KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS

Maui, Hawaii

DETAILED PROJECT REPORT and ENVIRONMENTAL IMPACT STATEMENT

DRAFT

[redacted]

MAR 1989

US Army Corps
of Engineers
Honolulu District

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

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KAHULUI, ISLAND OF MAUI, HAWAII

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SYLLABUS

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Kahului Light Draft Navigation Improvements
Kahului, Island of Maui, Hawaii

1. **Authority.** This study was accomplished under the authority of Section 107 of the River and Harbor Act of 1960, as amended.

2. **Purpose.** The study was conducted to evaluate and determine the need, feasibility, and Federal interest in providing commercial light draft navigational improvements at Kahului, Maui.

3. **Description.** The project study area is located within the Kahului Deep Draft Harbor on the north coast of the island of Maui, Hawaii. The north coast of Maui and the Kahului area have several navigational problems: 1) inadequate light draft navigation facilities, 2) excess demand for existing light draft navigation facilities due to a rapidly growing commercial fishing industry, and 3) windward exposure to trade winds.

The lack of a dredged entrance channel and protected turning basin, inadequate water depths, and numerous coral and rock outcroppings make use of the existing light draft navigation facility at Kahului hazardous. In addition, launching and retrieval operations are difficult due to the steepness of the existing ramp.

4. **Recommended Plan.** Based on the needs and desires of the community, the expected benefits and costs, and the environmental impacts of the alternatives investigated, Plan A1 is recommended as the most feasible and suitable plan.

PROJECT FEATURES	
Breakwater	130 feet
Turning Basin	
Length	100 feet
Width	100 feet
Depth	8.5 feet
Entrance Channel	
Length	1,030 feet
Width	50 feet
Depth	9.5 feet
Launch Ramp	Two lanes

PROJECT INVESTMENT COST	$2,047,000
AVERAGE ANNUAL COST [1]	
Investment	$184,000
Maintenace	$9,000
TOTAL	$193,000
AVERAGE ANNUAL BENEFITS	$339,000
AVERAGE ANNUAL NET NED BENEFITS	$146,000
BENEFIT TO COST RATIO	1.8

[1] Based on 50 years, 8-7/8% interest rate.

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NAVIGATION IMPROVEMENTS
MAUI, HAWAII

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KAHULUI LIGHT DRAFT
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MAIN REPORT

DRAFT DETAILED PROJECT REPORT
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS

1 STUDY AUTHORITY

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

2 STUDY PURPOSE AND SCOPE

2.1 Purpose

This study was conducted to evaluate and determine the need, feasibility, and Federal interest in providing commercial light draft navigational improvements within Kahului Deep Draft Harbor on the north coast of the island of Maui, Hawaii.

The study was initiated following a letter, dated 3 May 1983, from the State of Hawaii, Department of Transportation, Harbors Division, requesting that the U.S. Army Corps of Engineers, Pacific Ocean Division, Honolulu District (HED), conduct a study for a commercial fishing facility within the existing Kahului Deep Draft Harbor. The study request was made after the need for light draft navigation facilities at Kahului Harbor were identified and reviewed in a working document for the "Review of the Coasts of Hawaiian Islands Study" prepared by the U.S. Army Corps of Engineers, Honolulu District (HED) in March 1983. An initial appraisal report was completed in October 1983 and a reconnaissance report was completed in September 1984.

2.2 Description of Study Area

The study area is located within the Kahului Deep Draft Harbor, on the north coast of the island of Maui, Hawaii. Maui is a part of the Hawaiian Archipelago (see Figure 1) which is located in the North Pacific Ocean and extends northwest to southeast from about 155 to 179 degrees west longitude to around 19 to 28 degrees north latitude. The Hawaiian Island chain consists of eight major islands (Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai, and Niihau) which constitute more than 99 percent of the total land area of the State of Hawaii, or about 6,500 square miles. The state capitol, Honolulu, is located on the island of Oahu, approximately 2,560 miles southwest of Los Angeles, California.

Maui, located approximately 100 miles southeast of Honolulu, is the second largest in size of the eight major islands, consisting of 728 square miles of land area and 120 miles of coastline. The estimated 1986 resident population of Maui was 78,700. The island was formed from two major volcanic cones, the West Maui cone (Puu Iki) and the East Maui Cone or Haleakala. Kahului Harbor is situated on the north side of the isthmus which separates the two cones.

The town of Kahului, which surrounds the harbor, had an estimated population of 13,000 in 1980. Approximately 2 miles to the west of Kahului is the town of Wailuku, the Maui County seat, with a 1980 population of 10,000. Commercial activities for the island are centered around the Kahului-Wailuku area.

Kahului Harbor is Maui's only deep water port. The harbor features include a 600-foot wide entrance channel; two breakwaters on the east and west side of the entrance channel, 2,800 and 2,300 feet in length, respectively; and a harbor basin 2,050 feet wide, 2,400 feet long and 35 feet deep. The total freight traffic for Kahului deep draft harbor in 1986 was 1,626,650 short tons. Foreign import and export traffic equaled 43,379 and 78,485 short tons, respectively, and domestic receipts and shipments consisted of 873,387 and 631,399 tons, respectively. The study area is located on the west side of the harbor adjacent to an area of coral fill adjoining the west breakwater. The undeveloped fill area, has been designated for the development of a park. An existing boat launch ramp is located on the southwest corner of the fill area. The harbor area and existing facilities are presented on Figure 2.

2.3 Scope of Study

This study identified and evaluated the problems, needs, and opportunities associated with providing light-draft navigational improvements to serve the needs of local commercial fisherman in the Kahului-Wailuku area of Maui. In addition, this study assessed the impacts upon the overall environmental, economic, social, cultural, and recreational resources of the area. Alternative sites and design layouts were developed and the costs and benefits associated with implementing these measures were evaluated.

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

The objective of this study is to provide the results of a planning process based on increasingly specific stages of investigation. At the conclusion of each stage, the range of possible

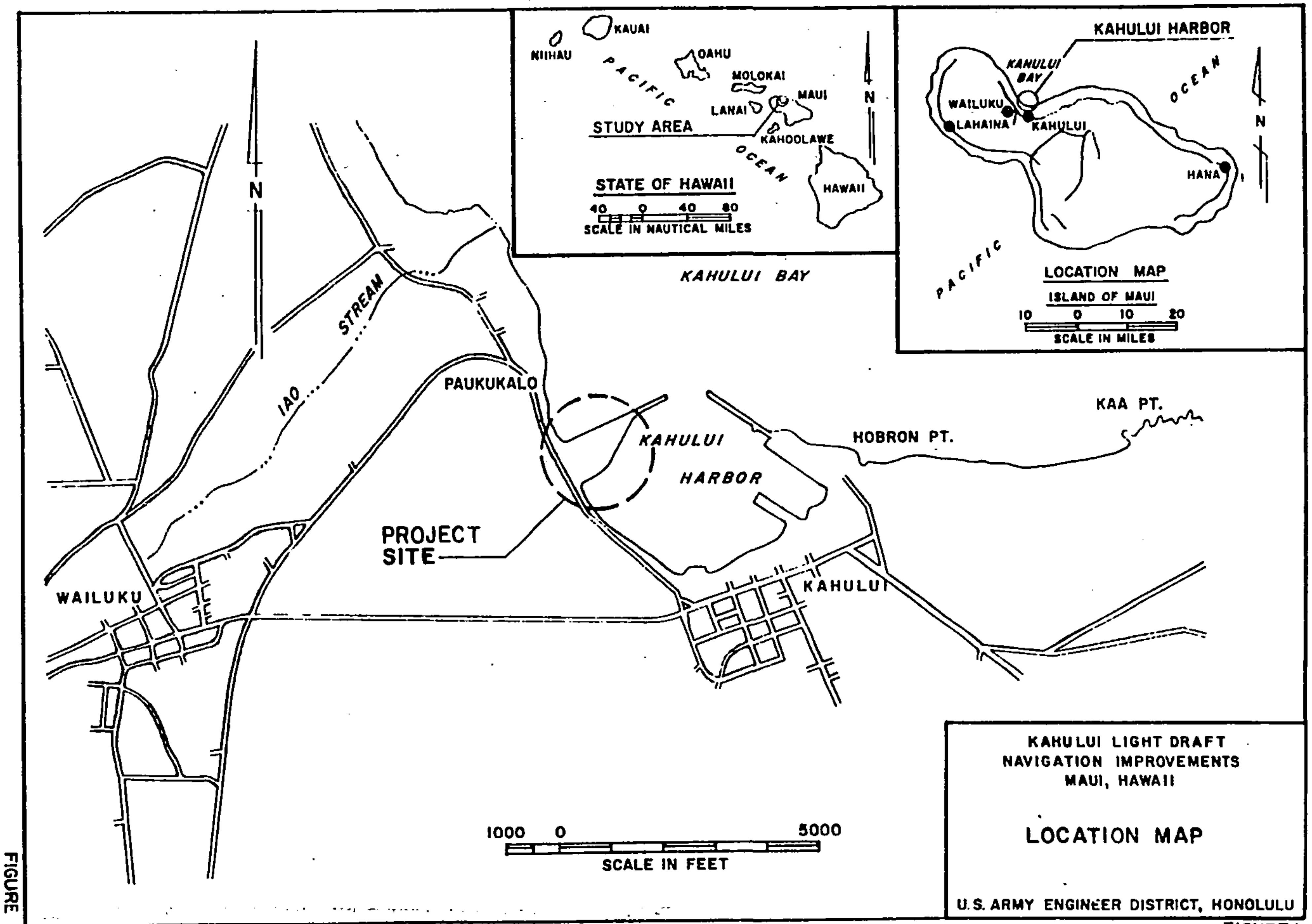
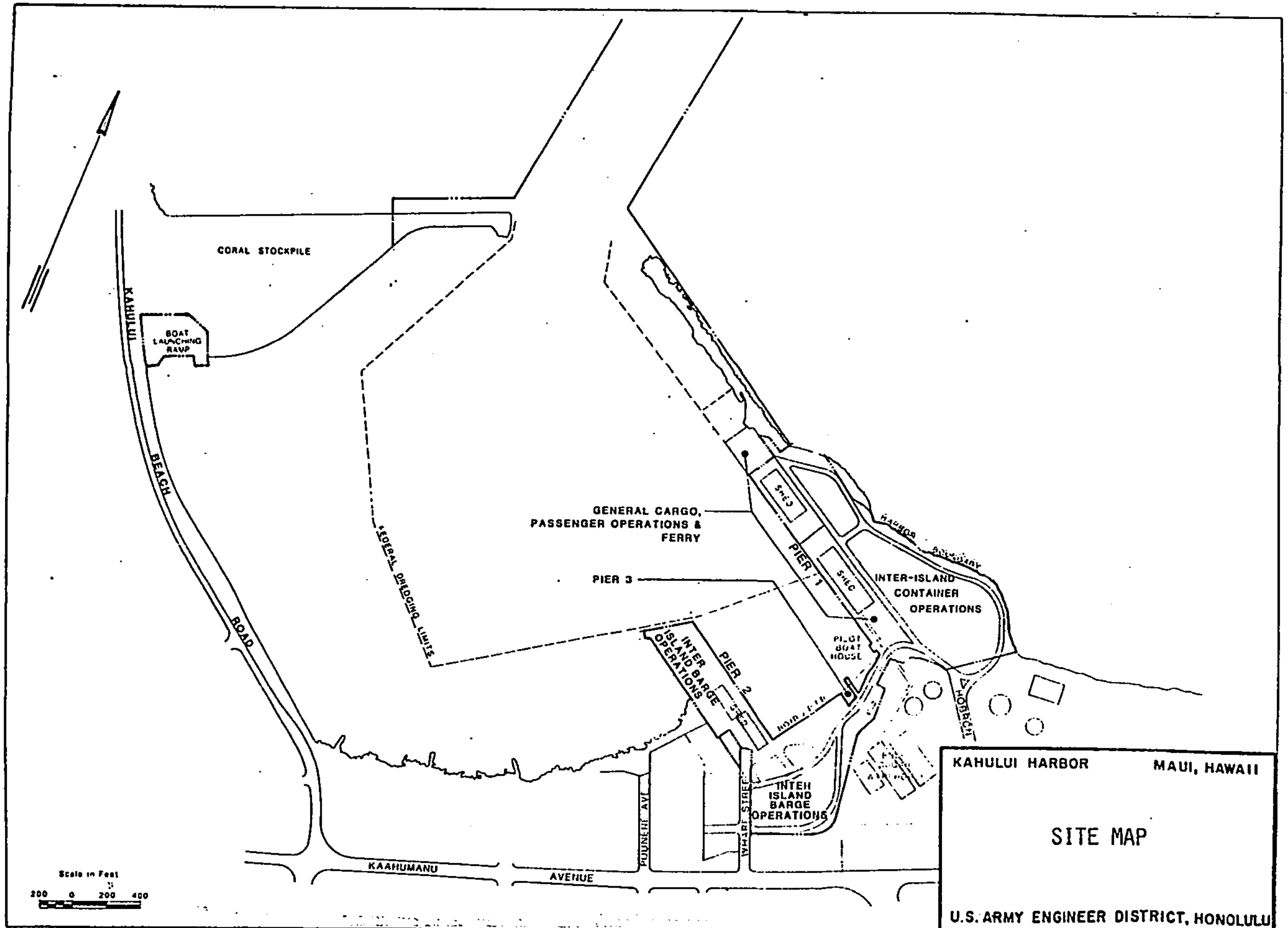


FIGURE 1

FIGURE 1


KAHULUI HARBOR
MAUI, HAWAII
SITE MAP
U.S. ARMY ENGINEER DISTRICT, HONOLULU
CORAL STOCKPILE
BOAT LAUNCHING RAMP
KAHULUI BEACH ROAD
FEDERAL DREDGING LIMITS
GENERAL CARGO, PASSENGER OPERATIONS & FERRY
PIER 3
PIER 1
SHED
INTER-ISLAND CONTAINER OPERATIONS
HARBOR BOUNDARY
PILOT BOAT HOUSE
PIER 2
INTER ISLAND BARGE OPERATIONS
INTER ISLAND BARGE OPERATIONS
WHARF STREET
PUUNENE AVE
KAAHUMANU AVENUE
Scale in Feet
200 0 200 400
FIGURE 2

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

The Detailed Project Report (DPR) constitute the basic document for construction for the U.S. Army Corps of Engineers small projects or continuing authorities program. Construction plans and specifications can be initiated after subsequent acceptance of the DPR by the Corps' Chief of Engineers and receipt of local assurances and funds from the State of Hawaii..

2.4 Study Participants and Coordination

The U.S. Army Corps of Engineers, Pacific Ocean Division, Honolulu District, was responsible for conducting and coordinating the overall study and preparing the study report. Close coordination has been maintained with the State of Hawaii, Department of Transportation, Harbors Division, the local study sponsor.

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.

3 PRIOR STUDIES, REPORTS, AND EXISTING WATER PROJECTS

The U.S. Army Corps of Engineers, Honolulu District, completed an initial appraisal report in October 1983 and a reconnaissance report in September 1984 on light draft navigation improvements for Kahului Harbor. These reports established Federal interest in providing possible light draft navigational facilities for Kahului Harbor under Section 107 of the River and Harbor Act of 1960, as amended.

A number of other studies have been prepared concerning Kahului Harbor and the island of Maui. Studies referenced or utilized in the preparation of this report are cited in the list of references.

4 PLAN FORMULATION

4.1 Planning Methodology

This section of the report describes the study area and defines the problems to be addressed by this study. This includes describing the base conditions, identifying public concerns, analyzing the navigation problems and needs and establishing planning criteria. Specific planning objectives are then identified and refined based on national policies and local concerns.

National planning policies are prescribed by the Water Resources Council's Principles and Guidelines (1983), 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 Water Resources Development Act of 1986 (PL 99-662), the Clean Water Act of 1977 (PL 95-217) and various Corps of Engineers policy guidelines and regulations.

The base condition of the study area is initially defined to help identify potential water resources problems and to identify valuable resources in the study area. The base condition is the existing economic, social and environmental characteristics of the study area. Future conditions are then projected and analyzed to arrive at the "most probable future." This is the condition that would be most likely to occur without any changes to existing facilities or resource management plans. This is also referred to as the "without project" condition. Planning objectives are then formulated based on the problems and needs of the study area as related to the "without project" condition. Any proposed plans of improvement are subsequently compared against the "without project" condition to determine their potential benefit.

4.2 National Objectives

The Water Resources Council Principles and Guidelines (P&G) for planning water and related land resources, define the objectives of national economic development (NED). The NED objective is achieved by increasing the value of the nation's output of goods and services and improving national economic efficiency. The Federal objective is to contribute to NED consistent with protecting the Nation's environment pursuant to national environment statutes, applicable executive orders, and other Federal planning requirements.

In accordance with the P&G, various alternative plans are to be formulated in a systematic manner to insure that all reasonable alternatives are evaluated, including a plan that reasonably maximizes the NED benefits, consistent with the Federal objective. Other plans which reduce net NED benefits in order to further address other Federal, State, local, and international concerns not fully addressed by the NED plan may also be formulated. The NED plan recommending Federal action is to be the alternative plan with the greatest economic benefit, unless the Secretary of a department or head of an independent agency grants an exception to this rule.

Four accounts are established to facilitate evaluation and display or effects of alternative plans. The national economic account is required. Other information that is required by law or that will have a material bearing on the decision making process should be included in the other accounts or in some other appropriate format used to organize information of effects.

1. The national economic (NED) account displays changes in the economic value of the national output of goods and services.

2. The environmental quality (EQ) account displays monetary effects on significant natural and cultural resources.

3. The regional economic development (RED) account registers changes in the distribution of regional economic activity that results from each alternative plan. Evaluations of regional effects are to be carried out using nationally consistent projections of income, employment, output, and population.

4. The other social effects (OSE) account registers plan effects from perspectives that are relevant to the planning process but are not reflected in the other three accounts.

4.3 Existing Conditions

4.3.1 Physical Setting

4.3.1.1 Geology

The island of Maui was formed from two volcanic domes, Haleakala and Puu Iki, which are separated by a low strip of land, consisting of overlapping lava flows, known as the Isthmus. Haleakala, sometimes called the East Maui volcano, is 10,025 feet high and 33 miles across. The West Maui volcano, Puu Iki, is roughly one-half the size of Haleakala. Eruptions which built most of these two volcanoes ended sometime around the early Pleistocene Epoch, or about 0.8 to 1.3 million years ago. Many smaller phases of volcanism have occurred in recent geologic times (~ 10,000 years b.p.) with local eruptions having occurred on Haleakala as late as about 1750. The relative sizes of the mountains in addition to the occurrence of deeply incised amphitheater headed valleys on the West Maui volcano, supports the fact that dormancy was achieved on this volcano before Haleakala. Most of the lava flows on both volcanoes dip gently seaward at about twelve degrees.

The Isthmus was formed by lava flows from Haleakala ponding against the older West Maui volcano. The Isthmus is covered with alluvium deposited chiefly by streams from West Maui which flow on steep gradients and drop their sediment load upon reaching the relatively flat Isthmus. Extensive calcareous sand dunes attaining heights up to 200 feet cover a narrow strip of the Isthmus from Kahului on the north shore to Kihei on the south shore. The dunes diminish rapidly in height and size in the southern direction. The dune sand is chiefly comminuted coral, shells, and foraminifera with small and variable percentages of basalt sand.

Kahului Harbor is located on the north shore of the Isthmus connecting East Maui and West Maui and is centrally positioned in Kahului Bay. Most of the harbor was dredged into the naturally formed Kahului Bay. The harbor is bordered to the south and east by Maui's principal towns of Kahului and Wailuku. Kahului Harbor is enclosed within Kahului Bay by two major breakwater structures. The mouth of Iao Stream is located approximately one mile north of the west breakwater of Kahului Harbor. Iao Stream has meandered throughout the Kahului Harbor area in the recent geologic past, incising ancient reefs and backfilling the stream valley with basalt sands, gravels, cobbles and boulders. These sediments have subsequently been reworked by wind, current and waves in the harbor. The backshore areas of the west half of Kahului Bay were subsequently inundated (and buried) by the landward migration of dune sand.

During the dredging for the deepening of Kahului Harbor in 1962, excavated earth materials were stockpiled (spoiled) along the inner nearshore portion of the west breakwater. A peninsula of filled land (at the study area) was created along this breakwater from the hydraulic (suction/cutter head) dredging method used. This undeveloped filled peninsula is approximately 8 to 13 feet in elevation, flat, revetted, and presently used for parking by fishermen. An existing boat launch ramp, small mooring dock and 70-foot long stub breakwater are located on this filled peninsula at the west corner of the Kahului Harbor.

The bathymetry of the nearshore area adjacent to the harbor is gentle and slopes seaward because of the relatively low energy depositional environment nearshore and the deposition of sediments in former topographic depressions and surge channels further offshore. The shoreline bottom area is a portion of a fringing coralline platform or marine shelf which is predominantly calcareous sediments in various degrees of lithification ranging from loose to well-cemented. The reef rests on ancient lava flows. The landward portion was constructed on cemented beach rock and volcanic boulders and cobbles (beach rubble). The sediments range in size from silts to boulders and are clastic marine sediments with occasional volcanic cobbles and boulders which form a gradual seaward sloping terrace.

4.3.1.2 Climate

Kahului has an equable temperature regime, marked by seasonal variation of rainfall, persistent surface winds from the northeast quadrant and the rarity of severe storms. The monthly average temperature is 75 degrees Fahrenheit with a range of around 7 degrees between the warmest month, August, and the coldest month, February. Rainfall averages below 20 inches annually with June being the driest month. Hurricanes with winds greater than 75 miles per hour rarely affect the Kahului area; however, tropical storms may pass through close enough to produce heavy rain and strong winds. Humidity at

Kahului is moderate to high, with wet season humidities averaging slightly higher than those in the dry season. The natural ventilation of the prevailing trade winds, however, provide a pleasant climate even during the warmer months.

4.3.1.3 Winds

Kahului Harbor is exposed to prevailing winds from the north and northeast directions. Trade winds from this quadrant, averaging from 10 to 15 miles per hour, prevail more than 75 percent of the time. Sustained wind velocities, ranging between 25 and 35 miles per hour, occur approximately one-third of the time.

4.3.1.4 Storms

The trade wind conditions which dominate the weather pattern in the Hawaiian Islands results in partly cloudy skies with brief showers prevalent in the mountain areas. Storm conditions usually result from a breakdown of the normal circulation of the trade winds and are relatively infrequent. Storms typically occur during the autumn and winter months; however, intense local convection storms of short duration can occur at any time of the year.

Three classes of disturbances which produce major storms in Hawaii are cold fronts, low pressure passages, and true tropical storms or hurricanes. Cold fronts, which occur about one to eight times during the winter, cause spotty rainfall and gusty winds. Low pressure storms called "Kona" storms, also occur during the winter months. These storms are characterized by strong and persistent southerly and south westerly winds and intense rainfall. However, due to the location of Kahului Harbor on the north side of Maui, Kona storms have only a minor effect on the harbor area. Hurricanes are infrequent, but tropical storms with winds below hurricane force are more prevalent and pass close to the Hawaiian Islands on the average of once every three years. Tropical storms generate very strong winds and intense rainfall.

4.3.1.5 Tides

The primary tidal bench mark for Kahului Harbor is a standard disc, stamped "2 1929" and set in the concrete deck floor at the northeast corner of the warehouse at the shore end of Pier 2. Tidal data based on nine years of records, 1951-1959, and taken by the U.S. Coast and Geodetic Survey are tabulated below.

	Feet
Highest Observed Tide (11/12/58 and 6/20/58)	3.6
Mean Higher High Water (MHHW)	2.30
Mean High Water (MHW)	1.90
Mean Tide Level (MTL)	1.15
Mean Low Water (MLW)	0.40
Mean Lower Low Water (MLLW)	0.00
Lowest Observed Tide (19-20 June 1955)	-1.2

4.3.1.6 Waves

Kahului Harbor is exposed to prevailing winds and waves from the north and northeast quadrants. The northeast tradewinds waves and the north swell are the two primary waves types that affect the harbor area. The northeast tradewind waves, present throughout the year but more frequent between May and September usually dominate the local wave spectrum. They result from the strong trade winds, averaging 10 to 20 miles per hour, blowing out of the northeast quadrant over long fetches of open ocean. Typically, these deep water waves have periods ranging from 6 to 10 seconds and heights of 4 to 12 feet. Generally, northeast trade waves are present from 80 to 90 percent of the time during the summer season, and from 60 to 70 percent of the time during the remainder of the year. Northern swells are generated in the north Pacific Ocean by intense winter storms. These waves typically have periods of 12 to 18 seconds with deep water heights of 5 to 25 feet. These are some of the largest waves that reach the Hawaiian islands and usually occur during the winter season of October through March.

Wave data for the Kahului area was collected from July 1966 to March 1969 from a wave gage sensor located approximately 1,860 feet north of the head of the east Kahului breakwater. The wave data recorded wave heights of 9 feet or less 96.1 percent of the time. The highest wave recorded was 28 feet with a period of 16 seconds and occurred during a storm from 4-6 December 1968. Prior to the December 1968 storm, the maximum recorded wave height was 19 feet. Periods of wave gage equipment outages did not coincide with any known occurrences of storm waves at Kahului Harbor.

4.3.1.7 Currents

Currents outside the Kahului Harbor breakwaters are predominantly east to west and northward along the coast. Inside the harbor, clockwise current prevails during flood tide; counterclockwise current during ebbtide. The currents along the west and south shores within the harbor show no definite pattern, but appear to be generally eastward as evidenced by accretion at Pier 2. Except in the dredged areas of the harbor, the water is relatively shallow with average depths of 5 to 10 feet.

4.3.1.8 Tsunamis

The history of tsunamis in Hawaii includes several phases. In the 19th century, tsunamis were reported in newspapers, weeklies and books written by residents and as a result, it was not always possible to know the cause of the various high wave phenomena. By the end of the 19th century seismological stations became available and it became easier to associate a distant earthquake with tsunamis in Hawaii. In the early 1900's, tide gage records were kept to see if distant earthquakes did cause waves in Hawaii. After 1946, the Pacific Tsunami Warning System was established which gathered information on tsunamis. In 1869, 1872, 1878, 1903, 1919, 1921 and 1924, locally generated tsunamis were associated with earthquakes of Kilauea and Mauna Loa. Since 1946, there has been six significant tsunamis in which the maximum wave height recorded at Kahului was 17 feet. A March 1964 tsunami resulted in a runup elevation of 12.1 feet and flooded the shopping center located near the waterfront causing about $53,000 in damages.

4.3.2 Environmental Resources

4.3.2.1 Terrestrial Biota

The terrestrial vegetation along the shoreline of the study area consists of common native and introduced species, including beach naupaka (Scaevola taccada), Bermuda grass (Cynodon dactylon) and tree heliotrope (Tournefortia argentea). Migratory shorebirds include the wandering tattle (Heteroscelus incanus) and ruddy turnstone (Arenaria interpres). No endangered species are known to inhabit the study area, although Kanaha Ponds, a State Wildlife Sanctuary over a half-mile from the study site provides habitat for the endangered Hawaiian Stilt (Himantopus mexicanus knudseni) and Hawaiian coot (Fulica americana alai).

4.3.2.2 Marine Biota

The coral fill at the west breakwater is revetted with armor stone boulder which provides habitat for intertidal organisms such as a'ama crab (Grapsus tenuicrustatus), periwinkles (Littorina spp.), false opihi (Siphonaria normalis), and various algae (Ulva sp.). The substrate in the area of the existing boat launch ramp is dominated by coarse sand and shell fragment with little topographic relief. The primary fish habitats are the interstices of the armor stone revetment and the pilings of the wooden dock. Of particular commercial fishery value are nehu (Stolopherus purpureus) and seasonal runs of oama

(**Mulloides flavolineatus**) and hahalalu (**Selar crumenophthalumms**) observed in the area. While crabbing, spearfishing, limu-picking, pole-fishing and harvesting baitfish occur in the study area, the area fronting the boat ramp is closed to net fishing, except for crab and opae (Palaemon debilis) netting and the harvest of baitfish by licensed commercial fishermen.

Further offshore, the reef flat substrate is characterized by cobble, fine sand, and occasional limestone boulders. The zooanthid **Palythoa** spp., the dominant organism on the reef flat, and **Holothuria atra**, sea cucumber, are common. Algae found on the reef flat includes **Cladophora fasicularis**, **Ulva fasciata**, **Stypopodium hawaiianesis**, and **Acanthophora spicifera**.

In the middle of the bay site, the intertidal habitat is characterized by well-worn large cobbles and small boulders. The most common species are **Littorina pintado** and **Siphonaria normalis**. Drifting seaweed collects in the shallow water at this site and opae are harvested there.

The subtidal habitat is characterized by a low relief cobble and sand substrate. Common species included zooanthid Palythoa spp. and various green algaes (Cladophora sp. and Ulva sp.).

The northern end of the fill revetment contains a more diverse marine community than the boat launch ramp area or the middle bay site. Corals such as Montipora flabellata, Pocillopora meandrina, P. damicornis, Porites lobata, and P. compressa have colonized on the boulders of the revetment. In this area, 35 fish species were observed. The vertical walls of the revetment provide the primary habitat for various reef fish with the interstices serving as an excellent habitat for the toau (Lutjanus fulvus) and other reef species.

4.3.2.3 Water Quality

Kahului Harbor is classified as Class II waters under the State of Hawaii Department of Health regulations, Title 11, Chapter 54 - Water Quality Standards. The harbor is part of Kahului Bay and is protected by two breakwaters. No fresh water streams or significant springs enter the harbor, although is some fresh water seepage into the harbor from the inland basal groundwater body. A summary of the water quality data is included in Appendix F.

4.3.2.4 Air Quality

Normal trade winds patterns in the Kahului area minimize the potential for air quality problems. During times of agricultural burning, levels of particulate matter are increased. The State

Department of Health monitors air quality in Kahului along with other sampling stations throughout the State. In most cases, the sampling data were below the State's air quality standards.

4.3.2.5 Noise Quality

The Kahului study area is adjacent to the most industrialized portions of Kahului. The deep draft harbor facilities and activities contribute to a generally high level of ambient noise. Numerous trucks, loaders, cranes, powered ramps and other pieces of mechanical equipment work throughout the day and often during the night when loading or off loading ships.

4.3.2.6 Endangered and Threatened Species

Two species protected under the Endangered Species Act of 1973, as amended, may be present in or near the study area. The humpback whale (Megaptera novaeangliae) is listed as endangered and is found seasonally within the 100 fathom isobath around all the main Hawaiian Islands from December through May during their seasonal migrations to the Hawaiian waters. Although no concentrations of humpback whales have been observed in the waters off Kahului, their presence has been noted during past whales seasons.

Casual observation and anecdotal information indicate the presence of the threatened green turtle (Chelonia mydas) along the coastline of the study area.

4.3.3 Historical, Archaeological and Cultural Resources

In 1863, the first western building, a warehouse near the beach was erected. Eventually development along Kahului Bay continued as sugar cane made its commercial debut on Maui and proved to be an economically viable crop. In 1879, a small landing was constructed in Kahului Bay to serve the sugar industry. When the bubonic plaque infected Kahului in 1900, Kahului was deliberately burned to the ground to destroy the infected rats spreading the disease. The rebuilding of Kahului town changed Kahului Bay into a full-scale commercial harbor. By 1910, Kahului Railroad had built an 1,800-foot long rubblemound breakwater, dredged the basin, and constructed a 200-foot wharf for vessels with 25-foot drafts.

Contrary to popular belief, the attack on Pearl Harbor on December 7, 1941 was not the only attack on American soil. In the early hours of January 1, 1942, Japanese submarines shelled Kahului Harbor and the U.S. retaliated with 75 mm shoreline artillery. After World War II, Kahului began another phase of expansion and today remains the most populated area on Maui.

An archaeological reconnaissance survey was conducted on 28-29 July 1988 and no cultural resources of significance were reported. There are no known archaeological or historical sites listed on the Hawaii and National Register of Historic Places within the study area. The study area primarily consists of dredged fill material which is unlikely of containing any archaeological structures or remains.

4.3.4 Socio-Economic Resources

4.3.4.1 Population

The population of Maui has shown the largest growth in the State of Hawaii, with an estimated 1986 resident population of 78,700, representing an increase of 25.3 percent from 1980. The ethnic make up of the population is Caucasian (25%), Hawaiian (25%), Japanese (24%), Filipino (14%), and other (12%). The study site is surrounded Kahului, which had an estimated population of 13,000 in 1980. Commercial activity of the island is centered around the Kahului-Wailuku area with major industries including sugar, pineapple and tourism. Wailuku is the county seat and the center of government activity.

4.3.4.2 Recreation

Kahului Harbor is used infrequently by recreational boaters due to strong tradewinds that make the offshore waters rough and choppy. Pole fishing for reef fish takes place along the entire harbor side of the western breakwater. Mullet, aholehole, manini, kumu and other species are caught by throw and lay net. Pole fishing for ulua and papio is common along the seaward side of the breakwaters. The shallow reef flat along the southwest perimeter of the harbor is a popular octopus (he'e) spearing ground. Bait fishing for nehu (Stolephorus purpureus) and i'ao (Pranesus insularum) is prohibited without a permit. Limu picking (seaward) also occurs in the study area.

Swimming and snorkeling along the south shore are also popular activities within the protected harbor. Large winter northern swells occasionally generate waves for board surfing at two sites within Kahului Harbor. According to the 1971 Statewide Surfing Site Survey, there are four surfing sites within the harbor area, three sites outside the east breakwater of the harbor, and four sites north of the west breakwater. Surfing surveys have indicated excellent surfing conditions during the winter months.

4.3.4.3 Economics

Maui County is the fastest growing community in the State of Hawaii. Economic development in the tourism sector is one of the main sources of income along with sugarcane and pineapple. Because tourism is the largest and fastest growing industry on the island, employment opportunities have increased and resulted in population growth and a rise in personal income. Visitor expenditures for Maui County have grown from $400.6 million in 1980 to $1,195.5 million in 1986. The civilian work force has increased from 37,550 in 1980 to 48,600 in 1986 with an unemployment rate of 5.3 percent. Total personal income has grown from $710.5 million in 1970 to $1,160.3 million in 1986. Sugarcane and pineapple production in 1986 were worth $67.5 million and $45.5 million, respectively.

While the Kahului-Wailuku area is not noted as a destination area, it plays an integral role as the gateway to Maui and as the economic, commercial, and governmental center for Maui County. Maui's primary airport, Kahului Airport, as well its only deep draft commercial harbor, Kahului Harbor, will continue to make the Kahului-Wailuku area a major urban center focusing on transportation, communication and utilities, services, and government. Tables 1 and 2 summarize the demographic, general social, and economic characteristics of Maui County.

4.4 Navigation Problems, Needs, and Opportunities

The north coast of Maui and the Kahului-Wailuku area have several navigational problems: 1) inadequate light draft navigation facilities, 2) excess demand for existing light draft navigation facilities due to a rapidly growing commercial fishing industry, and 3) windward exposure to trade winds.

The island of Maui presently has only two small boat harbors, one at Lahaina with 21 berths and 78 mooring spaces and one at Maalaea with 31 berths and 66 mooring spaces. Both harbors are located on the south coast of Maui. In the Kahului-Wailuku area there are only two single-lane launch ramps, one at Kahului Harbor and one at Maliko bay. Maliko bay is located approximately 10 road miles east-northeast of Kahului Harbor. The narrow, steep-sided bay is almost directly exposed to the north and large waves from winter storms make use of the ramp marginal. Surge is also experienced at the ramp. Access to the single lane launch ramp is via a narrow dirt road, and the site is somewhat distant from the population center at Kahului. The next nearest facilities on the north coast of Maui are single lane launch ramps located at Keanae, 33 miles from Kahului, and at Hana, 59 miles from Kahului (see Figure 3).

The need for commercial light draft navigation facilities in the Kahului-Wailuku area was indicated in the early 1960's under the Coast of Hawaiian Islands Survey. To meet the early need, the State of Hawaii constructed a 14-foot wide single lane launch ramp in 1963 at Kahului Harbor. The requirement for improved light draft navigation facilities was identified in Maui County's report to the Statewide Boating Task Force in early 1982. At a public workshop held at the Maalaea Boat and Fishing Club on 13 May 1982, sponsored by the Corps' Review of the Coasts of the Hawaiian Islands Study, Maui boaters expressed their desire for light draft commercial fishing facilities on the north coast of the island. The boaters suggested that the site be located within Kahului Harbor because the harbor's proximity to the prime fishing grounds and because the market for the catch is located in Kahului.

After a review of the working document for the "Coasts of Hawaiian Islands Study," the State of Hawaii, Department of Transportation, Harbors Division, requested that the Corps conduct studies for Kahului Harbor navigation improvements. Upon completion of the initial appraisal report in October 1983, a public workshop was held on 15 February 1984. At this workshop, the attendees again expressed and supported the need for commercial light-draft navigation facilities on the north side of Maui to help the growing fishing industry and to develop the productive northern fishing grounds. The local boaters strongly supported the development of navigational facilities with in Kahului Harbor. During subsequent public workshops held on 4 December 1984, 13 June 1985, and 7 August 1987, the boaters reaffirmed their support for light draft navigation facilities improvements at Kahului Harbor.

Boaters using the existing ramp at Kahului have expressed concerns that the ramp is too steep making launching and retrieval of their vessels difficult. In addition, the lack of an entrance channel and protected turning basin make use of the ramp hazardous because of numerous coral and rock outcroppings and inadequate water depths, especially during low tides. Boaters have reported scraping the bottom of their vessels and running into the submerged outcroppings.

4.5 Desired Improvements

Commercial fisherman who have used the existing facilities at Kahului have stated the need for a new protected launch ramp and a dredged turning basin and entrance channel. The need for these improvements have been expressed at the various public workshops held for the study.

Table 1

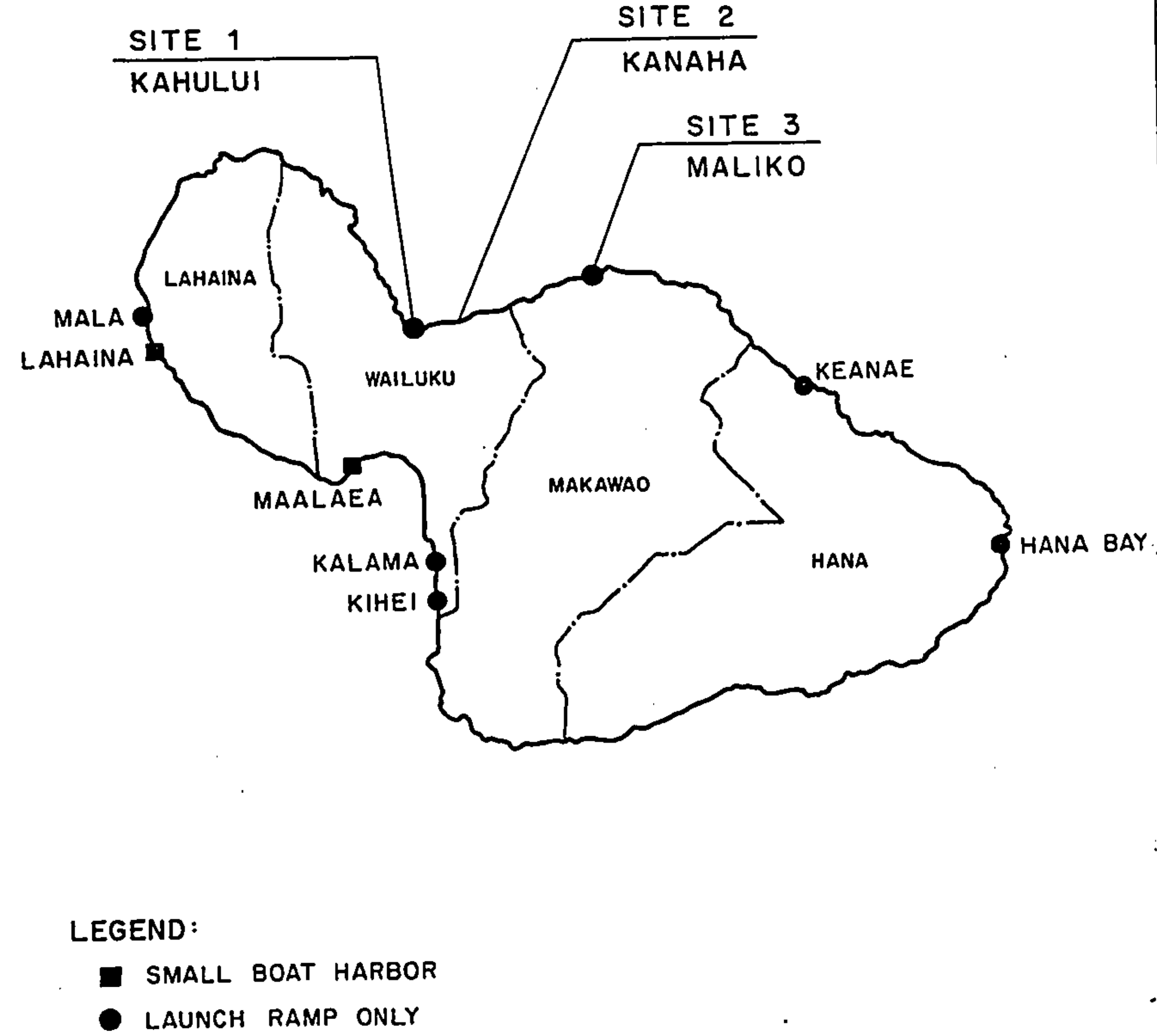
RESIDENT POPULATION OF MAUI ISLAND AND DISTRICTS
1970, 1980, AND 1986
(DBED, 1987)

	1980	1986
State of Hawaii	964,691	1,062,300
Maui	62,823	78,700
Hana	1,423	1,700
Makawao	19,005	23,100
Wailuku (includes Kahului)	32,111	40,200
Lahaina	10,284	13,700

Table 2

INCOME, LABOR FORCE, AND TOURISM
(DBED, 1987; DBED, 1988)

		1980	1986
Personal Income($ millions)		710.5	1,160.3
Per Capita Income ($)		9,916	13,254
Civilian Labor Force		37,550	48,600
Civilian Employment		35,650	46,050
Unemployment (%)		5.1	5.3
Westbound Visitors	(1981)	1,389,892	2,003,870
Visitor Expenditures ($ millions)		400.6	1,195.5
Hotel Occupancy Rate (%)		74.2	81.5



KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

NAVIGATION FACILTIES

U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 3

4.6 Related Problems and Needs

The development of light-draft navigation facilities within Kahului Harbor must also take into consideration the existing usage and resources of the study area.

Environmental Resources. Maintaining the area's natural environmental quality is important to the local community. Any navigation improvements should be designed to complement existing uses of the area's natural resources and should have little adverse impact on the coastal and marine environment as possible.

Recreational Resources. The study area provides recreational opportunities for Maui residents and is actively used by shore fisherman and surfers. The effects of navigation improvements on these activities and the possible secondary effects on the use of adjacent land areas must be assessed and evaluated.

Economic Resources. Kahului Harbor is Maui's principal and only deep draft port. Prior Corps' studies and the State of Hawaii's Year 2010 Master Plan for Kahului Harbor consider possible expansion into the study area to meet future commercial harbor needs. The impacts of the use of the harbor by both commercial fishing vessels and commercial deep draft vessels must be considered in addition to any future expansion of the deep draft harbor facilities into the study area.

4.7 "Without" Project 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 impose some constraints on economic growth in the area through reduced boating related commercial enterprise and employment opportunities. Without implementation of navigation improvements, the hazards resulting from the lack of an improved launch ramp, dredged turning basin and entrance channel will continue to be a danger to boaters.

The resident population and the small business activity in the Kahului-Wailuku area continues to grow along with the number of commercial fisherman and the demand for improved light-draft navigation facilities. 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. With the growth of the tourist industry and the demand for fresh fish, commercial fishing is fast becoming an important economic factor for the island of Maui and the Kahului-Wailuku area. The dollar value of fish caught for Maui increased from $483,980 in 1978 to $1,531,354 in 1986.

4.8 Planning Objectives and Constraints

The planning objectives and constraints for this study of light-draft navigation improvements for the Kahului area are based on analysis of the boating problems and needs as well as consideration of the environmental and human resources of the area. The following planning objectives and constraints were developed and adopted in consultation with local interests to guide the formulation and evaluation of alternative plans:

a. Improve commercial boating facilities for the study area.

b. Improve socio-economic opportunities for the people of Maui.

c. Minimize alterations to the marine and terrestrial environment and to the recreational, cultural, and archeological resources of the study area.

d. Avoid impacts to endangered or threatened species.

e. Increase commercial fishing opportunities in the study area.

f. Minimize conflicts with the existing and planned uses of the study area.

g. Identify and evaluate the adverse and beneficial impacts of alternative plans.

h. Evaluate all potential environmental and social impacts on an equal basis with the technical and economic considerations.

4.9 Formulation and Evaluation of Alternative Plans

Alternative measures were developed and evaluated to resolve the problems 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 authority or capability of the Corps of Engineers. If favorable or superior measures are available outside the range of Corps authorities, the final recommendations will also indicate these alternatives. The initial step in the formulation process is the identification of the type of measures, both structural and nonstructural, suitable to resolve the problems and meet the planning objectives. If the structural measures are considered to be the best type of solution, then the next step is to identify and evaluate potential sites where structural measures can be constructed with minimal adverse impacts. After the selection of a suitable project site, specific design layouts are then formulated, designed and evaluated. Those alternative plans that meet the planning objectives and are consistent with local desires and needs can then be identified.

4.10 Available Measures

Nonstructural alternatives or measures are those actions that can meet the planning objectives without construction of new facilities. Typical measures include improving the efficiency of existing facilities or converting facilities presently used for other purposes. The lack of harbors, protected mooring areas, and adequate launch ramps in north Maui makes it difficult to apply nonstructural measures to satisfy the identified need for improved light draft navigation facilities. To meet the existing and future demands of commercial fisherman in the study area, light draft navigation improvements are considered essential to the overall development plan. Since nonstructural alternatives are not applicable to the study area and do not meet the stated planning objectives, they will not be carried into the detailed stages of this study.

The following criteria were used in selecting potential harbor sites and in formulating the various alternative structural measures.

4.10.1 Technical Criteria

a. The plan of improvement for the light draft navigation facility should provide for a design vessel with a 25-foot length, 9-foot beam, and 3-foot draft. This represents the typical size of the fishing vessel which is anticipated to be a regular user of the facility. These design vessel dimensions were derived from data taken from the Hawaii Boating Survey conducted in 1981 and a list of registered commercial fishing vessels on Maui. Because it is not economical to design a harbor facility to accommodate the largest possible craft, the design vessel is selected to be the craft that will typically use the facility. Approximately 95 percent of the dry stored State of Hawaii registered vessels on Maui are of dimensions less than or equal to those of the design vessel. Craft larger than the design vessel may still use the facility, but without the benefit of all of the clearances and safety factors included for the design vessel.

b. The entrance channel should provide for two-way traffic and should be navigable during normal weather and sea conditions except during periods of severe storms. A protected turning basin should be provided to allow safe launching and retrieval of vessels.

c. Protective structures should be designed to withstand a combination of severe meteorological and oceanographic conditions that are characteristic of the study area.

4.10.2 Economic Criteria

a. Improvement plans recommended for implementation should have a benefit to cost ratio (BCR) greater than one (i.e. the average annual NED benefits should exceed the average annual costs) and, as far as is practical, should be maximized.

b. The benefits and costs should be expressed in comparable quantitative economic terms. Annual costs should be based on a 50-year amortization period and an 8-7/8 percent interest rate, and should include annual maintenance costs.

c. Develop alternative plans which maximize net economic benefits (National Economic Development - NED)

4.10.3 Environmental and Social Criteria

a. Alternative measures *shall minimize the impact by on* all affected forms of fish, wildlife and vegetation.

b. 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 site

c. Avoid severe dislocations of residents and minimize adverse social, health and safety impacts.

d. Site selection and design should minimize potential conflicts between existing harbor uses, boating, shore fishing, surfing and other recreational activities.

e. Avoid impacts to archeological, cultural and historical resources in the study area to the maximum extent possible.

4.11 Identification of Potential Sites

As expressed in the problems and needs section of this study, light-draft navigation improvements for the study area are considered essential to commercial fisherman. Navigation improvements would permit safe launching and retrieval of vessels and permit safe passage of fishing boats. 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. The alternative of no development was considered but rejected because it would not meet the expressed desire for improvement which is the basic objective of this study.

Potential sites were restricted to the north coast of Maui in the Kahului-Wailuku vicinity. The September 1984 Reconnaissance Report evaluated three potential locations: Maliko Bay, Kanaha, and Kahului Deep Draft Harbor (see Figure 3).

Maliko Bay. Maliko bay is located on the exposed north Maui coastline near Paia, approximately 10 road miles east-southeast of Kahului Harbor. It is a narrow, steep sided bay that faces nearly due north and is exposed to high wave most of the year. During the winter large waves from winter storms often close out the bay. There is an existing single lane launch ramp located near the east corner of the bay. The ramp constructed in 1970 and operated by the State of Hawaii, is subjected to considerable surge and siltation is a problem as Maliko Stream discharges into the bay. Access is via a narrow gravel road and limited parking area is available. There are no known archeological/historical sites in the area.

Kanaha. The Kanaha site is located approximately 2 miles east of Kahului along a sandy shoreline that is used as a beach park. The Kanaha Pond Waterfowl Refuge and the Kahului sewage treatment plant are located adjacent to the area. The Kanaha site is directly exposed to year round waves generated by the prevailing trade winds and northern winter storms that break along the sandy shoreline. There are no known archeological/historical sites in the area.

Kahului. The Kahului site is located on the north west side of Kahului deep draft harbor in the vicinity of the fill area adjacent to the west breakwater. This fill area was turned over to the County of Maui by the State for use as a park, but to date the area remains undeveloped and largely unused. The State operates a single lane, 14 feet wide launch ramp on a 2.5 acre parcel on the south east corner of the fill area. The two main breakwaters for the deep draft harbor provide substantial protection to the site. There are no known archeological/historical sites in the area.

4.12 Screening of Potential Sites

Table 3 provides an overview of the various items considered in the selection of a site. Based on careful consideration and review of the various aspects of the alternative sites, the Kahului Harbor location was selected as the preferred site.

The Maliko Bay site was not selected because of the site's exposure to waves, distance from Kahului, poor access, limited available land area, and possible maintenance problem due to siltation of the bay.

Although the Kanaha site is located near the population center of Kahului, this site was not selected because of its exposure to wave action and the need for a long entrance channel to reach deeper waters. In addition, because of the sandy nature of the shoreline, maintenance dredging costs would be high at the site. The proximity of the Kanaha Beach Park and the Kanaha Waterfowl Refuge may result in possible conflicts.

The Kahului site offers several advantages. The main breakwaters for the deep draft harbor provide protection to the study area and large protective structures are not required. There is a large undeveloped fill area available for parking and shoreside facilities. The fill area is already protected by revetment and there is an existing single lane boat launching ramp in place. State projections of future deep draft traffic for Kahului Harbor indicate that the south east corner will not be used for expanded deep draft facilities. In addition, during a public workshops held on 15 February 1984, 4 December 1984, 13 June 1985, and 7 August 1987 strong support was expressed by the commercial fisherman for the Kahului Harbor site because of its protected location, ample space for shoreside facilities, proximity to the prime fishing grounds, and location to the fish markets.

4.13 Development of Alternative Plans

The Initial Appraisal Report for Kahului Small Boat Harbor was completed in October 1983. This report evaluated a 120-boat commercial fishing harbor located in the vicinity of the existing ramp, and demonstrated a benefit-cost ratio of 3.8. The Reconnaissance Report was completed in September 1984, and evaluated three different sites for the 120-boat harbor: Kahului Harbor, Kanaha Beach Park and Maliko Bay. Of these alternative sites, the report concluded that the site within Kahului Harbor offered the best protection, would have the least environmental impacts, and would be the least costly to develop.

However, in December 1984, the Mayor of Maui County, Hannibal Tavares, expressed objections to a small boat harbor within Kahului Harbor. The principle objection concerned possible conflicts between small boat traffic and the deep draft commercial vessels using the same entrance channel. Mayor Tavares was especially concerned over the increased potential for an accident that would temporarily block the entrance channel to Kahului Harbor, with severe impacts on Maui's

Table 3

SCREENING OF ALTERNATIVE SITES

CRITERIA	MALIKO	KANAHA	KAHULUI
Meet planning objective of improving commercial fishing opportunities	Partially, too far from Kahului	Yes	Yes
Vehicular Access of to site	Poor	Excellent	Excellent
Access of site by design vessel	Moderate dredging required	Extensive dredging required	Moderate dredging required
Area to accommodate improvements	Limited	Adequate	Excellent
Compatibility with existing land uses	Compatible, presently used for launching	Marginal, adjacent to Kanaha Beach Park and Water-fowl Refuge	Compatible, presently used for launching
Exposure	Partially exposed	Directly exposed	Protected by Kahului Harbor Breakwaters
Land Ownership	State	State	State, County
Existing Facilities	Launch Ramp	None	Launch Ramp
Environmental Impacts on terrestrial or marine habitat	No significant impact	No significant impact	No significant impact
Archaeological and Historical Resources	No significant impact	No significant impact	No significant impact
Public Support	Poor	Poor	Strong
Tecnical	Poor	Poor	Excellent
Economic	Poor	Poor	Excellent

economy. Although the State Harbors Division and the Corps indicated that navigational safety would not be compromised, the County remained opposed to a small boat harbor within Kahului Harbor.

At a public workshop in December 1984, the Corps explained the County's position to local boaters and discussed possible alternatives. From the workshop it was learned that the fishermen would use a facility at Kahului only on a seasonal basis, because the waters on the north side of Maui are often too rough for safe small craft operation. Based on this usage pattern and the County's objections to a conventional small boat harbor, a revised concept was developed for an improved launch ramp with a protected mooring area for approximately 10 to 15 vessels. This revised concept met the needs of the local fishermen and also would alleviate the potential traffic conflicts. The small boat traffic would peak during periods of good weather (i.e. Kona winds with no tradewind generated waves), which would minimize the chances of an accident with the deep draft vessels. This revised plan met with the approval of the County and State Harbors Division in March 1985.

As the result of a public workshop held in August 1987, a reassessment of the study's economic benefits and requirements was conducted by the Corps and the National Marine Fisheries Service (NMFS). The results of the survey (see Appendix E) indicated that temporary mooring spaces could not be economically justified and that the primary benefits resulted from launched vessels. Based on the survey results, the study plan was reformulated to provide light draft navigation improvements consisting of an improved launch ramp, protected turning basin and dredged entrance channel.

Detailed investigations were conducted for the Kahului Site in order to better evaluate the existing conditions and to prepare more detailed analyses and designs. Hydrographic and topographic surveys were conducted for the site as well as geotechnical, archeological, and environmental investigations.

The geotechnical investigations were limited to visual observations and surface probing. It was decided that costly offshore borings would be taken prior to the initiation of the plans and specifications stage, after the economic viability of the study was determined by the DPR. Conservative design and cost estimate assumptions were used based on the visual observations and surface probing. Appendix C contains a summary of the reconnaissance findings.

An archaeological/cultural reconnaissance was conducted to determine whether historic properties were situated near or within the project sites. Of particular importance was the determination of potential significant historic properties or sites known to be within the project area and, if any, whether actions to avoid or mitigate impacts to such properties were needed. Appendix G includes a summary of the reconnaissance findings.

Environmental investigations were conducted to evaluate and assess the impacts of the proposed alternative plans on the surrounding environment and to identify the environmental consequences, if any, and to recommend mitigating measures. An Environmental Impact Statement was prepared and is incorporated as a part of this report.

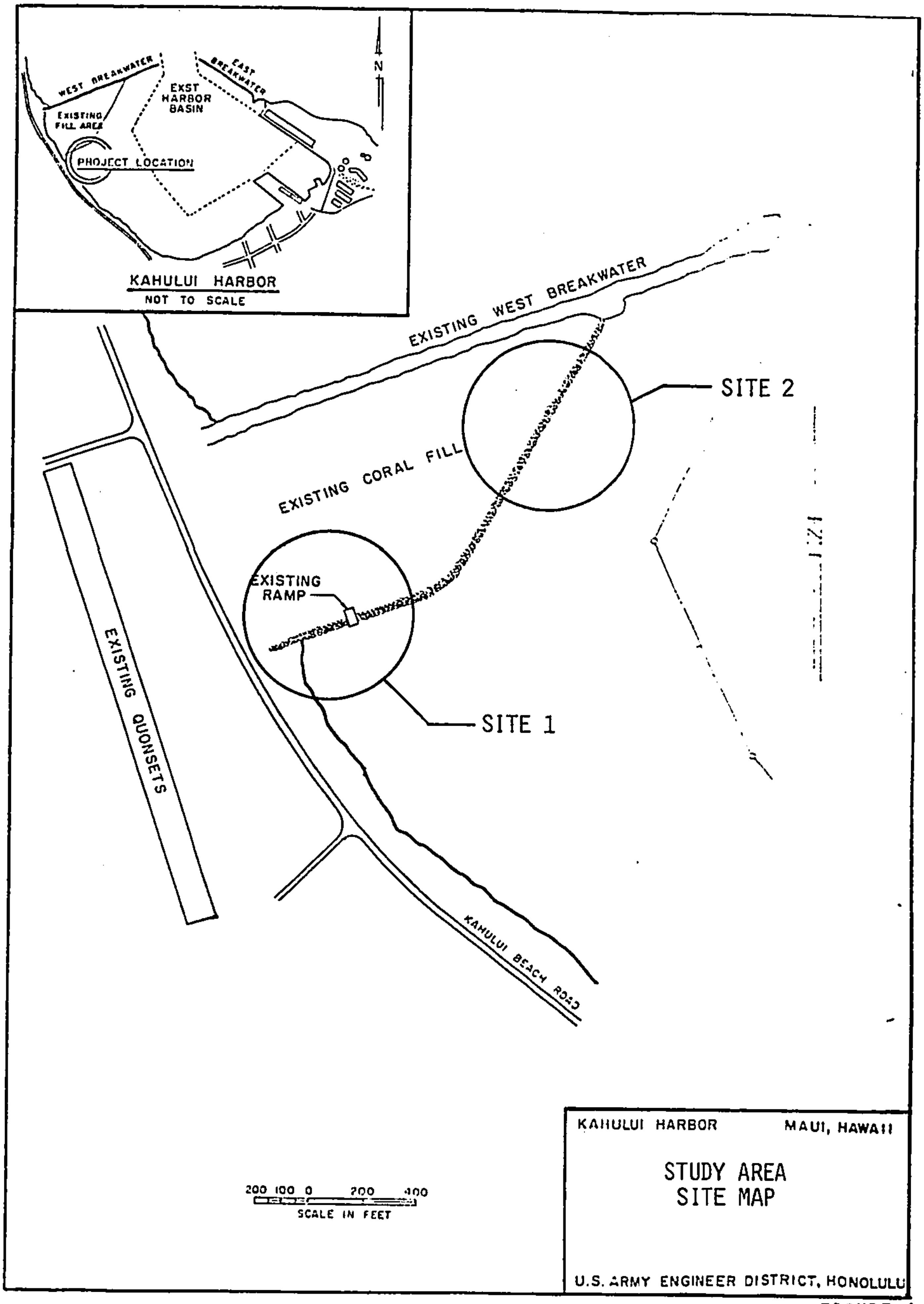
Economic investigations and analyses were conducted for the Corps by the National Marine Fisheries Service (NMFS) to evaluate the economic benefits of providing light draft navigation improvements. Results of the analyses are presented in Appendix E.

Based on the identified problems and needs, the planning objectives, the formulation and evaluation concepts, and the results of the public workshops and coordination, three basic alternative design plans were developed in detail and evaluated with respect to their contributions to navigation improvements, their beneficial and adverse impacts, and their benefits and costs. The three basic plans consist primarily of a protected launch ramp and a dredged turning basin and entrance channel.

Although the Corps and NMFS survey of boaters indicated that temporary mooring spaces could not be economically justified, non-federal expansion options to the three basic plans were developed, for consideration by the local sponsor, to provide temporary mooring areas for 10 to 15 vessels. The local sponsor, the State of Hawaii, would be responsible for the decision to construct the option and for the construction costs. Implementation of the expansion option has no impact on the Federal economic analysis because all benefits are based on launched vessels.

4.14 Description of Alternative Plans

Plans A and B are located near the shoreward portion of the fill area in the vicinity of the existing launch ramp, Site 1, and Plans C are located on the eastern harbor portion of the fill area, Site 2, (see Figure 4). Site 1, the location of plans A and B, was chosen because it is situated in the most protected portion of study area and is located at site of the existing launch ramp. In addition, the local sponsor, the State of Hawaii, owns the adjacent land on the fill area. The location of Plan C, at site 2, was selected because its location near the deeper waters of the deep draft harbor basin would eliminate the need to dredge a long entrance channel. However, the site is located in a more exposed area and is subjected to higher wave action than at site 1.



KAHULUI HARBOR MAUI, HAWAII

STUDY AREA
SITE MAP

U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 4

The basic plans (plans A1, B1, and C1) include a two lane launch ramp, protected turning basin, and dredged entrance channel . These are the basic plans upon which all economic benefits and evaluations are based on. The optional mooring plans for 10 to 15 vessels (plans A2, B2, and C2) were developed for the benefit of the local sponsor, the State of Hawaii. The decision for implementation of the options and the construction costs are the responsibility of the local sponsor and have no impact on the study's economic analysis as no economic justification for mooring areas was demonstrated and all benefits are derived from launched craft. The plans are detailed as follows.

PLAN A:

Plan A1, Launch Ramp - Plan A1 consists of a 130-foot breakwater; a turning basin 100 feet by 100 feet, 8.5 feet deep; a new two lane boat launch ramp and a 50-foot wide entrance channel, approximately 1,030 feet long and 9.5 feet in depth. Plan A1 is located at Site 1 (see Figures 5 and 6).

Plan A2, Launch Ramp with Moorings (Local Sponsor Option) - Plan A2 consists of the same general features as plan A1, however, a *temporary mooring area has been added consisting of a mooring* basin for 14 vessels, 105 feet by 105 feet, 6.5 feet in depth; and a revetted mole a 120-feet long by 50-feet wide (see Figures 7 and 8).

PLAN B:

Plan B1, Launch Ramp - Plan B1 consists of a turning basin 100 feet by 100 feet, 8.5 feet in depth excavated into the fill area near the existing ramp (Site 1); a 50-foot wide, 1,030-foot long, and 9.5-foot deep entrance channel; an approach channel 140-feet long, 50-feet wide, and 8.5-feet deep; and revetment surrounding the excavated turning basin (see Figures 9 and 10).

Plan B2, Launch Ramp with Moorings (Local Sponsor Option) - Plan B2 consists of the same features as plan B1 with the addition of a revetted 6.5-foot deep, 105 feet by 105 feet mooring basin for 14 vessels excavated into the existing fill area, adjacent to the turning basin (see Figures 11 and 12).

PLAN C:

Plan C, Launch Ramp - Plan C1 consists of a turning basin 100 feet by 100 feet and 8.5-feet deep; entrance channel revetment; a new two lane boat launch ramp; and a 240-feet entrance channel, 50-feet wide, and 9.5-feet deep. The plan is located at Site 2 which is nearer the harbor entrance and will require excavation of the existing fill (see Figures 13 and 14).

Plan C2, Launch Ramp with Moorings (Local Sponsor Option) - Plan C2 consists of the same features as plan C1 with the addition of a revetted 6.5-foot deep, 105 feet by 105 feet mooring basin excavated into the existing fill area, adjacent to the turning basin (see Figures 15 and 16).

NO ACTION:

No Action - The no action plan would not propose any improvements and does not meet the planning criteria and objectives.

4.15 Planning Considerations

a. Aids to Navigation. The U.S. Coast guard will provide the necessary aids to navigation for the selected site and plan. These aids are a Federal cost, but are not included in the maximum Corps of Engineers monetary limitations under the authorizing legislation.

b. Dredged Material and Disposal Site. Dredged material may be used for fill purposes when required by the alternative designs. Disposal of excess dredged material may be made on the existing coral fill area.

c. Construction Material Sources. Sources for construction materials are provided in Appendix C, Geotechnical Investigations.

4.16 Economic Analysis

Economic evaluations were conducted in accordance with the procedures and standards prescribed by the Water Resources Council and Corps of Engineers policy. The computations are based on a 8-7/8 percent interest rate and a 50-year project life.

4.16.1 Costs

The estimated project first costs for the three basic alternative plans and the optional mooring plans were developed using October 1988 price levels, assumptions based on the prevailing physical conditions, and allowances for contingencies, engineering and design (E&D), supervision and administration (S&A), and interest during construction (IDC). The average annual costs for purposes of the benefit to cost comparison for the three basic plans include interest (8-7/8 percent) and amortization (50 years) of the project first cost and the estimated annual maintenance costs associated with the project. Cost breakdowns and assumptions are provided in Appendix D.

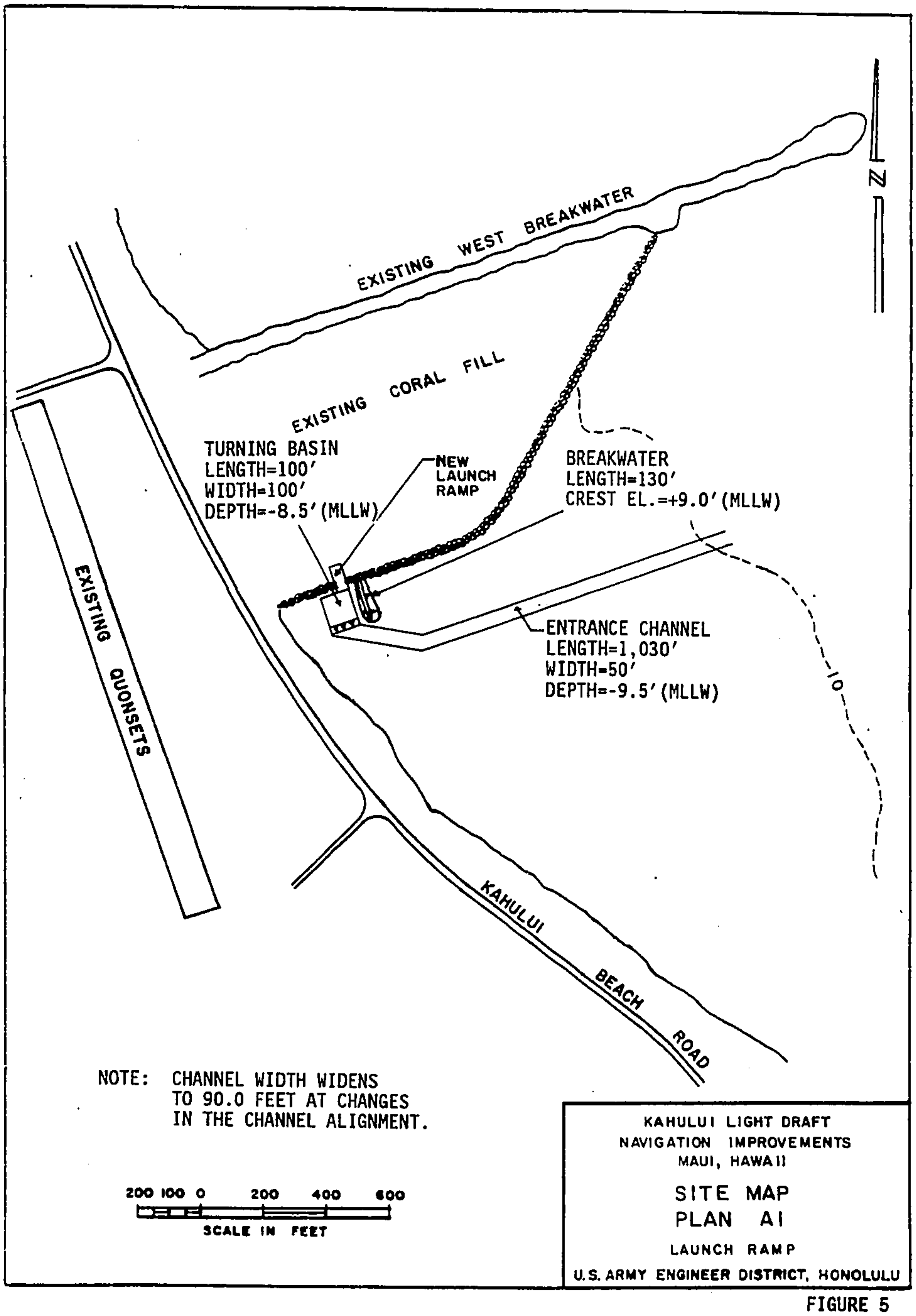

EXISTING WEST BREAKWATER
EXISTING CORAL FILL
N
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5'(MLLW)
NEW LAUNCH RAMP
BREAKWATER
LENGTH=130'
CREST EL.=+9.0'(MLLW)
ENTRANCE CHANNEL
LENGTH=1,030'
WIDTH=50'
DEPTH=-9.5'(MLLW)
-10-
EXISTING QUONSETS
KAHULUI BEACH ROAD
NOTE: CHANNEL WIDTH WIDENS TO 90.0 FEET AT CHANGES IN THE CHANNEL ALIGNMENT.
200 100 0 200 400 600
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
SITE MAP
PLAN A1
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 5

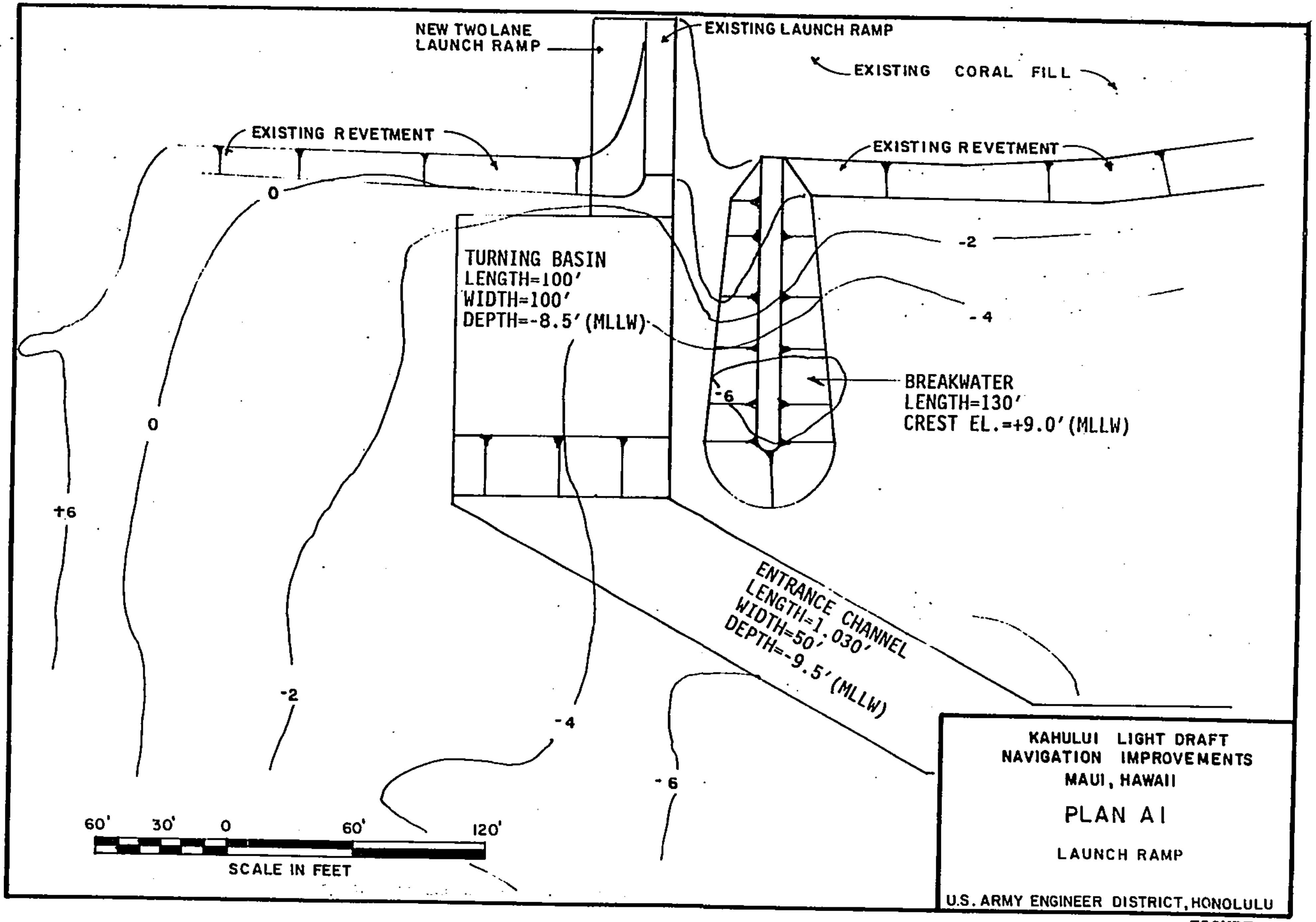
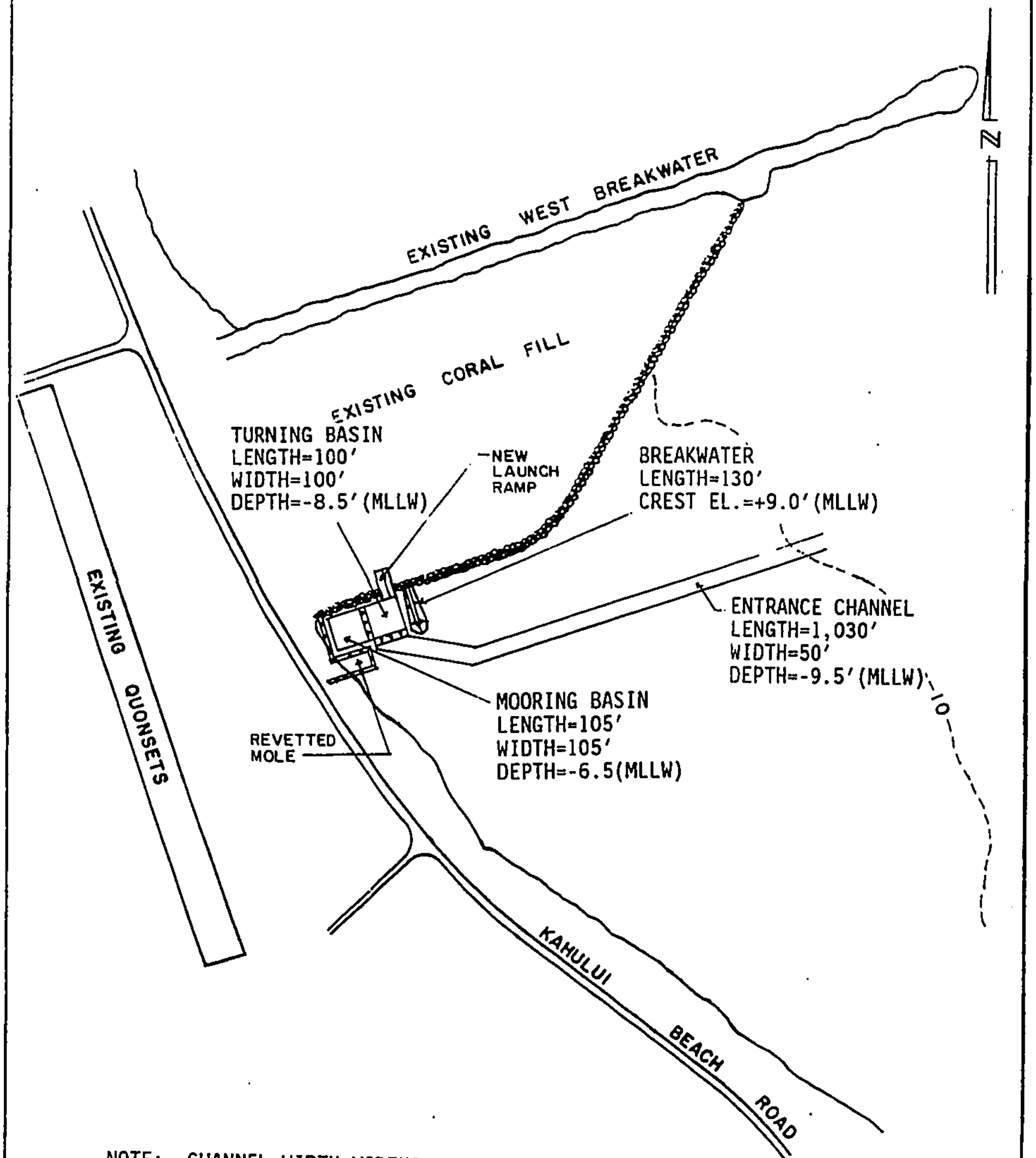

NEW TWO LANE LAUNCH RAMP
EXISTING LAUNCH RAMP
EXISTING CORAL FILL
EXISTING REVETMENT
EXISTING REVETMENT
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5' (MLLW)
BREAKWATER
LENGTH=130'
CREST EL.=+9.0' (MLLW)
ENTRANCE CHANNEL
LENGTH=1,030'
WIDTH=50'
DEPTH=-9.5' (MLLW)
+6
0
0
-2
-2
-4
-4
-6
-6
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN A1
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 6



NOTE: CHANNEL WIDTH WIDENS TO 90.0 FEET AT CHANGES IN THE CHANNEL ALIGNMENT.

KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

SITE MAP
PLAN A2

LAUNCH RAMP WITH MOORINGS

U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 7

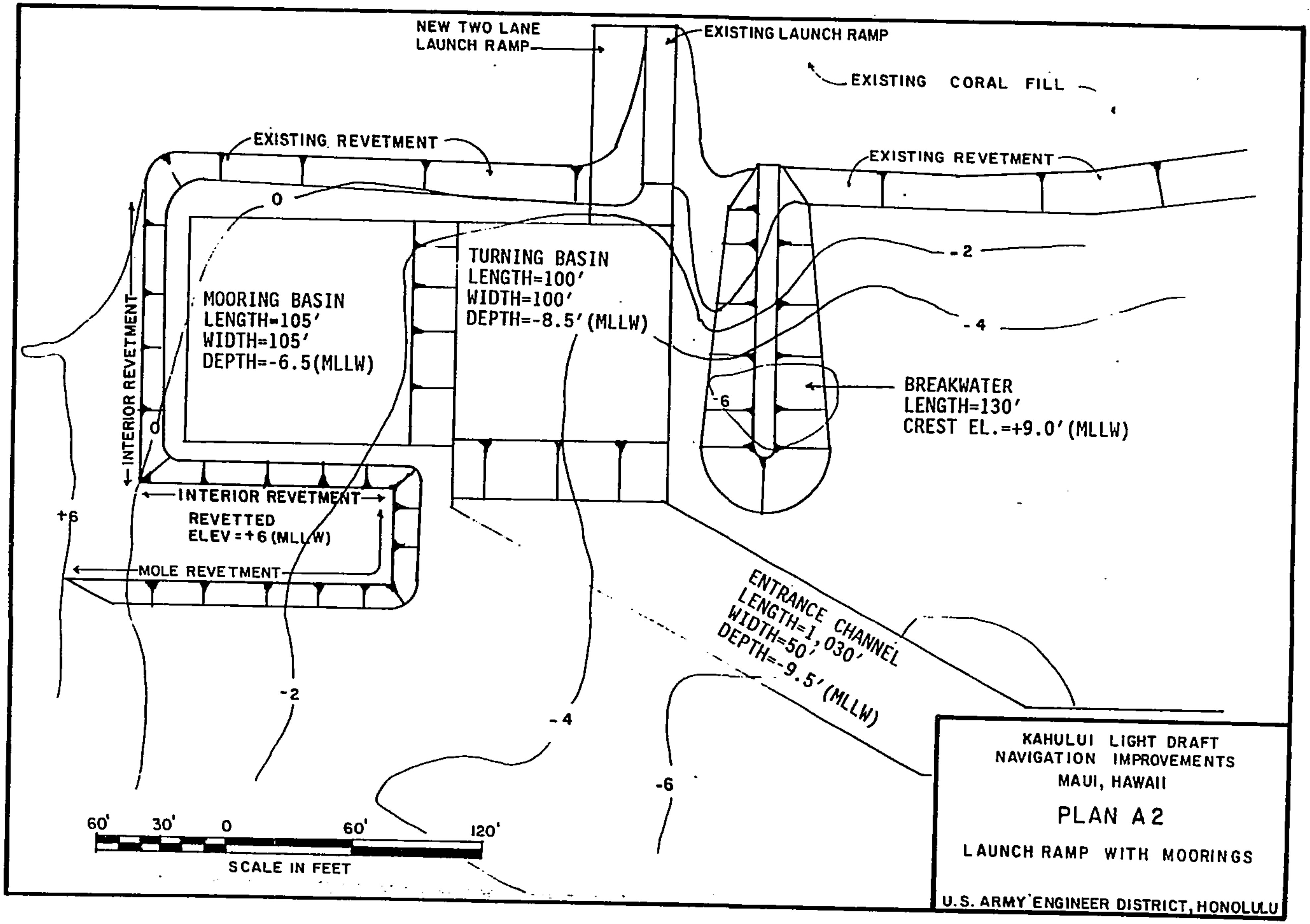

NEW TWO LANE LAUNCH RAMP
EXISTING LAUNCH RAMP
EXISTING CORAL FILL
EXISTING REVETMENT
EXISTING REVETMENT
INTERIOR REVETMENT
INTERIOR REVETMENT
MOORING BASIN
LENGTH=105'
WIDTH=105'
DEPTH=-6.5(MLLW)
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5'(MLLW)
BREAKWATER
LENGTH=130'
CREST EL.=+9.0'(MLLW)
REVETTED
ELEV=+6(MLLW)
MOLE REVETMENT
ENTRANCE CHANNEL
LENGTH=1,030'
WIDTH=50'
DEPTH=-9.5'(MLLW)
0
+6
-2
-4
-6
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN A2
LAUNCH RAMP WITH MOORINGS
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 8

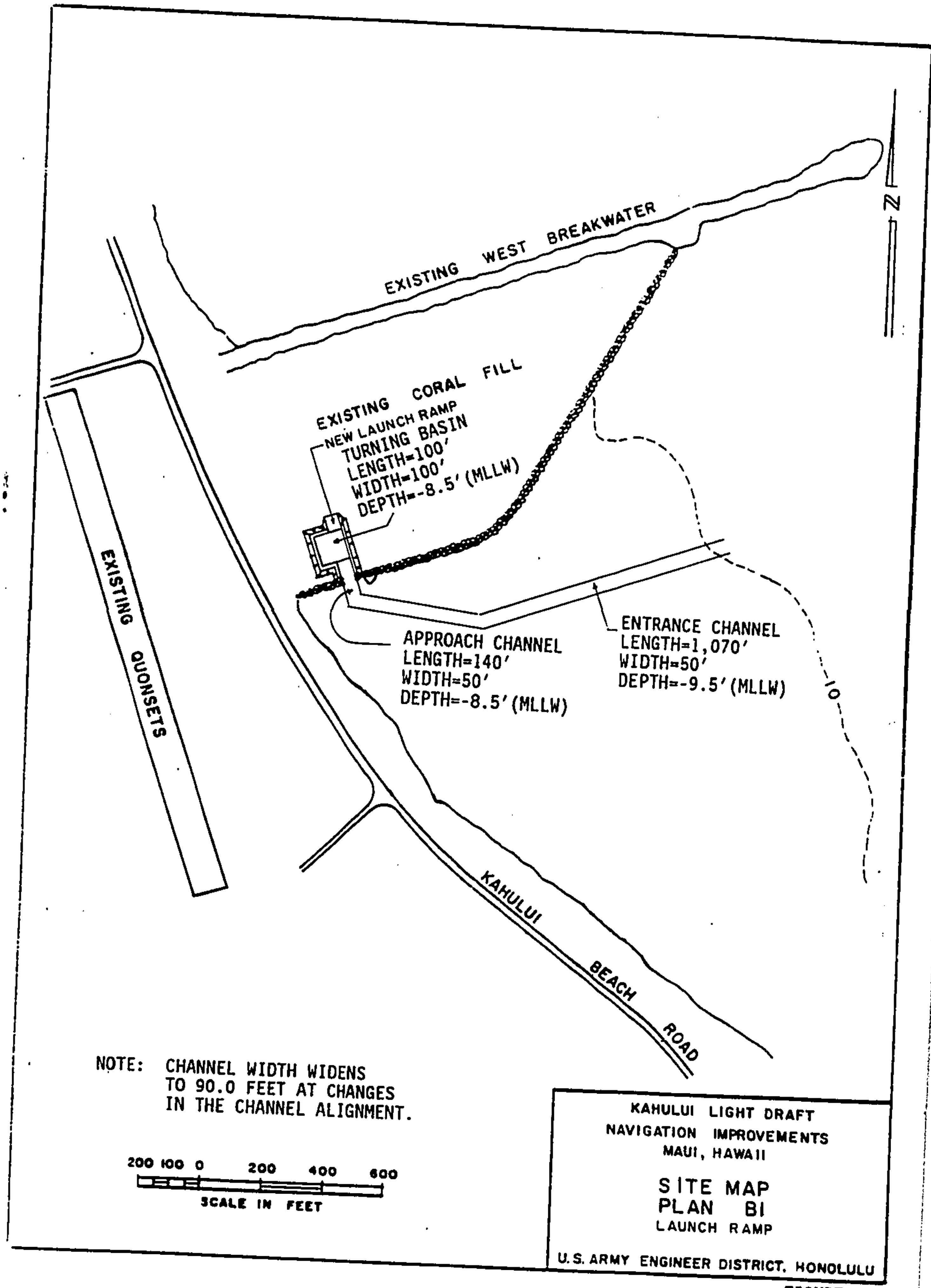
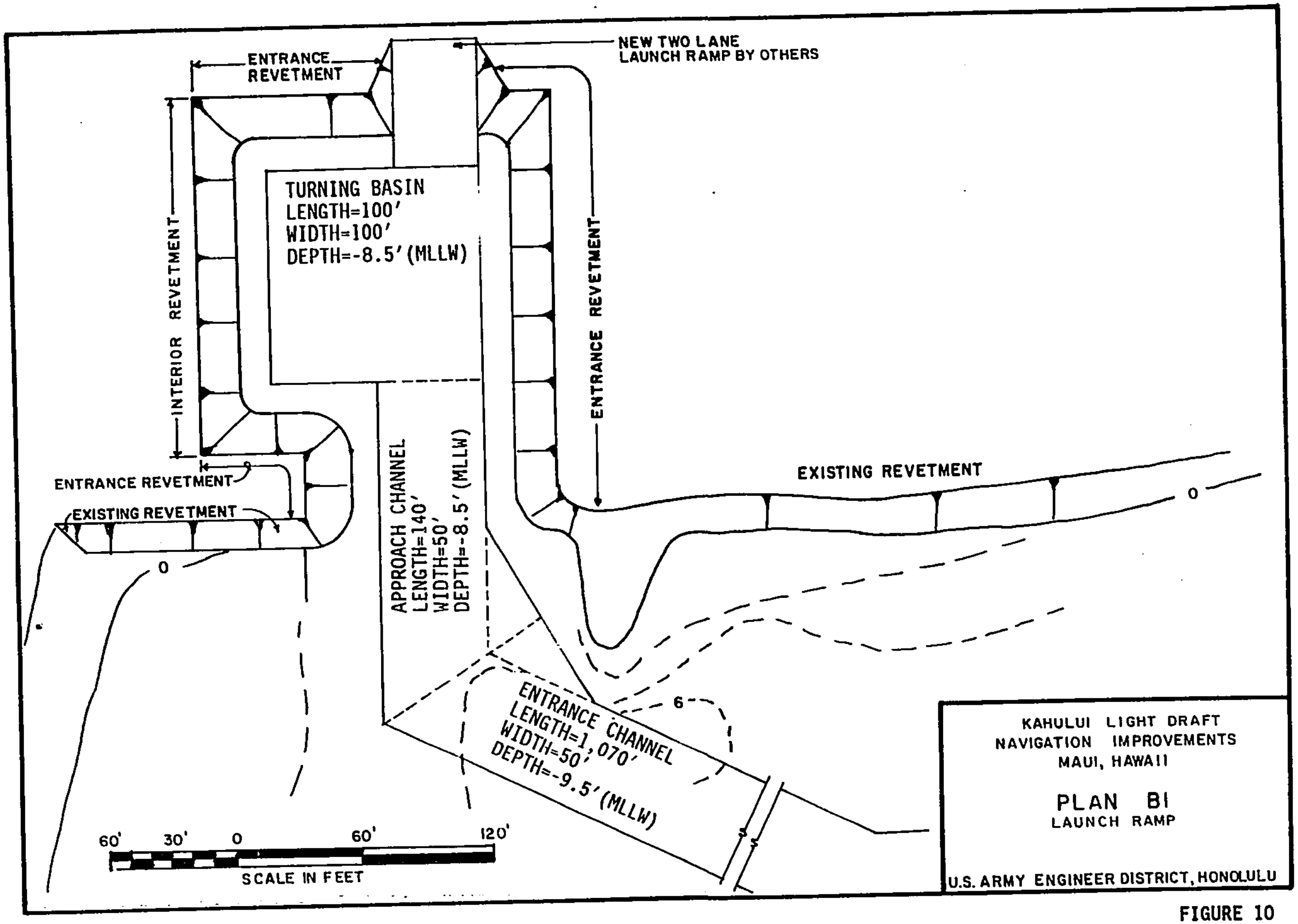

EXISTING WEST BREAKWATER
N
EXISTING CORAL FILL
NEW LAUNCH RAMP
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5' (MLLW)
EXISTING QUONSETS
APPROACH CHANNEL
LENGTH=140'
WIDTH=50'
DEPTH=-8.5' (MLLW)
ENTRANCE CHANNEL
LENGTH=1,070'
WIDTH=50'
DEPTH=-9.5' (MLLW)
10
KAHULUI BEACH ROAD
NOTE: CHANNEL WIDTH WIDENS TO 90.0 FEET AT CHANGES IN THE CHANNEL ALIGNMENT.
200 100 0 200 400 600
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
SITE MAP
PLAN B1
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 9


ENTRANCE REVETMENT
NEW TWO LANE LAUNCH RAMP BY OTHERS
TURNING BASIN
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WIDTH=100'
DEPTH=-8.5'(MLLW)
INTERIOR REVETMENT
ENTRANCE REVETMENT
ENTRANCE REVETMENT
EXISTING REVETMENT
EXISTING REVETMENT
APPROACH CHANNEL
LENGTH=140'
WIDTH=50'
DEPTH=-8.5'(MLLW)
ENTRANCE CHANNEL
LENGTH=1,070'
WIDTH=50'
DEPTH=-9.5'(MLLW)
0
0
6
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN B1
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 10

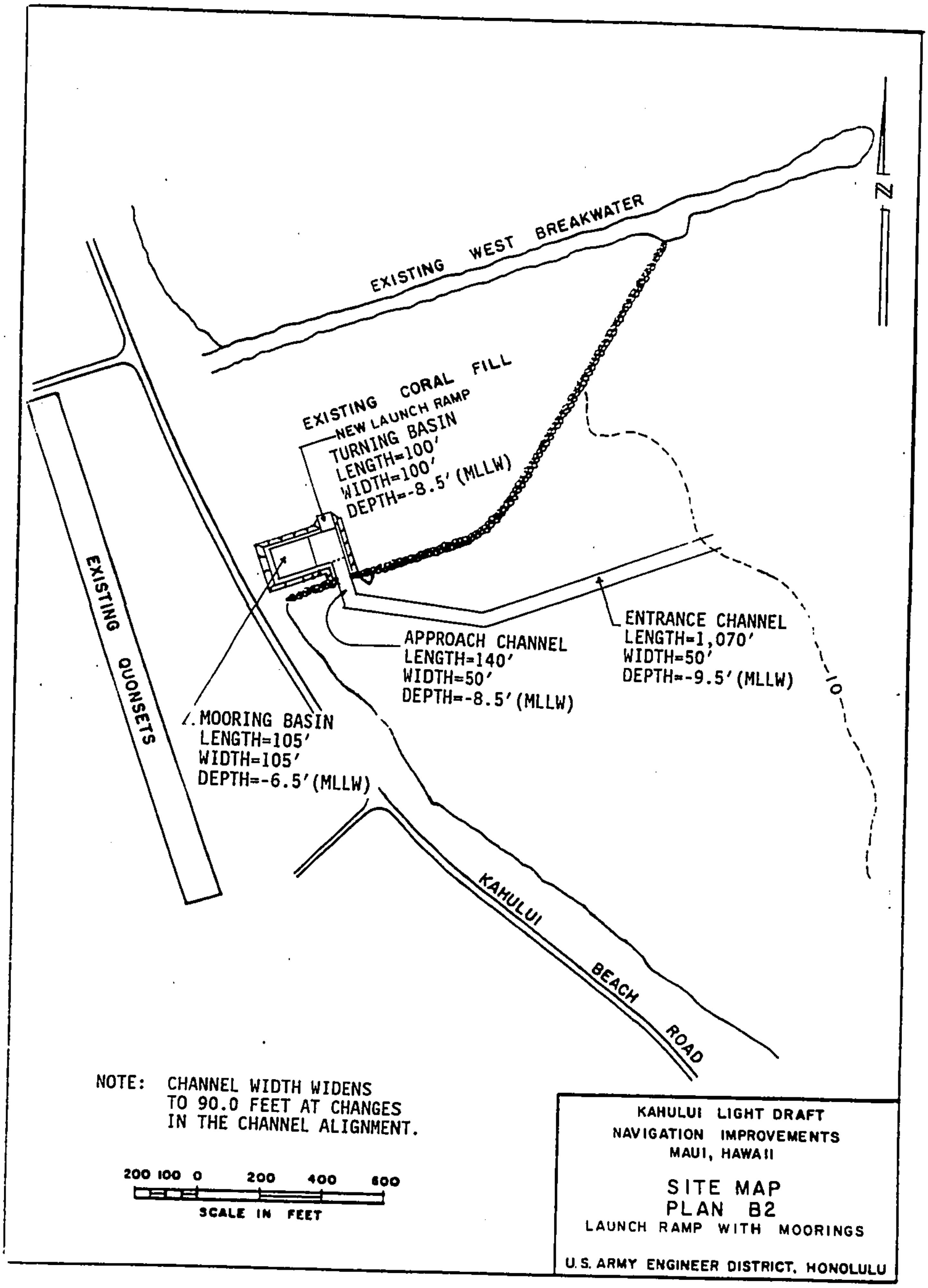

EXISTING WEST BREAKWATER
EXISTING CORAL FILL
NEW LAUNCH RAMP
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5' (MLLW)
EXISTING QUONSETS
ENTRANCE CHANNEL
LENGTH=1,070'
WIDTH=50'
DEPTH=-9.5' (MLLW)
APPROACH CHANNEL
LENGTH=140'
WIDTH=50'
DEPTH=-8.5' (MLLW)
MOORING BASIN
LENGTH=105'
WIDTH=105'
DEPTH=-6.5' (MLLW)
-10-
KAHULUI BEACH ROAD
N
NOTE: CHANNEL WIDTH WIDENS TO 90.0 FEET AT CHANGES IN THE CHANNEL ALIGNMENT.
200 100 0 200 400 600
SCALE IN FEET
KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
MAUI, HAWAII
SITE MAP
PLAN B2
LAUNCH RAMP WITH MOORINGS
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 11

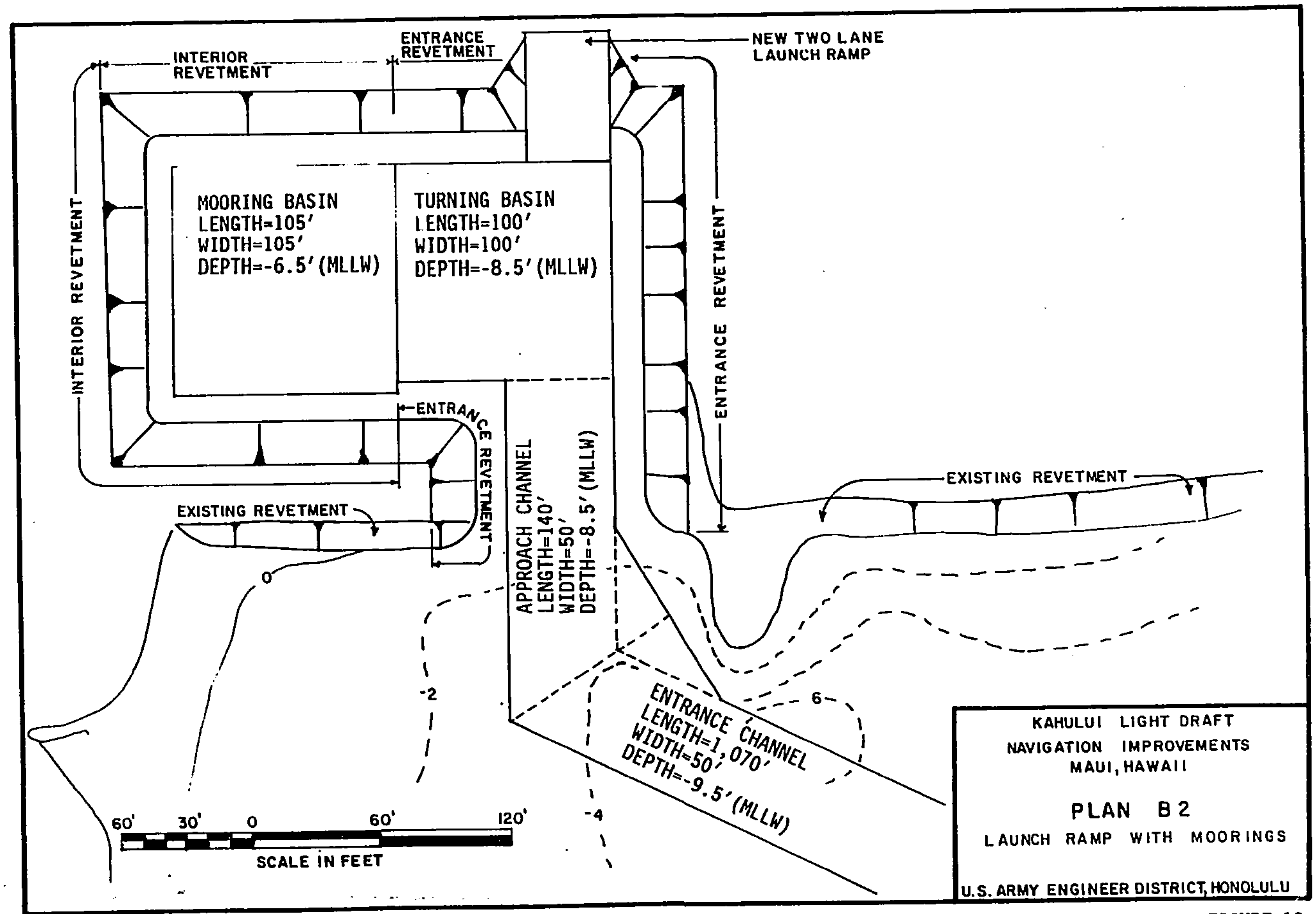
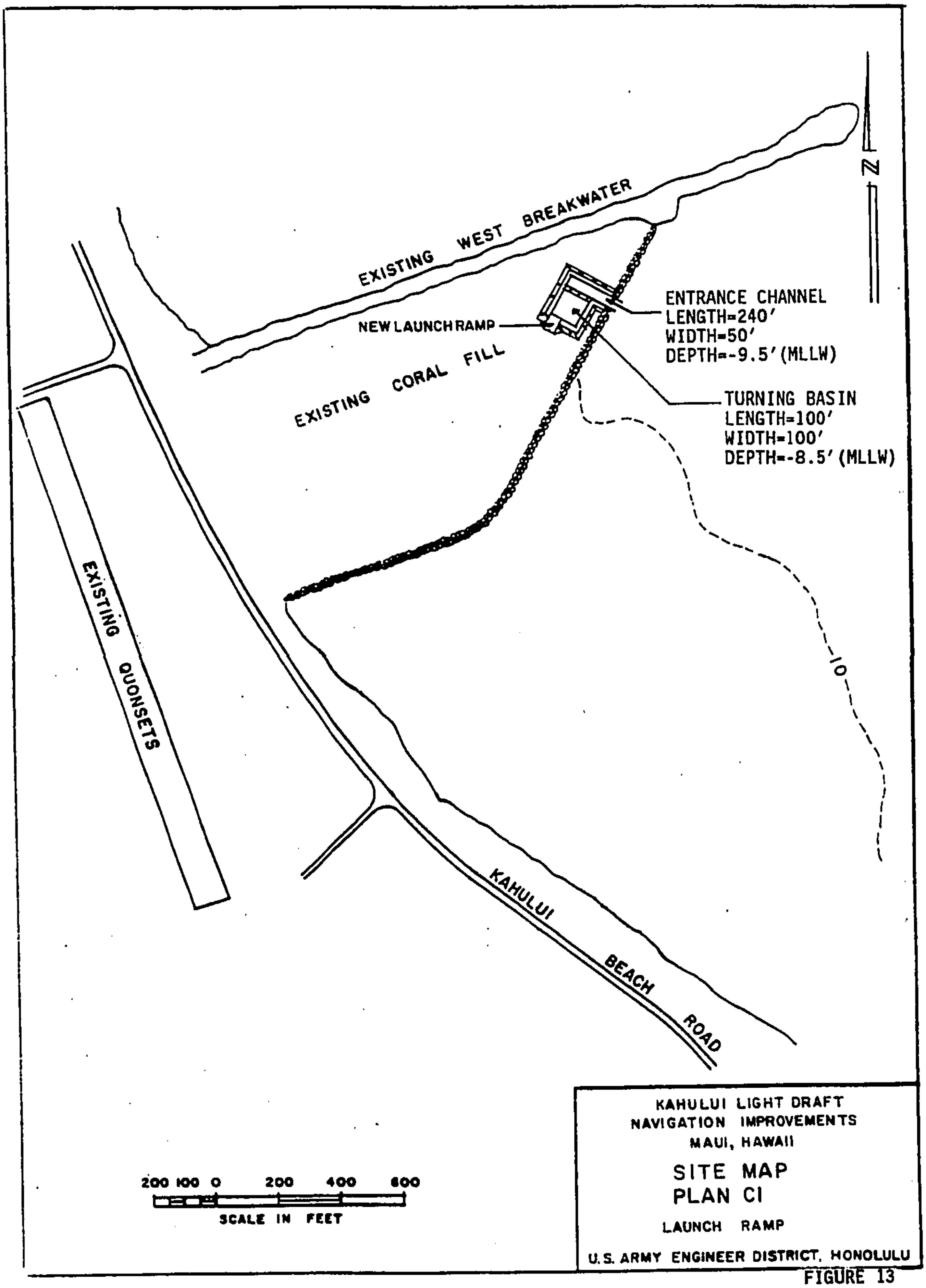

INTERIOR REVETMENT
ENTRANCE REVETMENT
NEW TWO LANE LAUNCH RAMP
MOORING BASIN
LENGTH=105'
WIDTH=105'
DEPTH=-6.5'(MLLW)
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5'(MLLW)
INTERIOR REVETMENT
ENTRANCE REVETMENT
ENTRANCE REVETMENT
EXISTING REVETMENT
EXISTING REVETMENT
APPROACH CHANNEL
LENGTH=140'
WIDTH=50'
DEPTH=-8.5'(MLLW)
ENTRANCE CHANNEL
LENGTH=1,070'
WIDTH=50'
DEPTH=-9.5'(MLLW)
0
-2
-4
6
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN B2
LAUNCH RAMP WITH MOORINGS
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 12


N
EXISTING WEST BREAKWATER
NEW LAUNCH RAMP
ENTRANCE CHANNEL
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WIDTH=50'
DEPTH=-9.5'(MLLW)
EXISTING CORAL FILL
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5'(MLLW)
EXISTING QUONSETS
-10-
KAHULUI BEACH ROAD
200 100 0 200 400 600
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
SITE MAP
PLAN C1
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FIGURE 13

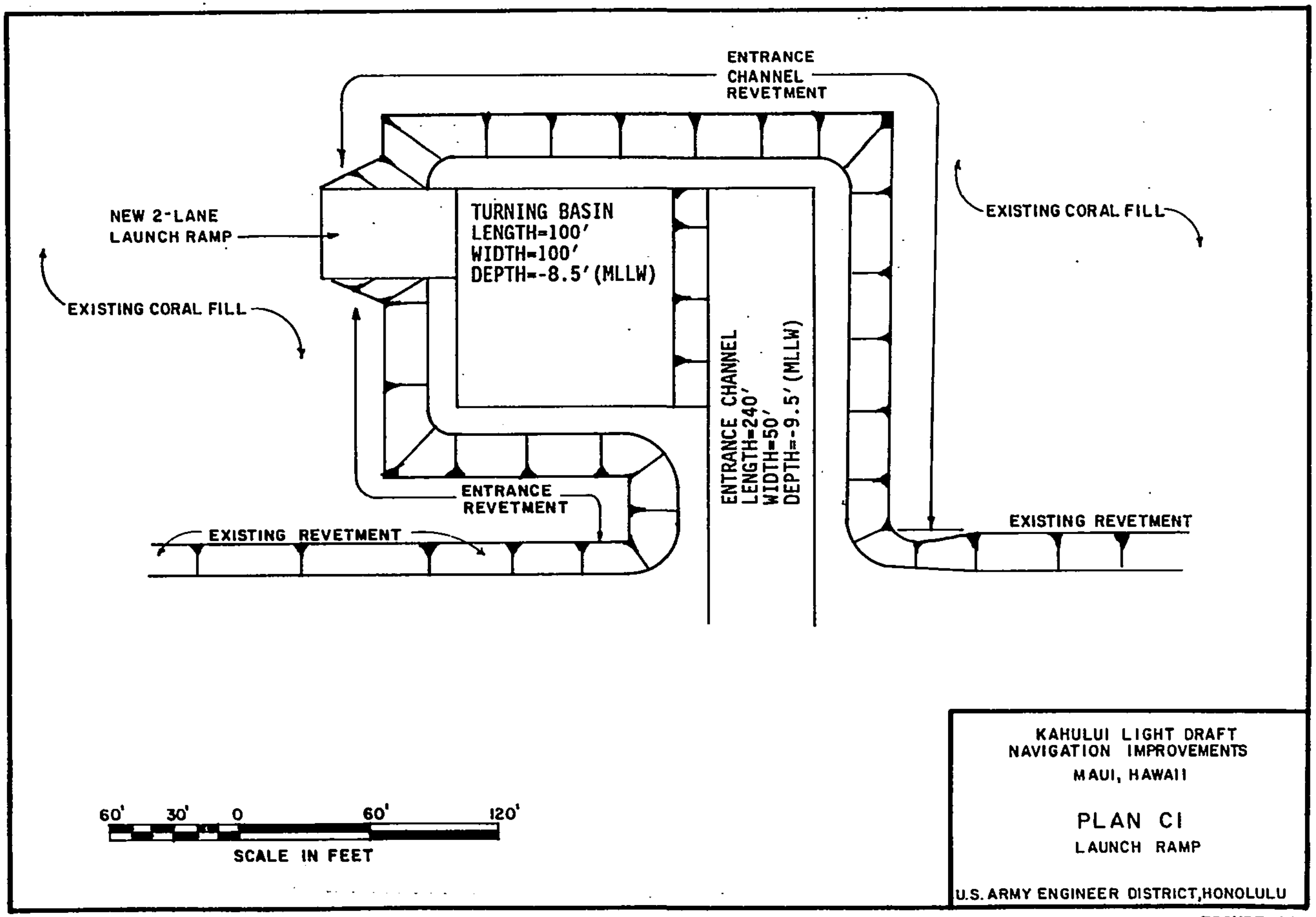
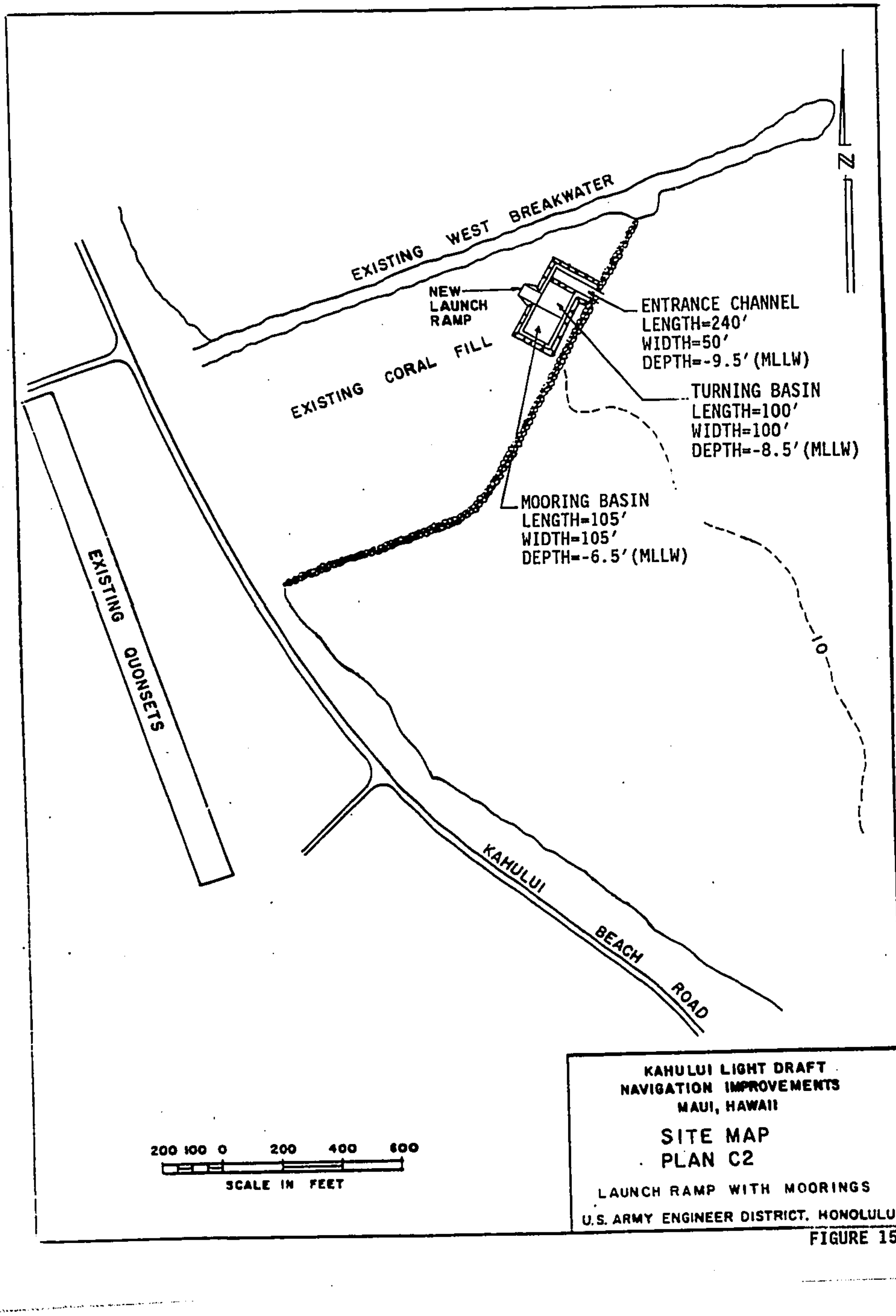

ENTRANCE CHANNEL REVETMENT
NEW 2-LANE LAUNCH RAMP
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5' (MLLW)
EXISTING CORAL FILL
EXISTING CORAL FILL
ENTRANCE CHANNEL
LENGTH=240'
WIDTH=50'
DEPTH=-9.5' (MLLW)
ENTRANCE REVETMENT
EXISTING REVETMENT
EXISTING REVETMENT
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN C1
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 14



KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

SITE MAP
PLAN C2

LAUNCH RAMP WITH MOORINGS

U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 15

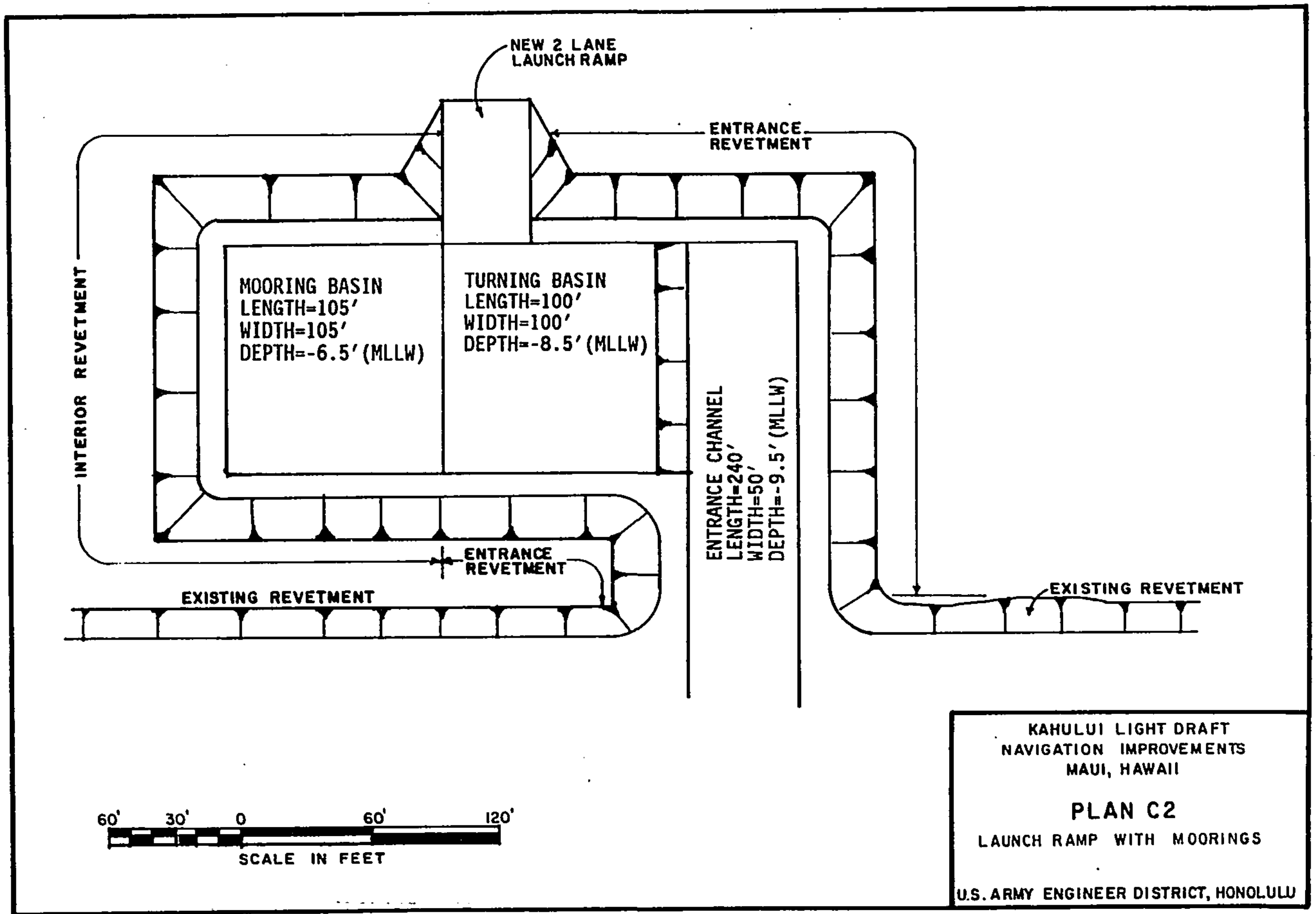

NEW 2 LANE LAUNCH RAMP
ENTRANCE REVETMENT
MOORING BASIN
LENGTH=105'
WIDTH=105'
DEPTH=-6.5'(MLLW)
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5'(MLLW)
INTERIOR REVETMENT
ENTRANCE CHANNEL
LENGTH=240'
WIDTH=50'
DEPTH=-9.5'(MLLW)
ENTRANCE REVETMENT
EXISTING REVETMENT
EXISTING REVETMENT
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN C2
LAUNCH RAMP WITH MOORINGS
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 16

4.16.2 Benefits

The initial evaluation of benefits conducted by the Corps for the proposed improvements focused on field data obtained from interviews in the Spring of 1985 with Maui commercial boat operators. The results, however, were not conclusively supportive of the need for improvements, although there was enthusiastic support for the proposed project. To obtain a more accurate assessment of the project benefits, the Corps contracted the National Marine Fisheries Service (NMFS) in Honolulu to conduct benefit analyses and to determine if there was a statistical advantage to fishing the north shore of Maui. NMFS has access to computerized data gathered by the State Department of Land and Natural Resources from commercial fish catches. The data showed that north shore is not now readily accessible and the proposed improvement at Kahului would allow a much shorter travel time to these fishing grounds. The preliminary results of the initial NMFS analysis showed that there were sufficient benefits from fishing the north shore of Maui to justify the proposed project. However, their benefit analysis was limited by the relative scarcity of accurate data on commercial fish catches for Maui and was therefore, based on several assumptions regarding use of a new harbor at Kahului.

Revisions made to the analysis, after consultation and review by the Corps' Headquarters, resulted in reduced benefits and a project that was no longer economically justified. When the results were presented to the fishermen of Maui in a public workshop held in August 1987, there was an outpouring of intense sentiment and a complaint that the data were not complete. In response, the Corps and NMFS conducted a special survey to obtain more current information from the fishermen. This survey was run in August and September 1987.

Altogether, 385 surveys were mailed out and another 80 were made available through the State of Hawaii and fishing club representatives. The results of the survey analysis, completed in March 1988, indicated that the benefits for a launch ramp improvement project at Kahului would be $339,000 a year, based on launched vessels. The responses to the survey did <u>not</u> show that temporary moorage space at the Kahului ramp could be economically and incrementally justified. The survey results indicated that the number of trips taken would increase by only 4 percent if mooring were provided. And as a result, temporary mooring space could not be economically justified. However, alternative optional expansion layouts to the basic plans providing temporary moorings have been developed for local consideration. The cost to provide the temporary mooring areas and the decision to implement the mooring options would be a local responsibility and are not included as a part of the benefit/cost analysis. The National Marine Fisheries Service survey findings and economic analysis prepared for the Corps are presented in the Economic Appendix E.

4.16.3 Benefits and Costs Analysis

The benefit and cost comparisons of the basic Federal plans (A1, B1, and B2) are shown on table 4. The cost for construction of the non-federal temporary mooring options are not included because the economic analysis showed that mooring spaces could not be economically justified.

4.17 Rationale for Designation of NED Plan

Plan A1 is the plan with the greatest positive net benefits. It is the NED plan. Plan A1 is also the easiest plan to expand should the State decide that they will provide a temporary mooring area.

4.18 Evaluation of Final Array of Plans

The evaluation of the economic, social and environmental effects of each alternative plan is described in Table 5. This table displays the significant contributions, the beneficial and adverse effects, and the extent to which various planning objectives and evaluation criteria met by each plan.

4.19 Trade-off Analyses

All the proposed basic plans make net contributions to the national economic development account. Plan A1 contributes the maximum net contributions to NED.

In addition to the economic or monetary factors analyzed for each plan, trade-off analysis must also include environmental, social, regional and aesthetic effects associated with each plan. Table 5 facilitates the evaluation and comparison of these criteria for each plan.

5 TENATIVE PLAN SELECTION

5.1 Rationale for Selection

The selection of the most desirable plan of improvement involves comparison and tradeoffs among the alternative plans. A comparison of the alternative plans was performed on the basis of 1) beneficial and adverse effects of each alternative, 2) relative contribution to the planning objectives, and 3) response to associated evaluation criteria as listed in Table 5.

Plan A1 is tenatively selected as the recommended plan. The final plan selection will be made following public review of this draft report and environmental impact statement.

Table 4

BENEFIT TO COST COMPARISON

	PLAN A1	PLAN B1	PLAN C1
Total Federal First Cost[1]	$1,817,000	$3,144,000	$2,933,000
Total Non-Federal First Cost	$125,000	$125,000	$125,000
U.S. Coast Guard	$20,000	$20,000	$20,000
TOTAL FIRST COST	$1,962,000	$3,289,000	$3,078,000
Interest During Construction [2]	$85,000	$143,000	$134,000
PROJECT INVESTMENT COST [1]	$2,047,000	$3,432,000	$3,212,000
AVERAGE ANNUAL COST			
Investment Cost	$184,000	$309,000	$289,000
Maintenance Cost	$9,000	$15,000	$14,000
TOTAL AVERAGE ANNUAL COSTS	$193,000	$324,000	$303,000
AVERAGE ANNUAL BENEFITS	$339,000	$339,000	$339,000
BENEFIT/COST RATIO	1.8	1.0	1.1
NET NED BENEFITS	$146,000	$15,000	$36,000

[1] Excludes preauthorization study costs $266,000.

[2] IDC = $A(1+i)^{n/2} - A$, where A = project first costs;
i = interest rate = 0.08875
n = construction period (yrs) = 1.0

TABLE 5 - SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE PLAN A1	ALTERNATIVE PLAN B1	ALTERNATIVE PLAN C1
A. PLAN DESCRIPTION	Use existing facility at Kahului Harbor. The next closest facility is at Maliko Bay, approximately 10 miles from Kahului.	Construcion of a 130-ft breakwater; a 100 by 100-ft turning basin, 8.5-ft deep; and an entrance channel 50-ft wide, 1,030-ft long , and 9.5-ft deep.	Construction of a 100 by 100-ft revetted turning basin, 8.5-ft deep excavated into the fill area near the existing ramp; an entrance channel 50-ft wide, 1,030-ft long, and 9.5-ft deep; and an approach channel 140-ft long, 50-ft wide, and 8.5-ft deep.	Construction of a 100 by 100-ft revetted turning basin, 8.5-ft deep excavated into the fill area near the harbor entrance ; an entrance channel 50-ft wide, 240-long, and 9.5-ft deep.
B. IMPACT ASSESSMENT				
1. Economic				
a. Public Facilities & Services	Exisiting ramp and 70-ft stub breakwater.	Would provide for safe navigation and launch/recovery of vessels and could promote the growth of related public facilities and services.	Same as Plan A1.	Same as Plan A1.
b. Commitment of Economic Resources	Not applicable.	Commitment of 5,500 tons of quarried stone, time, manpower, and energy resources.	Commitment of 12,300 tons of quarried stone, time, manpower, and energy resources.	Commitment of 27,300 ton quarried stone, time, manpower, and energy resources.

TABLE 5 (CON'T) - SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE PLAN A1	ALTERNATIVE PLAN B1	ALTERNATIVE PLAN C1
c. Recreation	No change.	Would provide improved opportunites for boating, fishing, and other water based recreation activities.	Same as Plan A1.	Same as Plan A1.
d. Regional Growth	May impose some constraints on economic growth in the area.	Would increase economic growth due to increased fishing opportunities.	Same as Plan A1.	Same as Plan A1.
e. Employment	Existing Conditions. Employment opportunities may be constrained due to reduced commercial fishing opportunities.	Would increase employment opportunities in commercial fishing and general boating related services.	Same as Plan A1.	Same as Plan A1.
f. Damages to Boats and Related Equipment.	Continued damages to boats.	Eliminate damages to boats.	Same as Plan A1.	Same as Plan A1.
g. Local Government Finance	None.	Requires cost sharing in accordance with WDRA 86 and the LCA.	Same as Plan A1.	Same as Plan A1.
2. Environmental				
a. Marine Environment	No change.	Dredge 13,200 cubic yards of material.	Dredge 25,600 cubic yards of material.	Dredge 22,500 cubic yard of material

TABLE 5 (CON'T) - SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE PLAN A1	ALTERNATIVE PLAN B1	ALTERNATIVE PLAN C1
b. Terrestrial Environment	No change.	Approx. 0.1 acres modified for construction of the new ramp.	Approx. 1.1 acres modified for construction of the turning basin and launch ramp.	Approx. 1.4 acres modified for constr. of a turning basin, entrance channel,& ramp.
c. Fish and Wildlife	No change.	The rubblemound breakwater will provide habitat for a variety of fish and invertebrates. Dredging and possible blasting will kill some invertebrates and fish.	The rubblemound revetments will provide habitat for a variety of fish and invertebrates. Dredging and possible blasting will kill some invertebrates and fish during construction.	Same as Plan B1.
d. Endangered Species	No change. Humpback whales migrate past Kahului and green sea turtle have been seen along the coast line in the study area.	No adverse impact. Any blasting operations may have to be restricted during the months of December to May during the whale calving season.	Same as Plan A1.	Same as Plan A1.
e. Circulation and Flushing	No change.	No adverse impact.	Same as Plan A1.	Same as Plan A1.
f. Air Quality	No change.	Temporary dust and exaust impacts during construction.	Same as Plan A1.	Same as Plan A1.
g. Water Quality	No change.	Temporary Turbidity during construction. No significant long-term impact.	Same as Plan A1.	Same as Plan A1.

TABLE 5 (CON'T) - SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE PLAN A1	ALTERNATIVE PLAN B1	ALTERNATIVE PLAN C1
3. Social				
a. Noise	No change.	Temporary increases during construction.	Same as Plan A1.	Same as Plan A1.
b. Population	No change.	No significant effect on population growth and no displacement of people.	Same as Plan A1.	Same as Plan A1.
c. Aesthetic Values	No change.	Visual intrusion from improvements.	Same as Plan A1.	Same as Plan A1.
d. Historical, Cultural and Archaeological Resources	No sites listed on the National or State Register of Historic Places.	No impact.	Same as Plan A1.	Same as Plan A1.
e. Health, Safety and Well-being of Community	Hazardous navigation conditions.	Would enhance health, safety and community well-being by providing improved navigation conditions for safe commercial fishing operations. Also decrease damages to vessels.	Same as Plan A1.	Same as Plan A1.
f. Community Growth and Cohesion	No Change.	No significant changes.	Same as Plan A1.	Same as Plan A1.

TABLE 5 (CON'T) - SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE PLAN A1	ALTERNATIVE PLAN B1	ALTERNATIVE PLAN C1
C. PLAN EVALUATION				
1. Contributions to Planning Objectives				
a. Improve Commercial boating facilities.	No change.	Provides improved light draft navigation facilities for commercial fishing.	Same as Plan A1.	Same as Plan A1.
b. Improve the Socio-Economic Opportunities for the People of Maui.	No change.	Provides improved employment opportunities, diversity of Maui's tax revenue base, and produces stability of fish supply and prices.	Same as Plan A1.	Same as Plan A1.
c. Minimize alterations to the marine and terrestrial environment and to recreational, cultural and archeological resources.	No change.	No significant impact.	Same as Plan A1.	Same as Plan A1.

TABLE 5 (CON'T) - SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE PLAN A1	ALTERNATIVE PLAN B1	ALTERNATIVE PLAN C1
d. Avoid impacts to endangered or threatened species.	No change.	No significant impact.	Same as Plan A1.	Same as Plan A1.
e. Increase commercial fishing opportunities.	Restricts commercial fishing opportunities.	Provides improved navigation facilities for the operation of trailered boats, contributes to the development of commercial fishing, increasces efficiency and opportunities for existing fishing operations and provides a social and economic commitment on the importance of fishing.	Same as Plan A1.	Same as Plan A1.
f. Minimize conflicts with existing and planned uses.	No change.	No significant impact.	Same as Plan A1.	Possible conflict with future deep draft harbor development.
2. Response to Formulation Criteria				

TABLE 5 (CON'T) - SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE PLAN A1	ALTERNATIVE PLAN B1	ALTERNATIVE PLAN C1
a. Technical				
-Safe Navigation Conditions	N/A	Yes.	Yes.	Yes.
-Structures designed for severe storm	N/A	Yes.	Yes.	Yes.
-Accommodate Design Vessel	N/A	Yes.	Yes.	Yes.
b. Economic				
-Economically Sound	N/A	Yes.	Yes.	Yes.
-BCR > 1	N/A	Yes.	Yes.	Yes.
-Maximize Net Benefits	N/A	Yes.	No.	No.
c. Environmental				
-Minimize Long-Term Effects	No change.	Yes.	Yes.	Yes.
-Confine Work Area	N/A	Yes.	Yes.	Yes.

TABLE 5 (CON'T) - SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE PLAN A1	ALTERNATIVE PLAN B1	ALTERNATIVE PLAN C1
3. Relationship to National Accounts				
National Economic Development				
-Average Annual Benefits	N/A	$339,000	$339,000	$339,000
-Average Annual Costs	N/A	$193,000	$324,000	$303,000
-Net Annual Benefits	N/A	$146,000	$15,000	$36,000
-Benefit to Cost Ratio	N/A	1.8	1.0	1.1
4. Response to Associated Evaluation Criteria				
a. Acceptability	N/A	High	Low	Low
b. Completeness	N/A	Complete as described with periodic maintenace. Temporary mooring area is State option.	Same as Plan A1.	Same as Plan A1.

TABLE 5 (CON'T) - SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE PLAN A1	ALTERNATIVE PLAN B1	ALTERNATIVE PLAN C1
c. Effectiveness	N/A	Effective.	Same as Plan A1.	Same as Plan A1.
e. Reversibility	N/A	Irreversible commitment of monetary and environmental resources.	Same as Plan A1.	Same as Plan A1.
f. Stability	N/A	Stable.	Same as Plan A1.	Same as Plan A1.
D. IMPLEMENTATION RESPONSIBILITIES				
1. Corps of Engineers	N/A	Provide estimated first cost share of $2.0 million, design and construction of breakwater, entrance channel and turning basin.	Provide estimated first cost share of $3.3 million, design and construction of entrance channel, turning basin, and revetment.	Provide estimated first cost share of $3.1 milli design and construction entrance channel, approa channel, turning basin, revetment.
2. State of Hawaii	N/A	Provide estimated first cost share of $2.0 million and provide local assurances and cooperation.	Provide estimated first cost share of $3.3 million and provide local assurances and cooperation.	Provide estimated first cost share of $3.1 milli and provide local assurances and cooperati
3. US Coast Guard	N/A	Provide Navigational Aids.	Same as Plan A1.	Same as Plan A1.

5.2 Plan Components

The tentatively selected plan includes the following components:

a. A 1,030-ft long entrance channel, 9.5-feet deep.

b. A turning basin 100 feet by 100 feet, 8.5 feet deep.

c. A rubble mound breakwater 130-foot long with a crest elevation of +9.0 feet (mllw).

d. A new two-lane launch ramp to be provided by the local sponsor.

5.3 Mitigation Measure

Surfing. Concerns have been raised regarding interference with surfing activities in Kahului Harbor. The conflict between surfing and the operations of the navigation improvements is anticipated to be minimal as the good surfing conditions within the harbor occur during times of very high and rough sea conditions outside the harbor. These conditions are unfavorable and hazardous for fishing and the facility is unlikely to be used during these periods. In addition, the entrance channel has been aligned to avoid the primary surfing shoal area in the Harbor. No significant effect on the wave patterns in the surfing areas is anticipated as a result of dredging of the entrance channel.

Deep Draft Harbor. Based on discussions from the December 1984 public workshop and approvals by the County of Maui and the State Harbors Division in March 1985, conflicts with the use of the deep draft harbor users are not anticipated as a result of the scaling down of the project from a full sized harbor to a protected launching and retrieval facility. The light draft navigation facility use would peak during periods of good weather which would minimize the chances of an accident occurring. In addition, the State of Hawaii's Year 2010 Master Plan for Kahului Harbor, published and signed in January 1989, includes recommendations for coordination and integration of the launching facility in the study area with the possible expansion and operations of the deep draft harbor.

Blasting. Any blasting required during construction will be restricted during the months of December to May during the Whale migration and calving season.

5.4 Plan Implementation

Offshore Borings. Offshore borings to verify subsurface conditions will be conducted upon approval of the DPR and prior to plans and specifications.

Plans and Specifications. Construction plans and specifications will be prepared by the Corps of Engineers after completion of the offshore borings investigation. During this stage the following will also be conducted:

a. Obtaining any necessary rights-of-way and easements.

b. Process the Local Cooperation Agreement (LCA) for signature by the project sponsor and the District Engineer.

c. Complete all Federal, State, and County compliance documents and obtain all necessary permits for construction.

Construction Schedule. Construction will require approximately 12 months to complete. Construction will be accomplished by contract to a private construction firm through competitive bidding under Corps of Engineers supervision.

5.5 Operation and Maintenance Considerations

The Corps of Engineers will be responsible for operation and maintenance of the general navigation facilities which include the entrance channel, turning basin, and breakwater. The Government's responsibility for operation and maintenance for the project will end when the Government's expenditures for this responsibility have reached the greater of $4,500,000 less the Government's share of the construction costs, of the general navigation facilities or 125 percent of the governments share of the general navigation facilities, both discounted on a present worth basis starting with the date the local sponsor accepts the project.

5.6 Apportionment of Costs

The apportionment of costs is based on Section 101 of the Water Resources Development Act of 1986 (WDRA 86), PL 99-662, which requires the non-federal sponsor to initially cost share 10 percent of the construction of the general navigation facilities during the period of construction of the project and an additional 10 percent payment over 30 years. Apportionment of the costs for the tentatively selected plan are shown on Table 6.

Table 6
PLAN A1 - COST APPORTIONMENT

INITIAL COST SHARING:	
Federal Share -	
Total Federal First Cost [1]	$1,817,000
Non-federal Cost Share During Construction [2]	($182,000)
Initial Corps Costs	$1,635,000
USCG Aids To Navigation	$20,000
TOTAL INITIAL FEDERAL SHARE	$1,655,000
Non-Federal Share -	
Non-Federal First Cost	$125,000
Non-federal Cost Share During Construction [2]	$182,000
TOTAL INITIAL NON-FEDERAL SHARE	$307,000
ULTIMATE COST SHARING:	
Federal Share -	
Total Federal First Cost [1]	$1,817,000
Non-federal Cost Share During Construction [2]	($182,000)
Non-federal Cost Share Over 30 Years [2]	($182,000)
Ultimate Corps Costs	$1,453,000
USCG Aids To Navigation	$20,000
TOTAL ULTIMATE FEDERAL SHARE	$1,473,000
Non-Federal Share -	
Non-Federal First Cost	$125,000
Non-federal Cost Share During Construction [2]	$182,000
Non-federal Cost Share Over 30 Years [2]	$182,000
TOTAL ULTIMATE NON-FEDERAL SHARE	$489,000

[1] *Excludes preauthorization study costs of $266,000.*
[2] *Ten percent (10%) of Total Federal First Cost.*

5.7 Federal Funding

The preparation of plans and specifications and the initiation of construction must be approved and authorized by the Chief of Engineers. U.S. Army Corps of Engineers' priority for funding of construction under the continuing authorities program is based on the needs and merits of similar projects nationwide and the availability of funds.

5.8 Views of the Sponsor

The sponsor approves of the tentative plan selection and has submitted letters of support and intent, dated 27 September 1988 (Figure 17) and January 25, 1989 (Figure 18).

6 SUMMARY OF COORDINATION, PUBLIC VIEWS AND COMMENTS

The public involvement program has consisted of workshops with the public at large, and meetings of Federal, State and County agencies. The first public workshop was conducted on 15 February 1984 at the Kahului Library. The meeting discussed the purpose of the study and the various alternative sites and plans considered. The workshop participants strongly supported the need for a small boat harbor on the north side of Maui, and particularly the site within Kahului Harbor.

A second public workshop was held on 4 December 1984 at the Maui Community College. Alternative plans for a 120 boat harbor within Kahului were presented. The County of Maui's objections to the small boat harbor and concerns over the potential safety problems with small boats using the same entrance channel as the large deep draft vessels were also discussed. In a meeting with Maui Mayor Tavares, during the afternoon prior to the workshop, the Mayor expressed concern over the possibility of an accident closing Kahului Harbor, Maui's only deep draft commercial harbor. Based on the discussions of the workshop, a scaled down facility, consisting of an improved launch ramp, turning basin, entrance channel and temporary mooring area was proposed to the participants. This meet to the satisfaction of the fisherman present. Continued support for the project was expressed.

The revised concept was presented to the County of Maui representatives in a 15 March 1985 meeting. All of the Maui County representatives at the meeting thought that the revised plan would be a good compromise solution that would serve the needs of the Maui's commercial fisherman and would be responsive to the County's concerns about potential traffic conflicts.

On 13 June 85, a third public workshop was held at the Kahului Library. This workshop presented the revised concept of the improved launch ramp, dredged turning basin and entrance channel, and temporary mooring area for 10 to 15 vessels. This concept was supported by the participants.

A fourth public meeting on 11 August 1987 was held at the Maui Community College. The meeting presented the various layouts for the revised navigation facility improvements and discussed the results of the National Marine Fisheries Economic Analysis. The analysis indicated that there were insufficient benefits to support any of the proposed plans. The participants indicated that the information used in the analysis was not accurate. As a result, it was decided that the Corps and National Marine Fisheries Service would conduct a survey of Maui's commercial fisherman. Approximately 90 fisherman participated in this workshop and all voiced strong support for the project.

In August and September 1987, 385 surveys were mailed out and another 80 were made available through the State of Hawaii and fishing club representatives. The results of the survey analysis, completed in March 1988, indicated that the benefits for a launch ramp improvement project at Kahului would be $339,000 a year, based on launched vessels. The responses to the survey showed that temporary moorage space at the Kahului ramp could not be economically justified. The survey results are presented in Appendix E.

JOHN WAIHEE
GOVERNOR

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

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

IN REPLY REFER TO:

September 27, 1988

HAR-EP 1389

Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
U. S. Army Engineer District, Honolulu
Building 230
Ft. Shafter, Hawaii 96858-5440

Dear Mr. Cheung:

Thank you for your letter of September 2, 1988 transmitting a draft copy of a Local Cooperation Agreement (LCA) for a proposed Kahului Light Draft Navigation Improvements project on the Island of Maui.

I fully support the preliminary plans for construction of a 130-ft. long breakwater, a 8.5-ft. deep by 1,030-ft. long entrance channel and a 100-ft. by 100-ft. by 7.5-ft. boat mooring basin in the area of the existing boat launching ramp.

This is my official notice of intent to participate in this joint Federal/State project and my assurance that the State's estimated share of $160,000 will be made available at the appropriate time. In the meantime, I will initiate our technical and legal review of the draft agreement document.

I appreciate your interest in providing this much needed small craft mooring facility within Kahului Harbor.

Very truly yours,

Edward Y. Hirata
Director of Transportation

FIGURE 17

JOHN WAIHEE
GOVERNOR

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. UCHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

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

IN REPLY REFER TO:

January 25, 1989

HAR-EP 2924

Colonel F. W. Wanner
District Engineer
U. S. Army Engineer, District Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Dear Colonel Wanner:

Draft Detailed Project Report and Environmental Impact Statement, Kahului Light-Draft Navigation Improvements, Maui, Hawaii, October 1988

We have reviewed the subject draft report and agree with the conclusions and recommendations of the Plan A-1 option.

The Plan A-1 has the flexibility to be expanded to Plan A-2 in the future if sufficient demand is generated.

Thank you for the opportunity to review this draft report. We will be looking forward to hearing from you on the determination of the project status.

Very truly yours,

Edward Y. Hirata
Director of Transportation

FIGURE 18

7 CONCLUSIONS AND RECOMMENDATIONS

The final plan selection, conclusions, and recommendations will be determined following completion of public review and input.

7.1 Conclusions

7.2 Recommendations

8 DISCLAIMER

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels. Consequently, the recommendations may be modified before they are transmitted to the Chief of Engineers as proposals for authorization and/or implementation funding.

9 REFERENCES

1. CERC - Coastal Engineering Research Center, "CETN-I-37, WAVRUNUP-Estimating Irregular Wave Runup Heights on Rough Slopes," Vicksburg, Mississippi, 1986.

2. CERC - Coastal Engineering Research Center, "CETN-I-32, SINWAVES-Linear Wave Theory Conditions," Vicksburg, Mississippi, 1987.

3. CERC - Coastal Engineering Research Center, "CETN-III-26, HUDSON-Breakwater Design by the Hudson Formula," Vicksburg, Mississippi, 1987.

4. CERC - Coastal Engineering Research Center, "Pacific Coast Hindcast Deepwater Wave Information," Vicksburg, Mississippi, 1986.

5. CERC - Coastal Engineering Research Center, "Shore Protection Manual (SPM)," Vicksburg, Mississippi, 1984.

6. DBED - Department of Business and Economic Development, "The State of Hawaii Data Book," Honolulu, Hawaii, 1987.

7. DBED - Department of Business and Economic Development, State of Hawaii, "Statistical and Economic Report," Honolulu, Hawaii, 3rd Quarter 1988.

8. HED - U.S. Army Engineer District, Honolulu, "Detailed Project Report and Environmental Impact Statement, Laupahoehoe Navigation Improvements, Laupahoehoe, Hawaii," Honolulu, Hawaii, 1983.

9. HED - U.S. Army Engineer District, Honolulu, "General Design Memorandum, Breakwater Rehabilitation, Kahului Harbor, Maui, Hawaii," Honolulu, Hawaii, 1981.

10. NOAA - National Oceanic and Atmospheric Administration, "Local Climatological Data, Annual Summary with Comparative Data," Kahului, Hawaii, 1987.

11. POD - U.S. Army Engineer Division, Pacific Ocean, "Detailed Project Report, Prevention and Mitigation of Shore Damages, Kahului Harbor, Maui, Hawaii," Honolulu, Hawaii, 1973.

12. State of Hawaii - Harbors Division, Department of Transportation, "2010 Master Plan for Kahului Harbor," Honolulu, Hawaii, January 1989.

13. USACE - U.S. Army Corps of Engineers, EM 1110-2-1613, "Hydraulic Design of Deep-Draft Navigation Projects," 1983.

14. USACE - U.S. Army Corps of Engineers, EM 1110-2-1615, "Hydraulic Design of Small Boat Harbors", 1984.

15. USACE - U.S. Army Corps of Engineers, EM 1110-2-2904, "Design of Breakwaters and Jetties", 1986.

16. USACE - U.S. Army Corps of Engineers, EP 1165-2-1, "Digest of Water Resources Policies and Authorities," 1983.

17. U.S. Water Resources Council, "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies," 1983.

18. WES - U.S. Army Engineer Waterways Experiment Station, "Design for Rubble-Mound Breakwater Repair, Kahului Harbor, Maui, Hawaii - Hydraulic Investigation Model, Resume of Test Results, WES Conference," Vicksburg, Mississippi, May 1962.

19. WES - U.S. Army Engineer Waterways Experiment Station, "Design for Rubble-Mound Breakwater Repair, Kahului Harbor, Maui, Hawaii - Hydraulic Investigation Model, Resume of Test Results, East Breakwater Truck and West Breakwater Head," Vicksburg, Mississippi, October 1962.

KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

DRAFT ENVIRONMENTAL IMPACT STATEMENT

DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR
KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
KAHULUI, MAUI, HAWAII

SEPTEMBER 1988

The responsible Federal lead agency is the US Army Corps of Engineers, Honolulu District, Hawaii. The responsible Federal cooperating agency is the US Fish and Wildlife Service. The responsible local cooperating agency is the State of Hawaii Department of Transportation, Harbors Division.

Information, displays and figures referred to in the Main Report and Appendices are incorporated as part of this Environmental Impact Statement.

Abstract: The project proposes to provide light-navigation improvements at Kahului Harbor. At present, Maui has two existing small boat harbors on the south side of the island. The fishing grounds on the north side are generally out of reach from these harbors. As a result, light draft navigation improvements are required to fulfill the need for Maui's northern side.

Three sites, Kahului Harbor, Kanaha, and Maliko were initially considered but the latter two were dropped due to unfeasible benefit-cost ratios. Kahului Harbor is surrounded by the town of Kahului and is the only deep-water port on Maui. Six alternative plans for the Kahului site were considered. The plans include a turning basin, entrance channel, breakwater, mooring area, parking and shore facilities. The major environmental impacts are damage to the benthic environment and fisheries dues to blasting, increase harbor usage, conflicts with boating uses, and adverse impacts to surfing.

If you have any comments on this draft EIS, please send them to the District Engineer within 45 days of the date when the EIS notice of availability is published in the Federal Register. At present, we anticipate the publication of the notice on or about March 31, 1989. If you would like further information on this environmental impact statement, please contact:

Dr. James E. Maragos, Chief
Environmental Resources Section
US Army Engineer District, Honolulu
Building T-1
Fort Shafter, Hawaii 96858-5440
Phone: (808) 438-2263

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I. SUMMARY

A. Major Conclusions and Findings. Six alternatives and no action were evaluated for Kahului Light Draft Navigation Improvements. The plans include a turning basin, mooring basin, entrance channel, breakwater and parking and shoreside facilities at two sites. Two other locations, Maliko Bay and Kanaha, were considered but later dropped during the planning process due to the lack of economic feasibility. The plans are detailed as follows:

TABLE 1. PLAN FEATURES

Plan A1	Plan A1 consists of a 130-foot breakwater; a turning basin 100 feet by 100 feet in area and 8.5 feet deep; a new two lane boat launch ramp and a 50-foot wide entrance channel extending approximately 1,030 feet long and 9.5 feet in depth. Plan A1 is located on the harborside of the fill area at Site 1 which is on the west end of the existing boat launch ramp in Kahului Harbor.
Plan A2	Plan A2 consists of a 130-foot breakwater; a turning basin approximately 100 feet by 100 feet in area and 8.5 feet in depth; a temporary mooring basin about 105 feet by 105 feet in area and 6.5 feet in depth; a new two lane boat launch ramp; and a 50-foot wide, 9.5-foot deep and 1,030-foot long entrance channel. Plan A2 is also located offshore of the fill area at Site 1 which is on the west end of the existing boat harbor. Plan A2 differs from Plan A1 in that it consists of a mooring basin.
Plan B1	Plan B1 consists of a turning basin 100 feet by 100 feet in area and 8.5 feet in depth; a 50-foot wide, 1,030-foot long, and 9.5-foot deep entrance channel; and an entrance revetment surrounding the turning basin. Plan B1, located at Site 1, will require excavation of the existing fill and replacement of the boat launch ramp.
Plan B2	Plan B2 consists of a 100 feet by 100 feet and 8.5 feet deep turning basin; a temporary mooring approximately 105 feet by 105 feet and 6.5 feet deep; a new two lane launch ramp; entrance revetment surrounding the turning and mooring basins; and a 1,030-foot entrance channel 50-feet wide and 9.5-feet deep. Plan B2 is similar to Plan B1 but differs in that it consists of a mooring basin. The alternative is located at Site 1 and will require excavation of the existing fill.
Plan C1	Plan C1 consists of a turning basin 100 feet by 100 feet and 8.5 feet deep; entrance channel revetment; a new two lane boat launch ramp; and an entrance channel approximately 50 feet wide and 9.5 feet deep. The plan is located at Site 2 which is nearer the harbor entrance and will require excavation of the existing fill.

Plan C2

Plan C2 consists of a turning basin 100 feet by 100 feet and 8.5 feet deep; a mooring basin 105 feet by 105 feet and 6.5 feet deep; a new two lane boat launch ramp; and an entrance channel about 9.5 feet deep and 50 feet wide. The plan is located at Site 2 and will require excavation of the existing fill.

No Action

The no action plan would not propose any improvements.

B. Areas of Controversy. A public workshop was held on June 13,1985 to discuss the various alternate plans. There was general support from the public to have an improved boat launch ramp with a protected area for temporary mooring of approximately 10-15 boats. The area proposed for Site 1 is within a Marine Fisheries Management Area as designated by the State of Hawaii Department of Land and Natural Resources regulations, Title 13, Chapter 51. The major environmental impacts are damage to the benthic environment and fisheries due to blasting, increased harbor usage, conflict with boating usage, and adverse impacts to surfing.

C. Unresolved Issues. None.

D. Relationship to Environmental Requirements. These relationships are located on Table 2.

II. NEED FOR AND OBJECTIVES OF THE ACTION

A. Study Authority. The project is authorized under Section 107 of the River and Harbor Act of 1960, as amended.

B. Historical Review of the Problem to be Solved. The island of Maui has two small craft harbors, namely Lahaina with 16 berths and 77 mooring spaces and Maalaea with 25 berths and 69 mooring spaces. Both harbors are located on the south side of the island. The need for additional wet stored boat facilities and launch ramps for north Maui was identified under the review of the Coast of the Hawaiian Islands Study. At a public workshop held at the Maalaea Boat and Fishing Club on May 13, 1982, Maui boaters expressed a desire for a commercial light-draft harbor on the northern coast of the island with the suggestion that it be located at Kahului Harbor. They stated that this harbor is close to the prime fishing grounds and the fish market in Kahului. The boating demand analysis of the Coasts of the Hawaiian Islands confirmed the need for light-draft facilities for north Maui. Subsequently, the State of Hawaii Department of Transportation, Harbors Division, requested a study under Section 107 authority for the site within Kahului Harbor.

C. Public Concerns. At previous workshops in February 1984 and December 1984, the Corps discussed the need for a small boat facility to serve local fishermen. The attendees agreed that a new commercial fishing harbor located on the north side of Maui was needed to support the growing fishing industry. The development of the small boat harbor within Kahului Harbor was strongly supported by them. Three alternative sites were evaluated, Kahului Harbor, Kanaha Beach, and Maliko Bay for a 120 boat commercial fishing harbor. It was concluded that the best site for such a harbor would be the Kahului Harbor. The County of Maui, however, expressed concern over the potential conflicts with deep-draft vessels and small boats. The Corps has subsequently

TABLE 2. RELATIONSHIP OF THE PLANS TO ENVIRONMENTAL PROTECTION STATUTES AND OTHER ENVIRONMENTAL REQUIREMENTS

	SITE 1				SITE 2	
FEDERAL STATUTES	Plan A1	Plan A2	Plan B1	Plan B2	Plan C1	Plan C2
Archaeological Resources Act	Full	Full	Full	Full	Full	Full
Clean Air Act	Full	Full	Full	Full	Full	Full
Clean Water Act	Full	Full	Full	Full	Full	Full
Coastal Zone Management Act	Full	Full	Full	Full	Full	Full
Endangered Species Act	Full	Full	Full	Full	Full	Full
Estuaries Protection Act	N/A	N/A	N/A	N/A	N/A	N/A
Federal Water Project Recreation Act	Full	Full	Full	Full	Full	Full
Fish and Wildlife Coordination Act	Full	Full	Full	Full	Full	Full
Land and Water Conservation Act	N/A	N/A	N/A	N/A	N/A	N/A
Marine Protection, Research and Sanctuaries Act	N/A	N/A	N/A	N/A	N/A	N/A
National Historic Preservation Act	Full	Full	Full	Full	Full	Full
National Environmental Policy Act	Full	Full	Full	Full	Full	Full
Rivers and Harbors Act	Full	Full	Full	Full	Full	Full
Watershed Protection and Flood Protection Act	N/A	N/A	N/A	N/A	N/A	N/A
Wild and Scenic Rivers Act	N/A	N/A	N/A	N/A	N/A	N/A
EXECUTIVE ORDERS, MEMORANDA						
Flood Plain Management	N/A	N/A	N/A	N/A	N/A	N/A
Protection of Wetlands	N/A	N/A	N/A	N/A	N/A	N/A
Environmental Effects Abroad of Major Federal Actions	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 2 (CONTINUED).

EXECUTIVE ORDERS, MEMORANDA	SITE 1 Plan A1	Plan A2	Plan B1	Plan B2	SITE 2 Plan C1	Plan C2
Analysis of Impacts on Prime and Unique Farmlands	N/A	N/A	N/A	N/A	N/A	N/A
STATE AND LOCAL POLICIES						
State EIS law, Chapter 343, HRS	Full	Full	Full	Full	Full	Full
State Coastal Zone Management Program	Full	Full	Full	Full	Full	Full
County Special Management Area Permit	Full	Full	Full	Full	Full	Full
State Conservation District Use Application	Full	Full	Full	Full	Full	Full
County General Plan	Full	Full	Full	Full	Full	Full
State Land Use Law	Full	Full	Full	Full	Full	Full
REQUIRED FEDERAL ENTITLEMENTS (PERMITS)						
None Required						

NOTES:

a. Full (Full Compliance). Having met all requirements of the Statute, Executive Order or other environmental requirements for the current stages of planning (either pre- of post-authorization).

b. Partial (Partial Compliance). Not having met some of the requirements that normally are met in the current stage of planning. Partial compliance entries should be explained in appropriate places in the report and/or EIS and referenced in the table.

c. Non-Compliance. Violation of a requirement of the Statute, Executive Order or other environmental requirement. Non-compliance entries should be explained in appropriate places in the report and/or EIS and referenced in the table.

d. N/A (Not Applicable). No requirements for the Statute, Executive Order or other environmental requirement for the current stage of planning.

TABLE 2 (CONTINUED).

EXECUTIVE ORDERS, MEMORANDA	SITE 1 Plan A1	Plan A2	Plan B1	Plan B2	SITE 2 Plan C1	Plan C2
Analysis of Impacts on Prime and Unique Farmlands	N/A	N/A	N/A	N/A	N/A	N/A
STATE AND LOCAL POLICIES						
State EIS law, Chapter 343, HRS	Full	Full	Full	Full	Full	Full
State Coastal Zone Management Program	Full	Full	Full	Full	Full	Full
County Special Management Area Permit	Full	Full	Full	Full	Full	Full
State Conservation District Use Application	Full	Full	Full	Full	Full	Full
County General Plan	Full	Full	Full	Full	Full	Full
State Land Use Law	Full	Full	Full	Full	Full	Full

REQUIRED FEDERAL ENTITLEMENTS (PERMITS)

None Required

NOTES:

a. Full (Full Compliance). Having met all requirements of the Statute, Executive Order or other environmental requirements for the current stages of planning (either pre- of post-authorization).

b. Partial (Partial Compliance). Not having met some of the requirements that normally are met in the current stage of planning. Partial compliance entries should be explained in appropriate places in the report and/or EIS and referenced in the table.

c. Non-Compliance. Violation of a requirement of the Statute, Executive Order or other environmental requirement. Non-compliance entries should be explained in appropriate places in the report and/or EIS and referenced in the table.

d. N/A (Not Applicable). No requirements for the Statute, Executive Order or other environmental requirement for the current stage of planning.

revised the plans accordingly. On August 11, 1987, a public workshop was held to discuss the project and the commercial fishing analysis prepared by the National Marine Fisheries Service. The attendees once again expressed strong support for the project and recommended that the Corps go to extra effort to devise at least one feasible plan for Kahului.

D. Planning Objective. The planning objective is to provide a light-draft vessel harbor for the north side of the island of Maui.

III. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

A. Plans Eliminated From Further Study. The 120-boat commercial fishing harbor has been eliminated from further study due to the lack of local support. The Kanaha and Maliko sites have been eliminated from further study due to high costs and low benefits.

B. Without Project Alternative. The no action alternative would continue the shortage of wet stored boat facilities. The boaters on Maui would not have any light-draft harbor on its northern coast which is closer to the prime fishing grounds and to the fish market.

C. Plans Considered in Detail.

1. Site 1, Plan A1. Plan A1 is located on the west end of Kahului Harbor at the existing boat launch ramp. An approximately 130-foot breakwater extends eastward from the existing coral fill area and perpendicular to the entrance channel. An entrance channel about 1,030 feet long, 50 feet wide, and 9.5 feet deep and a turning basin 100 feet by 100 feet and 8.5 feet deep would be dredged. A new two lane boat launch ramp at the existing ramp site would be constructed. The dredged material will be deposited on the existing fill area. The existing fill area will be used for parking and shoreside facilities.

2. Site 1, Plan A2. Located at the existing boat launch ramp facility, Plan A2 consists of a turning basin 100 feet by 100 feet and 8.5 feet deep; temporary mooring approximately 10 5 feet by 105 feet and 6.5 feet deep which will store about 10-15 boats; a 130-foot breakwater; an entrance channel about 1,030 feet long, 50 feet wide and 9.5 feet deep; and a revetted mole about 120 feet long and 50 feet wide. The revetted mole will be filled with material excavated from the turning basin and entrance channel. The existing area will be used for parking and shoreside development.

3. Site 1, Plan B1. Plan B1 is located inland of the existing boat launch ramp and consists of a turning basin 100 feet by 100 feet and 8.5 feet deep; a 1,030-foot long, 50-foot wide and 9.5 feet deep entrance channel; a single lane boat launch ramp; and revetment surrounding the turning basin. The existing area will be used for parking and shoreside development. Excavated material will be deposited on the existing fill area.

4. Site 1, Plan B2. Plan B2 is also located inland of the existing boat launch ramp and consists of excavation of a turning basin about 100 feet by 100 feet and 8.5 feet deep; a temporary mooring basin 105 feet by 105 feet and 6.5 feet deep; a new two lane boat launch ramp; and an entrance channel 1,030 feet long, 50 feet wide and 9.5 feet deep. The mooring basin will hold approximately 10-15 boats. The excavated material will be deposited on the fill area. The existing area will be used for parking and shoreside development.

5. Site 2, Plan C1. Located near to the harbor's entrance, Plan C1 consists of a turning basin about 100 feet by 100 feet and 8.5 feet deep; a two lane boat launch ramp; and an entrance channel about 50 feet wide, 9.5 feet deep and about 200 feet long. The excavated material will be deposited on the fill area. The existing area will be used for parking and shoreside development.

6. Site 2, Plan C2. The last plan consists of a turning basin about 100 feet by 100 feet and 8.5 feet deep; a mooring basin about 105 feet by 105 feet and 6.5 feet deep; a new two lane boat launch ramp; and an entrance channel 50 feet wide, 9.5 feet deep, and about 200 feet long. The mooring basin will accommodate about 10-15 boats. The excavated material will be placed on the existing fill area. The existing area will be used for parking and shoreside development.

D. Comparative Impacts of Alternatives. Table 3 compares the impacts of each alternative plan. Plan A1 is recommended because of minimal environmental impact, lower costs, and higher benefit cost ratio.

IV. AFFECTED ENVIRONMENT

A. Physical Setting.

1. General. Kahului Harbor, located on the northern side of the island of Maui, is the only deep-draft harbor serving the island. The island of Maui is the second largest island in the State of Hawaii with an area of 728 square miles and the third largest in population with approximately 62,823 residents in 1980. The island is of volcanic origin and consists of two major volcanic cones, namely Haleakala or the East Maui cone and the West Maui cone. Kahului Harbor is on the north side of the isthmus which separates the two volcanic cones. The harbor complex is surrounded by the town of Kahului and is two miles from Wailuku, the county seat. The deep draft harbor is primarily used by large ocean-going ships and inter-island barges. The small boat harbor will be sharing the deep-draft harbor's entrance channel.

2. Study Area. The proposed small boat harbor within Kahului deep-draft harbor is located on the northwest side of the harbor at the coral fill area (also known as Kahului Harbor Park) and existing boat launch ramp. The main breakwaters for the deep-draft harbor serves to protect the small boat harbor. The large fill area is available for shoreside facilities development and parking. Two sites have been considered in the fill area which is at the existing boat launch ramp and about 1,000 feet north of the launch ramp.

3. Climate. Kahului has an equable temperature regime, marked seasonal variation of rainfall, persistent surface winds from the northeast quadrant and the rarity of severe storm. The monthly average temperature is 75 degrees Fahrenheit with a range of 7.2 degrees between the warmest month, August, and the coldest month, February. Rainfall averages below 20 inches annually with June being the driest month. Hurricanes with winds greater than 75 miles per hour rarely affected Kahului area; however, tropical storms may pass through close enough to produce heavy rain and strong winds. Humidity at Kahului is moderate to high, with wet season humidities averaging slightly higher than those in the dry season. The natural ventilation of the prevailing winds, however, provide a pleasant climate even during the warmer months.

TABLE 3. COMPARATIVE IMPACTS OF ALTERNATIVES

RESOURCE	BASE CONDITION	PLAN A1	PLAN A2	PLAN B1	PLAN B2	PLAN C1	PLAN C2	WITHOUT PROJECT CONDITION
Recreation								
Beach park	Kahului Harbor Park	Adjacent to beach park.	Adjacent to beach park.	Adjacent to beach park.	Adjacent to beach park.	Adjacent to beach park.	Adjacent to beach park.	No effect
Fishing	Shoreline area	Adds new breakwater to shoreline.	Adds new breakwater to shoreline.	Adds new revetment to shoreline.	Adds new revetment to shoreline.	Adds new revetment to shoreline.	Adds new revetment to shoreline.	No effect
Surfing		No effect.	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.
Boating	Kahului Boat Ramp	Temporary inconvenience during construction.	Temporary inconvenience during construction.	Temporary inconvenience during construction.	No effect. inconvenience during construction.	No effect.	No effect.	No effect.
Natural Hazards								
Volcanic	Low risk	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.
Tsunami	High risk	Increase potential damage.	Increase potential damage.	Increase potential damage.	Increase potential damage.	Increase potential damage.	Increase potential damage.	No effect.

TABLE 3. COMPARATIVE IMPACTS OF ALTERNATIVES (cont.)

RESOURCE	BASE CONDITION	PLAN A1	PLAN A2	PLAN B1	PLAN B2	PLAN C1	PLAN C2	WITHOUT PROJECT CONDITION
Endangered Species								
Humpback whale (endangered)	No critical habitat, seasonal migration offshore.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.
Green Turtle (threatened)	No critical habitat, seasonal migration offshore.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.	No impact.
Terrestrial Area	None	None created.	Revetted fill.	None created.	None created.	None created.	None created.	None.
Marine Resources								
Fishery Resources	Recreational value high. O'ama, hahalu & nehu fishing.	Minor effect during construction.	Minor effect during construction.	Minor effect during construction.	Minor effect during construction.	No effect. during	No effect.	No effect.
Estuary	Kahului Bay	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.
Water Quality	Pollutants/contamination	Increase in petrochemicals & other related contaminants.	Increase in petrochemicals & other related contaminants.	Increase in petrochemicals & other related contaminants.	Increase in petrochemicals & other related contaminants.	Increase in petrochemicals & other related contaminants.	Increase in petrochemicals & other related contaminants.	Same as existing condition.
	Construction	Temporary increase in turbidity.	Temporary increase in turbidity.	Temporary increase in turbidity.	Temporary increase in turbidity.	Temporary increase in turbidity.	Temporary increase in turbidity.	Same as existing condition.

4. **Topography.** The coral fill area is relatively flat and occupies approximately 23 acres of which 2.451 acres is for the boat launching site. The coral fill located behind the western breakwater was a result of past dredging activities in the harbor.

5. **Geology.** The shoreline area is a portion of a fringing coralline platform or marine shelf which is predominantly calcareous sediments in various degrees of lithification ranging from loose to well-cemented. The reef rests on lava flows at an unknown depth, however, the depth of these flows are known to be considerably deeper than the proposed project excavation depth. The landward portion was constructed on cemented beach rock and volcanic boulders and cobbles (beach rubble). The sediments range in size from silts to boulders and are clastic marine sediments with occasional volcanic cobbles and boulders which form a gradual seaward sloping terrace. A one-foot mantle of gravel to boulder size sediments covers the site. Beneath the mantle, subsurface materials consist mostly of loose coralline sand. On the west side, however, next to the revetted fill area and north side of the project site, the beach rubble is underlain by cemented beach rock consisting of soft to moderately hard limestone breccia and coralline limestone.

6. **Natural Hazards.**

a. **Volcanic Hazards.** There are no active volcanoes on Maui. Haleakala on East Maui was the last active around 1790. As a result, volcanic hazards are considered minimal.

b. **Tsunami and Flood Plain Hazards.** The history of tsunamis in Hawaii includes several phases. In the 19th century, tsunamis were reported in newspapers, weeklies and books written by residents and as a result, it was not always possible to know the cause of the various high-wave phenomena. By the end of the 19th century seismological stations became available and it became easier to associate a distant earthquake with tsunamis in Hawaii. In the early 1900's, tide gage records were kept to see if distant earthquakes did cause waves in Hawaii. After 1946, the Tsunami Warning System was established which gathered information on tsunamis. In general, in 1869, 1872, 1878, 1903, 1919, 1921 and 1924, local generated tsunamis were associated with earthquakes of Kilauea and Mauna Loa on the island of Hawaii. Since 1946, there has been six significant tsunamis in which the maximum wave heights recorded in Kahului was 17-foot waves. The March 1964 tsunami resulted in an elevation of 12.1 feet and flooded the shopping center located near the waterfront and causing about $53,000 in damages.

7. **Water Quality.** Kahului Harbor is classified as Class A waters under the State of Hawaii Department of Health regulations, Title 11, Chapter 54 - Water Quality Standards. Kahului Harbor is not a true estuary. The harbor is part of the Kahului Bay and is protected by breakwaters. No fresh water streams or significant springs enter the harbor, although there must be some fresh water seepage into the harbor from the basal groundwater body inland. Some storm drains enter the harbor, but the sanitary sewage of the nearby populations enter Kahului Bay outside the harbor. A summary of the water quality data is included in Appendix F.

8. **Air Quality.** Normal trade winds patterns in the Kahului area minimize the potential for air quality problems. During times of agricultural burning, levels of particulate matter are increased. The State Department of Health monitors air quality in Kahului along with other sampling stations throughout the State. In most

cases, the sampling data were below the State's air quality standards.

9. **Noise Quality.** The Kahului study area is adjacent to the most industrialized portions of Kahului. The deep draft harbor facilities and activities contribute to a generally high level of ambient noise. Numerous trucks, loaders, cranes, powered ramps and other pieces of mechanical equipment work throughout the day and often during the night when loading or offloading ships.

10. **Physical Oceanographic Conditions.** Kahului Harbor is exposed to prevailing winds and waves from the north and northeast quadrants. The northeast tradewinds waves and the north swell are the two primary waves types that affect the harbor area. The northeast tradewind waves, present throughout the year but more frequent between May and September usually dominate the local wave spectrum. They result from the strong trade winds, averaging 10 to 20 miles per hour, blowing out of the northeast quadrant over long fetches of open ocean. Typically these deepwater waves have periods ranging from 6 to 10 seconds and heights of 4 to 12 feet. Generally, northeast trade waves are present from 80 to 90 percent of the time during the summer season, and from 60 to 70 percent of the time during the remainder of the year. Northern swells are generated in the north Pacific Ocean by intense winter storms. These waves typically have periods of 12 to 18 seconds with deepwater heights of 5 to 25 feet. These are some of the largest waves that reach the Hawaiian islands and usually occur during the winter season of October through March.

Wave data for Kahului area from a wave gage sensor located approximately 1,860 feet north of the head of the east breakwater. The wave data indicates that waves of 9 feet or less were recorded 96.1 percent of the time. The highest wave recorded was 28 feet with a period of 16 seconds and occurred during the 4-6 December 1968 storm. Prior to this storm, the maximum recorded wave height was 19 feet.

The range of tide between mean lower low water and mean higher high water is 2.3 feet and the extreme tidal range is 4.8 feet. Currents outside the Kahului Harbor breakwaters are predominantly east to west and northward along the coast. Inside the harbor, clockwise currents prevail during flood tide; counterclockwise currents during ebbtide. The currents along the west and south shores within the harbor show no definite pattern, but appear to be generally eastward as evidenced by accretion at Pier 2. Except in the dredged areas of the harbor, the water is relatively shallow with an average depth of 10 feet.

B. **SIGNIFICANT RESOURCES.** The significant resources identified by Section 122 of Public Law 91-611 are considered in the following discussion.

1. **Human Resources and Activities.**

a. **Community.** Maui is the fastest growing island in the State of Hawaii, with an estimated 1984 resident population of 73,128 persons. The ethnic make-up of the population is Caucasian (25%), Hawaiian (25%), Japanese (24%), Filipino (14%), and other (12%). The project site is surrounded Kahului, which had an estimated population of 13,000 persons in 1980. Commercial activity of the island is centered around the Wailuku-Kahului area with major industries including sugar, pineapple and tourism. Wailuku is the county seat and the center of government activity.

b. **Land Use.** The State Land Use Boundary classifies the project site as urban. The County of Maui has zoned the land use as agriculture, however, the General Plan designates the area as park use.

c. **Recreation and Aesthetics.** Kahului Harbor is used infrequently by recreational fishermen. Due to strong tradewinds that make harbor waters rough and choppy, pleasure boating is not usually common.

Pole fishing for common reef fish takes place along the entire harbor side of the western breakwater. Mullet, aholehole, manini, kumu and other species are caught by throw and lay net. Pole fishing for ulua and papio is common along the seaward side of the breakwater. The shallow reef flat along the southwest perimeter of the harbor is a popular octopus (he'e) spearing ground. Baiting fishing for nehu (Stolephorus purpureus) and i'ao (Pranesus insularum) is prohibited unless specifically permitted. Limu picking (seaward) also occurs in the project area.

Surfing, swimming and snorkeling along the south shore are also popular activities within the protect harbor. Northern swells occasionally generate small to moderate waves board surfing at two sites within Kahului Harbor.

According to the 1971 Statewide Surfing Site Survey, there are four surfing sites within the harbor area, three sites outside the east breakwater of the harbor, and four sites north of the west breakwater. Surfing surveys have indicated excellent surfing conditions during the winter months.

d. **Historical, Archaeological and Cultural Resources.** In 1863, the first Western building, a warehouse, near the beach was erected. Eventually, development along Kahului Bay continued as sugar cane made its commercial debut on Maui and proved to be an economically viable crop. In 1879, a small landing was constructed to serve the sugar industry and in 1891, and in 1881, the Kahului Railroad with its headquarters at the shore of the bay, connected Kahului and Wailuku. When the bubonic plaque infected Kahului in 1900, Kahului was deliberately burned to the ground to destroy the infected rats spreading the disease. The rebuilding of Kahului changed Kahului Bay into a full-scale commercial harbor. By 1910, Kahului Railroad had built an 1,800-foot long rubblemound breakwater, dredged the basin and constructed a 200-foot wharf for vessels with a 25-foot draft.

Contrary to popular belief, the attack on Pearl Harbor on December 7, 1941 was not the only attack on American soil. In the early hours of January 1, 1942, Japanese submarines shelled Kahului Harbor and the US retaliated with 75 mm shoreline artillery. After World War II, Kahului began another phase of expansion and today remains the largest population on Maui.

An archaeological reconnaissance survey was conducted on July 28-29, 1988 and no cultural resources of significance were reported. There are no known archaeological or historical sites listed on the Hawaii and National Register of Historic Places within the project area. The project area consists of dredged fill material which is unlikely to contain any archaeological structures or remains.

2. **Natural Resources.**

a. **Marine Resources.** The coral fill at the west breakwater is revetted with armor stone boulder which provides habitat for intertidal organisms such as a'ama crab (Grapsus tenuicrustatus), periwinkles (Littorina spp.), false opihi (Siphonaria normalis), and various algae (Ulva sp.). The substrate immediately next to the existing boat launch ramp is dominated by coarse sand and shell fragment with little topographic relief. The primary fish habitats are interstices of the armor stone revetment and the pilings of the wooden dock. Of particular commercial fishery value are nehu (Stolopherus purpureus) and seasonal runs of oama (Mulloides flavolineatus) and hahalalu (Selar crumenophthalums) observed in the area. While crabbing, spearfishing, limu-picking, pole-fishing and harvesting baitfish occur in the project area, the area fronting the boat ramp is closed to net fishing, except for crab and opae (Palaemon debilis) and the harvest of baitfish by licensed commercial fishermen.

Further offshore, the reef flat substrate is characterized by cobble, fine sand, and occasional limestone boulders. Most of the fish species observed are given on Table 4. The zooanthid Palythoa spp. was the dominant organism on the reef flat and was found on both the sand and boulder surfaces. Holothuria atra, sea cucumber, was common. Algae found on the reef flat includes Cladophora fasicularis, Ulva fasciata, Stypopodium hawaiianesis, and Acanthophora spicifera.

In the middle of the bay site, the intertidal habitat is characterized by well-worn large cobbles and small boulders. The most common species were Littorina pintado and Siphonaria normalis. Drifting seaweed collects in the shallow water at this site and opae are harvested here.

The subtidal habitat is characterized by a low relief cobble and sand substrate. Poor visibility of three feet and less hampered efforts of a thorough survey of the fishery resources (Table 5). Common species included zooanthid Palythoa spp. and various green algaes (Cladophora sp. and Ulva sp.).

The northern end of the revetment contains a more diverse marine community than the boat launch ramp area or the middle bay site as indicated by Table 6. Corals such as Montipora flabellata, Pocillopora meandrina, P. damicornis, Porites lobata, and P. compressa have colonized on the boulders of the revetment. In this area, 35 fish species were observed. The vertical walls of the revetment appeared to provide the primary habitat for various reef fish with the interstices serving as an excellent habitat for the toau (Lutjanus fulvus) and other reef species.

b. Flora and Fauna. The terrestrial vegetation along the shoreline for the project area consists of common native and introduced species, including beach naupaka (Scaevola taccada), Bermuda grass (Cynodon dactylon) and tree heliotrope (Tournefortia argentea). Migratory shorebirds include the wandering tattle (Heteroscelus incanus) and ruddy turnstone (Arenaria interpres). No endangered species are known to inhabit the project area, although Kanaha Ponds, a State Wildlife Sanctuary over a half-mile from the project sites provides habitat for the endangered Hawaiian Stilt (Himantopus mexicanus knudseni) and Hawaiian coot (Fulica americana alai).

c. Endangered and Threatened Species. Two species protected under the Endangered Species Act of 1973, as amended, may be present in or near the project area. The humpback whale (Megaptera novaeangliae) is listed as endangered and is found seasonally within the 100 fathom isobath around all the main Hawaiian Islands from December through May during their seasonal migrations to the Hawaiian waters. Although no concentrations of humpback whales have been observed in the waters off Kahului, their presence has been noted during past whales seasons.

Casual observation and anecdotal information indicate the presence of the threatened green turtle (Chelonia mydas) along the coastline of the project site.

d. Areas of Particular Concern. No areas of particular concerns have been identified.

TABLE 4.

Fish Species Observed at the Existing Boat Launch Ramp, Kahului Harbor, Maui. July 1985. Survey by U.S. Fish and Wildlife Service and Department of Land and Natural Resources, Division of Aquatic Resources.

	Location	
	Reef Flats	Revetment
Acanthuridae		
Acanthurus leucopareius (Jenkins)	x	
Ctenochaetus strigosus (Bennett)	x	
Canthigasterideae		
Canthigaster amboinensis Bleeker	x	
Chaetodontidae		
Chaetodon miliaris Quoy and Gaimard	x	
C. lunula (Lacepede)	x	x
Clupeidae		
Herklotsichthys quadrimaculatus	x	
Engraulidae		
Stolephorus purpureus Fowler	x	x
Kuhlidae		
Kuhlia sandvicensis (Steindachner)		x
Labridae		
Coris flavovittata (Bennett)	x	
C. venusta Vaillant and Sauvage	x	
Thalassoma duperrey Quoy and Gaimard	x	x
Monacanthidae		
Pervagor spilosoma (Lay and Bennett)	x	
Mugilidae		
Mugil cephalus Linnaeus	x	

	Reef Flats	Revetment
	Location	
Mullidae		
Parupeneus multifasciatus (Quoy and Gaimard)	x	
P. pleurostigma (Bennett)	x	
P. porphyreus (Jenkins)	x	x
Mulloides flavolineatus (Lacepede)	x	
Ostraciontidae		
Ostracion meleagris Shaw	x	
Pomacentridae		
Abudefduf sordidus (Forskal)		x
A. abdominalis (Quoy and Gaimard)		x
Dascyllus albisella Gill	x	x
Scorpididae		
Microcanthus strigatus (Cuvier and Valenciennes)		x
Zanclidae		
Zanclus cornutus Linnaeus	x	

TABLE 5.

Fish Species Observed Along the Middle Bay Area, Kahului Harbor, Maui. July 1985. Survey by U.S. Fish and Wildlife Service and Department of Land and Natural Resources, Division of Aquatic Resources.

Acanthuridae

Acanthurus triostegus (Linnaeus)
Ctenochaetus strigosus (Bennett)

Mullidae

Parupeneus porphyreus (Jenkins)

Pomacentridae

Abudefduf abdominalis (Quoy and Gaimard)

TABLE 5.

Fish Species Observed Along the Middle Bay Area, Kahului Harbor, Maui. July 1985. Survey by U.S. Fish and Wildlife Service and Department of Land and Natural Resources, Division of Aquatic Resources.

Acanthuridae

<u>Acanthurus</u> <u>triostegus</u> (Linnaeus)
<u>Ctenochaetus</u> <u>strigosus</u> (Bennett)

Mullidae

<u>Parupeneus</u> <u>porphyreus</u> (Jenkins)

Pomacentridae

<u>Abudefduf</u> <u>abdominalis</u> (Quoy and Gaimard)

TABLE 6.

Fish and Coral Species Observed at the Northern End of the West Breakwater Site, Kahului Harbor, Maui. July 1985. Survey by U.S. Fish and Wildlife Service and Department of Land and Natural Resources, Division of Aquatic Resources.

Fish

Acanthuridae

Acanthurus leucopareius (Jenkins)
A. triostegus (Linnaeus)
A. nigrofuscus (Forskal)
Ctenochaetus strigosus (Bennett)
Naso unicornis (Forskal)

Balistidae

Rhinecanthus rectangulus (Bloch and Schneider)

Canthigasterideae

Canthigaster amboinensis Bleeker
C. jactator (Jenkins)

Carangidae

Caranx melampygus Cuvier and Valenciennes

Chaetodontidae

Chaetodon miliaris Quoy and Gaimard
C. lunula (Lacepede)
C. fremblii Bennett
C. auriga Forskal

Diodontidae

Diodon hystrix Linnaeus

Kuhlidae

Kuhlia sandvicensis (Steindachner)

Kyphosidae

Kyphosus sp.

Labridae

Coris flavovittata (Bennett)
C. venusta Vaillant and Sauvage
C. gaimard ((Quoy and Gaimard)
Thalassoma duperrey Quoy and Gaimard
T. ballieui (Vaillant and Sauvage)
T. purpureum (Forskal)

Lutjanidae

Lutjanus fulvus (Bloch and Schneider)

Monacanthidae

Pervagor spilosoma (Lay and Bennett)

Mullidae

Parupeneus multifasciatus (Quoy and Gaimard)
Mulloides flavolineatus (Lacepede)
P. porphyreus (Jenkins)

Muraenidae

Gymnothorax sp.

Ostraciontidae

Ostracion meleagris Shaw

Pomacentridae

Acanthurus abdominalis (Quoy and Gaimard)
Dascyllus albisella Gill
Stegastes fasciolatus (Ogilby)

Scaridae

Scarus dubius Bennett

Sphyraenidae

Sphyraena sp.

Zanclidae

Zanclus cornutus Linnaeus

Corals

Scleractinian Corals

Montipora flabellata Studer
Porites lobata Dana
P. compressa Dana
P. meandrina Dana
Pocillopora damicornis (Linnaeus)

e. **Social and Socioeconomic Resources.** Maui is the fastest growing community in the State of Hawaii. Economic development in the tourism sector is one of the main source of income along with sugarcane and pineapple. Because tourism is the largest and fastest growing industry on the island, employment opportunities have increased and resulted in population growth and a rise in personal income.

f. **Utilities.** The shoreside facilities are expected to provide utility service for water, sewerage, electricity, and telephone.

V. ENVIRONMENTAL CONSEQUENCES

A. **Land Use.** All proposed plans will not change the existing land use. At present, the area consists of an existing boat launch ramp.

B. **Recreation.** All plans will increase recreational boating activities by providing improved navigation conditions. In addition, Plans A1 and A2 will provide an increase in the number of fishing sites and opportunities along the proposed breakwater. During construction activities, temporary impacts to fishing and boating activities may occur; however, it is not anticipated to be a significant adverse impact. Surfing sites are not expected to be affected since the proposed plans do not destroy any surfing sites. Conflicts with surfing and boaters are not expected since surf is generated during large northern swells. These large northern swells are not suitable for small craft navigation and it is expected that the navigation improvements would not be utilized during the rough ocean conditions.

C. **Natural Hazards.**

1. **Volcanic Hazards.** None of the plans will increase volcanic hazards.

2. **Tsunami and Riverine Flood Hazards.** None of the plans will effect any riverine flooding nor tsunami run-up elevations. With increased boats Kahului Harbor, potential damages from tsunami could increase.

D. **Water Quality.**

1. Existing water quality data for Kahului is summarized in Appendix G. The data indicates that the general water quality of Kahului Harbor is good and meets the State water quality standards.

2. All the plans involve dredging which will result in a temporary increase in water turbidity. Sewage is no longer discharged into Kahului Bay. During construction some localized turbidity will occur. The entrance channels for Plans A1, A2, B1, and B2 will required approximately 15,000 cubic yards of dredging. The turning basin for Plans A1 and A2 will require about 3,000 cubic yards to be dredged while the mooring basin for Plan A2 will require approximately another 3,000 cubic yards to be dredged or excavated. To mitigate the adverse impacts on the water quality, a turbidity control standard will be established for open water construction aspects. For turning basins mooring basins (Plans B1, B2, C1 and C2), a berm will be placed across the entrance before excavation is completed and then dredged as a last item of construction

to prohibit dredge material affecting water quality of the harbor. Thermal changes resulting from the proposed action dredging activities are not anticipated.

3. Use of mechanized equipment in the transport and placement of stones will involve some minimal risk of oil or fuel pollution. Potential impacts will be mitigated by ensuring that all transfer of fuel and storage tanks be placed on land, well away from water, and by specifying applicable restrictions on disposal of all materials, garbage, oil, grease and chemical.

4. The improvements will increase boat usage which will contribute to impacts associated with boating such as petroleum spillage,litter, hydrocarbon emission, noise, dust and turbidity. The amount of petroleum products released into the Bay is expected to be insignificant since boat users are mainly small craft which have a small fuel capacity. In case of an oil spill, the US Coast Guard will be notified. A Spill Prevention Control Plan and Countermeasure Plan will be considered in the design phase.

E. **Blasting.** To facilitate dredging, blasting may be required in the channel and the basins areas. If blasting becomes necessary, the Contractor will submit a blasting plan which must be approved by the Corps of Engineers Contracting Officer. The blasting plan shall contain the details of the blasting operations. The impacts of blasting are discussed below:

1. Marine Environment. Anticipated environmental impacts of blasting include but are not limited to fish and invertebrate kills, dislodging or shattering coral, increased predation on injured fish by predatory species such as sharks, increased wave heights, underwater shock, damage to the ocean floor, and increased turbidity and suspended sediments. Factors adversely causing injury and/or damages from underwater shock include the proximity to the sources of the blast, size, and character of the explosive, degree of submersion of receiver such as fish, influence of boundary reflections, duration of pressure pulse and location of the charge with respect to medium interfaces such as water and water-air. The direction of movement of blast energy through the water and substrate can affect the degree of damage or injury.

Air-filled organs such as swim bladders of fish are vulnerable to injury from underwater shock waves. The damage of the air-filled cavities is a function of impulse and peak pressure.

Water waves generated from explosions can cause damage to shoreline facilities based on how far the blast is located from the shore. Maximum height caused by a single charge or multiple charges can be predicted.

Fish will be killed, injured, temporarily injured or unaffected by the blasts depending upon the species, the proximity to the blast, depth of the water column, magnitude of charge, and other factors. Dead fish will either float to the surface or sink to the bottom where they will be eaten by other fish or decay. Certain groups of fish may be more sensitive such as flying fish, half beaks, damselfish, butterflyfish, triggerfish, and surgeonfish. Because Kahului harbor is highly productive for baitfish, any blasting could adversely impact the species. In addition, seasonal run of oama (Mulloides flavolineatus) and hahalalu (Selar crumenophthalums). Blasting should be avoided during the seasonal runs nehu, oama, and hahalu.

2. Water Quality. The hardness of the coral toward the project entrance channel may require blasting. Blasting or excavation will be highly noticeable and will have a significant impact to the existing water quality. Blasting activity generates conspicuous turbidity and suspended sediments, increased deposition of sediments downstream of the blast area, and destruction or damage to marine life. The immediate vicinity of the blast area will exhibit the most severe effects of turbidity and suspended sediments. The size of the plume and quantities of suspended sediments are dependent upon the size of the charge and method of blasting. Explosive by-products such as nitrogen gas, water, nitrogen dioxide, and aluminum oxide are not expected to significantly degrade the water quality.

3. **Blasting Noise.** The detonation of the blasting will generate noise. The sound level will depend upon the amount and type of explosive, the water depth over the charges, and the distance of the observer from the blast. The Contractor will be required to comply with all applicable State and local noise control regulations.

4. **Ground Vibration.** Seismic motion or ground vibration is generated from all detonations. The perception of explosives depends on such factors as geology of the site, the weight of explosives per delay, and the distance of the structures and observers. Blasting activities will comply to Corps safety and health plan. For example, the plan requires that a blast with a scaled distance less than 50, a 3-component seismograph will be required to monitor vibration levels. Scaled distance is a function of distance from the nearest structure to the blast site and the maximum weight of explosives per day. If vibration levels are below 2 inches per second, no damages to structures are anticipated. If the blast is below 0.2 inches per second, negative reactions from nearby residents will be minimized.

5. **Dust and Flyrock.** Dust is not anticipated since the blasts will be underwater. Some flyrock, however, may be generated for blasts in shallow water. Most particular matter will be contained by the water column if the charges are small.

6. **Smoke and Odors.** Smoke and odor from the blasting activities are not expected.

7. **Recreation.** Blasting activities will attract predators such as sharks due to the killing of fish from the blast. Since Kahului harbor is a popular water recreation area, the possible increased presence of sharks may discourage water recreation until the blasting is completed.

There are several methods that can be used to reduce the impacts of blasting. The size of the explosive can be limited, the number of delays per shot can be specified, and the method of drilling and shooting can be practiced to reduce the environmental effects of blasting.

8. **Safety.** The Contractor will be required to conduct his blasting operations in accordance with the blasting plan approved by the Corps Contracting Officer, Engineer Manual 385-1-1, Safety and Health Requirements and the State Occupational Safety and Health Standards.

F. **Sediment Quality.** The six uplands will not improve or further degrade sediment quality. Dredging will result in temporary resuspension of existing sediments.

G. **Estuaries.** Kahului Harbor is classified as an artificial basin. Moreover, all plans do not involve any work nor affect any estuaries.

H. **Air Quality.** None of the proposed plans when completed has the potential for affecting air quality. The dredged material may be a source of dust if deposited on the existing fill area.

I. **Noise Quality.** The proposed plans will not result in long-term increase in noise. The operation of equipment in the construction of breakwaters and dredging and filling will be temporary noise sources. Blasting will generate temporary noise and ground vibration.

J. **Historic and Archaeological Resources.** The proposed project will be coordinated with the State Historic Preservation Officer during the review of the draft EIS. The plans do not affect any sites listed on or eligible for inclusion to the National or Hawaii Register of Historic Places in the project area.

K. **Natural Resources.**

1. **Marine Resources.** The primary result of the any of six alternate plans is the conversion of shallow water, sand dominated, reef flat habitats to deeper water reef flat and edge habitats. The reef flat habitat that will be displaced does not support large large populations of important commercial or recreational fishery resources. During dredging, an artificial feeding situation will develop as predatory fish move in to exploit food resources displaced, exposed, or stirred up by dredging activities. Benthic organisms will be destroyed in areas dredged. Recolonization by similar organisms is expected from other bay populations in a relatively short time. It is anticipated that the floor of the entrance channel will be sand dominated and would eventually return to existing conditions. The walls of the entrance channel may provide increased topographic relief and may support a more diverse population of reef fish. Plans A1, A2, B1, and B2 may potentially disrupt baitfish harvesting during construction and cause temporary displacement of nehu stocks to other areas of Kahului Harbor.

2. **Terrestrial Resources.** The proposed plans are located in an area of previous dredged fill area. No adverse impacts to the barren terrestrial area is anticipated.

L. **Endangered and Threatened Species.**

1. **Endangered Humpback Whale.** The humpback whales migrating in the months of December through May off the northern shore of Maui are found between the edge of the outer reef margins and the 100 fathom isobath. This area has not been identified by the US National Marine Fisheries Service as a calving or mating site and is more likely a migration corridor for whales. All proposed plans will not affect the migratory route of the whales. Blasting will not impact the whales because blasting activities will not be permitted during the months of December through May. As a result, no adverse impact is anticipated on the whales.

2. **Threatened Green Turtle.** None of the plans will affect turtle potential nesting areas of turtle aggregation in Kahului Harbor. The plans will not eliminate foraging areas. The new breakwater structures and revetted borders may add foraging resources for the turtle. Visual look out for turtles will be required during construction blasting operations.

M. **Social and Socioeconomic Resources.** The improvements will not significantly alter Kahului's population or influence the existing economic trends. People, business, or farms will not be displaced by the proposed plans. Construction activities may temporary affect the use of the existing boat ramp. The breakwater for Plans A1, A2, B1, and B2 may be a visual intrusion into the presence of the scenic background of Kahului Harbor. The impact should be mitigated, however, by any shoreside development which provides landscaping.

VI. ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

A. **Turbidity and Sedimentation.** Temporary turbidity and sedimentation impacts are unavoidable impacts that results from offshore dredging and blasting activities. The amount of turbidity, sedimentation and fish kill are dependent on the size of the blasts and the number of blasts.

B. **Marine Life.** The dredging activities may attract a number of fish due to the exposure of food resources. Blasting activities, however, may destroy these fish. Predators such as sharks will be attracted to the area by the presence of dead or injured fish and will probably inhabit the area or nearby during the blasting and shortly thereafter. Recreational activities such as swimming, diving, snorkeling and other water type activities will be limited during these times. Indirectly, a completed project will encourage increased levels of fishing activity that could affect marine life.

C. **Recreation.** Recreational activities will be limited during construction. The boat launch ramp will be temporarily closed and shoreside fishing will be limited. The interruption to these activities is temporary in nature and is not expected to have a significant effect.

VII. MEANS TO MITIGATE ADVERSE ENVIRONMENTAL EFFECTS

A. **Blasting.** Blasting will be prohibited from December 1st to May 31st. To minimize the effect of blasting on the baitfish, omama, and hahalu seasonal runs, blasting will also be coordinated with the State Department of Land and Natural Resources Division of Aquatic Resources. A blasting plan will be submitted by the Contractor to the Corps for approval that may include additional controls to reduce the impact of blasting.

B. **Water Quality.** A water quality monitoring program will be established and a turbidity standard will be specified during construction activities to mitigate the impact.

VIII. PUBLIC INVOLVEMENT

A. **Public Involvement Program.** The public involvement has consisted of meetings and workshops with the public at large and members of Federal, State and County agencies. A public meeting was held on June 13, 1985 to discuss various alternate plans. On August 11, 1987, another public workshop was held to discuss the project and the commercial fishing analysis prepared by the US National Marine Fishery Service. A public meeting will be held during the review of the draft EIS.

B. **Required Coordination.** The following paragraphs list the status of coordination with various agencies:

1. Coastal Zone Management Act. A Federal Consistency Determination has been prepared by the Corps and is included in Appendix A. By way of this EIS, it is being submitted to the State of Hawaii Coastal Zone Management Office for their review and concurrence.

2. Endangered Species Act. Coordination letters from the US National Marine Fishery Service and the US Fish and Wildlife Service have indicated that there are no project impacts on protected species.

3. Marine Protection, Research and Sanctuaries Act. Ocean disposal of dredged material is not planned. As a result, this act is not applicable to the proposed action.

4. Clean Water Act. The project is subject to the Corps of Engineers SEction 404 permit. A Section 404 (b)(1) evaluation has been completed and is included in Appendix A. A requested for a water quality certification from the State of Hawaii has been initiated.

5. Fish and Wildlife Coordination Act. A draft Fish and Wildlife Coordination Act report has been prepared by the US Fish and Wildlife Service and is included in Appendix F. The final report will be included in the final EIS. The Corps has evaluated all US Fish and Wildlife recommendations and concurs with them.

6. *National Environmental Policy Act.* A notice of intent to prepare an environmental impact statement was published in the July 18, 1985 Federal Register. Public scoping has consisted of various meetings and workshops.

7. National Historic Preservation Act. Coordination with the State Historic Preservation Officer, the Keeper of the National Register and Advisory Council for Historic Preservation will be done during the review of the draft EIS and the archaeological reconnaissance reports attached as Appendix G.

8. Archaeological and Historic Preservation Act of 1974. Coordination with the State Historic Preservation Officer, the Keeper of the National Register and the Advisory Council for Historic Preservation will be done during the review of the draft EIS.

9. State and County Approvals. The State of Hawaii, Department of Transportation, is responsible for obtaining all necessary State and local permits and approvals and satisfying the requirements of the State EIS regulations. The construction impacts and compatibility of the action to local coastal zone management policies are discussed in the CZM Federal Consistency Determination.

C. Distribution List for the Draft EIS. The distribution list is included in the project report.

IX. LIST OF PREPARERS

The following persons are primarily responsible for preparing this draft environmental impact statement:

Dr. James E. Maragos, NEPA Coordinator and Reviewer of EIS. BS, Zoology; PhD, Oceanography; 2 years postodoctoral research; 8 years environmental consultant; 13 years EIS studies with the Corps of Engineers.

Helene Takemoto, EIS Preparer. AB, Chemistry; MS, Public Health (Environmental Health Management); 3 years research; 8 years EIS studies, 6 years EIS studies with the Corps of Engineers.

Farley Watanabe, Archaeologist. BA, Anthropology (Archaeology); 1 year post graduate studies; 4 years archaeological consultant; 13 years historic preservation experience; 3 years EIS studies with the US Army Corps of Engineers.

David Lau, Project Manager. BS, Civil Engineering; MS, Civil Engineering; 5 years engineering studies with the Corps of Engineers.

X. BIBLIOGRAPHY

Clark, John R. K. The Beaches of Maui County, University of Hawaii Press, 1980.

Cox, Doak C. and Lawrence C. Gordon, Jr. Estuarine Pollution in the State of Hawaii, Volume 1: Statewide Study, Water Resources Research Center, University of Hawaii, Technical Report No. 31, March 1970.

Cox, Doak C. and Joseph Morgan. Local Tsunami and Possible Local Tsunami in Hawaii, Hawaii Institute of Geophysics, University of Hawaii, November 1977.

Department of Business and Economic Development. State of Hawaii Data Book 1987, State of Hawaii, Department of Business and Economic Development, November 1987.

Loomis, Harold G. Tsunami Wave Runup Heights in Hawaii, Hawaii Institute of Geophysics, University of Hawaii, May 1976.

US Army Corps of Engineers. Maui Island Coral Reef Inventory (MICRI), undated.

KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

PLAN FORMULATION CRITERIA AND COMPLIANCE REPORTS

APPENDIX A

APPENDIX A

PLAN FORMULATION CRITERIA
AND
COMPLIANCE REPORTS

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I. STUDY AUTHORITY

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, Section 133(a) of the Water Resources Development Act, approved 22 October 1976, and Section 915 (d) of the Water Resources Development Act of 1986, states:

(a) The Secretary of the Army is authorized to allot from any appropriations hereafter made for rivers and harbors not to exceed $35,000,000 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 $4,000,000 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. 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), 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 is assessed in Appendix G 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 is 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 and 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 and 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 waters 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 1001 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 Territory of Guam (Guam E.O. 78-37: Compliance with the Guam Coastal Management Program Policies).

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 are contained in Appendix E.

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, U.S. 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. The draft 2(b) report is included in Appendix E.

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 Floodplain Management (EO 11988). This order requires that agencies avoid the base floodplain unless it is the only practicable alternative. For potential action in the floodplain, an evaluation of effects on floodplain values, a description of other practicable alternative actions outside the floodplain, and adequate dissemination of the action to the public must be undertaken. This evaluation is included in Section III of this appendix.

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 U.S. Department of the Interior.

III. PRESIDENTIAL EXECUTIVE ORDER 11988 ON FLOODPLAIN MANAGEMENT

1. The purpose of this supplemental report is to present the results of additional studies required by Executive Order 11988, Flood Plain Management, dated 24 May 1977. The objective of EO 11988 is to avoid to the maximum extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The Order requires Federal agencies to:

a. Avoid the base floodplain 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 floodplain values.

The proposed action at Kahului is not located within the base (i.e. 1% chance occurrence) floodplain of the Iao River. However, the project area is susceptible to inundation by tsunami and typhoons. The nature of harbors makes them prone to coastal flooding. The only practical non-floodplain alternative would be the without project condition.

The navigational improvement in the Kahului area would likely stimulate development in the surrounding community, particularly in light industry related to boating and fishing. Boating and fishery related activities are water dependent by their nature, necessitating their location in coastal zone areas which are subject to flood hazards. Development of this project would offer benefits which would outweigh the anticipated environmental losses and added potential flood damage resulting from this action.

IV. HAWAII CZM PROGRAM
ASSESSMENT FORM

Objective: Provide coastal recreational opportunities accessible to the public.

Policies

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

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

a. Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

b. 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;

c. Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

d. Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

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

f. 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;

g. Developing new shoreline recreational opportunities, where appropriate, such as artificial reefs for surfing and fishing; and

h. 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.

Check either "Yes" or "No" for each of the following questions.

	YES	NO
1. Will the proposed action involve or be near a dedicated public right-of-way?		X
2. Does the project site abut the shoreline?	X	
3. Is the project site near a State or County park?		X
4. Is the project site near a perennial stream?		X
5. Will the proposed action occur in or affect a surf site?		X
6. Will the proposed action occur in or affect a popular fishing area?	X	
7. Will the proposed action occur in or affect a recreational or boating area?	X	
8. Is the project site near a sandy beach?		X
9. Are there swimming or other recreational uses in the area?	X	

<u>Discussion</u>

The project document and subsequent authorization have resulted in the coordination and funding of harbor planning. Development of a light draft navigation project will provide for adequate and accessible boating opportunities in the Kahului area.

HISTORIC RESOURCES

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

Policies

1. Identify and analyze significant archaeological resources;

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

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

Check either "Yes" or "No" for each of the following questions.

	YES	NO
1. Is the project site within a historic/cultural district?		X
2. Is the project site listed on or nominated to the Hawaii or National register of historic places?		X
3. Does the project site include undeveloped land which has not been surveyed by an archaeologist?		X
4. Has a site survey revealed any information on historic or archaeological resources?		X
5. Is the project site within or near a Hawaiian fishpond or historic settlement area?		X

Discussion

An archaeological reconnaissance survey was conducted on July 28-29, 1988 by the staff archaeologist, Farley Watanabe. The archaeological survey is discussed in the EIS.

SCENIC AND OPEN SPACE RESOURCE

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

Policies

1. Identify valued scenic resources in the coastal zone management area;

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

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

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

Check either "Yes" or "No" for each of the following questions.

	YES	NO
1. Does the project site abut a scenic landmark?		X
2. Does the proposed action involve the construction of a multi-story structure or structures?		X
3. Is the project site adjacent to undeveloped parcels?	X	
4. Does the proposed action involve the construction of structures visible between the nearest coastal roadway and the shoreline?	X	
5. Will the proposed action involve construction in or on waters seaward of the shoreline? On or near a beach?	X	

Discussion

Minimal alterations to natural land forms along the shoreline will occur during project construction. The project has minimal scenic effects on shoreline open space and does not affect any scenic resources. The navigation improvement is coastal dependent.

COASTAL ECOSYSTEMS

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

Policies

1. Improve the technical basis for natural resource management;

2. Preserve valuable coastal ecosystems of significant biological or economic importance;

3. Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land water uses, recognizing competing water needs; and

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

Check either "Yes" or "No" for each of the following questions.

	YES	NO
1. Does the proposed action involve dredge or fill activities?	X	
2. Is the project site within the Shoreline Setback Area (20 to 40 feet inland of the shoreline)?	X	
3. Will the proposed action require some form of effluent discharge into a body of water?		X
4. Will the proposed action require earthwork beyond clearing and grubbing?	X	
5. Will the proposed action include the construction of special waste treatment facilities, such as injection wells, discharge pipes, or cesspools?		X
6. Is an intermittent or perennial stream located on or near the project site?		X
7. Does the project site provide habitat for endangered species of plants, birds, or mammals?		X
8. Is any such habitat located nearby?		X
9. Is there a wetland on the project site?		X

	YES	NO
10. Is the project site situated in or abutting a Natural Area Reserve?		X
11. Is the project site situated in or abutting a Marine Life Conservation District?		X
12. Is the project site situated in or abutting an estuary?		X

Discussion

The project report discusses the effect of proposed action on the coastal ecosystem.

ECONOMIC USES

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

Policies

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

2. Insure that coastal dependent development such as harbors and ports, visitor industry facilities, and energy generating facilities are located, designed, and construction to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

3. 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:

a. Utilization of presently designated locations is not feasible;

b. Adverse environmental effects are minimized; and

c. Important to the State's economy.

Check either "Yes" or "No" for each of the following questions.

	YES	NO
1. Does the project involve a harbor or port?	X	
2. Is the project site within a designated tourist destination area?		X
3. Does the project site include agricultural lands or lands designated for such use?	X	
4. Does the proposed activity related to commercial fishing or seafood production?	X	
5. Does the proposed activity relate to energy production?		X
6. Does the proposed activity relate to seabed mining?		X

Discussion

The project report provides discussion on the economic uses. Only a small portion of the shoreline area will be affected by the navigational improvements which is already dedicated to such use. The improvements will aid fishermen to be closer to the fishing grounds.

COASTAL HAZARDS

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

Policies

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

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

3. Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

4. Prevent coastal flooding from inland projects.

Check either "Yes" or "No" for each of the following questions.

	YES	NO
1. Is the project site on or abutting a sandy beach?		X
2. Is the project site within a potential tsunami inundation area as depicted on the National Flood Insurance Program flood hazard map?	X	
3. Is the project site within a potential flood inundation area according to a flood hazard map?	X	
4. Is the project site within a potential subsidence hazard area according to a subsidence hazard map?		X
5. Has the project site or nearby shoreline areas experienced shoreline erosion?		X

Discussion

The project report develops and communicates detailed information on storm waves, the risk of coastal flooding due to tsunami hazard. The navigation improvement may encourage development, however, such development is subject to coastal zone requirements.

MANAGING DEVELOPMENT

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

Policies

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

2. Facilitate timely processing of application for development permits and resolve overlapping or conflicting permit requirements; and

3. 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.

Check either "Yes" or "No" for each of the following questions.

	YES	NO
1. Will the proposed activity require more than two (2) permits or approvals?	X	
2. Does the proposed activity conform with the State and County land use designation for the site?		X
3. Has or will the public be notified of the proposed activity?	X	
4. Has a draft or final environmental impact statement of an environmental assessment been prepared?	X	

Discussion

The project report discusses these items and the draft EIS has been prepared and is included.

FEDERAL CONSISTENCY
SUPPLEMENTAL INFORMATION FORM

Project/Activity Title or Description: Kahului Light Draft Navigation Improvements

Island: Maui   Tax Map Key No. 3-7-01   Est. Start Date: unknown

APPLICANT OR AGENT

Name & Title: F. W. Wanner, Colonel

Agency/Organization: U.S. Army Corps of Engineers   Telephone: 438-2263

Address: Bldg 230, Ft Shafter, HI   Zip: 96858-5440

TYPE OF APPLICATION (check one only)

[X] I. Federal Activity
(statement "a")

"The proposed activity is consistent with and will be conducted in a manner consistent to the maximum extent practicable with the Hawaii Coastal Zone Management Program."

Signature: ______________________ Date: ______________

[ ] II. Permit or License
(statement "b")

"The proposed activity complies with Hawaii's Coastal Zone Management Program and will be conducted in a manner consistent with such a program."

Signature: ______________________ Date: ______________

[ ] III. OCS Plan/Permit

[ ] IV. Grants & Assistance

V. EVALUATION OF EFFECTS OF
THE DISCHARGE OF DREDGED OR FILL MATERIAL INTO
WATERS OF THE UNITED STATES USING THE SECTION 404(b)(1) GUIDELINES
KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
KAHULUI, MAUI, HAWAII
22 SEPTEMBER 1988

I. Project Description.

a. Location. The proposed action is located in Kahului Harbor on the northern side of the island of Maui. The project site is situated on the northwest side of the harbor at the coral fill area (also known as Kahului Harbor Park).

b. General Description. The following gives the description of each of the alternative plans:

Plan A1, Site 1. Plan A1 consists of a 130-foot breakwaters; a turning basin 100 feet by 100 feet in area and about 7.5 feet deep a new two lane boat launch ramp; and a 50-foot wide entrance channel extending approximately 1,030 feet long and about 8.5 feet in depth.

Plan A2, Site 1. Plan A2 consists of a 130-foot breakwater; a 100 by 100 feet turning basin; a temporary mooring basin about 105 feet by 105 feet in area and about 6.5 feet deep; a new two lane boat launch ramp; and a 50-foot wide, 8.5-foot deep and 1,030-foot long entrance channel. Plan A2 is also located at Site 1.

Plan B1, Site 1. Plan B1 consists of a turning basin 100 feet by 100 feet in area and 7.5 feet in depth; a 50-foot wide, 1030-foot long, and 8.5 foot deep entrance channel; and an entrance revetment surrounding the turning basin. Plan B1 will require excavation of the coral fill.

Plan B2, Site 1. Plan B2 consists of a 100 feet by 105 feet and 7.5 feet deep turning basin; a temporary mooring approximately 105 feet by 105 feet and 6.5 feet deep; a new two lane launch ramp; entrance revetment surrounding the turning basin and mooring basins; and a 1,030-foot entrance channel about 50-foot wide and 7.5-foot deep. Plan B2 will require excavation on the existing coral fill.

Plan C1, Site 2. Plan C1 consists of a turning basin 100 feet by 100 feet and 7.5 feet deep; entrance channel revetment a new two lane boat launch ramp; and an entrance channel approximately 50 feet wide and 8.5 feet deep. The plan will require excavation of the existing fill.

Plan C2, Site 2. Plan C2 consists of a turning basin 100 feet by 105 feet and 7.5 feet deep; a mooring basin 105 feet by 105 feet and 6.5 feet deep; a new two lane boat launch ramp; and an entrance channel about 8.5 feet deep and 50 feet wide. The plan will require excavation of existing fill.

c. Authority and Purpose. The authority for the project is provided by Section 107 of the River and Harbor Act of 1960, as amended. The purpose of the project is to provide a light draft navigation facility for north Maui.

d. General Description of Dredged or Fill Material.

(1) The existing breakwater (Plans A1, A2) consists of basaltic stones which will be utilized as part of the underlayer of the new rock revetment. The breakwater will consist of 5,000 to 8,000 quarrystone, an underlayer of 500 to 800 pound stone and core stone quarry spalls to about 30 pound stones. The breakwater will be approximately 10 feet across and about 9 feet mean low low water in elevation. The interior revetted section consists of 150 to 200 pound armor stone underlayer with 10 to 20 pound stones. Plan A2, typical revetted mole section consists of armor layer with 1,500 to 2,500 pound quarrystone, an under layer of 150 to 250 pound quarrystones, and a bedding layer with quarry spalls. The interior revetted sections for Plans A, B and C as similar with 150 to 200 pound armor layer, 10 to 20 pound underlayer and a filter cloth. Plans B and C will be built to an elevation of +10 feet mean low low water (MLLW) and Plan A will be built to an elevation of +6 MLLW

(2) The quantity of material proposed for placement is as follows:

	UNDERLAYER (Cu. yds.)	ARMOR LAYER (Cu. yds.)	BREAKWATER (Sq. ft.)
Plan A1 (ramp only)	400	800	8.000
Plan A2 (w/moorings)	1,200	2,300	12,700
Plan B1 (ramp only)	1,000	2,300	5,900
Plan B2 (w/moorings)	1,200	2,800	7,900
Plan C1 (ramp only)	3,200	7,500	7,000
Plan C2 (w/moorings)	4,600	10,500	9,000

(3) The source of the breakwater and revetment stones is from a local quarry on Maui.

e. Description of the Proposed Discharge Site(s).

(1) The location of the site is given on Figure 1.

(2) The breakwater and revetment will cover approximately 0.19 acre for Plan A1, 0.29 acre for Plan A2, 0.13 acre for Plan B1, 0.18 acre for Plan B2, 0.16 acre for Plan C1, and 0.21 acre for Plan C2.

(3) The type of site is intertidal.

(4) The types of habitat found are coral and intertidal sand/rubble.

(5) The placement of fill will occur during the construction period and has a project economic life of 50 years.

f. Description of Disposal Method. Mechanical construction equipment will be used for placing the stone revetment and breakwater.

II. Factual Determinations

a. Physical Substrate Determinations.

(1) The substrate elevation is between -3.0 and -4 feet and the slope is basically flat.

(2) The fill consists of material larger than silt size, i.e., spalls to 8,000-pound rocks.

(3) No fill material movement is expected to occur.

(4) The physical effects on the benthos will be the covering destruction of benthic species. Motile species will probably colonize the completed rock revetment and breakwater.

(5) Action taken to minimize the impacts include: avoiding unstable slopes slumping into the water, grading properly to mitigate erosion runoff, and assuring that no debris, petroleum products or other deleterious material will be allowed to fall, flow, leach or otherwise enter the water. The construction contractor will be required to maintain the water quality standards established by the State of Hawaii.

b. Water Circulation, Fluctuation and Salinity Determinations.

(1) Water. A temporary, minor and localized reduction in light transmission will be caused by turbidity generated during the placement of revetment rock and breakwater.

(2) Current Patterns and Circulation. No changes in water circulation will occur as the result of discharge of fill materials.

(3) Normal Water Level Fluctuations. The fill material will have negligible effects on the water level fluctuations.

(4) Salinity Gradients. Salinity gradients will not be affected by the discharge of fill materials.

(5) Actions That Will Be Taken to Minimize Impacts. Care will be taken to minimize turbidity by avoiding unstable slopes, grading properly to mitigate erosion from runoff and assuring that no debris,

petroleum products or other deleterious materials be allowed to fall, flow, leach or otherwise enter the water. The construction contractor will be required to maintain water quality standards set by the State of Hawaii.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site. Construction activities will generate temporary and minor turbidity in the project site.

(2) Effects on Chemical and Physical Properties of the Water Column. Not applicable.

(3) Effects on Biota. The project area consists of baitfish, oama, and hahalu. The baitfish is used by commercial fishermen and the oama and hahalu are provide recreational fishing. No fishery resources and commercial harvestable shellfish beds will be significantly adversely impacted. No marine sanctuaries, national wildlife refuges or wetlands will be affected by the proposed project.

(4) Action Taken to Minimize Impacts. The construction contractor will be required to maintain water quality standards of the State of Hawaii during construction.

d. Contaminant Determinations. No contaminants are expected since the material is basaltic stones that has been quarried.

e. Aquatic Ecosystem and Organism Determinations. The project will bury or destroy benthic organisms. Other motile organisms will probably colonize elsewhere. No effects on special aquatic sites and endangered and threatened species are anticipated.

f. Proposed Disposal Site Determinations. No zone of mixing will be required. The contractor will comply to applicable water quality standards established by the State of Hawaii. The project will not have an impact on municipal water supply intakes, shellfish, fisheries, wetlands, submerged vegetation, parks, national and historic monuments, national seashores, wilderness areas, research sites, recreational areas, and preserves.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. The cumulative impacts of the revetment will be minimal.

h. Determination of Secondary Effects on the Aquatic Ecosystem. The secondary impact on the aquatic ecosystem is deemed to be minimal.

III. Findings of Compliance or Non-Compliance With the Restriction on Discharge.

a. Adaptation of the Section 404 (b)(1) Guidelines to This Evaluation. The project complies to these guidelines.

b Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem. Six alternatives were considered. Plan A1 consisted of a breakwater, turning basin, two lane boat launch ramp, and an entrance channel. Plan A2 differs from Plan A1 in that it consists of a mooring basin. Plans B1 and B2 are located inside the existing fill area and consists of excavation, turning basin, replacement of the boat launch ramp, mooring basin for Plan B2 only, and an entrance channel. Plans C1 and C2 are located at Site 2 near the harbor's entrance and also inside the existing fill. The plans include a turning basin, mooring basin (Plan C2 only), excavation, and a new boat launch ramp. The no action alternative would not change the environment.

c. Compliances With Applicable Territorial Water Quality Standards. The contractor will comply to the water quality standards established by the State of Hawaii.

d. Compliance With Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act. Not applicable.

e. Compliance With Endangered Species Act of 1973. The Corps has made the determination that the project will not effect endangered or threatened species.

f. Compliance With Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research and Sanctuaries Act of 1972. Not applicable.

g. Evaluation of Extent of Degradation of the Waters of the United States. The project will not have an effect on: human health and welfare; life stage of aquatic life and other life stages dependent on aquatic ecosystems; aquatic ecosystem diversity, productivity and stability; and recreational, aesthetic and economic values.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem. Care will be taken to mitigate erosion from runoff. Extreme care will be taken to assure that no debris, petroleum products, or other deleterious materials be allowed to fall, flow, leach or otherwise enter the water. All construction activities within and adjacent to the water will be conducted so as to minimize turbidity and control erosion. The contractor will also be required to comply with the water quality standards established by the State of Hawaii.

i. On the Basis of the Guidelines, the Proposed Disposal Site for the Discharge of Fill Material is specified as complying with the requirements of these guidelines.

FINDING OF COMPLIANCE
FOR
KAHULUI LIGHT DRAFT NAVIGATION
KAHULUI, MAUI, HAWAII

22 September 1988

1. No significant adaptation of the guidelines were made relative to this evaluation.

2. Six alternative plans at two different locations were considered with Plan A1 at Site 1 being the preferred alternative. In general, the plans include variations of a turning basin (all plans), entrance channel (Plans A1, A2, B1, B2), breakwater (Plans A1, A2), mooring area (Plans A2, B2, C2), parking, and shore facilities. The environmental impacts from the proposed plans are damage to the benthic environment and fisheries due to blasting, increase harbor uses, conflicts with boating uses, and surfing.

3. The planned placement of fill material would not violate any applicable water quality standards established by the State of Hawaii.

4. Use of the selected disposal site will not harm any endangered species or their critical habitat.

5. The proposed placement of the fill material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, and aesthetic and economic values will not occur.

6. Appropriate steps to minimize potential adverse impacts of the discharge on aquatic systems include requiring the contractor comply to water quality standards established by the State of Hawaii, avoiding unstable slopes, grading properly to mitigate turbidity erosion from runoff and assuring no debris, petroleum products or other deleterious materials will be allowed to fall, flow, leach, or otherwise enter the water.

7. On the basis of the guidelines proposed, disposal of fill material is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystems.

F.W. WANNER
Colonel, Corps of Engineers
District Engineer

KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

PUBLIC INVOLVEMENT

APPENDIX B

APPENDIX B

PUBLIC INVOLVEMENT

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6 Jan 84	Letter of Agreement U.S Fish and Wildlife Service	Corps of Engineers	B-4
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GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HARBORS DIVISION

May 3, 1983

HAR-EP 4525

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

Dear Mr. Cheung:

Document on the Coasts of Hawaiian Islands Study

We have reviewed the subject document and found it very comprehensive and informative. On April 27, 1983, we met with members of your staff to discuss the contents of the document. As a result of that meeting, we wish to recommend the following projects (listed in the order of priority) be withdrawn from the document and studied under your Section 107 small projects authority:

1. Port Allen Harbor, Kauai
2. Honouliwai Boat Launching Ramp, Molokai
3. Hana Boat Launching Ramp, Maui
4. Kahului Commercial Fishing Harbor, Maui

For your information, a serious sand movement problem exists at the mouth of the Hanalei River. Shoaling often narrows the river's opening to the extent that makes navigation by small craft impossible or very difficult. A [illegible] ramp located nearby in the river is relatively useless [illegible] thick accumulation of sand. Trailered boats are forced to launch over the river bed. Therefore, we would like to suggest that the project list for Kauai be expanded to include a sand movement study conducted by the Corps to help determine a solution to the problem.

On Page 31, regarding the Waianae Boat Harbor, the last sentence should be changed to read "....for State or Federal action." We feel there may be a deficiency in the main and

B-1

stub breakwater design which is causing the problem of surge at and near the boat ramps. If such is the case, then any effort to resolve the problem should include Federal participation.

We would also like to take this opportunity to request that the Corps conduct a study of Maunalua Bay on Oahu under any authority you feel appropriate. The sensitive nature of the bay and its environs necessitate that a thorough evaluation of the potential uses be made similar to the Corps' 1977 Kaneohe Bay Urban Resources Study effort.

Thank you for coordinating this matter with us.

Very truly yours,

DAVID K. HIGA
Chief

June 3, 1983

Mr. David K. Higa, Chief
Harbors Division
Hawaii Department of Transportation
79 South Nimitz Highway
Honolulu, Hawaii 96813

Dear Mr. Higa:

Thank you for your letter of May 3, 1983 providing comments on our working document for the Coasts of the Hawaiian Islands Study.

We have reviewed your request and will initiate reconnaissance studies under our Section 107 Small Projects authority for Honouliwai, Molokai; Hana, Maui; and Kahului, Maui. As agreed upon in our June 1, 1983 meeting, we will prepare a letter report on the feasibility of a second breakwater at Port Allen. The Honouliwai and Hana reconnaissance studies will be completed by late summer and further expanded reconnaissance studies, if warranted, will follow in fiscal year 1984 prior to detailed project studies. The letter report on Port Allen and the reconnaissance study for Kahului will be completed in early fiscal year 1984.

Based on our past experience on the Hanalei River, we are extremely reluctant to conduct further studies. Prior studies for flood control and a small boat harbor at Hanalei met with strong local opposition to any Corps involvement in that area. Furthermore, the type of sand movement analysis suggested in your letter is not within the Coasts of Hawaiian Islands Study authority. Should a sand movement study be conducted by the State, we will be able to provide assistance to you under our Planning Assistance to States Program.

For the Waianae Small Boat Harbor, we have recently determined that an effort to look into the details of the problems being experienced at the Waianae Harbor is justified and have requested funds from our Washington Headquarters to initiate a wave monitoring program to fully evaluate the wave (surge) conditions in the berthing and launching ramp areas. We have recommended that a field data collection program be initiated and extended for approximately one year to identify the frequency and characteristics of adverse wave conditions inside the harbor area and to obtain information on damages being experienced. We will then evaluate whether a cost effective measure can be found to solve the problems within the harbor.

In regards to the requested study of Maunalua Bay, similar in scope to the Kaneohe Bay Urban Water Resources Study, such a study would have to be pursued as an interim study under the overall Harbors and Rivers of Hawaii authority. A new interim study of Maunalua Bay could not be initiated before fiscal year 1985 due to lack of available funds in FY 83 or FY 84.

Sincerely,

Alfred J. Thiede
Colonel, Corps of Engineers
District Engineer

PODED-PJ

January 23, 1984

NOTICE OF PUBLIC WORKSHOPS
FOR THE
KAHULUI SMALL BOAT HARBOR STUDY
AND THE
COAST OF HAWAIIAN ISLANDS STUDY

At the request of the State Department of Transportation - Harbors Division, the Honolulu District of the Corps of Engineers is studying the feasibility of implementing small craft navigation facilities on the island of Maui. We invite you to participate in the following informal workshops:

1. Kahului Small Boat Harbor Study
WEDNESDAY, FEBRUARY 15, 1984
AT 7:00 PM
AT THE KAHULUI LIBRARY
90 School Street, Kahului, Maui

2. Coast of Hawaiian Islands Study
THURSDAY, FEBRUARY 16, 1984
AT 7:00 PM
AT THE MAALAEA BOAT AND FISHING CLUB CLUBHOUSE
Maalaea Harbor, Maui

We would like to discuss the planning status of our studies, to obtain your opinions on small craft navigation improvements, and to discuss other items, including social, environmental and recreational aspects, that you feel are pertinent for consideration during our study process. Your participation will aid us in insuring that your views and desires are incorporated in the formulation of small craft navigation improvements.

Please bring this announcement to the attention of others who may be interested in these matters. We look forward to seeing you at the workshops.

MICHAEL M. JENKS
Colonel, Corps of Engineers
District Engineer

News Release

US Army Corps of Engineers
Pacific Ocean Division

Release No. 84-18 Contact: F. REZAC

For Release: 10 February 1984 Phone: 438-9862/9564

Fort Shafter, Hawaii

PUBLIC WORKSHOPS FEBRUARY 15 AND 16
ON MAUI TO DISCUSS NAVIGATION STUDIES

CALENDAR REMINDER

Engineer representatives will hold workshops with all interested persons on February 15 and 16 on Maui on feasibility studies for possible small craft navigation facilities on the island of Maui.

The February 15 (Wednesday) workshop will begin at 7:00 p.m. and will be held at the Kahului Library, 90 School Street, Kahului, to discuss the Kahului small boat harbor study.

The workshop the next evening (February 16) will be at the Maalaea Boat and Fishing Club Clubhouse, Maalaea Harbor. This session will focus on the Coasts of Hawaiian Islands Study and will start at 7:00 p.m. also. Although the Coasts of the Hawaiian Islands Study is a statewide study, this workshop will focus on problems and needs for Maui. Workshops on other islands are being scheduled to complete the overall state assessment.

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

January 6, 1984

Mr. Richard Myshak, Regional Director
Fish and Wildlife Service
US Department of the Interior
Lloyd 500 Building, Suite 1692
500 NE Multnomah Street
Portland, Oregon 96232

Dear Mr. Myshak:

Pursuant to the 1980 National Letter of Agreement between the Fish and Wildlife Service and the US Army Corps of Engineers, we are enclosing the Scope of Work for Kahului Small Boat Harbor (Enclosure 1). The Scope of Work and Cost Estimate have been coordinated through your Honolulu staff.

Your approval of the above project work under the 1980 National Agreement is indicated by your signature below. Please return the original letter and signed copy of DA Form 2544 to our office.

Sincerely,

Michael M. Jenks
Colonel, Corps of Engineers
District Engineer

for Richard Myshak — 1/27/84 (Date)
Regional Director
Fish and Wildlife Service
US Department of the Interior
Portland, Oregon 96232

Enclosure

Copy Furnished:

Mr. Allan Marmelstein
Fish and Wildlife Service
Honolulu, Hawaii 96850

United States
Department of the Interior

Fish and Wildlife Service
Lloyd 500 Building, Suite 1692
500 N.E. Multnomah Street
Portland, Oregon 97232

In Reply Refer To: Your Reference

January 24, 1984

Colonel Michael M. Jenks
District Engineer
Corps of Engineers, Honolulu
Building 230
Ft. Shafter, Hawaii 96858

Dear Colonel Jenks:

Attached is the signed Letter of Agreement together with a copy of the DA-2544 covering the Kahului Small Boat Harbor project, (1927-F5).

Sincerely,

James W. Teeter
Acting Asst. Regional Director
Habitat Resources

Attachment

March 23, 1984

Dr. Allan Marmelstein
Fish and Wildlife Service
US Department of the Interior
P. O. Box 50167
Honolulu, Hawaii 96850

Dear Dr. Marmelstein:

We are preparing an expanded reconnissance report for a small boat harbor within Kahului Deep Draft Harbor, Maui under the authority of Section 107 of the Rivers and Harbors Act of 1960, as amended. Pursuant to the 1978 amendments of the Endangered Species Act, we are requesting information on any listed, proposed or candidate endangered or threatened species that may be present in the project area and alternate sites (enclosures). We would appreciate your reply by April 16, 1984 in order to plan our project in a timely manner.

If you have any questions on this matter please contact Ms. Helene Takemoto at 438-2263.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

Enclosures

United States Department of the Interior

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

1-2-84-SP-133
ES 6307
APR 12 1984

Mr. Kisuk Cheung
Chief, Engineering Division
U.S. Army Corps of Engineers, Pacific Ocean Division
Ft. Shafter, Hawaii 96858

Dear Mr. Cheung:

This replies to your March 28, 1984 request for information on any listed or proposed endangered or threatened species that may be present in any of the three sites which may be chosen within the Kahului Deep Draft Harbor, Maui, Hawaii. Those three sites are at Maliko Bay, Kahului Harbor, and Kaa.

All three sites would be expected to provide habitat for the threatened green sea turtle (*Chelonia mydas*). As such, you may wish to contact the National Marine Fisheries Service. It is doubtful if this turtle would come ashore at any of the sites under consideration.

The Kaa site is close to the Kanaha Pond Waterfowl Refuge. This refuge provides habitat for two endangered species, the Hawaiian stilt (*Himantopus himantopus knudseni*) and the Hawaiian coot (*Fulica americana alai*). Either of these birds may fly over the Kaa area, but it would not be expected that they would regularly land there. We would not consider Kaa as habitat for either of these waterbirds.

If we can be of further service, please contact us again.

Sincerely yours,

Ernest Kosaka
Project Leader
Office of Environmental Services

cc: Regional Director, FWS, Portland, OR (AFA-SE)

Save Energy and You Serve America!

March 29, 1984

Mr. Doyle Gates
National Marine Fisheries Service
Western Pacific Program Office
P. O. Box 3830
Honolulu, Hawaii 96813

Dear Mr. Gates:

We are preparing an expanded reconnaissance report for a small boat harbor within Kahului Deep Draft Harbor, Maui under the authority of Section 107 of the Rivers and Harbors Act of 1960, as amended. Pursuant to the 1978 amendments of the Endangered Species Act, we are requesting information on any listed, proposed or candidate endangered or threatened species that may be present in the project area and alternate sites (enclosures). We would appreciate your reply by April 16, 1984 in order to plan our project in a timely manner.

If you have any questions on this matter, please contact Ms. Helene Takemoto at 438-2263.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

Enclosures

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
Western Pacific Program Office
P. O. Box 3830
Honolulu, Hawaii 96812

April 20, 1984 F/SWR1:ETN

Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
Pacific Ocean Division
Corps of Engineers
Fort Shafter, Hawaii 96858

Dear Mr. Cheung:

In response to your letter of March 29, 1984 regarding the expanded reconnaissance report for a small boat harbor within Kahului Harbor, the following is provided for your information.

We are aware of only two species listed pursuant to the Endangered Species Act of 1973, as amended, that may be present in or near the project sites as described. The humpback whale (Megaptera novaeangliae) is listed as endangered and is found seasonally within the 100 fathom isobath around all of the main Hawaiian Islands from December through May during their seasonal migrations to Hawaiian waters. Although no concentrations of humpback whales have been observed in the waters off Kahului, their presence has been noted during past whale seasons.

There is no site specific information regarding the distribution of the threatened green turtle (Chelonia mydas) along the north-central coast of Maui. Anecdotal information and casual observations indicate only the presence of green turtles along the coastline where the project sites are located.

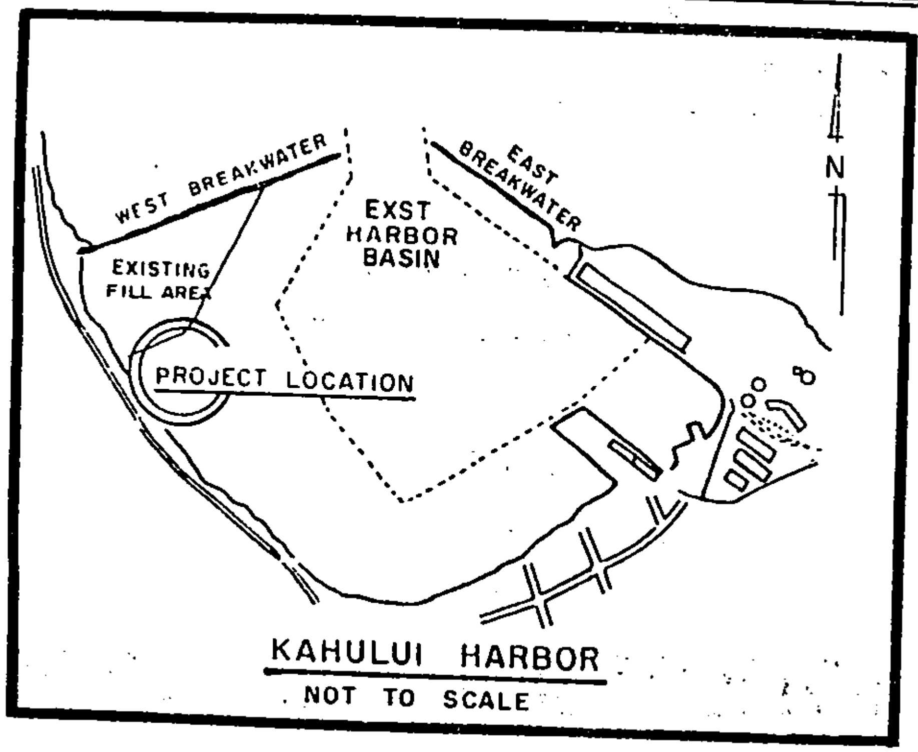
Should there be any further questions please contact Mr. Eugene Nitta at 955-8831.

Sincerely yours,

Doyle E. Gates
Administrator

PUBLIC WORKSHOP

MAUI COMMUNITY COLLEGE
COMMUNITY SERVICE BUILDING
ON
TUESDAY, DECEMBER 4, 1984 AT 7:30 P.M.



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

November 20, 1984

PODED-PJ

NOTICE OF PUBLIC WORKSHOP
FOR THE
KAHULUI SMALL BOAT HARBOR STUDY

The Honolulu District of the Corps of Engineers, in cooperation with Harbors Division of the State Department of Transportation, has been studying the feasibility of a small boat harbor in the Kahului area. At our last public workshop, held at the Kahului Library in February 1984, we discussed the need for a harbor to support the growing fishing industry and develop the northern fishing grounds. We also talked about three possible sites for such a harbor: the northwest corner of Kahului Harbor in the vicinity of the existing boat ramp, a site between the Kahului Sewage Treatment Plant and Kanaha Beach Park, and at Maliko Bay several miles east of Kahului. We have completed a preliminary analysis for a 120-boat harbor at each of these alternative sites. The location within Kahului Harbor seems to offer the best project economics and the least environmental impacts. We would like to present the results of our analyses for the three alternative sites, and also discuss the next level of detailed studies that we are initiating for the Kahului site.

I invite all interested parties to attend a public workshop on Tuesday, December 4, 1984 at 7:30 PM in the Community Service Building at Maui Community College in Kahului.

Besides informing you of the work we have completed to date and th direction of future studies, we would like to hear your opinions o this proposed navigation improvements, including any social, environmental or recreational aspects of the project. Your participation will aid us in insuring that your views and desires are incorporated in the study process.

Please bring this announcement to the attention of others who may be interested in these matters. We look forward to seeing you at the workshop.

MICHAEL M. JENKS
Colonel, Corps of Engineers
District Engineer

For further information, please contact:

Mr. Kevin V. Cook
(808) 438-1307

PUBLIC WORKSHOP

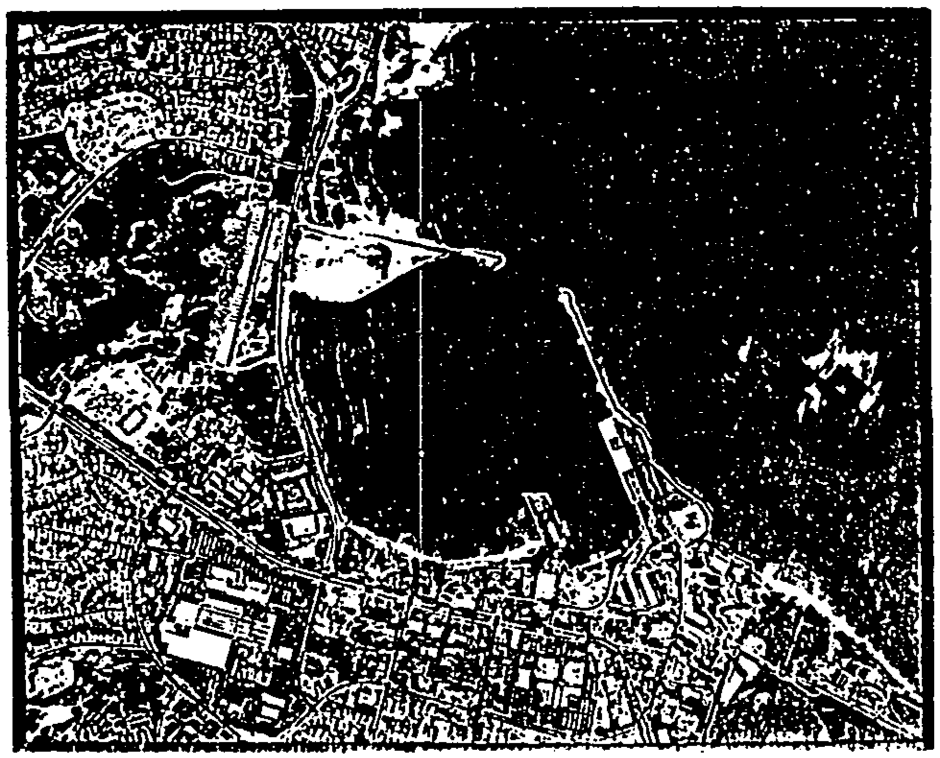
KAHULUI PUBLIC LIBRARY

90 SCHOOL STREET

ON

THURSDAY, 13 JUNE 1985

7:30 - 9:00 PM



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

May 28, 1985

NOTICE OF PUBLIC WORKSHOP
FOR THE
KAHULUI SMALL BOAT HARBOR STUDY

The Honolulu District of the Corps of Engineers, in cooperation with Harbors Division of the State Department of Transportation, has been studying improvements for small boat navigation in the Kahului area. At previous workshops in February 1984 and December 1984, we discussed the need for a small boat facility to serve local fishermen. We had evaluated three alternative sites (Kahului Harbor, Kanaha Beach and Maliko Bay) for a 120 boat commercial fishing harbor and concluded that the best site for such a harbor would be the northwest corner of Kahului Habor. However, the County of Maui had expressed concern over potential conflicts with deep-draft vessels if a small boat harbor is constructed within Kahului Harbor. Also, local boaters have informed us that they would use a harbor at Kahului only on a seasonal basis because waters on that side of Maui are often too rough for safe small boat operation. Based on this usage pattern and the County's concerns, we have developed a revised concept for a small boat facility within Kahului Harbor. This latest plan provides for an improved boat launching ramp with a protected area for temporary mooring of approximately 10-20 boats.

I invite all interested parties to attend a public workshop on Thursday, June 13, 1985 at 7:30 pm at the Kahului Public Library in Kahului.

Besides informing you of the work we have completed to date and the direction of future studies, we would like to hear your opinions on this proposed navigation improvement, including any social, environmental or recreational aspects of the project. Your participation will aid us in insuring that your views and desires are incorporated in the study process.

Please bring this announcement to the attention of others who may be interested in these matters. We look forward to seeing you at the workshop.

MICHAEL M. JENKS
Colonel, Corps of Engineers
District Engineer

For further information, please contact:
Mr. Kevin V. Cook (808-438-1307)

XEROX COPY

DANIEL K. INOUYE
HAWAII

United States Senate

ROOM 722, HART SENATE BUILDING
WASHINGTON, D.C. 20510
(202) 224-3934

June 10, 1985

Colonel Michael M. Jenks
District Engineer
Department of the Army
Corps of Engineers
Ft. Shafter, Hawaii 96858

Dear Colonel Jenks:

I wish to share with you a copy of correspondence which I have received regarding the small boat ramp at Kahului Harbor.

I would appreciate receiving the benefit of your views on the concerns raised by Mr. Keau at your earliest convenience.

Aloha,

DANIEL K. INOUYE
United States Senator

DKI:sgl
Enclosure

May 29, 1985

Honorable Daniel K. Inouye
U.S. Senator
Room 722, Hart Building
Washington, D.C. 20510

SUBJECT: KAHULUI HARBOR RAMP

Honorable K. Inouye,

I am righting you this letter because we need help. The small boat ramp at Kahului Harbor needs to be dredge. The sand has piled up at the base of the loading ramp and has made it difficult to load and unload our boats. This always happen when we have Kona winds or high surf conditions.

Mr. David Dang of U.S. Army Corp of Engineers came to talk at our meeting. He said they have a plan they are testing at their laboratory that would stop this condition.

I hope that no one has to get hurt first before something is done.

Thank you very much,

CALVIN P. KEAU
[illegible] BOATER

CPK:sk

DANIEL K. INOUYE
HAWAII

United States Senate
ROOM 722, HART SENATE BUILDING
WASHINGTON, DC 20510
(202) 224-3934

June 27, 1985

Colonel Michael M. Jenks
District Engineer
Department of the Army
Corps of Engineers
Ft. Shafter, Hawaii 96858

Dear Colonel Jenks:

I am acknowledging receipt of your correspondence regarding Mr. Calvin Keau's concerns on the Kahului Harbor small boat ramp. I appreciate your prompt response to my inquiry on his behalf, and I will be sharing a copy of your letter with Mr. Keau.

Thank you for your assistance.

Aloha,

DANIEL K. INOUYE
United States Senator

DKI:sgl

(Letter of response to Senator Inouye identical to letter.)

COMMITTEE ON WAYS AND MEANS
SUBCOMMITTEES
TRADE
OVERSIGHT

CECIL "CEC" HEFTEL
1st District, Hawaii

Congress of the United States
House of Representatives
Washington, DC 20515

June 13, 1985

Colonel Michael M. Jenks
District Engineer
Department of The Army
Honolulu District, Corps of Engineers
Fort Shafter, Hawaii 96858-5440

Dear Colonel Jenks:

Attached is a letter from Mr. Calvin P. Keau, 596 Linekona Street, Wailuku, Hawaii 96793, requesting my assistance concerning conditions at the Kahului Harbor small boat ramp.

Please review the situation as described by my constituent and advise me of your evaluation and action on the matter.

Your immediate response to my Honolulu District Office will allow for my complete assessment of the problem and enable me to respond to Mr. Keau accordingly.

Thank you for your cooperation.

Sincerely,

Cec Heftel
CEC HEFTEL
Member of Congress

CH/bfa

Attachment

Calvin P. Keau
596 Linekona Street
Wailuku, HI. 96793

May 29, 1985

Honorable Cecil HEFTEL
U.S. Representative
1030 Longworth House Office
Washington, D.C. 20515

SUBJECT: KAHULUI HARBOR RAMP

Honorable Cecil HEFTEL,

I am righting you this letter because we need help. The small boat ramp at Kahului Harbor needs to be dredge. The sand has piled up at the base of the loading ramp and has made it difficult to load and unload our boats. This always happen when we have Kona winds or high surf conditions.

Mr. David Dang of U.S. Army Corp of Engineers came to talk at our meeting. He said they have a plan they are testing at their laboratory that would stop this condition.

I hope that no one has to get hurt first before something is done.

Thank you very much,

Cal P Keau
CALVIN P. KEAU
CONCERN BOATER

CPK:sk

June 20, 1985

Honorable Cecil Heftel
Representative in Congress
300 Ala Moana Blvd, Rm 4104
P. O. Box 50143
Honolulu, Hawaii 96850

Dear Mr. Heftel:

Thank you for your letter of June 13, 1985 transmitting the concerns of Mr. Calvin Keau regarding conditions at the Kahului Harbor small boat ramp. We are aware that sediment has accumulated at the base of the ramp to the point where launch and retrieval operations have become difficult and occasionally hazardous. I am pleased to inform you that the Harbors Division of the State Department of Transportation has recently awarded a contract for this dredging, which should be completed by the end of July 1985. Since the launch ramp is a State-owned facility, the Corps of Engineers does not have the authority to perform the necessary dredging.

You and Mr. Keau may also be interested in the ongoing Corps study for an improved small boat facility in Kahului Harbor. This study, being conducted under our Section 107 small projects authority, is evaluating the feasibility of an expanded launching facility with breakwater protection and a temporary mooring area for 10-30 boats. The facility is intended to serve the commercial fishermen using small craft on the Kahului side of Maui. At our most recent public workshop for this study, held on June 13, 1985, the proposed project was strongly supported by local boaters. However, the same boaters expressed dissatisfaction with current Administration policy on cost-sharing for small boat harbors, which places the primary financial responsibility on the local sponsor.

I appreciate your continued interest in our efforts to continue to provide Federal assistance in the support of navigation needs in Hawaii's small boat facilities. Please contact our office if you or Mr. Keau have any further questions.

Sincerely,

Michael M. Jenks
Colonel, Corps of Engineers
District Engineer

Copy Furnished:

Honorable Cecil Heftel
House of Representatives
1034 Longworth House Office Bldg.
Washington, DC 20515

Mr. Wayne Yamasaki, Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

CDRUSACE (DAEN-CWZ-G)
20 Mass. Ave., N.W.
WASH DC 20314-1000

XEROX COPY

United States Senate

IN REPLY PLEASE REFER

TO: st

June 20, 1985

Respectfully referred to:

Brig. Gen. Robert M. Bunker
Division Engineer
U. S. Army Corps of Engineers
Pacific Ocean Division
Building 230
Fort Shafter, Hawaii 96858

Because of the desire of this office to be responsive to all inquiries and communications, your consideration of the attached is requested. Your findings and views, in duplicate form, along with return of the enclosure, will be appreciated by

Spark M. Matsunaga
U.S.S.

Form #2

July 2, 1985

Honorable Spark M. Matsunaga
United States Senate
109 Hart Senate Ofc Bldg.
Washington, D.C. 20510

Dear Senator Matsunaga:

Thank you for your letter of June 20, 1985 transmitting the concerns of Mr. Calvin Read regarding conditions at the Kahului Harbor small boat ramp. We are aware that sediment has accumulated at the base of the ramp to the point where launch and retrieval operations have become difficult and occasionally hazardous. I am pleased to inform you that the Harbors Division of the State Department of Transportation has recently awarded a contract for this dredging, which should be completed by the end of July 1985. Since the launch ramp is a State-owned facility, the Corps of Engineers does not have the authority to perform the necessary dredging.

You and Mr. Read may also be interested in the ongoing Corps study for an improved small boat facility in Kahului Harbor. This study, being conducted under our Section 107 small projects authority, is evaluating the feasibility of an expanded launching facility with breakwater protection and a temporary mooring area for 10-30 boats. The facility is intended to serve the commercial fishermen using small craft on the Kahului side of Maui. At our most recent public workshop for this study, held on June 13, 1985, the proposed project was strongly supported by local boaters. However, these same boaters expressed dissatisfaction with current Administration policy on cost-sharing for small boat harbors, which places the primary financial responsibility on the local sponsor.

I appreciate your continued interest in our efforts to continue to provide Federal assistance in the support of navigation needs in Hawaii's small boat facilities. Please contact our office if you or Mr. Seau have any further questions.

Sincerely,

Michael H. Jenks
Colonel, Corps of Engineers
District Engineer

Copy furnished:

Honorable Spark M. Matsunaga
United States Senator
Prince Kuhio Federal Bldg.
300 Ala Moana Blvd., Rm. 3104
Honolulu, Hawaii 96850

(Blank)

July 3, 1985

Director
Office of Federal Register
National Archives and Records
Service GSA
Washington, D.C. 20408

Dear Sir:

Pursuant to Section 1508.22 of the Council of Environmental Quality Final Regulations implementing the Procedural Provisions of the National Environmental Policy Act of 1969 (43 Federal Register 55978-56007), a Notice of Intent to prepare a Draft Environmental Impact Statement for Kahului Small Boat Harbor, Maui, Hawaii (Enclosure), is forwarded for publication in the Federal Register. Billing code is located on the Notice of Intent.

Sincerely,

Michael M. Jenks
Colonel, Corps of Engineers
District Engineer

Enclosure

Copy Furnished: (w/encl)

Mr. Allan Hirsch
Director
Office of Federal Activities (A104)
US Environmental Protection Agency
401M Street SW
Washington, D.C. 20460

Regional Administrator
US Environmental Protection
Agency, Region IX
EIS Review Section (P-3)
ATTN: L. Bartamian
215 Fremont Street
San Francisco, CA 94104

PODED-PV

3 July 1985
3710-NM

DEPARTMENT OF THE ARMY
NOTICE OF INTENT

To prepare a Draft Environmental Impact Statement (DEIS) for Kahului Small Boat Harbor, Kahului, Maui, Hawaii.

Agency: US Army Corps of Engineers, POD
Honolulu District

Action: Notice of Intent to Prepare a
Draft Environmental Impact
Statement

Summary:

1. The US Army Corps of Engineers is studying improvements for small boat navigation in the Kahului area, Kahului, Maui, Hawaii.

2. The Corps is studying six alternative plans including no action which provides for an improved boat launching ramp with a protected area for temporary mooring of approximately 10-20 boats. The plans generally include an entrance channel, mooring area, turning area, and parking and shoreside facilities.

3. On June 13, 1985, a public workshop was held at Kahului Public Library to discuss the proposed action. Local, State and Federal agencies were contacted as well as local interest groups and private organizations and parties. At this time, the draft EIS will address the impacts of the project on fish and wildlife resources, historic resources, aesthetic values and lifestyles. Coordination with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Environmental Protection Agency, State of Hawaii Department of Land and Natural Resources, State Department of Health, State Department of Planning and Economic Development, State Department of Transportation and other local agencies will be done.

4. A scoping meeting is not planned at this time.

If there are any questions regarding the draft [illegible], please contact:

Dr. James E. Maragos, Chief
Environmental Resources Section
US Army Engineer District, Honolulu
Building T-1
Ft. Shafter, Hawaii 96858-5440

Telephone: (808) 438-2263/2264

Date ______________

Michael M. Jenks
Colonel, Corps of Engineers
District Engineer

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

SEP 5 1985

Major John French, Deputy District Engineer
U.S. Army Corps of Engineers
Honolulu District
Building 230
Fort Shafter, Hawaii 96858

Dear Major French:

The Environmental Protection Agency (EPA) has reviewed the Notice of Intent (NOI) for the project titled KAHULUI SMALL BOAT HARBOR; KAHULUI, MAUI, HAWAII. Our review is based on the Council on Environmental Quality (CEQ) Regulations (40 CFR Parts 1500-1508). We have the enclosed comments to offer at this time.

We appreciate the opportunity to comment on the proposed project. Please send four copies of the DEIS to this office at the same time it is officially filed with our Washington, D.C. office. We also request notification of any public hearings or workshops to be held on this project. If you have any questions, please contact Patrick J. Cotter, Federal Activities Branch, at (415) 974-0948 or FTS 454-0948.

Sincerely yours,

Loretta Kahn Barsamian

Loretta Kahn Barsamian, Chief
Federal Activities Branch

Enclosure (2 pages)

General Comments

1. The DEIS should rigorously explore and objectively evaluate all reasonable alternatives and, for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated (40 CFR 1502.14).

2. The DEIS should clearly explain the relationship between the project's cost/benefit analysis and any analyses of unquantified environmental impacts, values, and amenities (40 CFR 1502.23).

Water Quality Comments

For each alternative, the DEIS should:

1. Fully discuss the project's compliance with State and local water quality management plans and State-adopted, EPA-approved water quality standards.

   a. The DEIS must focus on maintaining and protecting the beneficial uses of Kahului Bay.

   b. These existing and potential beneficial uses for marine waters include:

      1) Class A embayment,
      2) Class A open coastal waters,
      3) Class II beaches
      4) Class II artificial basin, (deep draft commercial harbor),
      5) Class II reef flats and reef communities, and
      6) Class II soft bottom communities.

   c. EPA recommends that project planning be fully coordinated with the Hawaii Department of Health to ensure protection of water quality and maintenance of beneficial uses.

2. Evaluate the potential for increased toxicity in the marine environment due to either discharge to the ocean or runoff from the surrounding area.

3. Evaluate likely changes in the salinity of ground water or surface water resulting from this project.

4. Identify any project impacts on marine ecosystems or present marine conditions such as changes in substrate, direction of ocean current flow or sediment and sand accumumation.

5. Identify appropriate mitigation measures to protect water quality both during and after project construction, including the use of silt curtains during dredging operations.

Section 404 Comments

1. EPA will review the project for compliance with Federal Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR 230), promulgated pursuant to Section 404(b)(1) of the Clean Water Act.

   a. EPA's evaluation will focus on the maintenance of water quality, the protection of fisheries and wildlife resources, threatened or endangered species, and special aquatic sites, including vegetated shallows (40 CFR 230.43) and coral reefs (40 CFR 230.44)

   b. These regulations require that no discharge shall be permitted which will result in unacceptable adverse impacts on the marine ecosystem.

   c. If applicable, the results of further studies should indicate the amount of dredging required, potential disposal sites, types of fill material to be utilized, and quantities to be discharged into waters and special aquatic sites that fall under Section 404 jurisdiction.

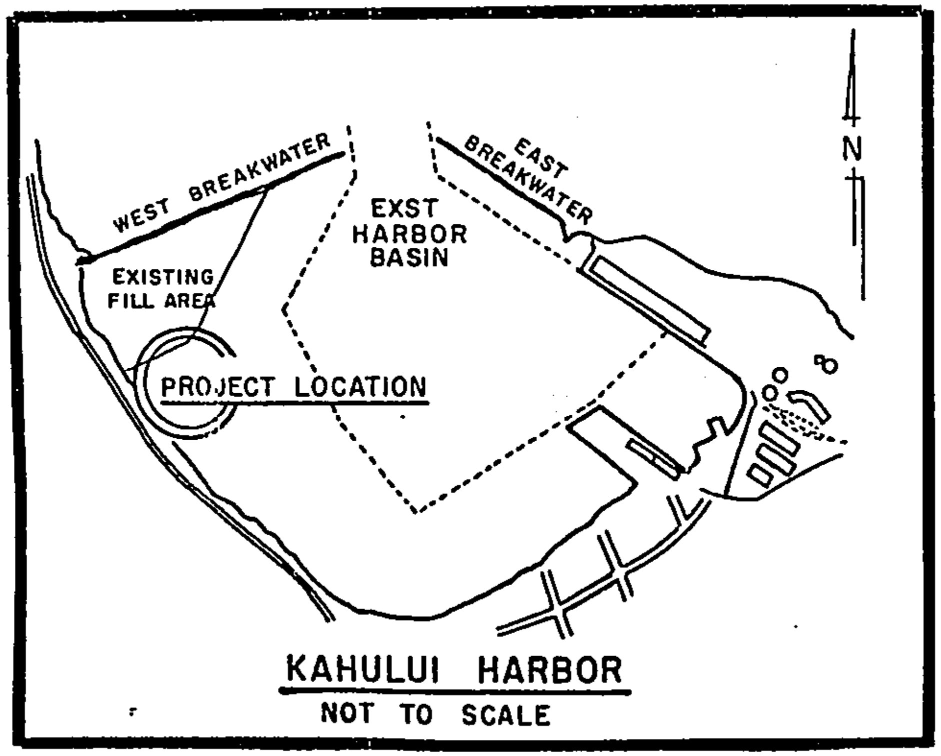
Hazardous Materials Comments

1. The DEIS should indicate that if hazardous materials (including petroleum products) are released into the environment, the responsible party will immediately inform the National Response Center at 800-424-8802. This information shall provide details of the incident and responsive measures taken. Local U.S. Coast Guard or Environmental Protection Agency offices may be notified in lieu of the National Response Center.

2. Title 40 CFR, Part 112 requires the preparation and implementation of a Spill Prevention Control and Countermeasure (SPCC) Plan. This includes all nontransportation-related facilities, either onshore or offshore, which have discharged or could reasonably be expected to discharge oil into the navigable waters of the United States or adjoining shorelines. These regulations should be considered during the design phase and expansion of marinas and port facilities at Kahului Bay.

PUBLIC WORKSHOP

MAUI COMMUNITY COLLEGE
SCIENCE BUILDING
LECTURE HALL 11A
TUESDAY, JULY 14, 1987
7:30 - 9:00 PM



B-18

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF:

CEPOD-ED-PJ

July 1, 1987

NOTICE OF PUBLIC WORKSHOP
FOR THE
KAHULUI SMALL BOAT HARBOR

The Honolulu District Corps of Engineers, in cooperation with Harbors Division of the State Department of Transportation, has been studying improvements for small boat navigation in the Kahului area. Previous workshops on this study have been held in February and November 1984 and May 1985. From these meetings with local boaters, and from discussions with the staffs of Harbors Division and the County of Maui, we have concluded that the most acceptable plan of improvement is a protected launch ramp and temporary mooring area in the vicinity of the existing launch ramp in Kahului Harbor. Several different alternative plans are being considered for the fill area on the west side of Kahului Harbor, with an improved single-lane launch ramp and a mooring area ranging in capacity from 10 to 37 vessels. Recent efforts have been directed at defining the commercial fishing benefits that would be realized if the proposed project were constructed. The commercial fishing analysis was conducted by the National Marine Fisheries Service (NMFS) office in Honolulu.

We invite all interested parties to attend a public workshop in Kahului on Tuesday, July 14, 1987, at 7:30 pm. The workshop will be held in the Science Building, Lecture Hall 11A, at the Maui Community College in Kahului.

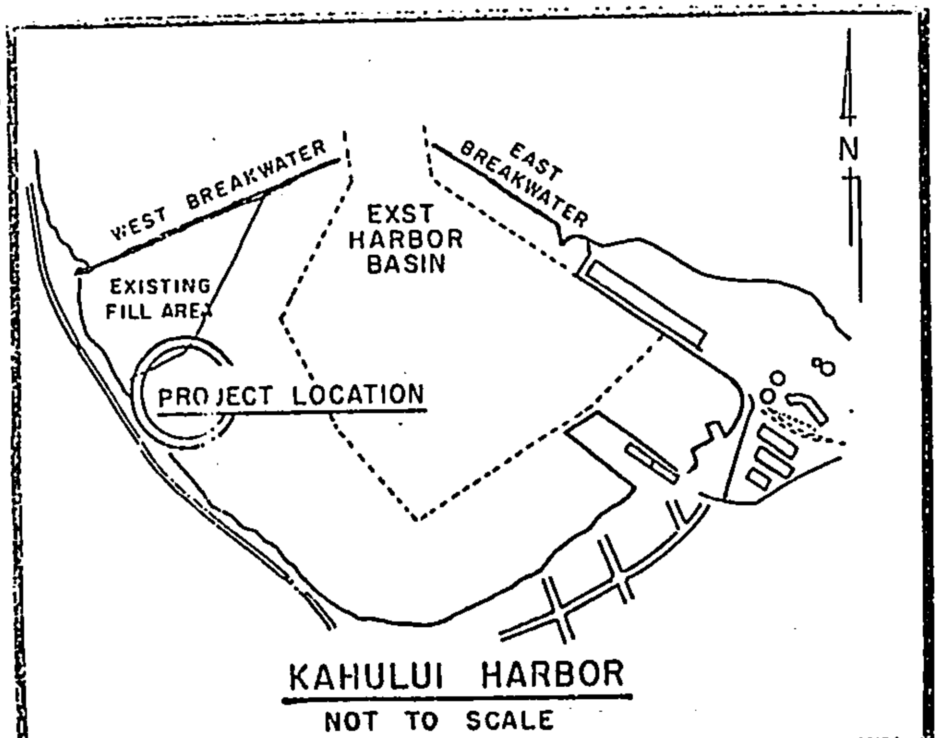
The purpose of this workshop is to review the results of the NMFS commercial fishing analysis and also to review the latest plans for the harbor improvements. We would like to hear your opinions on the proposed navigation improvements, including any social and environmental aspects of the project. Your participation will ensure that your views are incorporated into our study process.

Please bring this announcement to the attention of others who may be interested in these matters. We look forward to seeing you at this workshop.

F. W. WANNER
Colonel, Corps of Engineers
District Engineer

PUBLIC WORKSHOP

MAUI COMMUNITY COLLEGE
SCIENCE BUILDING
LECTURE HALL 11A
TUESDAY, AUGUST 11, 1987
7:30 - 9:00 PM



DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858 -5440

REPLY TO ATTENTION OF:

CEPOD-ED-PJ

July 9, 1987

NOTICE OF PUBLIC WORKSHOP
FOR THE
KAHULUI SMALL BOAT HARBOR

The Honolulu District Corps of Engineers, in cooperation with Harbors Division of the State Department of Transportation, has been studying improvements for small boat navigation in the Kahului area. Previous workshops on this study have been held in February and November 1984 and May 1985. From these meetings with local boaters, and from discussions with the staffs of Harbors Division and the County of Maui, we have concluded that the most acceptable plan of improvement is a protected launch ramp and temporary mooring area in the vicinity of the existing launch ramp in Kahului Harbor. We are now considering different configurations and capacities of the temporary mooring area and resultant ramp locations. Recent efforts have been directed at defining the commercial fishing benefits that would be realized if the proposed project were constructed. The commercial fishing analysis was conducted by the National Marine Fisheries Service (NMFS) office in Honolulu.

We invite all interested parties to attend a public workshop in Kahului on Tuesday, August 11, 1987, at 7:30 pm. The workshop will be held in the Science Building, Lecture Hall 11A, at the Maui Community College in Kahului. This workshop was originally scheduled for July 14, but has been delayed until August to ensure full participation by the local community.

The purpose of this workshop is to review the results of the NMFS commercial fishing analysis and also to review the latest plans for the harbor improvements. We would like to hear your opinions on the proposed navigation improvements, including any social and environmental aspects of the project. Your participation will ensure that your views are incorporated into our study process.

Please bring this announcement to the attention of others who may be interested in these matters. We look forward to seeing you at this workshop.

F. W. WANNER
Colonel, Corps of Engineers
District Engineer

HOUSE OF REPRESENTATIVES
THE FOURTEENTH LEGISLATURE

STATE OF HAWAII
STATE CAPITOL
HONOLULU, HAWAII 96813

May 25, 1988

US Army Corps of Engineers
Ft. Shafter, Bldg 230, Room 113B
Honolulu, HI 96819

Gentlemen:

I transmit herewith a copy of House Resolution No. 122 HD1, which was adopted by the House of Representatives of the Fourteenth Legislature of the State of Hawaii, Regular Session of 1988.

Very respectfully,

Gerald I. Miyoshi
Clerk, House of Representatives

HOUSE OF REPRESENTATIVES
FOURTEENTH LEGISLATURE, 1988
STATE OF HAWAII

H.R. NO. 122
H.D. 1

HOUSE RESOLUTION

REQUESTING ACTION RELATING TO HARBORS AND HARBOR FACILITIES TO IMPROVE MAUI'S ABILITY TO ACCOMMODATE GROWING MARINE COMMERCIAL AND RECREATIONAL ACTIVITIES.

WHEREAS, maritime and marine activities play an extremely important economic and social role in the lives of Maui's residents; and

WHEREAS, although development of these activities has increased considerably in recent years, further development is impeded by the lack of adequate harbors and facilities; and

WHEREAS, because shipping remains a major means of transporting imported goods to island residents and exporting commodities, adequate harbors are vital to an island's social and economic welfare; and

WHEREAS, of the four major islands in the State, Oahu, Kauai, and Hawaii have alternative "back-up" harbors that could serve their residents should their principal port be closed as a result of a disaster or emergency; and

WHEREAS, Maui, on the other hand, has only one deep or median draft harbor to serve its shipping needs; and

WHEREAS, if Maui's Kahului Harbor were closed for some reason, such as a vessel sinking or breaching in the harbor entrance, no adequate alternative exists by which needed goods could be shipped to Maui; and

WHEREAS, no contingency plan exists to ensure Maui residents will be provided for in the event of such an emergency; and

WHEREAS, commercial and recreational marine activities have outgrown the woefully inadequate facilities existing at Kahului Harbor; and

WHEREAS, of Kahului Harbor's three piers, Pier Two is used exclusively to accommodate burgeoning intrastate trade, and Pier

HR LRB [illegible]

Three is a solid fill pier along the shoreline which has an accompanying water depth of only sixteen feet, adequate only for small shallow draft vessels and barges; and

WHEREAS, accordingly, only Pier One is available to accommodate large ships, such as Matson freighters, passenger ships, sugar vessels, oil tankers, and Japanese freighters carrying tin plate vital for Maui's can manufacturing plant; and

WHEREAS, Pier One has space for only one large ship to berth at a time; and

WHEREAS, the increasingly high demand for and the inadequacy of existing berthing space results in unnecessary and costly delays in the loading and unloading of vessels; and

WHEREAS, Pier One should be extended to provide sufficient space to accommodate the simultaneous berthing of two large vessels; and

WHEREAS, Maui's commercial and recreational marine industries, such as sports fishing, recreational boating, and pleasure cruising, are growing rapidly and provide important recreational activities for tourists and residents alike; and

WHEREAS, these activities have made a significant impact on Maui's local economy and should be encouraged; and

WHEREAS, lack of proper harbor facilities seriously impedes the continued growth in this important industry; and

WHEREAS, immediate development of additional small boat harbors or marinas are needed on Maui to support and encourage these activities; now, therefore,

BE IT RESOLVED by the House of Representatives of the Fourteenth Legislature of the State of Hawaii, Regular Session of 1988, that the Department of Transportation is requested to develop an emergency, logistical support plan for Maui to be implemented in the event Kahului Harbor is closed unexpectedly; and

BE IT FURTHER RESOLVED that the Department of Transportation is requested to make immediate improvements to Pier One in

Kahului Harbor to provide additional berthing space to accommodate large ships; and

BE IT FURTHER RESOLVED that the Department of Transportation is requested to work with the county of Maui and private industry groups to begin immediate development of additional small boat harbors or marinas on Maui to accommodate expanding commercial and recreational marine activities; and

BE IT FURTHER RESOLVED that certified copies of this Resolution be transmitted to the Director of Transportation, the Mayor and County Council of Maui, and the U.S. Corps of Engineers.

101GSWMRD01F01
DIRECTOR HONOLULU LABORATORY
NAT MARINE FISHERIES SVC
US DEPARTMENT OF COMMERCE
2570 DOLE STREET
HONOLULU, HI 96822-2396

105GSWMRD01F01
OFFICE OF ENVIRON SERVICES
ENDANGERED SPECIES COORD
US FISH & WILDLIFE SERVICE
300 ALA MOANA BLVD, BOX 50167
HONOLULU, HI 96850

106GSWMRD01F01
DR. ALLAN D. MARMELSTEIN
PACIFIC ISLAND ADMINISTRATOR
P.O. BOX 50167
HONOLULU, HI 96850

108GSWMRD01F01
DIRECTOR
OFC OF ENVIRONMENTAL QUALITY
CONTROL, STATE OF HAWAII
465 SOUTH KING STREET
HONOLULU, HI 96813-2910

110GSWMRD01F01
ADMINISTRATOR
DIVISION OF STATE PARKS
DLNR, STATE OF HAWAII
P.O. BOX 621
HONOLULU, HI 96809

111GSWMRD01F01
DIRECTOR
DIV OF AQUATIC RESOURCES
DLNR, STATE OF HAWAII
1151 PUNCHBOWL ST
HONOLULU, HI 96813

114GSWMRD01F01
CHAIRMAN
STATE BD OF LAND & NAT RESRS
PO BOX 621
HONOLULU, HI 96809

116GSWMRD01F01
STATE HISTORIC PRSVN OFFICER
DLNR, STATE OF HAWAII
P.O. BOX 621
HONOLULU, HI 96809

117GSWMRD01F01
MARINE AFFAIRS COORDINATOR
OFFICE OF THE GOVERNOR
STATE OF HAWAII
HONOLULU, HI 96813

118GSWMRD01F01
DIRECTOR
DEPT OF PLANNING & ECONOMIC
DEVELOPMENT, STATE OF HAWAII
P.O. BOX 2359
HONOLULU, HI 96804

125GSWMRD01F01
MR. WILLIAM MEYER
GEOLOGICAL SURVEY
US DEPT OF THE INTERIOR
300 ALA MOANA BLVD, BOX 50166
HONOLULU, HI 96850

127GSWMRD02F02
COMMANDER
FOURTEENTH COAST GUARD DIST
300 ALA MOANA BLVD, 9TH FLR
ATTN: OAN, MSO
HONOLULU, HI 96850

136GSWMRD01F01
CHIEF, HARBORS DIVISION
DEPT OF TRANSPORTATION
STATE OF HAWAII
79 S. NIMITZ HWY
HONOLULU, HI 96813

140GSWMRD01F01
DIRECTOR, ENVIRONMENTAL CTR
UNIVERSITY OF HAWAII
2550 CAMPUS RD, CRAWFORD 317
HONOLULU, HI 96822

141GSWMRD01F01
DIRECTOR
WATER RES RESEARCH CTR
UNIVERSITY OF HAWAII
2444 DOLE ST
HONOLULU, HI 96822

143GSWMRD01F01
DIRECTOR
HI INST OF MARINE BIOLOGY
UNIVERSITY OF HAWAII
P.O. BOX 1346
KANEOHE, HI 96744

150GSWMRD01F01
DIRECTOR
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII
869 PUNCHBOWL ST
HONOLULU, HI 96813

154GSWMRD01F01
DIRECTOR, STATE CLEARINGHOUSE
DEPT OF PLNG & ECON DEV
P.O. BOX 2359
HONOLULU, HI 96804

201GSWMRD08F08
DIR, OFC OF ECOL & CONSERV
NOAA,DEPT OF COMMERCE
ROOM 5813
14TH & CONSTITUTION AVE, NW
WASHINGTON, DC 20230

203GSWMRD20F05
DIRECTOR
OFC OF ENVIR RVW.
US DEPT OF THE INTERIOR
RM 424-1,18TH & C ST,NW
WASHINGTON, DC 20240

204GSWMRD05F05
DIRECTOR
OFC OF FED ACTIVITIES(A-104)
US ENVIRON PROTECTION AGENCY
401 M ST, SW
WASHINGTON, DC 20460

206GSWMRD01F01
CHIEF, WESTERN PROJECT REVIEW
ADV COUNCIL ON HIST PRESERV
730 SIMMS STREET
ROOM 450
GOLDEN, CO 80401

208GSWMRD01F01
CZM PROGRAM COORDINATOR
DEPT OF PLNG & ECON DEVELOP
STATE OF HAWAII
P.O. BOX 2359
HONOLULU, HI 96804

209GSWMRD01F01
REGIONAL DIRECTOR, SW REGION
NAT MARINE FISHERIES SVC, NOAA
US DEPARTMENT OF COMMERCE
300 SOUTH FERRY STREET
TERMINAL ISLAND, CA 90731

212GSWMRD01F01
CHIEF
INTERAGENCY ARCHEOL SERVICE
NATIONAL PARK SERVICE
450 GOLDEN GATE AVE, BOX 36065
SAN FRANCISCO, CA 94102

213GSWMRD01F01
REGIONAL DIRECTOR, REGION IX
US FISH & WILDLIFE SERVICE
LLOYD 500 BLDG, SUITE 1692
500 NE MULTNOMAH STREET
PORTLAND, OR 97232

217GSWMRD01F01
SECRETARY'S FIELD REP
PACIFIC SOUTHWEST REGION
US DEPT OF THE INTERIOR
450 GOLDEN GATE AVE, BOX 36098
SAN FRANCISCO, CA 94102

225GSWMRD01F01

OFC OF ENERGY & ENV IMPACTS
FEDERAL MARITIME COMMISSION
1100 L STREET,NW
WASHINGTON, DC 20573

300ESWMRD01F01

HONORABLE DANIEL K. INOUYE
UNITED STATES SENATE
722 HART SENATE OFFICE BLDG
WASHINGTON, DC 20510

301ESWMRD01F01

HONORABLE DANIEL K. INOUYE
UNITED STATES SENATOR
300 ALA MOANA BLVD, ROOM 7325
HONOLULU, HI 96850

302ESWMRD01F01

HONORABLE SPARK M. MATSUNAGA
UNITED STATES SENATE
HART SENATE OFC BLDG, NO. 109
WASHINGTON, DC 20510

303ESWMRD01F01

HONORABLE SPARK M. MATSUNAGA
UNITED STATES SENATOR
300 ALA MOANA BLVD, ROOM 3104
HONOLULU, HI 96850

304ESWMRD01F01

HONORABLE DANIEL K. AKAKA
HOUSE OF REPRESENTATIVES
2301 RAYBURN HOUSE OFC BLDG
WASHINGTON, DC 20515

305ESWMRD01F01

HONORABLE DANIEL K. AKAKA
REPRESENTATIVE IN CONGRESS
300 ALA MOANA BLVD, ROOM 5104
HONOLULU, HI 96850

306ESWMRD01F01

HONORABLE PATRICIA SAIKI
HOUSE OF REPRESENTATIVES
1407
WASHINGTON, DC 20515

307ESWMRD01F01

HONORABLE PARTICIA SAIKI
REPRESENTATIVE IN CONGRESS
300 ALA MOANA BLVD, ROOM 4104
HONOLULU, HI 96850

308ESWMRD01F01
HONORABLE JOHN WAIHEE
GOVERNOR OF HAWAII
HONOLULU, HI 96813

322ESWMRD01F01
HONORABLE RICK REED
HAWAII SENATE
HONOLULU, HI 96813

331ESWMRD01F01
HONORABLE MAMORU YAMASAKI
HAWAII SENATE
HONOLULU, HI 96813

337ESWMRD01F01
HONORABLE MARK ANDREWS
HAWAII HOUSE OF REPRESENTATIVE
HONOLULU, HI 96813

348ESWMRD01F01
HONORABLE HERBERT HONDA
HAWAII HOUSE OF REPRESENTATIVE
HONOLULU, HI 96813

382ESWMRD01F01
HONORABLE BILL PFEIL
HAWAII HOUSE OF REPRESENTATIVE
HONOLULU, HI 96813

502GSWMRD01F01
MAUI DIST MANAGER
HARBORS DIV, DOT
STATE OF HAWAII
P. O. BOX 216
KAHULUI, HI 96732

506GSWMRD01F01
DIRECTOR
DEPT OF PARKS AND RECREATION
COUNTY OF MAUI
WAILUKU, HI 96793

507GSWMRD01F01
DIRECTOR
DEPARTMENT OF PLANNING
COUNTY OF MAUI
200 S HIGH ST
WAILUKU, HI 96793

509GSWMRD01F01
DIRECTOR
DEPT OF PUBLIC WORKS
COUNTY OF MAUI
200 S HIGH ST
WAILUKU, HI 96793

511ESWMRD01F01
HONORABLE HANNIBAL TAVARES
MAYOR OF THE COUNTY OF MAUI
WAILUKU, HI 96793

512ESWMRD01F01
MR. ROBERT H. NAKASONE
CHAIRMAN, MAUI COUNTY COUNCIL
200 S HIGH ST
WAILUKU, HI 96793

513ESWMRD01F01
MR. HOWARD S. KIHUNE
VICE-CHAIRMAN, MAUI COUNTY
COUNCIL
200 S HIGH ST
WAILUKU, HI 96793

516ESWMRD01F01
COUNCILMAN WAYNE K. NISHIKI
MAUI COUNTY COUNCIL
200 S HIGH ST
WAILUKU, HI 96793

517ESWMRD01F01
COUNCILWOMAN
LINDA CROCKETT LINGLE
MAUI COUNTY COUNCIL
200 S HIGH ST
WAILUKU, HI 96793

518ESWMRD01F01
COUNCILMAN THOMAS MORROW
MAUI COUNTY COUNCIL
200 S HIGH ST
WAILUKU, HI 96793

519ESWMRD01F01
COUNCILWOMAN VELMA M. SANTOS
MAUI COUNTY COUNCIL
200 S HIGH ST
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4158ISWMRD01F01

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MR. CRAIG ANDERSON ENVIRON & DEV CONT DEPT 3600 JEFFERSON HWY JEFFERSON, LA 70121		

KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

GEOTECHNICAL INVESTIGATIONS

APPENDIX C

APPENDIX C

PRELIMINARY GEOTECHNICAL APPENDIX
KAHULUI SMALL BOAT HARBOR
KAHULUI, MAUI, HAWAII

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APPENDIX C

PRELIMINARY GEOTECHNICAL APPENDIX
KAHULUI SMALL BOAT HARBOR
KAHULUI, MAUI, HAWAII

1 INTRODUCTION

In order to expedite completion of the Detailed Project Report and minimize expenditure of funds until the economic feasibility and acceptability of the project have been determined, subsurface explorations, laboratory testing and detailed geotechnical design and analyses will be performed prior to initiation of Plan and Specifications. These investigations are mandatory for geotechnical design and analysis of this project and for evaluating the dredgeability of the subsurface materials. For scheduling purposes, these investigations will require approximately six calendar months to complete.

In the absence of detailed geotechnical investigations, subsurface site descriptions and design recommendations contained in this report were based on visual observations (including SCUBA diving) and available literature. Accordingly, these subsurface site descriptions and design recommendations are preliminary in nature and subject to verification and/or revision upon completion of the mandatory geotechnical investigations.

2 GEOLOGY OF MAUI

The Island of Maui is the second largest Hawaiian island with a land area of 728 square miles. This island consists of two volcanic domes, the Haleakala and West Maui volcanoes which are separated by a low strip of land, consisting of overlapping lava flows, known as the Isthmus. Haleakala, sometimes called the East Maui volcano, is 10,025 feet high and 33 miles across. The West Maui volcano is roughly one- half the size of Haleakala. Eruptions which built most of these two volcanoes ended sometime around the early Pleistocene Epoch, or about 0.8 to 1.3 million years ago. Many smaller phases of volcanism have occurred in recent geologic times (~ 10,000 years b.p.) with local eruptions having occurred on Haleakala as late as about 1750. The relative sizes of the mountains in addition to the occurrence of deeply incised amphitheater headed valleys on the West Maui volcano, supports the fact that dormancy was achieved on this volcano before Haleakala. Most of the lava flows on both volcanoes dip gently seaward at about twelve degrees.

The Isthmus was formed by lava flows from Haleakala ponding against the older West Maui volcano. The Isthmus is covered with alluvium deposited chiefly by streams from West Maui which flow on steep gradients and drop their sediment load upon reaching the relatively flat Isthmus. Extensive calcareous sand dunes attaining heights up to 200 feet cover a narrow strip of the Isthmus from Kahului on the north shore to Kihei on the south shore. The dunes diminish rapidly in height and size in the southern direction. The dune sand is chiefly comminuted coral, shells, and foraminifera with small and variable percentages of basalt sand.

3 SITE GEOLOGY

Kahului Harbor is located on the north shore of the Isthmus connecting East Maui and West Maui and centrally positioned in Kahului Bay. Most of the harbor was dredged into the naturally-formed Kahului Bay. The harbor is bordered to the south and east by Maui's principal towns of Kahului and Wailuku. Kahului Harbor has been enclosed within Kahului Bay by two major breakwater structures. The mouth of Iao Stream is located approximately one mile north of the west breakwater of Kahului Harbor. Iao Stream has meandered throughout the Kahului Harbor area in the recent geologic past, incising ancient reefs and backfilling the stream valley with basalt sands, gravels cobbles and boulders. These sediments have subsequently been reworked by wind, current and waves in the harbor. The backshore areas of the west half of Kahului Bay were subsequently inundated (and buried) by the landward migration of dune sand.

During the dredging of Kahului Harbor, excavated earth materials were stockpiled (spoiled) along the inner nearshore portion of the west breakwater. A peninsula of filled land (at the proposed project site) was created along this breakwater from the hydraulic (suction/cutter head) dredging method used. This filled peninsula is low (about 8 to 13 feet elevation), flat, revetted and presently used for parking by fishermen. The existing boat launch ramp, small mooring dock and 70-foot long stub breakwater are located on this filled peninsula at the west corner of the Kahului Harbor.

The proposed sites for Kahului Small Boat Harbor are all in the west corner of Kahului Harbor in an area which has not been dredged. Here, a mantle of unconsolidated sandy gravel to boulder-sized beach and stream rubble of unknown thickness overlies the sites which are near the shoreline (Alternatives A and B). Further into the harbor (in the vicinity of Alternative C and the seaward 300+ feet of the entrance channel for Alternative A and B), there exists a cemented reef formation consisting of limestone breccia and calcareous sandstone with some unconsolidated sediments filling surge channels and reef depressions. A detailed description of these deposits is presented in paragraph SUBSURFACE CONDITIONS AND DREDGEABILITY. The bathymetry of the harbor bottom and shoreline is gentle and slopes seaward because of the relatively low energy depositional environment nearshore and the deposition of sediments in former topographic depressions and surge channels further offshore.

4 SUBSURFACE INVESTIGATIONS

No detailed subsurface investigations were made for the Detailed Project Report. Geotechnical information and design considerations presented in this report are based on visual observations from site reconnaissance studies (including SCUBA diving) and available literature. Subsurface investigations consisting of standard penetration testing and diamond core drilling will be performed prior to initiation of Plans and Specifications to establish geotechnical design parameters and to provide subsurface information for prospective bidders in the contract documents.

5 SUBSURFACE CONDITIONS AND DREDGEABILITY

5.1 Entrance Channel for Alternatives A and B

Weak to moderately hard, cemented limestone breccia and/or calcareous sandstone with occasional zones of loose, unconsolidated sediments (filling surge channels, reef irregularities, etc.) of sand to small boulder grain sizes are found along the outer (seaward) 300+ feet of the entrance channel. Blasting to loosen rock will be required.

Loose, unconsolidated sand to cobbles with some small boulders (basaltic and calcareous) cover the remainder of the proposed entrance channel. These materials are more calcareous offshore and grade into rounded basaltic stream sediments reworked and mixed with calcareous sand and gravel nearshore. Currents are generally light in this area and erosional features were not observed. Stability may be a problem because of loose and rounded condition of cobbles and small boulders. Reef rock was not observed in this area. No blasting will be required and dragline/clamshell dredging methods may be used.

5.2 Alternative A Harbor Site

Reworked, loose, calcareous and basaltic sand, gravel and cobbles cover the entire site. Foundation bearing strength potential for revetment and ramp is estimated to be fair to good (no evidence of compressible silts or clays). Erosion potential under existing conditions is low because of coarse grain-size fraction of sediments and a relatively low erosional energy environment. No erosion features in existing revetment or launch ramp were observed. No blasting will be required and dragline/clamshell dredging methods may be used.

5.3 Alternative B Harbor Site

Alternative B is located within the hydraulically-placed dredge fill (proposed inland harbor). The ground surface consists of limestone sand and gravel with occasional basalt and calcareous gravel and cobble. The thickness of the fill is estimated to be about 12 feet. The foundation bearing potential is estimated to be good to very good. No visible settlement or cracking of the existing boat-launch ramp was observed (ramp was constructed on dredge fill).

Reworked, loose, calcareous and basaltic sand, gravel and cobbles underlie the surface hydraulic fill as suggested by the flat relief within the adjacent site (Alternative A). Foundation bearing potential is estimated to be fair to good and blasting within this site will not be required. The erosion potential for this formation, like Alternative A, is low, under existing conditions, because of coarse grain-size fraction of the sediment and a low energy environment.

5.4 Alternative C Harbor Site

Alternative C is located within the hydraulically-placed dredge fill (proposed inland harbor). The fill is the same as that surface fill described in Alternative B. The maximum thickness of this fill is estimated to be approximately 16 feet. Underlying the fill to depths in excess of the proposed excavation are weak to moderately hard cemented reef limestone breccia and calcareous sandstone, similar to that described for the outermost 300 feet of the entrance channel for Alternatives A and B. Loose, unconsolidated zones may also be present within this formation. Blasting to loosen rock will be required. Foundation bearing potential for both deposits is estimated to be good. Unprotected cutslopes in the overlying hydraulic fill are not recommended because of a storm surge- induced high energy environment at this site.

6. <u>DESIGN CONSIDERATIONS</u>

Detailed geotechnical investigations for design of this project will be performed prior to initiation of Plans and Specifications. These geotechnical investigations will include subsurface explorations and laboratory testing for site characterization and determination of soil parameters; slope stability analyses for determination of stable excavation slopes for dredging and stable fill slopes for breakwaters and revetted moles; settlement analyses for breakwaters to investigate the need for over-building; and filter analyses of bedding layers to preclude migration of subgrade materials through the revetments. In the absence of subsurface explorations and detailed geotechnical investigations, the following preliminary design considerations are provided for the purpose of evaluating the economic feasibility of the project.

6.1 Preliminary Excavation Slopes for Dredging

Excavation slopes of 1V on 1H in cemented limestone breccia and/or calcareous sandstone and 1V on 3H in unconsolidated clastic sediments and hydraulically-placed dredged fill may be assumed.

6.2 Preliminary Setback Distance Between Top of Unrevetted Dredged Slopes and Toe of Revetments

Wave and current action may eventually flatten unrevetted dredged slopes in unconsolidated clastic sediments to approximately 1V on 5H or flatter. To preclude undermining of adjacent revetments, the toe of all revetted structures should be set back a sufficient distance from the top of all unrevetted dredged slopes such that a 10-foot wide bench would still remain in the event the dredge slope does flatten to 1V on 5H. Alternatively, dredged slopes in the vicinity of revetted structures may be protected with revetment stone to preclude eventual flattening.

6.3 Preliminary Slopes for Breakwaters, Revetted Moles and Miscellaneous Revetments.

Fill slopes of 1V on 1.5H may be assumed.

6.4 Toe Protection for Revetted Structures

Except where foundation materials consist of reef rock (cemented limestone breccia and/or calcareous sandstone) the toe of all revetments should be imbedded into the foundation below the depth of anticipated scour. A bedding layer should be provided beneath, and 5 feet beyond, the toe in accordance with the Shore Protection Manual.

6.5 Protection Against Migration of Subgrade Materials

Migration of subgrade materials through the revetments should be precluded by designing the gradation of the bedding layers to meet conventional filter criteria. Where use of a graded bedding layer is impractical or uneconomical, a plastic filter fabric may be used.

6.6 Concrete for Boat Ramp

In view of seawater exposure conditions, cement conforming to ASTM C150, Type II, shall be specified for this project. Additionally, the concrete shall have a maximum water-cement ratio of 0.45.

7 SOURCES OF REVETMENT STONE

7.1 Hawaiian Cement - Waikapu Quarry (Formerly Maui Concrete & Aggregate Co)

Quarrying operations involve stripping a broad talus deposit from the West Maui Mountains and segregating rock boulders for crushing into desired screen sizes. Two distinct rock types are being quarried, a dense fine-grained olivine basalt and vesicular (25 percent) andesite. The Waikapu quarry is located 4 miles southwest of Kahului on the Wailuku-Lahaina Highway. Hawaiian Cement has recently opened a rock quarry in the Puunene area producing materials similar to those produced at Ameron HC&D's Puunene Quarry (see below).

7.2 Ameron HC&D - Puunene Quarry

Kula lava flows from Haleakala are quarried at this site. The rock is a dense, fine-grained andesite and is the only rock type quarried. The quarry is located 4 miles southeast of the proposed project site. This rock is also crushed for aggregates but can be quarried to produce armor rock in quantities desired for this project.

7.3 Field Stone

Field stones stockpiles within the many nearby sugar cane fields may also be a potential source of armor rock. It appears that large quantities of field stones were used as armor rock for the construction of the Kahului Harbor breakwaters.

KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

ENGINEERING, DESIGN AND COST

APPENDIX D

APPENDIX D
DESIGN ANALYSIS
KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS

APPENDIX D
DESIGN ANALYSIS
KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS

1 DESIGN CRITERIA

1.1 General

The design analysis for the Kahului Light Draft Navigation Improvements study is based on available information and the practices and procedures contained in the Coastal Engineering Research Center's (CERC) Shore Protection Manual (SPM), Coastal Engineering Technical Notes (CETN), Microcomputer Applications for Coastal Engineering (MACE), and applicable Corps of Engineers Manuals (EM) and studies.

1.2 Tide Data

The primary tidal bench mark for Kahului Harbor is a standard disc, stamped "2 1929" and set in the concrete deck floor at the northeast corner of the warehouse at the shore end of Pier 2. Tidal data, based on nine years of record from 1951 through 1959 taken by the Environmental Services Administration Coast and Geodetic Surveys, are tabulated below:

	FEET
Highest Tide Observed (10/12/58 & 6/20/59)	3.6
Mean higher high water (mhhw)	2.3
Mean high water (mhw)	1.90
Mean tide level (mtl)	1.15
Mean low water (mlw)	0.40
Mean lower low water (mllw)	0.00
Lowest tide observed (6/19/55 & 6/20/55)	-1.2

1.3 Wave Data

Wave data for the Kahului area were obtained from three sources; 1) a wave gage, operated from July 1966 to March 1969, located approximately 1,860 feet north of the head of the east breakwater, 2) CERC's Pacific Coast Hindcast Deepwater Wave Information Study (WIS-14, 1986) for the Hawaiian Islands, and 3) CERC's physical model data for the "Kahului Breakwater Stability Study" (CERC, 1982).

The wave gage data were analyzed and tabulated by the Coastal Engineering Research Center. Table 1 and 2 shows the wave climatology for Kahului Harbor as a distribution of wave height in percent versus wave period. The highest wave recorded was 28 feet with a period of 16 seconds and occurred during a 4-6 December 1968 storm. Prior to this storm, the maximum recorded wave height was 19 feet. As shown in Table 1, waves of 9 feet or less were recorded 96.1 percent of the time. Periods of wave gage equipment outages did not coincide with any known occurences of storm waves at Kahului.

A summary of CERC's wave hindcasts for station 31, located at 21.9N and 155.7W (see Figure 1), is presented in Table 3 and Figure 2. The data presented are based on 20 years of hindcast from 1956 - 1975.

The wave data for the various hydrographs run for CERC's (1982) "Kahului Breakwater Stability Study" are presented in Tables 4, 5, 6 and 7.

1.4 Design Storm Parameters

The following design storm parameters based on the characteristics of Hurricane Iwa (16-25 November 1982) obtained from the "Hurricane Vulnerability Study For Honolulu, Hawaii, and Vicinity" (HED, 1985):

Max. Sustained Wind Speed, U (knots)	82.5
Forward Speed, Vf (knots)	33.3
Radius of Max. Winds, R (nautical miles)	34.7
Drop in Pressure, (Pn - Po) (Hg inches)	1.4

1.5 Design Water Levels

The design stillwater level (d_{swl}) is defined as the level of water above the elevation datum plane when no waves are present. Components of the design still water level are the astronomical tide level (S_a), the rise in water level due to atmospheric pressure reduction (S_p), the rise in water level due to storm surge (S_s) and the rise in water level due to wave setup (S_w).

$$d_{swl} = S_a + S_p + S_s + S_w$$

$$= 1.9' + 1.3' + 0.8' + 1.5' = 5.5 \text{ feet}$$

a. Astronomical Tide, S_a. The design astronomical tide is based on the mean high water level (mhw) for the project site.

$$S_a = 1.9 \text{ feet}$$

TABLE 1. WAVE CLIMATOLOGY FOR KAHULUI HARBOR

Distribution of Wave Height in Percent as a Function of Wave Period. Observation Period: Jul 66 - Jan 68
Number of Observations: 1,230

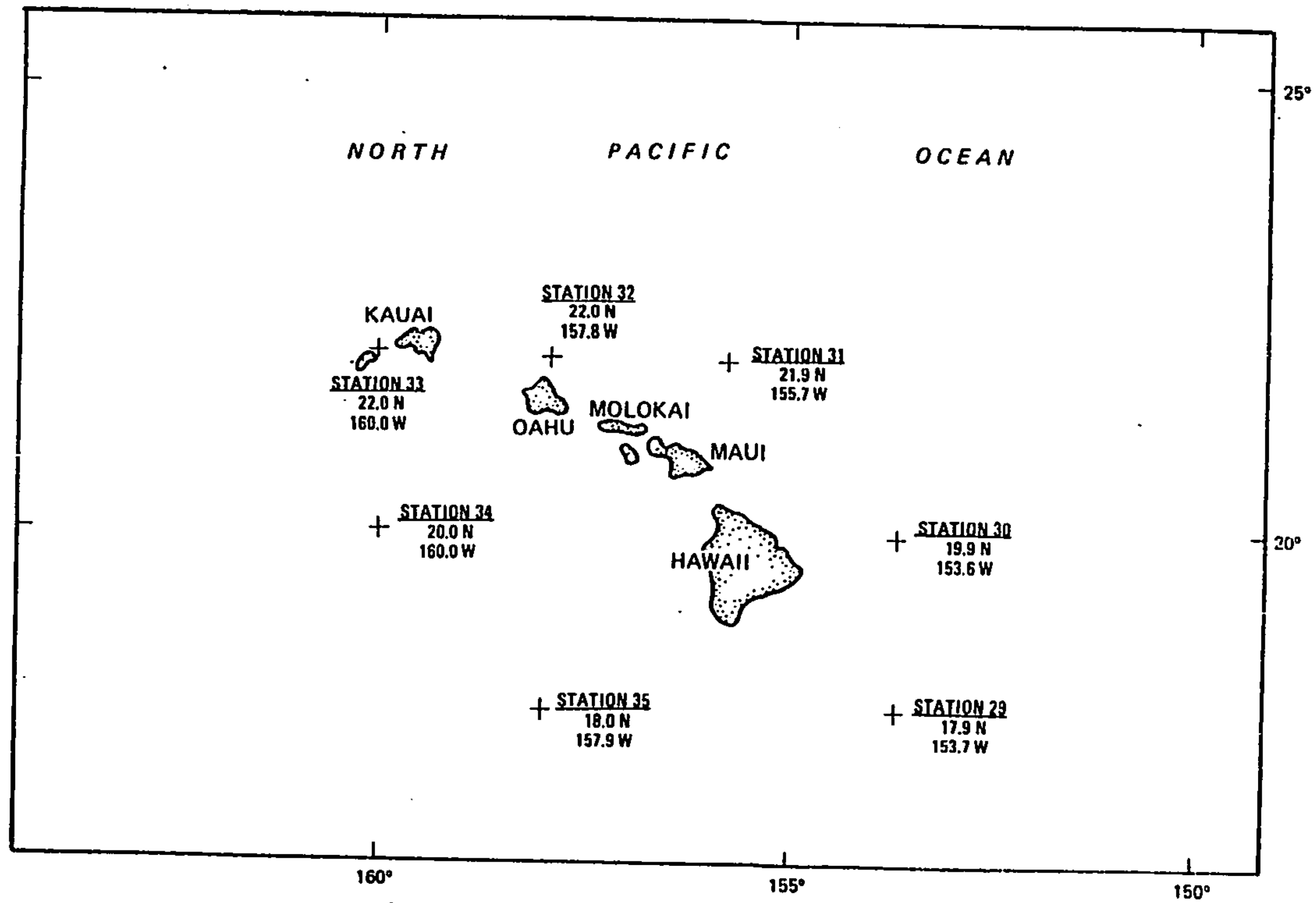
Wave Period (Seconds)	Wave Height (Feet) 0-3	3-6	6-9	9-12	12+	Total
0.0 - 6.9	2.8	0	0	0	0	2.8
7.0 - 9.9	24.8	11.6	1.2	0	0	37.6
10.0 - 12.9	11.6	25.8	9.0	2.0	0.4	48.8
13.0 - 15.9	1.1	4.3	2.9	0.9	0.9	10.1
16.0 - 18.9	0	0.7	0.3	0	0.2	1.2
19.0 +	0	0	0	0	0	0
TOTAL	40.3	42.4	13.4	2.9	1.5	100.5

Notes:
1. Record obtained with a pressure wave gage located at Kahului Harbor.
2. Departure from 100 percent total results from accumulation of rounding error and is not considered significant.

TABLE 2. STORMS AFFECTING KAHULUI HARBOR

Date	Deepwater Wave Height (Feet)	Period (Seconds)	Direction
3 Jan 1947	23	19	N
5-6 Mar 1954	26	18	NE
27-28 Nov 1956	9	15	N
22 Nov 1958	14	17	NE
18-21 Dec 1960	12.1	14.2	N
29 Jan - 3 Feb 1965	27	17	N
6-7 Oct 1966	14	12	-
27 Aug - 1 Sep 1967*	19	15	N
12-14 Dec 1967*	18	15	N
4-6 Dec 1968*	28	15-16	-
29 Nov - 1 Dec 1969**	20	-	-
22-24 Nov 1970	18	19	NNE

Note: Wave height based on hindcast unless otherwise noted.
* Wave height and period recorded by gages.
** Observed wave height.



Location of WIS Wave Hindcast Stations

FIGURE 1

Table 3

WIS Hindcast Wave Data

STATION 31 21.94N 155.69W FOR ALL DIRECTIONS

PERCENT OCCURRENCE(X100) OF HEIGHT AND PERIOD FOR ALL DIRECTIONS

HEIGHT(METRES)	PEAK PERIOD(SECONDS) 4.4-6.0	6.1-8.0	8.1-9.5	9.6-10.5	10.6-11.7	11.8-13.3	13.4-15.3	15.4-18.1	18.2-22.2	22.3-LONGER	TOTAL
0. -0.9	36	15	4	.	.	.	.	.	.	.	55
1.0-1.9	780	706	739	281	91	20	4	.	.	.	2621
2.0-2.9	317	1420	732	665	946	391	40	5	.	.	4516
3.0-3.9	.	348	97	85	453	961	198	8	.	.	2150
4.0-4.9	.	14	42	4	44	187	200	10	.	.	501
5.0-5.9	.	.	9	4	5	26	54	9	.	.	107
6.0-6.9	.	.	.	1	1	4	12	9	.	.	27
7.0-7.9	.	.	.	.	.	.	.	.	.	.	0
8.0-8.9	.	.	.	.	.	.	.	.	.	.	0
9.0-9.9	.	.	.	.	.	.	.	.	.	.	0
10.0+	.	.	.	.	.	.	.	.	.	.	0
TOTAL	1133	2503	1623	1040	1540	1599	508	41	0	0	

MEAN HS(M)= 2.5 LARGEST HS(M)= 7.1 MEAN TP(SEC)= 9.2 TOTAL CASES= 58440.

Figure 2

WIS Hindcast Wave Rose

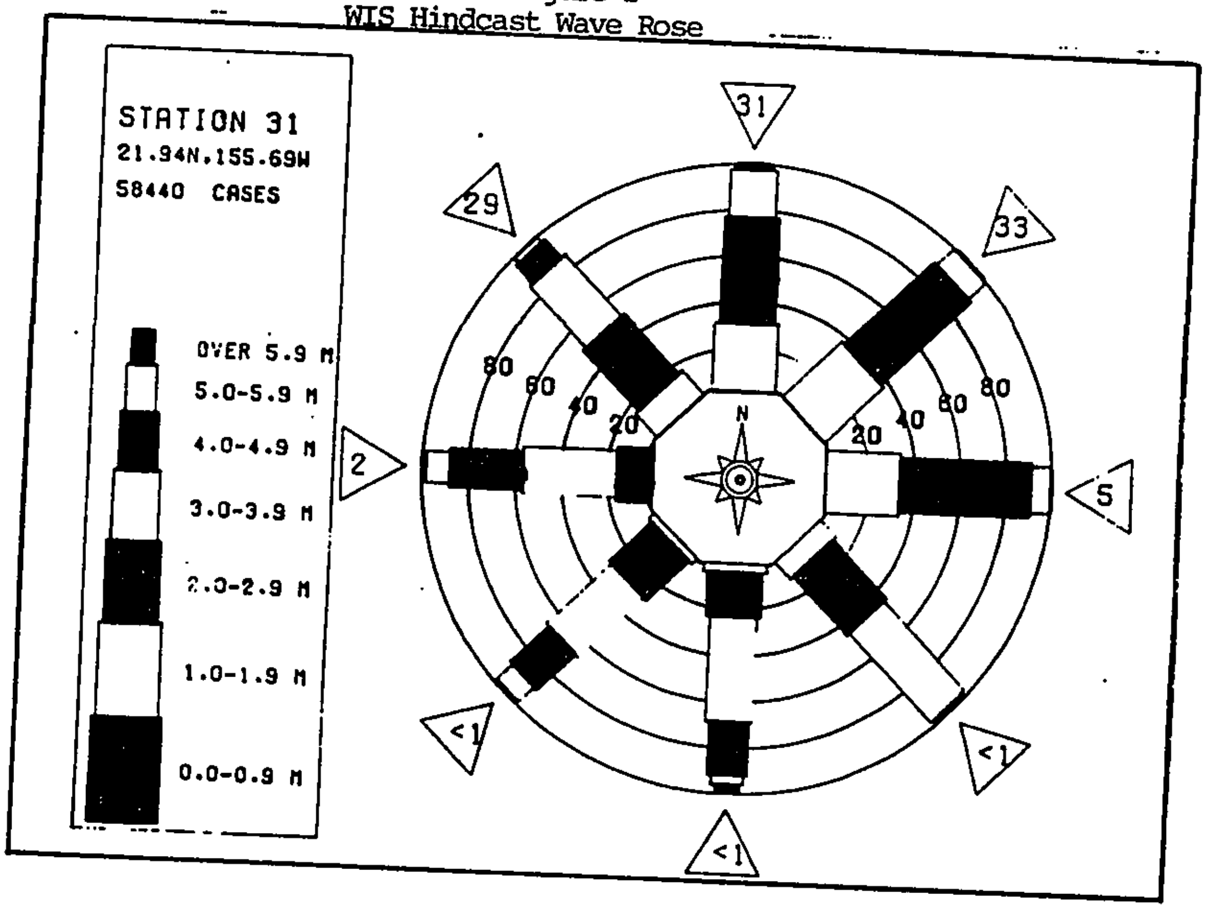


Table 4 - 7. Kahului Breakwater Stability Model Study (CERC, 1982) Wave Data .

Table 4

Hydrograph A

Step	swl ft mllw	Test Wave Period sec	Test Wave Height ft	Prototype Duration hr	Wave Type
	-1.0	16.0	10.0	0.25	Shakedown
1	-1.0	16.0	19.5	0.25	Worst breaking (Sea-side armor)
2	-1.0	18.0	21.0	0.25	Worst breaking (Sea-side armor)
3	+4.0	16.0	24.5	1.0	Worst breaking (Harbor-side armor)
4	+4.0	16.0	25.5	0.5	Worst breaking (Sea-side armor)
5	+4.0	18.0	25.6	1.0	Worst breaking (Sea- and harbor-side armor)
6	-1.0	18.0	21.0	0.25	Worst breaking (Sea-side armor)
7	-1.0	16.0	19.5	0.25	Worst breaking (Sea-side armor)

Table 5

Hydrograph B

Step	swl ft mllw	Test Wave Period sec	Test Wave Height ft	Prototype Duration hr	Wave Type
	-1.0	16.0	9.0	0.25	Shakedown
1	-1.0	16.0	16.0	0.25	Worst breaking
2	-1.0	18.0	18.0	0.25	Worst breaking
3	+4.0	16.0	20.5	1.00	Worst breaking
4	+4.0	18.0	21.5	1.00	Worst breaking
5	-1.0	18.0	18.0	0.25	Worst breaking
6	-1.0	16.0	16.0	0.25	Worst breaking

Table 6

Hydrograph C

Step	swl ft mllw	Test Wave Period sec	Test Wave Height ft	Prototype Duration hr	Wave Type
	+4.0	16.0	15.0	0.25	Shakedown
1	+4.0	16.0	30.5	1.00	Worst breaking
2	+4.0	18.0	34.0	1.00	Worst breaking

Table 7

Hydrograph D

Step	swl ft mllw	Test Wave Period sec	Test Wave Height ft	Prototype Duration hr	Wave Type
	+4.0	16.0	15.0	0.25	Shakedown
1	+4.0	16.0	29.0	1.00	Worst breaking
2	+4.0	18.0	29.8	1.00	Worst breaking

b. Atmospheric Pressure Reduction, S_p. The rise in water level due to a reduction in the atmospheric pressure was calculated using the following equation:

$$S_p = 1.41\ (P_n - P_o)(1-e^{-R/r}) \quad \text{(Eq. 3-85, SPM 1984)}$$

$$= 1.41(1.4)(1-e^{-34.7/21.7}) = 1.3 \text{ feet}$$

where: $(P_n - P_o)$ = central pressure reduction (Hg. inches)

R = radius of maximum winds (nautical miles)

r = radial distance from storm center to computational point (nautical miles) = 21.7 n.m. (based on Iwa, HED,1985)

c. Storm Surge, S_s. The rise in water level due to storm surge was calculated using the following equation.

$$S_s = \sum S_i = \sum (540\ k\ U_r^2\ D_x)/d_{mean} \quad \text{(TP-4, 1966)}$$

where: $k = 3 \times 10^{-6}$

U_r = maximum sustained wind speed

S_i = incremental rise in water level

d_{mean} = mean depth over increment

D_x = incremental distance

Based on the design storm conditions,

$$S_s = 0.8 \text{ feet.}$$

d. Wave Setup. The rise in water level due to wave setup is based on the following equation.

$$S_w = (dS) - S_b \quad \text{(Eq. 3-75, SPM 1984)}$$

where: (dS) = gross water level change
$= (0.15)d_b$ (Eq. 3-76, SPM 1984)

d_b = d(depth of water over reef) + $S_a + S_p + S_s$

= 6.0′ + 1.9′ +0.8′ + 1.5′ = 10 feet

S_b = setdown or decrease in water level at breaking zone

$$= g^{1/2}(H_o)^2/64(3.14)d_b^{3/2} \quad \text{(Eq. 3-74, SPM 1984)}$$

Assuming S_b is negligible,

$$S_w = (dS) = (0.15)d_b = 1.5 \text{ feet.}$$

1.6 Design Wave Height

The wave heights selected for use in designing the alternative plans for sites 1 and 2 (Figure 3) were derived from the available wave data and diffraction, depth limited breaking, and shoaling computations.

1.6.1 Diffraction Analyses

The critical direction of wave approach to Kahului Harbor is from the north. This is due to the harbor's orientation and offshore bathemetry. Diffraction analyses were conducted for waves entering Kahului Harbor *from the north* (Figures 4, 5, and 6) and for the various alternative plans (Figures 7, 8, 9, 10, and 11). Based on the analyses, the following design diffraction coefficients (K) were selected (Table 8).

1.6.2 Wave Heights

a. Wave Data. Based on the diffraction analysis of waves entering Kahului Harbor, a design diffraction coefficient of K = 0.15 was selected for site 1 and a K = 0.20 for site 2. The diffracted wave heights entering the harbor were determined by applying the diffraction coefficient to the selected design wave height based on the maximum wave heights obtained from the Kahului wave gage, the WIS hindcast data, depth limited breaking and the worst breaking wave height from the Kahului Breakwater Stability Model Study (CERC, 1982).

1. Kahului Wave Gage, H_{max} = 28 feet
2. WIS hindcast data, H_{max} = 23 feet

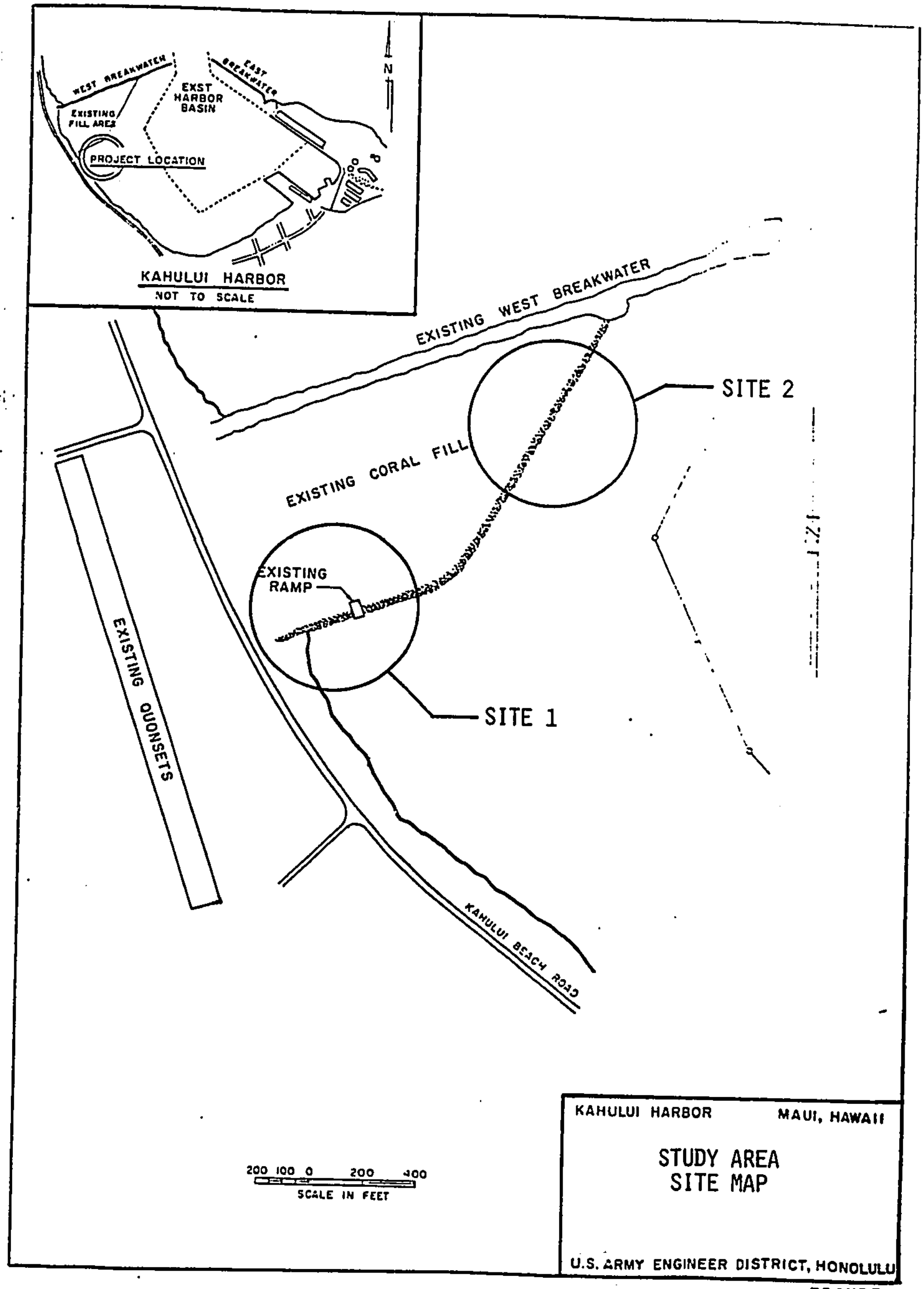

WEST BREAKWATER
EAST BREAKWATER
EXISTING FILL AREA
EXST HARBOR BASIN
PROJECT LOCATION
N
KAHULUI HARBOR
NOT TO SCALE
EXISTING WEST BREAKWATER
SITE 2
EXISTING CORAL FILL
EXISTING RAMP
SITE 1
EXISTING QUONSETS
KAHULUI BEACH ROAD
200 100 0 200 400
SCALE IN FEET
KAHULUI HARBOR
MAUI, HAWAII
STUDY AREA
SITE MAP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 3

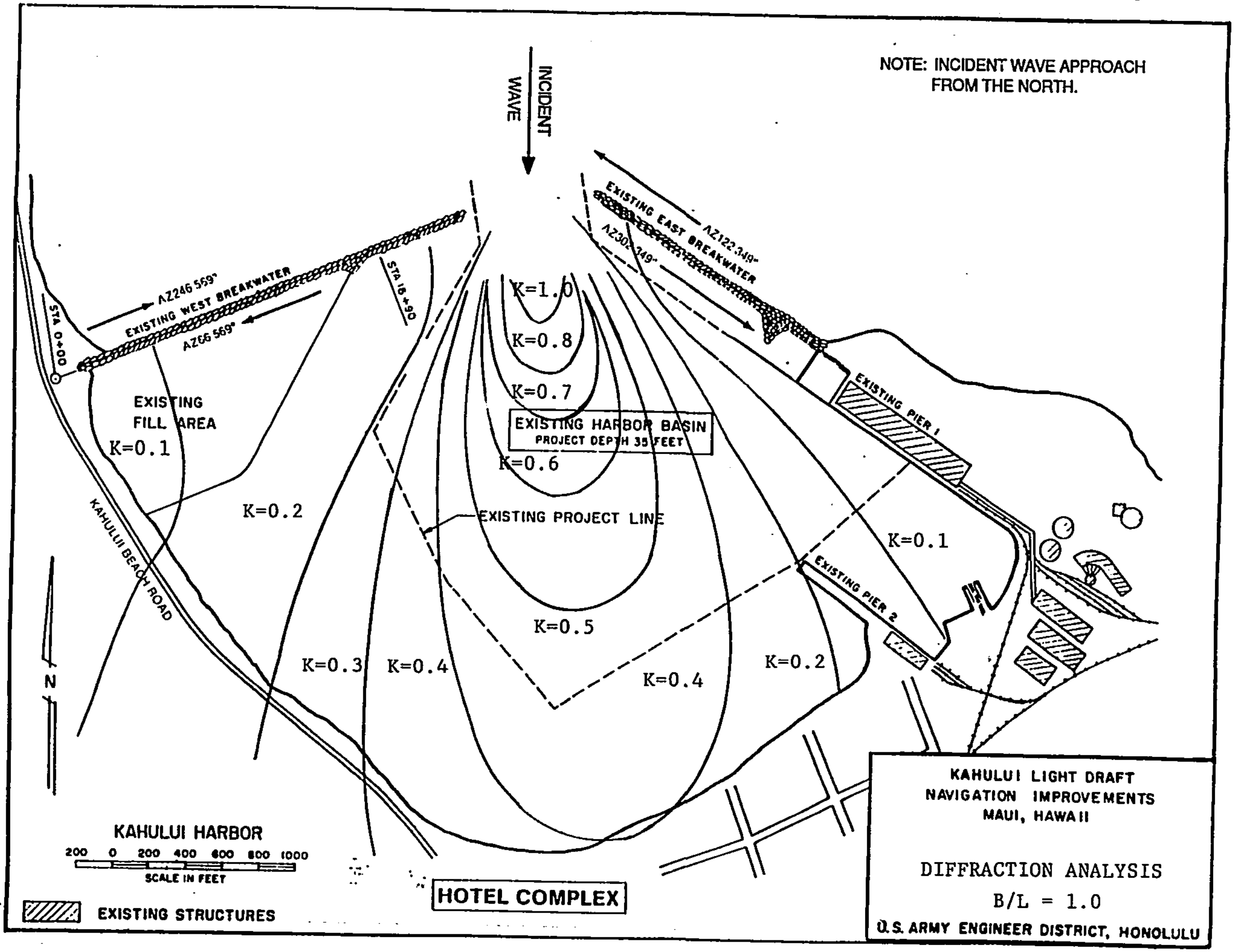

NOTE: INCIDENT WAVE APPROACH FROM THE NORTH.
INCIDENT WAVE
EXISTING WEST BREAKWATER
AZ246 569°
AZ66 569°
STA 0+00
STA 18+90
EXISTING EAST BREAKWATER
AZ122 349°
AZ302 349°
EXISTING PIER 1
EXISTING PIER 2
EXISTING FILL AREA
EXISTING HARBOR BASIN
PROJECT DEPTH 35 FEET
EXISTING PROJECT LINE
K=1.0
K=0.8
K=0.7
K=0.6
K=0.5
K=0.4
K=0.4
K=0.3
K=0.2
K=0.2
K=0.1
K=0.1
KAHULUI BEACH ROAD
HOTEL COMPLEX
N
KAHULUI HARBOR
200 0 200 400 600 800 1000
SCALE IN FEET
EXISTING STRUCTURES
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
DIFFRACTION ANALYSIS
B/L = 1.0
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 4

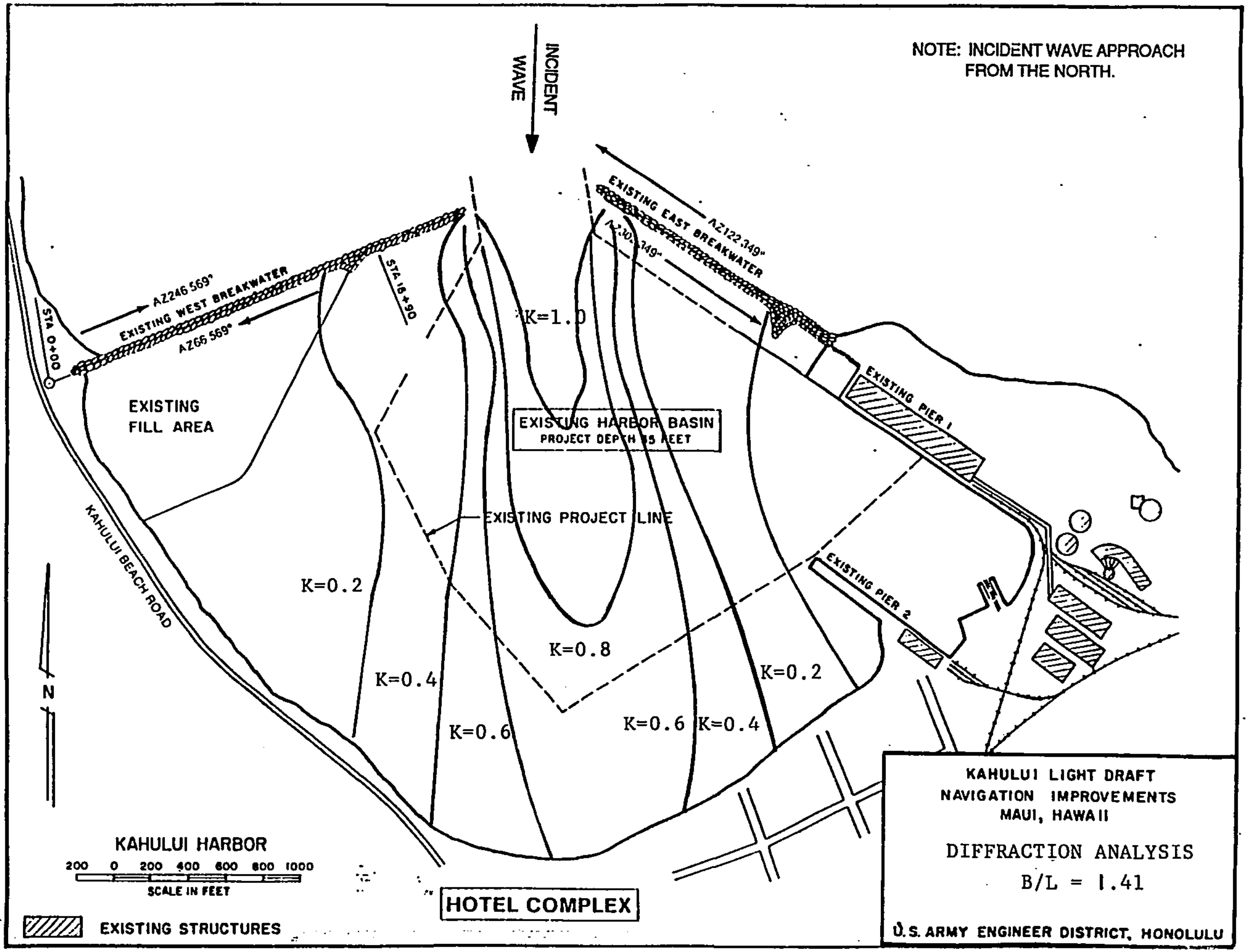
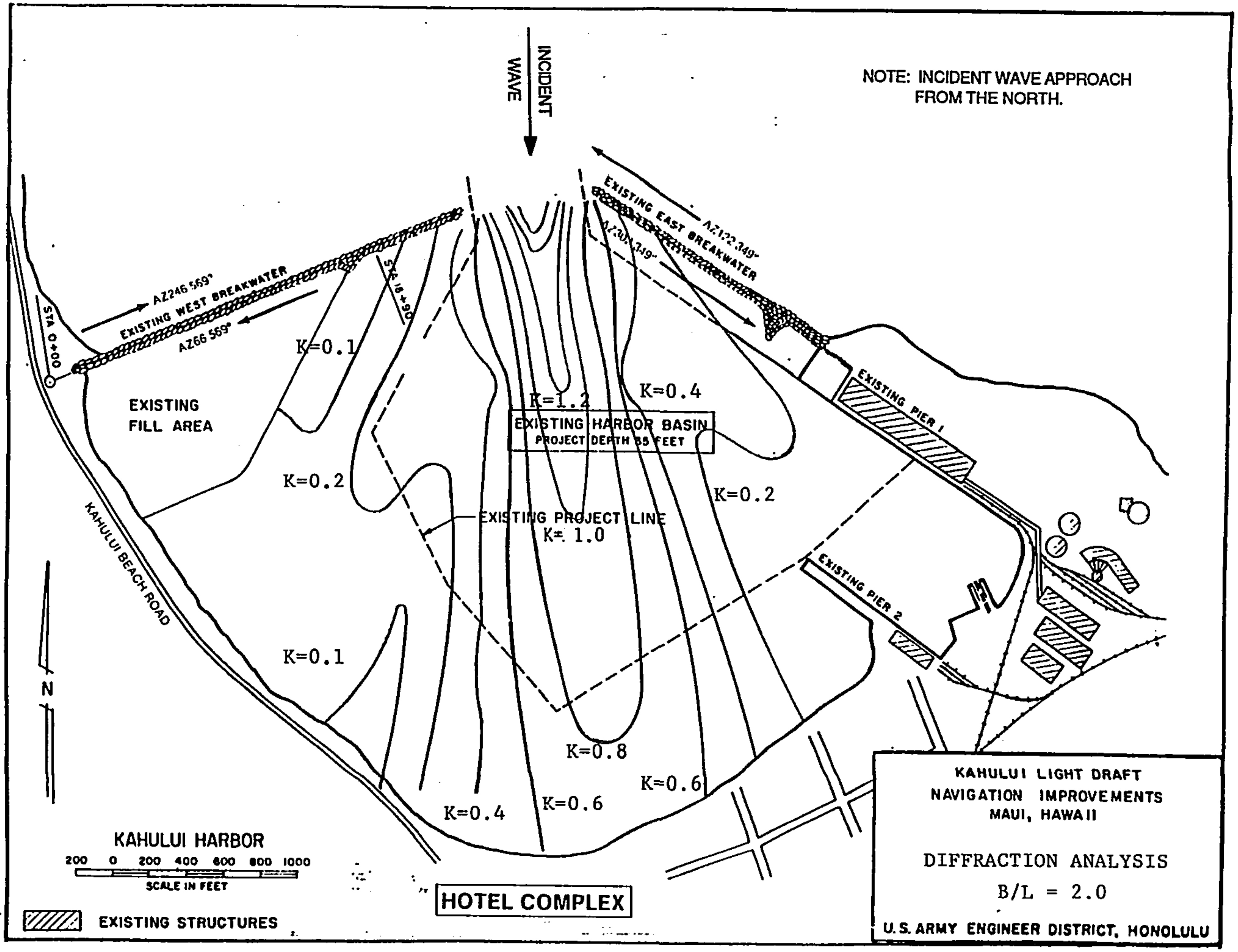

NOTE: INCIDENT WAVE APPROACH FROM THE NORTH.
INCIDENT WAVE
EXISTING EAST BREAKWATER
AZ122 349°
AZ302 349°
EXISTING WEST BREAKWATER
AZ246 569°
AZ66 569°
STA 0+00
STA 18+90
EXISTING FILL AREA
KAHULUI BEACH ROAD
EXISTING HARBOR BASIN
PROJECT DEPTH 35 FEET
EXISTING PROJECT LINE
EXISTING PIER 1
EXISTING PIER 2
K=1.0
K=0.8
K=0.6
K=0.4
K=0.2
K=0.2
K=0.4
K=0.6
K=0.6
K=0.4
K=0.2
N
KAHULUI HARBOR
200 0 200 400 600 800 1000
SCALE IN FEET
EXISTING STRUCTURES
HOTEL COMPLEX
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
DIFFRACTION ANALYSIS
B/L = 1.41
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 5



NOTE: INCIDENT WAVE APPROACH FROM THE NORTH.
INCIDENT WAVE
EXISTING EAST BREAKWATER
EXISTING WEST BREAKWATER
AZ246.569°
AZ66.569°
STA 0+00
STA 18+90
EXISTING FILL AREA
KAHULUI BEACH ROAD
EXISTING HARBOR BASIN
PROJECT DEPTH 35 FEET
EXISTING PROJECT LINE
EXISTING PIER 1
EXISTING PIER 2
K=0.1
K=0.2
K=0.1
K=1.2
K=0.4
K=0.2
K= 1.0
K=0.8
K=0.6
K=0.6
K=0.4
N
KAHULUI HARBOR
200 0 200 400 600 800 1000
SCALE IN FEET
EXISTING STRUCTURES
HOTEL COMPLEX
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
DIFFRACTION ANALYSIS
B/L = 2.0
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 6

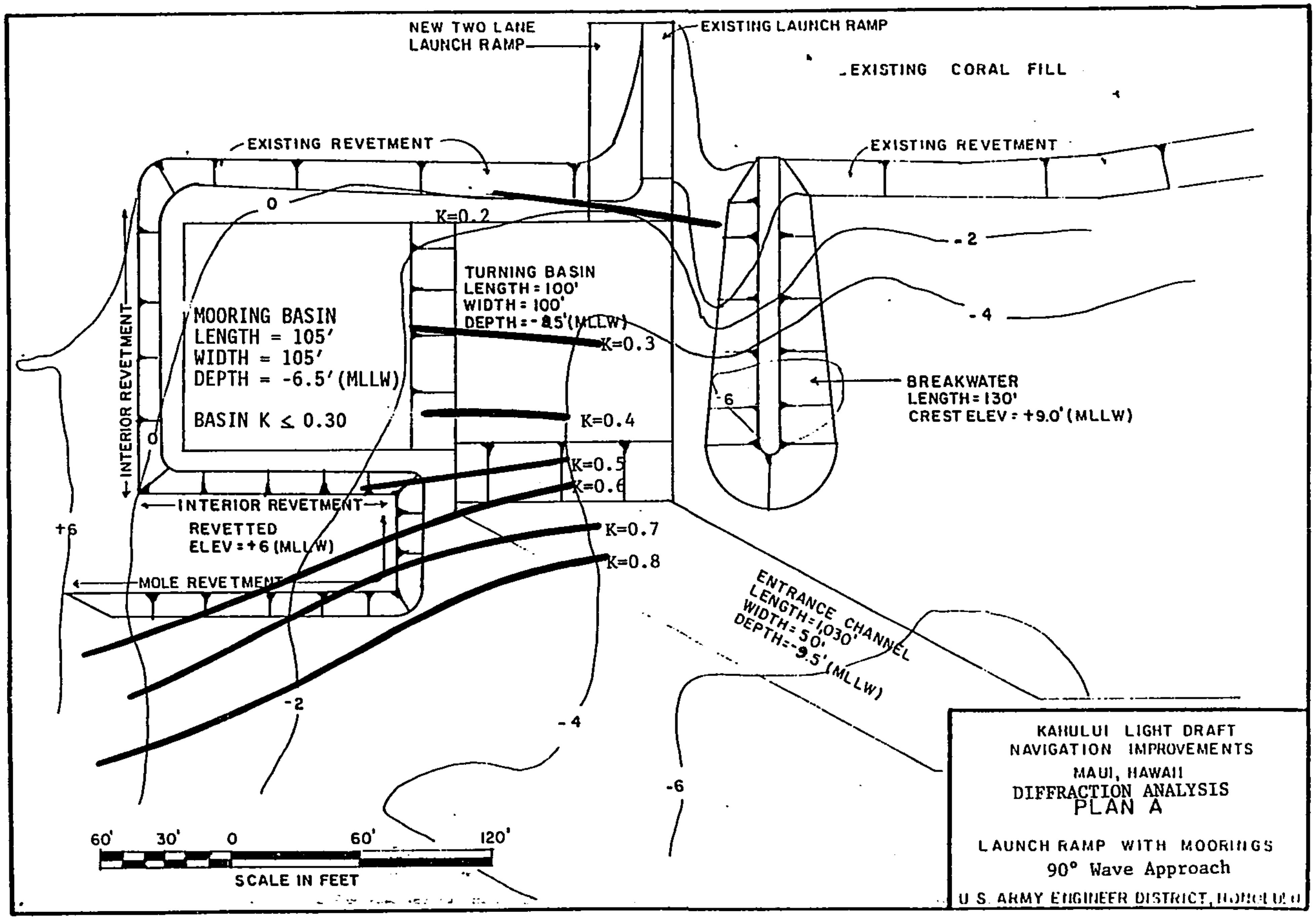

NEW TWO LANE LAUNCH RAMP
EXISTING LAUNCH RAMP
EXISTING CORAL FILL
EXISTING REVETMENT
EXISTING REVETMENT
INTERIOR REVETMENT
MOORING BASIN
LENGTH = 105'
WIDTH = 105'
DEPTH = -6.5' (MLLW)
BASIN K ≤ 0.30
TURNING BASIN
LENGTH = 100'
WIDTH = 100'
DEPTH = -8.5' (MLLW)
K=0.2
K=0.3
K=0.4
K=0.5
K=0.6
K=0.7
K=0.8
BREAKWATER
LENGTH = 130'
CREST ELEV = +9.0' (MLLW)
INTERIOR REVETMENT
REVETTED
ELEV = +6 (MLLW)
MOLE REVETMENT
ENTRANCE CHANNEL
LENGTH = 1030'
WIDTH = 50'
DEPTH = -9.5' (MLLW)
0
0
+6
-2
-2
-4
-4
-6
-6
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
DIFFRACTION ANALYSIS
PLAN A
LAUNCH RAMP WITH MOORINGS
90° Wave Approach
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 7

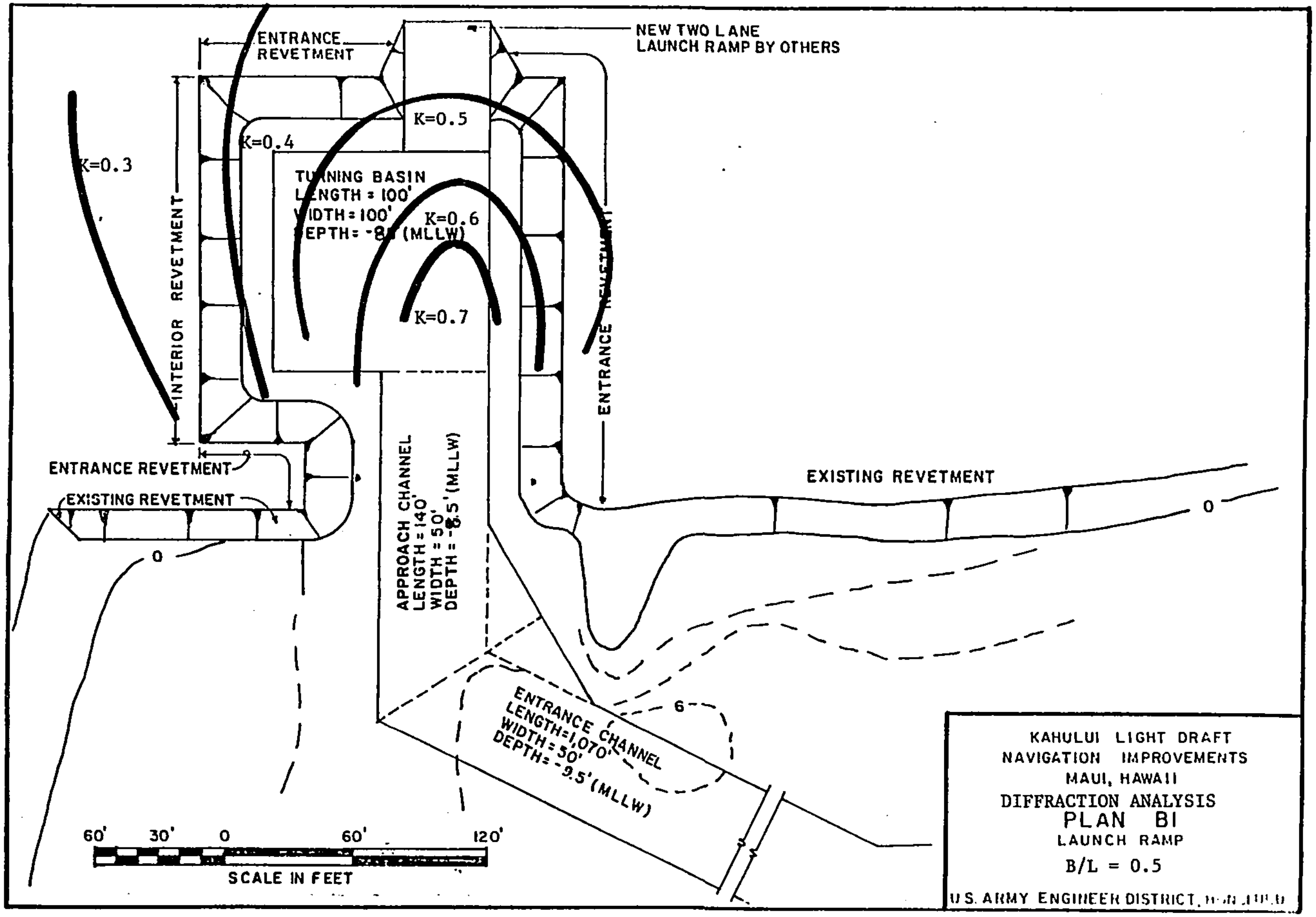
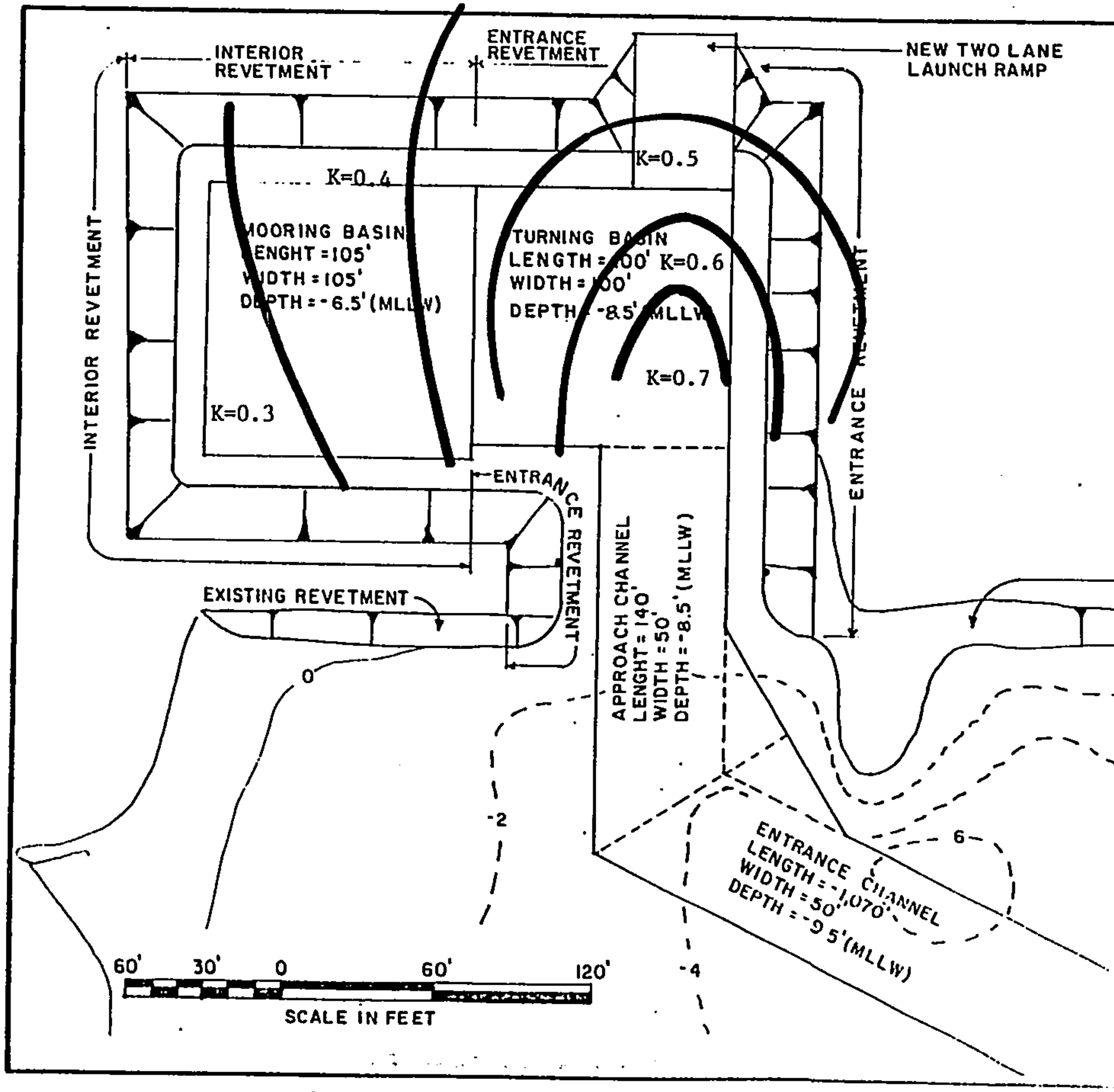

ENTRANCE REVETMENT
NEW TWO LANE LAUNCH RAMP BY OTHERS
K=0.3
K=0.4
K=0.5
K=0.6
K=0.7
INTERIOR REVETMENT
TURNING BASIN
LENGTH = 100'
WIDTH = 100'
DEPTH = -8' (MLLW)
ENTRANCE REVETMENT
EXISTING REVETMENT
ENTRANCE REVETMENT
EXISTING REVETMENT
0
0
6
APPROACH CHANNEL
LENGTH = 140'
WIDTH = 50'
DEPTH = -8.5' (MLLW)
ENTRANCE CHANNEL
LENGTH = 1,070'
WIDTH = 50'
DEPTH = -9.5' (MLLW)
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
DIFFRACTION ANALYSIS
PLAN BI
LAUNCH RAMP
B/L = 0.5
U.S. ARMY ENGINEER DISTRICT

FIGURE 8



KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

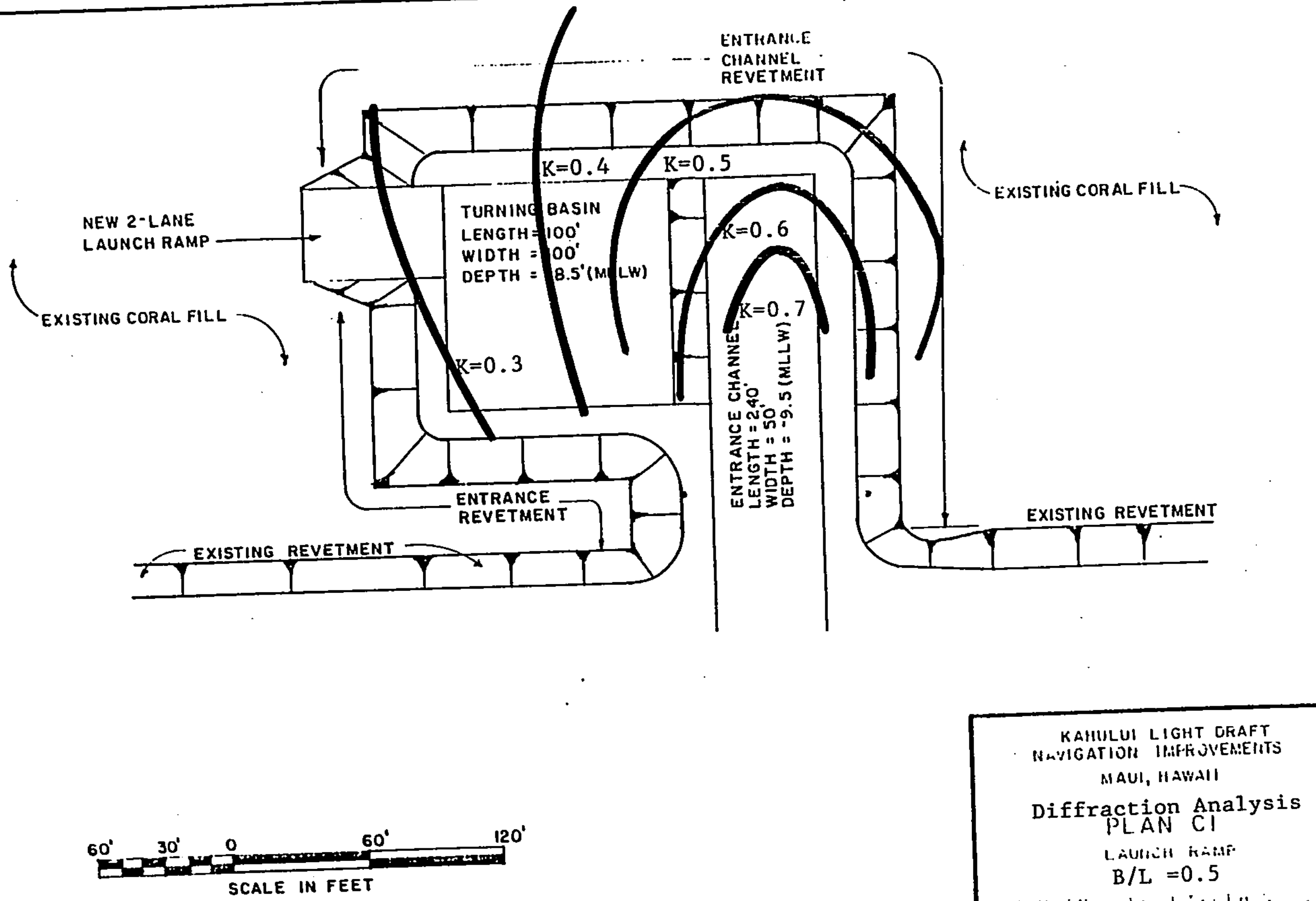
DIFFRACTION ANALYSIS
PLAN B2

LAUNCH RAMP WITH MOORINGS

B/L = 0.5

U.S. ARMY ENGINEER DISTRICT, HONOLULU

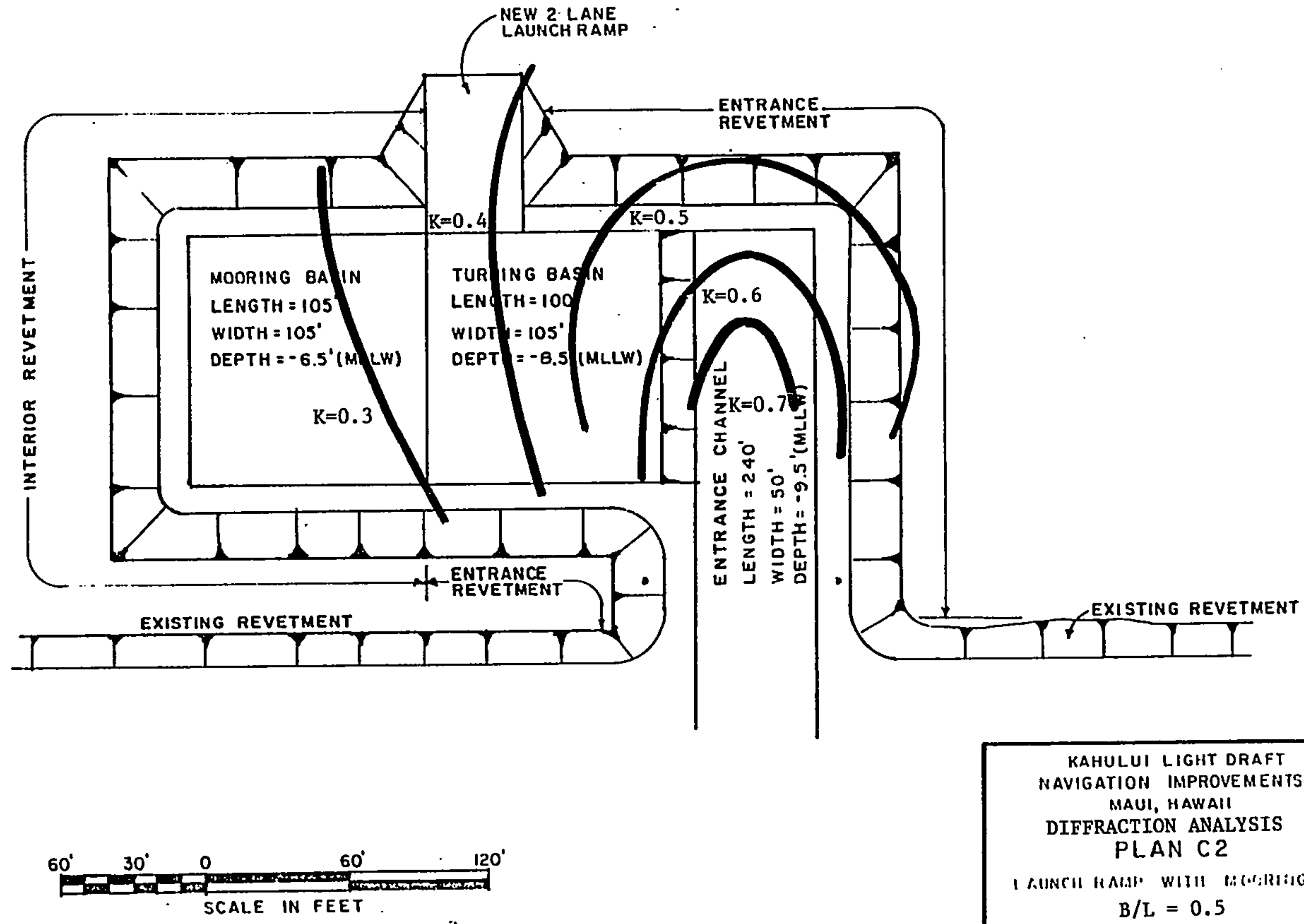
FIGURE 9



KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
MAUI, HAWAII

Diffraction Analysis
PLAN C1
LAUNCH RAMP
B/L = 0.5

FIGURE 10



KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
DIFFRACTION ANALYSIS
PLAN C2
LAUNCH RAMP WITH MOORINGS
B/L = 0.5
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 11

Table 8

Design Diffraction and Shoaling Coefficients

Location	Diffraction K	Shoaling Ks
Kahului Harbor		
Site 1 (plans A1, A2, B1, & B2)	0.15	1.00
Site 2 (plans C1 & C2)	0.20	1.00
Plans A1 & A2		
Interior Revetment	0.30	1.478
Revetted Mole	0.70	1.478
Plans B1 and B2		
Entrance Revetment	0.70	1.478
Interior Revetment	0.40	1.478
Plans C1 and C2		
Entrance Revetment	1.00	1.00
Interior Revetment	0.40	1.00

3. Depth limited breaking, assuming nearshore slope, $m = 0$:

$$H_{max} = 0.78\ (d_b) \qquad \text{(Eq. 2-92, SPM 1984)}$$

$$= 0.78\ (35' + 5.5') = 31.6 \text{ feet}$$

where d_b = depth at harbor entrance + d_{swl}.

4. Breakwater Stability Study, H_{max} = 34.0 feet.

From the data presented above, a design incident wave height of 34.0 feet was selected based on the Kahului Breakwater Stability Study (CERC, 1982).

Design Incident Wave Height, H_{max} = 34.0 feet

Design Diffracted Wave Height,

Site 1 - $H_k = K\ (H_{max}) = 0.15\ (34') = 5.1$ feet

Site 2 - $H_k = K\ (H_{max}) = 0.20\ (34') = 6.8$ feet

Based on the wave gage and WIS data, a wave period (T) of 16 seconds (s) is assumed for storm conditions.

b. Shoaling Wave Height. Because site 1 is located on a relatively shallow reef flat, the diffracted design wave height for site 1 will be affected by shoaling. The shoaling coefficient, Ks, is determined by the following equation.

$$Ks = \{[1/\tanh(2\pi d/L)][1/(1+(4pid/L)/\sinh(4\pi d/L))\}^{1/2} \quad \text{(Eq. 2-44, SPM 1984)}$$

where: d = depth of water = $d + d_{swl} = 6' + 5.5' = 11.5'$

L = wave length = 305' (from Table C-1, SPM 1984)

from Table C-1 (SPM 1984) for d/L = 0.0377,

Ks = 1.478

Using the diffracted design wave height for site 1. $H_k = 5.1'$, T=16.0 s, the design shoaled wave height at site 1 is:

$$H = 5.1'\ (1.478) = 7.5 \text{ feet.}$$

SPM (1984) Figure 7-75 indicates that the design shoaled wave height is close to the breaking wave limit.

c. Design Wave Heights. A summary of the design wave heights for sites 1 and 2 and plans A1, A2, B1, B2, C1 and C2 components are presented in Table 9.

2 ENTRANCE CHANNEL AND TURNING BASIN DESIGN

The entrance channel, approach channel, turning basin, and mooring basin designs are based on EM 1110-2-1615, "Hydraulic Design of Small Boat Harbors,"(USACE, 1984).

2.1 Design Vessel

The characteristics of the design vessel is based on the "State of Hawaii Boat Owner Survey," (HED,1981) and a list of registered commercial fisherman on Maui.

Length, L = 25.0 feet
Beam, B = 9.0 feet
Draft, D = 3.0 feet

These dimensions represent the typical size of fishing vessel which is anticipated to be a regular user of the navigation facility.

2.2 Entrance and Approach Channel

a. Width. The entrance and approach channel widths are calculated based on the design vessel's beam and two way traffic assuming good vessel controllability and good weather conditions and one way traffic under rougher sea conditions (wave heights in channel greater than 2.0 feet).

	Beam (feet)	Beam Factor	Width (feet)	
Left Bank Clearance	9.0	0.6	5.4	
Left Manuvering Lane	9.0	1.8	16.2	
Vessel Clearance	9.0	0.8	7.2	
Right Manuvering Lane	9.0	1.8	16.2	
Right Bank Clearance	9.0	0.6	5.4	
TOTAL CHANNEL WIDTH			50.4	use 50.0'
Channel Turn	9.0	4.4	39.6	
TOTAL CHANNEL TURN WIDTH			90	use 90.0'

Table 9

Design Wave Heights

	K	Ks	Design Incident Wave	Diffracted/ Shoaled Wave Height
Kahului Harbor				
Site 1	0.15	1.00	34	5.1
Site 2	0.2	1.00	34	6.8
Plan A1 and A2 (Site 1)				
Breakwater	1.0	1.478	5.1	7.5
Revetted Mole	0.7	1.478	5.1	5.3
Interior Revetment	0.3	1.478	5.1	2.3
Plan B1 and B2 (Site 1)				
Entrance Revetment	0.7	1.478	5.1	5.3
Interior Revetment	0.4	1.478	5.1	3.0
Plan C1 and C2 (Site 2)				
Entrance Revetment	1.0	1.00	6.8	6.8
Interior Revetment	0.4	1.00	6.8	2.7

The path of a vessel making a turn is wider than its path in a straight reach and as a result a wider maneuvering lane is required in the channel bends. The channel turning width factor is based on criteria provided in EM 1110-2-1615, "Hydraulic Design of Small Boat Harbors", for a 40 degree bend.

b. Depth. The entrance and approach channel depths were computed based on the following parameters:

	Entrance Channel (feet)	Approach Channel (feet)
Draft	3.0	3.0
Minimum Tide Allowance	1.0	1.0
Wave Allowance	2.0	1.0
Squat and Trim	0.5	0.5
Safety Allowance	3.0	3.0
TOTAL CHANNEL DEPTH	9.5 Feet	8.5 Feet

2.3 Turning Basin

a. Width. A minimum 100' by 100' turning basin is required for safe vessel launching and retrieval operations.

b. Depth. The turning basin depth was computed based on the following parameters:

	FEET
Draft	3.0
Minimum Tide Allowance	1.0
Wave Allowance	1.0
Squat and Trim	0.5
Safety Allowance	3.0
TOTAL BASIN DEPTH	8.5 Feet

2.4 Mooring Basin

Mooring basin design dimensions are based on mooring 14 design vessels, seven on each side of a basin fairway. The mooring basin designs were provided as options to the three basic plans for the benefit of the local sponsor as the study's economic analysis shows that temporary mooring spaces can not be economically incrementally justified. The decision to implement the mooring area options are the responsibility of the local sponsor, the State of Hawaii.

a. Width and Length. Design for the dimensions of the mooring basin are based on the length and beam of the design vessel.

Width:

	Vessel Length (feet)	Length Factor (feet)	Length (feet)
Berth Length	25	1.0	25.0
Fairway Width	25	2	50.0
Berth Length	25	1.0	25.0
TOTAL BASIN WIDTH			100.0

Length: The mooring basin length is based on mooring of 14 vessels, seven on each side of the fairway. Assuming a berth width of 15 feet for each vessel the required basin width is 7 x 15 feet = 105 feet.

b. Depth. The basin depth was computed based on the following parameters:

	FEET
Draft	3.0
Minimum Tide Allowance	1.0
Wave Allowance	1.0
Squat and Trim	0.5
Safety Allowance	1.0
TOTAL CHANNEL DEPTH	6.5 Feet

3 STRUCTURE DESIGN

3.1 Armor Layer

a. Armor Layer. The stable armor layer stone sizes and weights for the breakwater and revetment designs are based on the following equation and presented in Table 10.. Armor stone weights were computed using MACE-4-HUDSON,"Breakwater Design by Hudson Formula," (CERC, 1986)

Table 10

Armor Stone Weight

	H (feet)	Kd	Cot 0	Layer Thicknes (feet)	W (pounds)
Plan A1 and A2					
Breakwater					
Trunk	7.5	2.0	1.5	7.4	6,000 to 10,000
Head	7.5	1.9	1.5	7.4	6,000 to 10,000
Revetted Mole	5.3	2.0	1.5	5.1	2,000 to 3,000
Interior Revetment	2.3	2.0	1.5	2.2	200 to 300
Plan B1 and B2					
Entrance Revetment	5.3	2.0	1.5	5.1	2,000 to 3,000
Interior Revetment	3.0	2.0	1.5	2.9	400 to 600
Plan C1 and C2					
Entrance Revetment	6.8	2.0	2.0	6.6	4,000 to 6,000
Interior Revetment	2.7	2.0	1.5	2.9	400 to 600

$$W = W_r H^3 / [K_d (S_r - 1)^3 \cot 0] \quad \text{(Eq. 7-116, SPM 1984)}$$

where: W = weight of armor unit

W_r = unit weight = 156 lb/cubic ft.

H = design wave height

K_d = stability coefficient (Table 7-8, SPM 1984)

S_r = specific gravity of armor unit = 2.44

cot 0 = cotangent of the armor layer slope

b. Underlayer. The recommended underlayer stone size (Wu) for armor stone is one-tenth (W/10) to one-fifteenth (W/15) the armor weight. Underlayer stone size of W/10 was selected (see Table 11).

c. Bedding and Core Stone. The recommended bedding and core stone (W_b) sizes vary from W/200 to W/4000 (see Table 11). Filter cloth was also selected in conjunction with underalayer and bedding stone for the revetments to prevent leaching of the subbase material through the underlayer voids.

d. Layer Thickness. The layer thicknesses were computed using the following formula (see Table 11).

$$r = n\, k_D\, (W/W_r)^{1/3} \quad \text{(Eq. 7-121, SPM 1984)}$$

where: n = minimum number of layers = 2

k_D = layer coefficient = 1.0 (Table 7-13, SPM 1984)

3.2 Crest Elevations and Widths

The design crest heights were evaluated using MACE-14-WAVRUNUP, (CERC, 1985) to calculate the design wave runup elevation on the structure. Overtopping under design storm conditions is assumed to be allowable as the facility will not be used during these periods. Therefore, the design crest elevations were based on the calculated design wave runups (R), the existing ground elevations, and the need for slope protection. In addition, the crest widths (B) were designed for overtopping based on the following equation and construction equipment requirements (see Table 12).

$$B = n\ k_D\ (W/W_r)^{1/3} \quad \text{(Eq. 7-120, SPM 1984)}$$

where: n = minimum number of layers = 3 (overtopping)

k_D = layer coefficient (Table 7-13, SPM 1984) = 1.0

3.3 Design Layouts and Sections

The design layouts and sections are presented in Figures 12 thru 27.

4 COST ESTIMATES

The cost estimates are presented after each of their respective plans and sections (Figures 12 thru 27) and are based on October 1988 price levels and assume the following.

a. Oahu based contractor constructing the project.

b. Entrance channel dredging is in hard coral and will require blasting.

c. Turning basin and mooring area for plans B and C consists of coral fill above elevation 0.00' (mllw) and coral reef below.

d. Entrance channel dredging by marine equipment and dredged material to be disposed of at the project site.

e. All stone from commercial quarry on Maui.

Table 11

Underlayer and Bedding

	Wu (lbs)	ru (ft)	Wb (lbs)	rb (ft)
Plan A1 and A2				
Breakwater				
Trunk	600-1,000	3.4	2-40	Varies
Head	600-1,000	3.4	2-40	Varies
Revetted Mole	200-300	2.4	1-10	1.0' w/Filter
Interior Revetment	20-30	1.0	Filter Cloth	
Plan B1 and B2				
Entrance Revetment	200-300	2.4	1-10	1.0' w/Filter
Interior Revetment	40-60	1.0	Filter Cloth	
Plan C1 and C2				
Entrance Revetment	400-600	3.0	1-30	1.0 w/Filter
Interior Revetment	40-60	1.0	Filter Cloth	

Table 12

Design Crest Elevation and Widths

	Wave Height (ft)	Runup (ft)	Min. Crest Width (ft)	Crest Elevation (ft)
Plan A1 and A2				
Breakwater				
Trunk	7.5	8.4	11.0	9.0
Head	7.5	8.4	11.0	9.0
Revetted Mole	5.3	5.3	7.7	6.0
Interior Revetment	2.3	2.4	3.3	6.0
Plan B1 and B2				
Entrance Revetment	5.3	6.1	7.7	10.0
Interior Revetment	3.0	3.6	4.3	10.0
Plan C1 and C2				
Entrance Revetment	6.8	7.3	10.0	10.0
Interior Revetment	2.7	3.3	4.3	10.0

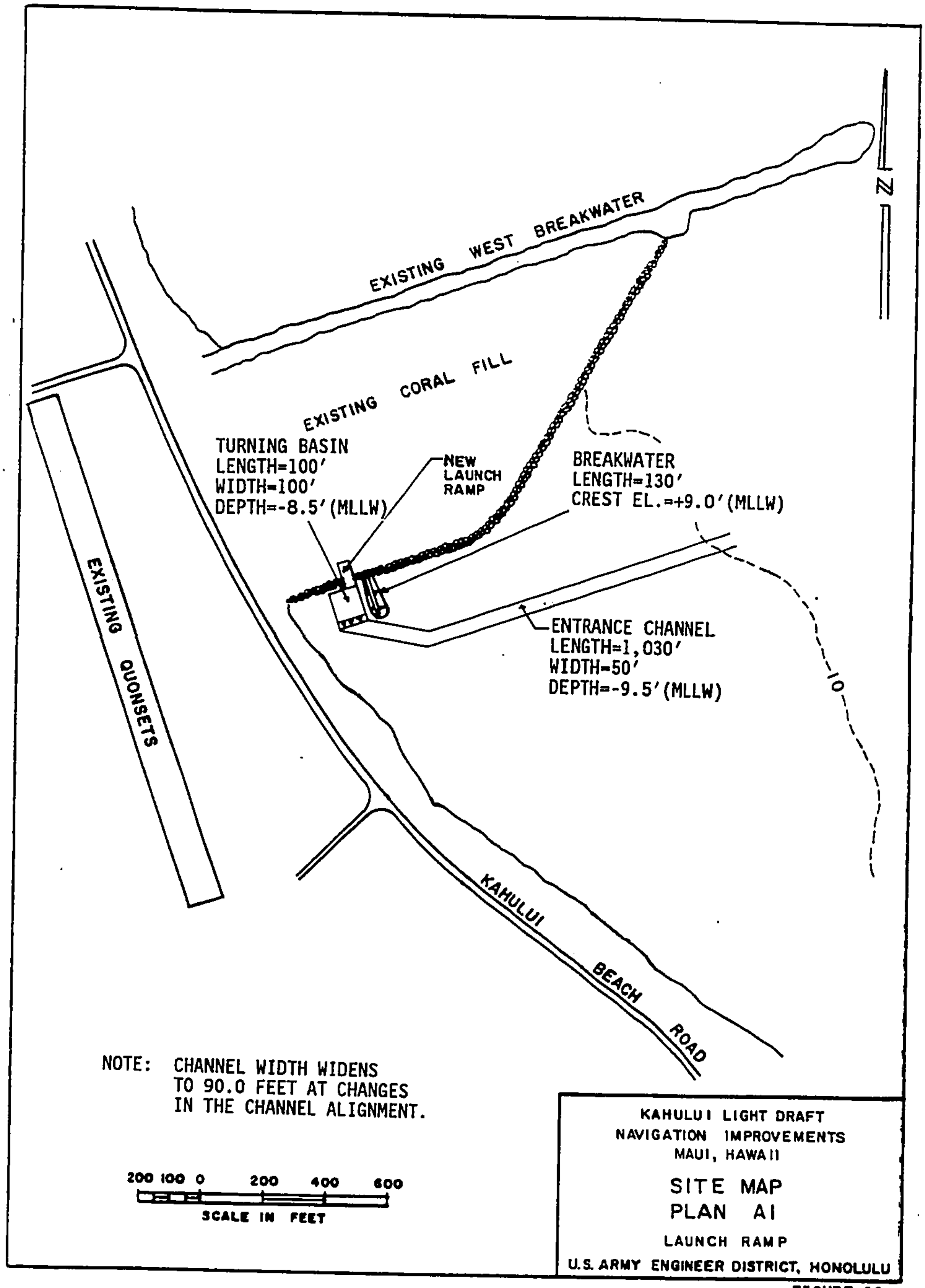

EXISTING WEST BREAKWATER
N
EXISTING CORAL FILL
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5'(MLLW)
NEW LAUNCH RAMP
BREAKWATER
LENGTH=130'
CREST EL.=+9.0'(MLLW)
ENTRANCE CHANNEL
LENGTH=1,030'
WIDTH=50'
DEPTH=-9.5'(MLLW)
-10
EXISTING QUONSETS
KAHULUI BEACH ROAD
NOTE: CHANNEL WIDTH WIDENS TO 90.0 FEET AT CHANGES IN THE CHANNEL ALIGNMENT.
200 100 0 200 400 600
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
SITE MAP
PLAN A1
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 12

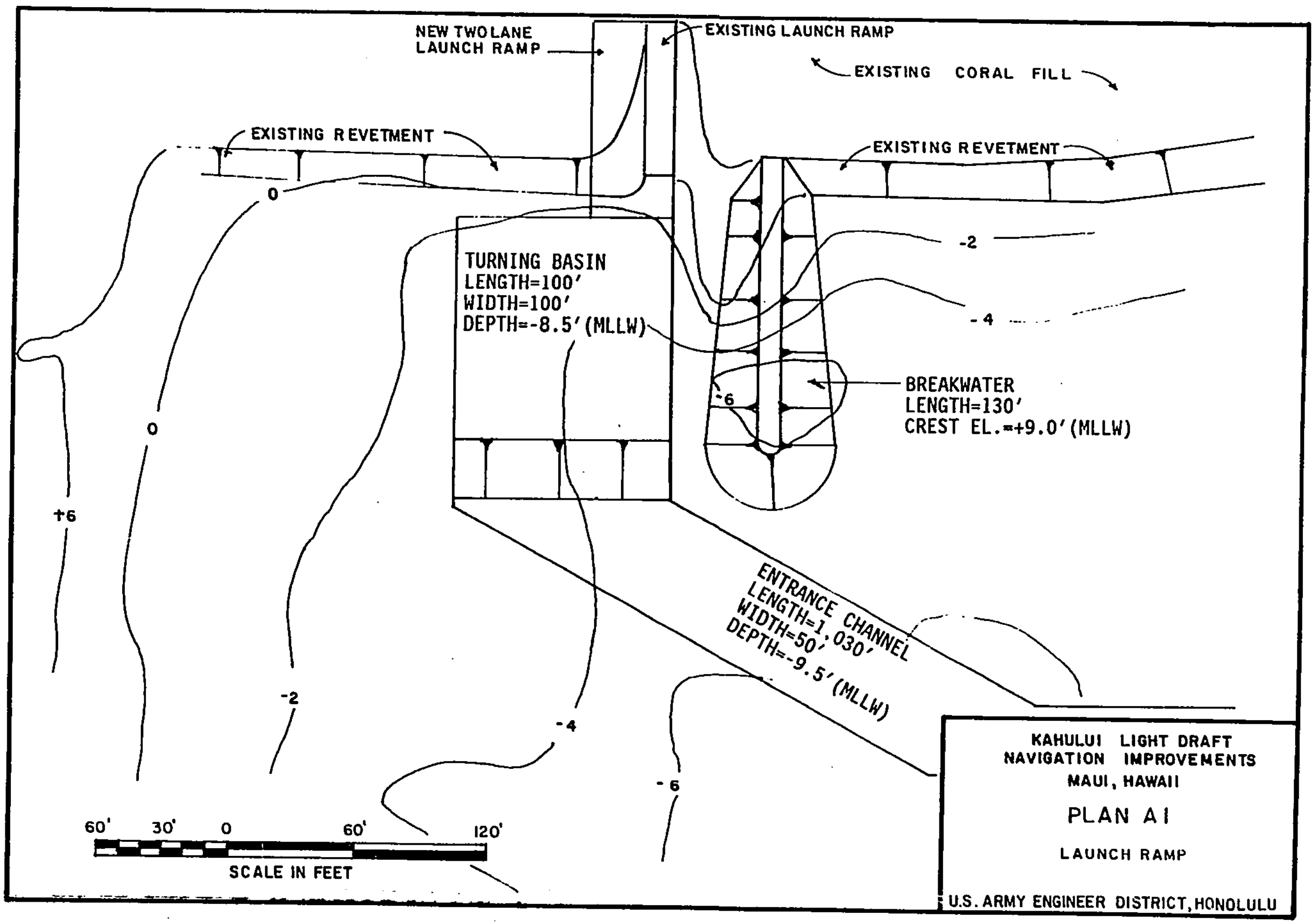

NEW TWO LANE
LAUNCH RAMP
EXISTING LAUNCH RAMP
EXISTING CORAL FILL
EXISTING REVETMENT
EXISTING REVETMENT
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5'(MLLW)
BREAKWATER
LENGTH=130'
CREST EL.=+9.0'(MLLW)
ENTRANCE CHANNEL
LENGTH=1,030'
WIDTH=50'
DEPTH=-9.5'(MLLW)
0
0
+6
-2
-2
-4
-4
-6
-6
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN A1
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 13

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
COST ESTIMATE

PLAN A1 - LAUNCH RAMP ONLY

ITEM	QUANTITY	UNIT	UNIT COST	SUB TOTAL	TOTAL
FEDERAL COST:					
Mob & Demob	1 JOB	---	---	$100,000	
Dredge					
Turning Basin (100x100)	2,200	CY	30	66,000	
Entrance Channel	11,000	CY	77	847,000	
Breakwater - 130 ft					
Armor Stone (2.5 to 4.0 tons)	3,500	Tons	39	136,500	
Underlayer (500 to 800 lb)	700	Tons	50	35,000	
Core Stone (spalls to 30 lb)	1,300	Tons	56	72,800	
				1,257,300	
Contingency (25%)				314,300	
Total Direct Federal Construction Cost					$1,571,600
Offshore Borings				50,000	
Plans and Specifications				75,000	
Engineering during Construction				10,000	
Supervision and Administration (7%)				110,000	
Total Engineering and Design Cost					$245,000
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES					$1,816,600
NON-FEDERAL COST:					
Launch Ramp (2 lanes)	1	Ea	---	$100,000	
Contingency (25%)				25,000	
TOTAL FIRST COST OF NON-FEDERAL CONSTRUCTION (Non-cost Shared Features)					$125,000
U.S. COAST GUARD AIDS TO NAVIGATION:					$20,000
TOTAL PROJECT FIRST COST					$1,961,600

[1] *Excludes preauthorization study costs of $266,000.*

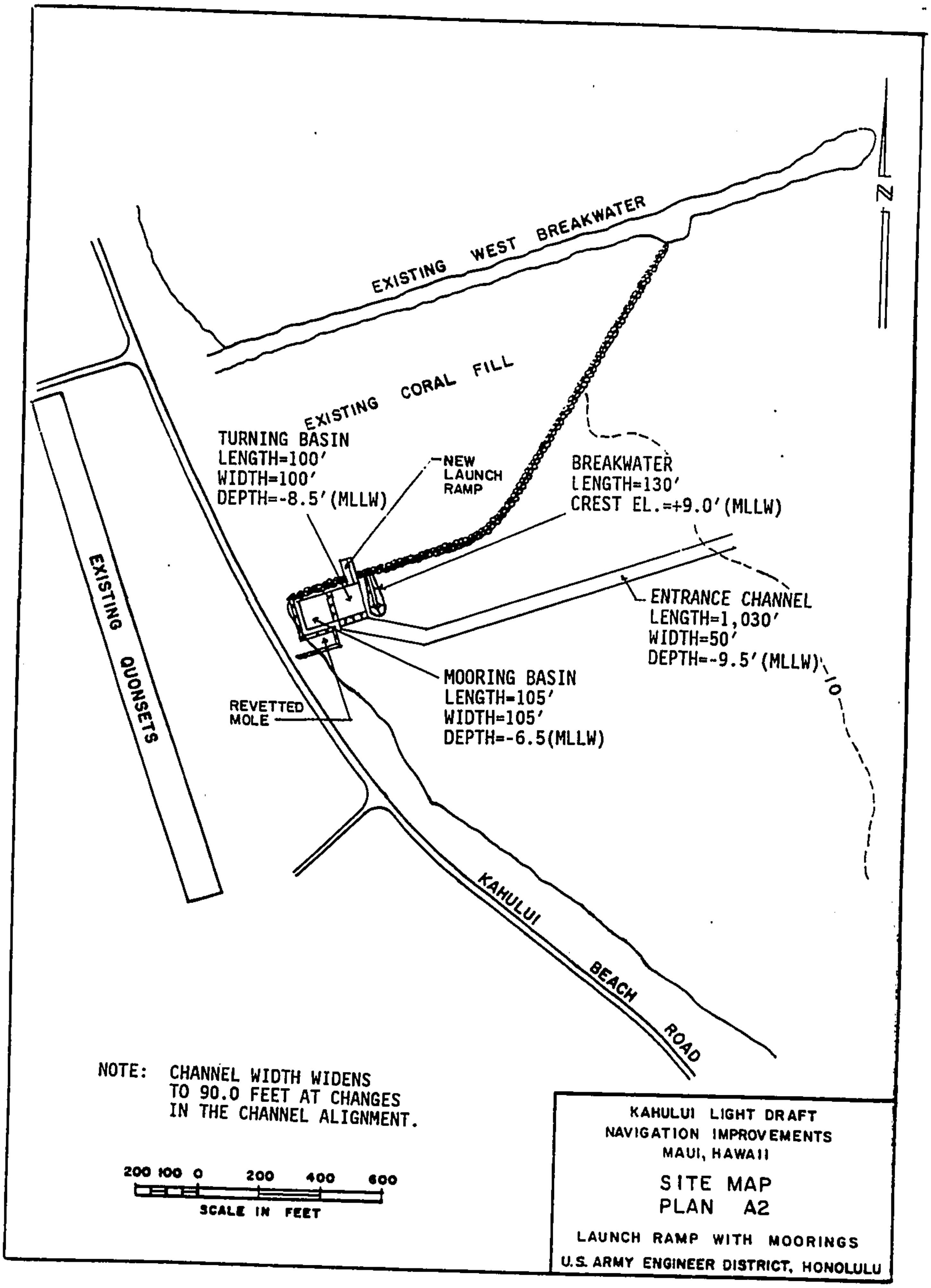

EXISTING WEST BREAKWATER
N
EXISTING CORAL FILL
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5' (MLLW)
NEW LAUNCH RAMP
BREAKWATER
LENGTH=130'
CREST EL.=+9.0' (MLLW)
ENTRANCE CHANNEL
LENGTH=1,030'
WIDTH=50'
DEPTH=-9.5' (MLLW)
-10-
EXISTING QUONSETS
REVETTED MOLE
MOORING BASIN
LENGTH=105'
WIDTH=105'
DEPTH=-6.5(MLLW)
KAHULUI BEACH ROAD
NOTE: CHANNEL WIDTH WIDENS TO 90.0 FEET AT CHANGES IN THE CHANNEL ALIGNMENT.
200 100 0 200 400 600
SCALE IN FEET
KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
MAUI, HAWAII
SITE MAP
PLAN A2
LAUNCH RAMP WITH MOORINGS
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 14

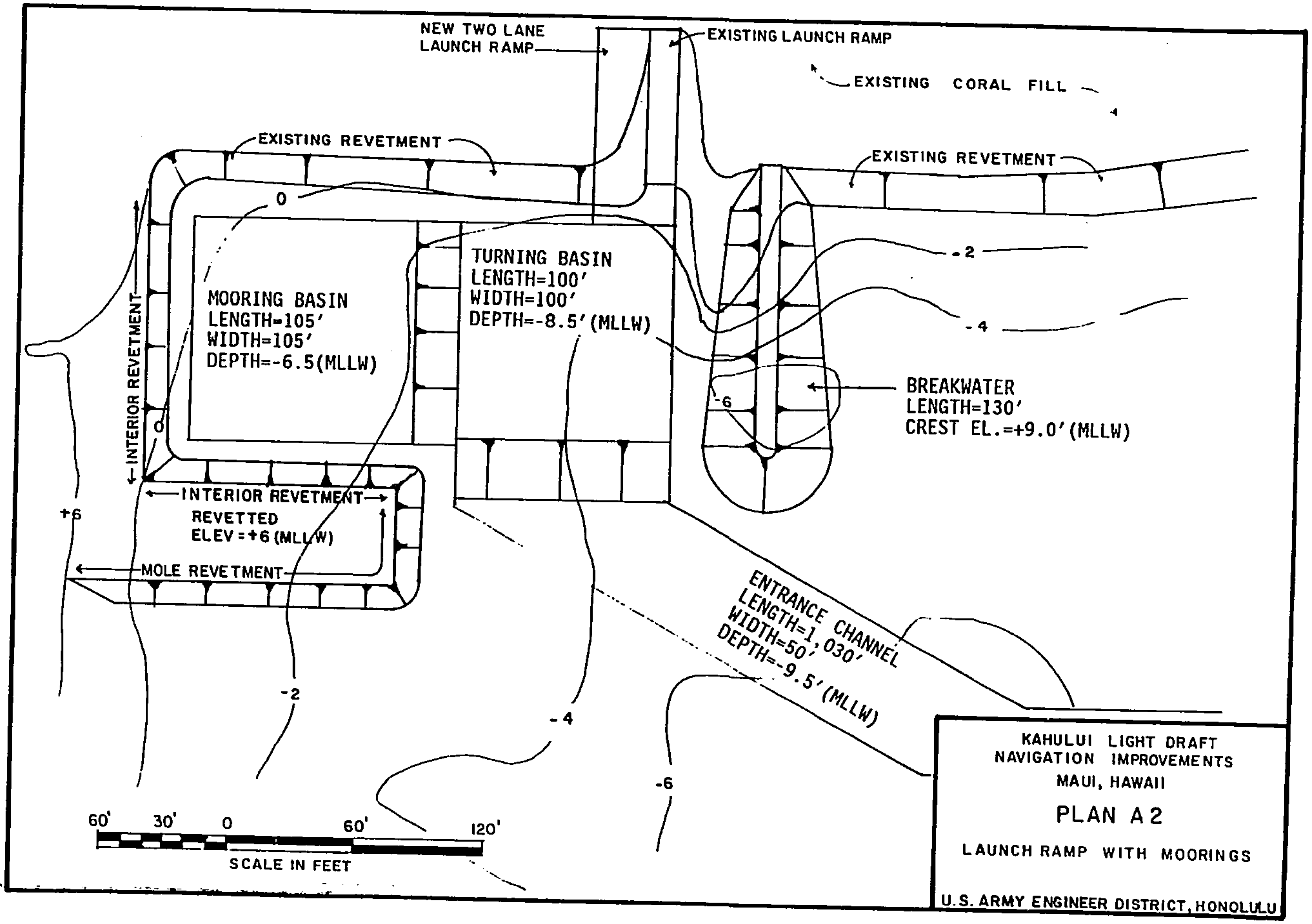
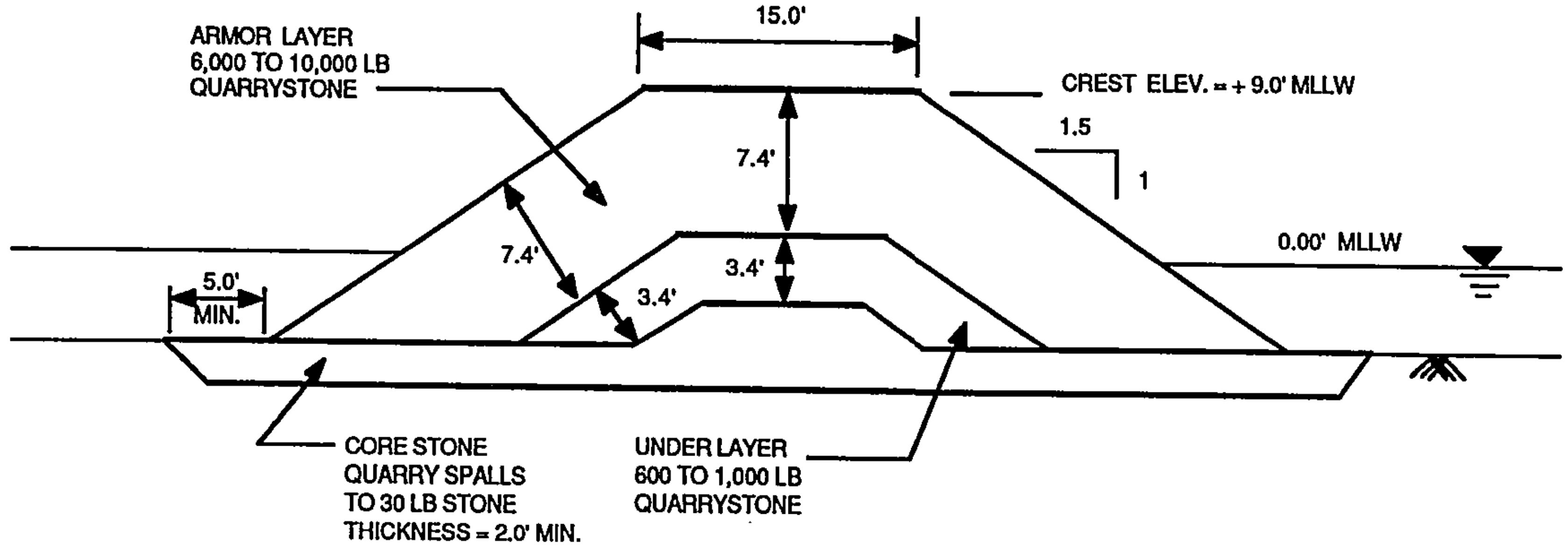

NEW TWO LANE LAUNCH RAMP
EXISTING LAUNCH RAMP
EXISTING CORAL FILL
EXISTING REVETMENT
EXISTING REVETMENT
MOORING BASIN
LENGTH=105'
WIDTH=105'
DEPTH=-6.5(MLLW)
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5'(MLLW)
BREAKWATER
LENGTH=130'
CREST EL.=+9.0'(MLLW)
INTERIOR REVETMENT
INTERIOR REVETMENT
REVETTED
ELEV=+6 (MLLW)
MOLE REVETMENT
ENTRANCE CHANNEL
LENGTH=1,030'
WIDTH=50'
DEPTH=-9.5'(MLLW)
0
0
+6
-2
-2
-4
-4
-6
-6
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN A2
LAUNCH RAMP WITH MOORINGS
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 15



PLAN A1 AND A2 - TYPICAL BREAKWATER SECTION

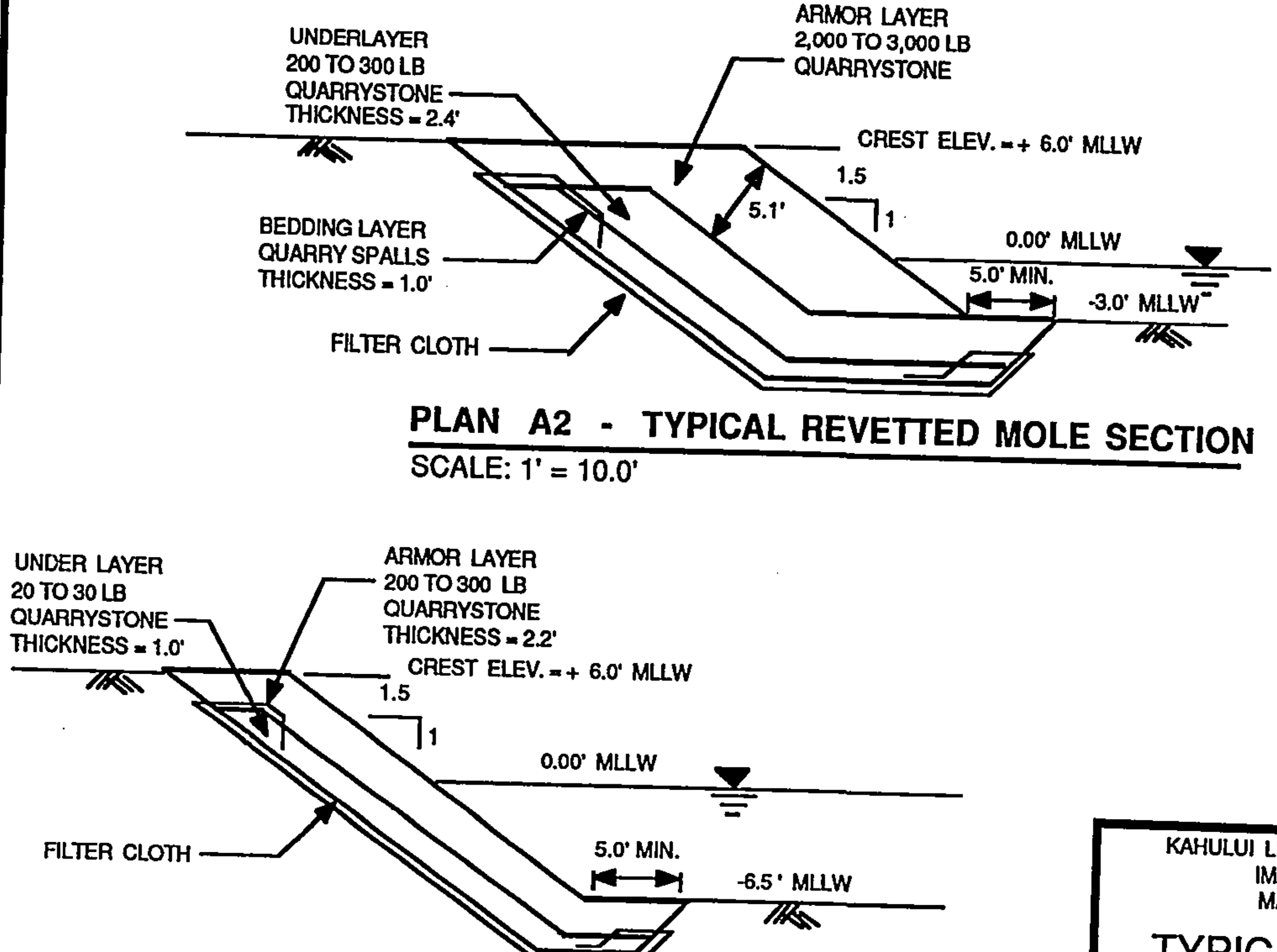
SCALE: 1' = 10.0'

KAHULUI LIGHT DRAFT NAVIGATION
IMPROVEMENTS
MAUI, HAWAII

TYPICAL SECTIONS
PLAN A1 AND A2

US ARMY ENGINEERING DISTRICT, HONOLULU

FIGURE 16



PLAN A2 - TYPICAL REVETTED MOLE SECTION

SCALE: 1' = 10.0'

PLAN A2 - TYPICAL INTERIOR REVETMENT SECTION

SCALE: 1' = 10.0'

KAHULUI LIGHT DRAFT NAVIGATION
IMPROVEMENTS
MAUI, HAWAII

TYPICAL SECTIONS
PLAN A1 AND A2

US ARMY ENGINEERING DISTRICT, HONOLULU

FIGURE 17

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
COST ESTIMATE

PLAN A2 - LAUNCH RAMP WITH MOORINGS

ITEM	QUANTITY	UNIT	COST	TOTAL	TOTAL
FEDERAL COST:					
Mob & Demob	1 JOB	---	---	$100,000	
Dredge					
Turning Basin (100x100)	2,200	CY	30	66,000	
Entrance Channel	11,000	CY	77	847,000	
Breakwater - 130 ft					
Armor Stone (2.5 to 4.0 tons)	3,500	Tons	39	136,500	
Underlayer (500 to 800 lb)	700	Tons	50	35,000	
Core Stone (spalls to 30 lb)	1,300	Tons	56	72,800	
				1,257,300	
Contingency (25%)				314,300	
Total Direct Federal Construction Cost					$1,571,600
Offshore Borings				50,000	
Plans and Specifications				75,000	
Engineering during Construction				10,000	
Supervision and Administration (7%)				110,000	
Total Engineering and Design Cost					$245,000
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES [1]					$1,816,600

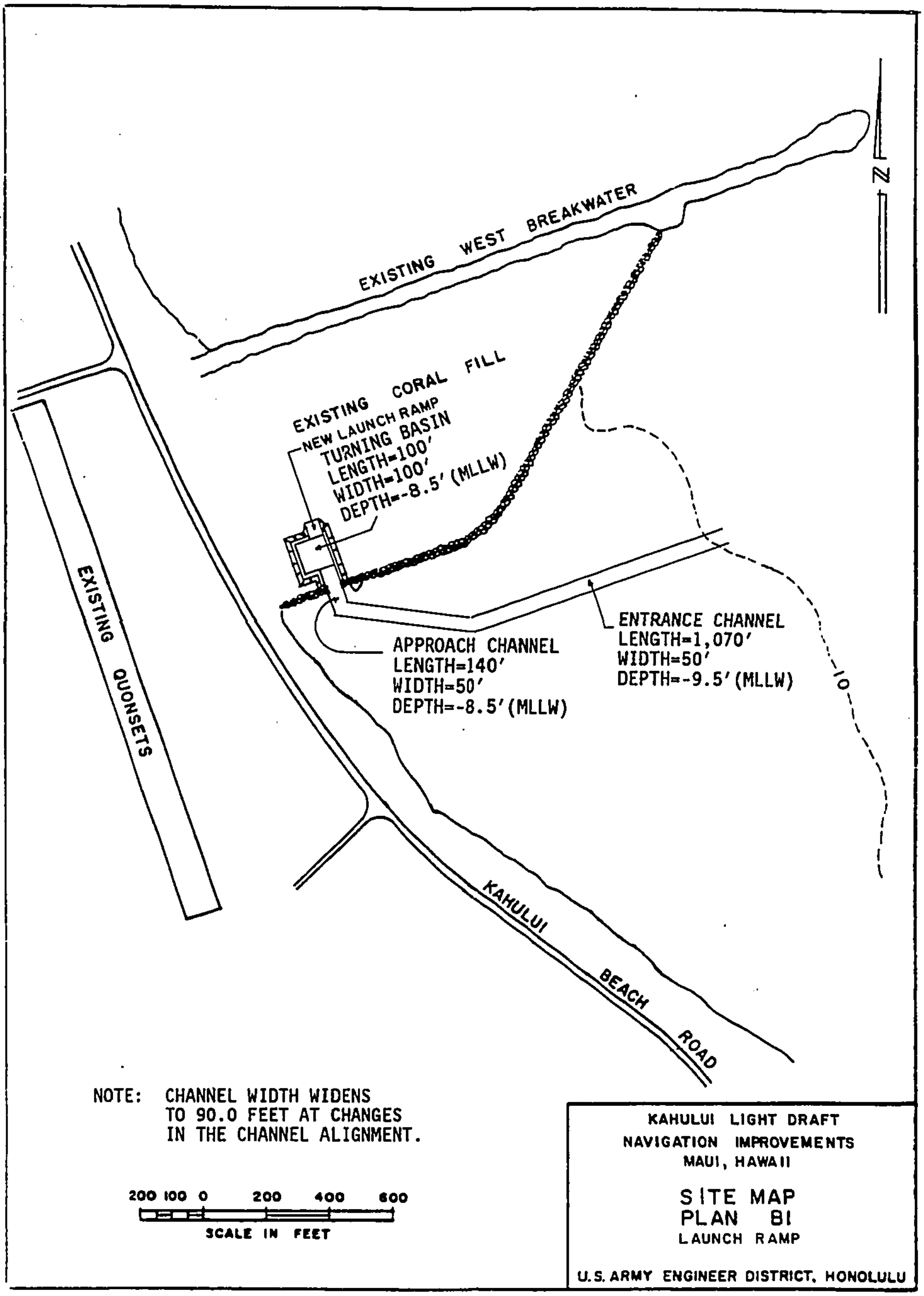
[1] *Excludes preauthorization study costs of $266,000.*

KAHULUI SMALL BOAT HARBOR
PRELIMINARY COST ESTIMATE

PLAN A2 - LAUNCH RAMP WITH MOORINGS (Con't)

ITEM	QUANTITY	UNIT	UNIT COST	SUB TOTAL	TOTAL
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES [1] (Carryover from previous sheet)					$1,816,600
NON-FEDERAL COST:					
Launch Ramp (2 lanes)	1	Ea	---	$100,000	
Revetted Mole 205'					
Excavation	1,700	CY	15	25,500	
Filter Fabric	1,300	SY	4	5,200	
Armor (1,500 to 2,500 lb)	1,400	Tons	43	60,200	
Underlayer (150 to 250 lb)	1,500	Tons	59	88,500	
Bedding Spalls	600	Tons	56	33,600	
Interior Revetment					
Excavation	1,700	CY	15	25,500	
Filter Fabric	1,300	SY	4	5,200	
Armor (150 to 200 lb)	1,200	Tons	43	51,600	
Underlayer (10 to 20 lb)	700	Tons	59	41,300	
Dredge					
Mooring Basin (105'x105')	2,400	CY	30	72,000	
				508,600	
Contingency (25%)				127,200	
TOTAL FIRST COST OF NON-FEDERAL CONSTRUCTION (Non-cost Shared Features)					$635,800
U.S. COAST GUARD AIDS TO NAVIGATION:					$20,000
TOTAL PROJECT FIRST COST					$2,472,400

[1] *Excludes preauthorization study costs of $266,000.*

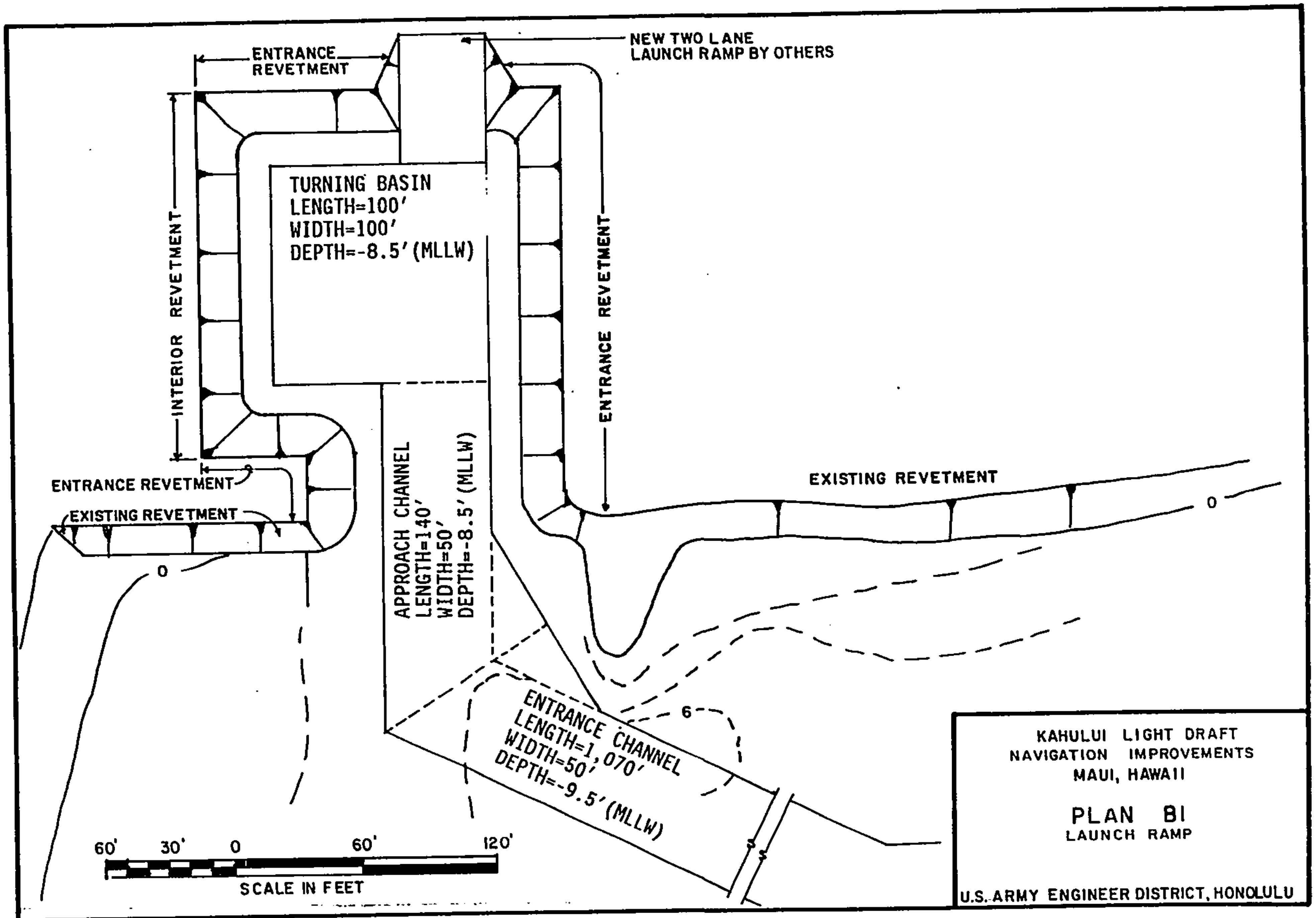


KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

SITE MAP
PLAN B1
LAUNCH RAMP

U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 18



ENTRANCE REVETMENT
NEW TWO LANE LAUNCH RAMP BY OTHERS
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5'(MLLW)
INTERIOR REVETMENT
ENTRANCE REVETMENT
ENTRANCE REVETMENT
EXISTING REVETMENT
EXISTING REVETMENT
APPROACH CHANNEL
LENGTH=140'
WIDTH=50'
DEPTH=-8.5'(MLLW)
ENTRANCE CHANNEL
LENGTH=1,070'
WIDTH=50'
DEPTH=-9.5'(MLLW)
0
0
6
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN BI
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 19

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
COST ESTIMATE

PLAN B1 - LAUNCH RAMP ONLY

ITEM	QUANTITY	UNIT	UNIT COST	SUB TOTAL	TOTAL
FEDERAL COST:					
Mob & Demob	1 JOB	---	---	$100,000	
Dredge					
Turning Basin (100x100)	9,600	CY	15	144,000	
Entrance Channel	16,000	CY	77	1,232,000	
Entrance Revetment (400′)					
Excavation	6,000	CY	15	90,000	
Filter Fabric	3,000	SY	4	12,000	
Armor Stone (1,500 to 2,500 lb)	4,500	Tons	43	193,500	
Underlayer (500 to 800 lb)	3,900	Tons	59	230,100	
Core Stone (spalls to 30 lb)	2,100	Tons	56	117,600	
Interior revetment (165′)					
Excavation	1,300	CY	15	19,500	
Filter Fabric	1,000	SY	4	4,000	
Armor Stone (150 to 200 lb)	1,300	Tons	61	79,300	
Underlayer (10 to 20 lb)	500	Tons	56	28,000	
				2,250,000	
Contingency (25%)				562,500	
Total Direct Federal Construction Cost					$2,812,500
Offshore Borings				50,000	
Plans and Specifications				75,000	
Engineering during Construction				10,000	
Supervision and Administration (7%)				196,900	
Total Engineering and Design Cost				331,900	
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES					$3,144,400

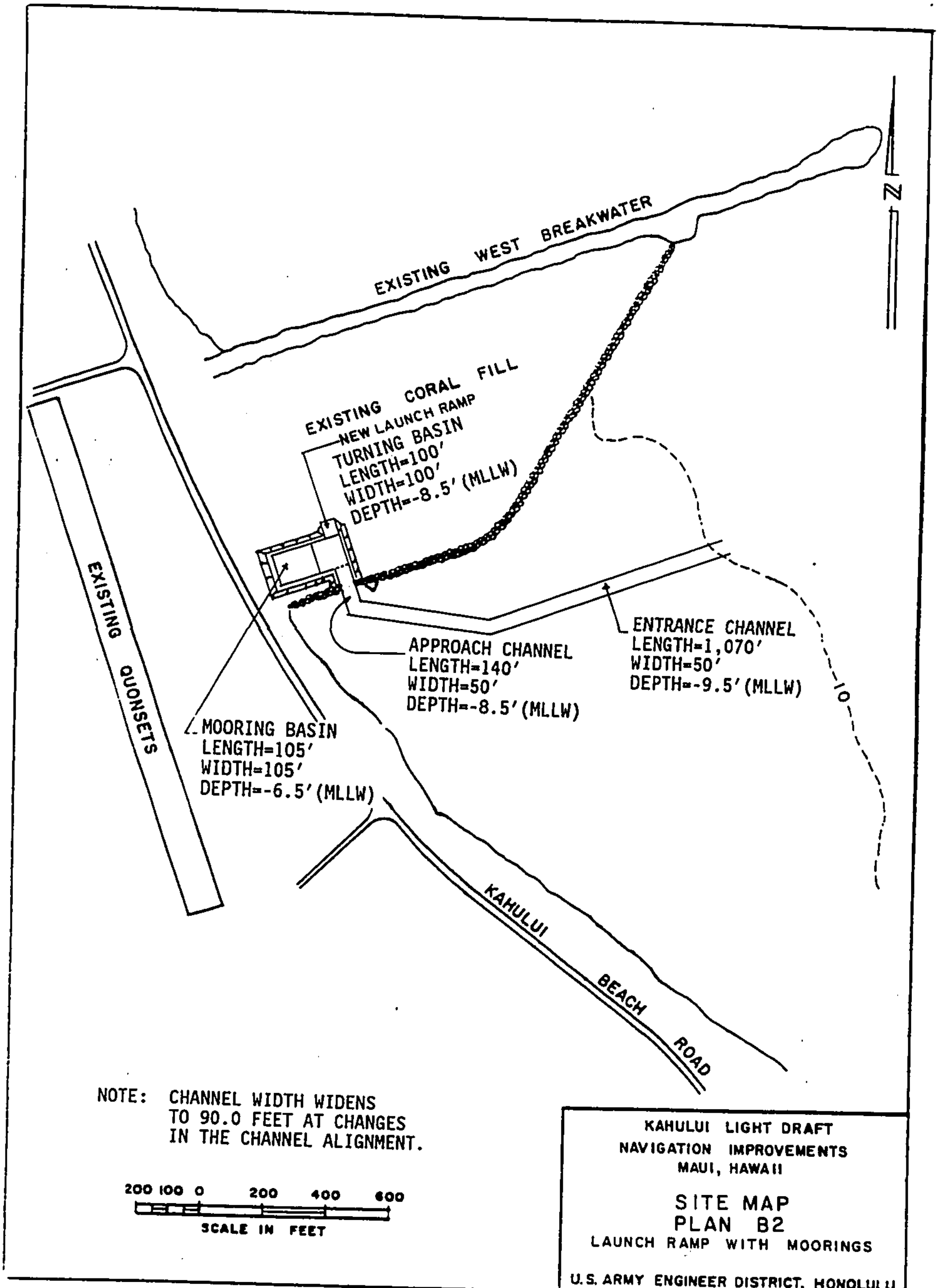
[1] *Excludes preauthorization study costs of $266,000.*

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
COST ESTIMATE

PLAN B1 - LAUNCH RAMP ONLY (CON'T)

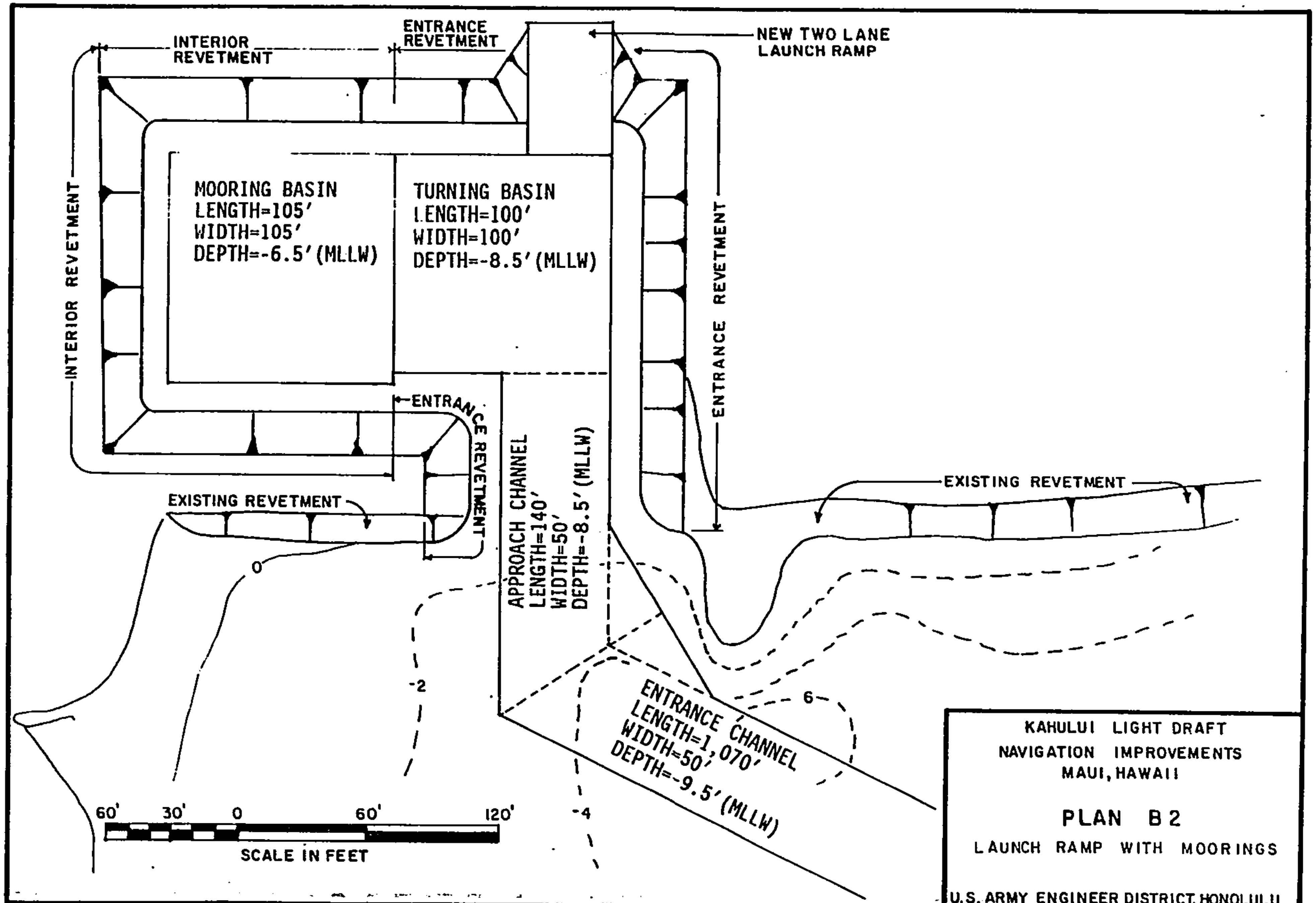
ITEM	QUANTITY	UNIT	UNIT COST	SUB TOTAL	TOTAL
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES [1] (Carryover from previous sheet)					$3,144,400
NON-FEDERAL COST					
Launch Ramp (2 lanes)	1	Ea	---	$100,000	
Contingency (25%)				$25,000	
TOTAL FIRST COST OF NON-FEDERAL FEATURES (Non-cost Shared)					$125,000
U.S. COAST GUARD AIDS TO NAVIGATION:					$20,000
TOTAL PROJECT FIRST COST					$3,289,400

[1] *Excludes preauthorization study costs of $266,000.*



EXISTING WEST BREAKWATER
N
EXISTING CORAL FILL
NEW LAUNCH RAMP
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5' (MLLW)
EXISTING QUONSETS
APPROACH CHANNEL
LENGTH=140'
WIDTH=50'
DEPTH=-8.5' (MLLW)
ENTRANCE CHANNEL
LENGTH=1,070'
WIDTH=50'
DEPTH=-9.5' (MLLW)
10
MOORING BASIN
LENGTH=105'
WIDTH=105'
DEPTH=-6.5' (MLLW)
KAHULUI BEACH ROAD
NOTE: CHANNEL WIDTH WIDENS TO 90.0 FEET AT CHANGES IN THE CHANNEL ALIGNMENT.
200 100 0 200 400 600
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
SITE MAP
PLAN B2
LAUNCH RAMP WITH MOORINGS
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 20



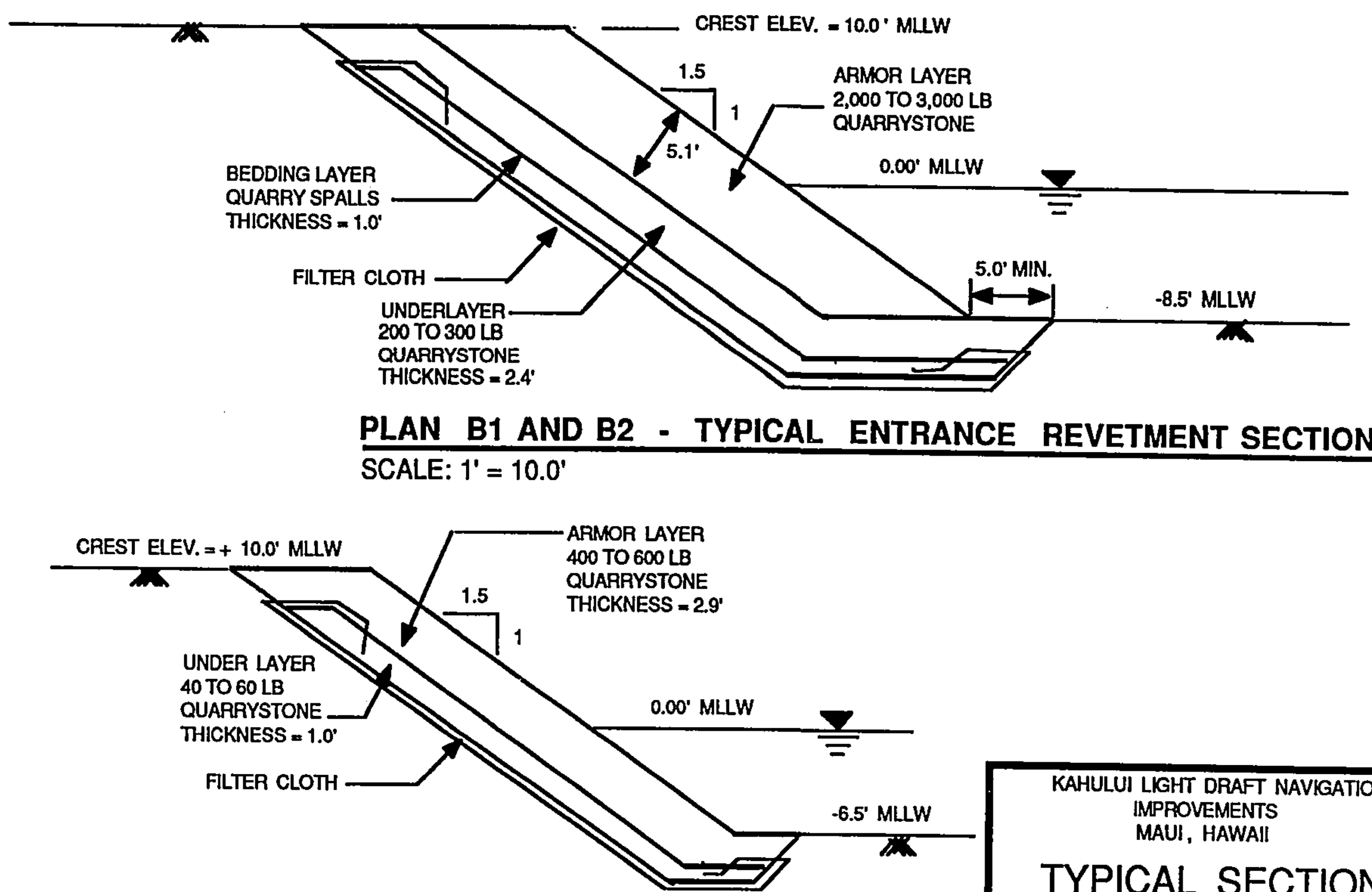
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

PLAN B 2

LAUNCH RAMP WITH MOORINGS

U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 21



PLAN B1 AND B2 - TYPICAL ENTRANCE REVETMENT SECTION

SCALE: 1' = 10.0'

PLAN B1 AND B2 - TYPICAL INTERIOR REVETMENT SECTION

SCALE: 1' = 10.0'

KAHULUI LIGHT DRAFT NAVIGATION
IMPROVEMENTS
MAUI, HAWAII

TYPICAL SECTIONS
PLAN B1 AND B2

US ARMY ENGINEERING DISTRICT, HONOLULU

FIGURE 22

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
COST ESTIMATE

PLAN B2 - LAUNCH RAMP WITH MOORINGS

ITEM	QUANTITY	UNIT	UNIT COST	SUB TOTAL	TOTAL
FEDERAL COST:					
Mob & Demob	1 JOB	---	---	$100,000	
Dredge					
Turning Basin (100x100)	9,600	CY	15	144,000	
Entrance Channel	16,000	CY	77	1,232,000	
Entrance Revetment (400')					
Excavation	6,000	CY	15	90,000	
Filter Fabric	3,000	SY	4	12,000	
Armor Stone (1,500 to 2,500 lb)	4,500	Tons	43	193,500	
Underlayer (500 to 800 lb)	3,900	Tons	59	230,100	
Core Stone (spalls to 30 lb)	2,100	Tons	56	117,600	
Interior revetment (165')					
Excavation	1,300	CY	15	19,500	
Filter Fabric	1,000	SY	4	4,000	
Armor Stone (150 to 200 lb)	1,300	Tons	61	79,300	
Underlayer (10 to 20 lb)	500	Tons	56	28,000	
				2,250,000	
Contingency (25%)				562,500	
Total Direct Federal Construction Cost					$2,812,500
Offshore Borings				50,000	
Plans and Specifications				75,000	
Engineering during Construction				10,000	
Supervision and Administration (7%)				196,900	
Total Engineering and Design Cost					$331,900
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES					$3,144,400

[1] *Excludes preauthorization study costs of $266,000.*

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
COST ESTIMATE

PLAN B2 - LAUNCH RAMP WITH MOORINGS (CON'T)

ITEM	QUANTITY	UNIT	UNIT COST	SUB TOTAL	TOTAL
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES [1] (Carryover from previous sheet)					$3,144,400
NON-FEDERAL COST					
Launch Ramp (2 lanes)	1	Ea	---	$100,000	
Interior revetment (265')					
Excavation	2,000	CY	15	30,000	
Filter Fabric	1,600	SY	4	6,400	
Armor Stone (150 to 200 lb)	2,000	Tons	61	122,000	
Underlayer (10 to 20 lb)	800	Tons	56	44,800	
				303,200	
Contingency (25%)				75,800	
TOTAL FIRST COST OF NON-FEDERAL FEATURES (Non-cost Shared Features)					$682,200
U.S. COAST GUARD AIDS TO NAVIGATION:					$20,000
TOTAL PROJECT FIRST COST					$3,846,600

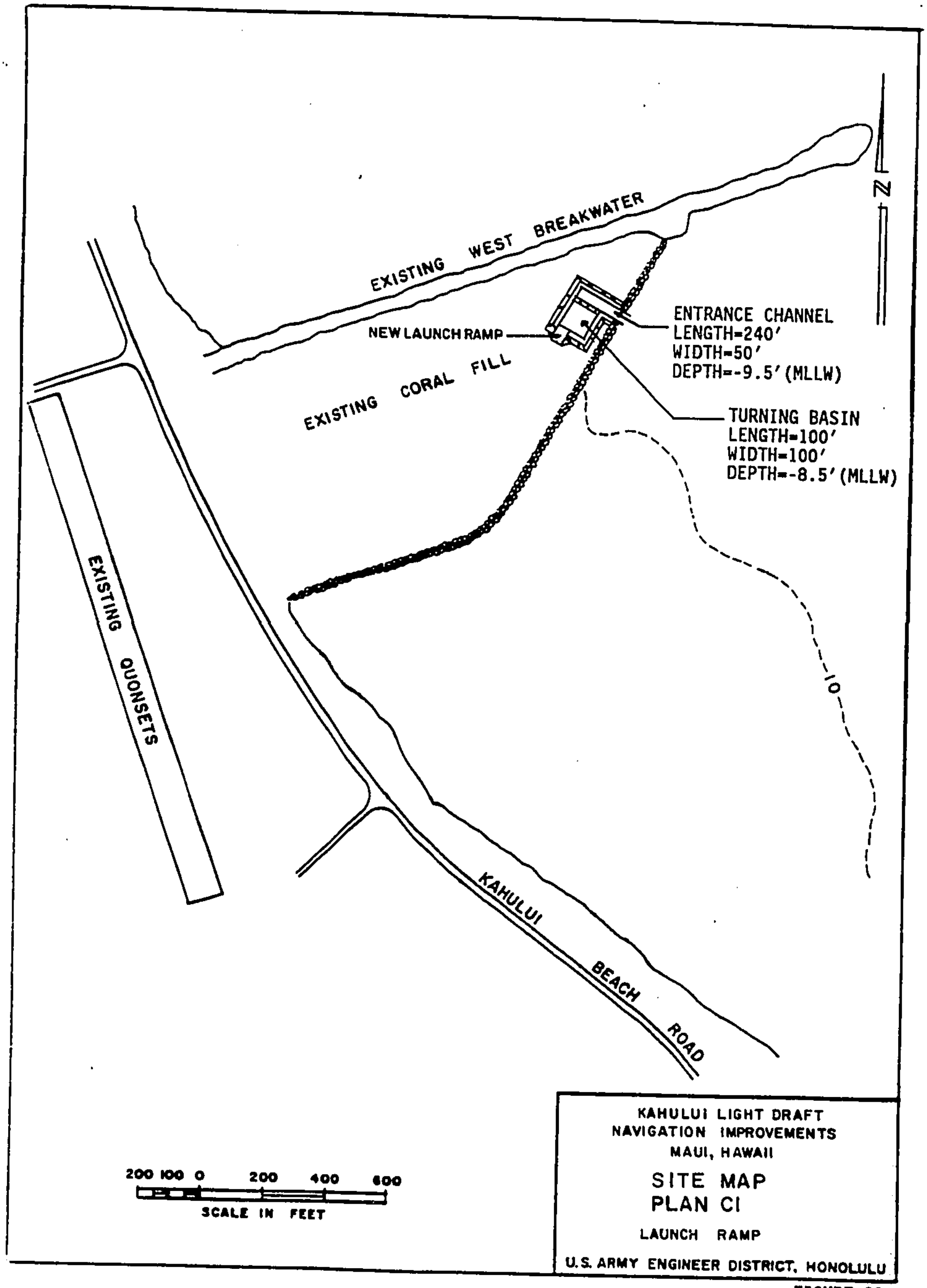

EXISTING WEST BREAKWATER
NEW LAUNCH RAMP
ENTRANCE CHANNEL
LENGTH=240′
WIDTH=50′
DEPTH=-9.5′(MLLW)
EXISTING CORAL FILL
TURNING BASIN
LENGTH=100′
WIDTH=100′
DEPTH=-8.5′(MLLW)
N
EXISTING QUONSETS
-10-
KAHULUI BEACH ROAD
200 100 0 200 400 600
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
SITE MAP
PLAN C1
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 23

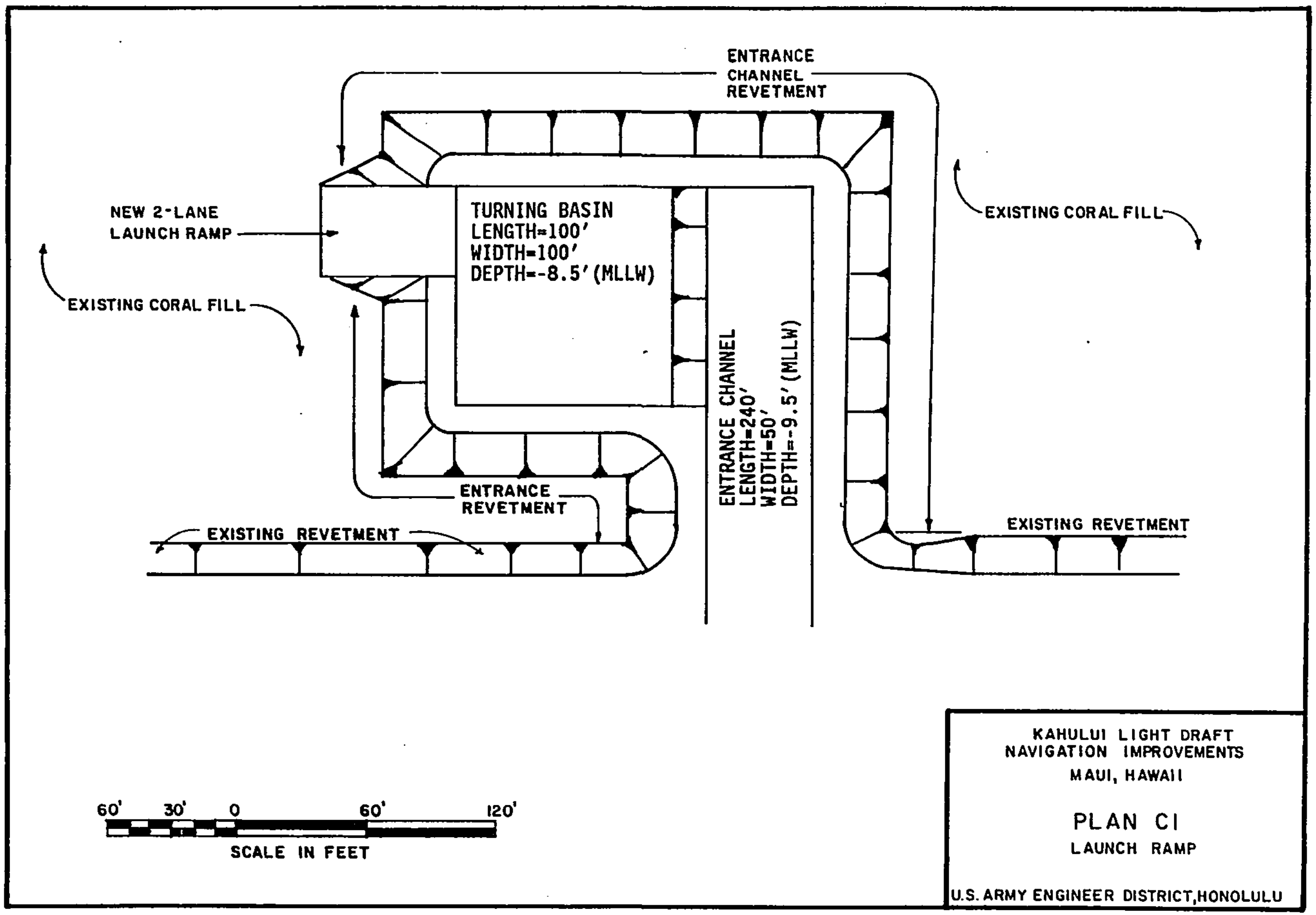

ENTRANCE CHANNEL REVETMENT
NEW 2-LANE LAUNCH RAMP
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5' (MLLW)
EXISTING CORAL FILL
EXISTING CORAL FILL
ENTRANCE CHANNEL
LENGTH=240'
WIDTH=50'
DEPTH=-9.5' (MLLW)
ENTRANCE REVETMENT
EXISTING REVETMENT
EXISTING REVETMENT
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN C1
LAUNCH RAMP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 24

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
COST ESTIMATE

PLAN C1 - LAUNCH RAMP ONLY

ITEM	QUANTITY	UNIT	UNIT COST	SUB TOTAL	TOTAL
FEDERAL COST:					
Mob & Demob	1 JOB	---	---	$100,000	
Dredge					
Turning Basin (100x100)	10,500	CY	15	157,500	
Entrance Channel	12,000	CY	15	180,000	
Entrance Revetment (758')					
Excavation	27,000	CY	15	405,000	
Filter Fabric	8,000	SY	4	32,000	
Armor Stone (2 to 3 ton)	15,500	Tons	39	604,500	
Underlayer (400 to 800 lb)	8,000	Tons	50	400,000	
Core Stone (spalls to 30 lb)	3,800	Tons	56	212,800	
				2,091,800	
Contingency (25%)				523,000	
Total Direct Federal Construction Cost					$2,614,800
Ofshore Borings				50,000	
Plans and Specifications				75,000	
Engineering during Construction				10,000	
Supervision and Administration (7%)				183,000	
Total Engineering and Design Cost					$318,000
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES [1]					$2,932,800

[1] *Excludes preauthorization study costs of $266,000.*

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
COST ESTIMATE

PLAN C1 - LAUNCH RAMP ONLY (CON'T)

ITEM	QUANTITY	UNIT	UNIT COST	SUB TOTAL	TOTAL
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES (Carryover from previous page)					$2,932,800
NON-FEDERAL COST:					
Launch Ramp (2 lanes)	1	Ea	---	$100,000	
Contingency (25%)				$25,000	
TOTAL FIRST COST OF NON-FEDERAL FEATURES (Non-cost Shared Features)					$125,000
U.S. COAST GUARD AIDS TO NAVIGATION:					$20,000
TOTAL PROJECT FIRST COST					$3,077,800

[1] *Excludes preauthorization study costs of $266,000.*

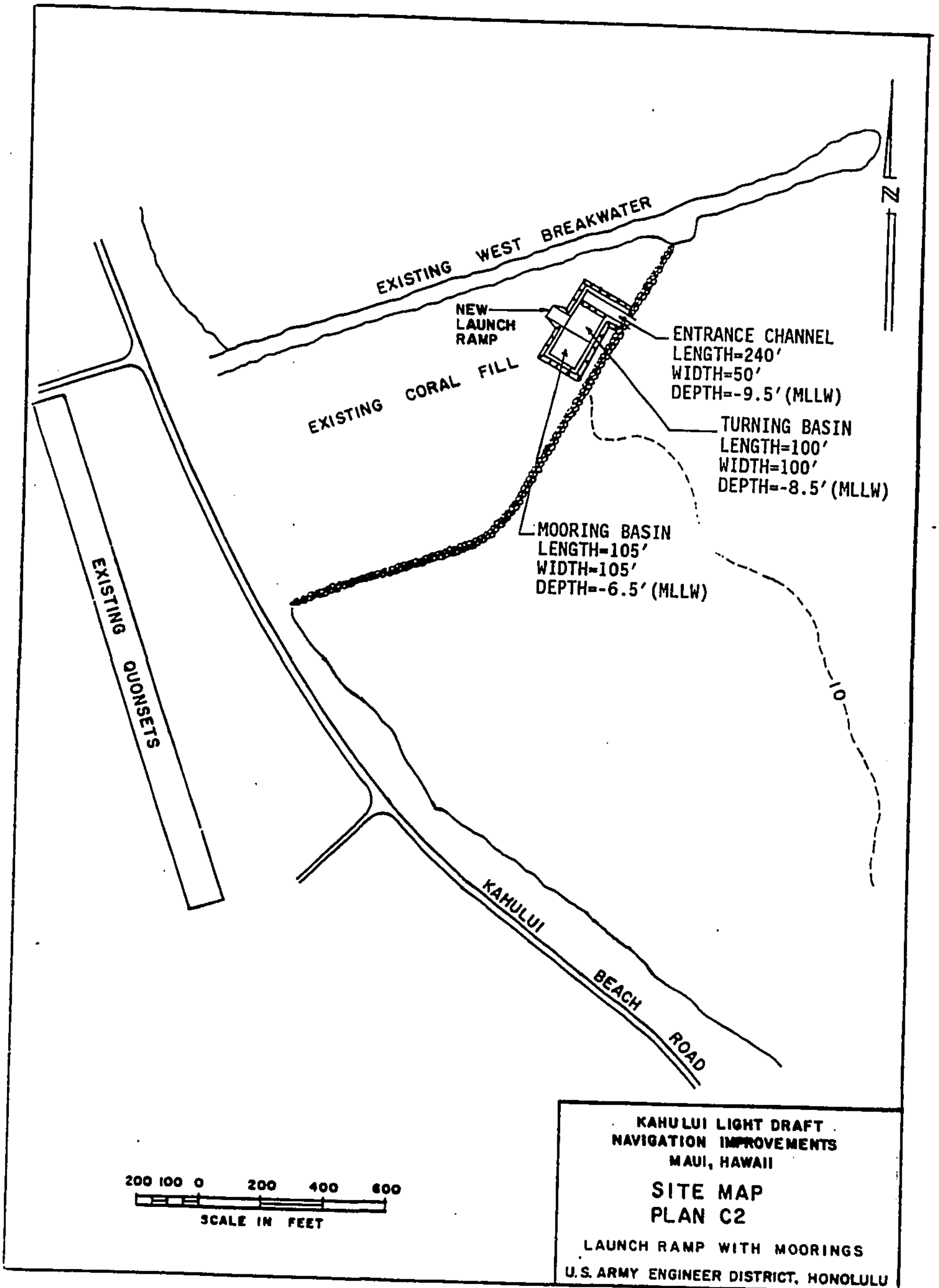

EXISTING WEST BREAKWATER
N
NEW LAUNCH RAMP
ENTRANCE CHANNEL
LENGTH=240'
WIDTH=50'
DEPTH=-9.5' (MLLW)
EXISTING CORAL FILL
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5' (MLLW)
MOORING BASIN
LENGTH=105'
WIDTH=105'
DEPTH=-6.5' (MLLW)
EXISTING QUONSETS
-10-
KAHULUI BEACH ROAD
200 100 0 200 400 600
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
SITE MAP
PLAN C2
LAUNCH RAMP WITH MOORINGS
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 25

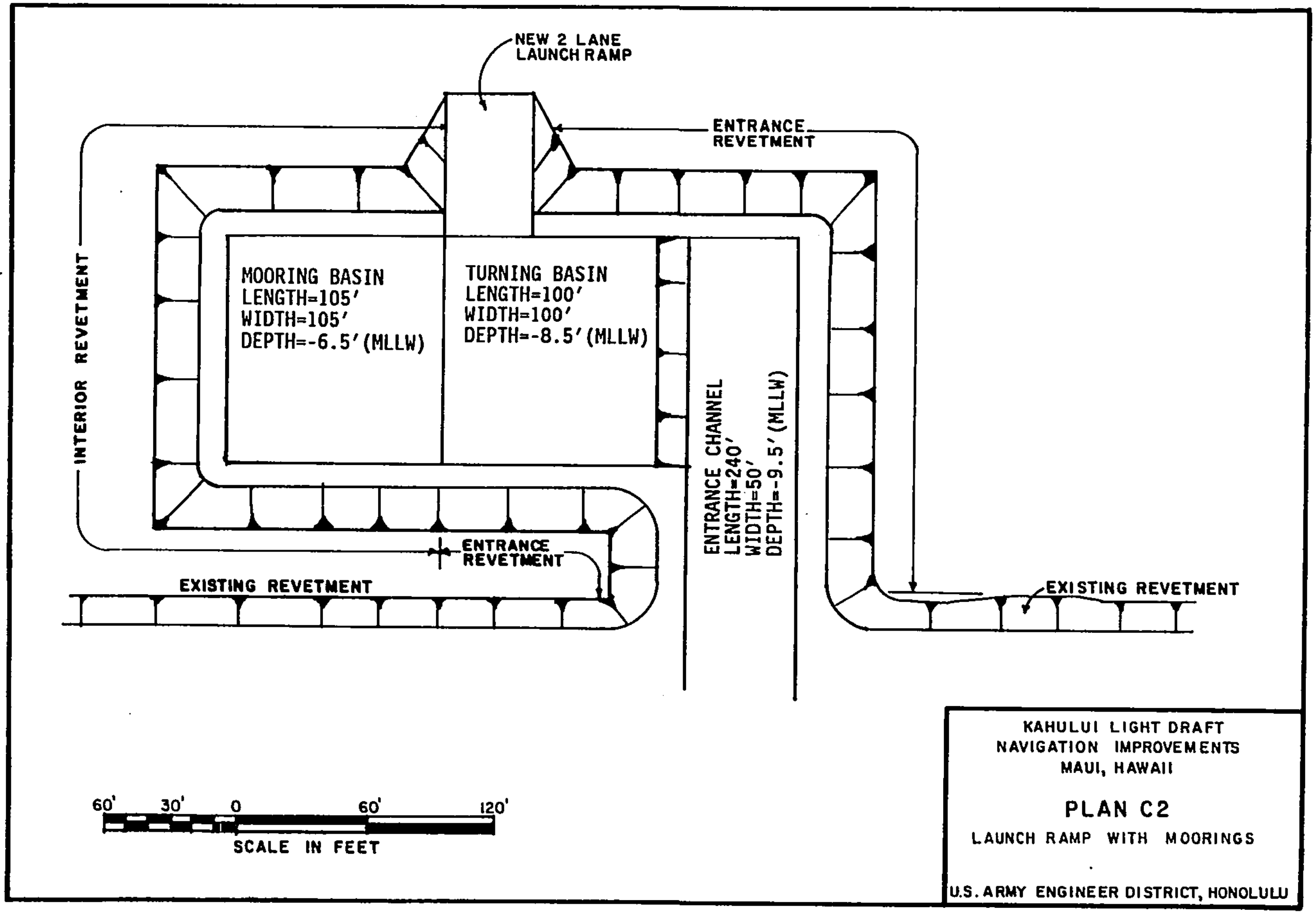
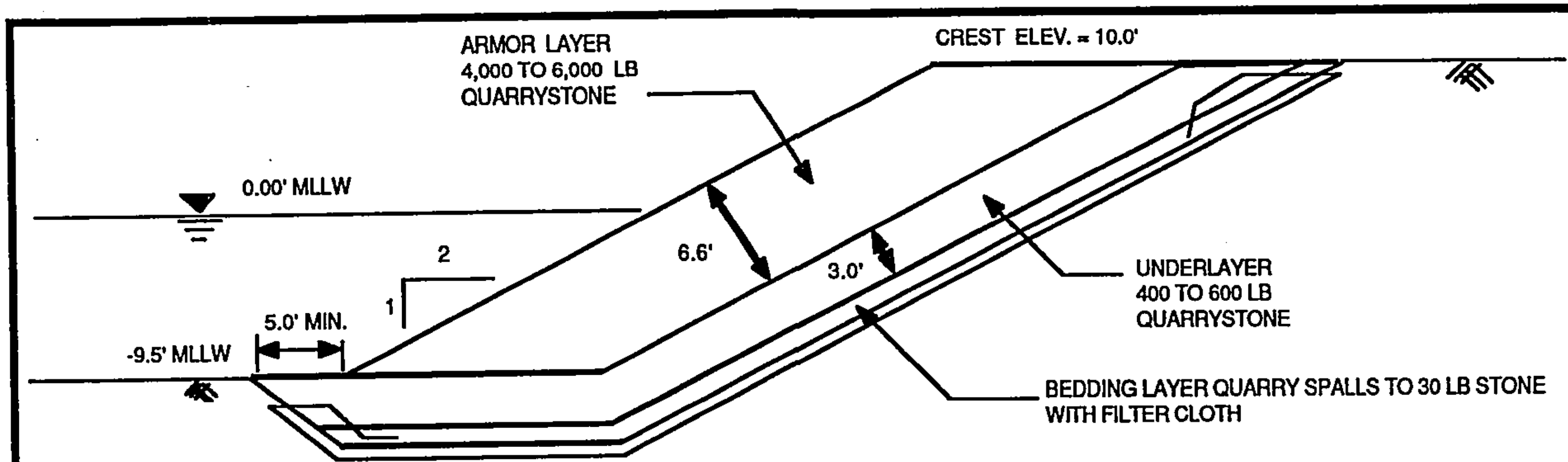
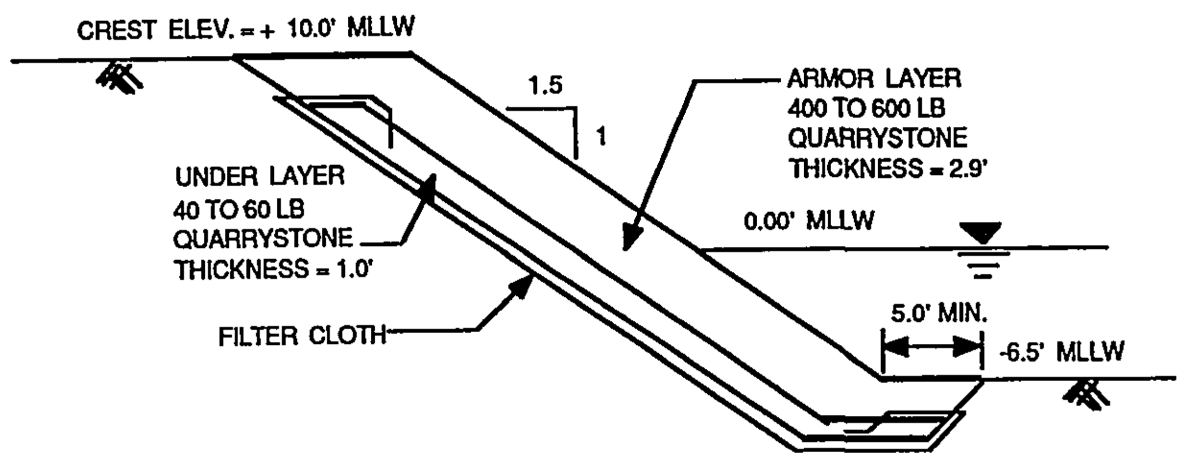

NEW 2 LANE LAUNCH RAMP
ENTRANCE REVETMENT
MOORING BASIN
LENGTH=105'
WIDTH=105'
DEPTH=-6.5'(MLLW)
TURNING BASIN
LENGTH=100'
WIDTH=100'
DEPTH=-8.5'(MLLW)
INTERIOR REVETMENT
ENTRANCE CHANNEL
LENGTH=240'
WIDTH=50'
DEPTH=-9.5'(MLLW)
ENTRANCE REVETMENT
EXISTING REVETMENT
EXISTING REVETMENT
60' 30' 0 60' 120'
SCALE IN FEET
KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII
PLAN C2
LAUNCH RAMP WITH MOORINGS
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 26



PLAN C - TYPICAL ENTRANCE REVETMENT SECTION

SCALE: 1' = 10.0'



PLAN C - TYPICAL INTERIOR REVETMENT SECTION

SCALE: 1' = 10.0'

KAHULUI LIGHT DRAFT NAVIGATION
IMPROVEMENTS
MAUI, HAWAII

TYPICAL SECTIONS
PLAN C1 AND C2

US ARMY ENGINEERING DISTRICT, HONOLULU

FIGURE 27

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
COST ESTIMATE

PLAN C2 - LAUNCH RAMP WITH MOORINGS

ITEM	QUANTITY	UNIT	UNIT COST	SUB TOTAL	TOTAL
FEDERAL COST:					
Mob & Demob	1 JOB	---	---	$100,000	
Dredge					
Turning Basin (100x100)	10,500	CY	15	157,500	
Entrance Channel	12,000	CY	15	180,000	
Entrance Revetment (758')					
Excavation	17,300	CY	15	259,500	
Filter Fabric	5,800	SY	4	23,200	
Armor Stone (2 to 3 ton)	12,000	Tons	39	468,000	
Underlayer (400 to 800 lb)	5,500	Tons	50	275,000	
Core Stone (spalls to 30 lb)	2,700	Tons	56	151,200	
				1,614,400	
Contingency (25%)				403,600	
Total Direct Federal Construction Cost					$2,018,000
Ofshore Borings				50,000	
Plans and Specifications				75,000	
Engineering during Construction				10,000	
Supervision and Administration (7%)				141,300	
Total Engineering and Design Cost					$276,300
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES [1]					$2,294,300

[1] *Excludes preauthorization study costs of $266,000.*

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
COST ESTIMATE

PLAN C2 - LAUNCH RAMP WITH MOORINGS (CON'T)

ITEM	QUANTITY	UNIT	UNIT COST	SUB TOTAL	TOTAL
TOTAL FEDERAL FIRST COST OF GENERAL NAVIGATION FEATURES [1] (Carryover from previous page)					$2,294,300
NON-FEDERAL COST:					
Launch Ramp (2 lanes)	1	Ea	---	$100,000	
Dredge					
Mooring Basin	8,000	CY	15	120,000	
Interior Revetment					
Excavation	3,200	CY	15	48,000	
Filter Fabric	2,200	SY	4	8,800	
Armor (150 to 200 lb)	2,800	Tons	61	170,800	
Underlayer (10 to 20 lb)	1,000	Tons	56	56,000	
				503,600	
Contingency (25%)				125,900	
TOTAL FIRST COST OF NON-FEDERAL FEATURES (Non-cost Shared Features)					$629,500
U.S. COAST GUARD AIDS TO NAVIGATION:					$20,000
TOTAL PROJECT FIRST COST					$2,943,800

[1] *Excludes preauthorization study costs of $266,000.*

KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

ECONOMICS

APPENDIX E

APPENDIX E

ECONOMIC ANALYSIS
FOR
KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
MAUI, HAWAII

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APPENDIX E

SECTION I. ECONOMIC AND SENSITIVITY ANALYSIS

1 BACKGROUND

The only existing adequate facility for small craft on the Kahului side of Maui is a single-lane launch ramp, constructed by the State Harbors Division in 1963, located on fill in the northwest corner of the deep-draft commercial harbor at Kahului. There is a ramp at Maliko Bay about 10 miles east of Kahului but this ramp has a very poor access road and the bay gets closed out completely by heavy winter surge and so is only marginally usable. In early 1982, the Statewide Boating Task Force recommended development of a commercial fishing harbor within Kahului Harbor. In addition, during a public meeting on 13 May 1982 for the Corps' Review of the Hawaiian Islands Study, local fishermen expressed the need for light draft navigation facilities at Kahului.

2 STUDIES COMPLETED TO DATE

The Initial Appraisal Report for Kahului Small Boat Harbor was completed in October 1983. This report evaluated a 120-boat commercial fishing harbor located in the vicinity of the existing ramp, and demonstrated a benefit-cost ratio of 3.8. The Reconnaissance Report was submitted in September 1984, and evaluated three different sites for the 120-boat harbor: Kahului Harbor, Kanaha Beach Park and Maliko Bay. Of these alternative sites, the report concluded that the site within Kahului Harbor offered the best protection for the small boats, would have the least environmental impacts and would be the least costly to develop.

However, in December 1984, the Mayor of Maui County, Hannibal Tavares, expressed objections to a small boat harbor within Kahului Harbor. The principle objection concerned possible conflicts between small boat traffic and the deep-draft commercial vessels using the same entrance channel. Mayor Tavares was especially concerned over the increased potential for an accident that would temporarily block the entrance channel to Kahului Harbor, with severe impacts on Maui's economy. Although State Harbors Division and the Corps indicated that navigational safety would not be compromised, the County remained opposed to a small boat harbor within Kahului Harbor.

At a public workshop in December 1984, the County's position was explained to the local boaters and possible alternatives discussed. It was learned that the fishermen would use a facility at Kahului only on a seasonal basis, because the waters on the north side of Maui are often too rough for safe small craft operation. Based on this usage pattern and the County's objections to a conventional small boat harbor, a revised concept was developed for an improved launch ramp with a protected mooring area for approximately 25 vessels. This revised concept seems to meet the needs of the local fishermen and also would alleviate the potential traffic conflicts. The small boat traffic would peak during periods of good weather (i.e. Kona winds with no tradewind-generated waves), which would minimize the chances of an accident with the deep-draft vessels. This revised plan has met with the approval of the County and State Harbors Division in March 1985.

The in-house evaluation of benefits for the proposed improvements for the DPR-level report focused on field data obtained from interviews in the Spring of 1985 with Maui commercial boat operators. However, the results were not conclusively supportive of the need for improvements, although there were some individuals that were quite enthusiastic about the proposed project. Because the National Marine Fisheries Service (NMFS) here in Hawaii has access to computerized data gathered by the State Department of Natural Resources from commercial fish catches, we contracted with NMFS to analyze that data to determine whether there is a statistical advantage to fishing the north shore of Maui. The north shore is not now readily accessible, but the proposed improvement at Kahului would allow a much shorter travel time to these fishing grounds. The preliminary results of the initial NMFS analysis showed that there were sufficient benefits from fishing the north shore of Maui to justify the proposed project. However, their benefit analysis was limited by the relative scarcity of accurate data on commercial fish catches for Maui and was therefore, based on several assumptions regarding use of the new harbor at Kahului.

Revisions made to the analysis, after consultation with, and comments from OCE economics staff members, resulted in reduced benefits and a project that was no longer economically justified. When these results were presented to the fishermen of Maui in a public workshop in August 1987, there was an outpouring of intense sentiment and a complaint that our data were not complete. The Corps and NMFS agreed to conduct a special survey to obtain more current information from the fishermen.

This survey was run in August and September 1987 by NMFS and the Corps jointly. Altogether, 385 surveys were mailed out and another 80 were made available through the State of Hawaii and fishing club representatives. There were 110 surveys returned to the Corps of Engineers by November 13, 1987: 67 from the first set of mailings and 43 from the commercial fishing boat owners. This was not an excellent response rate, but the information obtained from the surveys was very thorough.

There were 87 surveys with sufficient information on which to make statistical analyses. The remaining surveys represented people who no longer owned a boat, or who didn't want to give information on their fishing practices. Although these surveys were not included in the statistical analysis, opinions expressed on these survey forms have been saved. It proved not to be necessary to "extrapolate" this sample of Maui commercial fishers because the respondents appear to represent almost all those fishing boat operators who currently or expect to fish off Kahului.

The National Marine Fisheries Service surveys findings and economic analysis prepared for the Corps are presented in the Economic Appendix. The results of this analysis indicate that the benefits for a launch ramp improvement project at Kahului would be $339,000 a year. The responses to the survey did not show sufficient economic need to incrementally justify temporary moorage space at the Kahului ramp. However, several fishermen have verbally indicated a desire for temporary mooring there so alternative plans including temporary moorings have been developed for local consideration.

The resource density impact analysis was run. This analysis however, probably exaggerates the resource density effect for pelagic species while underestimating the long-term resource effect on bottom fish species. Since the purpose of the resource density equation is to bound our estimates of potential fisheries expansion, we are confident that the true resource effect will not be the effective constraint to fisheries development off the north coast of Maui given the level of fishing anticipated by this analysis. Even in terms of the bottom fish resource constraint, at the optimized level of fishing effort, 20% of the anticipated catch (358,000 pounds, Table 8) would yield 71,600 pounds of bottom fish,just one half of the estimated constraint.

If the full constraint of the resource density impact analysis is taken the average annual benefits are $36,000. Without any resource constraints at all, the average annual benefits are $688,000. An optimized response average annual benefit analysis was computed and this yielded average annual benefits of $339,000. This optimized response analysis optimized the mix of Kahului and non-Kahului trips by reducing the planned trips from Kahului WITH the project (but keeping the total number of Maui-wide trips per vessel the same, i.e. 79), using the full resource effect. This effectively increased the overall catch rate to 252 pounds per year. It is reasonable to assume that the fishermen will switch their fishing efforts to alternate fishing facilities to maximize their return on effort.

3 Sensitivity

The sensitivity of the beneficial impacts of the project to resource constraints has been addressed. However, the beneficial impacts also are affected by estimated with project catch per trip, price per pound, and expenses per trip. The response of total benefits of the optimized scenario to the above factors are shown in Table ECON 1.

TABLE ECON 1
KAHULUI SENSITIVITY CHECKS

	W/O PROJECT FLEET NET INCOME	WITH PROJECT FLEET NET INCOME	TOTAL AVERAGE ANNUAL BENEFITS	PLAN A1 BCR WITH $193,000 OF AVG ANNUAL COST
BASED OPTIMIZED SCENARIO	$502,000	$840,900	$338,900	1.8
PRICE PER LB UP 10% FOR WITH & W/O 1/	592,900	991,600	398,700	2.1
PRICE PER LB DOWN 10% FOR WITH & W/O	395,600	697,700	302,100	1.6
PRICE PER LB DOWN 32.5% FOR WITH & W/O	173,600	366,900	193,300	1.0
PRICE PER LB DOWN 10% FOR WITH ONLY	502,000	695,000	193,000	1.0
COST (EXCL CREW) DOWN 10% FOR WITH AND W/O	551,200	909,900	358,700	1.9
COST (EXCL CREW) UP 10% FOR WITH & W/O	452,800	782,200	329,400	1.7
COST (EXCL CREW) UP 23% FOR WITH ONLY	502,000	695,000	193,000	1.0
COMBINED PRICE & CATCH UP 10% COSTS DOWN 10% WITH & W/O	750,700	1,215,900	465,200	2.4
COMBINED PRICE & CATCH DOWN 10% COSTS UP 10% WITH AND W/O	257,600	502,900	245,300	1.3
CONBINED PRICE & CATCH DOWN 15% COSTS UP 15% WITH AND W/O	146,700	343,200	196,500	1.0

1/ PRICE PER LB AND CATCH PER TRIP CHANGES OF LIKE PERCENTS INDUCE THE SAME CHANGES IN NET INCOME

As this table shows, if the costs or the prices per pound (and/or catch per trip) estimates are off for both the without and the with project conditions, it will take relatively large changes in the assumptions to make the project infeasible. Price (and/or catch would have to be 32.5% lower before the project would be infeasible. The response to cost increases is even less sensitive. Even if prices were 15% lower and catch were 15% lower and costs were 15% higher (all at the same time) the project would still be close to feasibility. However, if the project induces conditions that would reduce prices (or catch rates) i.e. only affecting the with project condition, only an 10% lowering of either factor would bring the project BCR to unity.

The with project catch levels estimated for the "optimized" scenario are 252 pounds per trip. The with project level is 4 percent lower than the without project condition. If the 252 pounds were reduced another 10% (25 pounds) the catch rate would be 227 pounds per trip. This is about half way between the "full" resource constraint scenarios and the "optimized " scenario. See also the "spreadsheets" and the "Potential Resource Effect" section. That the 252 pound per trip catch rate might be driven 10% lower by the project does not seem too probable.

The with project and without project price per pound is estimated to average $2.14.

The "optimized" scenario will increase the total state catch by an estimated 226,000 pounds. Would this increase affect the market price of fish? The National Marine Fisheries Service in a study for the Corps of Engineers for the proposed East Hawaii commercial fishing facility concluded that with a 2.6 million pound increase in catch over the next 50 years the price for yellowfin tuna would actually rise. The analysis from the East Hawaii study is presented as follows:

> *Adding 2-5 million pounds to Hawaii's fresh fish markets might also be expected to have a price effect, although the market is no longer limited to the State's consumers. A long-term analysis of price effects created by fish landings, population growth, and per capita personal income (equation given in Exhibit 2) shows that at expected demographic values for the year 2040, the price of fresh yellowfin tuna would actually rise by 60% if the increase were only 2.6 million pounds. (Without any increase in catch, the growth of Hawaii's economy would generate sufficient increased demand to raise the price of fresh yellowfin tuna from a predicted $1.89 to $4.30 in the year 2040.) It would take an increase in yellowfin tuna landings of almost 5 million pounds (200-300%) to offset these demographic effects, although one can expect product substitution to have a stronger effect in the long run.*

Exhibit 2. -- Hawaii yellowfin tuna price equation.

Yellowfin tuna comprises 64% of landings at Pohoiki. Therefore the price analysis will be conducted under the conditions that an equivalent amount of total future landings will be yellowfin tuna. The following price equation was determined from HDAR monthly data for the period 1965-82 on a quarterly basis, taken as 12-month moving averages.

"Price of yellowfin tuna per pound =

-1.3531

*-0.00565821 * Average monthly quantity of yellowfin tuna landed*

*+0.00320306 * Hawaii resident population*

*+0.0016789 * Hawaii per capita disposable income (inflation-adjusted).*

The R-squared statistic was 43.49. Each variable was statistically significant at the 99% confidence level. Although there is a autoregressive effect (the Durbin Waston statistic is 0.158, significantly different from a 0 effect), correction does not substantially alter the results. These relationships are explored more fully in Higuchi and Pooley in press.

It is probably safe to assume that the Kahului facility improvements would not induce fish market price changes that would impact on the project feasibility.

In conclusion, the sensitivity analysis does not find any probable situations that would be critical to project feasibility.

4 <u>Project Economics</u>

The economics for the optimized scenario and the proposed improvements are summarized below:

Average Annual Benefits from Increased Fish Catch $ 338,900

Average Annual Costs $ 193,000

BCR 1.8

Net Benefits $ 146,000

APPENDIX E

SECTION II. NATIONAL MARINE FISHERIES SERVICE - KAHULUI SMALL FISHING BOAT FACILITY, ALTERNATIVE NET BENEFIT ESTIMATES

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National Marine Fisheries Service
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SECTION II.
KAHULUI SMALL FISHING BOAT FACILITY
Alternative Net Benefit Estimates

March 1, 1988

Prepared by

Dr. Samuel G. Pooley
Industry Economist

Introduction

This report presents estimates of the potential benefits from an improved small fishing boat facility in Kahului Harbor, Maui. It revises estimates originally presented in "Kahului small boat harbor -- benefit analysis -- 4th draft" (April 1987). The revisions are based on new information obtained through a collaborative special survey of boat owners on Maui fielded by the Corps in August and September 1987.

Historical information was presented in the 4th draft report but that data had a number of significant limitations which were revealed during the public review of the report's results. Therefore the contemporary situation is analyzed primarily from numbers obtained in the special survey. As a result, this report stands alone in providing information on the benefit estimation procedures.

The largest apparent constraints on the project are:

a. the resource dependent effect on catch rates **WITH** the project; and,

b. the cost of fishing per trip.

These effects reduce the catch rates at Kahului as fishing increases and reduce the net benefits of each day fishing. The first constraint is judged to be the most important; without the resource dependent effect, benefits would be substantially higher as indicated later in this report.

Survey Frame

The survey was conducted because information presented at a public workshop in Kahului made clear that the existing information on commercial fishing practices in that area was inadequate to make an accurate estimate of potential benefits from a proposed Corps of Engineers launching ramp and temporary moorage project in Kahului harbor.

The survey was prepared (Appendix A) and mailed first to those people who had attended the public workshop or who had earlier expressed interest in the project. The survey was also made available to two State of Hawaii officials on Maui and to leaders of two major fishing clubs for wider distribution. Finally, a month later, a second mailing of the survey was made to all persons living on Maui who had a commercial fishing boat registered with the State of Hawaii's Harbors Division who had not been included in the earlier distribution. The survey contained 61 numerical questions and a number of fill-in-the-blank opinion questions.

Altogether, 385 surveys were mailed out and another 80 were made available through the State of Hawaii and fishing club representatives.

There were 110 surveys returned to the Corps of Engineers by November 13, 1987: 67 from the first set of mailings and 43 from the commercial fishing boat owners. This was not an excellent response rate, but the information obtained from the surveys was very thorough.

Statistical Population

There were 87 surveys with sufficient information on which to make statistical analyses. The remaining surveys represented people who no longer owned a boat, or who didn't want to give information on their fishing practices. Although these surveys were not included in the statistical analysis, opinions expressed on these survey forms have been saved.

Survey Results

It proved not to be necessary to "extrapolate" this sample of Maui commercial fishers because the respondents appear to represent almost all those fishing boat operators who currently or expect to fish off Kahului. Furthermore, the resource constraint coincidentally restricts the optimal benefits to the expected number of trips indicated in the analysis of this sample alone.

Of the 87 respondents, 16 could be considered "full-time" commercial fishers, people who landed at least 10,000 pounds in 1986. The remainder are part-timers who nonetheless sell part of their catch.

Sample results are shown in Table 1 **only** for those respondents who indicated they fished from Kahului during 1986 (61). Table 2 also includes those who **would** fish from Kahului WITH the project (72). The results are adjusted to reflect **only** commercial and subsistence fishing trips (Survey questions Q3 & Q4).

Table 1: **WITHOUT** Project Baseline (Survey results), Kahului vessels (1)

	All vessels	"Full-time"	"Part-time"
Vessels	61	15	46
Total Trips	2862	1019	1843
(per vessel)	(46.9	67.9	40.0)
--Maui-wide			
Kahului Trips	1302	326	976
(per vessel)	(21.3	21.7	21.2)
Total Catch --Maui-wide	425,594	267,226	158,367
Kahului Catch	186,595	88,811	97,784
Catch per Trip --Maui-wide	149	262	86
Kahului Catch per Trip	143	272	100

(1) Respondents indicating they **currently** fish from Kahului.

Table 2: Current fishing practices, All vessels (1)

	All vessels	"Full-time"	"Part-time"
Vessels	72	15	57
Total Trips	3068	1019	2049
(per vessel)	(42.6	67.9	35.9)
--Maui-wide			
Total Catch			
--Maui-wide	446,507	267,226	179,281
Catch per Trip	146	262	87
--Maui-wide			

(1) Respondents indicating they currently fish from Kahului or **would** fish from Kahului, WITH the project.

Full-time Equivalent Estimation

The responses could be analyzed either as averages or as "full-time equivalent" fishing vessel operators. Although the latter is more difficult to perform, it coincides most closely with the Corps procedures for this type of benefit estimation, which emphasize commercial benefits. Using the information from Table 1, the current "full-time equivalent" usage of Kahului harbor is estimated based on the Kahului catch of "full-time" boats (Table 3). The gross (unadjusted) numbers of commercial fishing vessels and trips remain as indicated in Tables 1 and 2. Per vessel values are based on "full-time" boats. A similar "full-time" adjustment is made for Maui-wide fishing vessel activity (Table 4), using **only** those vessels that fished from Kahului in 1986.

Table 3: Kahului full-time equivalent adjustment, WITHOUT project (1)

Catch: C(F,K) = 88,811 C(P,K) = 97,784
C(K) = 186,595

Adjustment factor: C(P,K)/C(F,K) = 1.10

Trips: T(F,K) = 326 T(P,K)* = 326 X 1.10 = 359

T(K)* = 685 @ 272 LBS/TRIP

Vessels: V(F,K) = 15 V(P,K)* = 15 * 1.10 = 16.5
V(K)* = 31.5

T(K)/V(K) = 21.7

C represents catch in pounds.
T represents trips; V represents vessels.
Subscripts are indicated by ().
F represents full-time operators; P, part-time.
K represents Kahului-trips only
* represents adjusted figures to reflect full-time equivalents

(1) Respondents indicating they **currently** fish from Kahului.

Table 4: Maui-wide full-time equivalent adjustment, WITHOUT project (1)

C(F,M) = 267,226 C(P,M) = 158,367
C(M) = 425,594

Adjustment factor: C(P,M)/C(F,M) = 0.59

T(F,M) = 1019 T(P,M)* = 1019 X 0.59 = 601

T(M)* = 1620 @ 262 LBS/TRIP

T/V = 51.4 V* = 31.5

C represents catch in pounds.
T represents trips; V represents vessels.
Subscripts are indicated by ().
F represents full-time operators; P, part-time.
M represents Maui-wide trips.
K represents Kahului-trips only
* represents adjusted figures to reflect full-time equivalents

(1) Includes only those vessels **currently** fishing from Kahului.

WITHOUT Project Economic Condition

These results were entered into a vessel operations simulator which combines catch, revenue and vessel cost information to calculate net revenue. Aggregate cost data shows that these vessels have fixed costs of $3979 per year plus a capital cost of $3062 on an investment of $31,233. The vessels operate at a cost of $141 per trip, excluding a 29.5% crew share. The average price of fish landed by the respondents was $2.14 in 1986. With an average catch per trip of 262 pounds, revenue per trip was $561, and crew share was $124 per trip. Average estimated gross revenue per vessel was $28,819 per year WITHOUT the project.

The results from the vessel operations simulator are shown in Spreadsheet #1.

These data show the average full-time "equivalent" commercial fishing vessel which operates 22 trips per year out of Kahului harbor and 29 trips per year from other Maui sites makes $8,181 in net revenue and $6,370 in crew income.

WITH Project Economic Condition

The next step in the benefit estimation procedure is to calculate the operating characteristics **WITH** the project. Table 5 presents the survey results for expected activity levels for vessels which actually fished from Kahului in 1986 (to form a consistent basis for comparison to the WITHOUT project situation). These values are translated into "full-time equivalent" values in Table 6 and 7 for Kahului trips and Maui-wide trips.

Table 5: **WITH** Project Operating Estimates (1)
(Survey results)

	All vessels 61	"Full-time" 15	"Part-time" 51
Total Trips (per vessel) --Maui-wide	3,918 (64.2	1,295 86.3	2,623 51.4)
Kahului Trips (per vessel)	2,740 (44.9	889 59.3	1,851 36.3)
Total Catch --Maui-wide	848,718	404,521	444,197
Kahului Catch	631,214	274,132	357,082
Catch per Trip --Maui-wide	217	312	169
Kahului Catch per Trip	230	308	193

(1) Calculating **only** for vessels fishing from Kahului in 1986.

Table 6: Kahului **WITH project** full-time equivalent adjustment

--Expected Values WITH Project--

Catch: C(F,K) = 274,132 C(P,K) = 357,082
C(K) = 631,214

Adjustment factor: C(P,K)/C(F,K) = 1.30

Trips: T(F,K) = 889 T(P,K)* = 889 X 1.30 = 1158

T(K)* = 2045 @ 308 LBS/TRIP

Vessels: V(F,K) = 15 V(P,K) = 51
V(P,K)* = 15 X 1.30 = 19.5
V(K)* = 34.5 [full-time equivalents]

Trips per vessel: T(K)/V(K)* = 61

C represents catch in pounds.
T represents trips; V represents vessels.
Subscripts are indicated by ().
F represents full-time operators; P, part-time.
K represents Kahului-trips only
* represents adjusted figures to reflect full-time equivalents

Table 7: Maui-wide **WITH project** full-time equivalent adjustment

--Expected Values WITH Project--

Catch: C(F,M) = 404,521   C(P,M) = 444,197
C(M) = 848,718

Adjustment factor: C(P,M)/C(F,M) = 1.10

Trips: T(F,M) = 1,295   T(P,M)* = 1,295 X 1.10 = 1,425

T(M)* = 2,720   @ 312 LBS/TRIP

Vessels: V(M)* = 34.5 [full-time equivalents].

Trips per vessel: T(M)/V(M) = 79

C represents catch in pounds.
T represents trips; V represents vessels.
Subscripts are indicated by ().
F represents full-time operators; P, part-time.
M represents Maui-wide trips.
K represents Kahului-trips only
* represents adjusted figures to reflect full-time equivalents

Potential Resource Effect

However, although the respondents **anticipated** catching fish off Kahului at a rate of 308 pounds **WITH** the project (Table 6), the projected increase in Kahului fishing trips would lead to increased biological pressure on these fishery resources. In some cases, the overall population structure might be depressed (such as with bottom fish) while with others only their immediate density would be decreased (such as with tuna).

There is very little information available concerning the "carrying capacity" of fisheries off the north coast of Maui. Because of apparent under-reporting on official State of Hawaii Division of Aquatic Resources (HDAR) commercial fishing catch reports, and because there have been no contemporary resource surveys of the area, there is insufficient information for a precise and detailed resource assessment. Therefore we took two approaches to providing a provisional answer to the question: application of Ralston's (1987) bottom fish productivity estimates and comparison of the existing fisheries information from the north coast of Maui with similar fisheries, in particular the north coasts of Oahu and Molokai (neighboring islands).

The north coasts of the main Hawaiian islands are subject to strong winds and oceanographic conditions, and like most coasts in the main Hawaiian islands, the surface topography of the bottom drops off rapidly. This means that for bottom-associated fish, such as the snappers and groupers, the habitat range is narrow. Similarly, for small boat fishing methods which utilize topographical drop-offs, such as the handline tuna fisheries, there is a limited accessible range. From a fishing operations perspective, the north coasts are not nearly as easy to fish as the south and western coasts, which also have considerable bank areas associated with them. Given a choice, commercial small boat fishers have chosen the more protected grounds.

However, such protected grounds are now near their sustainable yields, and with the high demand for fresh bottom fish and tunas, commercial fishers have begun to explore the north coasts with greater intensity. An example of this can be seen in Figure 1 which shows the near doubling of handline fishing effort and catch rates off the north coast of Molokai in 1983 and 1984.

Ralston (1987) estimates bottom fish (snappers, groupers and jacks) annual productivity in the main Hawaiian islands at 286 Kg per linear nautical mile of 100 fathom (600 ft.) isobath. The north Maui 100 fathom isobath is approximately 225 nmi. so sustainable production is approximately 140,000 pounds of bottom fish annually. Ralston indicates (pers. comm.) there is no reason to expect the north coast of Maui to be less productive than other areas in the main Hawaiian islands, although absolute catch rates (catchability) may be lower due to fishing conditions.

The small boat commercial fishery on the north coast of Maui does not concentrate on bottom fish, although it will harvest these species to the extent possible. Bottom fish comprised only 20% of Kahului landings in 1983 (HDAR data). Therefore the bottom fish resource constraint is not an immediate bound on development of the fishery. The primary target species are the pelagic resources.

For the pelagic resources (tunas, mahimahi, and wahoo (ono)), the Maui fishery would have an infinitesimal effect on the Pacific-wide stocks of these species. However, there might be an immediate density effect on the stocks of fish available to north Maui fishers, i.e. the more fishing that takes place on the north coast of Maui, the less dense will be the supply of pelagic fish at any point in time, and therefore catch rates may be reduced if fishing increases substantially. Figure 2 summarizes recent fishing activity on the north coasts using HDAR data and Figure 3 shows the resource density problem for the small-boat trolling fleet operations off the north coasts of Maui, Molokai, and Oahu. Over a 5 year period, as the number of fishing trips increased, the catch per trip declined substantially. This is **not** an indication of biological resource stress, which might be true of a bottom-associated species, but of competition amongst fishers for a limited, but constantly renewing, pool of available pelagic fish. The handline fishery shows no such resource pressure (Figure 4), although the decline in catch rates on Oahu (the population center) is suggestive.

Therefore, a resource density equation was calculated from HDAR records for fishing off the north shores of Oahu, Molokai, and Maui. The equation depicts the relationship between fishing trips and catch rates over a 5-year period (Figure 3). It shows that for each 100 additional trips, the catch rate declines by 7.3 pounds per trip. We adjusted the HDAR data used in constructing the equation to account for under-reporting and the fishing power of full-time equivalent vessels. The equation is then used to estimate the resource effect on an expansion of fishing activity caused by the harbor improvement. The adjusted resource density equation is shown in Table 8.

Table 8: Resource density equation
North shores of Maui, Oahu and Molokai
(adjusted for "full-time equivalent" trips)

$$CPT(K)^* = 323.5 - [\ 0.073 \times T(K)^*\ ]$$

Linear regression results:

R^2 = .8105
N = 5
B = - 0.072601
t = 3.50

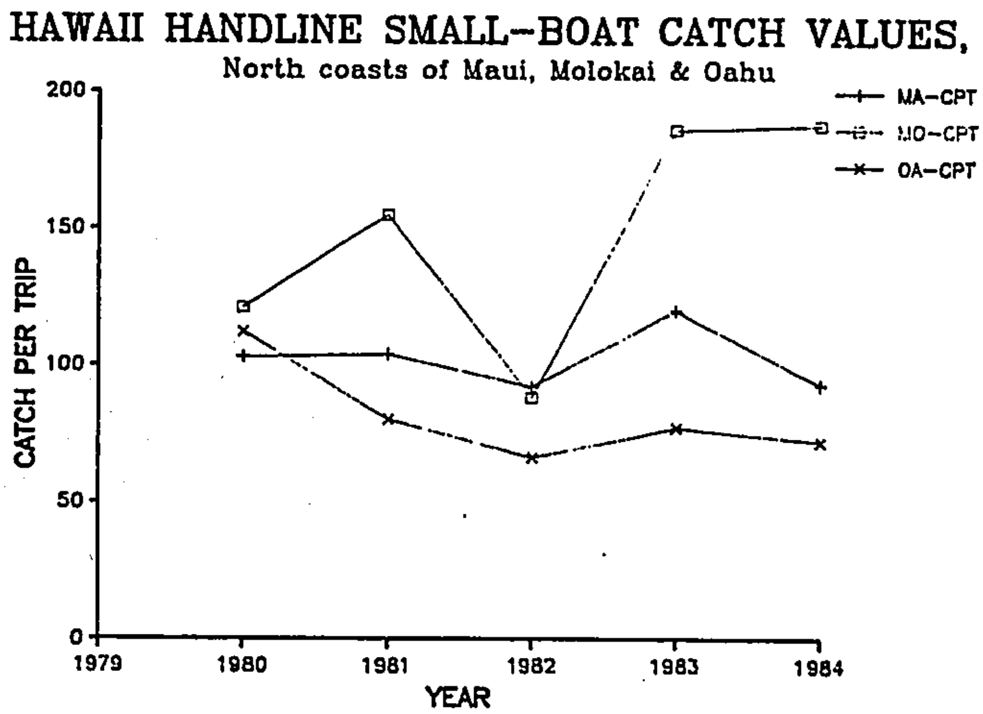
CPT represents catch per trip in pounds;
T represents the number of trips per year.
Subscripts are indicated by ().
K represents Kahului-trips only
* represents adjusted figures to reflect full-time equivalents

Data adjusted from Hawaii Division of Aquatic Resource commercial catch reports, 1980-84.

Simulation results:

Trips	Catch per trip	Catch
0	323.5	0
100	316.2	31,624
500	287.2	143,600
685	273.8	187,344
1000	250.9	250,900
2000	178.3	356,596
2045	175.0	357,938
2500	142.0	354,994

The resource density equation represents a compromise between alternative specifications of the biological and operational conditions of the fishery. It is not a true Schaefer production model because it is not species-dependent and its time period is sufficiently brief to raise questions of statistical reliability. It may exaggerate the resource density effect for pelagic species while underestimating the long-term resource effect on bottom fish species. Since the purpose of the resource density equation is to bound our estimates of potential fisheries expansion, which it does quite effectively, we are confident that the true resource effect will not be the effective constraint to fisheries development off the north coast of Maui given the level of fishing anticipated by this analysis. In terms of the bottom fish resource constraint, at the optimized level of fishing effort, 20% of the anticipated catch (358,000 pounds, Table 8) would yield 71,600 pounds of bottom fish, just one half of the estimated constraint.



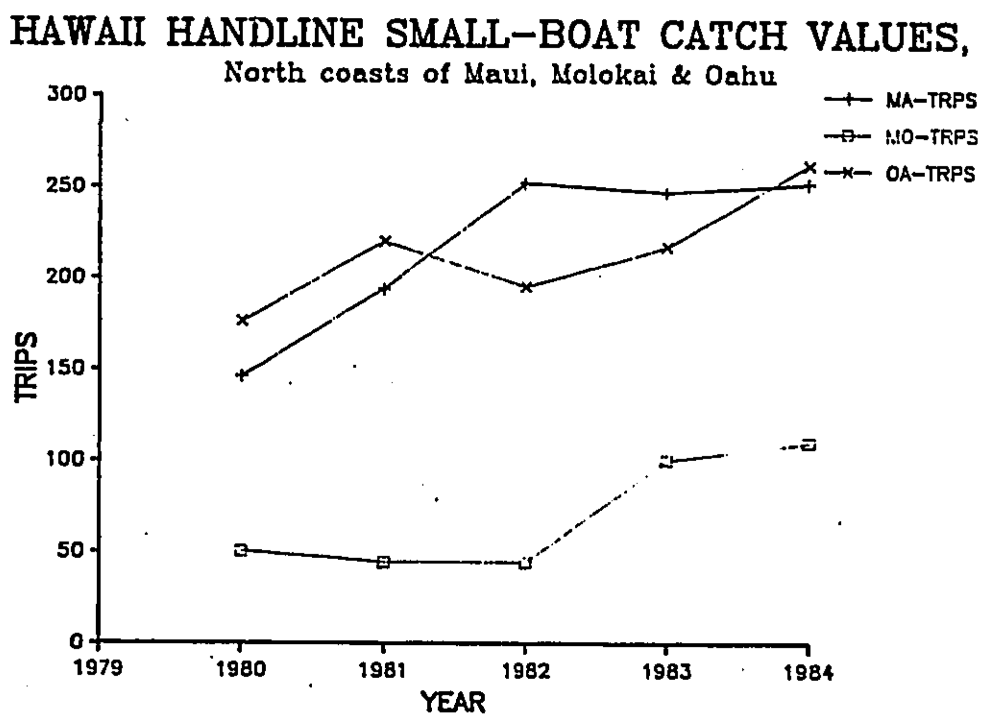
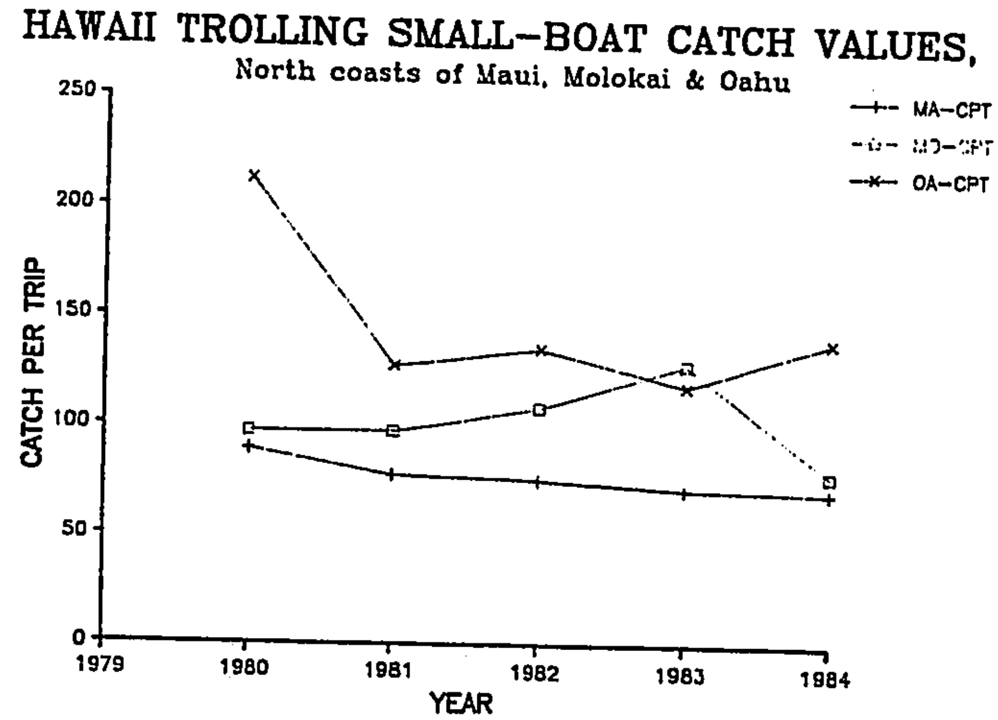


Figure 1: North coast handline fisheries
Hawaii Division of Aquatic Resources data
(Unadjusted for reporting problems or full-time equivalent levels)



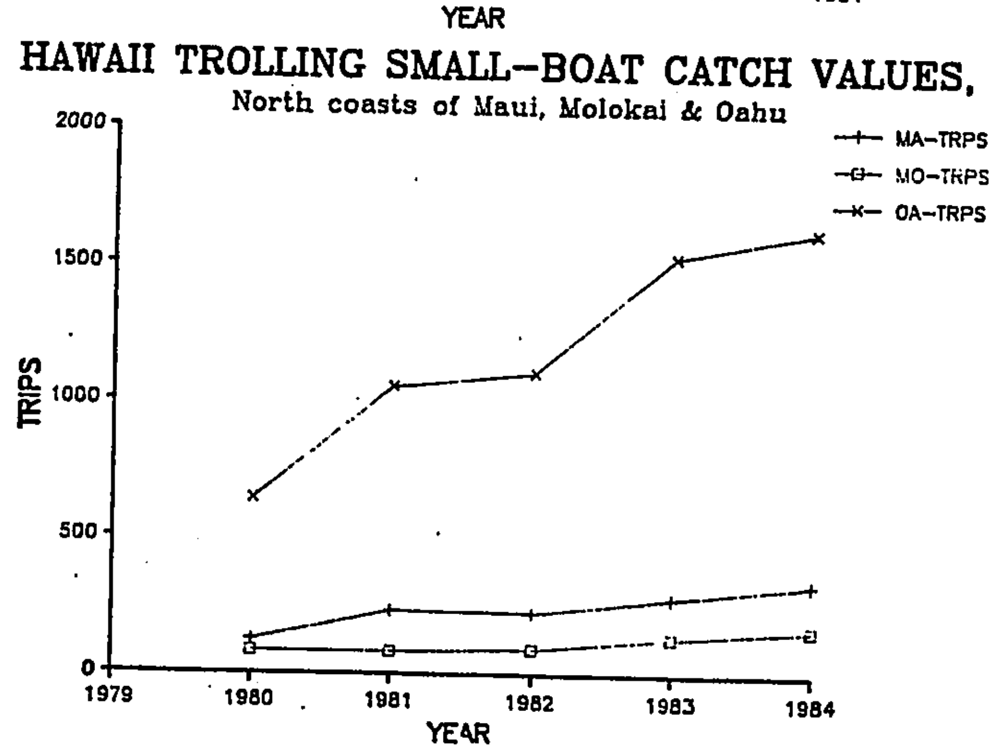
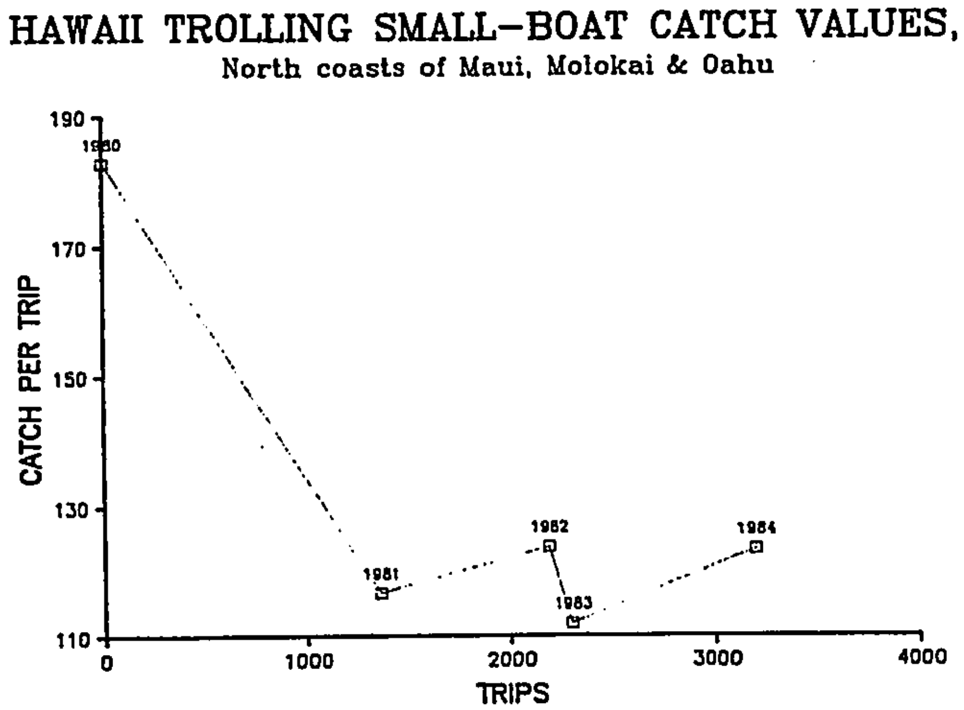


Figure 2: North coast troll fisheries
Hawaii Division of Aquatic Resources data
(Unadjusted for reporting problems or full-time equivalent levels)



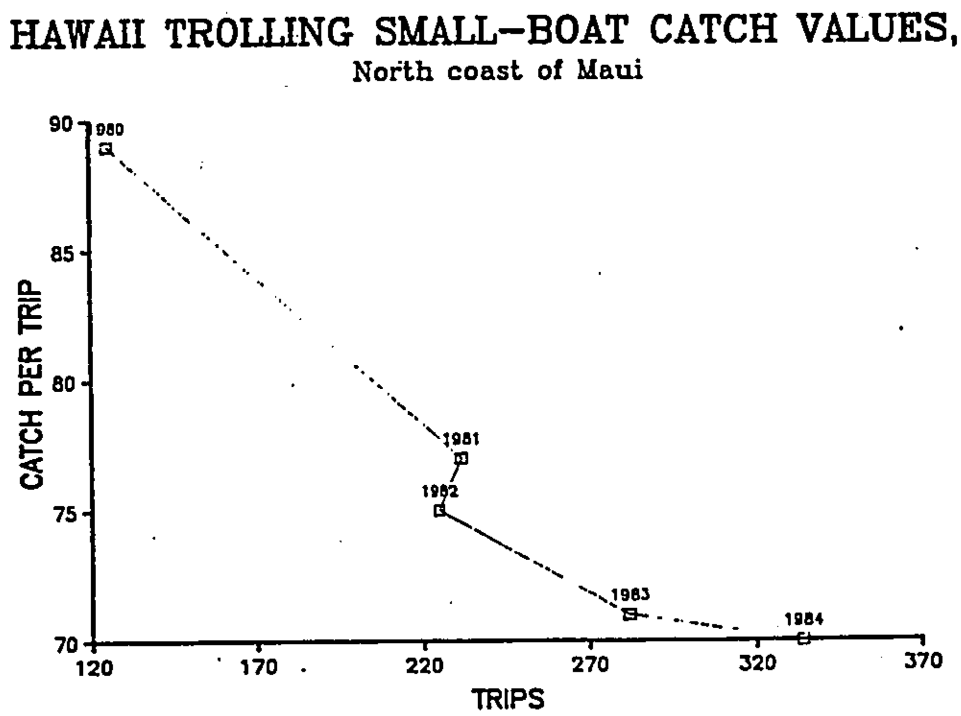
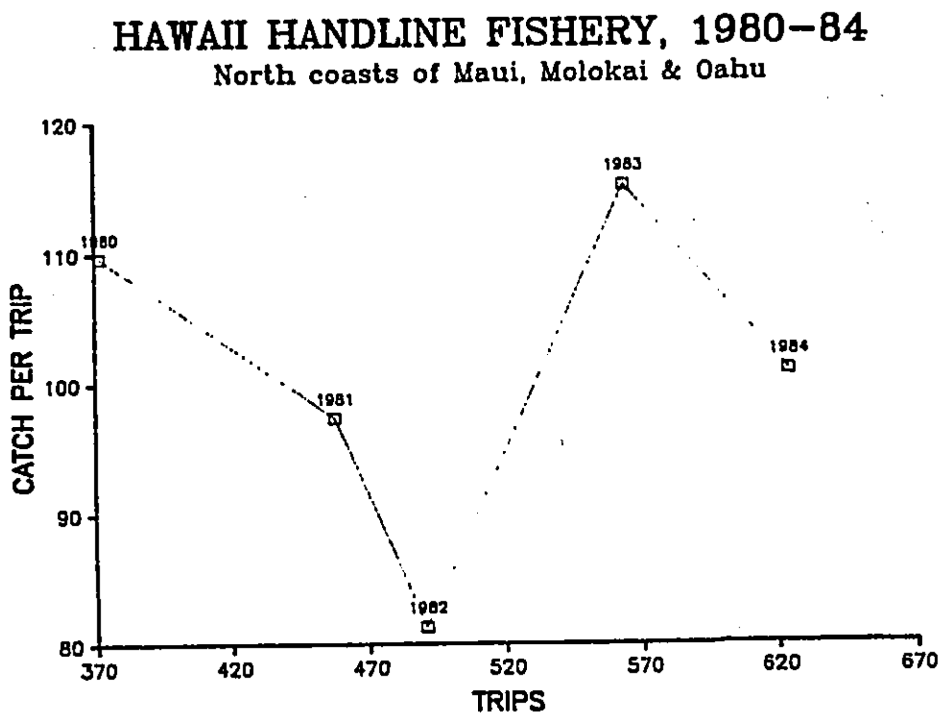


Figure 3: North coast troll fishery catch rate tendencies
Hawaii Division of Aquatic Resources data
(Unadjusted for reporting problems or full-time equivalent levels)



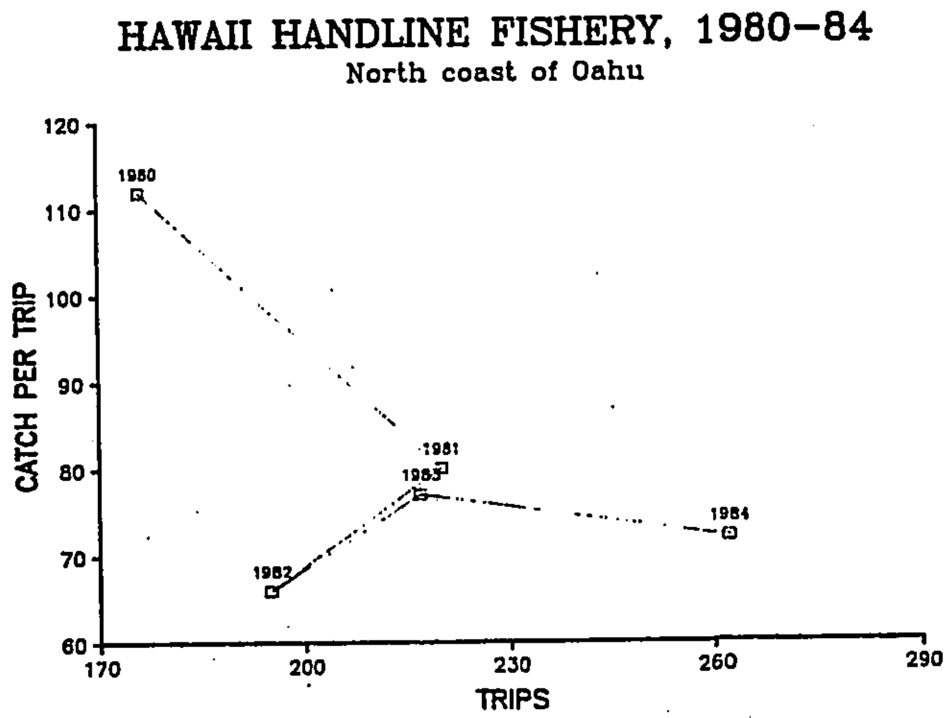


Figure 4: North coast handline fishery catch rate tendencies
Hawaii Division of Aquatic Resources data
(Unadjusted for reporting problems or full-time equivalent levels)

The estimated increase in Kahului trips is from 685 trips WITHOUT the project (Table 3) to 2045 trips WITH the project (Table 6). The effect of this increased fishing pressure is estimated to reduce catch rates by 28% off Kahului, from 272 pounds per trip (Table 3) to 197 pounds per trip (Table 9). Accounting for the difference in catch rates elsewhere in Maui, the adjusted Maui-wide catch rate is estimated at 200 pounds per trip, WITH the project. The details of this estimation are shown in the following table.

Table 9: Resource dependent effect

WITHOUT Project Condition

$CPT(K) = 323.5 - [\ 0.073 \times T(K)\ ] = 272$ pounds/trip

where $T(K) = 685$ Trips (full-time equivalent) [Table 3]

Equation may not balance perfectly due to sequential rounding.

WITH Project Condition: Kahului trips

$CPT(K)* = 323.5 - [\ 0.073 \times T(K)\ ] = 174$ pounds/trip

where $T(K)* = 2045$ Trips (full-time equivalent) [Table 6]

Equation may not balance perfectly due to sequential rounding.

Catch rate adjustment for expected values at Kahului

$CPT(K)** = CPT(K)* \times (308/272) =$
$= 174 \times 1.13 = 197$ pounds/trip

correcting for changes in fishing conditions, species composition, etc. [Kahului WITH/WITHOUT]

WITH project Maui-wide catch rate:

$CPT(M)* = CPT(K)** \times (312/308) = 200$ pounds/trip

where (312/308) represents the relative catch rates between **expected** Maui-wide landings and Kahului landings WITH the project.

CPT represents catch per trip in pounds;
T represents the number of trips per year.
Subscripts are indicated by ().
M represents Maui-wide trips
K represents Kahului-trips only
* represents adjusted figures to reflect full-time equivalents

The economic effect of the **resource dependent catch rates** is shown in Spreadsheet #2 where catch per trip Maui-wide is decreased to 200 pounds per trip (Table 9) and the number of trips increased to 79 trips (Table 7). Net revenue per vessel is $8,925, barely an improvement over the original situation.

To show the impact of the resource estimate, a spreadsheet is included which reduces the resource impact **in half** (Spreadsheet #3). The net revenue in this situation is substantially higher ($15,583), obviously, as is the situation with **no resource effect**, as shown in Spreadsheet #4 ($22,240).

Since the resource effect is so significant, we computed the optimized mix of Kahului and non-Kahului trips by reducing the planned trips **from Kahului** WITH the project (but keeping the total number of Maui-wide trips per vessel the same, i.e. 79), using the full resource effect. This effectively increased the Kahului catch rate to 249 and the overall catch rate to 252 pounds per trip. The **optimized activity level** results are shown in Spreadsheet #5: net revenue is $16,276 which is a net revenue WITH the project of $15,107.

Total Project Benefits

Net benefit WITH the project is calculated by comparing the WITH project level of total income (net revenue plus labor income) with the WITHOUT level of total income. Labor income is included as a net benefit because the increase in trips is marginal, i.e. crew time can be obtained without cost to alternative sources of income. The alternative net benefit estimates per vessel are shown in Table 10.

Table 10: Alternative estimated net benefits WITH project
(Values per vessel using the Kahului facility

	Net Revenue + Labor Income	Total Income	Net Benefit*
WITHOUT Project (Spreadsheet #1)	$8,181 +6,370	$14,551	N/A
WITH Project			
Full constraint (Spreadsheet #2)	8,925 +6,681	15,606	$1,055
Half constraint (Spreadsheet #3)	15,583 +9,467	25,050	10,499
No constraint (Spreadsheet #4)	22,240 +12,252	34,492	19,941
Optimized (Spreadsheet #5)	15,107 +9,268	24,375	9,824

* Net Benefit = Total Income (WITH) - Total Income (WITHOUT)

Total project benefits can be calculated from any of the alternative net benefit estimates, depending on ones assessment of the uncertainties in the resource effect. Net benefits per vessel are multiplied by the number of vessels expected to participate in the project (on a full-time equivalent basis). The optimized net revenue figures (Spreadsheet #5) project an **increase in total income** WITH the project of $338,928 per year for a "full-time equivalent" fleet of 34.5 vessels (Table 11). The increase in **net revenue** (i.e. **without** labor income) WITH the project in the optimized situation is $238,947.

Table 11: Total net benefits WITH project, fleet-wide

	Net Revenue basis	Total Income basis
	Net Benefit *	Net Benefit **
Full constraint (Spreadsheet #2)	$25,668	$36,398
Half constraint (Spreadsheet #3)	255,369	362,216
No constraint (Spreadsheet #4)	485,036	687,965
Optimized (Spreadsheet #5)	238,947	338,928

* Net Benefit = [Net Revenue (WITH) - Net Revenue (WITHOUT)] X 34.5 "full-time equivalent" vessels

** Net Benefit = [Total Income (WITH) - Tome Income (WITHOUT)] X 34.5 "full-time equivalent" vessels

The estimated gross number of full-time and part-time commercial fishing vessels which would operate from Kahului WITH the project is 72, an increase of 12 from the WITHOUT project situation. The gross number of expected trips from Kahului would be 2,740 trips, an increase of 110%.

Conclusion

It is an unfortunate fact that the biology of Hawaii's marine resources seems to limit their exploitation by small fishing vessels, despite the apparent breadth of our oceanic surroundings. However, the experience of the tremendous growth in the ika shibi and palu ahi fisheries on the Big Island of Hawaii indicates that estimates of resource dependency based on underutilized fishing grounds may prove to be overly conservative.

The optimized activity benefits ($339,000) appear to be a realistic estimate based on the available information. The tremendous avidity with which the Maui fishing community turned out to support improved facilities at Kahului can be used as "key respondent" evidence on anticipated fishery conditions. Even the unconstrained project benefits ($687,964) may not be excessive, while the fully-constrained ($36,398) benefit levels are almost certainly conservative. In a situation where the statistical data base is small and weak, it is prudent to weigh heavily the commentary of those who are experienced in the fishery. The optimized activity benefits lie appropriately in the middle.

-0-

Reference

Ralston, Stephen and Kurt E. Kawamoto.
1987. An assessment and description of the status of bottom fish stocks in Hawaii. Southwest Fisheries Center Administrative Report H-87-7, 55p.

Acknowledgment

A.C. Todoki and J.J. Czyz performed most of the computer summaries of the HDAR data contained in this report.

Kahurep2

Spreadsheet #1: WITHOUT Project Condition

Combined estimate of operating characteristics
1987

Income Statement	Full-time operation Survey Data	
Revenue		$28,819
Fixed Costs		$7,041
Capital Cost & Recovery	$3,062	
Annual Repair	$2,755	
Vessel Insurance	$507	
Other	$717	
Operating Costs		$13,597
Fuel & Oil	$2,806	
Ice	$766	
Bait	$1,326	
Handling	$252	
Supplies	$714	
Gear	$1,054	
Other	$308	
Crew Share	$6,370	
Total Cost		$20,638
Net Revenue		$8,181

Operating Parameters

Investment	$31,233	
Trips	51	
Catch per trip	262	13,467
Crew share	29.50%	
Crew	1	
Product Price per pound	$2.14	$28,819

Decimals suppressed in some displays.

File Name MAUIc12 2/11/1988

Spreadsheet #2: WITH Project Condition, Full resource constraint

Combined estimate of operating characteristics
1987

Income Statement	Full-time operation	
Revenue		$33,726
Fixed Costs		$7,041
Capital Cost & Recovery	$3,062	
Annual Repair	$2,755	
Vessel Insurance	$507	
Other	$717	
Operating Costs		$17,760
Fuel & Oil	$4,302	
Ice	$1,174	
Bait	$2,033	
Handling	$386	
Supplies	$1,095	
Gear	$1,615	
Other	$473	
Crew Share	$6,681	
Total Cost		$24,801
Net Revenue		$8,925

Operating Parameters

Investment	$31,233	
Trips	79	
Catch per trip	200	15,760
Crew share	29.50%	
Crew	1	
Product Price per pound	$2.14	$33,726

Spreadsheet #3: WITH Project Condition, Half resource constraint

Combined estimate of operating characteristics
1987

Income Statement	Full-time operation Survey Data	
Revenue		$43,170
Fixed Costs		$7,041
Capital Cost & Recovery	$3,062	
Annual Repair	$2,755	
Vessel Insurance	$507	
Other	$717	
Operating Costs		$20,546
Fuel & Oil	$4,302	
Ice	$1,174	
Bait	$2,033	
Handling	$386	
Supplies	$1,095	
Gear	$1,615	
Other	$473	
Crew Share	$9,467	
Total Cost		$27,587
Net Revenue		$15,583

Operating Parameters

Investment	$31,233	
Trips	79	
Catch per trip	256	20,173
Crew share	29.50%	
Crew	1	
Product Price per pound	$2.14	$43,170

Spreadsheet #4: WITH Project Condition, No resource constraint

Combined estimate of operating characteristics
1987

Income Statement	Full-time operation Survey Data	
Revenue		$52,613
Fixed Costs		$7,041
Capital Cost & Recovery	$3,062	
Annual Repair	$2,755	
Vessel Insurance	$507	
Other	$717	
Operating Costs		$23,332
Fuel & Oil	$4,302	
Ice	$1,174	
Bait	$2,033	
Handling	$386	
Supplies	$1,095	
Gear	$1,615	
Other	$473	
Crew Share	$12,252	
Total Cost		$30,373
Net Revenue		$22,240

Operating Parameters

Investment	$31,233	
Trips	79	
Catch per trip	312	24,586
Crew share	29.50%	
Crew	1	
Product Price per pound	$2.14	$52,613

Spreadsheet #5: WITH Project Condition, Optimized scenario

Combined estimate of operating characteristics
1987

Income Statement	Full-time operation Survey Data	
Revenue		$42,495
Fixed Costs		$7,041
Capital Cost & Recovery	$3,062	
Annual Repair	$2,755	
Vessel Insurance	$507	
Other	$717	
Operating Costs		$20,347
Fuel & Oil	$4,302	
Ice	$1,174	
Bait	$2,033	
Handling	$386	
Supplies	$1,095	
Gear	$1,615	
Other	$473	
Crew Share	$9,268	
Total Cost		$27,388
Net Revenue		$15,107

Operating Parameters

Investment	$31,233	
Trips	79	
Catch per trip	252	19,858
Crew share	29.50%	
Crew	1	
Product Price per pound	$2.14	$42,495

Appendix A

Kahului Special Survey

US Army Corps
of Engineers
Honolulu District

KAHULUI MAUI COMMERCIAL FISHING

SPECIAL SURVEY

AUGUST 1987

This survey is designed to get up-to-date and accurate information on commercial fishing practices from those of you who use or might use Kahului harbor.

Your answers to this survey are important to us. Your answers will be kept confidential and we will let you know the overall results.

If you do not have a fishing boat, please answer the first question of the survey and return the survey to us anyway.

Thank you!

....

Planning Branch
Pacific Ocean Division
Corps of Engineers
Fort Shafter, HI 96858

WHEN YOU HAVE COMPLETED THE SURVEY,
PLEASE RETURN IT IN THE ENCLOSED ENVELOPE
AS SOON AS POSSIBLE.

[No later than September 4th!]

CONFIDENTIAL .... CONFIDENTIAL

KAHULUI SPECIAL SURVEY

Please fill in the blanks as appropriate.

If you need to explain any answers, please write along the side or enclose a separate sheet.

About your Boat

Q1 Do you have a fishing boat on Maui? [check 1]

_____ Yes _____ No

If No, thank you for your interest. Please return the survey to us anyway. Thanks!

Q2 Is your boat moored or trailered? [Check 1]

Moored _____ Trailered _____

Fishing Trips

During 1986, how many of the following types of fishing trips did you take on Maui?

		1986
Q3	Commercial fishing trips (primarily to sell catch)	_______ trips
Q4	Fishing for food (family or friends)	_______ trips
Q5	Recreational fishing (primarily for sport)	_______ trips
Q6	Other (Please describe) ____________________	_______ trips

Q7 How many fishing trips have you taken so far in 1987?

_______ trips so far in 1987

KAHULUI SPECIAL SURVEY

More about Your Fishing Trips

How many of your fishing trips in 1986 were from ...

		1986
Q8	... Kahului	_______ trips
Q9	... Hana	_______ trips
Q10	... other north shore Maui sites	_______ trips
Q11	... Maalaea or Lahaina	_______ trips
Q12	... other Maui areas	_______ trips

Catch

What was your average catch per trip in 1986?

Q13 ... off Kahului _______ pounds / trip

Q14 ... off other areas _______ pounds / trip

Trip Time

How many hours do you spend actually fishing on an average trip?

[as compared to driving to the harbor, launch time, and at-sea transit time]

Q15 _______ fishing hours/ trip

KAHULUI SPECIAL SURVEY

Annual Costs

Now we need to know some details about your fishing costs, and then about your revenue. Your answers will be confidential.

Q16 Annual repairs & haulout $ ________ / year
(Choose an average if your expenses go over several years.)

Q17 Boat insurance $ ________ / year

Q18 Replacement parts/gear $ ________ / year

Other (please describe)

Q19 ____________ $ ________ / year

Q20 ____________ $ ________ / year

Q21 How much is your boat worth today?
(including gear & equipment) $____________

Damage

Q22 Have you ever damaged your boat launching or mooring in Kahului harbor? [Check 1]

Yes ____ No ____

If Yes,

please list the two most recent times:

Q23 Date ________ (approximately) Damage $ ________

Q24 Date ________ (approximately) Damage $ ________

If there was a previous time when your boat sustained more damage at Kahului harbor, please list it.

Q25 Date ________ Damage $ ________

KAHULUI SPECIAL SURVEY

Trip Costs

The following questions are about your costs and revenues per trip. If you take different types of trips, please think of an "average" trip when answering.

How much does it cost per trip to operate your boat?

Q26&27 Fuel $________ for ______ gallons

Q28&29 Oil $________ for ______ quarts

Q30&31 Ice $________ for ______ pounds

Q32&33 Bait $________ for ______ pounds

Q34 Handling $________
(Cost to sell your catch, such as auction fees or transportation)

Q35 Gear $________
(Gear which might be used up on a single trip, such as lures, leader, and gloves.)

Q36 Supplies $________

Other
(Please describe)

Q37 ____________ $________

Q38 ____________ $________

Q39 If you pay a crew share, how much do you pay per trip?

$ ________ / trip or _____ % of revenue

Q40 Do you give yourself part of the crew share, or just keep what is left-over? [Check 1]

Pay myself part of the crew share _____

Only keep what is left _____

Trip Revenues

Q41 How much of your catch do you sell? _____ %

Q42 How much does your average catch sell for?

$ ________ / trip

Fishing experience and fishing problems

Q*1 What is the main problem with fishing off Kahului? [Please describe]

____

Q*2 If it were easier to use Kahului harbor as a commercial fishing base, what would the main benefit be to you? [Please describe]

____
(catch rates, species, less travel time, etc.)

Future Plans

Finally, this part of the survey is designed to get your opinions on future commercial fishing use of Kahului harbor.

The Corps of Engineers is considering an improved two-lane launching ramp in Kahului harbor (probably near the existing ramp) with 24 temporary mooring spaces and a deeper channel.

If the project is built,

how many fishing trips per year would you take from ...

Q43 ... Kahului harbor _____ trips/year

Q44 ... Other harbors or launch sites _____ trips/year

More about the Future

If the project were built,

Q45 what do you think your average catch rate would be from trips launched/moored at Kahului?

________ pounds / trip for Kahului trips

How many pounds of each species group did you catch in 1986 from the Kahului area and how many do you think you would catch if the new facility were built?

(Pounds Caught)
(All Year)
(Kahului area only)

		In 1986	With A New Kahului Facility
Q46&47	Tunas	______	______
Q48&49	Billfish	______	______
Q50&51	Mahimahi & Ono	______	______
Q52&53	Bottomfish	______	______
Q54&55	Reef Fish	______	______
Q56&57	Akule & Opelu	______	______
Q58&59	Other	______	______

Q60 If the project were only an improved two-lane launch ramp and did not have temporary moorings,

would you take less trips from Kahlului harbor?

Yes _____ No ____

Q61 How many trips would you take from Kahului harbor in this case?

________ trips / year from Kahului

Q*3 Can you see any major difficulties with the Corps of Engineers' proposal for improvements in Kahului harbor?

Please tell us.

As you know, we've tried to get as much public input into this project plan as possible, but we're not perfect. So, to complete the survey,

Q*4 how satisfied are you now with your chance for giving us your opinion on this project? [Check 1]

Very satisfied ____

Satisfied ____

Not satisfied ____

Not sure ____

**5 What could we do better next time?

Please tell us.

Thank you. Everyone who participates in this survey will get a copy of the overall results.

-0-

PLEASE RETURN THIS SURVEY TO US
IN THE ENCLOSED ENVELOPE
AS SOON AS POSSIBLE.

KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

NATURAL RESOURCES

APPENDIX F

APPENDIX F

NATURAL RESOURCES

TABLE OF CONTENTS

APPENDIX F

NATURAL RESOURCES

SECTION I. FISH AND WILDLIFE 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

AUG 3 1984

Colonel Michael M. Jenks
U.S. Army Engineer District, Honolulu
Bldg. 230
Fort Shafter, Honolulu 96858-5440

Re: Planning Aid Letter,
Kahului Small Boat Harbor
Study, Maui, Hawaii

Dear Colonel Jenks:

This is the U.S. Fish and Wildlife Service's (FWS) Planning Aid Letter for the expanded reconnaissance study regarding the Honolulu District's Kahului Small Boat Harbor Study. The purpose of this report is to advise you of significant fish and wildlife resources within the study areas. This report does not fully satisfy the requirements of Section 2(b) of the Fish and Wildlife Coordination Act.

The Planning Aid Letter was prepared by Andy Yuen and includes available literature and data from an inter-agency field survey conducted by John Ford (U.S. Fish and Wildlife Service) and Robert Moncrief (Honolulu District, Corps of Engineers) of the inshore areas of Kahului Bay, Maliko Bay, and a site near the Kanaha Pond Wildfowl Refuge (hereafter called Kaa Point). Robert Moncrief is acknowledged for his valuable support during the field work and writing of the report.

Description of the Planning Area

The study areas are located along the north coast of Maui. The shorelines along Kahului Bay and Kaa Point are the remnants of lithified calcareous sand dunes formed when the sea level was much lower than the present sea level (Reference 4). The Kaa Point shoreline is broken up by outcrops of beachrock and boulder groins (see Figure 1). A strip of sand dunes runs along the shore. A longshore current runs westward except during southern storms (Reference 3). During the winter, large surf breaks on the edge of the reef and causes turbid water conditions in the inshore areas. The substrate in the Kaa Point was a mixture of calcareous sand and a low relief limestone reef flat. The shallow reef flat extends northward for about 2,500 feet before sloping gradually into deeper water.

The Kahului Bay site is within the Kahului Harbor near the existing small boat launch ramp on the west breakwater (Figure 2). The substrate in the proposed berthing area consists of coral rubble, shell fragments, gravels, and sand. The currents in Kahului Harbor are dominated by tidal currents, the flood current entering and the ebb current leaving the harbor (Reference 3). Outside of the harbor, the current has a continuous westward drift and shows no tidal reversal.

Maliko Bay is at the mouth of Maliko Gulch and is a partially drowned river valley (Figure 3). The shoreline near Maliko Bay is the exposed remnants of the Honomanu volcanic series (Reference 4). A cobble and shingle beach lies at the head of the bay. The walls of the bay are lined by a boulder beach. The inshore waters of the bay are usually murky from discharges from Maliko Stream and turbid conditions often extend out to the boat launch. The substrate in the inshore areas is a gravel and cobble bottom. In the middle of the bay the substrate is comprised of boulders, cobble, gravel, and coral rubble. The boulders have a high coral cover.

Description of the Proposed Actions

The Kaa Point site consists of a 3,300-foot long entrance channel with a depth of twelve-feet, a 600-foot long breakwater, and a four-acre berthing area with a depth of ten feet (Figure 4). A portion of the shoreline would be filled along the south and west margins of the berthing area. The root of the proposed breakwater would be joined with an existing basalt rock jetty. The midsection and the toe of the breakwater would be laid on coral reef rock. The basin would be excavated in sand and rock. Blasting may be required to excavate the basin. The entrance channel would be cut through the shallow limestone reef flat.

The Kahului Harbor site consists of a 520-foot long breakwater, a 1000-foot long entrance channel with a depth of 13 feet, a 4-acre berthing site with a depth of nine feet, access channel, turning basin, launch ramps, and protective works (Figure 2). The proposed entrance channel would cut through a reef consisting of limestone boulders and sand.

The Maliko Bay site consists of an east and west breakwater, two berthing areas, and an entrance channel (Figure 5). The east breakwater has a length of 300 feet and a crest elevation of 22 feet. The west breakwater has a length of 450 feet and a crest elevation of 15 feet. The entrance channel has a width of 120 feet and a depth ranging from 10 to 14 feet. The berthing areas combined are about 9 acres in size.

Fish and Wildlife Resources Without the Proposed Project

The Kaa Point site is characterized by a low relief limestone reef flat. Table 1 is a checklist of the macrobiota found at this study site. The limited cover and relief is probably responsible for the relatively depauperate fish fauna. Close to shore, the hard substrate is colonized by soft coral, algae, and several species of echinoderms. Further offshore, scattered colonies of hard corals were present. Along the proposed entrance channel, brittle stars, sea urchins, and sea cucumbers were observed. *Holuthuria atra* was the most common echinoderm observed. Spearfishing, gill-netting, and limu-picking are popular activities along this stretch of coast (Reference 1).

The gravel and rock substrates at the Kahului Harbor site are dominated by the soft coral *Palythoa* sp. Within the proposed basin and channel, the marine algae *Cladophora fascicularis*, *Ulva fasciata*, *Stypopodium hawaiiensis*, and *Acanthophora spicifera* were common. Within the proposed project limits, 16 species of reef fishes were observed. Crabbing, gill-netting, spearing octopus, limu-picking, and catching baitfish are activities occurring within the project site (Reference 1). Table 2 is a checklist of species found at the site.

The boulder and cobble substrate of Maliko Bay supports a diverse fauna of fish and corals. At least 46 species of reef fishes and at least 7 species of hard corals were observed during the field study (Table 3). *Acanthurus triostegus sandvicensis*, other surgeon fish, and butterfly fish are particularly abundant at this site. Maliko Bay is considered one of the best akule and opelu fishing grounds on Maui (Reference 2). Pole and line fishing, spearing octopus, throw-netting, gill-netting, and catching baitfish are other activities occurring within Maliko Bay (Reference 2).

Summary of Potential Environmental Consequences

Adverse environmental impacts will result primarily from the (1) dredging and blasting of the entrance channels, turning basins, and berthing areas, (2) fills associated with the breakwater, boat ramps, and shoreside facilities (Reference 5).

There are several short-term environmental impacts associated with the construction activities. There will be local increases in turbidity and sedimentation caused by the blasting and dredging. These activites will primarily affect slow-moving benthic organisms like corals and algae. Corallivorous and herbivorous fishes will be secondarily affected by the loss of these benthic organisms. Blasting may cause localized fish and invertebrate kills. The fills associated with the breakwater and boat ramps will smother benthic fauna.

The improved launching facilities will encourage greater exploitation of the local fishery resources and will increase the potential for over-fishing certain species. It is unclear whether the productive akule and opelu fishing grounds off Maliko Bay are the result of difficult and limited fishing access or of particular marine conditions conducive to these species.

Long-term environmental impacts will result primarily from the alteration of local current patterns. Within the proposed berthing areas, reduced water circulation may cause eutrophic conditions and localized areas of oxygen depletion. Occasional discharges of petroleum products may also cause water quality degradation.

Fish and Wildlife Resources With the Proposed Project

The project will primarily affect benthic organisms. Benthic organisms within the dredging, blasting, and fill areas will be destroyed. However, the construction of the breakwaters will create new habitat space that will be suitable for subtidal and intertidal benthic organisms. The communities that develop on these new substrates may be different than the present communities. The increase in surface relief caused by dredging the entrance channels, berthing areas, and breakwater may increase the number and diversity of reef fishes, provided water quality is adequate.

Recommended Mitigation

The environmental impacts of this project are inherent to the construction activities. As such, the impacts can only be minimized and not eliminated. Silt retention screens should be deployed where practical to reduce the dispersal of fine sediments during dredging and blasting. The explosive charges should be sand-bagged to reduce incidental fish kills. Visual surveys should be conducted prior to blasting to insure that no endangered species, i.e., sea turtles or marine mammals, are within the area which might be affected by the blasting. Dredged materials should be stored on land and maintained behind berms to prevent silt discharges. No stockpiling of the dredged material in the water should be allowed.

The Maliko Bay site has the most diverse biota among the three proposed alternatives. The benthic community would be most adversely impacted by the proposed construction. The Kaa Point site, while relatively depauperate of fish and invertebrates, would have a large area impacted because of the long entrance channel that would be cut through the reef. The Kahului Harbor site, while having a high cover of Palythoa sp., is in an area altered by previous construction activities. The effects of further construction activities will only be an incremental change in the present environment of Kahului Harbor. In contrast, the construction of breakwaters, turning basins, and entrance channels at the Maliko Bay and Kaa Point sites will be a large departure from the present conditions.

We appreciate this opportunity to comment.

Sincerely yours,

Allan Marmelstein

Allan Marmelstein
Pacific islands Administrator

Enclosure

cc: HDF&W
HDAR
Director, FWS, Washington, D.C. (AHR-ES/FD)
Regional Director, FWS, Portland, Oregon (AHR)
NMFS - WPPO
EPA, San Francisco

BIBLOGRAPHY

1. Aecos, Inc. 1979. Maui Coastal Zone Atlas. Hawaii Coral Reef Inventory. Island of Maui (MICRI). Part C.

2. Clark, J. R. K. 1980. The Beaches of Maui County. The University Press of Hawaii, Honolulu.

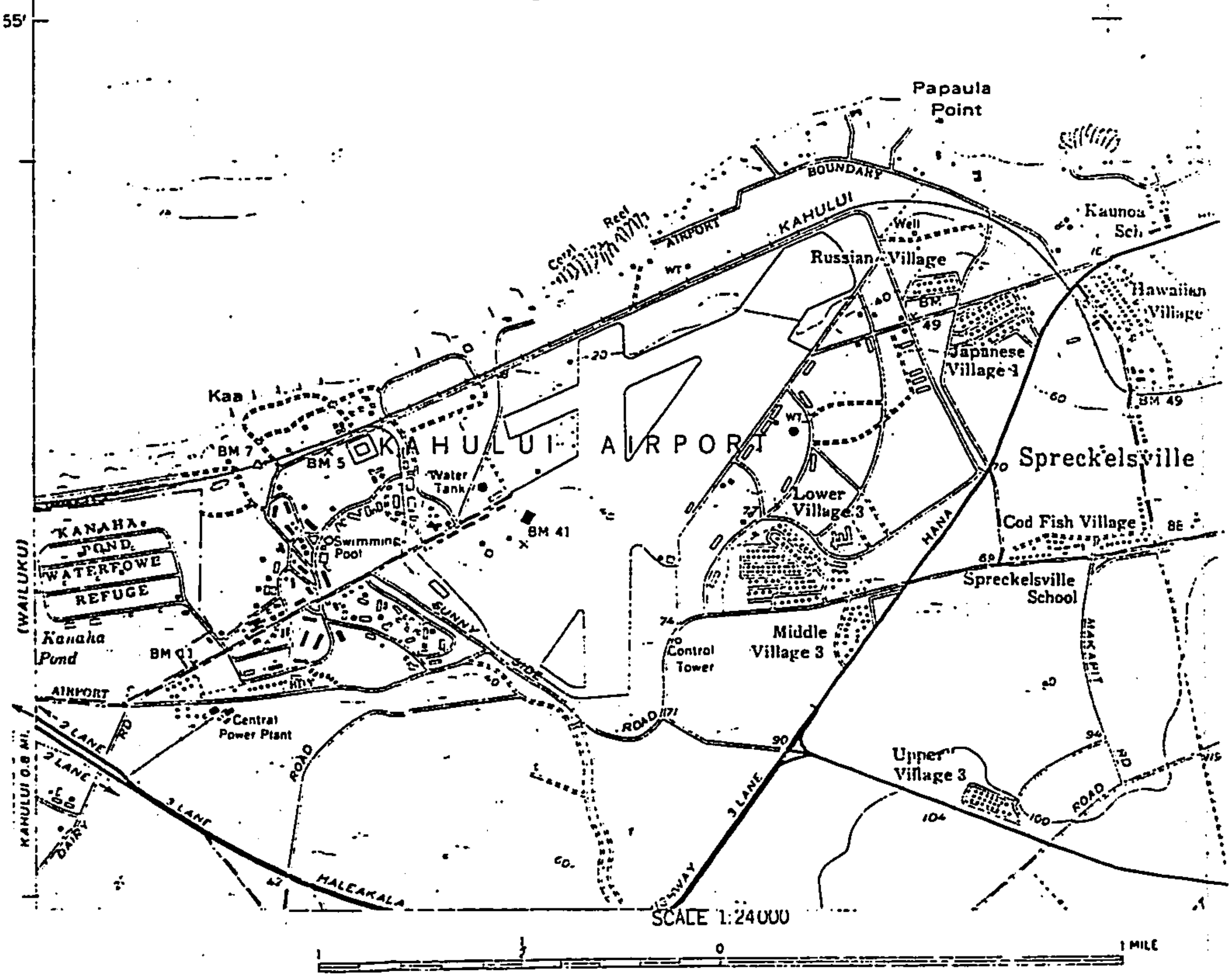
3. Laevasty, T., D. E. Avery, & D. C. Cox. 1964. Coastal Currents and Sewage Disposal in the Hawaiian Islands. University of Hawaii Institute of Geophysics, HIG-64-1.

4. Macdonald, G. A. & A. T. Abbott. 1970. Volcanoes in the Sea. The University of Hawaii Press, Honolulu.

5. Mulvihill, E. L., C. A. Francisco, J. B. Glad, K. B. Kaster and R. E. Wilson. 1980. Biological impacts of minor shoreline structures on the coastal environment: State of the art review. U.S. Fish & Wildlife Service Biological Services Program. FWS/OBS-77/51.

Spartan Reef

Figure 1. Map of the Kaa Point Area



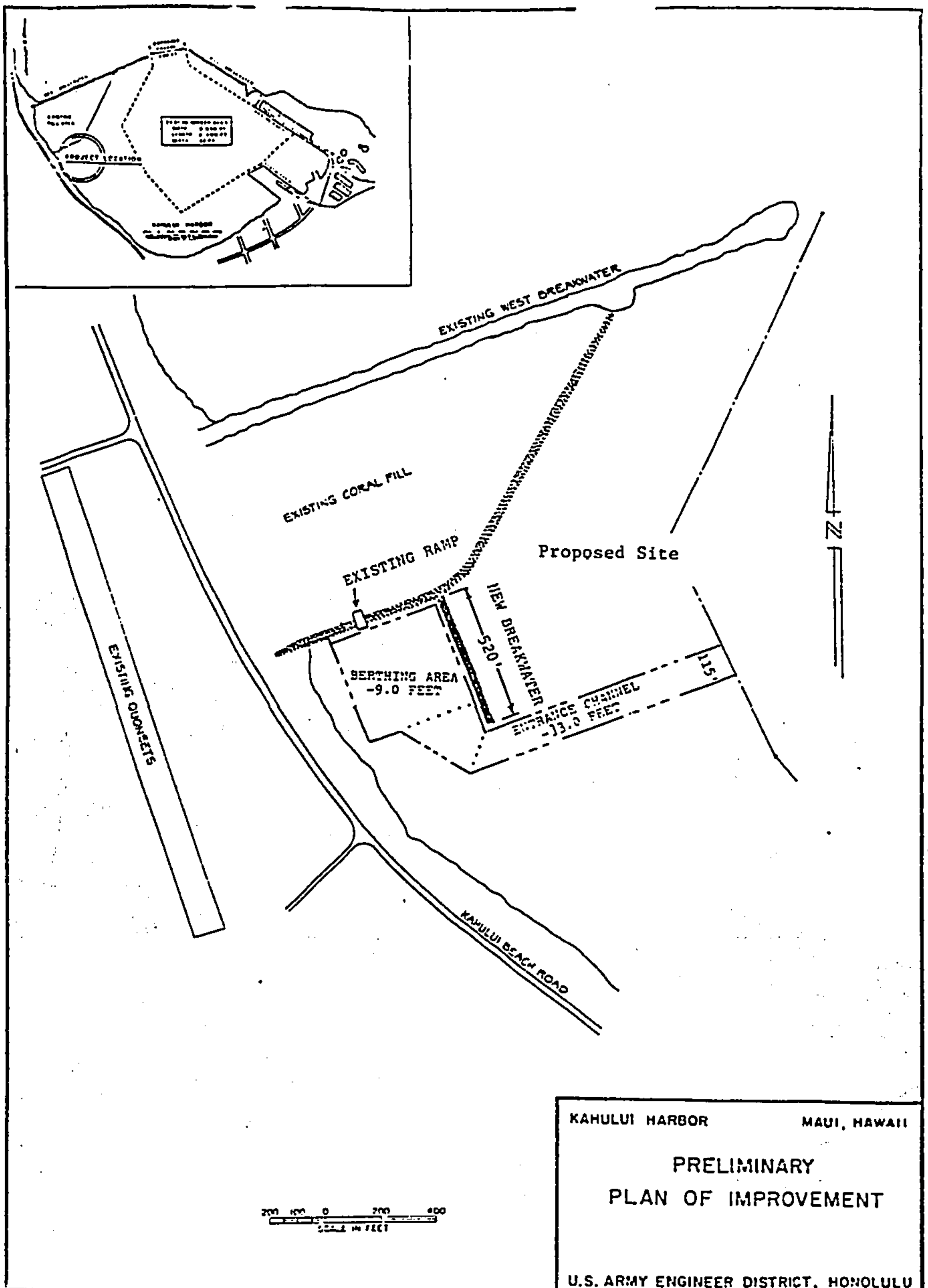
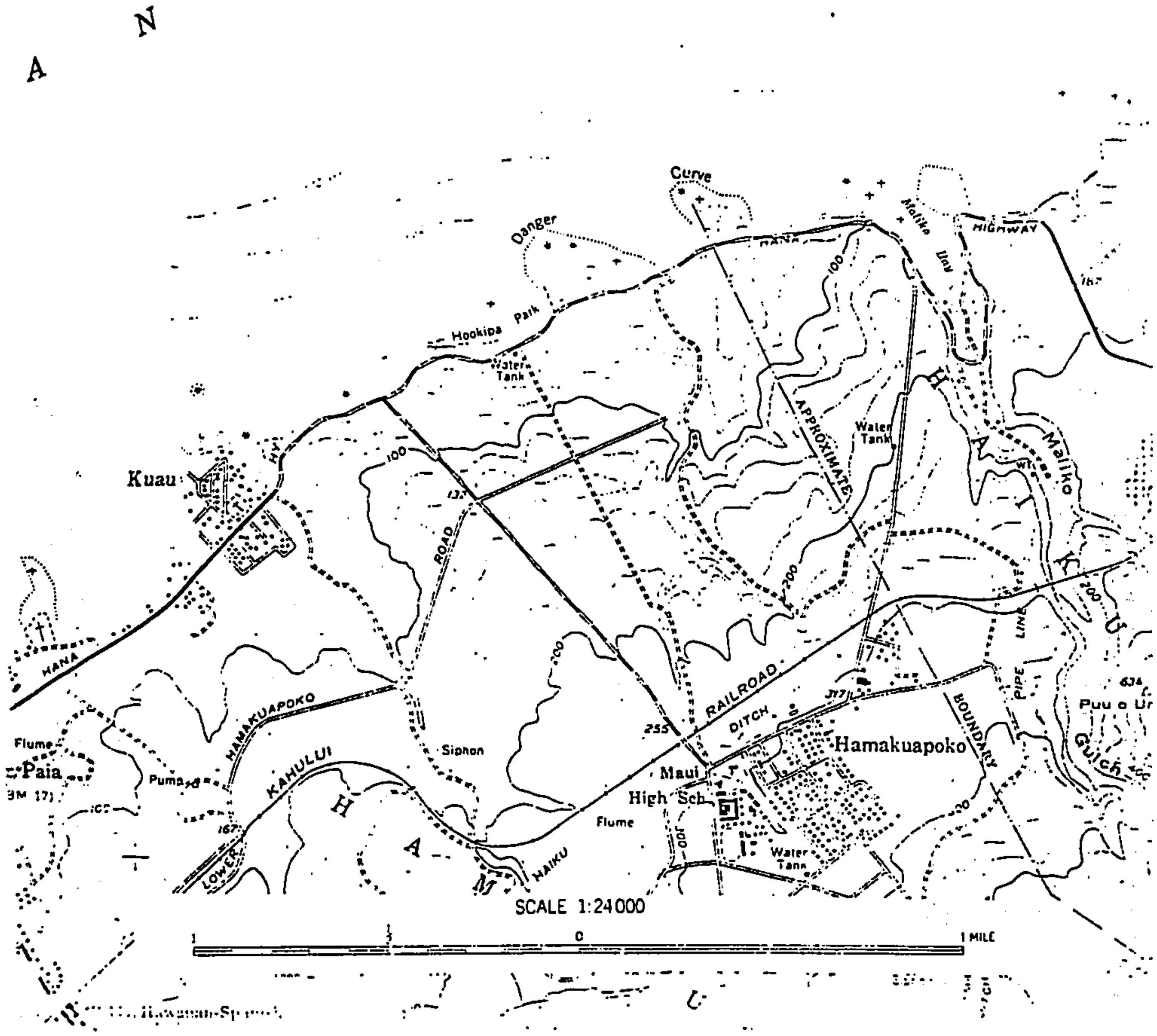

EXISTING WEST BREAKWATER
EXISTING CORAL FILL
EXISTING RAMP
Proposed Site
N
NEW BREAKWATER
520'
BERTHING AREA
-9.0 FEET
ENTRANCE CHANNEL
-13.0 FEET
115'
EXISTING QUONSETS
KAHULUI BEACH ROAD
200 100 0 200 400
SCALE IN FEET
KAHULUI HARBOR
MAUI, HAWAII
PRELIMINARY
PLAN OF IMPROVEMENT
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 2

Figure 3. Map of the Maliko Bay Area



U.S. ARMY ENGINEER DIVISION, PACIFIC OCEAN
CORPS OF ENGINEERS

PROJECT TITLE Kahului - Alt. 1 (Kanaha) SH NO. 1 OF ____ SHS
LOCATION ____ SECTION ____
DRAWING(S) NO. ____
COMPUTED BY ____ DATE ____ CHECKED BY ____ DATE ____

DESIGN ANALYSIS

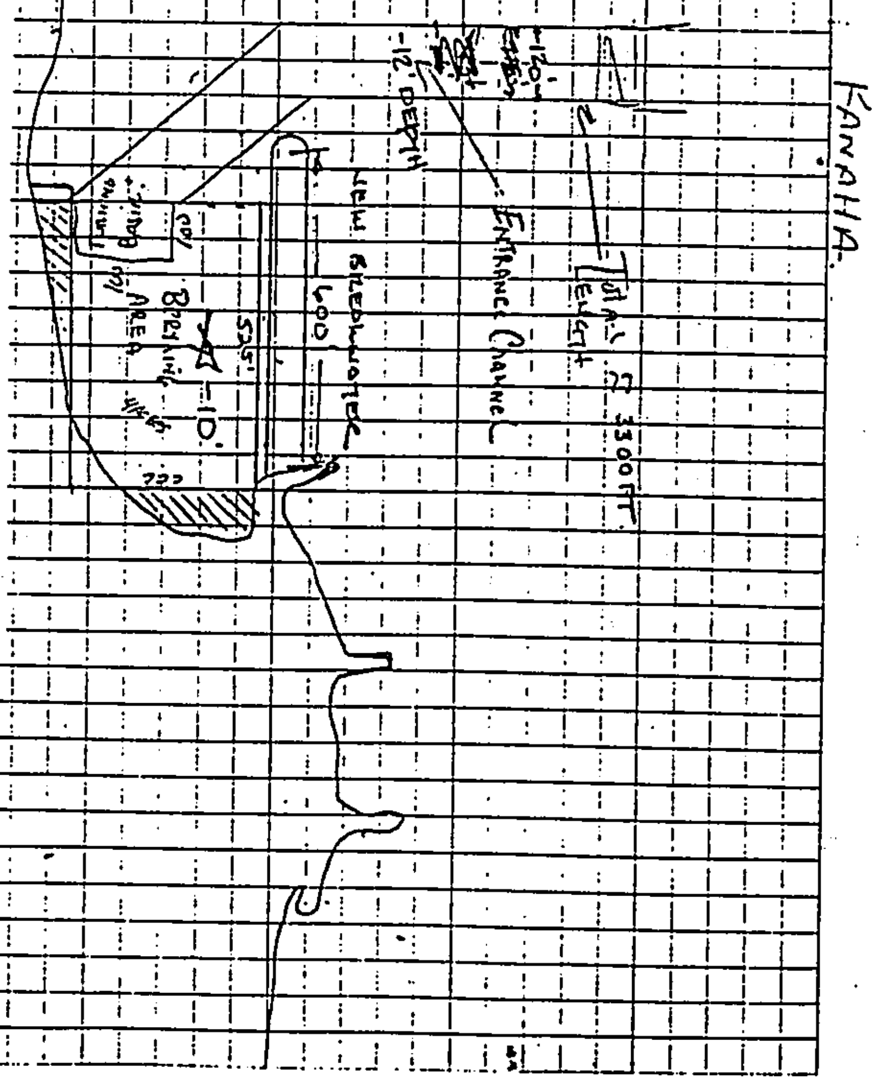


Figure 4. Kaa Point Small Boat Harbor Alternative

POD Form 115
1 Jul 70

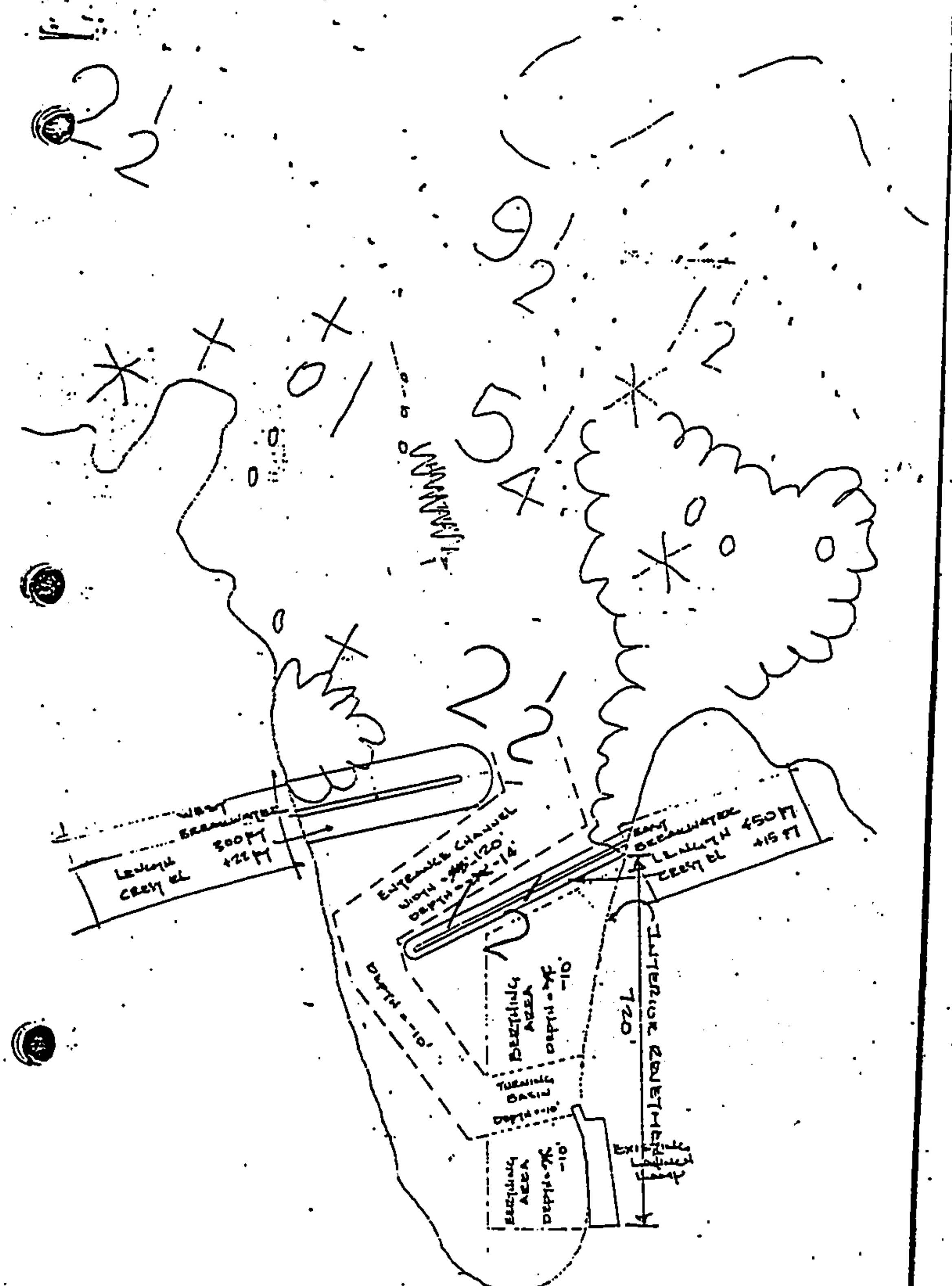


Figure 5. Maliko Bay Small-Boat Harbor Alternative

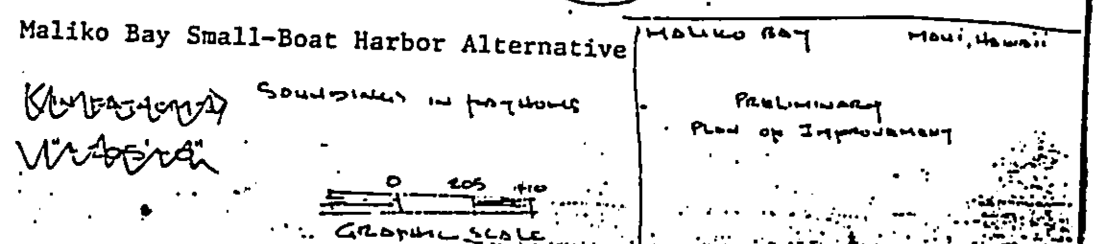


TABLE 1. CHECKLIST OF THE MACROBIOTA FOUND IN THE INSHORE WATERS NEAR THE KAA POINT SITE, MAUI, MARCH 1984

Fish

Labridae
Thalassoma duperrey Quoy and Gaimard
T. ballieui (Vaillant and Sauvage)
Pseudocheilinus sp.

Pomacentridae
Abudefduf abdominalis (Quoy and Gaimard)

Invertebrates
Cnidaria
Palythoa sp.
Pocillopora meandrina Dana
P. damicornis (Linnaeus)
Montipora flabellata Studer
M. verrucosa (Lamarck)

Echinodermata
Diadema paucispinum
Echinometra mathaei
Actinopyga mauritania
Holothuria atra
Echinothrix diadema
Ophiocoma sp.

Mollusca
Serpulorbis sp.

Algae
Padina sp.
Halimeda opuntia
Cladophora fascicularis
Acanthophora spicifera (Vahl)
Codium edule
Stypopdium hawaiiensis

TABLE 2. CHECKLIST OF THE MACROBIOTA FOUND IN THE INSHORE WATERS OF THE KAHALUI BAY SITE, MAUI, MARCH 1984

Fish

Acanthuridae
- *Acanthurus nigrofuscus* (Forskal)
- *A. nigroris* Cuvier and Valenciennes
- *A. triostegus sandvicensis* Randall
- *A. xanthopterus* Cuvier and Valenciennes
- *Ctenochaetus strigosus* (Bennett)

Ostraciidae
- *Lactoria fornasini* (Bianconi)
- *Ostracion meleagris camurum* Jenkins

Balistidae
- *Rhinecanthus rectangulus* (Bloch and Schneider)

Labridae
- *Gomphosus varius* Lacepede

Chaetodontidae
- *Chaetodon miliaris* Quoy and Gaimard
- *C. fremblii* Bennett
- *C. miliaris* Quoy and Gaimard
- *C. unimaculatus* Bloch

Pomacentridae
- *Abudefduf sordidus* (Forskal)
- *Plectroglyphidodon johnstonianus* Fowler and Ball
- *Pomacentrus jenkinsi* Jordan and Evermann

Invertebrates

Cnidaria
- *Pocillopora meandrina* Dana
- *P. damicornis* (Linnaeus)
- *P. molokensis* Vaughan
- *Montipora verrucosa* (Lamarck)
- *M. flabellata* Studer

Echinodermata
- *Echinometra mathaei*
- *Holothuria atra*
- *Actinopyga mauritiana*
- *Tripneustes gratilla*
- *Diadema paucispinum*
- *Echinothrix diadema*

Algae

Caulerpa sp.
Grateloupia sp.
Ulva fasciata
Cladophora fascicularis
Champia sp.
Acanthophora spicifera
Gracilaria bursapastoris
Stypopodium hawaiiensis

TABLE 3. CHECKLIST OF THE MACROBIOTA FOUND IN THE INSHORE WATERS OF THE MALIKO BAY SITE, MAUI, MARCH 1984

Fish

Acanthuridae
Acanthurus dussumieri Cuvier and Valenciennes
A. leucopareius (Jenkins)
A. nigrofuscus (Forskal)
A. triostegus sandvicensis Randall
A. mata Cuvier and Valenciennes
A. nigroris Cuvier and Valenciennes
Ctenochaetus strigosus (Bennett)
Naso unicornis (Forskal)

Zanclidae
Zanclus cornutus Linnaeus

Balistidae
Melicthys vidua (Solander)
Rhinecanthus rectangulus (Bloch and Schneider)

Chaetodontidae
Chaetodon fremblii Bennett
C. miliaris Quoy and Gaimard
C. ornatissimus Cuvier and Valenciennes
C. quadrimaculatus Gray
C. unimaculatus Bloch
Forcipiger flavissimus Jordan and McGregor

Kyphosidae
Kyphosus bigibbus Lacepede

Labridae
Bodianus bilunulatus Lacepede
Anampses cuvieri Quoy and Gaimard
Cheilio inermis Forskal
Labroides phthirophagus Randall
Coris flavovittatus Bennett
C. gaimard Quoy and Gaimard
Stethojulis albovittata Bonnaterre
Thalassoma duperrey Quoy and Gaimard
T. ballieui Vaillant and Sauvage
T. fuscum Lacepede

Balistidae
Melicthys vidua (Solander)
Rhinecanthus rectangulus (Bloch and Schneider)
Sufflamen bursa (Bloch and Schneider)

Ostraciidae
Ostracion meleagris camurum Jenkins

Mullidae
Mulloidichthys flavolineatus (Lacepede)

M. vanicolensis (Cuvier and Valenciennes)
Parupeneus multifasciatus (Quoy and Gaimard)
P. bifasciatus (Lacepede)
P. cyclostomus (Lacepede)
P. porphyreus (Jenkins)
P. pleurostigma (Bennett)

Pomacentridae
Abudefduf abdominalis (Quoy and Gaimard)
A. sordidus (Forskal)
Plectroglyphidodon johnstonianus Fowler and Ball
Chromis vanderbilti (Fowler)

Scaridae
Calotomus spinidens (Quoy and Gaimard)
Scarus rubroviolaceus (Bleeker)

Mugilidae
Mugil cephalus Linnaeus
Chelon engeli (Bleeker)

Reptiles
Chelonia mydas (Linnaeus)

Invertebrates

Cnidaria
Palythoa tuberculosa (Esper)
Montipora verrucosa (Lamarck)
M. flabellata Studer
Pocillopora meandrina Dana
P. damicornis (Linnaeus)
Porites lobata Dana
P. compressa Dana
Pavona duerdeni Vaughan

Echinodermata
Tripneustes gratilla
Holuthuria atra
Actinopyga mauritiana

Mollusca
Serpulorbis sp.
Isognomen sp.
Nerita picea

Algae
Ulva sp.
Galaxaura sp.
Ahnfeltia concinna J. Agardh

APPENDIX F

NATURAL RESOURCES

SECTION II. FISH AND WILDLIFE COORDINATION REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

AUG 25 1988

Colonel Francis W. Wanner
District Engineer
U.S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Re: Kahului Light Draft Navigation Improvements Study, Maui

Dear Colonel Wanner:

The enclosed letter is the Service's revised draft Fish and Wildlife Coordination Act (FWCA) report for the proposed Kahului Light Draft Navigation Improvement Study, Maui. This report supplements the Final FWCA report prepared for this project in 1985. We will prepare the final FWCA report upon your selection of a preferred alternative and final project design drawings.

Sincerely,

Allan Marmelstein
Pacific Islands Administrator

Enclosure

cc: RD, FWS, Portland, OR (AFWE)
NMFS-WPPO
DLNR
EPA, San Francisco
Planning Branch, CE

DRAFT REVISED FISH AND WILDLIFE COORDINATION ACT REPORT

KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS STUDY, MAUI

prepared by

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
HONOLULU FIELD OFFICE

prepared for

U.S. ARMY CORPS OF ENGINEERS
PACIFIC OCEAN DIVISION
FORT SHAFTER, HAWAII

August 1988

DESCRIPTION OF THE PROJECT

Kahului Harbor Sites

Six alternative project sites were identified within Kahului Harbor along the existing coral fill at the west breakwater (Figure 1). The letter descriptors for the following project alternatives do not correspond to the project alternatives described in the Service's 1985 Final FWCA report.

Plan A1 (Figure 2) consists of a two-lane launch ramp and turning basin at the existing launch ramp site. The turning basin would be 100-ft. long by 100-ft. wide with a depth of -7.5 feet. The entrance channel would be 50-ft. wide and 1,030-ft. long. A breakwater approximately 140-ft. long by 50-ft. wide would be constructed.

Plan A2 (Figure 2) consists of a two-lane launch ramp, turning basin, temporary mooring basin, breakwater, and revetted mole at the existing launch ramp site. The turning basin and entrance channel would have the same dimensions as Plan A1. The mooring basin would be 105-ft. wide by 105-ft. long and have a depth of -6.5 feet. The revetted mole would be approximately 120-ft. long by 60-ft. wide and would require filling in a portion of the shoreline to construct. The breakwater would be approximately 140-ft. long by 50-ft. wide. The entrance channel would be 50-ft. wide and 1,030-ft. long.

Plan B1 (Figure 3) is similar to Plan A1 except that the harbor improvements are located within the fill area near the existing launch ramp site. This alternative consists of a launch ramp and turning basin constructed within the fill area. The turning basin would be 100-ft. wide by 100-ft. long and have a depth of -7.5 feet. The interior basin would be revetted. The entrance channel would be 50-ft. wide and 1,030-ft. long.

Plan B2 (Figure 4) is similar to Plan A2 except that the harbor improvements are located within the fill area near the existing launch ramp site. The breakwater and revetted mole would not be required. The interior basin would be revetted. A new two-lane launch ramp would be constructed. The turning basin would be 100-ft. wide by 100-ft. long and have a depth of -7.5 feet. The mooring basin would be 105-ft. wide by 105-ft. long and have a depth of -6.5 feet. The entrance channel would be 50-ft. wide by 1,030-ft. long and have a depth of -7.5 feet.

Plan C1 (Figure 5) consists of a two-lane launch ramp and turning basin in the northeastern section of the coral fill area. The turning basin would be 100-ft. wide by 100-ft. long and have a depth of -7.5 feet. The access channel through the existing revetment would be 50-ft. wide and have a depth of -8.5 feet.

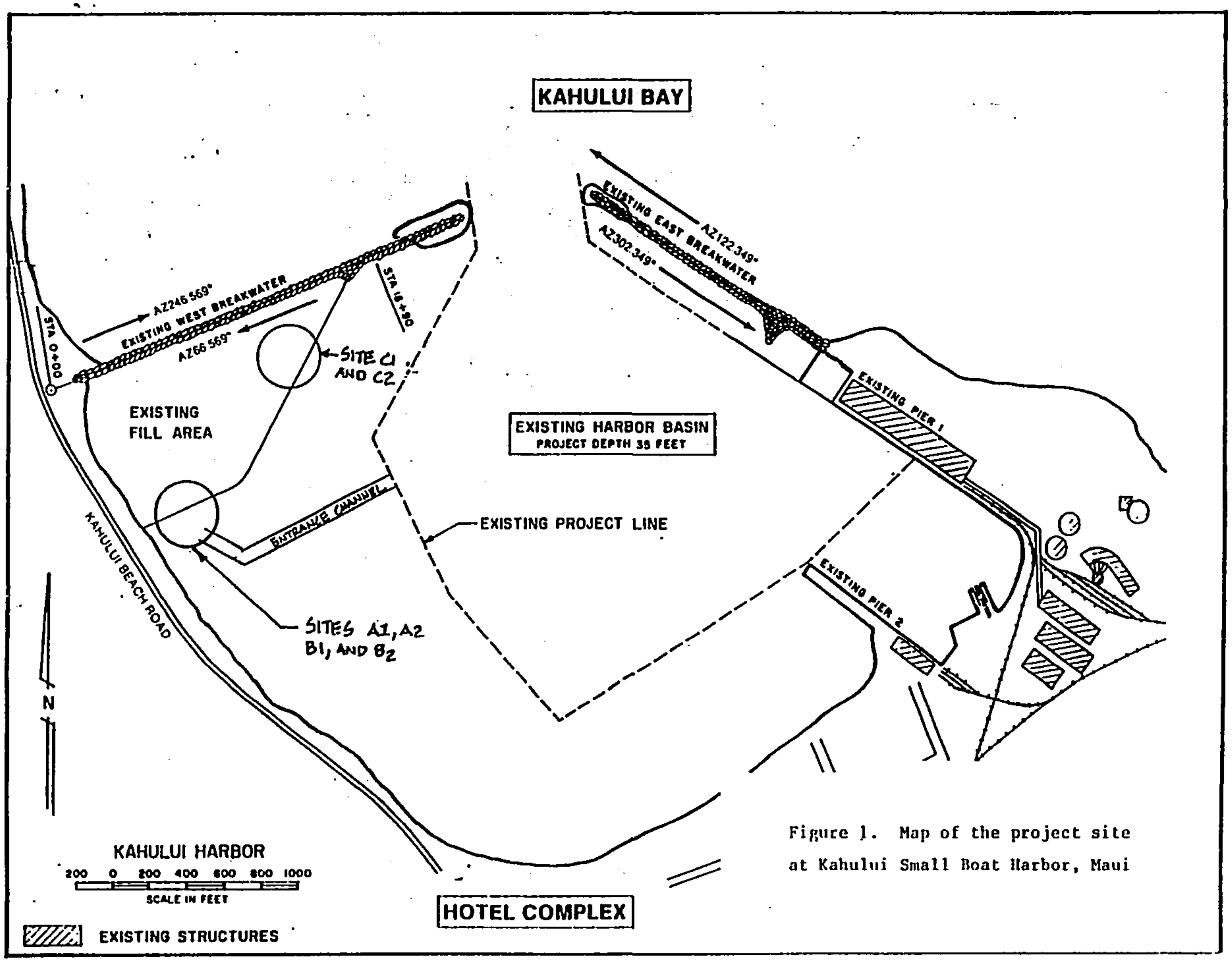


Figure 1. Map of the project site at Kahului Small Boat Harbor, Maui

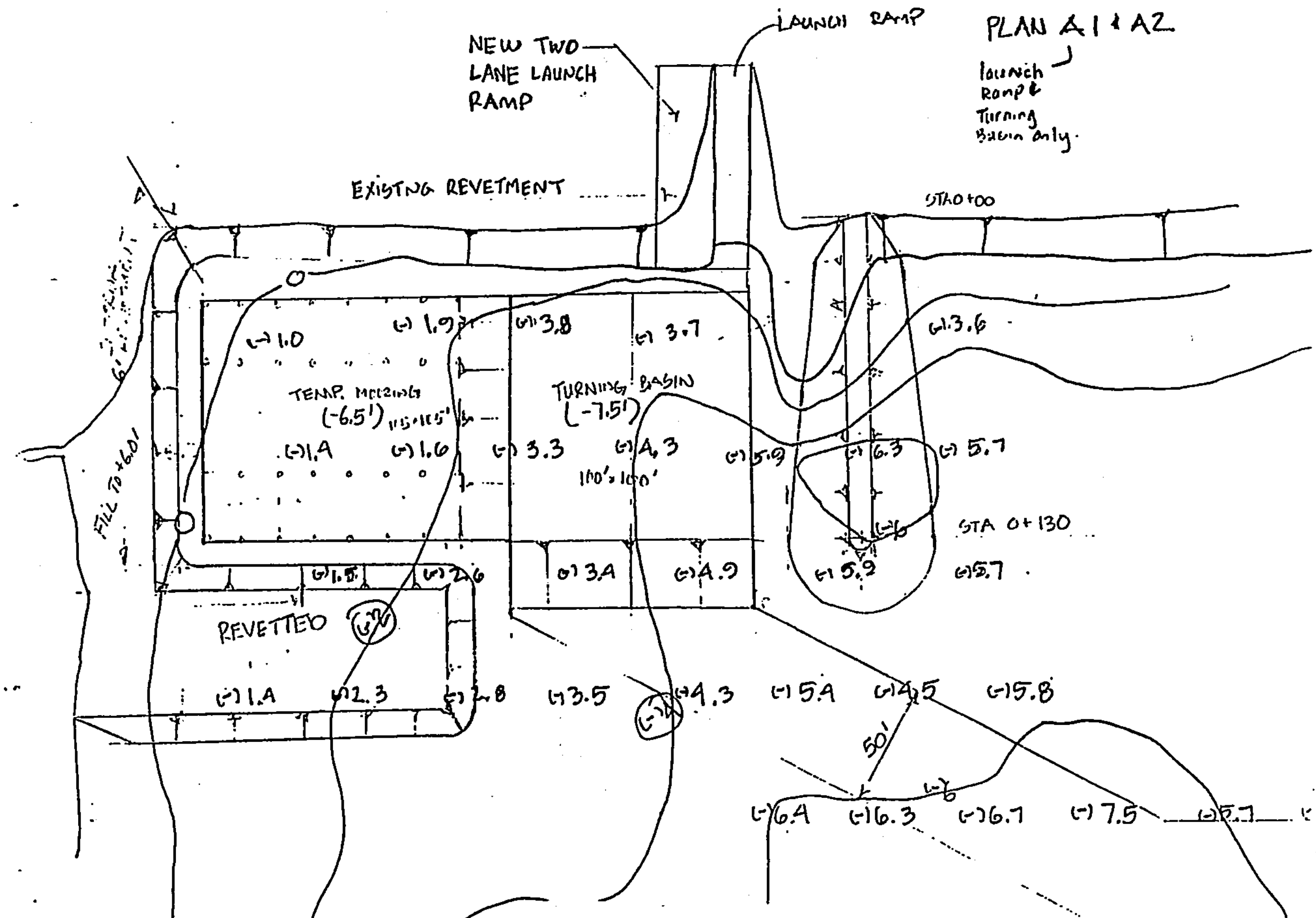


Figure 2. Alternatives A1 and A2.

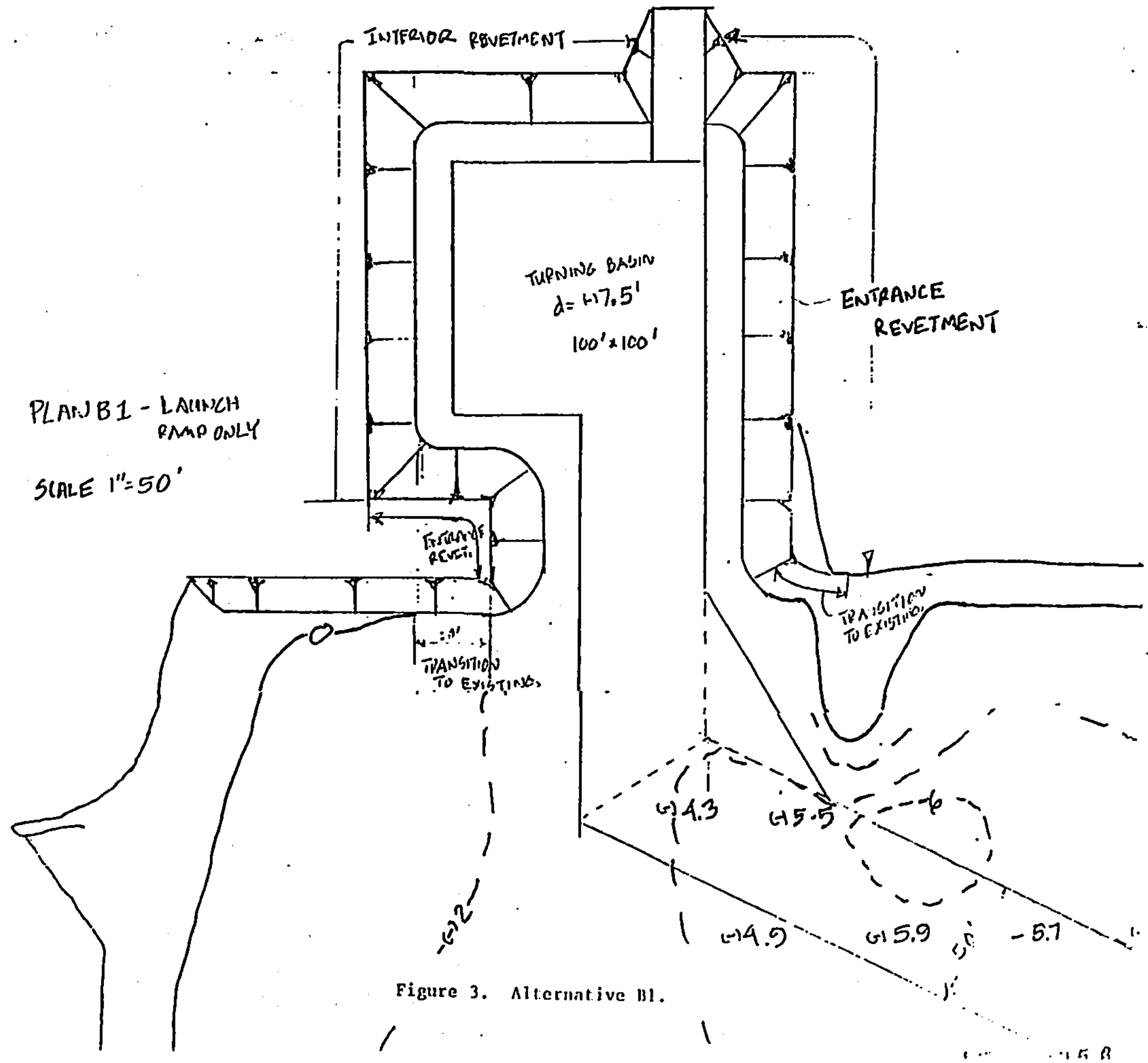


Figure 3. Alternative B1.

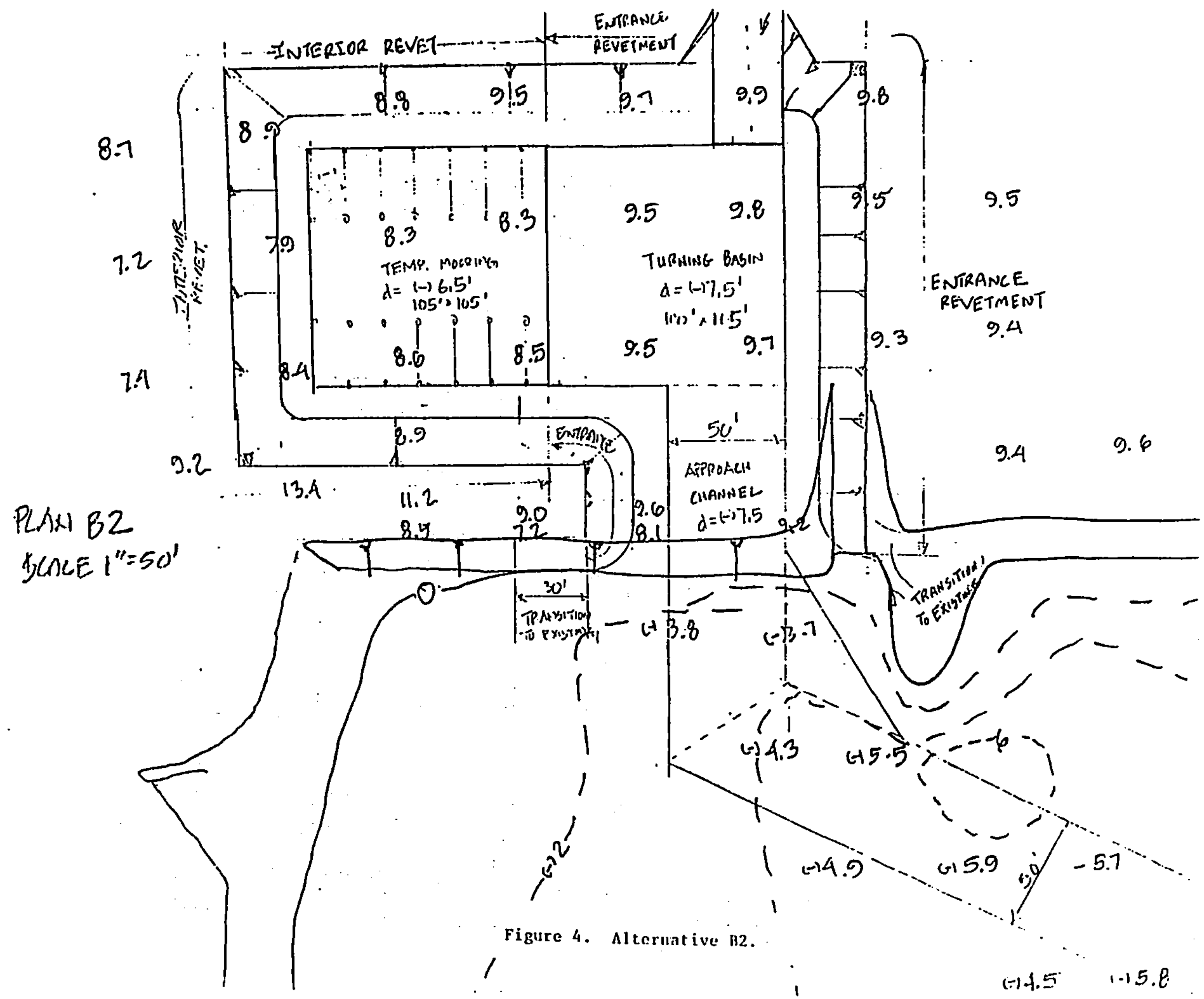


Figure 4. Alternative B2.

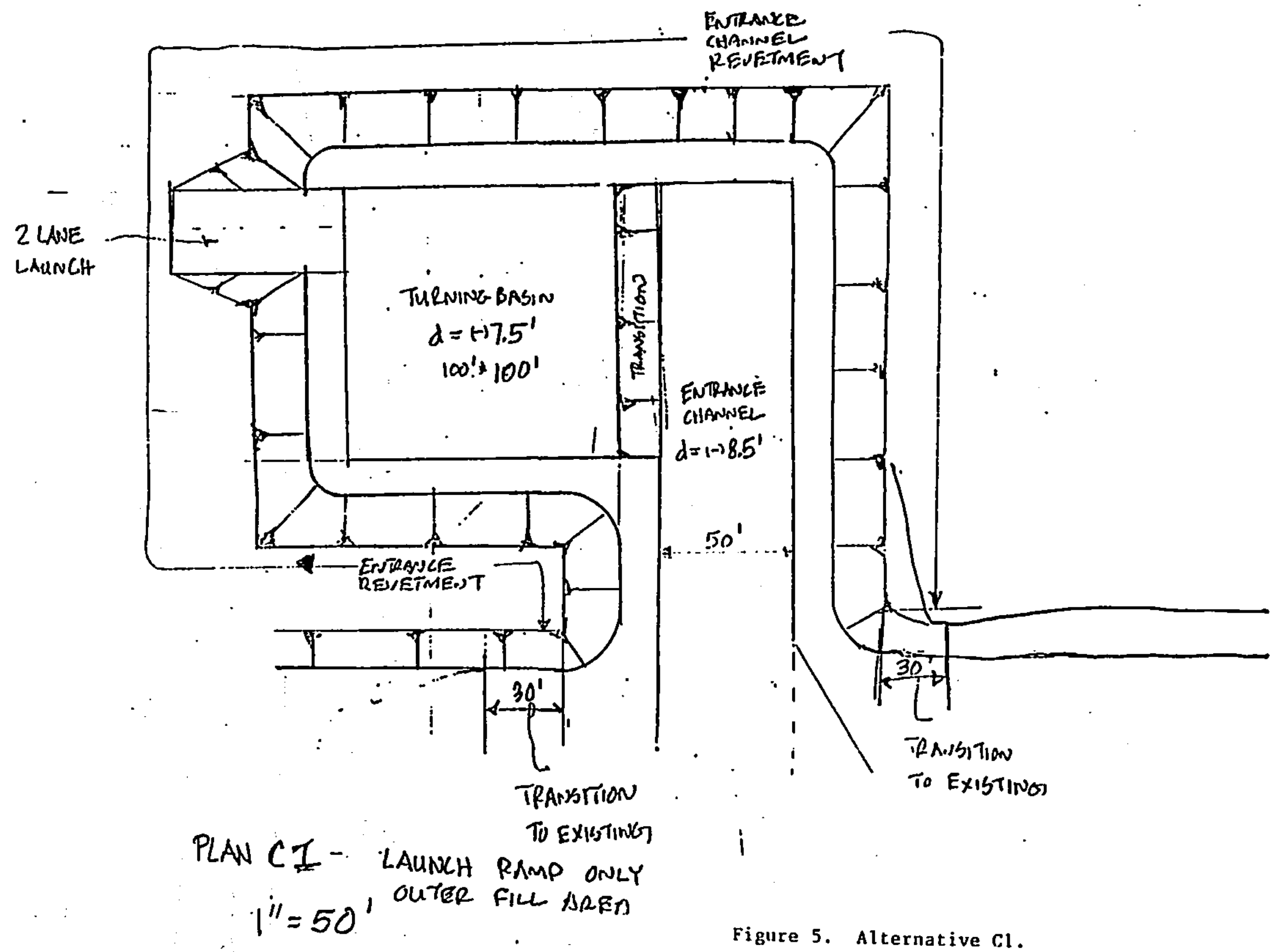


Figure 5. Alternative C1.

Plan C2 (Figure 6) consists of a two-lane launch ramp, turning basin, and mooring basin. The turning basin would have the same dimensions as in Plan C1. The mooring basin would be 105-ft. wide by 105-ft. long and have a depth of -6.5 feet. The access channel through the existing revetment would be 50-ft. wide and have a depth of -8.5 feet.

FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

Please refer to the 1985 Final FWCA report for a description of the fish and wildlife resources of the project site. No additional field studies were conducted for this revised report.

FISH AND WILDLIFE RESOURCES WITH THE PROJECT

Kahului Harbor Sites

Alternative A1: Approximately 0.23 acres of shallow water, sand-dominated reef flat habitat would be displaced by the dredging of the turning basin. Approximately 0.2 acres of reef flat would be lost by the construction of the breakwater. The entrance channel would deepen approximately 1.2 acres of sand-dominated reef flat habitat. A small amount of intertidal and subtidal boulder habitat on the revetment would be lost by the expansion of the launch ramp.

Alternative A2: Approximately 0.5 acres of shallow water, sand-dominated reef flat habitat would be displaced by the dredging of the turning and mooring basins. Approximately 0.5 acres of reef flat habitats would be destroyed by the construction of the breakwater, mole and shoreside fill. The entrance channel would deepen approximately 1.2 acres of sand-dominated reef flat habitat. A small amount of intertidal and subtidal boulder habitat on the revetment would be lost by the expansion of the launch ramp.

Alternative B1: The launch ramp and turning basin would be constructed on fast lands. Loss of approximately 1.2 acres of reef flat habitat would result from the construction of the entrance channel. A small amount of intertidal and subtidal boulder habitat on the revetment would be lost by the opening of an entrance channel.

Alternative B2: The launch ramp, turning basin, and mooring basin would be constructed on fast lands. Loss of approximately 1.2 acres of reef flat habitat would result from the construction of the entrance channel. A small amount of intertidal and subtidal boulder habitat on the revetment would be lost by the opening of an entrance channel.

Plan C2 (Figure 6) consists of a two-lane launch ramp, turning basin, and mooring basin. The turning basin would have the same dimensions as in Plan C1. The mooring basin would be 105-ft. wide by 105-ft. long and have a depth of -6.5 feet. The access channel through the existing revetment would be 50-ft. wide and have a depth of -8.5 feet.

FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

Please refer to the 1985 Final FWCA report for a description of the fish and wildlife resources of the project site. No additional field studies were conducted for this revised report.

FISH AND WILDLIFE RESOURCES WITH THE PROJECT

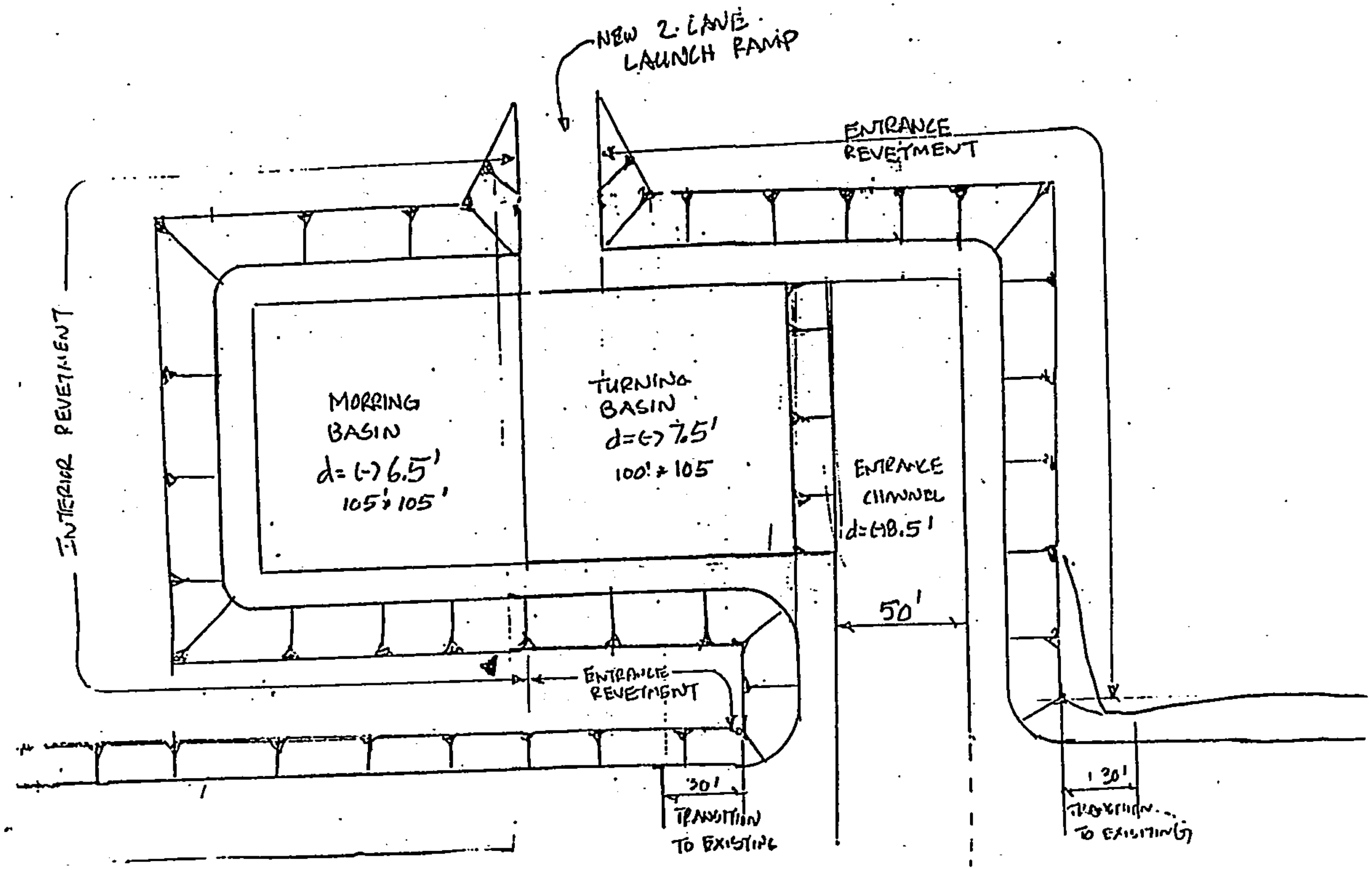
Kahului Harbor Sites

Alternative A1: Approximately 0.23 acres of shallow water, sand-dominated reef flat habitat would be displaced by the dredging of the turning basin. Approximately 0.2 acres of reef flat would be lost by the construction of the breakwater. The entrance channel would deepen approximately 1.2 acres of sand-dominated reef flat habitat. A small amount of intertidal and subtidal boulder habitat on the revetment would be lost by the expansion of the launch ramp.

Alternative A2: Approximately 0.5 acres of shallow water, sand-dominated reef flat habitat would be displaced by the dredging of the turning and mooring basins. Approximately 0.5 acres of reef flat habitats would be destroyed by the construction of the breakwater, mole and shoreside fill. The entrance channel would deepen approximately 1.2 acres of sand-dominated reef flat habitat. A small amount of intertidal and subtidal boulder habitat on the revetment would be lost by the expansion of the launch ramp.

Alternative B1: The launch ramp and turning basin would be constructed on fast lands. Loss of approximately 1.2 acres of reef flat habitat would result from the construction of the entrance channel. A small amount of intertidal and subtidal boulder habitat on the revetment would be lost by the opening of an entrance channel.

Alternative B2: The launch ramp, turning basin, and mooring basin would be constructed on fast lands. Loss of approximately 1.2 acres of reef flat habitat would result from the construction of the entrance channel. A small amount of intertidal and subtidal boulder habitat on the revetment would be lost by the opening of an entrance channel.



PLAN C2 - W/ MORRINGS W/ OUTER FILL AREA

1" = 50'

Figure 6. Alternative C2.

Alternative C1: The launch ramp and turning basin would be constructed on fast lands. No reef flat habitats would be displaced by this alternative. A small amount of intertidal and subtidal boulder habitat on the revetment would be lost by the opening of an entrance channel.

Alternative C2: The launch ramp, turning basin, and mooring basin would be constructed on fast lands. No reef flat habitats would be displaced by this alternative. A small amount of intertidal and subtidal boulder habitat on the revetment would be lost by the opening of an entrance channel.

FISH AND WILDLIFE MITIGATION POLICY

The Service's Mitigation Policy was formulated with the intent to ". . . protect and conserve the most important and valuable fish and wildlife resources while facilitating balanced development of the Nation's natural resources." The policy outlines internal guidance for Service staff and complements our participation under the National Environmental Policy Act and Fish and Wildlife Coordination Act. The Mitigation Policy does not apply to threatened or endangered species; specific requirements for these resources are covered in the Endangered Species Act of 1973.

The policy focuses on the mitigation of habitat value, and on impacts to fish and wildlife populations. Our recommendations for mitigation/compensation will be based upon the habitat values adversely affected by the project, and not by loss of acreage alone.

We consider the sand-dominated reef flat at the existing launch ramp and slopes along the northeast revetment to be of medium to low value for reef fish and stony corals. The mitigation goal is to minimize loss of habitat values.

PROJECT SITING RECOMMENDATIONS

The project alternatives that place the harbor facilities within the existing coral fill (Alternatives B1, B2, C1, and C2) would result in the least disruption to marine communities. These alternatives would only require dredging in reef flat habitats for the entrance channel. Of these alternatives, C1 or C2 have relatively shorter access channels and would involve less dredging than B1 and B2.

The primary direct impact from Alternatives C1 and C2 would be the loss of a small amount of boulder revetment habitat from the opening of the entrance channel. This is a man-made habitat and would likely be replaced by the lining of the interior basins with boulder revetments.

Alternatives A1 and A2 would directly affect sand-dominated reef flat habitats by the construction of turning and mooring basins, breakwater, and entrance channel. Alternatives B1 and B2 would affect this habitat by the construction of the entrance channel. While this reef flat does not support large populations of reef fish or corals, it seasonally supports hahalalu fishery (juvenile Selar crumenophtalmus). The area fronting the launch ramp is regulated by the Department of Land and Natural Resources to resolve conflicts between pole-and-line and net fishermen for this seasonal fishery. Selection of Alternatives C1 or C2 would avoid this regulated area completely (see Appendix 1).

We recommend the National Marine Fisheries Service be contacted to discuss potential impacts to endangered humpback whales and threatened green sea turtles.

RECOMMENDED MITIGATION

We recommend the following mitigation measures:

a. Silt curtains or other silt containment devices should be deployed during the dredging of the entrance channel for all alternatives.

b. If blasting is necessary, the charges should be sandbagged to prevent incidental fish kills. No blasting will be conducted if the threatened green sea turtle (Chelonia mydas) is in the vicinity. A blast plan should be coordinated with the National Marine Fisheries Service and State Division of Aquatic Resources.

c. For alternatives with the basins located within the fill area, the basins should be excavated to their design dimensions and revetted prior to opening the connection to the entrance channel. This construction method should substantially reduce sediment input into adjoining waters.

d. If possible, the dredging should be scheduled to avoid the seasonal run of oama (Mulloides flavolineatus) which starts roughly from May - August and ends in September - October, and the seasonal run of hahalalu (Selar crumenophthalums) which occurs from July to December. The timing of construction work in the water should be coordinated with the State Division of Aquatic Resources.

e. The dredge spoils should be disposed of on land and contained within maintained berms above the influence of the tides. Only runoff water from the dewatering basins meeting State of Hawaii water quality standards should be allowed to return to the harbor.

f. Signs and displays that describe Hawaii's fishing regulations and restrictions should be posted at the launch ramp. The information for these displays should be coordinated with the State Division of Aquatic Resources.

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

DIVISIONS:
AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

September 18, 1985

Dr. Allan D. Marmelstein
Pacific Islands Administrator
U.S. Fish & Wildlife Service
P. O. Box 50167
Honolulu, HI 96850

Dear Dr. Marmelstein:

Thank you for providing us copies of the Service's Final Coordination Act Report for the Corps of Engineers' Kahului Small Boat Harbor Study. We are pleased that Skippy Hau of our Division of Aquatic Resources was able to assist the field investigations, and appreciate your acknowledgement of his assistance.

Improving launch facilities near Kahului will enhance fishing opportunities for Maui residents. However, it should be noted that net fishing in front of the existing launch ramp is regulated specially (by Chapter 13-51, Administrative Rules; copy attached for your information) for the purpose of resolving conflict between pole-and-line fishermen and fishermen with nets over the hahalalu which gather in this location seasonally. Thus, while we do not disagree with the conclusion of the Report that alternatives "C" and "E" would achieve minimum destruction of aquatic life, alternative "C" would alter a portion of the regulated area (dredged for a channel) and alternative "E" would avoid the regulated area entirely.

Very truly yours,

SUSUMU ONO, Chairperson
Board of Land and Natural Resources

encl.: Chapter 51

SEP 25 '85
RECEIVED

Appendix 1.

TITLE 13

DEPARTMENT OF LAND AND NATURAL RESOURCES

SUBTITLE 4 FISHERIES

PART II MARINE FISHERIES MANAGEMENT AREAS

CHAPTER 51

KAHULUI HARBOR, MAUI

§13-51-1 Definitions. As used in this chapter:

"Kahului Harbor" means that harbor situated at Kahului, Wailuku, Maui, Hawaii. [Eff: MAR 8 1984] (Auth: HRS §188-53) (Imp: HRS §188-53)

§13-51-2 Prohibited activities. (a) No person shall use any thrownet, or draw, drag, seine or any other type of net except crab net and hand net for shrimp, within those portions of Kahului Harbor:

(1) Bounded by the shoreline between Kahului Harbor piers 1 and 2, and a seaward boundary delineated by a straight line drawn from the base of Kahului Harbor pier 2 across to the southernmost corner of the building on Kahului Harbor pier 1, designated as area 1;

(2) Bounded by the shoreline along the southeastern portion of Kahului Harbor between the Puunene Avenue extension to and along Kahului Harbor pier 2, and a seaward boundary delineated by a straight line drawn from the northwesternmost corner of Kahului Harbor pier 2 to the shoreline at the Puunene Avenue extension, designated as area 2; and

(3) Bounded by the shoreline along the southern portion of the Kahului Harbor park adjacent to the boat launching ramp and the shoreline along Kahului Beach Road, and a seaward boundary delineated by a straight line drawn following the northern portion of the eastern shoreline of the Kahului Harbor park to the shoreline along Kahului Beach Road, designated as area 3;

as delineated on the "Map of Kahului Harbor, Maui, 01/13/84", located at the end of this chapter.

(b) Nothing in this chapter shall be construed as allowing activities within any portion of Kahului Harbor which may be otherwise prohibited by law or rules adopted by the department of transportation. [Eff: MAR 8 1984] (Auth: HRS §188-53) (Imp:

HRS §188-53)

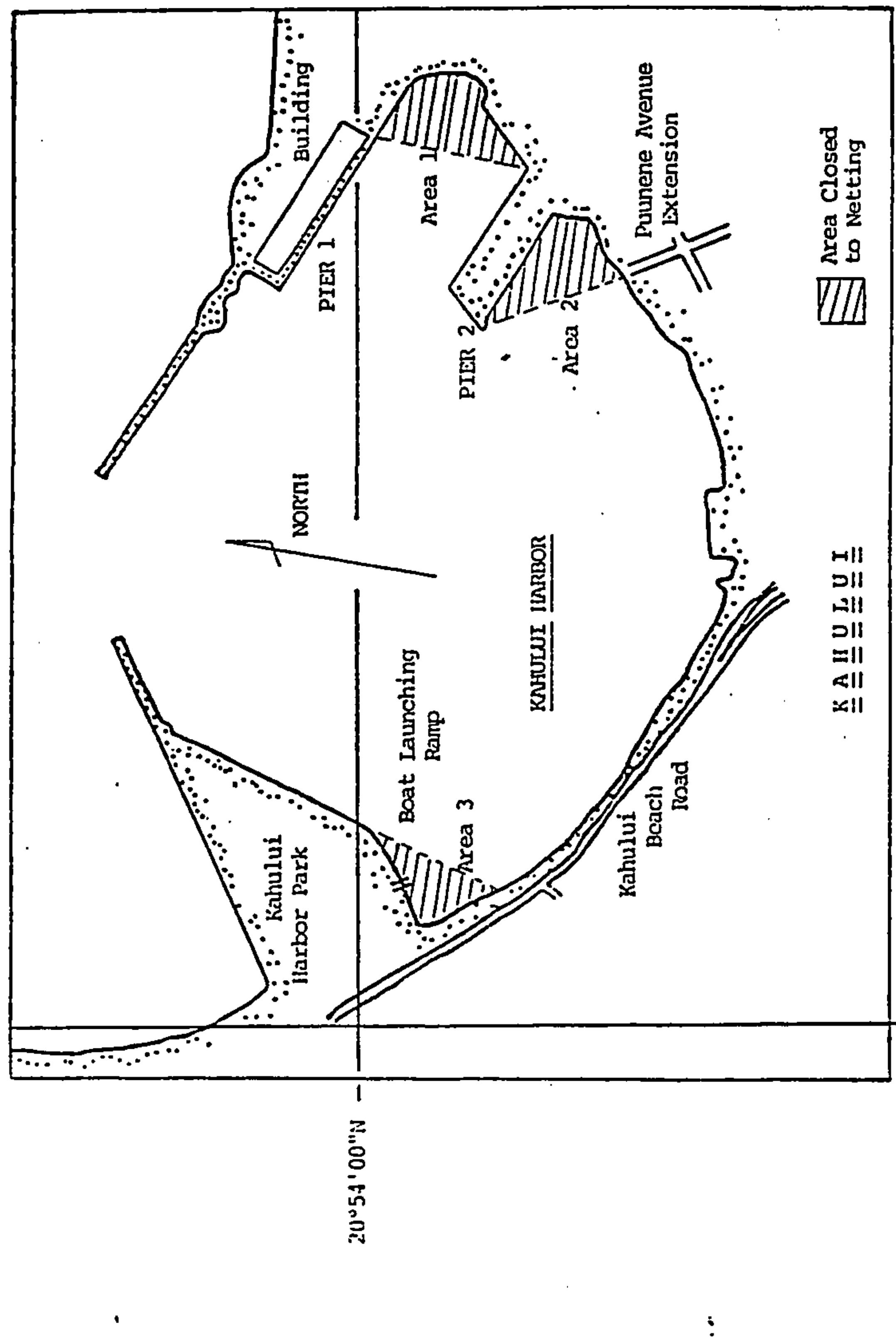
§13-51-3 Permitted activities. Pond owners or operators, or commercial fishermen, with an appropriate license, may use nets within the protected areas to:

(1) Take young mullet or pua (*Mugil cephalus*) for the purpose of stocking their pond; or

(2) Take nehu, iao or other baitfishes for which an open season has been declared for bait purposes only.

[Eff: MAR 8 1984] (Auth: HRS §188-53) (Imp: HRS §§188-44, 188-45, 188-53)

§13-51-4 Penalty. Any person violating the provisions of this chapter shall be punished as provided by section 188-70, Hawaii Revised Statutes. [Eff: MAR 8 1984] (Auth: HRS §188-53) (Imp: HRS §188-70)



MAP OF KAHULUI HARBOR, MAUI 01/13/84

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

Colonel Michael M. Jenks
District Engineer
U.S. Army Engineer District, Honolulu
Bldg. 230
Ft. Shafter, Hawaii 96858-5440

Dear Colonel Jenks:

This is the U.S. Fish and Wildlife Service's Final Coordination Act Report for the Honolulu District's Kahului Small Boat Harbor Study, Kahului Harbor, Maui, Hawaii.

This is the report of the Secretary of the Interior in accordance with Section 2(b) of the Fish and Wildlife Coordination Act. It is also consistent with the National Environmental Policy Act.

Sincerely,

Allan Marmelstein
Pacific Islands Administrator

cc: Director, FWS, Washington, D.C. (AHR-ES/FP)
RD, FWS, Portland, OR (AHR)
NMFS-WPPO
EPA, San Francisco
Planning Br., COE
DLNR
DAR
DAR, Attn: Skippy Hau

FINAL COORDINATION ACT REPORT
KAHULUI SMALL BOAT HARBOR STUDY
KAHULUI HARBOR
MAUI, HAWAII

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
HONOLULU FIELD OFFICE

AUGUST 1985

Prepared for the U.S. Army Engineer District, Honolulu

TABLE OF CONTENTS

PREFACE

This report was prepared by staff fishery biologist Andy Yuen and includes the results from an inter-agency field survey conducted by John Ford (formerly with the U.S. Fish and Wildlife Service) and Robert Moncrief (Planning Branch, Engineering Division, U.S. Army Engineer Division, Pacific Ocean) in March 1984; a field survey conducted by Andy Yuen and Skippy Hau (Department of Land and Natural Resources, Division of Aquatic Resources) in July 1985; and available literature. Kevin Cook and Helene Takemoto (Planning Branch, Engineering Division, U.S. Army Engineer Division, Pacific Ocean) provided engineering information.

The Service would like to thank Robert Moncrief and Skippy Hau for their field support.

DESCRIPTION OF THE PROJECT AREA

Kahului Harbor is located on the north side of the isthmus that connects East and West Maui and is the primary commercial port on Maui. The harbor structures consist of a 600-foot wide entrance channel, a 2,800-foot long breakwater on the east end, a 2,300-foot long breakwater on the west end, and a 113-acre basin. A single-lane small boat launch ramp is located on the coral fill adjacent to the west breakwater (U.S. Army Corps of Engineers, 1983) (Figure 1).

The Kanaha Beach site is along the north coast of Maui near the State of Hawaii Kanaha Pond Waterfowl Refuge (Figure 2). The shoreline is the remnant of lithified calcareous sand dunes formed when the sea level was much lower than present levels (Macdonald and Abbott, 1970). The shoreline is broken up by outcrops of beachrock and boulder groins. A strip of sand dunes run along the shoreline. The reef flat extends northward for about 2,500 feet before sloping gradually into deeper water.

Maliko Bay is at the mouth of Maliko Gulch and is a partially drowned river valley (Figure 3). The shoreline near Maliko Bay is the exposed remnants of the Honomanu volcanic series (Macdonald and Abbott, 1970). A cobble and shingle beach lies at the head of the bay. The walls of the bay are lined by a boulder beach. The inshore waters of the bay are usually murky from discharges from Maliko Stream and turbid conditions usually extend out to the boat launch. In the middle of the bay the substrate is comprised of boulders, cobble, gravel, and coral rubble. The boulders have a high coral cover.

DESCRIPTION OF THE PROJECT

Five alternative sites are located along the existing coral fill within the west breakwater (Figures 4-8). The sixth alternative site is located near the existing Kahului Beach Road revetment (Figure 9).

Kahului Harbor Sites

Plan A (Figure 4) utilizes the existing boat launch ramp site and consists of a 4.0-acre 10-foot deep berthing area, a 120-foot wide, 970-foot long, and 13-foot deep entrance channel, and a 520-foot long breakwater. The boat basin, turning basin, and entrance channel would be dredged in the inshore reef flat.

Plan B (Figure 5) utilizes the existing boat launch ramp site and consists of a 2.6 - 2.8-acre 7 - 9-foot deep mooring area, a 60-foot wide, 1,270-foot long, and 10-foot deep entrance channel, and a 415-foot long breakwater. The basin and entrance channel would be dredged in the inshore reef flat. Single point moorings would be used to secure the boats.

Plan C (Figure 6) is landward of the existing boat launch ramp site and consists a 2.6 - 2.8-acre 7-foot deep mooring and berthing basin, a 60-foot wide, 1,000-foot long, and a 10-foot deep entrance channel. The basin would be lined with 935 feet of revetment and would include a wave absorber at the base of the entrance channel. The basin would be dredged in the existing coral fill. The entrance channel would be dredged in the inshore reef flat. Single point moorings would be used to secure the boats.

Plan D (Figure 7) is near the bend in the coral fill and consists of a 2.6 - 2.8-acre 7-foot deep mooring and berthing area, a 60-foot wide, 1,150-foot long, and a 10-foot deep entrance channel and a 450-foot long breakwater. The mooring area and entrance channel would be dredged from the inshore reef flat. Single point moorings would be used to secure the boats.

Plan E (Figure 8) is at the north end of the coral fill and consists of a 2.6 - 2.8-acre 7-foot deep mooring basin, a 60-foot wide, 320-foot long, and a 10-foot deep entrance channel. The basin would be lined with 1,700 feet of revetment. The mooring and berthing areas would be dredged in the existing coral fill area. Single point moorings would be used to secure the boats.

In all of the above alternatives, the parking and shoreside facilities would be located on the existing coral fill area adjacent to the west breakwater.

Plan F (Figure 9) consists of 2.6 - 2.8-acre 7-foot deep mooring basin, a 60-foot wide, 650-foot long, and a 10-foot deep entrance channel, and a 1,100-foot long breakwater/revetted mole. Approximately 2 acres of the inshore reef flat would be filled for the parking and shoreside facilities. Single point moorings would be used to secure the boats.

Kanaha Beach Site

The Kanaha Beach site consists of a 12-foot deep, 3,300-foot long, and 120-foot wide entrance channel, a 600-foot long breakwater, and a 10-foot deep 4-acre berthing area. (Figure 10). A portion of the shoreline would be filled along the south and west margin of the berthing area. The entrance channel would be dredged through the shallow limestone reef flat.

Maliko Bay Site

The Maliko Bay site consists of an east and west breakwater, two berthing areas, and an entrance channel (Figure 11). The east breakwater is 300-feet long and has a crest elevation of 22 feet. The west breakwater is 450-feet long and has a crest elevation of 15 feet. The entrance channel has a width of 120 feet and a depth ranging from 10 to 14 feet. The berthing areas are about 9 acres in size.

FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

The existing coral fill at the west breakwater site is revetted with armor stone boulders. This revetment provides habitat for various intertidal organisms like the a'ama crab (*Grapsus tenuicrustatus*), periwinkles (*Littorina* spp.), false opihi (*Siphonaria normalis*), and various algae (*Ulva* sp.). The areas surveyed in July 1985 are shown on Figure 12.

The substrate in the area immediately fronting the existing boat ramp is dominated by coarse sand and shell fragments with little topographic relief. The primary fish habitats in this area are the interstices provided by the armor stone revetment and the pilings of the wooden dock. Fish species observed in the vicinity of the revetment are shown in Table 1. Of particular commercial fishery value are the schools of nehu (*Stolopherus purpureus*) observed in this area.

Further offshore, the reef flat substrate is characterized by cobble, fine sand, and occasional limestone boulders. Most of the fish observed on the reef flats were associated with these boulders or were feeding in the sandy areas (Table 1). The zooanthid *Palythoa* spp. was the dominant organism on the reef flat and was found on both sand and boulder surfaces. The sea cucumber *Holothuria atra* was also common. Algae found on the reef flat included *Cladophora fascicularis*, *Ulva fasciata*, *Stypopodium hawaiiensis*, and *Acanthophora spicifera*.

Crabbing, spearfishing, limu-picking, pole fishing, and harvesting bait-fish occur in the project area (Aecos, Inc., 1979). The area fronting the boat ramp is closed to net fishing, except for crab and opae (*Palaemon debilis*) netting and the harvest of baitfish by licensed commercial fishermen (State of Hawaii, DLNR, 1984). During the July 1985 survey, pole-fishing and opae netting along the ili'ili stone beach and spearfishing near the boat launch were observed.

The intertidal habitat at the middle bay site is characterized by well-worn large cobbles and small boulders. The most common intertidal species was the pipipi (*Nerita picea*). Drifting seaweed collects in the shallow water at this site and opae are harvested here.

The subtidal habitat is characterized by a low relief cobble and sand substrate. Poor visibility (less than three feet) prevented a thorough survey of fishery resources at this site (Table 2). The zooanthid *Palythoa* spp. and various green algaes (*Cladophora* sp. and *Ulva* sp.) were common. It is likely that the marine resources at this site are similar to those at the boat launch ramp site.

The northern end of the revetment contains a more diverse marine community than the boat launch ramp site or the middle bay site (Table 3). Various corals (*Montipora flabellata*, *Pocillopora meandrina*, *P. damicornis*, *Porites lobata*, and *P. compressa*) have colonized the boulders of the revetment. At least 35 species of fish were observed at this site. The vertical walls of revetment appeared to provide the primary habitat for various reef fish. The interstices in the boulder revetment appeared to provide excellent habitat for the toau (*Lutjanus fulvus*) and other reef species. Beyond the toe of the revetment, the substrate is limestone outcrops with fine sand substrate.

The macrobiota observed during the March 1984 survey is shown on Table 4.

The Kanaha Beach site is characterized by a low relief limestone reef flat. Few fish species were observed at this site (Table 4). Nearshore, the hard substrate was colonized by zooanthids, echinoderms, and algae. Further offshore, scleractinian corals were present. Along the proposed entrance channel, brittle stars, sea urchins, and sea cucumbers were present. *Holothuria atra* was the most common echinoderm observed.

The boulder and cobble substrate of Maliko Bay supports a diverse fauna of fish and corals. At least 46 species of reef fishes and at least 7 species of scleractinian corals were observed (Table 5). Manini (Acanthurus triostegus), other surgeon fish, and butterfly fish were particularly abundant at this site.

Maliko Bay is considered one of the best akule and opelu fishing grounds on Maui (Clark, 1980).

FISH AND WILDLIFE RESOURCES WITH THE PROJECT

Kahului Harbor Sites

Estimated Habitat Losses from Direct Impacts

Plan A. The dredging for the mooring and berthing areas would destroy approximately 4.0 acres of reef flat. Dredging of the entrance channel would affect approximately 2.7 acres of reef flat. Construction of the breakwater would impact approximately 0.7 acres of reef flat.

Plan B. Dredging the mooring area would destroy approximately 2.6 - 2.8 acres of reef flat habitat. Dredging the entrance channel would destroy approximately 1.7 acres of reef flat. Construction of the breakwater would affect approximately 0.6 acres of reef flat.

Plan C. The mooring and berthing areas would be dredged out of fast lands and would not displace any reef flat habitat. Dredging the entrance channel would destroy approximately 1.4 acres of reef flat.

Plan D. Dredging the mooring areas would displace approximately 2.6 - 2.8 acres of reef flat. Dredging the entrance channel would destroy approximately 1.6 acres of reef flat. The breakwater would displace approximately 0.7 acres of reef flat.

Plan E. The mooring and berthing areas would be dredged out of fast lands and would not displace any reef flat habitat. Dredging the entrance channel would affect approximately 0.4 acres of reef flat.

Plan F. Construction of the mooring areas would destroy approximately 2.6 - 2.8 acres of reef flat. Approximately 2 acres of reef flat would be filled for the parking and shore facilities. Dredging the entrance channel would affect approximately 0.9 acres of reef flat.

Table 7. Amount of Habitat Affected by the Various Alternatives

Plan	A	B	C	D	E	F
Acres of reef flat affected	7.4	5.0	1.4	5.0	0.4	5.6

The primary result of these alternatives is the conversion of shallow water, sand dominated, reef flat habitats to deeper water reef flat and edge habitats. The reef flat habitat that would be displaced does not support large populations of important commercial or recreational fishery resources. It is anticipated that the floor of the entrance channel would be sand dominated and would eventually return to existing conditions. The walls of the entrance channel, if structurally stable, would provide increased topographic relief and would probably support a more diverse population of reef fish.

A concern for these sites, particularly Plans A, B, and D, is the potential disruption of nehu harvesting in this section of Kahului Harbor during construction and the temporary displacement of nehu stocks to other areas in Kahului Harbor. It is anticipated that the nehu would return to the area after the construction is completed.

Kanaha Site

The dredging of the entrance channel would destroy approximately 9.1 acres of reef flat. The dredging of the berthing areas would displace approximately 4 acres of reef flat.

The Kanaha beach site would be converted from a shallow water limestone reef flat habitat to a deeper water limestone reef flat habitat. The increased relief in the entrance channel, if it were structurally stable, would probably support a more diverse population of reef fish. The impacts would probably be similar to the Kahului Harbor sites.

Maliko Site

The dredging of the entrance channel would affect approximately 4.7 acres of boulder and cobble habitats, the breakwater would displace approximately 1.1 acres of boulder and cobble habitats, and the berthing area would replace approximately 9 acres of boulder and cobble habitats.

The diverse boulder community at Maliko Bay would be partially displaced by the construction of the breakwaters and entrance channel. The dredging of the entrance channel would probably increase levels of suspended materials and may negatively affect corals in the area. The reduced circulation from the harbor improvements would increase turbidity levels within the bay and may negatively affect corals, algae, and fish.

FISH AND WILDLIFE MITIGATION POLICY AND RECOMMENDATIONS

The Service's Mitigation Policy (Federal Register, Vol. 46, No. 15, January 23, 1981) was formulated with the intent to ". . . protect and conserve the most important and valuable fish and wildlife resources while facilitating balanced development of the Nation's natural resources." The policy outlines internal guidance for Service staff and complements our participation under the Fish and Wildlife Coordination Act and National Environmental Policy Act. The Mitigation Policy does not apply to threatened or endangered species; specific requirements for these resources are covered in the Endangered Species Act of 1973 (50 CFR 17).

The policy focuses on the mitigation of habitat value, and on impacts to fish and wildlife populations. Our recommendations for mitigation/compensation will be based upon the habitat values adversely affected by the project, and not by loss of acreage alone. Our habitat valuations and recommendations will be based upon thorough consideration of all relevant biological data.

The Service considers the reef flat at the boat launch ramp, middle bay, the northern revetment sites, and the Kanaha Beach site to be Resource Category 4. Under this category, the habitat to be impacted is of medium to low value for the evaluation species. The mitigation goal is to minimize loss of habitat value. Specific planning guidelines include recommendations to minimize habitat losses and provide habitat compensation depending on the significance of the potential loss. The primary fishery habitat at these sites appears to be the artificial boulder revetment. This is the result of the adjoining areas being dominated by low relief sand and cobble substrates.

The Service considers the Maliko Bay site to be Resource Category 3. Under this category, the habitat to be impacted is of high to medium value for the evaluation species and is relatively abundant on a national basis. The mitigation guideline is to recommend ways to immediately rectify or reduce the habitat losses over time. If losses remain likely to occur, the Service will recommend that the losses be compensated by replacement of habitat value.

The evaluation species were reef fish of recreational fishery value (primarily Mullidae and Acanthuridae) and scleractinian corals.

PROJECT SITING RECOMMENDATIONS

In general, the alternatives that place the berthing area within the existing coral fill (Plans C and E) would result in the least disruption to marine communities. For these alternatives, the only dredging required is for the entrance channel and turning basin. Of these 2 alternatives, Plan E is preferable because of the shorter entrance channel (Plan C - 1,000 feet vs. Plan E - 320 feet) and the smaller amount of marine habitat affected (Plan C - 1.4 acres vs. Plan E - 0.4 acres).

The primary direct impact of Plans C and E would be the loss of a small amount of boulder habitat caused by the removal of the existing revetment. This would be compensated by the creation of new marine habitats from the dredging of existing fast lands and from the new revetments that line the mooring area. It is anticipated that marine communities similar to existing ones would develop in the newly dredged areas.

The dredging for the mooring areas and entrance channel for Plans A, B, D, and F would affect similar habitat types. Plan A affects the largest amount of reef flat because of the increased project size. These proposals would result in the loss of varying amounts of reef flat habitat. It is anticipated that marine communities similar to existing ones would develop in the newly dredged areas.

The sand-dominated reef flats do not support large populations of important recreational and commercial fishery resources. Between Plans A, B, D, and F, Plan B is preferable since it would affect the least amount of revetment boulder habitat.

The Service does not recommend the selection of Plan F because of the conversion of approximately 2 acres of reef flat into fast lands for shoreside facilities.

The effects of further construction within Kahului Harbor will represent only an incremental change in the present conditions within the harbor. The construction of breakwaters, mooring and turning basins, and entrance channels would be a large departure from the existing conditions at the Maliko Bay and Kanaha Beach sites. The Service does not recommend the selection of the Kanaha Beach or Maliko Bay sites.

RECOMMENDED MITIGATION

The Service's primary mitigation recommendation is to limit turbidity and sedimentation of adjoining benthic communities during the construction phase of the project.

We recommend the following:

a. Silt curtains or other silt containment devices be deployed during the dredging of the entrance channel and mooring basin.

b. If blasting is necessary, the charges will be sandbagged to prevent incidental fish kills. No blasting will be conducted if green sea turtles (Chelonia mydas) are within 1,000 feet of the blast area. Blasting will be coordinated with the Department of Land and Natural Resources, Division of Aquatic Resources and the National Marine Fisheries Service.

c. If Plans C or E are selected, the mooring areas will be excavated to their design dimensions and revetted prior to opening the connection to the entrance channel. This should substantially reduce sediment input into adjoining waters.

d. If possible, the dredging will be scheduled to avoid the seasonal runs of oama (Mulloides flavolineatus) which starts roughly from May-August and ends in September-October and the seasonal runs of halalu (Selar crumenophthalmus) which occurs from July to December. These times should be coordinated with the Division of Aquatic Resources.

e. The dredge spoils will be disposed of on land and contained behind maintained berms above the influence of the tides. Only clean runoff water will be allowed to return to the ocean.

f. Signs and displays that adequately describe Hawaii's fishing regulations and restrictions will be posted at the launch ramp and parking areas. The information for the displays should be coordinated with the Division of Aquatic Resources.

REFERENCES

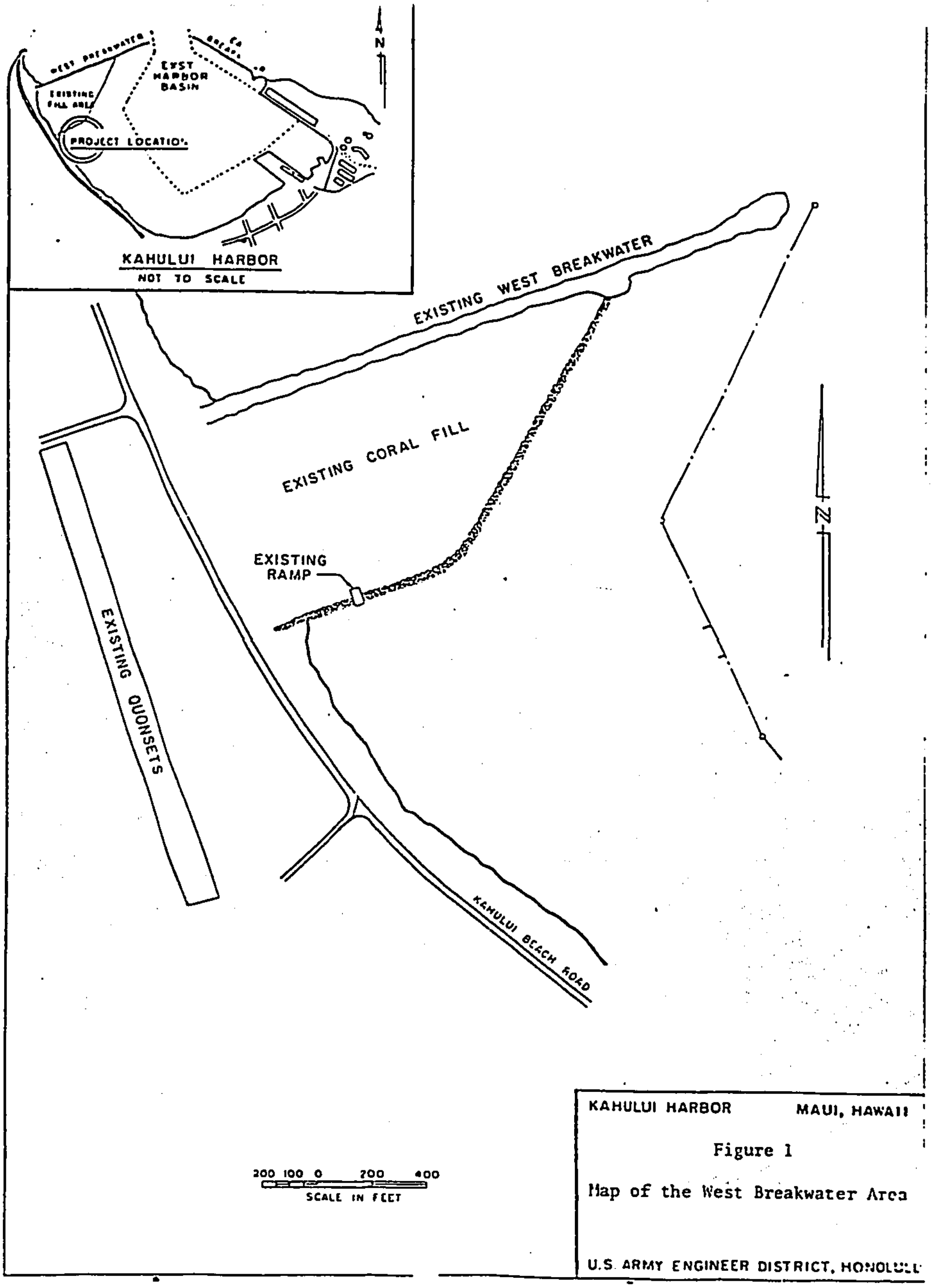
1. Aecos, Inc. 1979. Maui Coastal Zone Atlas. Hawaii Coral Reef Inventory. Island of Maui (MICRI). Part C.

2. Clark, J.R.K. 1980. The Beaches of Maui County. The University of Hawaii Press, Honolulu.

3. Macdonald, G.A. and Abbott, A.T. 1970. Volcanoes in the Sea. The University of Hawaii Press, Honolulu.

4. Title B, Department of Land and Natural Resources, Subtitle 4 - Fisheries, Part I - Marine Fisheries Management Areas, Chapter 51, Kahului Harbor, Maui. HRS 188-53. 1984.

5. U.S. Army Corps of Engineers, Pacific Ocean Division. Reconnaissance Report on Navigation Improvements for Kahului, Island of Maui, Hawaii. 1983.



KAHULUI HARBOR MAUI, HAWAII

Figure 1

Map of the West Breakwater Area

U.S. ARMY ENGINEER DISTRICT, HONOLULU

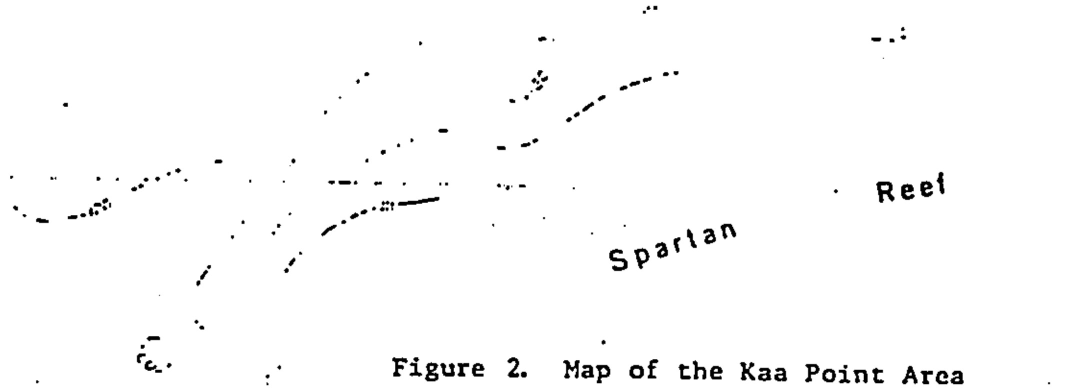


Figure 2. Map of the Kaa Point Area

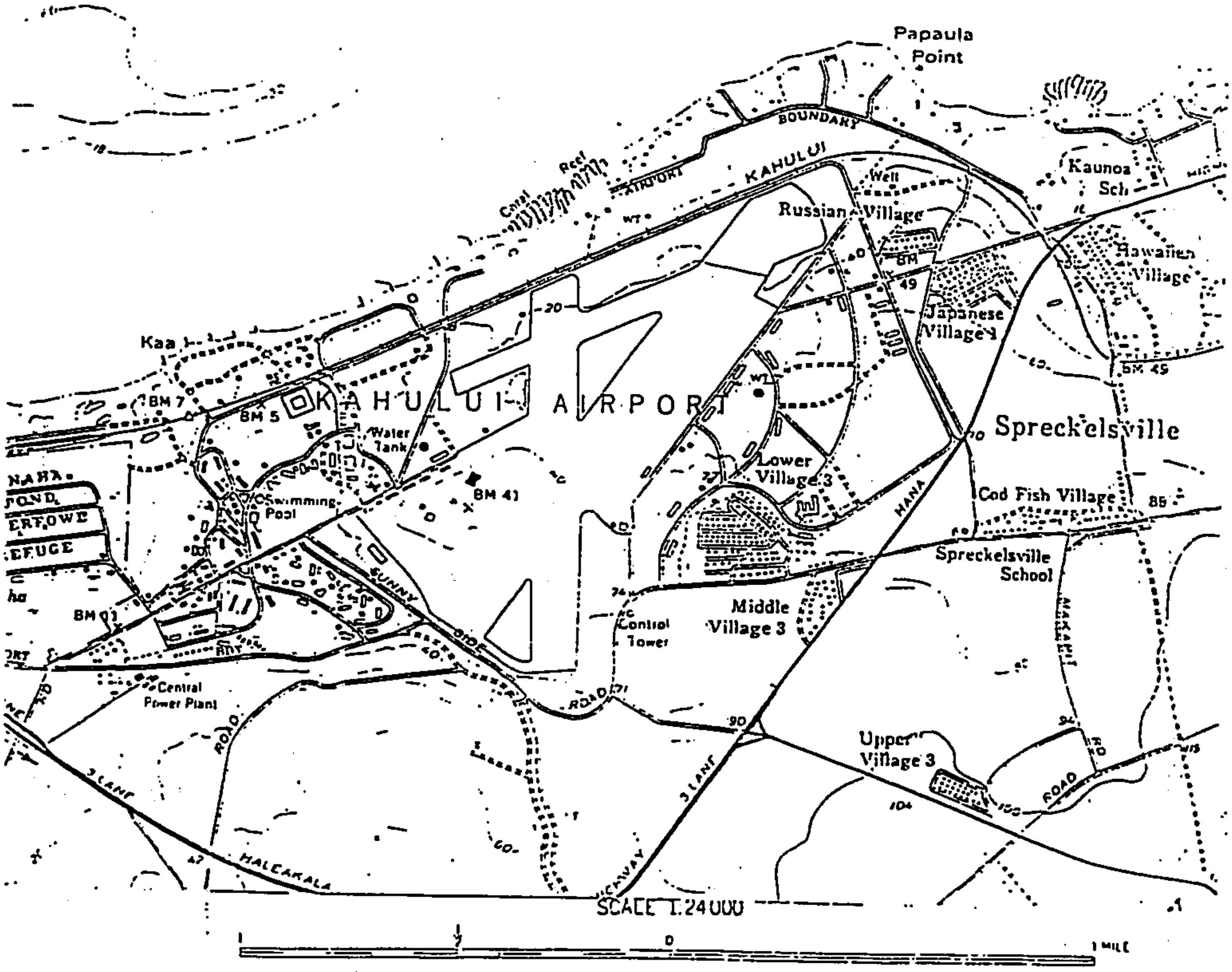
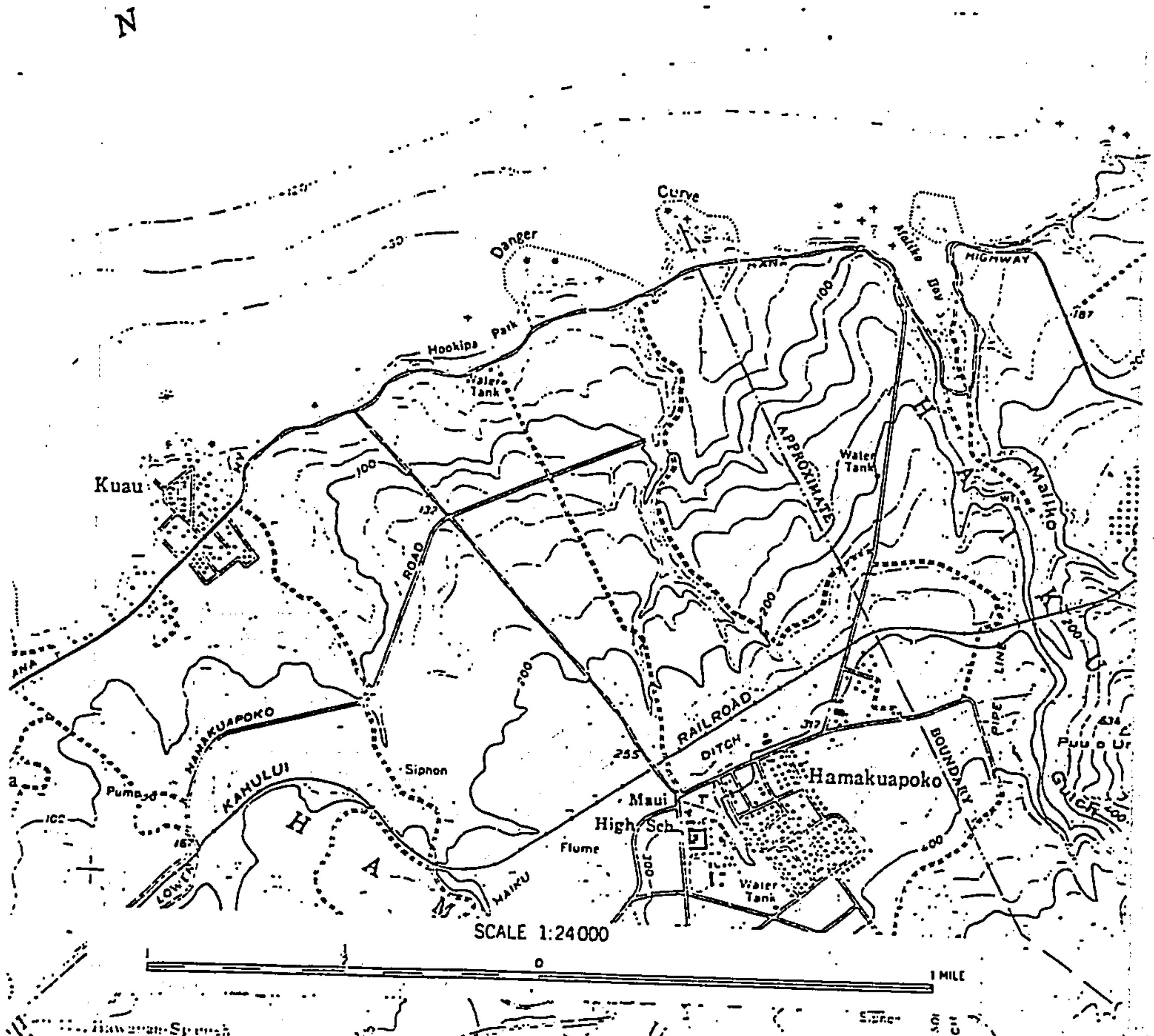


Figure 3. Map of the Maliko Bay Area



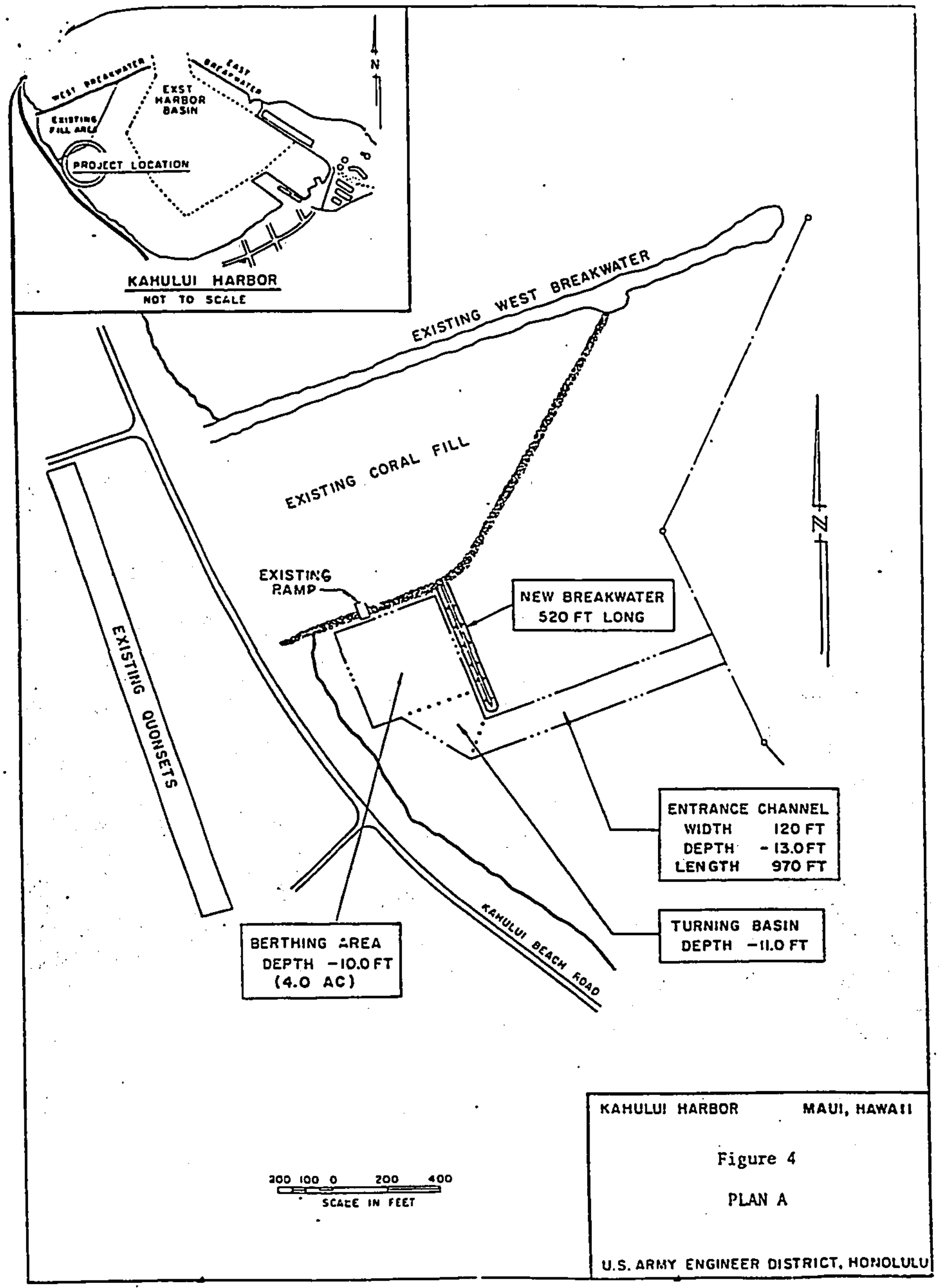
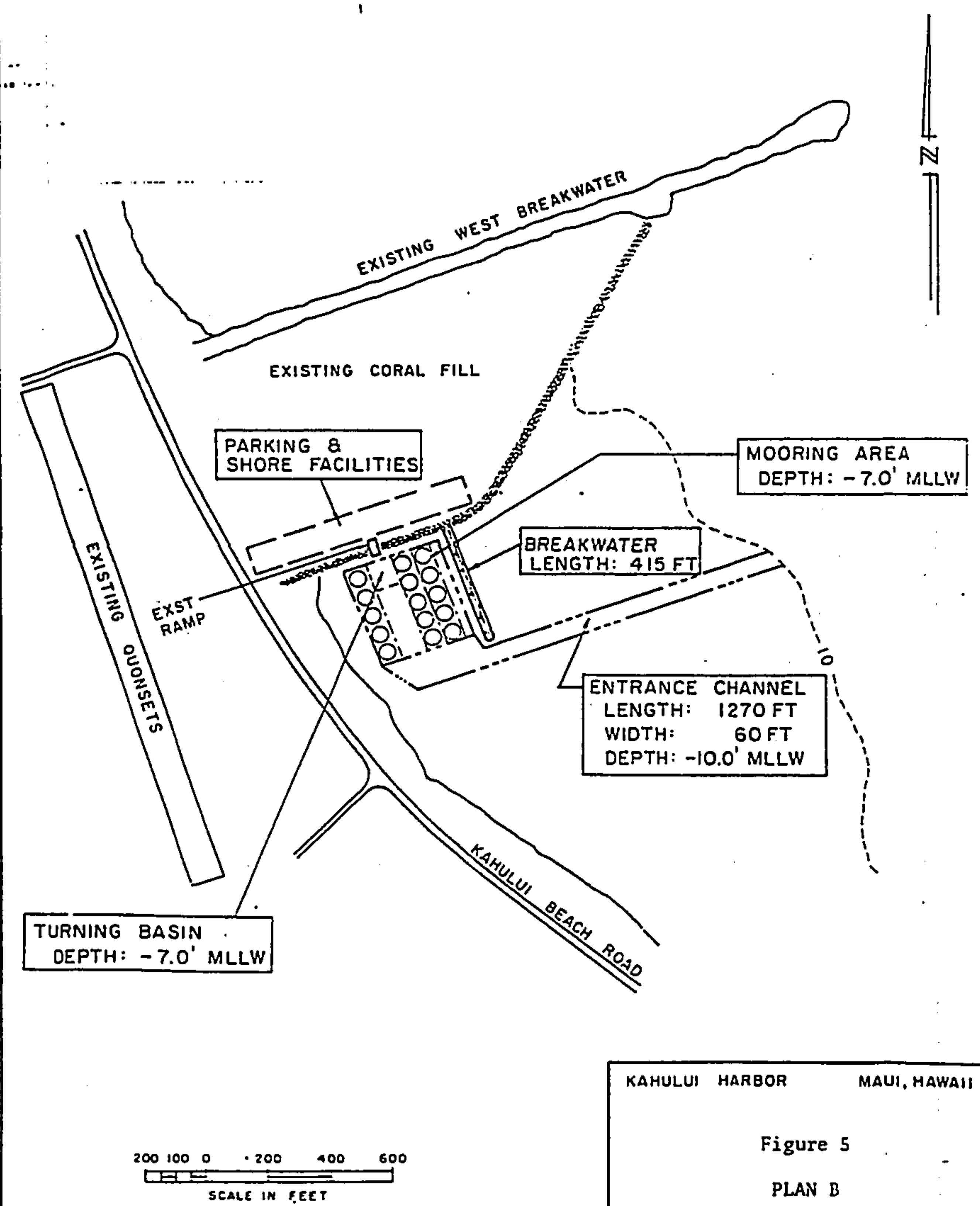


Figure 4

PLAN A

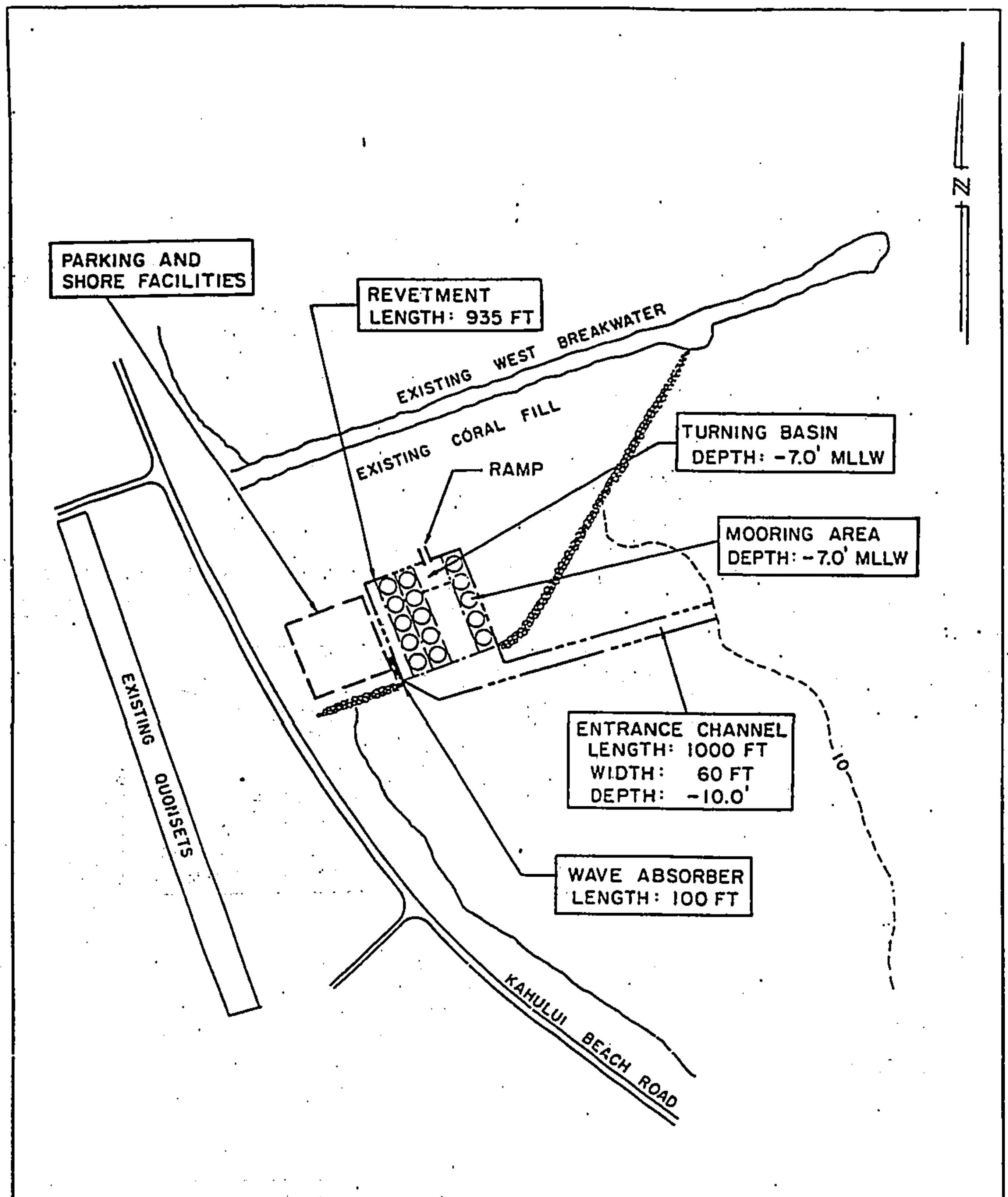


KAHULUI HARBOR MAUI, HAWAII

Figure 5

PLAN B

U.S ARMY ENGINEER DISTRICT, HONOLULU



KAHULUI HARBOR MAUI, HAWAII

Figure 6

PLAN C

U.S. ARMY ENGINEER DISTRICT, HONOLULU

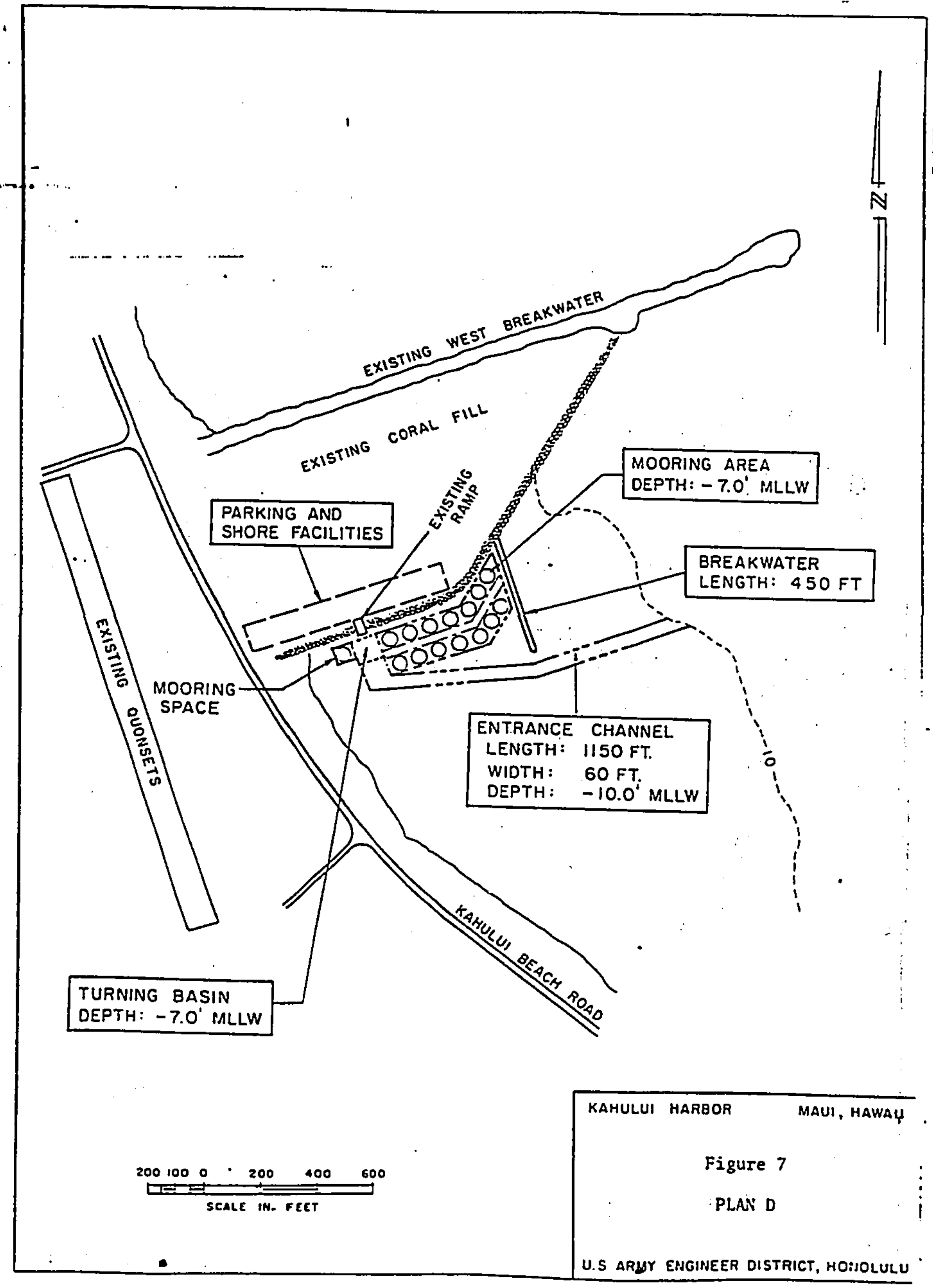


Figure 7

PLAN D

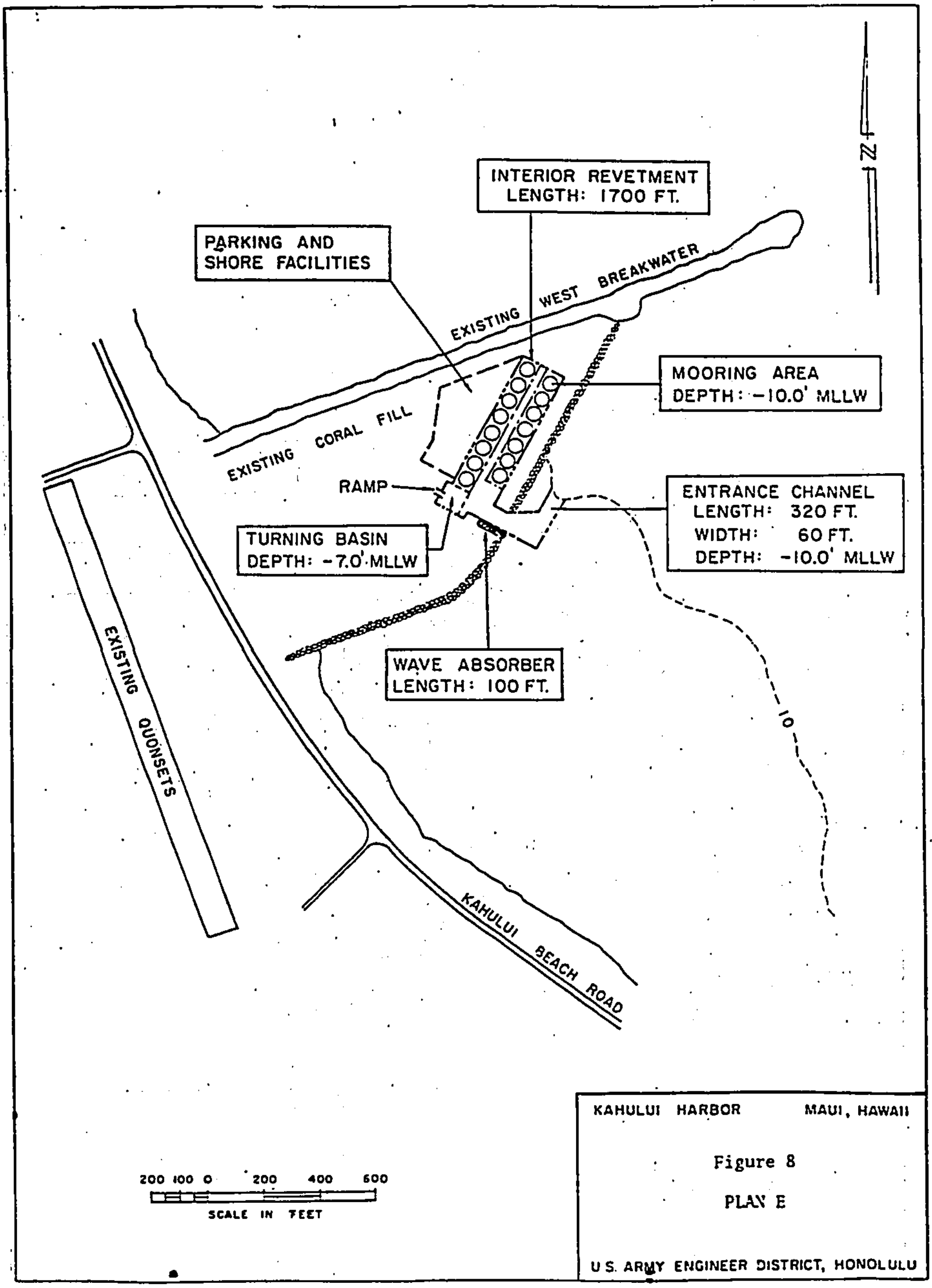
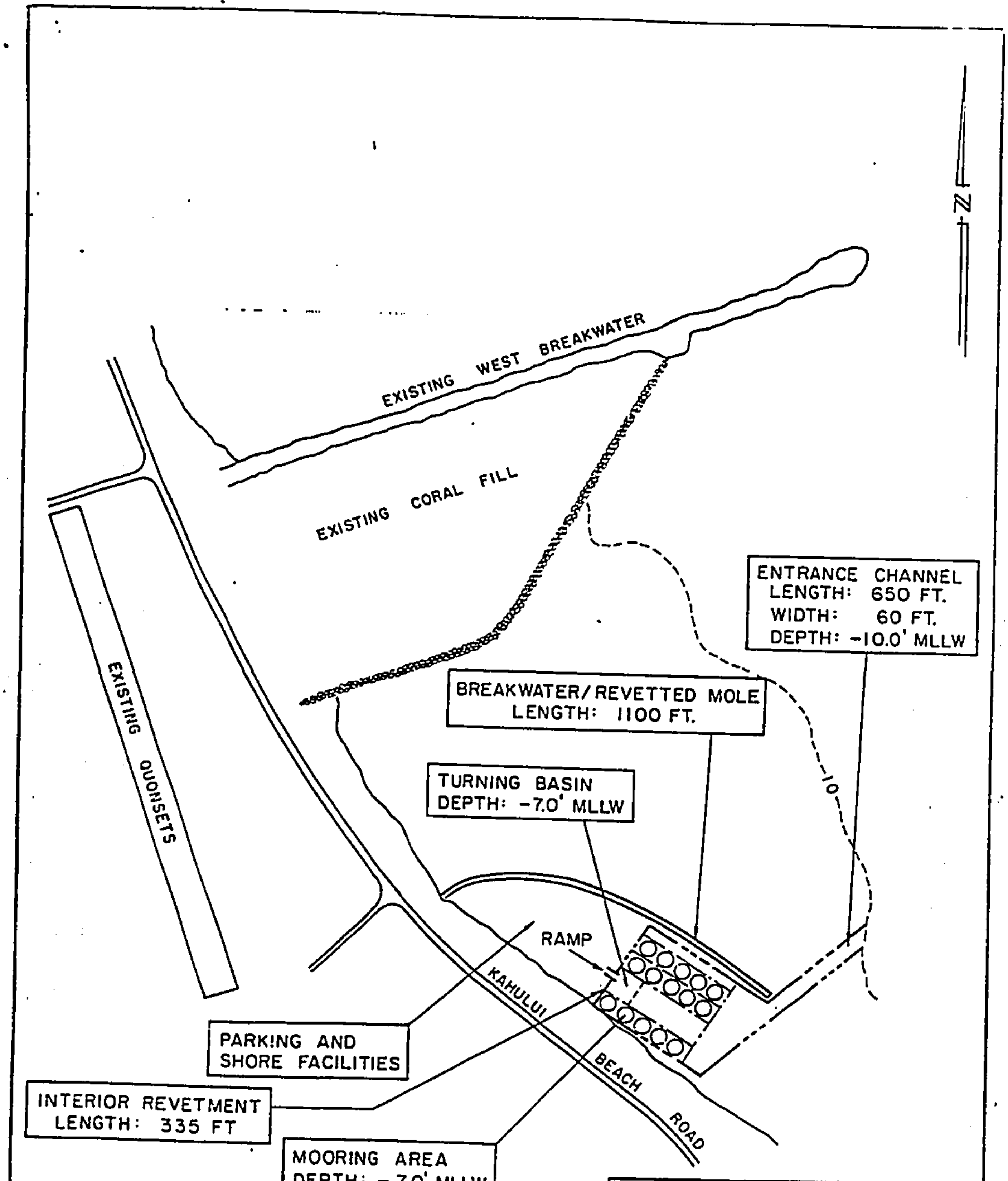


Figure 8

PLAN E



KAHULUI HARBOR MAUI, HAWAII

Figure 9

PLAN F

U.S. ARMY ENGINEER DISTRICT, HONOLULU

U.S. ARMY ENGINEER DIVISION, PACIFIC OCEAN
CORPS OF ENGINEERS

PROJECT TITLE Kahului - Alt 1 (Kanaha) SH NO. 1 OF ____ SHS
LOCATION ____ SECTION ____
DRAWING(S) NO. ____
COMPUTED BY ____ DATE ____ CHECKED BY ____ DATE ____

DESIGN ANALYSIS

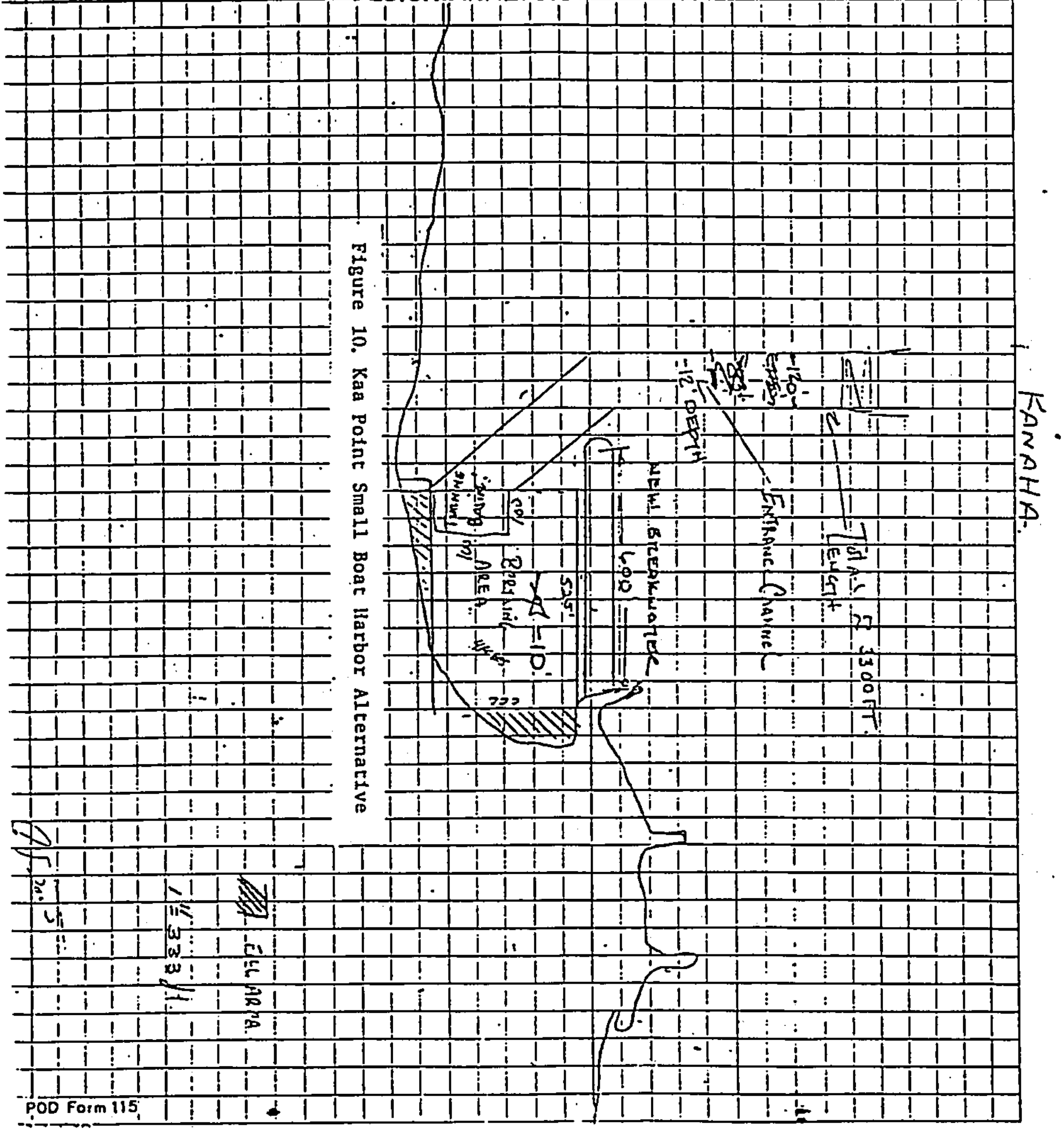
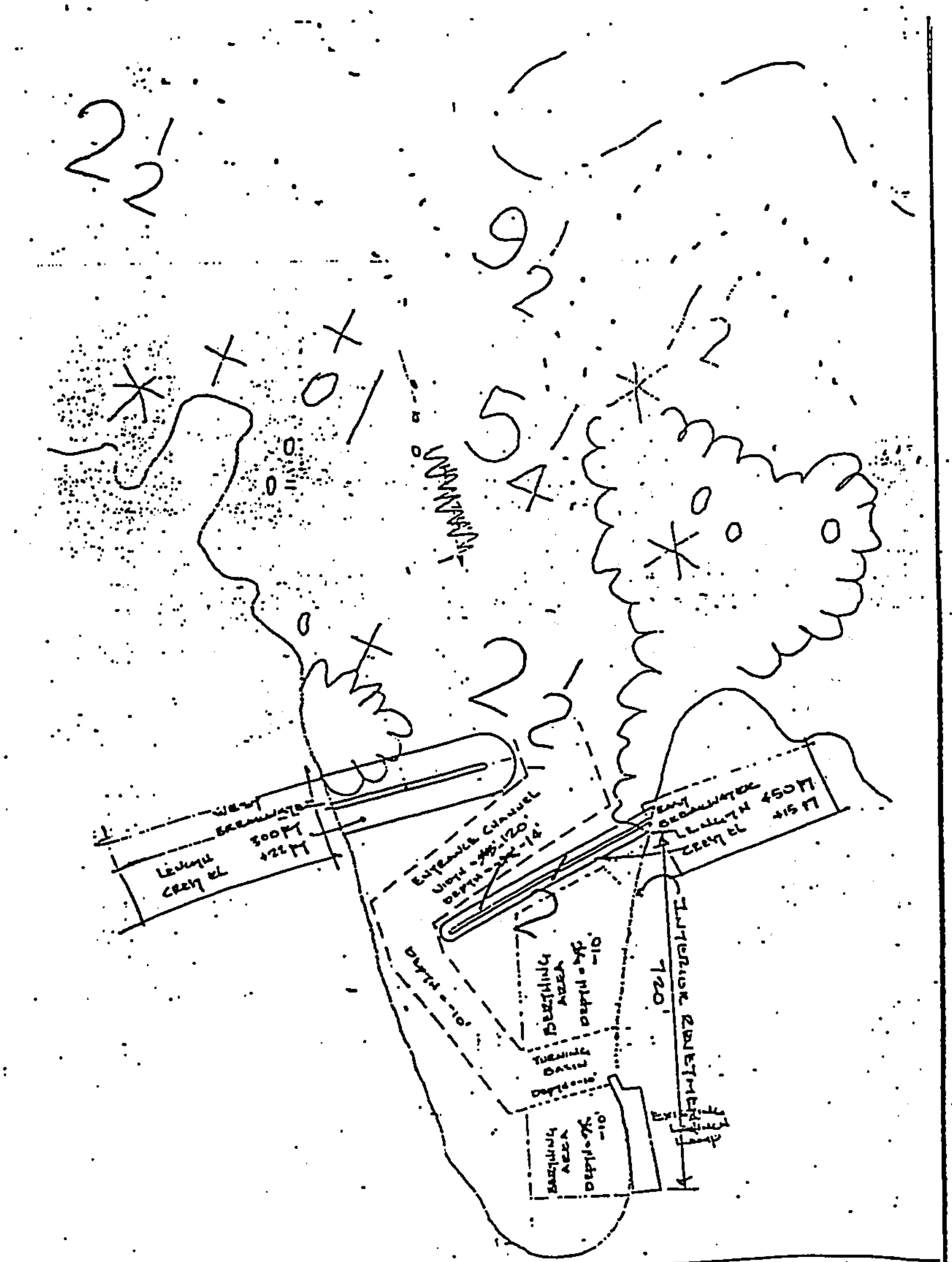


Figure 10. Kaa Point Small Boat Harbor Alternative

POD Form 115



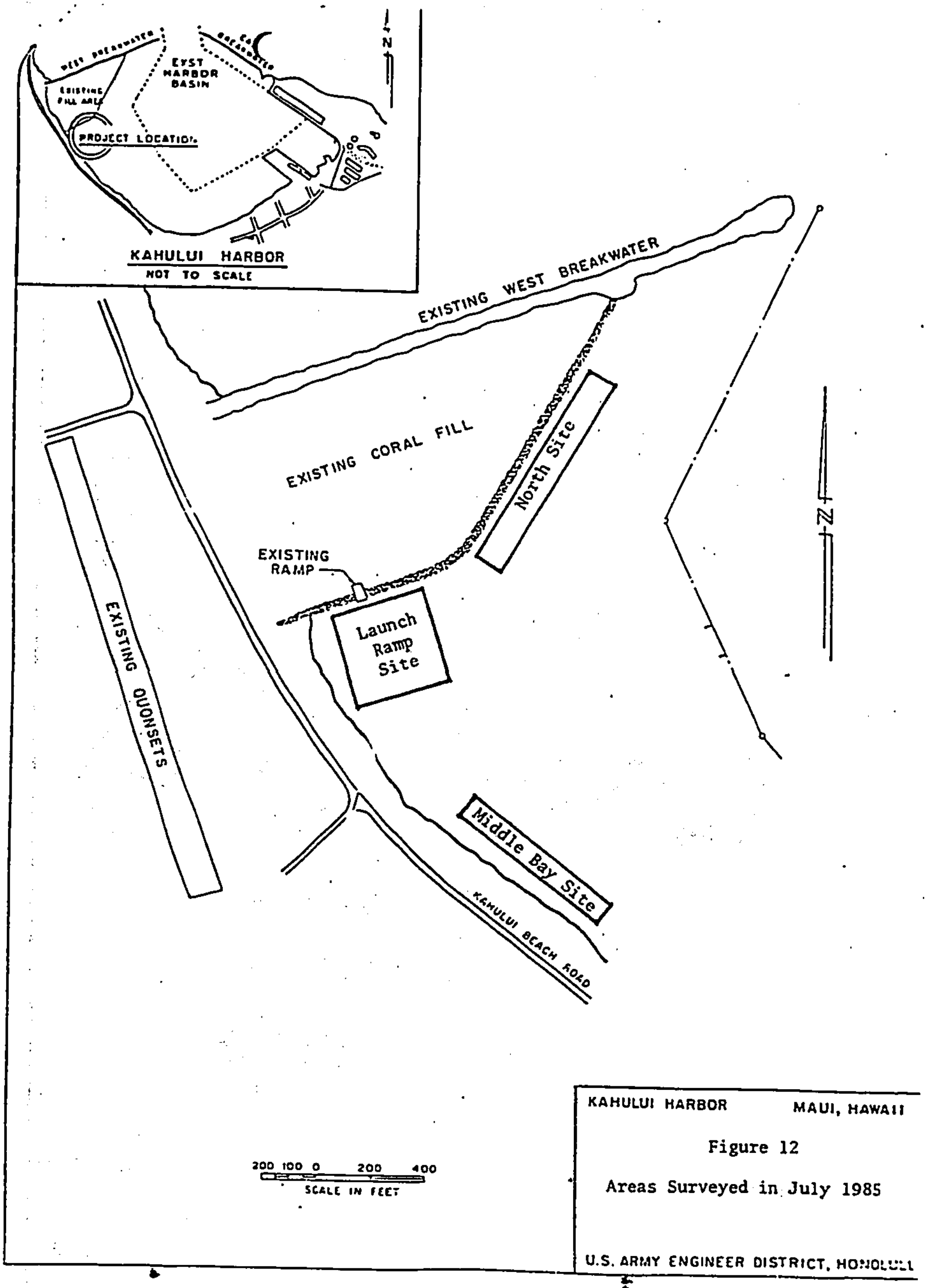
gure 11. Maliko Bay Small-Boat Harbor Alternative

Maliko Bay   Maui, Hawaii

Preliminary
Plan of Improvement

Soundings in fathoms

0 205 410



KAHULUI HARBOR MAUI, HAWAII

Figure 12

Areas Surveyed in July 1985

U.S. ARMY ENGINEER DISTRICT, HONOLULU

TABLE 1.

Fish Species Observed at the Existing Boat Launch Ramp, Kahului Harbor, Maui. July 1985. Survey by U.S. Fish and Wildlife Service and Department of Land and Natural Resources, Division of Aquatic Resources.

	Location	
	Reef Flats	Revetment
Acanthuridae		
Acanthurus leucopareius (Jenkins)	x	
Ctenochaetus strigosus (Bennett)	x	
Canthigasterideae		
Canthigaster amboinensis Bleeker	x	
Chaetodontidae		
Chaetodon miliaris Quoy and Gaimard	x	
C. lunula (Lacepede)	x	x
Clupeidae		
Herklotsichthys quadrimaculatus	x	
Engraulidae		
Stolephorus purpureus Fowler	x	x
Kuhlidae		
Kuhlia sandvicensis (Steindachner)		x
Labridae		
Coris flavovittata (Bennett)	x	
C. venusta Vaillant and Sauvage	x	
Thalassoma duperrey Quoy and Gaimard	x	x
Monacanthidae		
Pervagor spilosoma (Lay and Bennett)	x	
Mugilidae		
Mugil cephalus Linnaeus	x	

	Reef Flats	Revetment
Mullidae		
Parupeneus multifasciatus (Quoy and Gaimard)	x	
P. pleurostigma (Bennett)	x	
P. porphyreus (Jenkins)	x	x
Mulloides flavolineatus (Lacepede)	x	
Ostraciontidae		
Ostracion meleagris Shaw	x	
Pomacentridae		
Abudefduf sordidus (Forskal)		x
A. abdominalis (Quoy and Gaimard)		x
Dascyllus albisella Gill	x	x
Scorpididae		
Microcanthus strigatus (Cuvier and Valenciennes)		x
Zanclidae		
Zanclus cornutus Linnaeus	x	

TABLE 2.

Fish Species Observed Along the Middle Bay Area, Kahului Harbor, Maui. July 1985. Survey by U.S. Fish and Wildlife Service and Department of Land and Natural Resources, Division of Aquatic Resources.

Acanthuridae

Acanthurus triostegus (Linnaeus)
Ctenochaetus strigosus (Bennett)

Mullidae

Parupeneus porphyreus (Jenkins)

Pomacentridae

Abudefduf abdominalis (Quoy and Gaimard)

TABLE 3.

Fish and Coral Species Observed at the Northern End of the West Breakwater Site, Kahului Harbor, Maui. July 1985. Survey by U.S. Fish and Wildlife Service and Department of Land and Natural Resources, Division of Aquatic Resources.

Fish

Acanthuridae

Acanthurus leucopareius (Jenkins)
A. triostegus (Linnaeus)
A. nigrofuscus (Forskal)
Ctenochaetus strigosus (Bennett)
Naso unicornis (Forskal)

Balistidae

Rhinecanthus rectangulus (Bloch and Schneider)

Canthigasterideae

Canthigaster amboinensis Bleeker
C. jactator (Jenkins)

Carangidae

Caranx melampygus Cuvier and Valenciennes

Chaetodontidae

Chaetodon miliaris Quoy and Gaimard
C. lunula (Lacepede)
C. fremblii Bennett
C. auriga Forskal

Diodontidae

Diodon hystrix Linnaeus

Kuhlidae

Kuhlia sandvicensis (Steindachner)

Kyphosidae

Kyphosus sp.

Labridae

Coris flavovittata (Bennett)
C. venusta Vaillant and Sauvage
C. gaimard ((Quoy and Gaimard)
Thalassoma duperrey Quoy and Gaimard
T. ballieui (Vaillant and Sauvage)
T. purpureum (Forskal)

Lutjanidae

Lutjanus fulvus (Bloch and Schneider)

Monacanthidae

Pervagor spilosoma (Lay and Bennett)

Mullidae

Parupeneus multifasciatus (Quoy and Gaimard)
Mulloides flavolineatus (Lacepede)
P. porphyreus (Jenkins)

Muraenidae

Gymnothorax sp.

Ostraciontidae

Ostracion meleagris Shaw

Pomacentridae

Acanthurus abdominalis (Quoy and Gaimard)
Dascyllus albisella Gill
Stegastes fasciolatus (Ogilby)

Scaridae

Scarus dubius Bennett

Sphyraenidae

Sphyraena sp.

Zanclidae

Zanclus cornutus Linnaeus

Corals

Scleractinian Corals

Montipora flabellata Studer
Porites lobata Dana
P. compressa Dana
P. meandrina Dana
Pocillopora damicornis (Linnaeus)

TABLE 4. CHECKLIST OF THE MACROBIOTA FOUND IN THE INSHORE WATERS OF THE KAHULUI BAY SITE, MAUI, MARCH 1984

Fish

Acanthuridae
Acanthurus nigrofuscus (Forskal)
A. nigroris Cuvier and Valenciennes
A. triostegus sandvicensis Randall
A. xanthopterus Cuvier and Valenciennes
Ctenochaetus strigosus (Bennett)

Ostraciidae
Lactoria fornasini (Bianconi)
Ostracion meleagris camurum Jenkins

Balistidae
Rhinecanthus rectangulus (Bloch and Schneider)

Labridae
Gomphosus varius Lacepede

Chaetodontidae
Chaetodon miliaris Quoy and Gaimard
C. fremblii Bennett
C. miliaris Quoy and Gaimard
C. unimaculatus Bloch

Pomacentridae
Abudefduf sordidus (Forskal)
Plectroglyphidodon johnstonianus Fowler and Ball
Pomacentrus jenkinsi Jordan and Evermann

Invertebrates
Cnidaria
Pocillopora meandrina Dana
P. damicornis (Linnaeus)
P. molokensis Vaughan
Montipora verrucosa (Lamarck)
M. flabellata Studer

Echinodermata
Echinometra mathaei
Holothuria atra
Actinopyga mauritiana
Tripneustes gratilla
Diadema paucispinum
Echinothrix diadema

Algae

Caulerpa sp.
Grateloupia sp.
Ulva fasciata
Cladophora fascicularis
Champia sp.
Acanthophora spicifera
Gracilaria bursapastoris
Stypopodium hawaiiensis

TABLE 5. CHECKLIST OF THE MACROBIOTA FOUND IN THE INSHORE WATERS NEAR THE KAA POINT SITE, MAUI, MARCH 1984

Fish

Labridae

Thalassoma duperrey Quoy and Gaimard
T. ballieui (Vaillant and Sauvage)
Pseudocheilinus sp.

Pomacentridae

Abudefduf abdominalis (Quoy and Gaimard)

Invertebrates

Cnidaria

Palythoa sp.
Pocillopora meandrina Dana
P. damicornis (Linnaeus)
Montipora flabellata Studer
M. verrucosa (Lamarck)

Echinodermata

Diadema paucispinum
Echinometra mathaei
Actinopyga mauritania
Holothuria atra
Echinothrix diadema
Ophiocoma sp.

Mollusca

Serpulorbis sp.

Algae

Padina sp.
Halimeda opuntia
Cladophora fascicularis
Acanthophora spicifera (Vahl)
Codium edule
Stypopdium hawaiiensis

TABLE 6. CHECKLIST OF THE MACROBIOTA FOUND IN THE INSHORE WATERS OF THE MALIKO BAY SITE, MAUI, MARCH 1984

Fish

Acanthuridae
- *Acanthurus dussumieri* Cuvier and Valenciennes
- *A. leucopareius* (Jenkins)
- *A. nigrofuscus* (Forskal)
- *A. triostegus sandvicensis* Randall
- *A. mata* Cuvier and Valenciennes
- *A. nigroris* Cuvier and Valenciennes
- *Ctenochaetus strigosus* (Bennett)
- *Naso unicornis* (Forskal)

Zanclidae
- *Zanclus cornutus* Linnaeus

Chaetodontidae
- *Chaetodon fremblii* Bennett
- *C. miliaris* Quoy and Gaimard
- *C. ornatissimus* Cuvier and Valenciennes
- *C. quadrimaculatus* Gray
- *C. unimaculatus* Bloch
- *Forcipiger flavissimus* Jordan and McGregor

Kyphosidae
- *Kyphosus bigibbus* Lacepede

Labridae
- *Bodianus bilunulatus* Lacepede
- *Anampses cuvieri* Quoy and Gaimard
- *Cheilio inermis* Forskal
- *Labroides phthirophagus* Randall
- *Coris flavovittatus* Bennett
- *C. gaimard* Quoy and Gaimard
- *Stethojulis albovittata* Bonnaterre
- *Thalassoma duperrey* Quoy and Gaimard
- *T. ballieui* Vaillant and Sauvage
- *T. fuscum* Lacepede

Balistidae
- *Melicthys vidua* (Solander)
- *Rhinecanthus rectangulus* (Bloch and Schneider)
- *Sufflamen bursa* (Bloch and Schneider)

Ostraciidae
- *Ostracion meleagris camurum* Jenkins

Mullidae
- *Mulloidichthys flavolineatus* (Lacepede)

M. vanicolensis (Cuvier and Valenciennes)
Parupeneus multifasciatus (Quoy and Gaimard)
P. bifasciatus (Lacepede)
P. cyclostomus (Lacepede)
P. porphyreus (Jenkins)
P. pleurostigma (Bennett)

Pomacentridae
Abudefduf abdominalis (Quoy and Gaimard)
A. sordidus (Forskal)
Plectroglyphidodon johnstonianus Fowler and Ball
Chromis vanderbilti (Fowler)

Scaridae
Calotomus spinidens (Quoy and Gaimard)
Scarus rubroviolaceus (Bleeker)

Mugilidae
Mugil cephalus Linnaeus
Chelon engeli (Bleeker)

Reptiles
Chelonia mydas (Linnaeus)

Invertebrates

Cnidaria
Palythoa tuberculosa (Esper)
Montipora verrucosa (Lamarck)
M. flabellata Studer
Pocillopora meandrina Dana
P. damicornis (Linnaeus)
Porites lobata Dana
P. compressa Dana
Pavona duerdeni Vaughan

Echinodermata
Tripneustes gratilla
Holuthuria atra
Actinopyga mauritiana

Mollusca
Serpulorbis sp.
Isognomen sp.
Nerita picea

Algae
Ulva sp.
Galaxaura sp.
Ahnfeltia concinna J. Agardh

APPENDIX F

NATURAL RESOURCES

SECTION III. ENDANGERED SPECIES COORDINATION

United States Department of the Interior
FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

MAR 2 1 1989

Mr. Kisuk Cheung
Chief, Engineering Division
U. S. Army Engineer District, Honolulu
240 Dunning Hall
Fort Shafter, Hawaii 96858-5440

Attn: Planning Branch

This replies to your March 17, 1989 request for our review and comments on the proposed Detailed Project Report and Environmental Impact Statement for the Kahului Light Draft Navigation Improvements dated October 1988. Specifically, you sought our concurrence that the project would have no effect on listed species within our statutory jurisdiction.

We agree with your determination that the referenced project will have no effect on endangered and threatened species of plants and animals under our jurisdiction. We do note, however, that the threatened green sea turtle may be found in the waters of the project area. As listed species of sea turtles are under the jurisdiction of the National Marine Fisheries Service when they are in the water, we suggest you contact them for comment.

Thank you for allowing us to review the project.

Sincerely yours,

William R. Kramer

William R. Kramer
Acting Field Office Supervisor
Office of Environmental Services

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
Western Pacific Program Office
P. O. Box 3830
Honolulu, Hawaii 96812

April 20, 1984 F/SWR1:ETN

Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
Pacific Ocean Division
Corps of Engineers
Fort Shafter, Hawaii 96858

Dear Mr. Cheung:

In response to your letter of March 29, 1984 regarding the expanded reconnaissance report for a small boat harbor within Kahului Harbor, the following is provided for your information.

We are aware of only two species listed pursuant to the Endangered Species Act of 1973, as amended, that may be present in or near the project sites as described. The humpback whale (Megaptera novaeangliae) is listed as endangered and is found seasonally within the 100 fathom isobath around all of the main Hawaiian Islands from December through May during their seasonal migrations to Hawaiian waters. Although no concentrations of humpback whales have been observed in the waters off Kahului, their presence has been noted during past whale seasons.

There is no site specific information regarding the distribution of the threatened green turtle (Chelonia mydas) along the north-central coast of Maui. Anecdotal information and casual observations indicate only the presence of green turtles along the coastline where the project sites are located.

Should there be any further questions please contact Mr. Eugene Nitta at 955-8831.

Sincerely yours,

Doyle E. Gates
Administrator

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:
1-2-84-SP-133
ES 6307
APR 12 1984

Mr. Kisuk Cheung
Chief, Engineering Division
U.S. Army Corps of Engineers, Pacific Ocean Division
Ft. Shafter, Hawaii 96858

Dear Mr. Cheung:

This replies to your March 28, 1984 request for information on any listed or proposed endangered or threatened species that may be present in any of the three sites which may be chosen within the Kahului Deep Draft Harbor, Maui, Hawaii. Those three sites are at Maliko Bay, Kahului Harbor, and Kaa.

All three sites would be expected to provide habitat for the threatened green sea turtle (Chelonia mydas). As such, you may wish to contact the National Marine Fisheries Service. It is doubtful if this turtle would come ashore at any of the sites under consideration.

The Kaa site is close to the Kanaha Pond Waterfowl Refuge. This refuge provides habitat for two endangered species, the Hawaiian stilt (Himantopus himantopus knudseni) and the Hawaiian coot (Fulica americana alai). Either of these birds may fly over the Kaa area, but it would not be expected that they would regularly land there. We would not consider Kaa as habitat for either of these waterbirds.

If we can be of further service, please contact us again.

Sincerely yours,

Ernest Kosaka

Ernest Kosaka
Project Leader
Office of Environmental Services

cc: Regional Director, FWS, Portland, OR (AFA-SE)

APPENDIX F

NATURAL RESOURCES

SECTION IV. WATER QUALITY

WATER QUALITY DATA

The Kahului Bay Water Quality Data presented here was obtained from the State of Hawaii, Department of Health. Kahului is classified as Class A waters under the State of Hawaii Department of Health regulations, Title 11, Chapter 54 - Water Quality. Class A are marine waters that are designated for recreational purposes and aesthetic enjoyment. The data presented were collected from January 1983 to January 1988 at various locations within Kahului Bay.

Dissloved oxygen (DO) and coliforms (COLI) are important parameters for surface waters. The gross data indicates that the mean DO within Kahului Bay is 8.7 mg/l with a minimum measurement of 4.2 mg/l and a maximum of 14 mg/l. The total mean coliform measured is 6.3/100 ml (2.0/100 ml minimum and 790/100 ml maximum measured), and fecal coliform is 3.06/100 ml (2.0/100 ml minimum and 79.0/100 ml maximum measured). Typical surface water standards set by the Water Pollution Control Act for water contact recreation and fisheries are minimum DO between 4 to 6 mg/l, total maximum coliform 1000/100 ml, and maximum fecal fecal coliform 200/100 ml. The data indicates that the general water quality of Kahului Harbor is good and meets State water quality standards.

KAHULUI BAY WATER QUALITY DATA

?? 5? ??.? ?? 19 ??.? 5
KAHULUI BAY
15009 HAWAII
MAUI
KAHULUI
21HI 760303
0000 FEET DEPTH

/TYPA/AMBNT/ESTURY

DATE FROM TO		00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU LOG	00300 DO MG/L	00400 PH SU	00480 SALINITY PPTH	00530 RESIDUE TOT NFLT MG/L LOG	00600 TOTAL N N MG/L LOG	00610 NH3+NH4- N TOTAL MG/L LOG	00625 TOT KJEL N MG/L LOG	00630 NO2&NO3 N-TOTAL MG/L LOG
83/01/01 YEAR	NUMBER	28	27	18	25	28	25	28	28	28	28
	MAXIMUM	27.5000	9.00000	14.8000	7.90000	35.0000	229.000	.640000	1.00000	.480000	.520000
	MINIMUM	22.0000	.400000	8.50000	6.20000	29.7000	10.0000	.0100000	.100000	.100000	.0100000
	MEAN	25.6071	1.83168	12.4055	7.41199	33.5678	40.3068	.180947	.135175	.137446	.0482133
83/12/31	STAND DEV	1.34301	2.26064	1.97053	.482450	1.52050	2.23478	2.37348	2.06058	1.57867	4.05572
84/01/01 YEAR	NUMBER	15	12	12	14	15	12	15	9	15	12
	MAXIMUM	26.1000	20.0000	8.90000	8.10000	39.0000	62.0000	.540000	.120000	.540000	.140000
	MINIMUM	22.0000	.500000	5.90000	7.20000	32.0000	7.00000	.100000	.100000	.100000	.0100000
	MEAN	23.7600	1.55714	7.40833	7.69999	34.3600	26.5740	.219200	.102047	.190239	.0508384
84/12/31	STAND DEV	1.42708	3.06552	1.05440	.311296	2.24304	1.96643	1.81269	1.06267	1.71918	2.89413
85/01/01 YEAR	NUMBER	18	18	17	18	18	18	15	15	17	15
	MAXIMUM	25.4000	6.00000	9.30000	8.20000	34.2000	109.000	.850000	.160000	.670000	.180000
	MINIMUM	21.7000	.200000	4.20000	7.10000	32.0000	1.00000	.100000	.0500000	.100000	.0100000
	MEAN	23.0888	.802701	6.99999	7.82333	33.3833	18.2752	.262784	.0737549	.226777	.0346723
85/12/31	STAND DEV	1.09698	2.92904	1.26590	.333831	.777380	3.75187	1.95093	1.56258	1.80893	3.39857
86/01/01 YEAR	NUMBER	21	21	21	21	21	21	21	21	21	21
	MAXIMUM	23.1000	3.70000	9.50000	8.20000	34.5000	79.0000	.800000	.0600000	.550000	.360000
	MINIMUM	20.1000	.300000	6.20000	7.20000	28.9000	8.00000	.100000	.0050000	.100000	.0100000
	MEAN	21.6714	.713781	7.82857	8.04761	32.8142	27.3806	.190908	.0451986	.151603	.0481739
86/12/31	STAND DEV	.756095	2.10552	1.12301	.275084	1.79311	1.75507	2.14952	1.65872	1.85403	3.65492
88/01/01 YEAR	NUMBER	3	3	3		3	3	3	3	3	3
	MAXIMUM	19.8000	1.10000	8.30000		32.2000	15.0000	.650000	.0500000	.540000	.120000
	MINIMUM	19.5000	.900000	7.20000		31.9000	10.0000	.180000	.0080000	.0699999	.110000
	MEAN	19.6333	1.02883	7.89999		32.1000	12.1644	.312167	.0271443	.174264	.113237
	STAND DEV	.154285	1.12283	.608385		.173993	1.22519	1.93721	2.88073	2.82634	1.05159

								82	76	84	79
				[illegible]	9.20000	39.0000	229.000	.850000	1.00000	.670000	.520000
		[illegible]	.00000	6.20000	6.20000	28.9000	1.00000	.0100000	.0050000	.0699999	.0100000
	MEAN	2.5647	1.14129	8.72252	7.72973	33.4305	27.2413	.207518	.0804497	.166601	.0471482
	STAND DEV	2.04768	[illegible]	2.57458	.442515	1.66994	2.49752	2.12493	2.13185	1.79216	3.52336

STORET RETRIEVAL DATE 88/08/17

KAHULUI BAY WATER QUALITY DATA (continued)

000680
20 54 00.0 156 28 00.0 5
KAHULUI BAY
15009 HAWAII
MAUI
KAHULUI
21HI 760303
0000 FEET DEPTH

/TYPA/AMBNT/ESTURY

DATE FROM TO		00665 PHOS-TOT MG/L P LOG	32209 CHLRPHYL A UG/L LOG	70507 PHOS-T ORTHO MG/L P LOG	31505 TOT COLI MPN CONF /100ML LOG	31615 FEC COLI MPNECMED /100ML LOG
83/01/01						
YEAR	NUMBER	28	21	28	5	5
	MAXIMUM	.0989999	572.000	.0859999	110.000	79.0000
	MINIMUM	.0100000	10.0000	.0010000	2.00000	2.00000
	MEAN	.0270208	38.8618	.0162434	6.26865	4.17205
	STAND DEV	2.18124	3.37471	2.49719	5.83264	5.17630
83/12/31						
84/01/01						
YEAR	NUMBER	15	15	15	2	2
	MAXIMUM	.0500000	322.000	.0310000	110.000	11.0000
	MINIMUM	.0130000	2.50000	.0050000	33.0000	4.00000
	MEAN	.0212441	18.0262	.0091472	60.2493	6.63324
	STAND DEV	1.38451	4.11417	1.74692	2.34277	2.04482
84/12/31						
85/01/01						
YEAR	NUMBER	18	17	18	7	7
	MAXIMUM	.0400000	15.0000	.0230000	9.00000	6.00000
	MINIMUM	.0120000	2.50000	.0050000	2.00000	2.00000
	MEAN	.0230018	3.89044	.0105504	3.50356	2.33986
	STAND DEV	1.36335	1.83605	1.74722	2.06714	1.51473
85/12/31						
86/01/01						
YEAR	NUMBER	21	21	21	7	7
	MAXIMUM	.0610000	418.000	.0480000	790.000	12.0000
	MINIMUM	.0050000	2.50000	.0050000	2.00000	2.00000
	MEAN	.0188496	17.5081	.0102696	5.91323	2.58341
	STAND DEV	1.94869	6.40512	2.03684	8.95713	1.94840
86/12/31						
88/01/01						

[illegible]		[illegible]	[illegible]	.0088969		
	STAND DEV	1.05775	1.00113	1.20190		
[illegible]	NUMBER	85	77	85	21	21
	MAXIMUM	.0989999	572.000	.0859999	790.000	79.0000
	MINIMUM	.0050000	2.50000	.0010000	2.00000	2.00000
	MEAN	.0225721	14.5543	.0117100	6.28204	3.06494
	STAND DEV	1.82229	4.92214	2.11532	5.47425	2.54775
99/99/99						

STORET RETRIEVAL DATE 88/08/17

GROSS ANALYSIS

DATE FROM TO		00010 WATER TEMP CENT	00076 TURB TRBIDMTR HACH FTU LOG	00300 DO MG/L	00400 PH SU	00480 SALINITY PPTH	00530 RESIDUE TOT NFLT MG/L LOG	00600 TOTAL N N MG/L LOG	00610 NH3+NH4- N TOTAL MG/L LOG	00625 TOT KJEL N MG/L LOG	00630 NO2&NO3 N-TOTAL MG/L LOG
00/00/00	NUMBER	85	81	71	78	85	79	82	76	84	79
	MAXIMUM	27.5000	20.0000	14.8000	8.20000	39.0000	229.000	.850000	1.00000	.670000	.520000
	MINIMUM	19.5000	.200000	4.20000	6.20000	28.9000	1.00000	.0100000	.0050000	.0699999	.0100000
	MEAN	23.5647	1.14128	8.72252	7.72973	33.4305	27.2413	.207518	.0804497	.166601	.0471482
	STAND DEV	2.04768	2.64926	2.57458	.442515	1.66994	2.49752	2.12493	2.13185	1.79216	3.52336
99/99/99											

STORET RETRIEVAL DATE 88/08/17

GROSS ANALYSIS

DATE FROM TO		00665 PHOS-TOT MG/L P LOG	32209 CHLRPHYL A UG/L LOG	70507 PHOS-T ORTHO MG/L P LOG	31505 TOT COLI MPN CONF /100ML LOG	31615 FEC COLI MPNECMED /100ML LOG
00/00/00	NUMBER	85	77	85	21	21
	MAXIMUM	.0989999	572.000	.0859999	790.000	79.0000
	MINIMUM	.0050000	2.50000	.0010000	2.00000	2.00000
	MEAN	.0225721	11.5543	.0117100	6.28204	3.06494
	STAND DEV	1.82229	4.92214	2.11532	5.47425	2.54775
99/99/99						

STORET RETRIEVAL DATE 88/08/17

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KAHULUI LIGHT DRAFT
NAVIGATION IMPROVEMENTS
MAUI, HAWAII

CULTURAL AND SOCIAL RESOURCES

APPENDIX G

CULTURAL AND SOCIAL RESOURCES IN THE VICINITY OF
KAHULUI LIGHT DRAFT NAVIGATION IMPROVEMENTS
KAHULUI, MAUI, HAWAII

A. INTRODUCTION

1. Although the proposed construction of light draft navigation improvements at Kahului Harbor is not expected to have any significant social impacts, a brief discussion of Kahului, Hawaii is provided.

2. The State of Hawaii Historic Preservation Officer (SHPO) will have the opportunity to review this document and the Corps' Archaeological Reconnaissance Report. It is anticipated that they will concurr with a finding of no effect for alternatives located at Kahului Harbor.

B. HISTORIC SITES

1. Requirements. Section 106 of the National Historic Preservation Act of 1966, as amended, requires that the Corps identify any historic sites that may be eligible for inclusion on the National Register of Historic Places and if present, determine the impacts of the project on those cultural resources. Under the Corps' regulations (Engineering Regulation 1105-2-50), the responsibility of the Corps during survey level studies is directed to identifying those sites located in the area of potential environmental impact and evaluating alternative plans in relation to those sites. Consultation with the Advisory Council on Historic Preservation under Section 106 of the National Historic Preservation Act of 1966 is required if any of the affected project areas contain historic properties eligible for, or listed on the National Register.

2. Archaeological Reconnaissance. Limited surface and underwater archaeological reconnaissance survey were conducted at Kahului Harbor as well as limited surface reconnaissance survey at alternative considered but eliminated from further consideration on July 28-29, 1988 by the US Army Corps of Engineers. Eight study areas were examined on foot within the six study areas and supplemented by underwater observations. These alternative sites are plans A1, A2, B1, B2, C1, and C2 at Kahului Harbor and eliminated plan areas at Maliko Bay, and Kanaha area. Alternate sites A, B, and C are situated within or ajdacent to Kahului Harbor. Alternatives C1 and C2 are located in coral and basalt fill which have been laid on a weathered reef at depths up to 4 meters deep. Alternatives A1, A2, B1 and B2 are situated in the nearshore waters of Kahului Harbor at depths ranging from 1 to 3 meters. Underwater reconnaissance in the nearshore water consisted of random transects of general boat channels to be dredged, the portion of beach revetment

directly adjacent to the channel to be created by fill land excavation, and the tentative alignments for Alternatives A and B. Bottom underwater substrate consists of discontinuous areas of sand patches, re-deposited river gravels and cobbles, isolated and concentrated basalt outcrops. Bottles, plastic and rubber debris is interspersed throughout the area. No significant objects or structures were seen.

Maliko Bay, which has been eliminated from further consideration (TMK: 2-7-04: portion 7,) was examined on foot by a Physical Environmental Specialist, at the immediate vicinity along the shoreline. At present, the entire northeast side of the bay above the river gravel and cobble shoreline to the base of Maliko Gulch consists of the existing parking lot, a single boat launch ramp, and a turnaround area of compacted gravel surface or concrete platform that has been extensively disturbed and graded. The area north and east of the existing launch ramp to the east end of Maliko Bay is an exposed basalt bench covered with waterworn talus boulders. The existing roadway from the Hana Highway to the boat launch area also consists of a compacted gravel surface. Visible shallow scarps and erosion faces between Maliko Stream and the existing boat launch area was examined and consisted largely of dirt and coarse gravel fill lying on a riverine gravel substrate. No cultural remains or structures consisting of pondfilled walls, property wall remnants, or habitation areas were observed. The shoreline boulders do have small populations of opihi (Cellana earata) and the nearshore waters do have edible algae, both of which were being collected by fishermen in the area.

The Kanaha location (TMK: 3-8-01: portion 19) which has been eliminated from further consideration, was also examined. The northern portion of this small bay is dominated by a deteriorating basalt armorstone beach revetment with the adjacent beach area consisting largely of dredge spoil or otherwise imported coarse coral sand fill. The intrusive, additive layer of sand is greatly disturbed by vehicular traffic and picknickers, and contains a large amount of modern trash. Visible ruts, erosion faces and the surrounding dune faces show no evidence of buried soil horizons containing cultural remains, structures, burials, and the like. The little bay itself appears to have once been where a sand dune or beach berm once was, since basal portions of ironwood (Casuarina equisetifolia) appear to be imbedded in the nearshore bottom.

3. Historical/Archaeological Sites. There are no known historic/archaeological sites on the Hawaii or National Registers of Historic Places within the Kahului Harbor project sites, Maliko Bay, and Kanaha Beach area. Preliminary surface reconnaissance survey of the land and nearshore environment did not locate any cultural resources consisting of significant structures, remains, objects, or artifacts likely to be eligible for listing to either the Hawaii or National Registers of Historic Places.

C. KAHULUI

1. General. The town of Kahului surrounds the harbor complex and is two miles from the county seat of Wailuku on the second largest island in the State of Hawaii. The island of Maui is the second largest island in the State of Hawaii with an area of 728 square miles and the third largest in population. The island is of volcanic origin and consists of two major volcanic cones, namely Haleakala and the West Maui cone. Kahului Harbor is on the north side of the isthmus which separates the two volcanic cones. The harbor complex is surrounded by the town of Kahului and is where a large part of the population reside in that area.

2. Population. Maui is one of the fastest growing islands in the State with a population increase of 76.1 percent since 1970 to 1980. The 1980 resident population of Kahului was 12,978 persons. In general, the ethnic make-up of Maui is Caucasian (25%), Hawaiian (25%), Japanese (24%), Filipino (14%), and others (12%). In 1979, the median income for Maui families is $22,579

3. Land Use. The State Land Use Boundary classification of the project site is urban and the County of Maui zones the land as agriculture; however, the General Plan designates the area as park use.

4. Recreational Resources.

a. National Scenic and Wild Rivers. None present.

b. National Trails. None present.

c. Natural Landmarks. None present.

d. National Shoreline Parks or Beaches. None present.

e. Water Contact Recreation. Principal water contact recreation activities in Kahului Bay include shoreline fishing, boating, swimming, and surfing and are discussed below:

(1) Fishing. Recreation fishing areas and resources in Kahului Bay are popular and needed to be retained. Leisure time, recreational fishing is an important source of seafood for local residents. Pole fishing for common reef takes place along the entire harbor site of the western breakwater and during seasonal runs for o'ama and hahalu, fishing becomes an important recreation. Baitfish are also caught within the project area for commercial fishermen.

(2) Surfing. According to the 1971 Statewide Surfing Site Survey, there are four surfing sites within the harbor area, three sites outside the east breakwater of the harbor, and four sites north of the west breakwater. Surfing surveys have indicated excellent surfing conditions during the winter months.

(3) Boating. Kahului is nearer to the fishing grounds and as a result the boat launch ramp serves as a faster access to these grounds; however, strong tradewinds cause Kahului Harbor waters to be rough and choppy. During the winter months, large waves inside of the harbor prevents light draft boats to use the area.

(4) Beach Parks. The coral fill behind the western breakwater has been proposed as a future park. On the other side of the project, a Kahului Beach exists. According to the Statewide Recreation Resources Inventory Principal Swimming Areas, this beach park is of limited regional significance. It is suitable for all ages. The nearshore waters are normally murky due to poor water circulation and shipping activities.