprehensive Outdoor Recreation Plan. Moreover, the non-Federal cost for the project may not be paid out of LWCFA funds.

Rivers and Harbors Appropriation Act of 1899, as amended (33 USC 401 et seq.). This statute, which established Corps' regulatory responsibilities and generally prohibited a wide range of actions which might obstruct navigable wat rs of the United States, does not impose any requirements on projects that are affirmatively authorized by Congress.

Watershed Protection and Flood Prevention Act, as amended (16 USC 1101 et seq.). This statute, which authorized the Soil Conservation Service to construct dams and other works in upstream watersheds, imposes no requirements on Corps projects.

National Environmental Policy Act of 1969 (Public Law 91-190). The National Environmental Policy Act (NEPA) requires an environmental statement in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment.

Clean Water Act of 1977 (Public Law 95-217). This act was formerly known as the Federal Water Pollution Control Act Amendments of 1972. The requirement is to evaluate discharge effects of dredged or fill materials into waters of the United States.

Coastal Zone Management Act of 1972 (Public Law 92-583). This act requires that the project must comply with the Federal law as well as be consistent with the Coastal Management Program for the State of Hawaii.

Endangered Species Act of 1973 (Public Law 93-205). The implementing agency shall coordinate with the appropriate Federal wildlife agency to determine the presence of listed endangered or threatened species or their critical habitat may be present in the area of proposed action. The results of the assessment shall be contained in the EIS.

Fish and Wildlife Coordination Act of 1958 (Public Law 85-624). This act requires any Federal agency proposing to impound, divert, or modify the channel of any stream or other body of water to consult with the Department of Interior, US Fish and Wildlife Service (USFWS) and the head of the state or territorial agency exercising control over fish and wildlife resources, concerning the impacts of such action. The USFWS shall recommend, in a 2(b) report, methods to mitigate impacts of the proposed action and to conserve fish and wildlife resources.

Marine Protection, Research, and Sanctuaries Act of 1972 (Public Law 92-532). This act regulates the evaluation of the need and transportation of dredged material for the purpose of dumping in ocean waters. In the case of this project, there is no specific need to provide an ocean dump site for excess construction materials.

National Historic Preservation Act of 1966 (Public Law 89-635). Section 106 of this act requires that Federal agencies shall, prior to the approval of the expenditure of any funds on an undertaking, or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any property included in, or eligible for inclusion in the National Register and shall afford the Advisory Council on Historic Preservation a reasonable opportunity to comment with regard to such undertaking. The Commonwealth Historic Preservation Officer must also be given a reasonable opportunity to comment on the undertaking.

Executive Order on Flood Plain Management (EO 11988). This order requires that agencies avoid the base flood plain unless it is the only practicable alternative. For potential action in the flood plain, an evaluation of effects on flood plain values, a description of other practicable alternative actions outside the flood plain, and adequate dissemination of the action to the public must be undertaken.

Executive Order on Protection of Wetland, (EO 11990). This order requires the agency to analyze potential impacts to existing wetlands and associated values and to give the public early public review of proposed actions.

Wild and Scenic Rivers Act of 1968 (Public Law 90-542). This act requires agencies to identify potential impacts to designated wild and scenic rivers and to coordinate action and obtain concurrence with the US Department of the Interior.

## IV. PRESIDENTIAL EXECUTIVE ORDER 11988 ON FLOOD PLAIN MANAGEMENT EVALUATION REPORT

The objective of Executive Order 11988, Flood Plain Management, dated 24 May 1977, is to avoid to the maximum extent possible the long and short term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of flood plain development wherever there is a practicable alternative. The Order requires Federal agencies to:

a. Avoid the base flood plain unless it is the only practicable alternative;

b. reduce the hazard and risk of flood loss;

c. minimize the impact of floods on human safety, health, and welfare; and

d. Restore and preserve the natural and beneficial flood plain values.

Since the proposed action at Kaulana Bay is not located within or near any base flood plain, the recommended plan will be in compliance with all requirements set by Executive Order 11988.

## V. EVALUATION OF THE EFFECTS OF THE DISCHARGE OF DREDGED OR FILL MATERIAL INTO WATERS OF THE U.S. USING U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) SECTION 404 (b) GUIDELINES

1. Project Description.

| | |
|---|---|
| a. Description of the material proposed discharge. | |
| (1) General Characteristics of the Material. | Quarried basalt ranging in size from spall to 2-10 ton boulders. |
| (2) Quantity of Material to be Discharged. | Plan 1 - 9,400 tons<br>Plan 2 - 1,800 tons<br>Plan 3 - 3,000 tons |
| (3) Source of the Material. | Existing quarry at Hilo, Hawaii. |
| b. Description of the proposed discharge site. | |
| (1) Location. | Kaulana Bay. |
| (2) Type of discharge site. | Nearshore bay site. |
| (3) Method of discharge. | Material will be used to construct harbor protective structure at the discharge site. The material will be placed by cranes and bulldozers to form the breakwater. |
| (4) Date and length of time when discharge will occur. | The project will be implemented within 2 years. Plan 1 will take approximately 12 months to construct while Plans 2 and 3 will take 6 months. |
| (5) Life of the discharge site. | All harbor plans have an economic life of 50 years. |
| (6) Bathymetry (if open water discharge site is used). | Water depths range from: 0 feet MLLW to -10 feet MLLW. |

2. Physical Effects.

| | |
|---|---|
| a. Potential Destruction of Wetlands. | Site is not considered a wetland. |
| b. Other Physical Effects. | |
| (1) Area of bottom covered by discharge. | Plan 1 - 0.31 acres<br>Plan 2 - 0.15 acres<br>Plan 3 - 0.18 acres |

2. Physical Effects. (Cont)

| | |
|---|---|
| (2) Changes in bottom geometry and substrate composition. | The bottom substrate consists mainly of basalt material. The discharged material will raise the bottom elevation from approximately -5.0 feet MLLW to +8.0 to +11.5 feet MLLW. |
| (3) Water circulation and flushing. | The protective structure will reduce wave influence on water mixing and possibly increase water residence time within the protected basin. At Kaulana Bay wind and tides will continue to dominate the surface current regime. |
| (4) Salinity distribution and gradients. | No alterations are anticipated because discharge does not involve a release of high or low salinity waters or materials. |
| (5) Natural drainage characteristics, and flood and stormwater storage. | Kaulana Bay site involves no drainage basin modifications; site has no flood or stormwater storage capability. |
| (6) Groundwater levels and recharge. | The site is not known as a groundwater recharge area, and the discharge is not expected to alter groundwater levels. |

3. Chemical-Biological Interactive Effects.

a. The material proposed for discharge meets EPA exclusion criteria and no bioassay testing is required. The material to be discharged is larger than silt size, similar in composition to the substrate at the project site, and is obtained from sources removed from pollution point-sources.

b. Impacts on the Water Column.

| | |
|---|---|
| (1) Reduction in light transmission. | Temporary increase in water turbidity is anticipated as dust may be washed from the quarried basalt by wave action. |
| (2) Degradation of water aesthetic values. | Only temporary effects and in area already turbid. |

V. EVALUATION OF THE EFFECTS OF THE
DISCHARGE OF DREDGED OR FILL MATERIAL INTO
WATERS OF THE U.S. USING U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
SECTION 404 (b) GUIDELINES

3. Chemical-Biological Interactive Effects. (Cont)

| | |
|---|---|
| (3) Direct destructive effects on nektonic and planktonic populations. | Temporary disturbance and displacement during construction. Minor permanent loss of existing water column habitat. |
| (4) Are contaminants found in the material? | None anticipated. |
| (5) Concentration of contaminants released from sediment to the water column. (Results of elutriate testing). | Material exempt from chemical and bioassay testing. |
| (6) Comparison of constituent concentrations with applicable water quality standards. | Not applicable. |
| (7) Size of mixing zone. | Not applicable. |
| c. Impacts on Benthos. | |
| (1) Area of benthic community covered by material. | Plan 1 - 0.26 acres<br>Plan 2 - 0.10 acres<br>Plan 3 - 0.12 acres |
| (2) Changes in community structure and function. | Protective structure will raise bottom elevation creating terrestrial, intertidal, and rocky interstitial marine habitat. Changes in community structure and function are localized and involve replacement of habitat. |
| (3) Effects of chemical constituents on benthos. | None anticipated. |

4. Impacts of the Discharge at the Discharge Site.

| | |
|---|---|
| a. Need for the proposed action. | The discharge is needed to construct a protective structure for the development of the Kaulana navigation facility. |
| b. Availability of alternate discharge sites and alternate methods of discharge. | None. |

V. EVALUATION OF THE EFFECTS OF THE DISCHARGE OF DREDGED OR FILL MATERIAL INTO WATERS OF THE U.S. USING U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) SECTION 404 (b) GUIDELINES

4. Impacts of the Discharge at the Discharge Site. (Cont)

c. Evaluation of Impacts.

| | |
|---|---|
| (1) Chemical, physical and biological integrity of the aquatic ecosystem. | Discharge is localized in effect, and will not affect availability of biological resources. The basalt material will not alter the chemical integrity and the aquatic ecosystem. An increased water residence time is anticipated within the protected basin. Also increased habitat diversity will be created by the rocky substrate. |
| (2) Food chain and tropic level. | No effect anticipated. |
| (3) Diversity of plant and animal species. | A localized increase in habitat and species diversity is anticipated. |
| (4) Obstruction of movement into and out of feeding, spawning, breeding and nursery areas. | None anticipated. |
| (5) Wetlands having significant functions of water quality maintenance. | Not applicable. |
| (6) Natural highwater or flood water storage. | Not applicable. |
| (7) Degradation of Water Quality. | Temporary increase in water turbidity anticipated during construction. |
| d. Methods to minimize turbidity. | None. |
| e. Methods to minimize degradation of aesthetic, recreational and economic value. | Not applicable. No significant impacts anticipated. |
| f. Methods investigated to minimize possible harmful effects. | Not applicable. No impacts anticipated. |

## V. EVALUATION OF THE EFFECTS OF THE DISCHARGE OF DREDGED OR FILL MATERIAL INTO WATERS OF THE U.S. USING U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) SECTION 404 (b) GUIDELINES

g. Impacts on water uses.

| | | |
|---|---|---|
| (1) | Municipal water supply intakes. | None. |
| (2) | Shellfish | None. |
| (3) | Fisheries | None. |
| (4) | Wildlife | None. |
| (5) | Recreation Values | Improves recreational values and commercial fishing and idle time diversion. |
| (6) | Threatened and endangered species. | None. |

| | | Plan 1 | Plan 2 (In Acres) | Plan 3 |
|---|---|---|---|---|
| (7) | Benthic life. | | | |
| | benthic area covered | 0.26 | 0.10 | 0.12 |
| | intertidal, rocky interstitial habitat | 0.09 | 0.05 | 0.06 |
| (8) | Wetlands. | None affected. | | |
| (9) | Submerged vegetation. | None affected. | | |
| (10) | Size of disposal site. | 1 acre | | |

## VI. FEDERAL COASTAL ZONE MANAGEMENT (CZM) CONSISTENCY EVALUATION REPORT

1. Purpose

The Coastal Zone Management (CZM) Act of 1972 (Public Law 92-583) and the regulations on Federal consistency with approved Coastal Zone Management programs (15 CFR 930) provide that all Federal activities must be consistent to the maximum extent practicable with the Hawaii State Coastal Zone Management Program.

2. The Kaulana Bay Harbor navigation improvement project, located at South Point on the island of Hawaii, will involve construction within the CZM area. The three alternative plans involve construction of a main breakwater and the widening and deepening of an entrance channel and turning basin. (See page 24 for detailed description of plans.) The improvements were requested by the State of Hawaii. The following consistency determination summarizes the projects conformance with policies of the Hawaii State Coastal Zone Management Program.

3. The alternative plans meet the objectives and policies of the CZM program as follows:

SECTION 205A-(b)(1), RECREATIONAL RESOURCES

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

a. Improve coordination and funding of coastal recreation planning and management.

The project document and subsequent authorization have resulted in the coordination and funding of harbor planning.

b. Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

(1) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas.

(2) Requiring replacement of coastal resources having significant recreational value, including but not limited to, surfing sites and sandy 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.

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

(4) Encouraging expanded public recreational use of County, State, and Federally owned or controlled shoreline lands and waters having recreational value.

(5) 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.

(6) Developing new shoreline recreational opportunities, where appropriate, such as artificial reefs for surfing and fishing.

(7) 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, county planning commissions; and crediting such dedication against the requirements of Section 46-6.

Development of a protected basin and safe entrance channel will provide for adequate and accessible recreational boating opportunity in the Ka'u District.

SECTION 205A-2(b)(2), HISTORIC RESOURCES

Objective: Protect, preserve, and where desirable, restore those natural and man-made historic and prehistoric resources in the CZM area that are significant in Hawaiian and American history and culture.

Policies:

a. Identify and analyze significant archaeological resources.

Archaeological resources were identified during project planning. Construction specifications will detail procedures for dealing with these archaeological resources and any others discovered during project construction.

b. Maximize information retention through preservation of remains and artifacts or salvage operations.

Construction specifications will detail methods of maximizing preservation of any remains or artifacts identified during project planning or discovered during construction activities.

c. Support State goals for protection, restoration, interpretation, and display of historic resources.

State goals regarding historic resources will be supported via active coordination throughout the planning and construction phases of the project with the State Historic Preservation Officer.

SECTION 205A-2(b)(3), SCENIC AND OPEN SPACE RESOURCES

Objective: 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 CZM area.

No scenic resources will be affected by navigation improvements.

b. Control development in areas subject to storm wave, tsunami, flood, erosion, and subsidence hazard.

This navigation improvement project may encourage related development, however, such development is subject to coastal zone requirements. The improved boating facility will offer storm wave protection for areas within the basin.

c. Ensure that developments comply with requirements of the Federal Flood Insurance Program.

Not applicable to the project.

d. Prevent coastal flooding from inland projects.

Not applicable to the project.

SECTION 205A-2(b)(7), MANAGING DEVELOPMENT

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

Policies:

a. Effectively utilize and implement existing law to the maximum extent possible in managing present and future coastal zone development.

The project planning process utilizes and implements existing Federal, State, and County laws and ordinances as well as existing Federal and US Army Corps of Engineers regulations.

b. Facilitate timely processing of application for development permits and resolve conflicting permit requirements.

The implementation of project planning facilitates timely processing of permit applications to the maximum extent practicable.

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

The project report thoroughly discusses all aspects of short- and long-term impacts relative to the project. Significant impacts will be discussed at a public meeting held prior to commencement of actual project construction.

Construction specifications and State and local laws will promote planning and management practices which reflect the tolerances of marine ecosystems and prohibit uses which violate State water quality standards. A water quality certification will be obtained from the State Department of Health prior to the start of construction.

SECTION 205A-2(b)(5), ECONOMIC USES

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

Policies:

a. Concentrate in appropriate areas the location of coastal dependent development necessary to the State's economy.

The project modifies an existing State-owned facility. The project will enhance commercial fishing opportunities which aids the State's economy.

b. Insure that coastal dependent development such as harbors and ports, visitor industry facilities, and energy generating facilities are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the CZM area.

The project will add to an existing facility and thus will minimize the social, visual, and environmental impacts in the coastal zone. Only a small portion of shoreline area will be affected by the navigational improvements.

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

(1) Utilization of presently designated locations is not feasible.

(2) Adverse environmental effects are minimized.

(3) Important to the State's economy.

The project is confined to an area already committed to boating activities.

SECTION 205A-2(b)(6), COASTAL HAZARDS

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

Policies:

a. Develop and communicate adequate information on storm wave, tsunami, flood, erosion, and subsidence hazard.

The project report develops and communicates detailed information on storm waves and on the risk of coastal flooding due to tsunami.

b. Insure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural land forms and existing public views to and along the shoreline.

The project modifies an existing facility and therefore is compatible with the existing visual environment. Minimal alterations to natural land forms along the shoreline will occur during project construction.

c. Preserve, maintain and, where desirable, improve and restore shoreline open space and scenic resources.

The project has only minimal effects on shoreline open space and does not affect any scenic resources.

d. Encourage those developments which are not coastal dependent to locate in inland areas.

The navigation improvement project is coastal dependent.

SECTION 205A-2(b)(4), COASTAL ECOSYSTEMS

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

Policies:

a. Improve the technical basis for natural resource management.

Geo-technical investigations conducted during project planning will improve technical knowledge of the offshore area in the vicinity of the harbor and will aid in the management of that resource.

b. Preserve valuable coastal ecosystems of significant biological or economic importance.

Although project construction may temporarily disturb the nearby ecosystems, those ecosystems will be enhanced after project completion due to the additional marine habitat created by the project.

c. 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.

Coastal waters will be temporarily degraded during dredging activities, but this degradation will be minimized by the enforcement of specified standards during construction.

d. Promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate State water quality standards.

# KAULANA BAY

# NAVIGATION IMPROVEMENTS

# SOUTH POINT, ISLAND OF HAWAII

## PUBLIC INVOLVEMENT PROGRAM

APPENDIX B

APPENDIX B

PUBLIC INVOLVEMENT PROGRAM

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# I. PUBLIC INVOLVEMENT PROGRAM

## OBJECTIVES

To insure that the desires and needs of the public were identified and considered, a public involvement program was developed. The public, as broadly interpreted by the US Army Corps of Engineers, is any affected or interested non-Corps of Engineers entity; other Federal and state government entities and officials; public and private organizations, and individuals. The public participation program is directed to maintaining information flow, achieving a mutual understanding and acceptance of the problems and opportunities, and attainment of interest level for proper decision making.

The objectives of the public participation program are:

a. To inform citizens of the current Corps of Engineers planning process and direction.

b. To surface key planning issues and concerns so that they are given full consideration.

c. To help formulate and review potential plans and improvement.

d. To offer technical, historical, and localized information pertinent to the study.

e. To provide a communicative forum between the Corps, local agencies, advocacy groups, and interested citizens on the subject plan and problems.

## TECHNIQUES

The type of public participation forum in this study was a public workshop held on 9 July 1980. A public meeting is scheduled for July14,1981.

a. Workshops: These meetings are informal exchange sessions open to the general public and usually numbering from 10 to 50 persons. The purpose is to promote the full airing of various views in recognition of current Corps' planning efforts. Public information notices and fact sheets are issued to all interested parties prior to the meeting.

b. Public Meeting: A formal public meeting will be held at a key point in the study effort. The purpose is to notify all interested parties of the planning effort to date and to obtain specific views on various items of the agenda. The meeting, presided by the District Engineer, will include a summary of findings to date, an informal question and answer period, a presentation of formal statements by others, and tentative conclusions. A public notice of the meeting is issued to the media and the general public invited. All information and statements are documented as part of the planning record.

## ACTIVITIES CONDUCTED

Government officials and agencies were notified by letter in June 1980 of the initiation of detailed studies for possible light-draft navigational improvements. A notice of intent to prepare a Draft Environmental Impact Statement (DEIS) for the Kaulana Bay Harbor was published in the Federal Register to notify those interested in contributing to the preparation of the DEIS.

An informal workshop was conducted on 9 July 1980 in the South Point area of the Big Island to obtain public input on the desires and needs of providing possible light-draft navigational improvements. Details of this workshop is provided in Section II of this appendix.

## FUTURE ACTIVITIES

After this draft report is circulated to Federal and local governmental agencies and interested citizens, a public meeting will be held to obtain the public's view on the alternative plans. Public views and concerns expressed at that meeting will be a major factor in the final selected plan. All public comments will be documented in the final report. A final public meeting, if necessary, will be held to present the final selected plan.

This draft report will be filed with the US Environmental Protection Agency and a notice of availability will be published in the Federal Register in accordance with current environmental quality policy and procedure guidelines (44 FR 127). A 45-day comment period from the date of publication in the Federal Register will be available for those who wish to review and make comments to the DEIS. In addition, no administrative action on this study will be taken for a minimum of 90 days.

# II. PUBLIC WORKSHOP

An information workshop was held on 9 July 1980 at the Naalehu Youth Center, Island of Hawaii. Public notices were sent to the local residents of the Ka'u area as well as to Federal and local governmental agencies.

## ATTENDANCE AT THE PUBLIC WORKSHOP, 9 JULY 1980

### Federal, Corps of Engineers

Mr. Scott Sullivan
Mr. John Ford
Ms. Lynn Martin

### State of Hawaii

| | |
|---|---|
| Mr. Dan Tanaka | -- Department of Transportation (Planning Department, Harbors Division) |
| Mr. Dennis Ruthrauff | -- Department of Transportation (Harbors Division) |
| Mrs. Kats Yamada | -- State representative |

County of Hawaii

Ms. Violet Hansen -- Research and Conservation Development
Mr. George Yokoyama -- Director, Hawaii County Economic Opportunity Council (HCEOC)
Ms. Lily Kong -- HCEOC (Kona)
Ms. Mary Evangelista -- HCEOC (Ka'u-Puna)

Ka'u Kamaaina Fishing Association

Mr. Robert Makuakane -- President
Mr. John Makuakane
Mr. Scott Makuakane
Mr. Steve Oyama
Mr. Kenneth Enitan
Mr. Ralph Louis
Mr. Robert Beck
Mr. Eddie Kuahiwinui, Jr.
Mr. Danny Cambia
Mr. S. Cambia
Mr. Zachary Cambia
Mr. Arnold Howard

Individuals

Mr. Edward Medeiros
Mr. John Hansen
Ms. Julia K. Kaupor
Mr. Dean Palua
Ms. Lanna Cariage
Ms. Jeannette Howard

SUMMARY

The Corps of Engineers reviewed and briefed the participants on the status of the study, Corps planning policy, and study concerns. The floor was then opened to discuss specific topics geared to providing facts and information necessary for project planning. Among the items gathered from workshop participants included:

a. Boat type and value.

b. Number of fishermen (Ka'u area).

c. Average catch of fish.

d. Damages incurred during launch and recovery operations.

e. Average operating cost.

There was also considerable discussion on the pros and cons of alternative sites. County officials and those present at the workshop favored Kaulana Bay as a good site for navigation improvements, however, an arrangement would have to be made with Hawaiian Homes Land for access and shoreside space.

Certain problems were identified. Among those voiced were:

a. Launch basins are too shallow and sand has shoaled in existing launch areas.

b. Lack of a safe and protected boating facility.

c. Offshore protective structures could solve these problems.

## III. PUBLIC MEETING

A public meeting is scheduled for 14 July 1981 on the Big Island. A public notice will be mailed to the general public, governmental agencies, the media, and interested parties to inform them of this meeting. Copies of the Draft DPR Report will be made available to governmental agencies (Federal and local) and the residents of Ka'u, Hawaii, prior to the scheduled public meeting. A transcript of the public meeting will be made as part of the documentation process and will be included in the Final DPR Report.

## IV. PERTINENT CORRESPONDENCE

1. List of Letters:

| Date | Subject | Initiating Agency | Page No. |
|---|---|---|---|
| 10 Jun 80 | Initiation of DPR | US Army Corps of Engineers | B-5 |
| 16 Jun 80 | Acknowledgment of Initiation of DPR | US Senator, Daniel K. Inouye | B-5 |
| 19 Jun 80 | Historic Preservation | National Park Service | B-6 |
| 20 Jun 80 | Public Workshop Notice | US Army Corps of Engineers | B-6 |
| 13 Jan 81 | Endangered Species | US Army Corps of Engineers | B-7 |
| 20 Jan 81 | Endangered Species | Fish and Wildlife Service | B-7 |

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858

PODED-PJ

1 0 JUN 1980

Dear Sir:

The US Army Engineer District, Honolulu, has initiated a study for possible navigation improvements in the area of South Point on the island of Hawaii. The study is in response to a request from the State of Hawaii, Department of Transportation.

The study will determine the feasibility of navigation improvements and the extent, if any, to which the Federal Government should participate. The first step will focus on the problems and needs of boaters and fishermen, areas of particular concern, and possible alternatives. As the study progresses, a full range of alternative solutions will be developed and evaluated and the final result of the study will be a report on the possible improvements including an environmental statement assessing the impacts of the proposed solution.

To aid us in this study we will maintain close coordination between all interested federal, state, and county agencies as well as the general public. We will continue to keep you informed of the study progress and welcome your comments or suggestions on any aspect of the project.

Sincerely,

B. R. Schlapak

B. R. SCHLAPAK
Colodel, Corps of Engineers
District Engineer

R-5

DANIEL K. INOUYE
HAWAII

United States Senate
ROOM 141, RUSSELL SENATE BUILDING
WASHINGTON, D.C. 20510
(202) 224-3934

Pacific Basin Federal Building
Room 6104, 300 Ala Moana Boulevard
Honolulu, Hawaii 96850
(808) 546-7550

June 16, 1980

Colonel B. R. Schlapak
District Engineer
Corps of Engineers
Department of the Army
Building 230
Ft. Shafter, Hawaii 96858

Dear Colonel Schlapak:

I wish to acknowledge receipt of your recent communication advising me that the U.S. Army Corps of Engineers has initiated a study for possible navigational improvements in the area of South Point on the Island of Hawaii, pursuant to a request from the State Department of Transportation.

Your thoughtfulness in sharing the abovementioned information with me is most appreciated. Please continue to keep me apprised of the progress of this study.

Aloha,

DANIEL K. INOUYE
United States Senator

DKI:jmpl

United States Department of the Interior

NATIONAL PARK SERVICE

HAWAII STATE OFFICE
300 ALA MOANA BLVD., SUITE 6305
BOX 50165
HONOLULU, HAWAII 96850

IN REPLY REFER TO:

H32
XIL6

June 19, 1980

Colonel B. R. Schlanak
District Engineer, Corps of Engineers
U. S. Army Engineer District
Building 230
Fort Shafter, Hawaii 96858

Dear Colonel Schlanak:

In reply to your letter of June 10, 1980 concerning the study for possible navigation improvements at South Point, Hawaii Island, this is to remind the planners that South Point is a National Historic Landmark, a property listed in the National Register of Historic Places. The procedures of the Advisory Council on Historic Preservation apply.

B-6

Sincerely yours,

Thomas S. Ogi
Acting State Director

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT SHAFTER, HAWAII 96858

PODED-PJ

20 June 1980

Dear Boater:

The US Army Corps of Engineers has initiated studies for possible harbor improvements in the area of South Point on the Island of Hawaii. An informal public workshop meeting to assist in gathering information concerning problems, needs, and community desires will be held on:

WEDNESDAY, JULY 9

AT 6:00 P.M.

IN THE NAALEHU YOUTH CENTER

Information of particular importance to the study includes problems and damages associated with launch and recovery of trailered boats at the existing Kaulana Bay ramp; the increased fishing that would occur if the ramp was improved; considerations such as historic sites or special environmental conditions; and possible alternative small harbor sites that should be considered. Inclosed is a short questionnaire which I would appreciate your filling out and mailing back. Simply fold it so that the Corps of Engineers' address shows and drop it in the mail. Better yet, bring it to the workshop meeting with you. Some of you may have already received the questionnaire as it was recently used to obtain information on state-wide boating needs. If so, I would appreciate your completing it again so that boating problems and needs specifically in the South Point area may be determined. Thank you very much for your cooperation.

Sincerely,

B. R. SCHLAPAK
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

PODED-PV

13 January 1981

Mr. Dale Cogreshall
Pacific Islands Administrator
US Fish and Wildlife Service
US Department of the Interior
300 Ala Moana Boulevard, PO Box 50167
Honolulu, HI 96850

Dear Mr. Cogreshall:

Pursuant to the 1978 Amendments of the Endangered Species Act of 1973, we are requesting information on any listed or proposed endangered or threatened species that may be present in the Kaulana Small Boat Harbor project area, Ka'u, Hawaii (Incl 1). The US Army Corps of Engineers initiated general fish and wildlife coordination with the US Fish and Wildlife Service, Division of Ecological Services in Honolulu in January 1980.

R-7

We will appreciate any additional information provided by the Office of Endangered Species. If you have any questions, please contact Mr. Robert Moncrief, Environmental Resources Section, at (808) 438-2264.

Sincerely,

1 Incl
As stated

KISUK CHEUNG
Chief, Engineering Division

CF:
Mr. R. Kahler Martinson, Regional Director
Fish and Wildlife Service
US Department of the Interior
Lloyd 500 Building, Suite 1692
500 N.E. Multnomah Street
Portland, OR 96232

JAN

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P. O. BOX 50167
HONOLULU, HAWAII 96850

IN REPLY REFER TO:
1-2-81-SP-208

JAN 2 1981

Mr. Kisuk Cheung
Chief, Engineering Division
U.S. Army Engineering District, Honolulu
Ft. Shafter, Hawaii 96858

Dear Mr. Cheung:

This is in reply to your letter of January 13, 1981, requesting a list of listed and proposed endangered and threatened species that may occur within the area of your proposed Kaulana Small Boat Harbor project. Your request and this response are made pursuant to Section 7(c) of the Endangered Species Act of 1973 as amended (PL 95-632).

We have reviewed the most recent information and, to the best of our knowledge, the endangered Hawaiian hoary bat (Lasiurus cinereus semotus) is the only listed species which may occur in the project area; no proposed species occur at the site. However, two plants in the vicinity of the project are candidates for listing: Portulaca hawaiiensis and Sesbania hawaiiensis. It is not known if these plants are found within the boundaries of the proposed project, but they have been noted in the general Ka'u area. As candidates, these species are presently being reviewed by this Service for consideration to propose and list as endangered or threatened. It should be noted that the candidate species have no protection under the Endangered Species Act and are included for your consideration as it is possible the candidates could become formal proposals and be listed during your construction period.

We appreciate your concern for endangered species and look forward to continued coordination. If you have further question, please contact Lucian Kramer, Environmental Services, at 546-7530.

Sincerely yours,

ACTING Pacific Islands Administrator

CONSERVE AMERICA'S ENERGY

*Save Energy and You Serve America!*

## V. MAILING LIST

### STATE OF HAWAII

Honorable George R. Ariyoshi
Governor of Hawaii
Honolulu, HI 96813

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Washington, DC 20510

Honorable Spark Matsunaga
United States Senator
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Honorable Daniel K. Inouye
United States Senate
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Honorable Cec Heftel
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322 Cannon House Office Bldg
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Honorable Cec Heftel
Representative in Congress
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Honorable Daniel K. Akaka
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869 Punchbowl St
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Chief, Harbors Division
State Department of Transportation
79 S Nimitz Highway
Honolulu, HI 96813

Chief
Water Transportation Facilities Div
State Department of Transportation
79 S Nimitz Highway
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Mr. Dan Tanaka
Planning Department
State Department of Transportation
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State Dept of Land & Natural Resources
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State Historic Preservation Officer
Department of Land & Natural Resources
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Administrator, State Parks Outdoor
Recreation & Historic Sites Div
Department of Land & Natural Resources
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Chairman
Land Use Commission
Pacific Trade Center, Suite 1795
Honolulu, HI 96813

## STATE OF HAWAII (Contd)

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State Planning Office
Dept of Land & Natural Resources
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State Dept of Land & Nat Resources
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Chairman
Board of Agriculture
1428 S King Street
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State of Hawaii
P. O. Box 2359
Honolulu, HI 96813

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550 Halekauwila Street
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P. O. Box 2359
Honolulu, HI 96804

Director
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University of Hawaii
10 Maile Way
Honolulu, HI 96822

Director
Department of Hawaiian Home Lands
550 Halekauwila Street
Honolulu, HI 96813

Hawaii State Library
ATTN: Documents Center
478 S King St
Honolulu, HI 96813

University of Hawaii Library
Serial Records
2550 The Mall
Honolulu, HI 96822

Director
Department of Health
State of Hawaii
1250 Punchbowl St.
Honolulu, HI 96813

## FEDERAL

HQDA (DAEN-CWP-W)
WASH DC 20314

Department of Agriculture
Office of the Secretary
Coordinator, Environmental
Quality Activities
Washington, DC 20250

Staff Director
Council on Environmental Quality
722 Jackson Place, NW
Washington, DC 20006

Assistant Secretary, Program Policy
Ofc of Environmental Proj Review
U.S. Department of the Interior
Washington, DC 20240

Deputy Assistant Secretary
for Environmental Affairs
U.S. Department of Commerce
Washington, DC 20230

Secretarial Representative, Rgn IX
U.S. Department of Commerce
Federal Bldg, Box 36135
450 Golden Gate Ave
San Francisco, CA 94102

Regional Director, SW Region
National Marine Fisheries Svc, NOAA
300 S Ferry Street
Terminal Island, CA 97031

Office of Federal Activities, A-104
Environmental Protection Agency
ATTN: EIS Filing Section
Room 537 West Tower, Waterside Mall
401 M Street, SW
Washington DC 20460

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Manager, Pacific Islands Office
US Environmental Protection Agency
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Advisory Council on Historic Preservation
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Lakewood, CO 80228

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State Conservationist
Soil Conservation Service
U.S. Department of Agriculture
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National Marine Fisheries Svc
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National Weather Svc, Pacific Region
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Commander
Naval Air Station
FPO San Francisco 96630

Commander
Fourteenth Coast Guard District
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Honolulu, HI 96850

Commander
Fourteenth Coast Guard District
ATTN: Aids to Navigation
300 Ala Moana Blvd, 9th Floor
Honolulu, HI 96850

## ISLAND OF HAWAII(COUNTY & STATE AGENCIES)

Honorable Herbert T. Matayoshi
Mayor of the County of Hawaii
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District Administrator
Division of Water & Land Development
DLNR, State of Hawaii
75 Aupuni Street
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Director
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Chairman
Planning Commission
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Hilo, HI 96720

Director
Department of Planning
County of Hawaii
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Chairman
Hawaii County Council
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Hawaii District Land Agent
Land Management Division
DLNR, State of Hawaii
Hilo, HI 96720

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Division of State Parks
DLNR, State of Hawaii
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Hilo, HI 96720

## OTHER

Mr. Robert Makuakane, President
Ka'u Kamaaina Fishing Association
Pahala, HI 96777

Ms. Anna Cariaga
Pahala, HI 96777

Mr. Dennis O'Shea
Box 5263
Kona, HI 96740

Ms. Violet Hansen, Chairwoman
RC&D Recreation & Historic Sites Committee
P. O. Box 915
Hilo, HI 96720

# KAULANA BAY

# NAVIGATION IMPROVEMENTS

# SOUTH POINT, ISLAND OF HAWAII

## ENGINEERING INVESTIGATIONS

## AND

## DESIGN ANALYSIS

APPENDIX C

# APPENDIX C

## ENGINEERING INVESTIGATIONS AND DESIGN ANALYSIS

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APPENDIX C

SECTION I. DESIGN ANALYSIS SECTION

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LIST OF TABLES



LIST OF FIGURES

# I. DESIGN ANALYSIS

## 1. GENERAL

A navigation project design analysis requires the determination of the following elements:

a. DESIGN VESSEL.

(1) Dimensions.

(2) Maneuverability.

(3) Channel frequency of use.

b. WEATHER AND HYDRAULIC CONDITIONS.

(1) Wind.

(2) Waves.

(3) Tides.

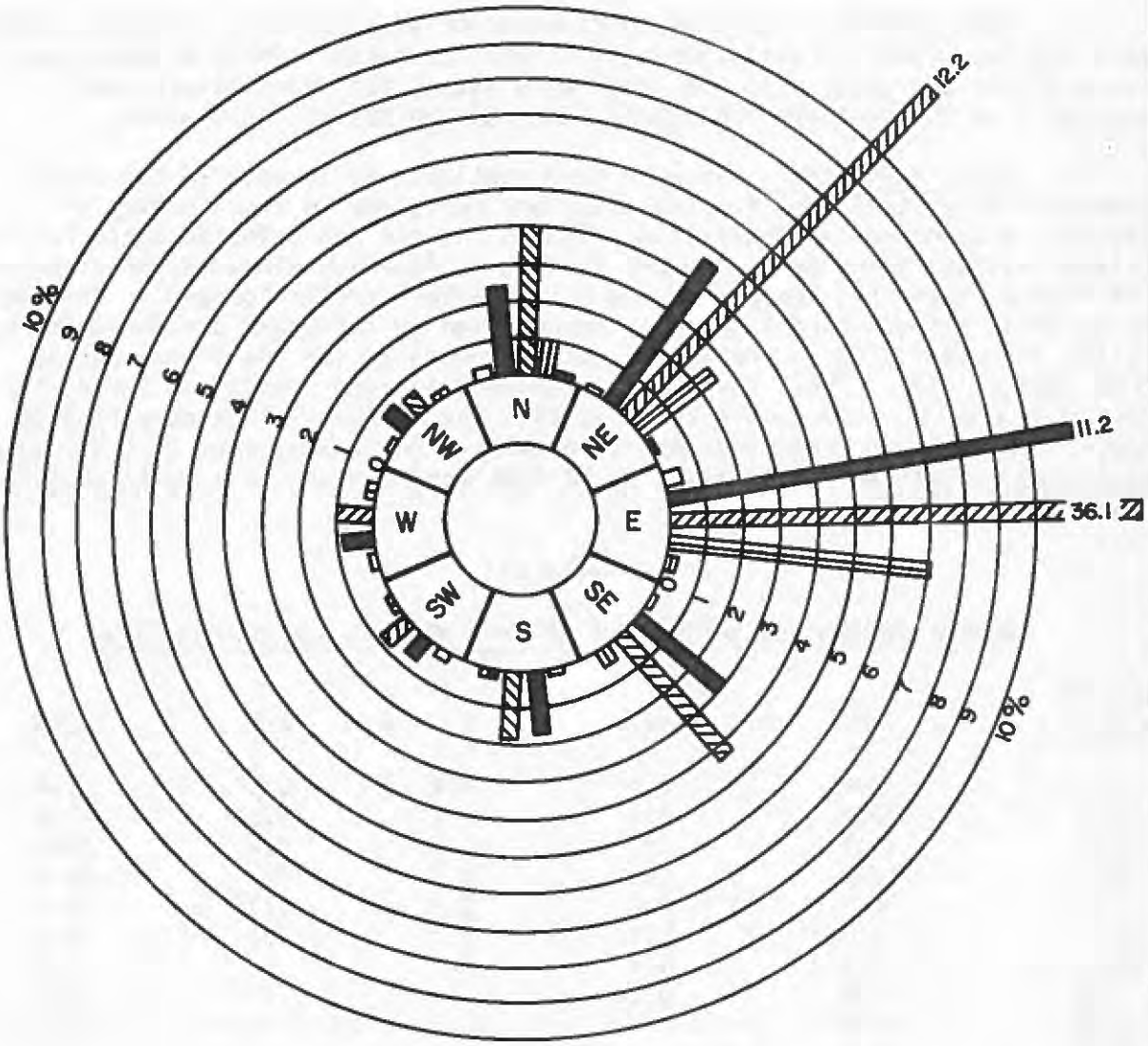
## 2. SITE LOCATION

Kaulana Bay is located on the southern coast of the island of Hawaii, roughly 80 road miles southwest of Hilo Harbor at about 18° 55' north latitude and 155° 40' west longitude.

## 3. WIND CONDITIONS

a. PREDOMINANT WIND. No wind data are available for the immediate vicinity of Kaulana Bay. For this design analysis, it is assumed extrapolated statistical data on offshore winds contained in the U.S. Naval Weather Surface Command publication, "Summary of Synoptic Meteorological Observation," June 1971, is applicable to the site. The wind information is for the position 20.9° north latitude and 156.0° west longitude. Local variations due to land mass effects and temperature variations are expected. An offshore wind diagram shown on Figure C-1 indicates wind direction, speed, and frequency.

b. TROPICAL STORMS AND HURRICANES. Although extremely rare in the Hawaiian Islands, intense tropical storms and hurricanes have and do, from time-to-time, directly affect the islands. Tropical storms are defined as having sustained wind speeds between 34 and 63 knots, while hurricanes are defined as storms with sustained wind speeds equal to or greater than 64 knots. Based on information from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Weather Service, from 1950 to 1980, at least 14 tropical storms or hurricanes have intruded within 500 miles of the State. So far, most of the threatening storms have weakened before reaching the islands and their effects have been minor in most cases. Hurricane effects in Hawaiian waters generally occur during the summer months.




TOTAL % OF THE YEAR

10 %

PERIOD OF RECORD

1963 TO 1970

STATION LOCATION

209 NORTH LATITUDE
156 WEST LONGITUDE

SOURCE

U.S. NAVAL WEATHER SERVICE COMMAND

LEGEND:

- 1 - 3 KTS
- 4 - 10 KTS
- 11 - 21 KTS
- 22 - 33 KTS
- 34 - 37 KTS

KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII

# OFFSHORE WIND DIAGRAM

US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE C-1

4. WAVE CONDITIONS

a. WAVE CLIMATE. Kaulana Bay faces south and generally is subject to a wave spectrum from the east clockwise to the southwest. Three primary wave types affect the area: (1) the local wind waves, (2) the southern swell generated in the Southern Hemisphere, and (3) the "kona" storm waves.

(1) LOCAL WIND WAVES. No wave gage stations are located in the area. Deepwater wave statistics for the study are contained in the "Summary of Synoptic Meteorological Observations (SSMO), Hawaii and Selected North Pacific Island Coastal Marine Areas, Volume I, Area 1, Hawaiian Windward, prepared by the National Climatic Center for the U.S. Weather Service Command." This data is obtained through direct synoptic observation by shipboard personnel in the Island of Hawaii area and represent data recorded during the 8-year period from 1963 to 1970. These statistics represent average conditions during the period of record. The data also shows that the majority of waves affecting Hawaii are easterly tradewind-generated waves. The tables show that deepwater wind wave heights are generally 2 to 10 feet with periods of 6 to 12 seconds (Table C-1 and C-2).

TABLE C-1

ANNUAL PERCENT OF OCCURRENCE OF WAVE HEIGHTS VERSUS DIRECTION

| Wave Ht (Feet) | E | SE | S | SW | TOTAL |
|---|---|---|---|---|---|
| 1 | 1.4 | 0.4 | 0.4 | 0.2 | 2.4 |
| 1-2 | 10.0 | 2.1 | 1.2 | 0.5 | 13.8 |
| 3-4 | 19.1 | 3.2 | 1.3 | 0.4 | 24.0 |
| 5-6 | 13.9 | 1.5 | 0.7 | 0.3 | 16.4 |
| 7 | 6.2 | 0.6 | 0.1 | 0.1 | 7.0 |
| 8-9 | 3.0 | 0.1 | 0.1 | 0.1 | 3.3 |
| 10-11 | 0.9 | 0.1 | - | - | 1.0 |
| 12 | 0.4 | 0.1 | - | - | 0.5 |
| 13-16 | 0.2 | - | - | - | 0.2 |
| 17-19 | 0.1 | - | - | - | 0.1 |
| TOTAL | 55.2 | 8.1 | 3.8 | 1.6 | 68.7 |

TABLE C-2

PERCENT FREQUENCY OF WAVE HEIGHT VERSUS WAVE PERIOD

| Period (Sec) | Wave Height (Feet) 1 | 1-2 | 3-4 | 5-6 | 7 | 8-9 | 10-11 | 12 | 13-16 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 1.0 | 8.7 | 17.9 | 9.4 | 3.3 | 1.3 | 0.3 | 0.1 | 0.1 | 42.1 |
| 6-7 | - | 1.3 | 6.9 | 10.8 | 6.0 | 2.6 | 1.1 | 0.6 | 0.2 | 29.5 |
| 8-9 | - | 0.3 | 1.6 | 3.8 | 4.5 | 2.3 | 1.1 | 0.5 | 0.4 | 14.5 |
| 10-11 | 0.0 | 0.1 | 0.4 | 0.9 | 1.5 | 1.1 | 0.7 | 0.4 | 0.4 | 5.5 |
| 12-13 | 0.0 | - | 0.1 | 0.3 | 0.4 | 0.4 | 0.3 | 0.2 | 0.1 | 1.8 |
| 13 | 0.0 | - | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.6 |
| Indet | 2.5 | 0.8 | 0.8 | 0.7 | 0.3 | 0.2 | 0.1 | - | - | 5.4 |
| TOTAL PERCENT | 3.5 | 11.3 | 27.6 | 26.0 | 16.2 | 8.1 | 3.6 | 1.8 | 1.3 | 99.4 |

(2) SOUTHERN SWELL. Southern swell is generated during the Antarctic winter months by strong winds blowing over long fetches of the southern Pacific and Indian Oceans. After traveling over thousands of miles of open ocean, these waves arrive at the southern shores of the Hawaiian Islands as long period swell. Periods typically range between 14 and 22 seconds with heights generally 1 to 4 feet. In an average year, southern swell arrives at Kaulana Bay about 10 percent of the time; usually during the summer months from April to October.

(3) "KONA" STORM WAVES. "Kona" storm waves are generated by local storms and fronts which generally cause winds and waves from the south through the west. These storms are neither frequent nor consistent, however, they may generate large destructive waves which can directly affect Kaulana Bay. Commonly, periods range from 8 to 10 seconds, with heights of 10 to 15 feet. In any year, Kona storms may occur several times or not at all. They occur most often during the winter months.

(4) TROPICAL STORM WAVES. In addition to the primary wave types discussed above, there are others which are less frequent, but which are significant. One of these is the large swell generated by tropical storms in the equatorial regions and southern hemisphere. Wave heights may be 8 to 15 feet with periods of 10 to 15 seconds. These waves generally approach the Hawaiian Islands from the southeast through the southwest and are most likely to occur in August and September.

(5) HURRICANES. Another infrequent source of large destructive waves are hurricanes. The most recent hurricanes passed through the Hawaiian chain in August 1959, December 1975, and again in July 1978. Theoretical calculations indicate that a significant deepwater wave height of 27 feet can be expected for a typical 50-year hurricane having the following parameters: (a) central pressure reduction of 1 inch of mercury, (b) radius of maximum winds of 20 nautical miles, (c) forward speed of 12 knots.

b. REFRACTION ANALYSIS. Wave refraction studies were conducted to aid in locating zones of high-energy concentration in the vicinity of the mouth of the bay, and to determine the probable approach alignment of the primary wave types affecting the site. Wave refraction diagrams were drawn for deepwater waves approaching each site. These directions were selected after evaluating the storm exposure regime. The deepwater wave height from the SSMO data for the directions affecting the site was analytically transformed considering refraction and shoaling to shallow wave heights at the harbor entrance. Based on Table C-2, Percent Frequency of Wave Height Versus Wave Period, 8- and 10-second waves were considered for refraction purposes as being representative of the local wind-wave period. Wave period of 15 seconds were considered characteristic of deepwater swells contributed by tropical storms and hurricanes. Refraction analyses were evaluated for waves from the east clockwise to the southwest. These waves were refracted to enter the bay as shown in Figure C-2.

5. TSUNAMI AND EARTHQUAKES

During the past 31 years, eight tsunami have affected the Island of Hawaii. Four of the eight caused major damage throughout the State. These occurred on 1 April 1946, 4 November 1952, 9 March 1957, and 23 May 1960. The most recent tsunami, which occurred on 29 November 1975, was unique because it was generated locally by a large-scale land subsidence which occurred during an earthquake centered off the southeast coast of the island of Hawaii. The earthquake was the largest in over a century--magnitude 7.2 on the Richter Scale. The tsunami caused runups of about 25 feet along certain areas of the southeastern coast of Hawaii. Ground subsidence, which occurred simultaneously with the earthquake, fell 10 feet in some areas.

6. WATER LEVEL

a. TIDES. The nearest tidal benchmark to Kaulana Bay is at Honuapo, approximately 15 miles northeast from Kaulana Bay. The tidal data shown were obtained from the U.S. Coast and Geodetic Survey and are referenced to mean lower low water (MLLW). All elevations in this appendix is in feet and referenced to MLLW datum.

| | Feet |
|---|---|
| Highest tide (observed) | *4.0 |
| Mean higher high water | 2.50 |
| Mean high water | 2.00 |
| Half tide level | 1.15 |
| Mean low water | 0.30 |
| Mean lower low water | 0.00 |
| Lowest tide (observed) | *-1.50 |

*Estimated.

b. ASTRONOMICAL TIDE.

The astronomical tide is estimated to be equivalent to the Mean Higher High Water or 2.5 feet.

c. ATMOSPHERIC PRESSURE DROP.

The water level rise due to atmospheric pressure is calculated by:

$$S_p = 1.14\ (P_n - P_o)\ (1 - e^{-R/r})$$

Assuming parameters of hurricane Fico, 1978:

$P_n$ = 29.92 inches

$P_o$ = 28.20 inches

R = 25 nautical miles

r = 100 nautical miles

$S_p$ = 0.4 feet

d. STORM SURGE.

The water level rise due to storm surge is calculated by:

Storm surge = $S_i$, where $S_i$ is the incremental rise in water level due to wind stress perpendicular to the bottom contour.

$$S_i = \frac{540K\ U_R^2\ \Delta X}{\overline{d}}$$

$K = 3.0 \times 10^{-6}$

$U_R$ = 94 knots

$\Delta X$ = incremental distance in nautical miles

$\overline{d}$ = mean depth over increment (FT)

Storm surge in the study area is estimated to be 0.5 feet for the July 1978 hurricane Fico.

e. WAVE SETUP.

The water level rise due to wave setup ($S_w$) is estimated using Figure 3-45, Shore Protection Manual.

$S_w$ = 1.4 feet

f. DESIGN STILLWATER LEVEL.

The design stillwater level (SWL) during hurricane conditions consists of (1) astronomical tide, (2) the rise due to atmospheric pressure drop, (3) the rise due to storm surge, and (4) the rise due to wave setup.

| | | |
|---|---|---|
| (1) | Astronomical tide | +2.5 ft |
| (2) | Atmospheric pressure drop | +0.4 ft |
| (3) | Storm surge | +0.5 ft |
| (4) | Wave setup | +1.4 ft |
| | SWL | +4.8 ft |

7. ENTRANCE CHANNEL AND TURNING BASIN DESIGN

The entrance channel and turning basin are designed to accommodate vessels up to a length of 27 feet, a beam of 7 feet, and a draft of 2.5 feet. This criteria represents the dimensions of a loaded fishing boat, which is the largest vessel anticipated to use this boating facility.

a. ENTRANCE CHANNEL.

The entrance channel width and depth were computed as follows:

(1) Minimum Width (based on one-way traffic).

Width = 5 x design vessel beam x 1.5 to allow for wave action within channel

= 5 x 7 x 1.5

= 52.5 feet

In consideration of currents in the entrance channel and the alignment of the channel, an 80-foot bottom width was chosen for Plans 1 and 2. A 60-foot bottom width was chosen for Plan 3, based on boater experience in the area. A 60-foot bottom width for the entrance channel will provide more protection at the ramp and more area for refuge during storms.

(2) Minimum Depth.

Depth = design vessel draft + wave allowance + minimum tide below MLLW + bottom clearance and squat

= 2.5 + 3 + 1 + 2

= 8.5 feet

Use: 8.5 feet

b. TURNING BASIN.

The minimum dimensions for the basin were computed as follows:

(1) Minimum Length and Width

Length and Width = 3 x design vessel length

= 3 x 27

= 81 feet

Use: 100 feet

(2) Minimum Depth.

Depth = design vessel draft + wave allowance + bottom clearance

= 2.5 + 2 + 2

= 6.5 feet

Use: 6.5 feet

8. BREAKWATER LAYOUT.

a. DESIGN WAVE HEIGHT. The design of the structural elements was based on the controlling depth criteria which determines the maximum wave height to which the structure might reasonably be subjected. The design wave height is based on the depth ($d_s$) at the structure toe, the wave period (T), and the slope (m) seaward of the structure. Using Figure 7-4, Shore Protection Manual, with values of:

$d_s$ = 13.3 feet; T = 15 seconds; m = 0.01.

Design Wave Height = 11.4 feet

b. DIFFRACTION ANALYSIS. Theoretical wave diffraction analyses were conducted for each alternative plans. Incident wave direction was determined from the refraction analysis described previously. Wave periods were determined from Table C-2, Percent Frequency of Wave Height Versus Wave Period. A wave period of 10 seconds would be exceeded 10% of the time in a normal year and an 8-second wave would be exceeded 15% of the time. Figures C-3 to C-5 show the diffraction coefficient, K', for each wave period analyzed.

9. BREAKWATER DESIGN.

a. ARMOR LAYER. Shore Protection Manual (SPM) design formulas were used to determine the weight of the stone and the thickness of the stone layer. (Typical sections shown in main report.)

(1) Weight.

Armor stone size:

$$W = \frac{W_r H_b^3}{K_D (S_r - 1)^3 \cot \theta}$$

$W_r$ = unit weight of stone = 165 pcf

$H_b$ = design wave height = 11.4 feet

$K_D$ = stability coefficient = 2.5 (2 stones thick)

$S_r$ = specific gravity of armor unit relative to seawater = 2.58

$\cot \theta$ = cotangent of structure slope = 2.0

W = Armor Stone Size=12,400 lbs= 6 tons

Since the ramp is assumed to be used during non-storm conditions only, the breakwater is designed for overtopping conditions and the stone size is increased by 30%. To allow for variations in stone sizes, a range of 0.5 to 1.25 is allowed, giving a range in stone sizes of 5 to 10 tons. The lower range of 0.5 is used instead of 0.75 to help reduce wave transmission.

(2) Thickness

$$\text{Thickness} = nk \left(\frac{W}{W_r}\right)^{1/3}$$

$n$ = layer thickness = 2

$k$ = layer coefficient = 1.15

Thickness = 10.6 feet

b. CREST WIDTH. The crest width was calculated using the same formula for determining the armor layer thickness.

$n = 3$, $k = 1.10$

Crest Width = 15.2 feet

c. WAVE RUNUP. The wave runup was calculated using the Coastal Engineering Research Center's Technical Report No. 80-1 (TR-80-1).

$$\frac{R}{H} = \frac{aE}{1 + bE}$$

$$E = \frac{\tan \theta}{\sqrt{H/L_o}}$$

$a$ = empirical coefficient = 0.775

$b$ = empirical coefficient = 0.361

$E$ = surf parameter

$H$ = design wave height = 11.4 feet

$\tan \theta = 0.5$

$L_o$ = deepwater wave length = 1152 feet

$\frac{R}{H} = 1.4$ = wave runup factor

d. CREST ELEVATION. The crest elevation was based on the wave that would break at the head of the structure causing the bay to be non-navigable. As discussed earlier, the breakwater is designed for overtopping therefore the design stillwater level is not used. The stillwater level used is the half-tide level. The use of this water level will allow minor overtopping during storm conditions and will keep the breakwater crest at an elevation that coincides with the natural ground. The crest elevation for the proposed plans are in Table C-3.

TABLE C-3. BREAKWATER CREST ELEVATION

| Plan | (1) Wave Height (Feet) | (2) Runup Factor | (3) Half-Tide Level | Crest 1/ Elevation (Feet) |
|---|---|---|---|---|
| 1 | 7.5 | 1.4 | +1 | +11.5 |
| 2 | 5 | 1.4 | +1 | + 8.0 |
| 3 | 7.5 | 1.4 | +1 | +11.5 |

1/ Crest elevation = (1) x (2) + (3).

10. BASIN RESPONSE TO INCIDENT WAVE CRESTS.

With the proposed basin being rectangular in shape and the increased channel depth, a theoretical analysis was conducted to determine the wave periods that would increase resonant surging. The fundamental resonance period (T) is the time it takes a wave to travel from one end of the basin to the other end and back. Any multiple of this wave period may induce resonant surging. The fundamental resonance was computed as follows:

$$T = \frac{2b}{\sqrt{gd}}$$

b = basin length, 200 ft

g = acceleration due to gravity, 32.2 ft/sec$^2$

d = basin depth, 8 ft

T = 25 seconds

11. REFERENCES.

Dunham, James W. and Arnold A. Finn, Small-Craft Harbors: Design, Construction and Operations. Special Report No. 2 prepared for the US Army Coastal Engineering Research Center, Fort Belvoir, VA, Dec 1974.

US Army Coastal Engineering Research Center, Shore Protection Manual, Vols. I, II, III, Fort Belvoir, VA, 3d Edition, 1977.

US Army Coastal Engineering Research Center, Technical Report No. 4, Fort Belvoir, VA, 3d Edition, 1966.

US Army Coastal Engineering Research Center, Technical Report No. 80-1, Fort Belvoir, VA, 1980.

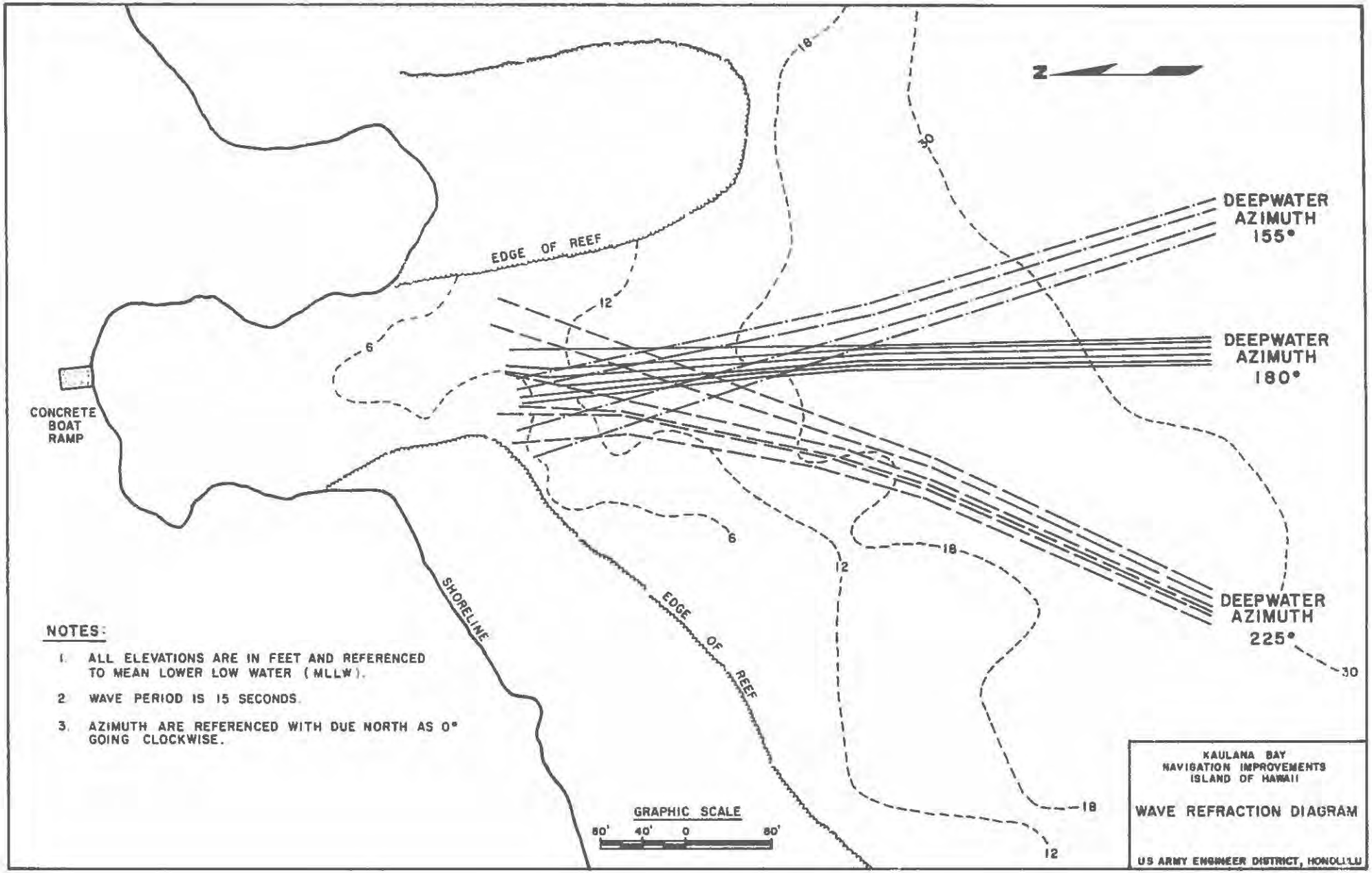
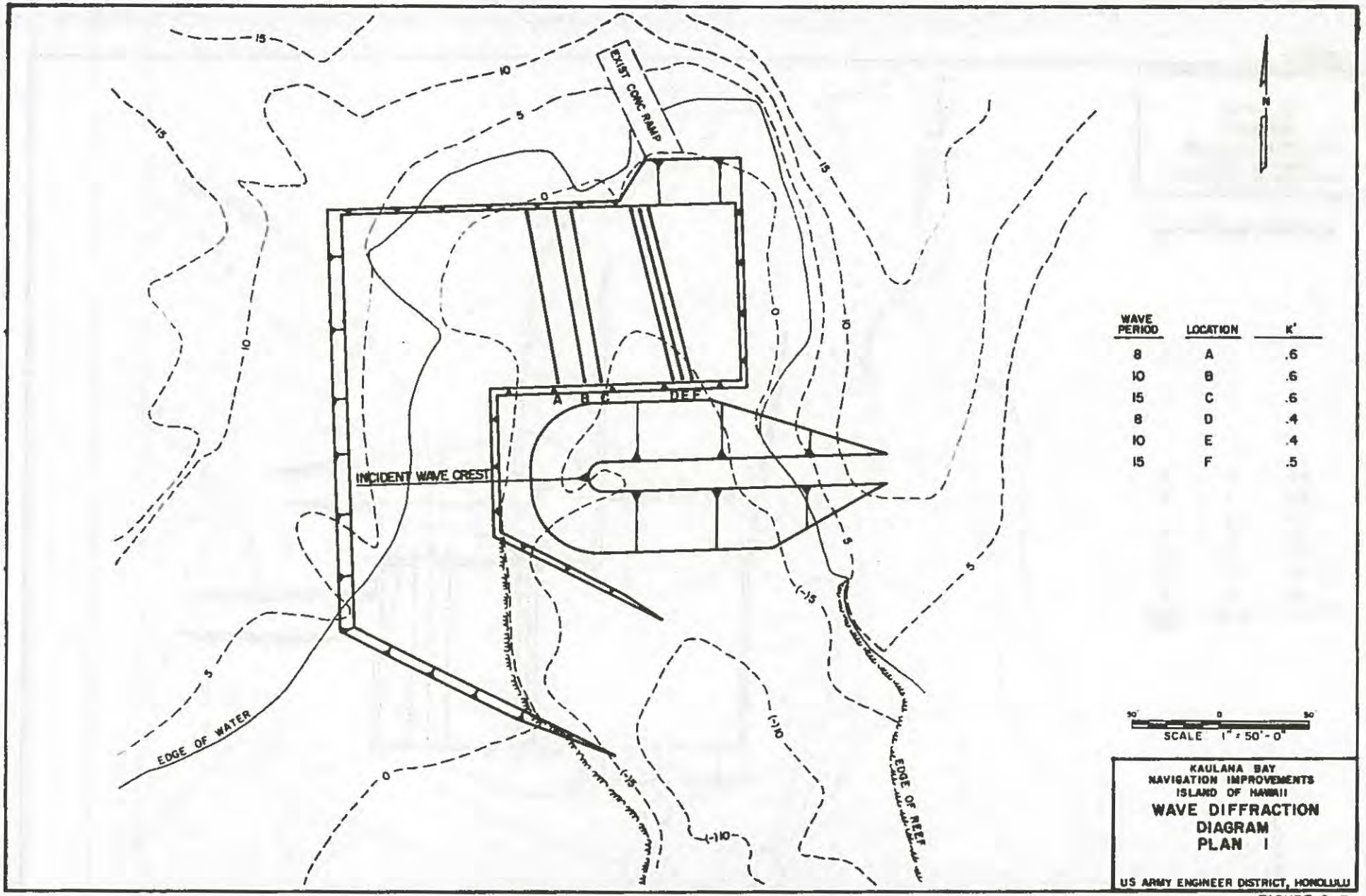

N
DEEPWATER AZIMUTH 155°
DEEPWATER AZIMUTH 180°
DEEPWATER AZIMUTH 225°
EDGE OF REEF
CONCRETE BOAT RAMP
SHORELINE
EDGE OF REEF
18
9
12
6
6
12
18
18
12
30
NOTES:
1. ALL ELEVATIONS ARE IN FEET AND REFERENCED TO MEAN LOWER LOW WATER (MLLW).
2. WAVE PERIOD IS 15 SECONDS.
3. AZIMUTH ARE REFERENCED WITH DUE NORTH AS 0° GOING CLOCKWISE.
GRAPHIC SCALE
80' 40' 0 80'
KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII
WAVE REFRACTION DIAGRAM
US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE C-2



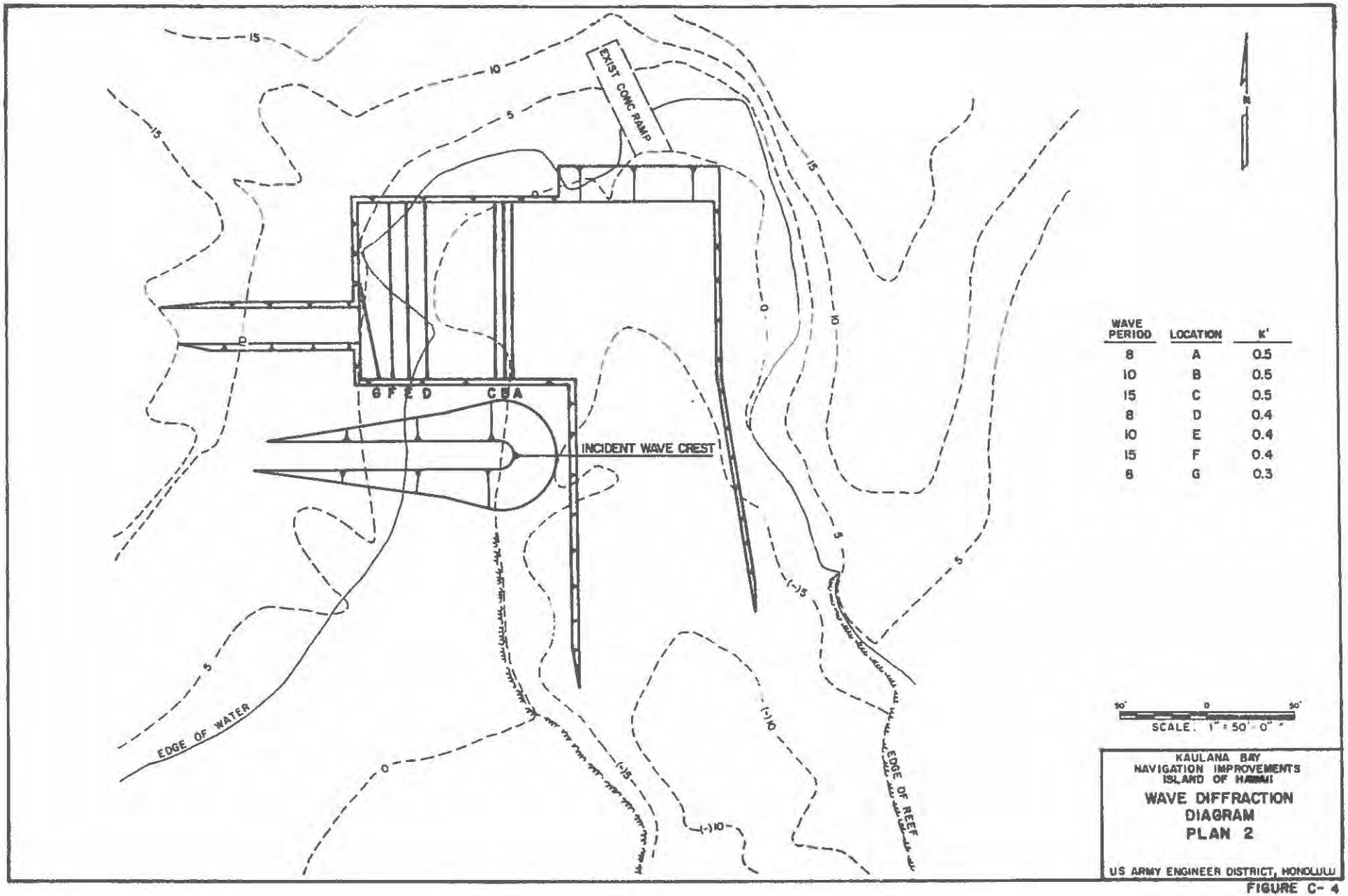

| WAVE PERIOD | LOCATION | K' |
|---|---|---|
| 8 | A | .6 |
| 10 | B | .6 |
| 15 | C | .6 |
| 8 | D | .4 |
| 10 | E | .4 |
| 15 | F | .5 |

KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII

**WAVE DIFFRACTION DIAGRAM PLAN I**

US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE C-3



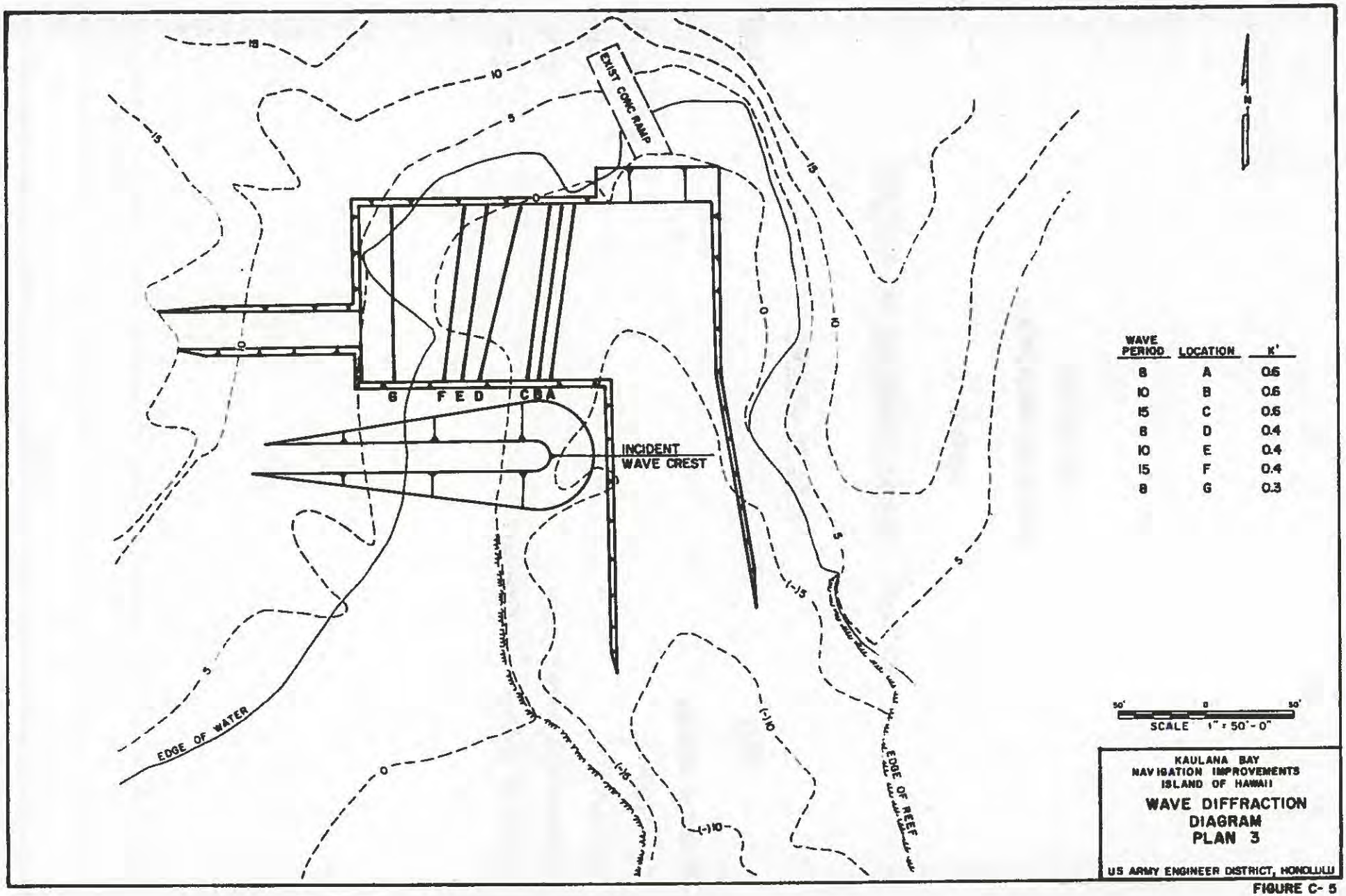

| WAVE PERIOD | LOCATION | K' |
|---|---|---|
| 8 | A | 0.5 |
| 10 | B | 0.5 |
| 15 | C | 0.5 |
| 8 | D | 0.4 |
| 10 | E | 0.4 |
| 15 | F | 0.4 |
| 8 | G | 0.3 |

KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII

**WAVE DIFFRACTION DIAGRAM PLAN 2**

US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE C- 4




| WAVE PERIOD | LOCATION | K' |
|---|---|---|
| 8 | A | 0.6 |
| 10 | B | 0.6 |
| 15 | C | 0.6 |
| 8 | D | 0.4 |
| 10 | E | 0.4 |
| 15 | F | 0.4 |
| 8 | G | 0.3 |

KAULANA BAY
NAVIGATION IMPROVEMENTS
ISLAND OF HAWAII

**WAVE DIFFRACTION DIAGRAM PLAN 3**

US ARMY ENGINEER DISTRICT, HONOLULU

FIGURE C- 5

KAULANA BAY

NAVIGATION IMPROVEMENTS

APPENDIX C

SECTION II. GEOLOGY, FOUNDATIONS AND MATERIALS

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# GEOLOGY, FOUNDATIONS & MATERIALS
## KAULANA SMALL BOAT HARBOR
## KAULANA BAY, HAWAII

REGIONAL GEOLOGY

1. The Hawaiian Islands are a chain of broad, shield basalt domes built on a 1600 mile long fissure in the ocean floor. The Island of Hawaii is the largest, youngest and southernmost of the chain. It is the result of many thousands of thin lava flows from rift zones (zones of fractures) from five volcanoes.

2. Mauna Loa is the volcano responsible for the greater bulk of the island's southern half. Erupting as late as 1975, it is one of two active volcanoes in this area. The slopes of Mauna Loa are covered with finger-shaped recent flows of lava-basalts, tuffs and ash deposits of the Kau Volcanic Series. Small but frequent "Kipukas" (Hawaiian word referring to an area of older land surface surrounded by the lava of new flow) expose the Kahuku Volcanic Series. The Kahuku Volcanic Series consist of thin lava-basalt flows intercalated with ash and capped with yellow pyroclastic ash (Pahala Ash).

3. The Kahuku and Kau Volcanic Series occurred during the Middle Pleistocene (50,000 $\pm$ years) and Late Pleistocene to Recent Epochs of geologic time, respectively. The young age of the Island of Hawaii is characterized by rough, irregular coast lines with cliffs, frequently exposed lava-basalt flows, steep offshore margins and lack of extensive coral reefs.

SITE GEOLOGY

4. Kaulana Bay is located south of Mauna Loa's southwest rift and several miles northeast of South Point (Kalae). The bay measures roughly two hundred (200) feet in width and runs inland for about four hundred (400) feet. The east and west sides of the bay are relatively straight and the north shore is symmetrically curved. The bay is open to the south and enclosed to the north by several thin flow-units extruded from the southwest rift of Mauna Loa.

5. The east shore of the bay is part of a finger or extension of the most recent and prominent lava flow, which rises twenty (20) feet above the bay and tapers gently towards the ocean. At the bay margin the east shore is considerably steeper from the top of the flow to the floor of the bay. Thin deposits of subanglar to subrounded basalt gravels to boulders (up to 18 inches in diameter) and clinkers are scattered over the east shore and flow surface.

6. On the west and north shores of the bay the lava flows (or flow) are considerably lower (7 feet maximum elevation) and older than the flow of the east shore. The north shore is nearly covered by a thin deposit of subangular to subrounded basalt gravel and cobbles which abruptly changes to a yellow pyroclastic ash (Pahala) thirty (30) feet north of the shoreline and extends beyond the limits of the study area. The lava flow of the west shore is almost level but is intensely fractured and jointed. A thin (approx. 2 foot thick) deposit of sand and fine gravel with occasional basalt cobbles covers

the lava flow forty (40) feet from the west shoreline. The sand-gravel deposit is thirty (30) feet wide and parallels the entire length of the west shore. It grades into a wave-cut section of the yellow pyroclastic ash (Pahala). A six (6) to eight (8) foot wave-cut scarp in the pyroclastic ash parallels the west shoreline at a distance of about one hundred (100) feet from the water's edge. Inland from the scarp, a gently undulating grass-covered terrace of yellow pyroclastic ash caps the lava-basalt flows. The thickness of the ash terrace is approximately thirteen (13) feet.

7. The floor of the bay is shallow (less than 10 feet) and irregular. The floor consists of an accumulation of recent lava-basalt flows on top of older flows. The floor surface is partly covered by thin deposits of subangular to subrounded basalt cobbles and boulders. One small sand-filled trough (30 feet to 100 feet) trends north-south near the middle of the bay. A small thin (less than a foot thick) sand deposit (75 feet in diameter) lies east of the boat launch ramp. All deposits consist of fine to medium grained coral sand. A few scattered coral formations (colonies) avarage three (3) feet in height and parallel the sand-filled trough. Beyond the mouth of the bay, the depth of the ocean floor increases rapidly.

SEISMICITY

8. Hawaii has the highest density of earthquakes (occurrence rate of magnitude two and greater earthquakes per unit area) in the United States. During the past 18 years, about 48,000 earthquakes in Hawaii have been located and their magnitude determined. Of these, more than 3,000 events were of magnitude 3.0 to 7.2; magnitude 3.0 is generally the threshold of felt earthquakes.

9. The strongest earthquake in historic time in the islands occurred on April 2, 1868 and was centered along the south coast of the Island of Hawaii. The earthquake had a Richter magnitude of about 7.5 and caused serious damage across the entire island, even stopping clocks as far away as Honolulu. Practically all earthquakes on the Island of Hawaii and Maui are associated with intermittent volcanic activity. However, potential earthquakes in the islands can also be caused by deep seated tectonic forces and not from the indirect action of volcanic activity. A Richter magnitude 7 earthquake on January 23, 1938 had an epicenter 25 mile north of Pauwela Point on the north shore of Haleakala, Maui. Recent explorations of geophysical methods show that faults and rift zones cut through the major islands and that these faults are branches of a gigantic fracture system known as the Molokai Fracture Zone.

10. The only major earthquake felt on Oahu since 1938 occured in April 26, 1973. The tremor registered 6.2 on the Richter scale and was centered offshore about twelve miles northeast of Hilo, Hawaii and about 35 miles deep.

11. The uniform building code and the Corps Engineering Manual 1110-2-1902 assign a zone three (3) seismic risk rating of the Island of Hawaii for design considerations.

12. The magnitude of Hawaiian earthquakes was not routinely determined locally until 1958. Prior to that, magnitudes of large earthquakes were measured by seismograph stations on continental United States, usually by those at the California Institute of Technology, University of California at Berkeley and Columbia University.

ENGINEERING CONSIDERATIONS

13. Both pahoehoe and aa flows are common on the slopes of Mauna Loa with aa usually found at lower elevations. The terms pahoehoe and aa are Hawaiian and are used to classify surface appearances and structure of lava flows. At Kaulana Bay, lava basalt rocks are varible and unpredictable in physical and chemical properties. The loose scoriaceous surface layer (clinker) of aa is open, porous and very easy to excavate. Dense, hard basalt underlies the clinker layer and generally requires ripping to excavate. Excavation of some of the harder layers will require drilling and blasting or comparable effort. Rough, irregular cutslopes are anticipated in all excavations regardless of excavation methods because of the varying rock properties. The designed excavation slope of 1 vertical to 1 horizontal is adequate for this project.

14. The lava-basalt flows of the bay floor provide an adequate foundation for the breakwater, as designed herein. Removal of basalt cobbles and loose clinker material in the foundation will be required.

15. Surface drainage around and above Kaulana Bay is channeled through naturally-formed erosion gullies. The highly erodible ash which covers the ground surface to the north and west of the bay may become sediments in the bay after heavy rains unless surface drainage is diverted around the project area.

SOURCES OF CONSTRUCTION MATERIALS

16. Construction materials produced in the South Point-Naalehu (Kau District) area are primarily fills and base course materials used for highway construction. The porous, vesicular nature of the lava rock produced in this area precludes usage as revetment as well as concrete and asphalt aggregates. Excavated rock from the bay will also be unsuitable for the breakwater revetment. Rock materials from Hilo quarries may be selectively used in the proposed breakwater. Basalt rock from the Honokohau Small Boat Harbor excavation is stockpiled adjacent to that harbor and consists of small rock pieces up to 10 tons and larger. The rock quality varies from dense, hard basalt to highly vesicular and scoriaceous clinker; however, more than enough quality (dense) rock exists in the spoil piles to construct the proposed breakwater at Kaulana Bay. The spoil is a result of random excavating and dumping which, if selected for use, will require re-excavating, grading, separating, handling and segregating before placing.

APPENDIX C

SECTION III. COST ESTIMATION SECTION

TABLE OF CONTENTS

## III. COST ESTIMATION SECTION

### 1. COST ESTIMATING ASSUMPTIONS

a. The following assumptions were utilized in estimating construction costs:

(1) Big Island based contractor to perform work.

(2) All stone materials to come from existing commercial quarry in Hilo.

(3) Estimated quantities based on hydrographic survey map and typical plans and sections.

(4) Prices projected to May 1981 price levels.

(5) A 20% contingency cost allowance.

(6) 12 months construction period for Plan 1.
6 months construction period for Plans 2 and 3.

### 2. COST ESTIMATES

a. Plan 1

Total Project First Cost

| Item | Unit | Quantity | $ Unit Cost | $ Total Cost |
|---|---|---|---|---|
| I. FEDERAL | | | | |
| A. Construction Costs | | | | |
| Mobilization and Demobilization | LS | 1 Job | - | 50,000 |
| Dredging | CY | 11,700 | 65.00 | 760,500 |
| Main Breakwater | | | | |
| Armor (5-10 Tons) | Tons | 7,350 | 120.00 | 882,000 |
| Underlayer (.5-1 Ton) | Tons | 2,040 | 108.00 | 220,300 |
| Subtotal | | | | $1,913,000 |
| Contingency (20%) | | | | 382,600 |
| Total Direct Federal Constr Cost | | | | $2,296,000 |
| B. Engineering and Design | | | | |
| Detailed Project Report (pre-authorized study costs) | | | | 100,000 |
| Plans and Specifications | | | | 46,000 |
| Engineering During Construction | | | | 18,000 |
| Total Engineering and Design Costs | | | | 164,000 |

Total Project First Cost

| Item | Unit | Quantity | $ Unit Cost | $ Total Cost |
|---|---|---|---|---|
| C. Supervision and Administration (S&A) | | | | $161,000 |
| D. US Coast Guard Aids to Navigation | | | | 10,000 |
| II. NON-FEDERAL | | | | |
| A. Lands, Easements, & Rights of Way (Non-Federal) | LS | | | 23,000 |
| Total Project First Cost | | | | $2,654,000 |

b. Plan 2

Total Project First Cost

| Item | Unit | Quantity | $ Unit Cost | $ Total Cost |
|---|---|---|---|---|
| I. FEDERAL | | | | |
| A. Construction Costs | | | | |
| Mobilization and Demobilization | LS | 1 Job | - | 50,000 |
| Dredging | CY | 5,300 | 65.00 | 344,500 |
| Main Breakwater Armor (5-10 Tons) | Tons | 1,810 | 120.00 | 217,000 |
| Subtotal | | | | $611,500 |
| Contingency (20%) | | | | 122,300 |
| Total Direct Federal Construction Cost | | | | $734,000 |
| B. Engineering and Design | | | | |
| Detailed Project Report (pre-authorized study costs) | | | | 100,000 |
| Plans and Specifications | | | | 46,000 |
| Engineering During Construction | | | | 18,000 |
| Total Engineering and Design Costs | | | | 164,000 |
| C. Supervision and Administration (S&A) | | | | 59,000 |
| D. US Coast Guard Aids to Navigation | | | | 10,000 |
| II. NON-FEDERAL | | | | |
| A. Lands, Easements & Rights of Way (Non-Federal) | LS | | | 23,000 |
| B. Construction Costs | | | | |
| 20' x 93' Launch Ramp | 1 Job | | | 70,000 |
| C. Indirect Costs | | | | 8,000 |
| Total Project First Cost | | | | $1,068,000 |

c. Plan 3

Total Project First Cost

| Item | Unit | Quantity | $ Unit Cost | $ Total Cost |
|---|---|---|---|---|
| I. FEDERAL | | | | |
| A. Construction Costs | | | | |
| Mobilization and Demobilization | LS | 1 Job | - | 50,000 |
| Dredging | CY | 5,200 | 65.00 | 338,000 |
| Main Breakwater Armor (5-10 Tons) | Tons | 3,000 | 120.00 | 360,000 |
| Subtotal | | | | $748,000 |
| Contingency (20%) | | | | 149,600 |
| Total Direct Federal Construction Cost | | | | $898,000 |
| B. Engineering and Design | | | | |
| Detailed Project Report (pre-authorized study costs) | | | | 100,000 |
| Plans and Specifications | | | | 46,000 |
| Engineering During Construction | | | | 18,000 |
| Total Engineering and Design Costs | | | | 164,000 |
| C. Supervision and Administration (S&A) | | | | 70,000 |
| D. US Coast Guard Aids to Navigation | | | | 10,000 |
| II. NON-FEDERAL | | | | |
| A. Lands, Easements & Rights of Way (Non-Federal) | LS | | | 23,000 |
| B. Construction Costs | | | | |
| 20' x 93' Launch Ramp | 1 Job | | | 70,000 |
| C. Indirect Costs | | | | 8,000 |
| Total Project First Cost | | | | $1,243,000 |

d. Non-Federal Costs. Non-federal costs are those costs that the State of Hawaii must provide in accordance with local cooperation agreements and assurances. Non-federal project first costs are anticipated for all alternative plans. The cost to lease and acquire lands, easements, and rights-of-ways from Hawaiian Homes Land will be a non-federal cost.

Other non-federal costs include a portion of the total project construction cost for the new single lane launch ramp in Plans 2 and 3 and associated indirect costs. The total cost of the launch ramp may be included into the overall federal construction contract using State of Hawaii Funds. The estimated cost of the ramp is $70,000.

3. ESTIMATED AVERAGE ANNUAL COST

a. The average annual cost is the equivalent annual charges which includes interest, amortization of the initial investment, cost of maintenance and operation, and replacement costs during the project life.

b. Interest rate used follows the U.S. Water Resources Council's rate of 7-3/8 percent. The project economic life is 50 years.

c. Annual replacement, operation and maintenance costs can be broken down into the following categories:

(1) Maintenance dredging due to shoaling.

(2) Periodic maintenance and repair for aids to navigation.

(3) Maintenance and repair costs for the breakwater structure.

Maintenance Dredging

Maintenance dredging to maintain the Kaulana Bay launch facility is based on an estimated 2,500 cubic yards for each alternative plan every 50 years. The cost of maintaining the facility includes mobilization and demobilization of dredging equipment. Mobilization and demobilization cost is estimated at $150,000. Dredging cost is estimated at approximately $20.00 per cubic yard of material.

Aids to Navigation

Periodic maintenance and repair for the light structures (aids to navigation) is estimated at $1,500 per year.

Maintenance and Repair Costs for the Breakwater

Annual maintenance and repair costs of the breakwater for the economic life of the project is based on 1% of the initial cost of the armor stone.

Summary of Average Annual Maintenance Costs

| | Plans | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Maintenance Dredging | $4,000 | $4,000 | $4,000 |
| Aids to Navigation | 1,500 | 1,500 | 1,500 |
| Protective Structure | 8,800 | 2,200 | 3,600 |
| Total Average Annual Maintenance Cost | $14,300 | $7,700 | $9,100 |

d. Summary of the average annual costs for determining the benefit to cost comparison is shown below:

| | Plans 1 | 2 | 3 |
|---|---|---|---|
| Total Project First Cost 1/ | $2,554,000 | $968,000 | $1,143,000 |
| Average Annual First Cost | 193,900 | 73,500 | 86,800 |
| Average Annual Maintenance Cost | 14,300 | 7,700 | 9,100 |
| Total Average Annual Cost | $208,000 | $81,000 | $96,000 |

1/ Excludes pre-authorized study costs for benefit cost analysis.

4. APPORTIONMENT OF COSTS

In accordance with Section 107 of the River and Harbor Act of 1960, the apportionment of costs between federal and non-federal cost is specified below. The Federal share is a statutory limit of $2 million. All costs exceeding this amount must be borne by the State of Hawaii. The non-federal share includes the cost for a new ramp, indirect costs, and lands, easements and rights of way.

Summary of Apportionment of First Cost

| | Plans 1 | 2 | 3 |
|---|---|---|---|
| Federal Share 1/ | | | |
| Corps of Engineers | $2,000,000 | $957,000 | $1,132,000 |
| U.S. Coast Guard | 10,000 | 10,000 | 10,000 |
| Non-Federal Share 2/ | 644,000 | 101,000 | 101,000 |
| Total Project First Costs | $2,654,000 | $1,068,000 | $1,243,000 |

1/ All future costs associated with future maintenance dredging, repairs to the breakwater structure and maintenance for aids to navigation is Federal. These costs are not included in the project first costs but are considered in determining the average annual costs for developing the benefit to cost comparison.

2/ This share does not include the costs of local cooperation and assurances specified in Appendix A.

# KAULANA BAY

# NAVIGATION IMPROVEMENTS

# CULTURAL AND SOCIAL RESOURCES

APPENDIX D

APPENDIX D

# CULTURAL AND SOCIAL RESOURCES

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# APPENDIX D

## CULTURAL AND SOCIAL RESOURCES

### I. INTRODUCTION

1. Part I of Appendix D summarizes the findings of the Corps in identifying prehistoric sites, historic structures, or other cultural resources in the study area and assessing the effects of the alternatives on the sites or resources. Identification of historic sites is required by the Reservoir Salvage Act of 1960 as amended and Executive Order 11593 (1971). The Federal agency must evaluate the significance of the sites in order to determine possible eligibility for the National Register of Historic Places. If any sites in the project area were determined eligible for or already listed on the National Register, they would be protected by Federal law and regulation to the extent that the Federal agency must consult with the State Historic Preservation Officer and the US Advisory Council on Historic Preservation to determine the effect of the Federal project and to identify measures to either avoid or mitigate for any adverse effects.

2. Part II of the cultural and social resources appendix summarizes pertinent socioeconomic profile data on the study area and assesses the social well-being components of the four alternative plans. The other social effects component analysis derives from the Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources--Level C" (P&S), 45 Federal Register 64366-64400, 29 September 1980. The other social effects components now required by P&S consist of (a) Urban and community impacts such as income distribution, employment distribution, population distribution and composition, the fiscal condition of the local government, and the quality of community life; (b) Life, health and safety; (c) Displacement including people, businesses, and farms; (d) Long-term productivity involving renewable resources such as fisheries; and (e) Energy requirements and energy conservation both during construction and operation of facilities. Part III of the appendix discusses the impacts of the three alternative plans on the cultural resources and the other social effects elements.

### II. AFFECTED RESOURCES

3. Historical Background. The South Point or Ka Lae area of Hawaii Island, believed at one time to be the earliest occupied site complex in the Hawaiian Islands, has been subject to a large number of intensive archaeological and historical studies conducted principally under the auspices of the Bernice P. Bishop Museum. A paper by Marion Kelly of the Museum on the "Historical Background of the South Point Area, Ka'u, Hawaii" presented as Pacific Anthropological Records No. 6 in 1969, summarizes the previous archaeological studies of the South Point area which began in 1953 and culminated in that period by a survey of a portion of Kapalaoa Bay Village, adjacent to Kaulana Bay, by Edmund J. Ladd and Ms. Kelly in October 1969 (Ms, 1969). No additional investigations have been performed on sites along the southeast coast of the South Point area except for a US Army Corps of Engineers' sponsored cultural and historical survey of the Ka'alu'alu Bay area by Ms. Kelly and Violet Hansen of Bishop Museum in 1972 and two studies performed in conjunction with the present study. Ms. Hansen prepared a brief cultural reconnaissance report in December 1979 on her own initiative representing the Big (Hawaii) Island Resource

Conservation and Development Council and Dr. Paul Rosendahl, Consulting Archaeologist, conducted a more intensive reconnaissance survey in 1981 under contract to the Corps. Detailed site maps and the Ladd manuscript with illustrations and the Hansen and the Rosendahl reconnaissance reports are provided under separate cover to historic site agencies and appropriate professionals in accordance with the Archaeological Resources Protection Act of 1979.

4. South Point National Historic (Landmark) District. The South Point Complex is a group of prehistoric and historic sites which was believed in 1969 to provide the longest and most complete record of human occupation in the Hawaiian islands according to K. Emory and Y. Sinoto, "Age of the Sites in the South Point Area, Ka'u, Hawaii," Pacific Anthropological Records, No. 8, Bishop Museum, 1969 (Figure D-1). The Puu Alii Sand Dune Site (Site No. 50-HA-B20-1 or H1) was a fisherman's habitation later covered by sand and used as a burial ground. It was originally dated by radiocarbon-dating methods to about 124 A.D. (National Park Service, 1962). A nearby inland site, Makaai Cave Shelter (Site No. 50-HA-B20-2 or H2), is believed to date to about 1750 A.D. Kalalaea Heiau, located adjacent to the modern lighthouse, is a fishermen's heiau of the small court variety which has been generated for years and is still maintained by the local fishermen. Other sites identified as formally within the National Landmark historic district are eighty or more canoe-mooring holes carved into the lava cliff overlooking the sea; numerous carved and natural salt pans at and near the heiau site; and Pohakuokeau "Stone of the Times" which is supposed to turn over when the traditional reign changed. According to Ladd (1969), not included in the site inventory of the South Point Historical District Landmark, but of utmost importance to the total interpretation of the prehistory and history of the area are the Kapalaoa Bay Village site (located adjacent to Kaulana Bay and within the historic district), Molilele heiau, perched on the edge of the spectacular Pali-(cliff)-o-Kalani, and the prehistoric shelter cave and village of Waiahukini (Sites 50-HA-B21-1 or H8 and 50-HA-B21-2 or H28). The latter three sites are outside the historic district.

5. Excavations and dating conducted in the late 1960's now indicate that the sand dune site (H1) was only occupied for a relatively short period from about 1250 to 1350 A.D. based on radiocarbon dating, stratigraphic analysis and an analysis of changing forms of fishhooks (Emory and Sinoto, 1969). They believe that the Waiahukini shelter (H8) was occupied from as early as 750 A.D. to no later than about 1850 A.D. No dating has been conducted at the Kapalaoa Village site near Kaulana Bay, but Ladd suggests that the prehistoric village as probably abandoned in the mid- and late-19th century (Figure D-2). At any one time during the peak occupation there may have been 35 to 40 people living within the eight house sites at Kapalaoa Village. The choice of the ancient Hawaiians to occupy this particular site was probably made because it provided protection from the winds and because it was adjacent to Kapalaoa and Kaulana Bays which provide suitable landing places for canoes. According to "Place Names of Hawaii" by Pukui, Elbert, and Mookini published in 1974, Kaulana literally means "(boat) landing." Ladd suspected that the inhabitants of this village saw Captain Cook's Resolution and Discovery passing offshore early in the year 1779 and possibly visited the ships in canoes launched from Kaulana and Kapalaoa Bays.

6. Indeed, Cook's journal entry for January 5, 1779 reported that as his ship rounded the South Point of Hawaii Island:

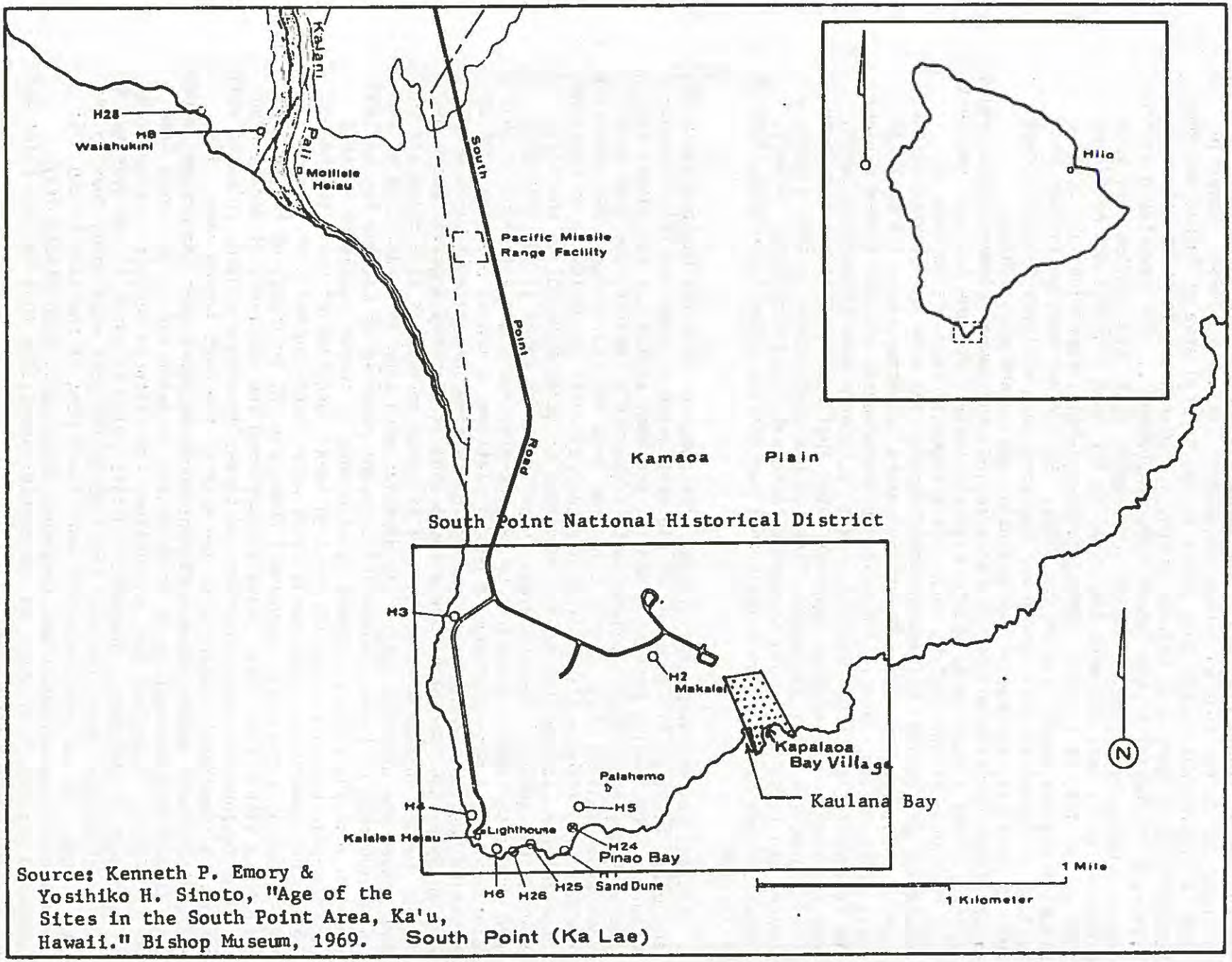



Figure D-1. Location of Archaeological Sites in South Point Area

"On this point stands a pritty (sic) large village, the inhabitants of which thronged off to the ship with hogs and women" [in Kelly, 1969]. Later in 1789, a significant battle took place in the general area of Ka Lae and the Kamaoa Plain (Figure D-1) between Keoua, a high-ranking Chief of Ka'u and Kaiana, a lieutenant of the future King Kamehameha I. The Hawaiian historian Samuel Kamakau noted that "if word was brought that 'ahi (yellow fin) were plentiful at Ka Lae, off went the Chief to the 'ahi fishing, and he fished also at Kaulana, Ka'iliki'i, Pohue, Na-pu-u-o-Pele, Kapalilua, and other places along the coast" (in Kelly, 1969). No further mention is made of Kaulana in the historical record for the prominent villages along the coast were at Kailikii, Waiahukini and Kaalualu, and inland at Waiohinu. Observations by Reverend John D. Paris in 1841 and Samuel Clemens (Mark Twain) in 1866 of the situation at nearby Kaalualu imply a decline in local residents from "hundreds of natives" to none. This suggests that the decline in population of Kapalaoa Village occurred during that same period when diseases, onerous poll, land and labor taxes and natural disasters were taking their heavy price (Kelly, 1969). The volcanic disturbances of 1868 spared Kaulana the ravages of lava flows but hit it with a tsunami wave of perhaps twenty feet in height. One unnamed observer noted that between Kaalualu and South Point (about six miles distance), "The sea had been inland in some places, a hundred and fifty yards, and the whole coast was lined with house timbers, lumber, broken canoes, dead animals that had drifted ashore" (Brigham, 1909 in Kelly, 1969).

7. Kaulana Bay Archaeological Sites. The function that the Kaulana Bay boat ramp plays today is evidenced by an old photograph in Ladd and Kelly's manuscript of 1969 showing perhaps a Model-T and tent staked out at Kaulana Bay just as today auto campers belonging to fishermen's families dot that South Point area awaiting their men to come home from the sea. Figure D-2 shows the remnants of a fisherman's shack at Kaulana Bay which according to an Hawaiian informant for Ladd was the former residence of Kalai Moku Halii, who lived there in the 1920's. The shack was in periodic use until it was destroyed some time after 1969. According to Ladd, the archaeological remains in this point area are a poorly preserved (rock) platform, a (rock) platform with an adjoining house pavement, and a rather interesting composite of walls which form an open-ended enclosure and a mound that is probably a grave (Ladd, Ms, 1969). Ladd's informant said that one of these structures is a heiau and for that reason the area was kapu. The Hawaiian word kapu is a variation of the Polynesian tabu or taboo. Rosendahl's recent resurvey of Kaulana Bay in 1981 revealed that the sites described by Ladd were in poorer condition or that Ladd's map of the sites had described an ideal condition of the sites rather than a real condition. Additional sites were found southward or seaward of the previously sited area. Rosendahl found six (6) artifacts on the surface around and within the sites. He also confirmed the existence of undisturbed cultural features including hearths and fire-pits within a hard, volcanic soil embankment immediately adjacent to and east of the boat launch ramp. The cultural features appear along a discontinuous exposure near the present water line extending approximately 20 to 25 meters landward and to the north from the ramp area. Rosendahl does not believe the cultural deposits extend below the approach to the ramp. Scattered surface cultural material was observed at the "intersection" where the Jeep trail meets the dirt road going down to the launch ramp. No cultural materials were found west of the launch ramp. If any materials had existed there they have undoubtedly been eroded away. Rosendahl reported that there was no counter-indication that Kaulana Point was not a traditionally kapu area.

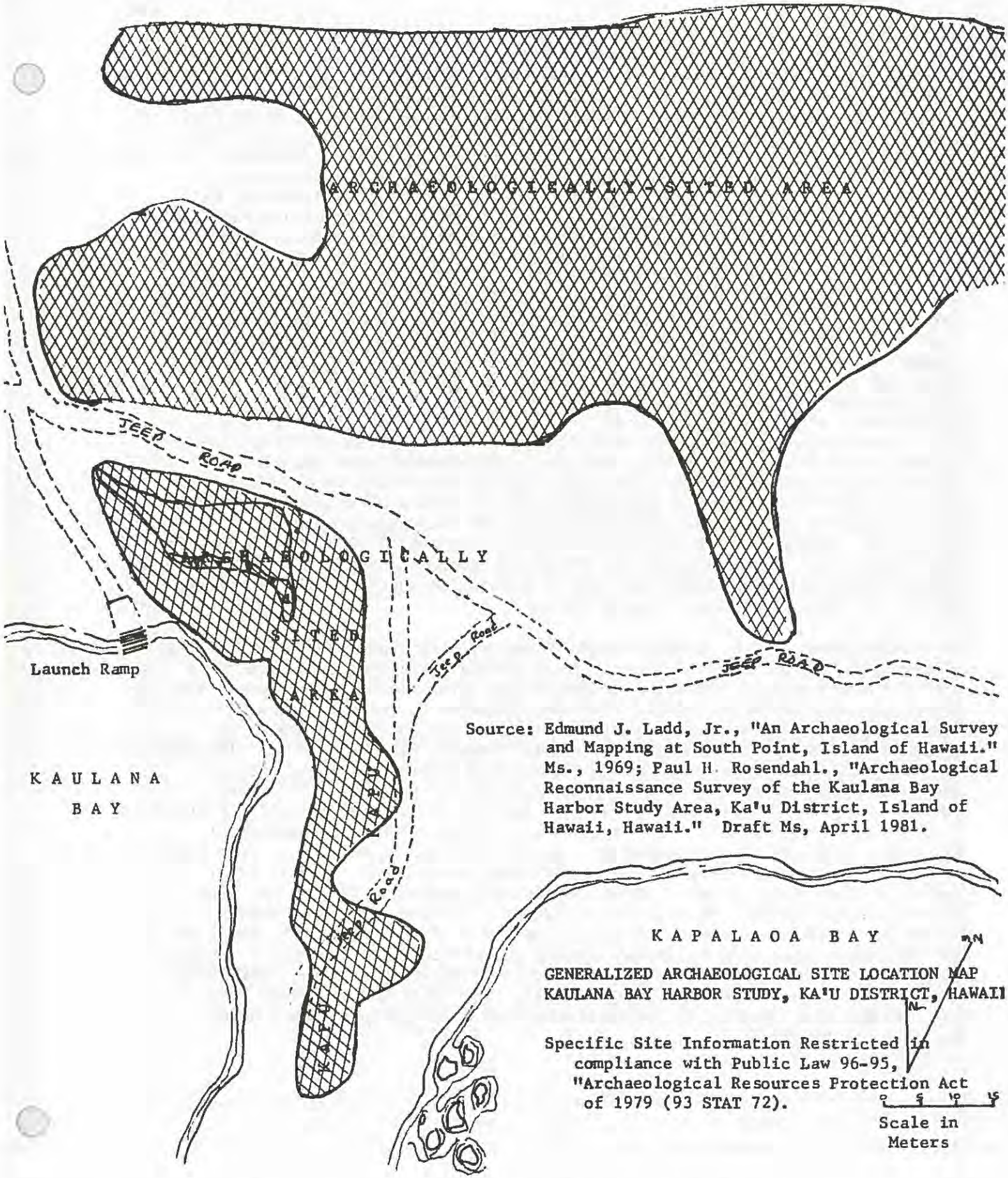



Figure D-2. Location of Archaeological Sites at Kaulana Bay

8. Urban and Community Characteristics: Ka Lae, the southernmost point in the Hawaiian Islands, is an open, windswept land covered with grass and used as a grazing area for cattle. It is largely controlled by the State Department of Hawaiian Home Lands except for a lighthouse operated by the US Coast Guard at the extreme tip of the land and the unimproved, County-controlled Kalae Boat Landing and Park (see Figure 1). Kaulana Bay is located over ten miles from the main highway and thirteen miles from the nearest village of Waiohinu. It is estimated that no more than one hundred people live in the expansive, grazing land south of the highway. All of the principal communities of Ka'u District, Waiohinu, Pahala and Naalehu, are close-knit, sugar plantation towns. Population levels and composition have not substantially changed in Ka'u District and its villages in the past decade, in marked comparison with other districts and communities in Hawaii County (see Table D-1). There are few economic opportunities or environmental incentives for permanent residents to settle in Ka'u District, except for the area's isolation and stark, volcanic landscape. The latter has encouraged one of the area's largest individual landowners, C. Brewer and Company, to develop its Seamountain Resort at Ninole Cove near Punaluu and other interests to develop residential areas called Oceanview and Discovery Harbor, northwest and north of Ka Lae, respectively. One resident of Oceanview optimistically suggests that Oceanview will be Ka'u's future population center with 10,000 residents by 1990 or later. Both Oceanview and Discovery Bay have remained largely undeveloped and have attracted very few residents. Discovery Bay has one of the three golf courses in Ka'u District. These two developments and an influx of artists and craftsmen to Waiohinu are probably responsible for the increased proportion of Caucasians in the district population from 24.7 percent in 1970 to 27% in 1980 (see Table D-1). It is likely that the ethnic composition will continue to change in the future and that the rate of population increase will be greater than it has been in the last twenty years.

9. Unemployment levels in Hawaii County have usually been higher than the rest of the state due to an historic decline in agriculturally-related jobs and a widely-varying tourist industry. Unemployment levels in Ka'u were lower than the county as a whole in 1970, 2.1 percent compared to 2.7 percent, and it is likely that these trends prevail in the present time due to the generally constant employment in the District's sugar industry (see Table D-2). The OEO 1975 Census Update Survey prepared by Survey & Marketing Services, Inc., in September 1976 showed that of the 26,437 jobs in the farming, fishing and forestry sector in the County, fully 13.5 percent or 3,562 of the jobs occurred in Puna and Ka'u Districts. No reliable statistics are kept on numbers of fishermen, but estimates obtained at a public workshop at Naalehu in July 1980 indicated there were twenty full-time fishermen in Ka'u and fifty to sixty part-time fishermen. A small number of the full- and part-timers came from outside Ka'u District. An analysis of Tables D-1 and D-2 indicate that residents of Filipino origin are proportionally less unemployed than Hawaiians and part-Hawaiians. The Filipinos provide the primary workforce for the sugar industry in Ka'u. Due to the high dependence on agriculture for a livelihood, the median family income levels for Ka'u are lower than for the County and considerably more families in Ka'u have incomes below poverty than compared to the rest of the county.

## TABLE D-1. POPULATION CHARACTERISTICS

| Year | POPULATION | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Hawaii County | Hilo Town | South Hilo | Kailua Town | North Kona | South Kona | Ka'u | Pahala Town | Naalehu Town | Other Ka'u Areas |
| 1960[1] | 61,332 | 25,966 | 31,558 | 499 | 4,451 | 4,292 | 3,368 | 1,392 | 952 | 1,024 |
| Change (%) | 3.5 | 1.5 | 7.5 | -26.9 | 8.6 | -6.7 | 0.9 | 8.3 | 6.5 | -14.3 |
| 1970[1] | 63,468 | 26.353 | 33,915 | 365 | 4,832 | 4,004 | 3,398 | 1,507 | 1,014 | 877 |
| Change (%) | 45.0 | 34.0 | 24.7 | 1,200 | 184.5 | 47.7 | 8.9 | 8.2 | 14.5 | 3.4 |
| 1980[2,3] | 92,053 | 35,303 | 42,278 | 4,763 | 13,748 | 5,914 | 3,699 | 1,631 | 1,161 | 907 |
| 1990[4] | 105,100 | DATA NOT AVAILABLE | | | | DATA NOT AVAILABLE | | | | |
| 2000 | 123,300 | DATA NOT AVAILABLE | | | | DATA NOT AVAILABLE | | | | |

| Ethnic Composition | Hawaii County | | | | Ka'u District | | | |
|---|---|---|---|---|---|---|---|---|
| | 1970[5] | Percentage | 1980[6] | Percentage | 1970[5] | Percentage | 1980[6] | Percentage |
| Caucasian | 18,298 | 28.8 | 31,316 | 34.0 | 839 | 24.7 | 998 | 27.0 |
| Japanese | 23,817 | 37.5 | N/A | | 881 | 25.9 | N/A | |
| Filipino | 10,454 | 16.5 | N/A | | 1,096 | 32.3 | N/A | |
| Hawaiian | 7,809 | 12.3 | N/A | | 452 | 13.3 | N/A | |
| Total Asian and Pacific Islanders | 44,251 | 69.7 | 57,063 | 62.0 | 2,528 | 74.4 | 2,547 | 68.9 |

[1]Hawaii Department of Planning and Economic Development (DPED, The Hawaii Urban Planning Information Center. "Community Profiles for Hawaii," February 1973.
[2]Hawaii DPED. "The State of Hawaii Data Book 1980. A Statistical Abstract." Table 7.
[3]County of Hawaii Department of Research and Development. "Big Island Report" March 1981.
[4]Hawaii Data Book 1980, Table 10.
[5]Community Profiles for Hawaii, 1973
[6]Big Island Report, March 1981.

TABLE D-2. EMPLOYMENT AND INCOME CHARACTERISTICS

| Civilian Labor Force[1] (March 1981) | State of Hawaii | Percentage | County of Hawaii | Percentage | District of Ka'u | Percentage |
|---|---|---|---|---|---|---|
| Male | 405,000 | 100.0 | 36,000 | 8.9 | est. 1,241 | 0.3 |
| Female | | | | | | |
| Unemployed | 21,500 | 5.3 | 2,700 | 7.5 | N/A | N/A |
| Unemployment by Ethnic Group[2] (Total 1975) | | | 2,668 | 100.0 | DATA NOT AVAILABLE | |
| Caucasian (incl Portugese) | | | 824 | 30.9 | | |
| Japanese | | | 675 | 25.3 | | |
| Filipino | | | 151 | 5.7 | | |
| Hawaiian and Part Hawaiian | | | 670 | 25.1 | | |
| Other | | | 348 | 13.0 | | |
| | | | | 100.0 | | |
| Income Distribution | | | | | Puna-Ka'u District | |
| No. of Families (1975) | 201,000[3] | 100.0 | 19,514[4] | 100.0 | | |
| Median Income per Family (1975)[4] | N/A | | $11,354 | | $10,131 | |
| No. Families below Poverty (1975)[5] | 13,000 | 6.4 | 2,959 | 15.2 | | |

[1] State Department of Labor and Industrial Relations, Research and Statistics Office, "Labor Area News," April 1981.

[2] Hawaii Data Book 1981, Table 211.

[3] Hawaii Data Book 1977, Table 190.

[4] County of Hawaii, Department of Research and Development, "County of Hawaii Data Book 1980, Table 162."

[5] Hawaii Data Book 1980, Table 249.

10. The fiscal conditions of the State of Hawaii and County of Hawaii are better than they have been in the past due to a new state constitutional amendment limiting expenditures and recent State tax revenues being higher than budgeted. In fiscal year 1979, State revenues totalled $1,577,866,000 of which $337,367 was in Federal grants-in-aid. Expenditures amounted to only $1,482,995,000 (Hawaii County Data Book, 1980). County of Hawaii revenues for the same period totalled $41,371,000 and expenditures were only $38,784,000.

11. Life, Health, and Safety. A discussion of tsunamis and earthquakes appears in paragraph 5, Appendix C. All of Ka'u is in the US Geological Survey Seismic Zone 3, the highest and most dangerous. On January 1, 1975, there was a major subsidence of the land centered off Punaluu estimated to be 5.6 on the Richter scale. The most dramatic tsunami occurred on April 2, 1868, accompanying a local earthquake, which resulted in what was believed to be a runup of more than 65 feet in the South Point-Punaluu region. See paragraph 6 above for a description of the destruction in the Kaulana Bay area. During the same period, a destructive lava flow inundated several prehistoric Hawaiian settlements below the pali (cliff), four miles northwest of Kaulana Bay. An ancient, undated aa lava flow itself forms the rocky point bordering the east side of Kaulana Bay while the western portion of the bay area consists of older, weathered flows.

12. As outlined in the Main Report, boat damage and health risk to boaters and fishermen is a major concern to the local fishermen of Ka'u who normally use the Kaulana Bay launch ramp. One long-time commercial fisherman noted at a workshop held in September 1979 at Naalehu that he damaged his boat one out of every five times he launched or recovered it using the Kaulana Bay ramp. Another full-timer fisherman remarked that he had lost seven boats in his first 20 years of fishing at South Point. Damage occurs not only during launch and recover, but also due to having to moor on the west side of South Point when recovery is impossible due to high waves. High waves also damaged parked trailers near the launch ramp. The Hawaii County Economic Opportunity Council estimated in July 1979 that during the previous four or five years, two lives had been lost due to conditions at Kaulana, sixteen boats and pieces of equipment had been damaged, two individuals had been injured and $30,000 worth of damage had been done to vehicles. (The monetary measurements of these damages have been factored into the National Economic Development Account). At the Corps-sponsored public workshop held on July 9, 1980 at Naalehu, the participants noted that the two lives had been lost in 1979 due to high surf and an inability to seek shelter along the South Point coast. In addition, one fisherman had suffered a heart attack at sea and was delayed in coming into shore at Kaulana by high seas.

13. There is also a complete lack of utilities and readily-available emergency services for those who utilized Kaulana Bay launch ramp. The nearest permanent water line is four miles distant north toward the highway. The nearest US Coast Guard Patrol Boat is stationed at Hilo, approximately 80 nautical miles from South Point. There is a County police station at Naalehu, about 16 miles from Kaulana Bay and a County fire station at Pahala, about 30 miles from Kaulana. The nearest hospital is a State-operated facility at Pahala with a 15-bed capacity.

14. Long-Term Productivity and Displacement of People, Farms and Businesses. There are no temporary or permanent residences, farms or businesses in the immediate vicinity of Kaulana Bay. The nearest permanent residence is believed to be about eight road miles (or six direct miles) from Kaulana Bay

in the Kamaoa Homestead area. There are only a small number (less than ten) of farm residences located in Kamaoa Homestead. Nearly all the land in Kamaoa Homestead and the large surrounding parcels owned by B.P. Bishop Estate and the State Department of Hawaiian Home Lands are utilized solely for cattle grazing. This area, designated as Tax Map Key Zone 9, Section 3 of the Third Division comprises 28,562 acres, of which 25,762 acres (or 90 percent) is zoned Agriculture by the County of Hawaii (Hawaii County Data Book, 1980). The remaining acreage is zoned as Open. Existing land uses are similar to the zoned areas. In fact only 0.14 percent of all Ka'u District land is in non-agricultural or non-open uses. For a distance of five miles to the north and northwest, all land is owned by the Department of Hawaiian Home Lands. This area, which comprises most of the Kamaoa-Puueo ahupua'a (a traditional Hawaiian land unit), consists mainly of Eutrandept soils, a well-drained volcanic ash soil with high inherent fertility. The prehistoric aa lava flows located adjacent and to the northeast of Kaulana Bay are a comparatively small area containing too little soil to be considered a true soil group and have practically no agricultural potential. Water is the limiting factor. Rainfall averages between 10 and 30 inches per year south of the main highway and there are no large-scale developed groundwater sources in the Kamaoa-Puueo region, although potential sources do exist near Naalehu and eastward toward Punaluu (Hawaii Water Resources Regional Study, April 1975). If a plentiful supply of inexpensive water could be developed, the Big Island Resource Conservation and Development Council believes that Kamaoa-Puueo could be developed into a productive area for sugarcane, truck crops or orchard uses (1978). A more conservative attitude is reflected in the "Hawaiian Home Lands General Plan" adopted by the State of Hawaii in April 1976. That plan recommends that the best potential for its 10,366 acres lies in grazing, and forage crops if additional water can be obtained. Under the plan, the current policy is to convert the Kamaoa-Puueo holdings from general lease to pastoral lease for eligible Hawaiians who would be permitted to construct single-family farm residences on their leased parcels. Funds were appropriated for preparing a development plan for the Kamaoa-Puueo area, but they lapsed before the plan could be prepared. The Kawaihae Ranch currently holds a revocable, year-to-year permit to utilize 10,190 acres for grazing purposes. The cattle are not bound within fenced areas, thus they often wander down into the boat launch ramp area.

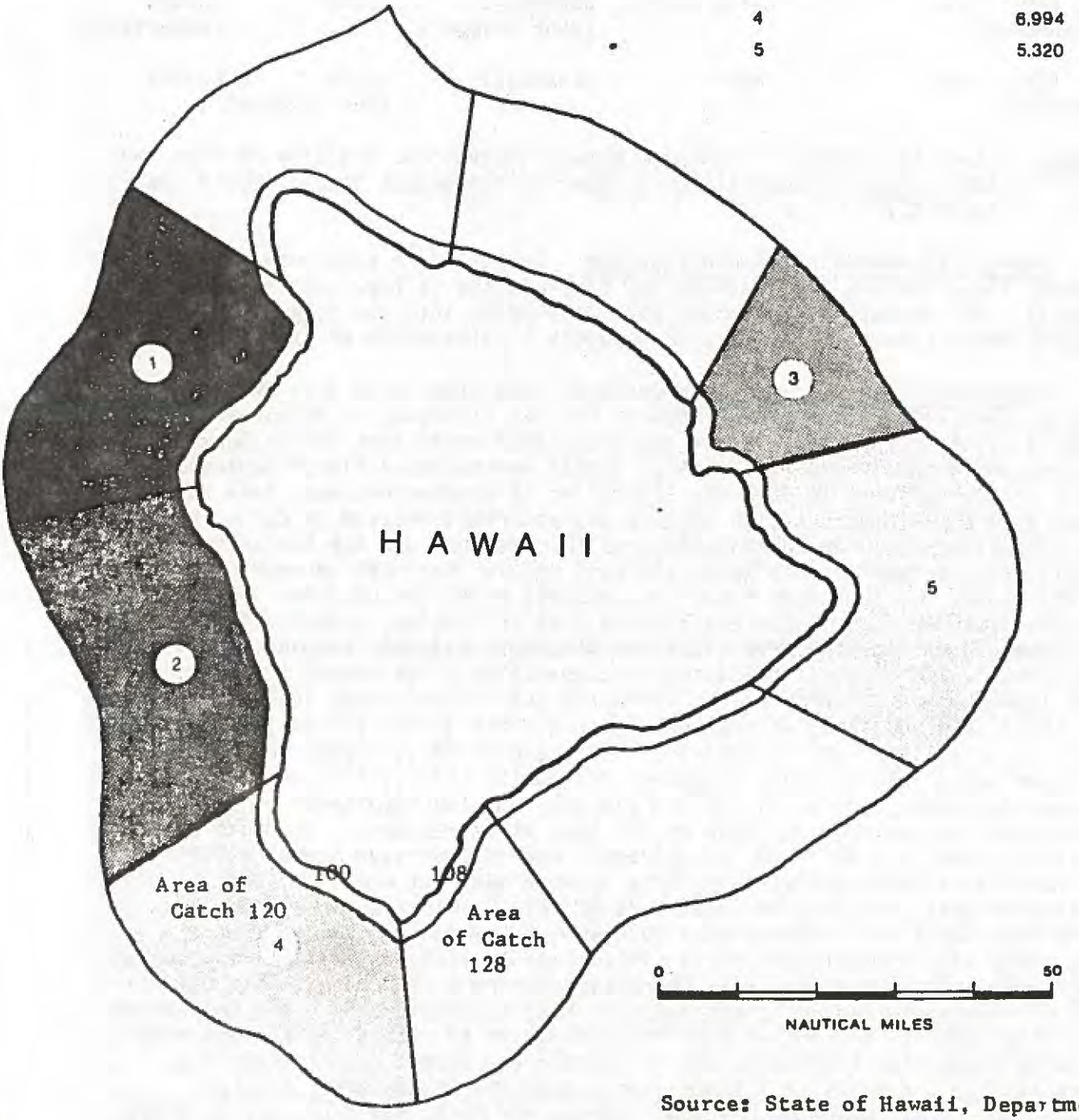
15. Approximately 1,000 feet west of Kaulana Bay lies an abandoned World War II airstrip and associated concrete pads that once anchored temporary buildings. This facility is now controlled by the Department of Hawaiian Home Lands, but could conceivably be developed into living quarters or a commercial base for the fishing and recreational activities that occur at Ka Lae.

16. No studies have been conducted to determine the long-range potential of the fisheries to the west and east of Ka Lae. The "Hawaii Coastal Zone Fisheries Management Study" produced by the State Division of Fish and Game in March 1980 reports that the waters west of Ka Lae ranked fourth in average annual catch of major bottom fishes from 1973-1977 (see Figure D-4). Table D-3 below indicates the top ranking species for the inshore and offshore area of catch to the west of Ka Lae (Areas 100 and 120, respectively) and the inshore and offshore areas of catch east of Ka Lae (Areas 108 and 128, respectively). Another fish not mentioned in the Fisheries Management Study is the ulua or jack crevalle which is supposed to be the most popular fish caught by shoreline fishermen, particularly those fishing off the cliffs on the west side of Ka Lae Lighthouse. The only statement that can be made about the long-term productivity of this area of converging currents is that it has been attracting native fishermen for over 1,200 years.

Figure D-3

AVERAGE ANNUAL CATCH OF MAJOR BOTTOM FISHES FROM 1973 – 1977

| SEGMENT RANKING | CATCH (POUNDS) |
|---|---|
| 1 | 24,398 |
| 2 | 12,631 |
| 3 | 7,629 |
| 4 | 6,994 |
| 5 | 5,320 |




Source: State of Hawaii, Department of Lan and Natural Resources, Division of Fish and Game, "Hawaii Coastal Zone Fisheries Management Study," March 1980.

Table D-3. Top Ranking Fish by Total Pounds Caught in 1977, Island of Hawaii

| Area | #1 | #2 | #3 | #4 | #5 |
|---|---|---|---|---|---|
| 100 (offshore) | opelu (Mackerel Scad) | ahi (Yellow Fin) | menpachi (squirrel fish) | aweoweo (red bigeye) | moana (goat fish) |
| 108 (inshore) | opihi (limpet) | ahi | menpachi | opelu | ono (wahoo) |
| 120 (offshore) | ahi | blue marlin | opakapaka (pink snapper) | opelu | kahala (amberjack) |
| 128 (inshore) | ahi | ono | opakapaka | onaga (red snapper) | kahala |

Source: State Department of Land and Natural Resources, Division of Fish and Game. "Hawaii Coastal Zone Fisheries Management Study," March 1980, Table 6.2.

17. Energy Requirements and Conservation. There are no electrical transmission lines leading into Kaulana Bay nor into the Ka Lae/South Point area in general. The nearest established power line leads into the former US Navy Pacific Missile Range Facility approximately 2 miles north of Ka Lae point.

18. Recreational Resources. In comparison with other districts in Hawaii County, there is greater overall demand for participation in inland-resource-based activities than for coastal-resource based activities (State Department of Land and Natural Resources (DLNR), "State Recreational Plan," September 1980). This reflects in part the attraction of Volcano National Park and the three public golf courses (the most of any district) located in Ka'u. Ka'u is the second-most popular destination area for visitors and the fourth most popular for residents, Kona being the most popular for both categories of participants. On the other hand, the greatest perceived need for facilities or perceived individual interest in Ka'u lies in fishing, swimming/sunbathing at a beach park, boating from slips and moorages, walking, jogging, and bicycling. DLNR surveys showed that a comparatively low demand for boating from launch ramps. There are two currently used launch ramps in Ka'u. One is the State-owned facility at Kaulana Bay; the other is the privately-owned, but publicly accessible ramp at Punaluu. The State of Hawaii Department of Transportation holds no legal easement for public transit through Department of Hawaiian Home Lands to Ka Lae and Kaulana, but the Department of Hawaiian Home Lands has not made an issue of the lack of an easement. In South Kona District, there are also two launch ramps, one is a private one at Milolii and the other is a State-operated facility at Honaunau. At one time, the "Statewide Boat Launching Facilities Master Plan" prepared in 1972 for the State Department of Transportation by Koebig & Koebig recommended that a long-range plan be developed for a single-lane facility at Kaalualu Bay, about five miles northeast of Kaulana, to replace the ramp at Kaulana. The Department of Transportation no longer supports that recommendation. The Department currently supports the Master Plan recommendation to retain the Kaulana ramp to serve commercial fishermen, and to improve the access road to the site. There is also a remnant of a State pier within the State-owned, County-controlled parcel called Ka Lae Boat Landing and Park, but there are no plans to develop this area as a boat landing.

19. Other recreational resources in the Ka Lae-Kaulana Bay area include the unimproved Ka Lae Beach Reserve located along the western coast of Ka Lae (see above) and Mahana Bay (Green Sands) Beach, located two miles northeast of Kaulana Bay, which is only a potential resource. There are no present plans to develop either of these two beaches into formal recreational areas. Still, on most any week day, there may be ten or more auto campers scattered around Ka Lae, mostly families of shoreline and offshore fishermen. These numbers increase on weekends. The Ka Lae area is recognized as one of seven critical demand camping areas on Hawaii by the "County of Hawaii: Recreation Plan" prepared by Aotani & Associates in 1973. Some people also come to the Ka Lae area to see the ancient archaeological sites.

## III. IMPACTS

20. South Point National Historical District. This discussion of the effects of the alternative plans on the National Register district serves as partial compliance with the Advisory Council on Historic Preservation's 36 CFR 800.9 and 800.13(b). Plans 1, 2, and 3 have been evaluated and found to have potentially adverse effects on archaeological features located on the rocky point bordering the eastern side of Kaulana Bay and perhaps the cultural features found in the embankment immediately adjacent to and east of the present ramp. These features are located within the South Point National Historical District which is listed on the National Register of Historic Places and is also designated as a National Landmark. The features on Kaulana Bay Point are probably associated with Kapalaoa Village which has been identified to be of precontact (1778) origin. If construction equipment such as trucks and cranes must maneuver along the eastern bank of Kaulana Bay to dredge the entrance channel and part of the turning basin for all three plans and to place stone to construct the breakwater for Plan 1, then there is a high probability of direct damage to or destruction of some of the archaeological features identified on Figure D-3. Since the point is also allegedly kapu or tabu, any major disturbance to the structures on the point may be culturally unacceptable to local residents. It is conceivable that the construction equipment may be able to maneuver within severely restricted paths and zones which would serve to isolate the equipment from the surface archaeological features, but placing such restrictions on a construction contractor may not be feasible. It is likely therefore the construction of Plan 1 would result in unavoidable damage to or destruction of some of the aforementioned archaeological features.

21. Construction of Plans 2 and 3 could be planned to avoid most, if not all, contact with any of the archaeological features by directing the contractor build temporary moles extending from the western edge of the bay. The dredging and rock laying equipment would then operate from these moles without having to maneuver directly on Kaulana Point. If these avoidance measures cannot be implemented, the less desirable alternative remains to mitigate for the possible damage to or destruction of features by recording the features in detail and recovering an adequate sample of the information contained in the features by salvage archaeology. For reasons discussed in the Main Report, no other sites in the study area were considered to satisfactorily achieve the planning objectives nor did they meet desires of the resident Ka'u fishermen. The construction of a breakwater does introduce a new visual element into the

physical and cultural landscape of Kaulana Bay [36 CFR 800.3(b)], but it is reasoned that the function of the breakwater and improved navigational facilities at Kaulana Bay is in keeping with the prehistoric and historic offshore fishing tradition at Ka Lae. Thus, the visual intrusion of the breakwater is not considered adverse.

22. Urban and Community Impacts. Any navigational improvements to the Kaulana Bay boat launch ramp under either Plans 1, 2, or 3 are expected to have no direct measurable effect on population growth or composition in Ka'u District. The isolation of the launch ramp and the normal roughness of the offshore water is not expected to attract many new recreational boaters and fishermen, particularly those who would permanently relocate to the Ka'u District. Nevertheless, a gradual growth in some of the district's existing new residential developments at Ocean View Estates, Discovery Bay, and C. Brewer's resort at Punaluu and Ninole can be anticipated over the next twenty years and some of the new residents probably will utilize the improved boat launch ramp. Neither is the improved boat ramp expected to have greatly significant effects on increased employment and income levels in the fishing, boating and related industries in Ka'u. There will be some direct effect as discussed in the Evaluation Appendix F, but the effect will be relatively insignificant compared with the tourist and agricultural sectors or the Ka'u and Hawaii County economy as a whole. If a fishing industry can develop on the scale of Stan Shimizu's Fishery out of Honaunau, Kona, an example of a small entrepreneur made good, then the effects on local employment and income levels will be more pronounced. Full-time and part-time commercial fishing out of Kaulana Bay should remain an occupation confined primarily to local Japanese, Filipino and Hawaiians. More fishermen from outside Ka'u District, however, are likely to drive to South Point from North and South Kona and from Hilo to utilize the new facilities with its safer and more ready access to the rich fishing grounds nearby.

23. Life, Health, and Safety Impacts. Improved launching conditions should substantially reduce personal injuries and the likelihood of being unable to recover boats in severe conditions offshore. Personal risk and possibility of damage to boats moored on the western side of Ka Lae may not be substantially altered even with the improved conditions at Kaulana, depending on how long fishermen chose to remain near the good fishing spots there even when sea conditions begin to turn dangerous.

24. If electrical power, telephone service and water and sanitary services are provided at the new launch ramp site, the distance over which the new utilities will cover will probably involve the local sponsor in spending a relatively large amount of money in addition to its share of construction costs. Bringing utilities into isolated South Point could also have adverse visual effects on the wild, natural landscape. It would be preferable to leave the launch ramp area unimproved, including no paved parking facility. As more and more fishermen and boaters come to use the improved facilities at Kaulana Bay, there will be a concurrent deterioration of the road into the launch ramp. Consideration may have to be given by the State to improve portions of the access road, as recommended by the 1972 "Statewide Boat Launching Facilities Master Plan." Navigational aids should be battery powered to avoid the necessity and cost of bringing power lines into Kaulana Bay and to conserve energy. If a supply of potable water and the provision of restroom facilities are needed, consideration should be given to developing them at the old military camp where the

landscape has already been modified and where an abandoned water tank remains. Emergency telephone service may also be deemed a necessity, but consideration should be given to providing a CB radio for emergency purposes to avoid the high cost in money and energy to bring telephone lines several miles from existing lines to Kaulana Bay.

25. Impacts on Long-Term Productivity and Displacements of People, Business and Farms. There will be no displacements of any people, businesses, or farms as a result of implementing any of the alternatives. There should be no direct or indirect effect on the long-term productivity of the surrounding agricultural lands since their future is controlled by the State Department of Hawaiian Home Lands. It is not known what effect there will be on the long-term productivity of the nearshore and offshore fishery at Ka Lae. Ka'u residents have shown some concerns about outsiders coming in to pick crab and opihi (limpets) off the strand should an improved boating facility be provided.

26. Energy Requirements and Conservation. Energy consumption for construction of the project can be estimated by the amount of fuel required to run construction equipment including trucking of concrete, stone and other supplies from Hilo, dredging the entrance channel and turning basin, and constructing the breakwater. The fuel estimates were based on the assumption that 50 percent of the project direct costs would be for equipment and that 15 percent of the equipment cost would be for diesel fuel and 5 percent for lubrication oil. The volume of fuel used under Plan 1 was calculated to about 141,000 gallons @ $.90/gallon. The volume of fuel used under Plans 2 and 3 amounted to about 50,000 gallons.

27. If utilities such as potable water, sewage, electricity or telephone service were provided to the Kaulana launch ramp site, the indirect energy costs of bringing these utilities five miles or more from their present extensions into the Kamaoa-Puueo plain would be extremely high. Moreover the provision of the utilities to the remote Kaulana Bay area could induce further development which would be out of character with the nature of the National Historic District and the bleak, wind-swept cape. It is suggested that no utilities be brought into the site and that navigational lights be restricted to battery-powered facilities.

# KAULANA BAY

# NAVIGATION IMPROVEMENTS

# SOUTH POINT, ISLAND OF HAWAII

## NATURAL RESOURCES
## AND
## FISH AND WILDLIFE COORDINATION

APPENDIX E

APPENDIX E

NATURAL RESOURCES AND
FISH AND WILDLIFE COORDINATION
APPENDIX

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# I. NATURAL RESOURCES

## a. Marine Resources

The substratum throughout most of Ka'u coastline consists of hard lava rock covered in places by accumulation of silt and coral rubble. A number of bays along this coastline contain scattered massive heads of Porites coral. Coral growth elsewhere in these bays are limited to scattered Pocillopora colonies possibly a consequence of the constant wave action occurring in these areas. A variety of common reef fish and marine benthic invertebrates including gastropod mollusks, sea urchins, sea cucumbers and crabs are present along the coastline. Table E-1 provides a list of marine fishes and invertebrates observed at two sites by Corps of Engineers biologists during a field trip in June 1980. Green sea turtles are occasionally observed offshore but no known nesting beaches are located in the Ka'u area. The endangered humpback whale has also been observed along the Ka'u coast in transit to or from the shallow shoals that comprise their preferred wintering habitat, primarily Penguin Banks and the area between Maui, Lanai and Molokai.

## b. Vegetation

The coastal area of the Ka'u District is characterized by sparse vegetation consisting primarily of indigenous strand plants such as ilima, Pa'u-o-Hiiaka and beach morning glory with patches of Bermuda grass occurring in backshore areas. A list of plant species observed at two locations along the Ka'u coast by Corps biologists is contained in Table E-1.

## c. Wildlife

Wildlife species in the Ka'u District are also limited in abundance and diversity. Shorebirds including the golden plover, wandering tattler and ruddy turnstone probably utilize available shallow feeding habitat in the area. Passerine birds, field mice, and rats are also found in this area. Domestic cattle are raised on the extensive pasture lands of Southpoint. Other domestic animals may occasionally be found in the area.

## d. Endangered Species

No species listed on the Federal List of Endangered Species have been observed in the immediate project area at Kaulana. The U.S. Fish and Wildlife Service Endangered Species Office has indicated that the endangered Hawaiian hoary bat may occur in the project area. If this is the case, it would be transiting the airspace above the bay while feeding off the Ka'u coast. The project area is barren and otherwise devoid of roosting habitat for the Hawaiian bat. Hence the proposed project would have no impact on this species. Two endemic plants occurring in the Ka'u region are candidates for listing on the Federal list. As candidates these species are presently being reviewed by the FWS for consideration to propose and list as endangered or threatened. Neither of these species have been observed in the project area.

## e. Air Quality

No air quality data are available from the Southpoint area. Because of its distance from the highway and other sources of particulate emissions, air quality in the study area is presumed to be good.

f. Coastal Water Quality

Water quality data are not available from the study area. The waters are considered perennially dry open coastal waters receiving very little influence from terrestrial sources. However, during trade wind and Kona storm conditions, water in Kaulana Bay and adjacent nearshore areas are generally turbid resulting from suspended particulate matter.

g. Marine Mammals

The bottlenose dolphin (Tursiops gilli) has been sighted in coastal waters adjacent to the study area. Two strandrings have been recorded in the area involving a killer whale (Orcinus orca) and a gooseneck whale (Ziphius cavirostris). Humpback whales (Megaptera novaengliae) have also been observed off the Ka'u coast. No marine mammals are known to appear in the harbor project area.

h. Wildlife Refuges. No national or local wildlife refuges occur within the project area.

i. Marine Sanctuaries. No marine sanctuary has been designated in or adjacent to the project area.

j. Harvestable Shellfish Beds. No harvestable shellfish beds occur within or adjacent to the project area.

k. Migratory Birds. No migratory bird breeding or nesting areas are located in the project area.

l. Wetlands. No wetlands occur in or immediately adjacent to the project area. An anchialine pond is located approximately a mile from Kaulana Bay at Lua O Palahemo. The pond is the result of a flooded lava tube. Lua O Palahemo has been nominated for inclusion in the State Natural Area Reserve System.

TABLE E-1
FLORA AND FAUNA OBSERVED AT KAULANA AND PUNALUU BAYS

A. Vegetation

| Family<br>Genus species | KAULANA | PUNALUU |
|---|---|---|
| Anacardiaceae | | |
| Schinus terebinthefolius | | X |
| Boraginaceae | | |
| Heliotropium spp. | X | |
| Messerschmidia argentea | | X |
| Convolvulaceae | | |
| Impomoea pes-caprae | X | X |
| Jacquemontia sandwicensis | X | |
| Leguminosae | | |
| Seucaena leucocephala | | X |
| Malvaceae | | |
| Sida fallax | X | |
| Palmae | | |
| Cocos nucifera | | X |
| Passifloraceae | | |
| Passiflora spp. | X | X |
| Gramineae | | |
| Cynodon dactylon | | X |

B. Marine Fishes

| Family (Common name)<br>Genus species | KAULANA | PUNALUU |
|---|---|---|
| Engraulidae (Nehu) | | |
| Stolephorus purpureus | X | |
| Synodontidae (Lizardfish) | | |
| Saurida gracilis | X | |
| Muraenidae (Moray eel) | | |
| Gymnomuraena zebra | | X |
| Gymnothorax undulatus | X | X |
| Holocentridae (Squirrelfish) | | |
| Myripristis sp. | | X |
| Mugilidae (Mullet) | | |
| Mugil cephalus | | X |

TABLE E-1 Continued
FLORA AND FAUNA OBSERVED AT KAULANA AND PUNALUU BAYS

| | | |
|---|---|---|
| Kuhliidae (Aholehole) | | |
| *Kuhlia sandvicensis* | | X |
| Apogonidae (Cardinalfish) | | |
| *Apogon* spp. | X | X |
| Mullidae (Goatfish) | | |
| *Mulloidichthys flaviolineatus* | X | X |
| *Parupeneus multifasciatus* | X | X |
| Kyphosidae (Rudderfish) | | |
| *Kyphosus bigibbus* | | X |
| Chaetodontidae (Butterflyfish) | | |
| *Chaetodon miliaris* | | X |
| *C. quadrimaculatus* | X | X |
| *C. auriga* | | X |
| *C. lunula* | X | |
| Cirrhitidae (Hawkfish) | | |
| *Paracirrhites forsteri* | X | X |
| *P. arcatus* | | X |
| *Cirrhites pinnulatus* | X | X |
| Pomacentridae (Damselfish) | | |
| *Plectroglyphidodon johnstonianus* | X | X |
| *Chromis* sp. | X | X |
| *Abudefduf abdominalis* | | X |
| Labridae (Wrasse) | | |
| *Labroides phthirophagus* | | X |
| *Chelinus rhodochrous* | | X |
| *Thalassoma fuscum* | X | X |
| *T. dupperre* | X | X |
| *Coris gaimard* | | X |
| *Stethojulis balteata* | X | X |
| *Gomphosus varius* | X | |

B. Marine Fishes (Cont'd)

| Family (Common name) Genus species | KAULANA | PUNALUU |
|---|---|---|
| Scaridae (Parrotfish) | | |
| *Scarus dubius* | X | X |
| *S. perspicullatus* | X | X |
| Zanclidae (Moorish idol) | | |
| *Zanclus cornutus* | | X |

TABLE E-1 Continued
FLORA AND FAUNA OBSERVED AT KAULANA AND PUNALUU BAYS

| | | |
|---|---|---|
| Acanturidae (Surgeonfish) | | |
| *Acanthurus triostegus* | X | X |
| *A. nigrofuscus* | X | X |
| *A. dussumieri* | | X |
| *Naso unicornis* (skeletal remains only) | X | |
| Blenniidae (Blennys) | | |
| *Cirripectes variolosus* | | X |
| *Plagiotremus goslini* | | X |
| Canthigasteridae (Sharpback puffer) | | |
| *Canthigaster jactator* | | X |

C. Marine Invertebrates

| Phylum<br>Family (Common name)<br>*Genus species* | KAULANA | PUNALUU |
|---|---|---|
| Porifera<br>(Sponges) | | |
| 2 unknown species | 1 species | 1 species |
| Coelenterata | | |
| Poritidae (Lobe coral | | |
| *Oirutes lobata* | X | X |
| Pocilloporidae (Finger coral) | | |
| *Pocillopora meandrina* | X | X |
| Annelida | | |
| Terebellidae (Spaghetti work) | | |
| *Lanice* sp. | | X |
| Mollusca | | |
| Neritidae (pipipi) | | |
| *Nerita picea* | X | X |
| Littorinidae (Periwinkle) | | |
| *Littorina pintado* | X | X |
| Thaididae (Drupe) | | |
| *Drupa ricina* | X | |
| *Morula* sp. | X | |
| Conidae (Cone shell) | | |
| *Conus flavidus* | | X |
| Vermetidae (Tube worm) | | |
| *Serpulorbis variabilis* | X | X |
| Crustacea | | |
| Grapsidae (Rock crab) | | |
| *Metapograpsus messor* | | X |
| *Grapsus grapsus* | X | X |

TABLE E-1 Continued
FLORA AND FAUNA OBSERVED AT KAULANA AND PUNALUU BAYS

| | | |
|---|---|---|
| Echinodermata | | |
| Asteroidea (Sea star) | | |
| Linckia multifora | | X |
| Echinoidea (Sea urchin) | | |
| Echinometra mathaei | | X |
| E. oblongata | | X |
| Diadema paucispinum | X | X |
| Echinothrix spp. | | X |
| Colobocentrotus atratus | X | X |
| Heterocentrotus mammilatus | | X |
| Tripneustes gratilla | | X |
| Eucidaris metularia | | X |
| Holothuroidea (Sea cucumbers) | | |
| Holothuria atra | X | X |
| H. hilla | X | X |
| Actinopygia mauritiana | X | X |
| Ophiuroidea (Brittle star) | | |
| 2 unidentified species | 2 species | 2 species |

## II. FISH AND WILDLIFE COORDINATION

a. Fish and Wildlife Coordination Act of 1958.

In accordance with the Fish and Wildlife Coordination Act of 1958 (P.L. 85-624) the US Fish and Wildlilfe Service was officially consulted. Figure E-1 indicates the Fish and Wildlife coordination input requirements at the various stages of the study.

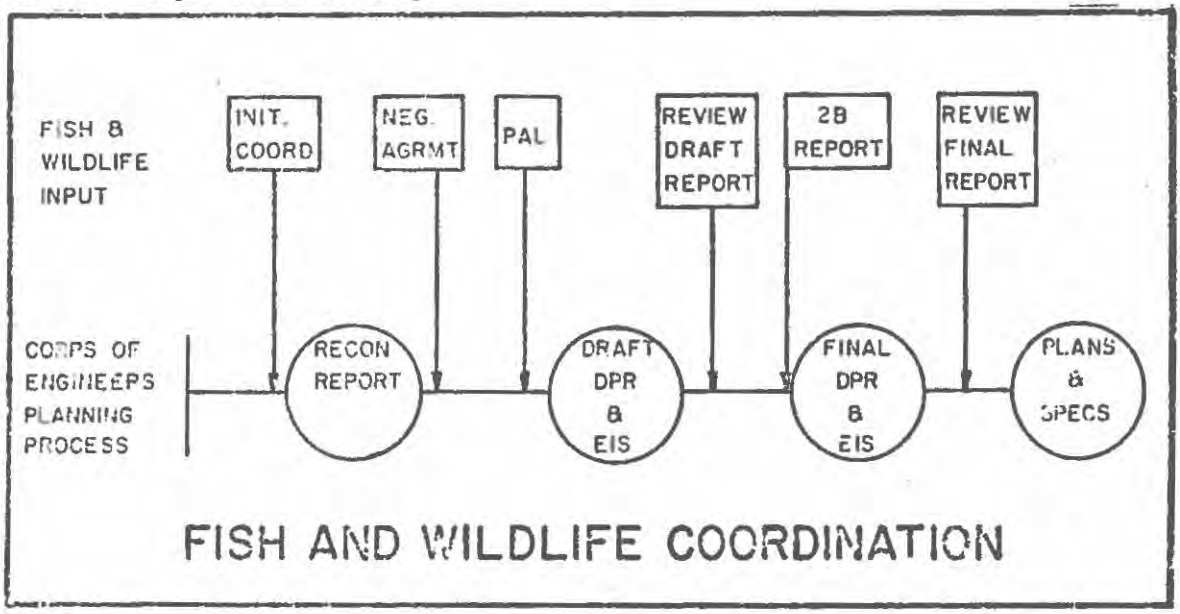


Figure E-1

A Planning Aid Letter (PAL) report was provided to the Corps of Engineers on 24 August 1979 and included in this appendix. This planning aid evaluated the construction of navigation improvements at Kaulana Bay. A Section 2(b) report will be provided after a plan has been selected. The report will recommend fish and wildlife conservation and development, mitigation and/or compensation for habitat and resource losses associated with our proposed plan. The 2(b) report will be included into the final Detail Project Report.

b. Summary of Requirements.

| FWL Input | Time Table |
|---|---|
| PAL | Completed January 1981 |
| Review Draft Report and EIS | 45 days after receipt of draft report<br><br>Tentative date of draft report. Completion: June 1981. |
| Section 2(b) Report | 30 days after notification of the selected plan.<br><br>Tentative schedule: August 1981 for submission of 2(b) report. |

c. Planning Aid Letter.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P. O. BOX 50167
HONOLULU, HAWAII 96850

IN REPLY REFER TO:
ES
Room 6307

January 27, 1981

Colonel Alfred J. Thiede
U.S. Army Engineer District Honolulu
Building 230
Fort Shafter, Hawaii 96858

Re: (PAL) Kaulana Bay
Small Boat Harbor
Island of Hawaii, Hawaii

Dear Colonel Thiede:

This is the U.S. Fish and Wildlife Service's Planning Aid Letter regarding plans by the Honolulu District of the U.S. Army Corps of Engineers to construct a small boat harbor at Kaulana Bay, Island of Hawaii, Hawaii. These comments are preliminary in nature and do not constitute the report of the Secretary of the Interior on the project within the meaning of Section 2(b) of the Fish and Wildlife Coordination Act. When a final construction plan is selected and provided to the Service, a Section 2(b) Report will be prepared.

This document has been prepared using various reports provided by the Corps, a project site inspection by Service biologists and other relevant data concerning the project area.

DESCRIPTION OF THE AREA

Kaulana Bay is a small indentation on the southern coast of the island of Hawaii, approximately 1 mile east of South Point. It is approximately 200 feet wide and 265 feet long. A concrete boat ramp at the foot of the bay is used as a launching site for small fishing vessels.

The area is somewhat isolated and does not appear to receive much water-oriented recreational use except boating.

On January 6, 1981, Service biologists conducted a snorkeling survey of the bay . Twenty-two species of fish were identified and several unidentified species were seen. There were numerous small heads of coral (Porites lobata) and other common Hawaiian invertebrates. The tide pools adjacent to the bay contain the common blennie Istiblennius zebra and various species of algae, the most prominent of which was Caulerpa racemosa.

The submerged portion of the project area is not unique as similar habitat exists throughout the Kona coast.

An alternate harbor site at Punaluu Beach Park was also investigated. Although a snorkeling survey of the northern portion of the bay was attempted, very little could be determined regarding abundance or diversity of the fish and invertebrates due to a severe thermocline or halocline coupled with high turbidity. Most of the time, visability was so poor that fish could not be identified. In the occasional clear spots, large numbers of Tripneustes gratilla, Diadema sp. and Echinometra mathaei were seen. In these clear areas, fish could be identified and were approximately the same species as seen at Kaulana Bay.

The black sand beach at Punaluu is a popular recreation area. It is likely that if this site was selected for the project, the increased boat traffic would conflict with the recreational use of the beach.

DISCUSSION

Five alternative project plans were evaluated, four at Kaulana Bay and one at Punaluu. Construction of any of the five alternatives would have a similar and minimal impact on fish and wildlife resources in the area since neither site is biologically unique.

The possible presence of two rare plants (Sesbania hawaiiensis and Portulaca hawaiiensis) in the Kaulana Bay area has been noted in the project Reconnaissance Report dated January 8, 1980 and in the Section 7 Consultation Report provided by the Service on January 20, 1981. In this regard, our principal concern is to insure that these plants are not damaged by project construction activities.

RECOMMENDATIONS

Since the two project sites are biologically similar, the U.S. Fish and Wildlife Service recommends the Kaulana Bay site be selected for the project to avoid conflict with recreational uses. If the Kaulana Bay site is selected, the Service also recommends that prior to the start of construction, a detailed survey be conducted to locate and mark individuals of the two rare plant species in the area to be utilized by construction equipment. A similar survey should be conducted in the dredge spoil disposal site and quarry or borrow site. Additionally we recommend the following precautions be taken to protect water quality.

1. Extreme care will be taken to insure that no debris, petroleum products, or other deleterious materials be allowed to fall, flow, leach or otherwise enter the water.

2. All construction activities within and adjacent to the water will be conducted so as to minimize turbidity and control erosion.

3. If a bucket dredge is used, there shall be no stockpiling of materials in the water to obtain full buckets.

4. On land, spoil disposal will be conducted behind maintained berms above the influence of the tide. Only clean runoff water from the spoil disposal area will be allowed to re-enter the waterway.

5. Spoil disposal areas will be protected against erosion by vegetative cover or other suitable means.

If due caution is exercised during construction, the project should have a minimal adverse biological impact on the area.

We hope this information will prove useful. Please keep us informed as to further Corps action on the project.

Sincerely yours,

Nevin D. Holmberg
Deputy Project Leader for
Environmental Services

# KAULANA BAY

# NAVIGATION IMPROVEMENTS

# SOUTH POINT, ISLAND OF HAWAII

## ECONOMIC ANALYSIS

APPENDIX F

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ECONOMIC ANALYSIS APPENDIX

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APPENDIX F

# ECONOMIC ANALYSIS

## BENEFIT ANALYSIS

Benefits are estimated to accrue to the commercial fishing fleet using Kaulana navigation facility. These benefits basically result from the measured difference between conditions with and without the proposed plan of improvements. All of the proposed plans accomplish essentially the same physical results, and benefits attributable to the alternative plans do not differ measurably from each other.

The existing fishing fleet of about 80 boats will experience benefits due to decreased damage, greater fish catch, and enhanced safety. Recreational boating is minimal in this area due to rough sea conditions. Recreational opportunities may be somewhat enhanced with an improved launching area. However, rough seas in the area require expert boatmanship, and any increase in recreational use will probably not be economically significant.

## FISHING FLEET

The fishing fleet at Kaulana consist of about 80 boats, some full-time, some part-time, and come mainly from three districts. For congruency, all fishing boats at Kaulana are converted to equivalent full time fishing boats. Of the 66 boats from Ka'u-Kona District, 17 percent are full-time, and 83 percent are part-time averaging one trip per week. The 14 boats from Hilo average four months of the year fishing at Kaulana. The total equivalent full-time fishing boats equal 23 boats.

$$(66 \times 17\%) + (66 \times 83\% \times 52/365) + (14 \times 4/12) = 23 \text{ boats}$$

## REDUCTION OF DAMAGES

Present users of the launch ramp experience destruction and damages to boats and launching equipment of about $74,700 per annum as detailed in Table F-1. All repairable damages are based on 23 equivalent full-time fishing boats and 55 percent of the fleet experiencing damages during a typical year.

It is difficult to accurately estimate the reduction in sustained damages with improved conditions. Damage reduction benefits are based on the assumption that damages incurred are proportional to the percent of time that conditions prohibit launching. Based on an engineering analysis of navigation at Kaulana, existing conditions preclude launching 40 percent of the time. With the proposed improvement, this is reduced to 15 percent of the time, resulting in average annual damages of $74,700 x 15/40 = $28,000 per year for a saving of $46,700 per year.

TABLE F-1. DAMAGES AT KAULANA RAMP

| Description | Damage Estimated |
|---|---|
| Damage to propellers and housing. Average cost $160 to $250 each. Average three per boat per year [($160 + $250) (1/2) (3) (23) (55%)] | $ 7,800 |
| Gimbal Housing. Average two break each month of total fleet at an average cost per break of $1,000 [(2) (12) ($1,000) (55%)] | 13,200 |
| Bent or broken trailer spindal (axle and housing) from bouncing with waves. Average three to four times per trailer per year. Average cost $150 per trailer damaged per year [(3 + 4) (1/2) ($150) ($23) (55%)] | 6,600 |
| Damage to truck pulling trailer while bobbing on ramp. Average $400 to $500 per damaged truck per four months. [(400 + 500) (1/2) (12/4) (23) (55%)] | 17,100 |
| Damaged bottom of boat from bouncing at ramp with waves. Repairs done by owner. | 10,500 |
| Sub Total (repairable damages) | $55,200 |
| Twenty-eight boats destroyed within the past 15 years while moored along the coastline or while being delayed at the launch ramp due to wave action. Average boat value $12,700. Damages = (23 x $12,700 x 1/15) | 19,500 |
| Damages for a typical year | $74,700 |

INCREASED FISH CATCH

Using data from a most recent (1980) survey at Kaulana, the commercial fishing fleet operation from Kaulana currently averages 1,481 fishing trips per year with an average catch per trip of 361 pounds and average value per pound of $1.20. The average net income computed per trip is $377 as shown on Table F-2. With the proposed project, an increase in the fish catch and hence increase in net income can be expected as a result of:

a. An increase in the average number of boats able to operate due to the decrease in damages resulting in less "downtime."

b. An increase in the number of trips due to improved conditions which would permit launching a greater percent of the time.

TABLE F-2. AVERAGE NET INCOME PER TRIP, KAULANA FISHING FLEET

| | |
|---|---|
| Average Catch Per Trip | = 361 lbs |
| Average Value Per Pound | = $1.20 |
| Average Revenue Per Trip | = 361 lbs x $1.20 = $433 |
| Average Cost Per Trip | = $56 |
| Average Net Income Per Trip | = $433 - 56 = $377 |

Although the fleet is comprised of 23 equivalent boats, the average equivalent number of boats operational at any time is less than 23, since damaged boats are inoperative during repair. A survey of fisherman using the ramp has reported that during the past years 55 percent of the boats received damages each year. This computes to an equivalent 12.6 boats (23 x 55% = 12.6) damaged per year. It took an average of 1/2 month for the repair of each boat damaged. With the proposed improvement this downtime will be reduced so that the effective size of the operational fleet will be greater, resulting in an increase in trips, fish catch, and net income.

The downtime experienced for the Kaulana fishing fleet is equal to one equivalent boat out of 23 boats being inoperative for 6.3 months per year. (23 x 55% x 1/2 mo = 6.3 mos.) With the project, this downtime factor will decrease by an estimated 5/40 (based on the assumption discussed in connection with damage reduction benefits). The effect on the equivalent size of the operational fleet is as follows:

a. Average equivalent boats operating per year without project [23 - (6.3/12)] = 22.47 boats.

b. Average equivalent boats operating per year with project [23 - (6.3/12 x 15/40)] = 22.80 boats.

An engineering analysis of Kaulana navigation conditions has shown that launching is now possible about 60 percent of the time, and that project protection would result in an icrease to 85 percent. If the number of trips made per year per boat were proportional to this factor, the indicated increase in trips per year would be about 42 percent (85/60 = 1.42). Contacts with fishermen using the launch ramp have indicated that conditions permit launching 50.4 percent of the year. With the project the ramp would be usable 85 percent of the time, indicating an increase in trips per year of about 69 percent (85/50.4 = 1.69).

Analysis of physical conditions at Kaulana suggest that an increase in boat trips per year of between 42 percent and 69 percent is possible and reasonable. The lower estimate of 42 percent, which relies on available climatological data is used in the benefit computations.

The benefits resulting from an increase in the number of trips per year due to improved navigability and launching conditions, and to the increase in the number of boats in operating condition is calculated below. This benefit is the increase in net income based on an increased fish catch.

Net income without project:

(1,481 trips/yr) ($377/trips) = $558,000 per year

Net income with project:

(1,481 trips/yr) (85%/60%) (22.80/22.47) ($377/trip) = $802,000 per year

Average annual increased fish catch benefit:

$802,000 - 558,000 = $244,000

Not included in the above downtime is time lost while waiting for wave conditions to improve to either launch or retrieve boats. A time-loss incident was recorded (Table F-3) when it required 1-hour and 10-minutes to launch one boat and retrieve four boats from sea. Assuming 2 to 5 minutes as an average time per movement on the ramp under ideal condition, the entire procedure could have been accomplished in 25 minutes (5 boats x 5 min = 25 min). Fishermen at Kaulana stated that an average waiting period of 1/2 to 1 hour outside the bay for wave action to subside so that channel conditions are safe to enter is a normal occurrence.

TABLE F-3. TIME LOSS INCIDENT

| Period | Incident |
|---|---|
| 12:55 p.m. | 2 boats entered bay for retrieval.<br>2 boats arrived outside bay; waiting. |
| 13:07 p.m. | 1st boat brought on land. |
| 13:09 p.m. | 2d boat brought on land.<br>3d boat waiting outside came in bay. |
| 13:40 p.m. | 3d boat cannot land on ramp and returned to sea outside of bay; began waiting. |
| 13:41 p.m. | 4th boat came in to bay. |
| 13:46 p.m. | 4th boat brought on land. (A fortuitous minute.) |
| 13:50 p.m. | One boat entering ramp to go into water, having a hard time going in the water. |
| 13:53 p.m. | Boat off trailer and into water and out into ocean. |
| 13:56 p.m. | 3d boat returned to bay. |
| 14:05 p.m. | 3d boat brought on land. |

ENHANCED SAFETY

In addition to the economic returns resulting from improved conditions as described above, unquantifiable benefits would result from a greater degree of safety. Numerous injuries have been incurred with use of the existing launching facility, as indicated below. Information was obtained from interviews covering a 12-month period.

a. Smashed toe from trailer bouncing on ramp from wave action.

b. Smashed finger and hand from boat bouncing on trailer during launch and retrieval of boat.

c. Cut hand and sprained muscle while holding guideline (rope) that stretch from ramp to channel entrance to keep boat from drifting into the rocky coast.

d. Cut feet and gash on head from fall due to rough wave action during retrieval.

As a direct result of incidents like these, expenses are incurred in the form of medical costs and potential income foregone because of a missed trip. Improved launching condition would largely eliminate such occurrences and could possibly prevent a fatal accident.

SUMMARY OF BENEFITS

The estimated average annual benefits which would result from the proposed plan of improvement are summarized in Table F-4.

TABLE F-4. SUMMARY OF AVERAGE ANNUAL BENEFITS

| | |
|---|---|
| Reduction of damage | $ 46,600 |
| Increased fish catch | 244,000 |
| Reduction of loss time and catch from waiting outside of bay | not computed |
| Enhanced safety | not quantified |
| TOTAL | $290,600 |