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KAWAIHAE HARBOR, T. H.

LETTER

FROM

THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, UNITED STATES ARMY, DATED JULY 6, 1949, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND AN ILLUSTRATION, ON A PRELIMINARY EXAMINATION AND SURVEY OF KAWAIHAE HARBOR, HAWAII, AUTHORIZED BY THE RIVER AND HARBOR ACT APPROVED ON JULY 24, 1946

AUGUST 19, 1949.—Referred to the Committee on Public Works and ordered to be printed, with one illustration.

LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY,
Washington, D. C., August 9, 1949.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

DEAR MR. SPEAKER: I am transmitting herewith a report dated July 6, 1949, from the Chief of Engineers, United States Army, together with accompanying papers and an illustration, on a preliminary examination and survey of Kawaihae Harbor, Hawaii, authorized by the River and Harbor Act approved on July 24, 1946.

In accordance with section 1 of Public Law 14, Seventy-ninth Congress, the views of the Governor of the Territory of Hawaii and the Department of the Interior are set forth in the enclosed communications.

The Bureau of the Budget advises that there is no objection to the submission of the report to Congress.

Sincerely yours,

GORDON GRAY,
Secretary of the Army.

95509—49——1

COMMENTS OF THE GOVERNOR OF THE TERRITORY OF HAWAII

TERRITORY OF HAWAII,
EXECUTIVE CHAMBERS,
Honolulu, June 13, 1949.

Maj. Gen. LEWIS A. PICK,
Chief of Engineers, Department of the Army,
Washington, D. C.

DEAR GENERAL PICK: In further reference to your letter, File ENGWR, dated June 3, 1949, with which you transmitted your proposed report on a preliminary examination and survey of Kawaihae Harbor, Island of Hawaii, Territory of Hawaii, together with reports of the Board of Engineers for Rivers and Harbors and of the district and division engineers on the same subject, kindly be advised that a study has been made of this report, and I am in full accord with the conclusions which have been reached and your favorable report on the need of this project.

The 1947 session of the Territorial legislature, by the passage of Act 95, has provided for the sale of revenue bonds in the amount of $1,000,000 toward the Territory's share of the cost of this project and you can be assured that the recommended cooperation of the Territory, as enumerated in your preliminary report, will be forthcoming at the appropriate time.

A deep-water, all-weather port at Kawaihae on the west coast of the island of Hawaii will greatly assist in the development of a large area of farm and ranch land which has been slow in developing due to the lack of adequate shipping facilities in the vicinity.

Yours very truly,

INGRAM M. STAINBACK,
Governor of Hawaii.

COMMENTS OF THE DEPARTMENT OF THE INTERIOR

DEPARTMENT OF THE INTERIOR,
Washington 25, D. C., June 30, 1949.

Maj. Gen. LEWIS A. PICK,
Chief of Engineers, Department of the Army.

MY DEAR GENERAL PICK: The Department appreciates the opportunity to review and comment on your proposed report recommending improvement of Kawaihae Harbor, Island of Hawaii, Territory of Hawaii, to provide a deep-water all-weather port on the west coast of the island of Hawaii. In your letter dated June 3, 1949, transmitting the report and requesting comments and recommendations, it is noted that copies of the report were also furnished the Governor of Hawaii.

Construction of the harbor will not adversely affect interests of the Department of the Interior. In the opinion of the Fish and Wildlife Service, the report will stimulate the fishing industry and should result in substantial benefit to the fishery interests. From every point of view it appears that the harbor project will result in substantial economic benefit to the Territory of Hawaii and it is the hope of the Governor of Hawaii and of this Department that the

Congress will take expeditious and favorable action on the recommendations contained in the report.

Sincerely yours,

OSCAR L. CHAPMAN,
Under Secretary of the Interior.

REPORT OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY

DEPARTMENT OF THE ARMY,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., July 6, 1949.

Subject: Kawaihae Harbor, Island of Hawaii, T. H.
To: The Secretary of the Army.

1. I submit for transmission to Congress my report with accompanying papers on preliminary examination and survey of Kawaihae Harbor, Hawaii, authorized by the River and Harbor Act approved July 24, 1946.

2. Kawaihae Harbor is located on the west coast of the island of Hawaii, 45 miles northwesterly from Hilo Harbor. It consists of a natural channel and small-boat mooring area from 150 to 300 feet wide located shoreward of a protective coral reef, about 1,800 feet wide, which is partially exposed at low tide. Depths in the channel and basin range from 1 to 9 feet. The average tidal range is about 2 feet but the tsunami of April 1946 caused the water to rise 12 feet above mean lower low water. The harbor is on the lee side of the island from the prevailing northeast trade wind storms and is protected from less frequent storms from the south and southwest by the reef and a promontory to the southward. Hilo on the east coast of the island, 75 miles by highway from Kawaihae, is the only protected, all-weather, deep-water port on the island. There is no existing Federal project for improvement of Kawaihae Harbor. An open-sea pier constructed north of the harbor by the Territory of Hawaii at a cost of $89,000, accommodates interisland vessels with drafts up to 18 feet, during favorable weather.

3. The prospective area tributary to an improved harbor at Kawaihae comprises 1,090 square miles along the west coast and northern tip of the island. It had a population of 20,000 in 1940. It includes all of the Kona coast coffee, fruit, and vegetable producing area; the major portion of the island's cattle-raising areas; and about one-third of the northeast coast sugar-producing area. Kamuela, with a population of 445 in 1940, is the center of large cattle-raising activities. The region is served by highways and air lines. Terminal and transfer facilities in the vicinity of the harbor consist of the Territorial pier which provides 60 feet of wharf frontage and 1,800 square feet of storage area. It is equipped with light mechanical equipment and facilities for handling livestock. These facilities are open to all on equal terms. Ample areas, owned by the Territory, are available for development of additional terminals. Commerce of Kawaihae Harbor averaged 8,320 tons annually during the six prewar years 1936 through 1941, with an average of 3,500 passengers annually. The averages for the two postwar years 1946 and 1947 were 13,500 tons of commerce and 278 passengers. Vessel traffic during 1947 consisted of 58 calls

by interisland vessels with drafts up to 18 feet and the activities of 65 small fishing and recreational craft and numerous small barges.

4. Local interests desire a deep-water, all-weather harbor consisting of a basin and entrance channel 35 feet deep, protected by a breakwater or revetted fill on the coral reef. They have indicated willingness and ability to provide a reinforced concrete wharf, suitable han dling and storage facilities, and access highways.

5. The district engineer finds that the most practicable plan for improvement of Kawaihae Harbor consists of providing a harbor basin 1,250 feet square dredged to a depth of 35 feet below mean lower low water with an entrance channel 40 feet deep, 400 feet wide, and about 2,900 feet long extending northwesterly to the ocean; and construction of a breakwater about 4,400 feet long, with maximum crest elevation 13 feet above mean lower low water, extending from the shore generally along the southeast and oceanward sides of the basin. The breakwater would be constructed of dredged material with heavy stone revetment on the 3,200-foot oceanward section. He estimates the total first cost of the proposed improvement at $7,054,500 of which $5,576,500 would be Federal, including $51,000 for aids to navigation, and $1,478,000, non-Federal. The corresponding Federal and non-Federal annual charges are $233,000 and $65,000, respectively, a total of $298,000. The Federal annual charges include $10,000 for harbor maintenance. The district engineer believes that a deep-water, all-weather, protected harbor with necessary wharfage and shore facilities is essential to permit year-round trans-Pacific and interisland shipping, and to meet the increasing shipping needs of the communities on the western half of the island of Hawaii. He estimates that 167,000 tons of commerce would pass through the harbor annually. The gross annual tangible benefits from the improvement are estimated at $545,455 consisting of $198,794 from reduction in handling cost of sugar by bulk method in lieu of sack method, $64,647 from reduction in transportation costs of sugar and other commodities, $94,146 from elimination of costs at several small ports, $29,088 from reduction in handling costs of petroleum products, $153,780 from potential increase in commerce, and $5,000 from enhancement of property values. The district engineer estimates that there will be an increased cost, amounting to $52,236, for hauling commerce from more distant port areas to the proposed port. Deducting this cost from the gross benefits leaves the total evaluated net benefits at $493,219. The benefit-cost ratio is 1.66. Additional intangible benefits would accrue from stimulated development of the tributary area, increased fishing activities and tourist trade, and from use of the port as a harbor of refuge and for national defense purposes during emergencies. The intangible benefits would increase the benefit-cost ratio. The district engineer concludes that improvement of Kawaihae Harbor to provide a deep-water, all-weather port on the west coast of the island of Hawaii is warranted. He recommends that the United States adopt a project for improvement and maintenance of Kawaihae Harbor at a cost of $5,525,500 for construction and $10,000 for annual maintenance to provide (*a*) an entrance channel 40 feet deep below mean lower low water, 400 feet wide, and 2,900 feet long; (*b*) a harbor basin 1,250 feet square and 35 feet deep below mean lower low water; and (*c*) a protective breakwater with maximum crest elevation 13 feet above mean lower low water and approximately

4,400 feet long, of which the seaward 3,200 feet would be protected with heavy stone revetment; subject to the conditions that local interests provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction, maintenance, and operation of the project, to include specifically the properties landward of the proposed harbor basin and breakwater from the shore line to the paved public highway; hold and save the United States free from all claims for damages arising from the construction and maintenance of the project; provide and maintain adequate public terminals and transfer facilities open to all on equal terms; and accomplish without expense to the United States alterations as required in water supply, sewerage, drainage, and other utilities. The division engineer concurs.

6. The Board of Engineers for Rivers and Harbors concurs generally in the views of the reporting officers that the proposed improvement would provide a suitable deep-water, all-weather port on the west coast of the island of Hawaii which would meet the needs of the western and northern portions of the island and would be of material advantage to the United States in case of emergency. The Board accordingly recommends improvement of Kawaihae Harbor, Island of Hawaii, generally in accordance with the plan of the district engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable at an estimated cost to the United States of $5,525,500 for new work and $10,000 annually for maintenance subject to certain conditions of local cooperation.

7. After due consideration of these reports I concur in the views of the Board. The only deep-water, all-weather port on the island of Hawaii is at Hilo on the east coast. Access to Hilo Harbor from the western and northern portion of the island is difficult because of the mountainous terrain and absence of railroads. A deep-water, all-weather port on the west coast which would accommodate both interisland and trans-Pacific shipping is needed for accommodation of commerce originating in or destined to those areas. Such facilities would also be of advantage to the United States in case of emergency. The excess of prospective benefits over the estimated annual carrying charges for the improvement is sufficient to warrant expenditure of the required public funds. I accordingly recommend adoption of a project for the improvement of Kawaihae Harbor, island of Hawaii, to provide for a basin 35 feet deep below mean lower low water and 1,250 feet square with an entrance channel 40 feet deep, 400 feet wide, and approximately 2,900 feet long extending northwestward to deep water in the ocean; and a protective breakwater about 4,400 feet long with maximum crest elevation 13 feet above mean lower low water, of which the seaward 3,200 feet shall be protected by heavy stone revetment, all generally in accordance with the plan of the district engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable, at an estimated cost to the United States of $5,525,500 for new work, and $10,000 annually for maintenance; provided that responsible local interests give assurances satisfactory to the Secretary of the Army that they will (*a*) provide without cost to the United States all lands, easements, rights-of-way, and spoil disposal areas necessary for the construction and subsequent maintenance of the project, when and as required, to include specifically properties landward of the proposed harbor basin and break-

waters from the shore line to the paved public highway; (*b*) hold and save the United States free from damages due to the construction and subsequent maintenance of the works; (*c*) provide and maintain at their own expense adequate public terminal and transfer facilities, open to all on equal terms; and (*d*) accomplish without cost to the United States all necessary alterations in water supply, sewerage, drainage, and other utilities.

LEWIS A. PICK,
Major General, Chief of Engineers.

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

[Second endorsement]

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., April 22, 1949.

To: The Chief of Engineers, United States Army.

1. Local interests were advised of the conclusions of the division engineer and were invited to submit additional information to the Board. Careful consideration has been given to communications received.

2. The Board of Engineers for Rivers and Harbors concurs generally in the views and recommendations of the reporting officers. Access from the western and northern portions of the island to Hilo Harbor, the only all-weather port on the island, is difficult because of mountainous terrain and absence of railroads. As a consequence a large portion of the commerce of those areas is handled at a number of unprotected localities along the coast by shallow-draft boats, lighters, and other water craft operating only during favorable weather. In many instances shipments are handled by lighter or aerial cableway from offshore anchorages. All such existing facilities are inadequate and hazardous. The proposed improvement would provide a suitable and convenient deep-water, all-weather port for accommodation of the interisland and trans-Pacific commerce of those areas. The benefit-cost ratio of 1.66 justifies the expenditure of the necessary funds.

3. The Board accordingly recommends adoption of a project for the improvement of Kawaihae Harbor, Island of Hawaii, to provide for a basin 35 feet deep below mean lower low water and 1,250 feet square with an entrance channel 40 feet deep, 400 feet wide, and approximately 2,900 feet long extending northwestward to deep water in the ocean, and a protective breakwater about 4,400 feet long with maximum crest elevation 13 feet above mean lower low water, of which the seaward 3,200 feet shall be protected by heavy stone revetment, all generally in accordance with the plan of the district engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable, at an estimated cost to the United States of $5,525,500 for new work, and $10,000 annually for mainte-

nance; provided that responsible local interests give assurances satisfactory to the Secretary of the Army that they will: (*a*) provide without cost to the United States all lands, easements, rights-of-way, and spoil disposal areas necessary for the construction and subsequent maintenance of the project, when and as required, to include specifically properties landward of the proposed harbor basin and breakwater from the shore line to the paved public highway; (*b*) hold and save the United States free from damages due to the construction and subsequent maintenance of the works; (*c*) provide and maintain at their own expense adequate public terminal and transfer facilities, open to all on equal terms; and (*d*) accomplish without cost to the United States all necessary alterations in water supply, sewerage, drainage, and other utilities.

For the Board:

R. C. CRAWFORD,
Major General, Chairman.

REPORT OF THE DISTRICT ENGINEER

SYLLABUS

The district engineer finds that a deep-water, all-weather port located at Kawaihae would be advantageous to the United States and is essential to the present needs and future development of the communities of north and west Hawaii. He estimates the tangible benefits at $512,119 per year and finds that such a harbor would encourage the development of the tributary area and provide advantages during times of national emergency. He estimates the total cost of the project at $5,576,500 and the annual charges at $298,000, with a resulting benefit-cost ratio of 1.72 to 1. He estimates the annual harbor maintenance at $10,000.

The district engineer recommends that the United States adopt a project for the improvement and maintenance of Kawaihae Harbor at a total initial expenditure by the Corps of Engineers of $5,525,500. He recommends that the improvement consist of: (1) An entrance channel 400 feet wide and approximately 2,900 feet long to a depth of 40 feet below mean lower low water, with side slopes as required; (2) a harbor basin 1,250 feet square to a depth of 35 feet below mean lower low water, with side slopes as required; (3) a revetted fill breakwater approximately 3,200 feet long, to a maximum elevation of 13 feet above mean lower low water, with a seaward side slope of 1½ to 1, except at the 100-foot end sections where the seaward side slope will be 2 to 1; and (4) an unrevetted breakwater extension in the quieter water behind the reef approximately 1,200 feet long from the end of the revetted fill to shore.

The district engineer further recommends that the project be made subject to the condition that local interests provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction, maintenance, and operation of the project, to include specifically the properties located landward of the proposed harbor basin and breakwater from the shore to the paved public highway; that they hold and save the United States free from all claims for damages arising from the construction and maintenance of the project; that they provide and maintain adequate public terminal and transfer facilities open to all on equal terms; and that they accomplish without expense to the United States alterations as required in water supply, sewerage, drainage, and other utilities.

CORPS OF ENGINEERS, UNITED STATES ARMY,
OFFICE OF THE DISTRICT ENGINEER, HONOLULU DISTRICT,
Honolulu, T. H., January 15, 1949.

Subject: Report on Survey for Navigation, Kawaihae Harbor, Island of Hawaii, T. H.

Through: The Division Engineer, Western Ocean Division, Sausalito, Calif.

To: The Chief of Engineers, United States Army, Washington, D. C.

AUTHORITY

1. This report on survey for navigation at Kawaihae Harbor, island of Hawaii, T. H. is submitted in compliance with directive from the Chief of Engineers, dated October 20, 1947, based on an authorization by act of Congress, Public Law 525, Seventy-ninth Congress, chapter 595, second session, H. R. 6407, approved July 24, 1946. Section 7 of the act reads in part as follows:

> The Secretary of War is hereby authorized and directed to cause preliminary examinations and surveys to be made at the following-named localities, the cost thereof to be paid from appropriation heretofore or hereafter made for such purposes: *Provided*, That no preliminary examination, survey, project, or estimate for new works other than those designated in this or some prior Act or joint resolution shall be made: *Provided further*, That after the regular or formal reports made as required by law on any examination, survey, project, or work under way or proposed are submitted no supplemental or additional report or estimate shall be made unless authorized by law: *Provided further*, That the Government shall not be deemed to have entered upon any project for the improvement of any waterway or harbor mentioned in this Act until the project for the proposed work shall have been adopted by law: * * * *And provided further*, That this section shall not be construed to interfere with the performance of any duties vested in the Federal Power Commission under existing law: * * * Kawaihae Harbor, Hawaii.

2. A preliminary examination report, dated May 27, 1947, was reviewed by the Board of Engineers for Rivers and Harbors.

SCOPE OF SURVEY

3. A survey of Kawaihae Harbor to determine the advisability and cost of improvement and the local cooperation required was authorized by the Chief of Engineers on October 20, 1947.

4. Topographic and hydrographic surveys were made to cover the land and sea areas of the proposed harbor, and the alternate harbor plans considered in the study. Core and wash borings were made to ascertain the type of material to be dredged. Office studies were undertaken to determine the benefits to be obtained, the most practicable plan of improvement, and the costs thereof. All interested parties were contacted for their views as to the extent and type of development desired.

DESCRIPTION

5. *Location.*—The town of Kawaihae, the proposed harbor site, is situated on the west coast of the island of Hawaii, the largest island of the Hawaiian Archipelago. It is 45 miles northwesterly from Hilo and connected thereto by 75 miles of medium grade 2-lane highway.

6. *Shore-line data.*—The site is located in Kawaihae Bay, shoreward of a protecting reef. The curved portion of the shore line is about 1.5

miles long, with rocky shore lines extending northerly and southerly from the bay for several miles.

7. *Hydrography.*—The coral reef, about 1,500 yards long and 600 yards wide, lies offshore from the northern half of the curved shore line and is partially exposed at low tide. A natural channel and small boat mooring area between the reef and shore varies from 50 to 100 yards in width and from 1 to 9 feet in depth. This channel, extending southward, broadens to about 300 yards and, in general, is a few feet deeper than its northern section. However, the water depths south of the reef are only about 2 feet for a distance of 650 yards seaward. The depths of the bay area north of the reef vary from 2 feet near the shore to 30 feet at points from 200 to 400 yards offshore.

8. United States Coast and Geodetic Survey data on tide elevations and ranges for Kawaihae Harbor, adapted from Honolulu Harbor records, are presented in the following table:

TABLE 1.—*Tide data—Kawaihae Harbor*

[Datum is mean lower low water]

Tide	Low-level data		High-level data		Tide range in feet
	Item	Elevation	Item	Elevation	
Springtide (major):					
Maximum	Lower low water	−1.00	Higher high water	3.5	4.5
Average	do	0.00	do	2.1	2.1
Mean tide	Low water	0.20	High water	1.60	1.4

9. During the tsunami of April 1, 1946, the water surface at Kawaihae rose 10 to 12 feet above mean lower low water. Damage to shore structures was slight because the coral reef greatly dissipated the potential energy of the wave and reduced its damaging effect.

10. *Exposure and wind data.*—The site is on the lee side of the island from the prevailing northeast trade-wind storms and is protected from the less frequent south and southwesterly storms by the reef and the promontory to the south.

11. *Navigable capacity.*—The general vicinity of the site for the proposed harbor is now used by small boats of draft up to 5 feet. Northerly from the site is a pier used by interisland vessels drawing up to 18 feet. This pier projects from the rocky shore line into the open sea and is used for interisland shipments in good weather.

12. *Published charts.*—Kawaihae and the adjoining coastal areas to the north and south are shown on United States Geological Survey quadrangle maps "Kohala" and "Puako." Adjacent areas inland are shown on quadrangle maps "Waipio" and "Waikii." These quadrangle maps are to a scale of 1 to 62,500, and show 50-foot contours. The topography is from surveys of 1923–24.

13. Hydrographic details of the Kawaihae area are shown on the United States Coast and Geodetic Survey map 4166, the scale of which is 1 to 5,000. Hydrography for the area extending 5.5 miles to the south is shown on United States Coast and Geodetic Survey map 4167 at a scale of 1 to 80,000. These maps were prepared from surveys of 1928–29, but are editions of 1932, 1941, and 1942.

14. *Transmittal map.*—The map transmitted with this report was prepared from topographic and hydrographic surveys by the Honolulu

district, Corps of Engineers. The plate shows a plan and typical sections of the recommended improvement, a log of test borings, and a vicinity map showing the project location.

15. *Adjacent harbors.*—The harbor at Hilo is the only protected, all-weather, deep-water port on the island and is 75 miles by highway from Kawaihae Harbor. The west coast of the island has a number of small ports, which accommodate shallow-draft boats, lighters, and other small watercraft. Several of the sugar plantations have landings with offshore anchorages near their mill sites. Loading and unloading are accomplished by lighters or by aerial cableway. In all cases they are inadequate and hazardous facilities which cannot be operated during unfavorable weather.

16. Data on small harbors and landings are presented in the following table:

TABLE 2.—*Data on small harbors and landings*

Name	Location	Distance from Kawaihae	Water depth at pier	Type of harbor	Facilities
			Feet		
Kukuihaele	Northeast coast	20 miles east	45–84	Offshore anchorage	Aerial cableway, 5 mooring buoys.
Mahukona	West coast	11 miles north	7	do	Wharf, lighterage, 5 mooring buoys.
Puako	do	5 miles south	6	Small-boat harbor	Small pier.
Kailua	do	31 miles south	3–5	Small-boat harbor and offshore anchorage	Small pier, lighterage, 1 mooring buoy.
Napoopoo	do	40 miles south	4	Small-boat harbor	Small pier.
Milolii	do	61 miles south	5–7	do	Do.

TRIBUTARY AREA

17. *Present tributary area.*—Kamuela,[1] population 445, 1940 census, is the center for the largest group of cattle-raising enterprises in the Territory. One ranch is reputed to be second only to the King's ranch, of Texas, in size. Approximately 465 square miles are now tributary to Kawaihae's open-sea wharf. The greater portion of the productive area is grazing land. The area also includes the fertile Waimea plateau truck-farming area. The interconnecting paved roadways are in fair to poor condition. Funds in the amount of $400,000 per year are available to rehabilitate 103 miles of federally approved highways on the island. All island transportation is by truck, except that livestock is herded cross country to Kawaihae.

18. *Source of export items.*—The present areas contributing to activities at the port of Kawaihae consist of the following:

TABLE 3.—*Present tributary areas*

Tributary area	Approximate distance from Kawaihae Harbor [1]	Main export commodity
Kona cost area	30 miles south	Coffee and fruit.
West slope of Maunakea	20 miles southeast	Vegetables.
Waimea plateau	10 miles east	Do.
West slope of Maunakea	20 miles southeast	Poultry products.
Waimea plateau	10 miles east	Do.
Kailua area	30 miles south	Livestock and hides.
Area south of Kawaihae	15 miles south	Livestock, hides, and honey.
North slope of Maunakea	25 miles east	Livestock and hides.
Kamuela area	12 miles east	Do.
North Kohala	10 miles north	Do.

[1] Straight-line distance.

[1] See map of island of Hawaii on accompanying drawing for proximity to Kawaihae.

19. *Prospective tributary area.*—Commercial enterprises in an area extending from the vicinity of Milolii, on the southwestern coast to Honokaa on the northeast coast, will ship by way of an improved Kawaihae Harbor, instead of trucking to Hilo or shipping through the small local unprotected ports. This area of approximately 1,090 square miles includes all of the Kona-coast coffee-, fruit-, and vegetable-producing areas, the majority of the island's cattle ranches, and about one-third of the northeast coast sugar-producing area. In addition to the towns of Kawaihae, Kamuela, Puako, Hawi, Kohala, Honokaa, and Kailua, numerous small settlements are scattered throughout the coastal area. The total population of the enlarged tributary area was about 20,000 (1940 census).

20. The commodities and sources presented in paragraph 18 will be greatly increased by the addition of the larger Kona-coast tributary area, the entire Kohala district, and part of the Hamakua-coast sugar areas.

21. There are no existing developments for other water uses that will be involved in the construction of Kawaihae Harbor.

BRIDGES

22. There are no existing or contemplated bridges in the area proposed for the development of Kawaihae Harbor.

PRIOR REPORTS

23. There are no prior reports on Kawaihae Harbor, other than the preliminary examination report for navigation dated May 27, 1947.

EXISTING CORPS OF ENGINEERS' PROJECT

24. No Federal improvement has been made relative to Kawaihae Harbor by the Corps of Engineers.

LOCAL COOPERATION ON EXISTING AND PRIOR PROJECTS

25. There being no existing or prior Corps of Engineers' projects at Kawaihae, no local cooperation has been required.

OTHER IMPROVEMENTS

26. The present comparatively minor navigation facilities at Kawaihae were planned, constructed, and are maintained entirely by the Territory or by individual enterprises.

27. Since 1905, maintenance and minor construction at this port have amounted to $100,753. In 1937 the existing open-sea pier was built on hard-rock sea bottom in sufficiently deep water to accommodate interisland vessels. The cost of this improvement was $89,000. No navigation improvements exist in the waterways of the proposed Kawaihae Harbor development.

TERMINAL AND TRANSFER FACILITIES

28. *Existing pier facilities.*—The present pier is located approximately 2,200 feet northwesterly from the location of the proposed harbor development. It is 60 feet wide and 104 feet long, and provides

60 feet of wharf frontage and about 1,800 square feet of storage area. An approach to the pier extends 323 feet offshore and consists of a reinforced-concrete substructure, 130 feet of timber decking, and 193 feet of reinforced-concrete slab. There is a light hoist available for handling freight, and a cattle chute for handling livestock. The pier is owned and administered by the Territorial board of harbor commissioners and is open to all on equal terms.

29. Small interisland vessels call here from other Territorial ports. There are no canal, river, or rail connections to Kawaihae. Overland transportation is entirely by highway.

30. *Facilities needed.*—Kawaihae Harbor has long been known as one of the best potential anchorages on the island of Hawaii. A deep-water, all-weather, protected harbor with necessary wharfage and shore facilities is essential to permit year-round trans-Pacific and interisland shipping, and to meet the increasing shipping needs of the communities of the western half of the island of Hawaii.

31. *Available wharf frontage and terminal space.*—The undeveloped coastal area for a distance of about 1 mile on each side of Kawaihae Bay, except for a few private dwellings, is owned almost entirely by the Territory, and is available for development as wharf frontage and terminal areas.

IMPROVEMENTS DESIRED

32. *Views of local interests.*—Several conferences were held with local interests, including representatives of the Territorial board of harbor commissioners, shipping companies, sugar-plantation companies, port captains, and interisland and vessel pilots and captains. The development of Kawaihae Harbor proposed herein will meet the needs and views expressed by local interests.

33. *Public hearing.*—A public hearing was held on October 26, 1946, at the town of Kamuela, Hawaii, this being the largest community in the area tributary to Kawaihae Harbor. The hearing was presided over by the district engineer and was attended by 25 local, interested parties representing 2 Federal agencies, 3 sugar companies, 5 Territorial departments, 2 agricultural and cattle interests, 2 navigation companies, 1 community organization, and 10 miscellaneous local interests.

34. *Summary of improvements desired.*—The improvements desired, as indicated by the expressions of local opinion, consist of the following:

(*a*) A deep-water, all-weather harbor dredged to a depth of 35 feet, to consist of a channel and a harbor basin.
(*b*) A breakwater or revetted fill constructed on the partially exposed coral reef.
(*c*) A reinforced-concrete quay-type wharf.
(*d*) Bulk sugar-handling facilities and storage silos.
(*e*) A metal-storage shed.
(*f*) Miscellaneous freight-handling facilities.
(*g*) Improved connecting highways to the harbor.

35. The interested parties have advocated that, of the above-listed items, (*a*) and (*b*) be undertaken by the Federal Government and that items (*c*) to (*f*) comprise the local cooperation offered. Item (*g*) is proposed for accomplishment under the Federal-aid Territorial highway program.

COMMERCE

36. *Past commerce through Kawaihae.*—Detailed commercial statistics are presented in appendix A.[1] A résumé of the total commerce and passenger traffic through Kawaihae Harbor during the years from 1936 to 1947 is shown in the following table:

TABLE 4.—*Kawaihae Harbor commerce and passenger statistics, 1936–47*

Year	Tons of cargo	Number of passengers	Year	Tons of cargo	Number of passengers
1936	7,596	1,832	1944 [1]	13,287	98
1937	8,243	2,834	1945 [1]	10,468	60
1938	8,525	4,886	1946	14,925	403
1939	8,884	5,139	1947	12,062	154
1940	7,470	3,242			
1941	9,183	3,053	Average of normal years (1936–41, 1946–47)	9,611	
1942 [1]	3,202	11			
1943 [1]	4,198	51			

[1] War years.

37. *Interpretation of data and trend.*—In general, commerce through the port of Kawaihae has gradually increased except for the year 1940 and a few of the war years. Commerce decreased somewhat during the early years of the war because of restrictions placed on shipping, and increased later because of the shipping of war material and equipment. At present, there is practically no passenger traffic since air travel has become the mode of interisland travel.

38. *Prospective commerce through Kawaihae.*—In the event that Kawaihae Harbor is developed, the volume of shipping will increase due to the following factors: (1) A deep-water, all-weather port would provide year-round shipping; (2) the facilities would encourage further development of the fertile agricultural lands in the Kohala, Waimea, and Kona districts with consequent increase in exports; (3) all commerce now being shipped through the inadequate and unsatisfactory ports at Kukuihaele, Mahukona, Puako, Kailua, and Napoopoo would be shipped through Kawaihae.

39. With respect to the Waimea area referred to under item (2) above, the United States Department of the Interior has reported on a plan for irrigating 1,500 acres of land on this plateau. The plan, based on a survey by the Bureau of Reclamation, would involve an expenditure estimated at $850,000. The Territorial board of agriculture and forestry has estimated that truck-farming areas referred to under item (2) could produce 15,000 to 20,000 tons of fruit and vegetables each year. It is estimated that 5,900 tons of produce are already in production annually.

40. The principal commodities shipped to and from the tributary area are raw sugar, molasses, livestock, fresh fruit, fresh vegetables, coffee, petroleum products, lumber, fertilizer, machinery, and general merchandise. The present average annual tonnage is 121,233. Increases in vegetable production and in sugar production are expected to increase imports and exports to 167,000 tons annually.

[1] Not printed

41. *Small watercraft.*—At present, about 65 fishing and pleasure boats use the natural shallow anchorage at Kawaihae. The development of servicing facilities at the wharf would increase the usefulness of the port to this class of vessel. The harbor would become the operating base for an increased number of such craft if improved as proposed.

VESSEL TRAFFIC

42. *Present data.*—During the year 1947, the latest year of complete record, a total of 58 port calls were made at Kawaihae by interisland vessels. In addition, the port is used by numerous small boats and barges. Kawaihae is a regular weekly port of call by the interisland vessel steamship *Humuula* and by other interisland vessels on special occasions. The size of interisland vessels varies from 507 net registered tons to 1,803 tons, the maximum draft being 18 feet. Trans-Pacific vessels do not now make Kawaihae a port of call, as the existing facilities can accommodate only vessels with drafts such as those of the interisland service.

43. *Future data relative to an improved harbor.*—The proposed improvement of Kawaihae Harbor would establish it as the only deep-water, all-weather port on the west coast of the island. Proposed navigation facilities would then accommodate trans-Pacific vessels, which vary in size from 7,176 tons to 17,226 tons, with an average maximum draft of 30 feet. Prospective vessel traffic, when increased by that transferred from the ports of Kukuihaele, Mahukona, Puako, Kailua, and Napoopoo, would amount to an annual average of 53 port calls by trans-Pacific vessels and 150 by interisland vessels.

DIFFICULTIES ATTENDING NAVIGATION

44. *Port of Kawaihae.*—The existing port of Kawaihae has an unprotected pier in the open sea with a maximum docking depth of approximately 22 feet. No dredging has been done in the Kawaihae area. During the stormy winter months the rough seas endanger vessel dockings and during a portion of the time make shipping activities impossible. Docked vessels, when warned of an approaching storm, weigh anchor and head for the open sea. There have been occasions when the storms have severed the mooring lines. Inbound vessels anchor offport and wait for favorable docking weather, or proceed to Hilo for discharging cargo intended for Kawaihae. The proposed improvement would eliminate this undesirable difficulty and procedure, and provide facilities for dependable, year-round shipping activities.

45. *Nearby unimproved ports.*—Navigation difficulties at nearby ports reveal the need of an adequate harbor in west Hawaii. A brief description of the three most important nearby ports is now presented (see also table 2, par. 16, for a listing of the meager harbor facilities at three other small west Hawaii ports):

(*a*) *Port of Kukuihaele.*—The coast line in the vicinity of the port of Kukuihaele is precipitous. The anchorage is situated below a 250-foot precipice. Interisland and trans-Pacific vessels anchor about 700 feet offshore. Freight is handled by means of a 2.5-ton capacity aerial cableway, owned and operated by Honokaa Sugar Co. These facilities are inoperable during high winds and heavy seas.

(*b*) *Port of Mahukona.*—This landing is owned and operated by the Kohala Sugar Co. It is located in a small open bay in North Kohala and has a docking

depth of 7 feet. During favorable weather, freight is lightered to and from vessels anchored about 900 feet offshore. Even during fair weather, considerable difficulty is experienced when the cargo is heavy or bulky. During adverse weather, when the port is unusable, shipping operations are delayed, or must be handled through Hilo and the cargo trucked the 94 miles back to the port. Geological features make the cost of developing an all-weather port prohibitive at this location.

(*c*) *Port of Kailua.*—The port of Kailua is owned by the Territory of Hawaii. It is located in a small bay in the North Kona district and can only accommodate boats of a maximum draft of 5 feet. Freight is lightered to and from vessels anchored offshore, weather permitting. Cattle are towed offshore by small boats and then hoisted aboard. Lumber is formed into rafts and floated ashore. These methods are not feasible during the adverse weather of the winter months.

46. *Record of accidents and vessel groundings.*—Formal records of accidents and groundings of vessels at Kawaihae and other west Hawaii ports are not available. Damages to pier facilities at Kawaihae caused by kona storms and resultant high seas, as reported by the Territorial board of harbor commissioners, amounted to $10,000 in 1939. For the subsequent years up to and including 1947, the total damage, including that from the tidal wave of 1946, amounted to $37,000.

WATER POWER AND OTHER SPECIAL SUBJECTS

47. There are no water power or other special water uses involved in the proposed improvement at Kawaihae.

PLAN OF IMPROVEMENT

48. *Most practicable plan.*—The plan of improvement considered most practicable for Kawaihae Harbor (see accompanying drawing) is as follows:

(*a*) Dredge an entrance channel 400 feet wide and approximately 2,900 feet long to a depth of 40 feet below mean lower low water, with side slopes of 1 to 1.

(*b*) Dredge a harbor basin 1,250 feet square to a depth of 35 feet below mean lower low water.

(*c*) Construct a revetted fill breakwater approximately 3,200 feet long, to a maximum elevation of 13 feet above mean lower low water, with a seaward side slope of 1½ to 1, except for the last 100 feet at each end, where the seaward side slope will be 2 to 1. (See also accompanying drawing for details and par. 2, appendix D [1].)

(*d*) Construct an unrevetted breakwater extension in the quieter water behind the reef approximately 1,200 feet long from the end of the revetted fill to the shore.

49. The amount of dredging required is estimated at 3,305,000 cubic yards (see appendix B [1]), of which 257,000 cubic yards could be used on the shore area adjoining the harbor development. Local interests would do the grading to provide wharf and storage area. Approximately 1,100,000 cubic yards could be placed in the revetted breakwater and in and on the unrevetted fill. These three disposal areas are those of lowest cost. All dredged material in excess of these amounts would be disposed of in approved dumping areas at sea.

50. *Factors influencing the determination of the plan.*—The harbor is on the west side of the island and thus protected from the northeasterly trade winds. Protection from the west and southwest winds, waves, and storms is partially afforded by the coral reef. The reef also provides a foundation for the proposed breakwater. (See par. 1, appendix D [1].) The entrance channel would face the sea in a north-

[1] Not printed.

westerly direction, which from all evidence obtainable, is the direction of least disturbances. One of the principal reasons for selection of a northerly entrance rather than a southerly one is to provide a turn to starboard upon the decelerating approach to the wharf for a single-screw vessel. A reversal of the screw brings the stern of the vessel to port. This turning will put the vessel along the proper course. With a southerly entrance, however, this action would tend to set the vessel across the entrance channel. During exit through the channel this effect is less noticeable as the vessel is accelerating and responds well to the rudder. The winds at Kawaihae will be across the proposed channel during a major portion of the time. This condition obtains, however, at a majority of the Hawaiian ports and appears to be not entirely avoidable where consideration must be given to other factors. The height of 13 feet above mean lower low water for the breakwater was determined through study of the effectiveness of other breakwaters at harbors of the Territory. (See also par. 2, appendix D [1].) Breakwaters of this height will provide adequate protection from all storm intensities anticipated. The location of the basin somewhat offshore was required by the occurrence of hard basalt rock which dips below elevation minus 35 feet only at the proposed shoreward harbor line.

51. The channel width of 400 feet and channel depth of 40 feet below mean lower low water were adopted for the following reasons: (1) the width was desired by local interests and is safe for navigating interisland and trans-Pacific vessels at this location; (2) this width is comparable to navigable channels in use at other island ports; (3) the 40-foot depth of the channel would provide safe navigation throughout its unprotected portion for all contemplated interisland and trans-Pacific vessels.

52. A protected harbor basin 1,250 feet square with a depth of 35 feet below mean lower low water would accommodate all vessels expected to use the harbor. Ninety-six percent of the vessels using Honolulu Harbor, the busiest port in the Hawaiian Islands, have a draft of 30 feet or less. It is anticipated that the larger vessels calling at Kawaihae will have loaded drafts of from 26 to 30 feet. The size of the basin for turning and anchorage was selected after careful consideration of all use factors. A "rule of thumb" for the selection of size, by which the turning basin has a least dimension equal to 2½ times the length of the vessel expected to turn easily without tug service, has been confirmed by experience in Hawaiian waters and by conferences with navigation officials concerned. The trans-Pacific vessels now calling at other Hawaiian ports, and which will call at Kawaihae if the improvement is made, are all of length slightly less than 500 feet. These vessels are newly constructed and are expected by the owners to be in use for 20 years or more. Those rare cases where a larger vessel may call at Kawaihae for some unforseeable reason will require tug service or will require the assistance of lines to the wharf. The modern C–3 type cargo vessel, now in predominant use in the Pacific, is 492 feet in length. The C–4 cargo vessel is of 496-foot length at the water line. However, should vessels of somewhat larger size come into common use in future years, they can safely and conveniently use the harbor without tug service through the later installation and use of breasting buoys.

53. The excess dredged material would be placed ashore and would be made available to the Territory for the development of port

[1] Not printed.

facilities. This disposal and that on the area for the broad unrevetted portion of the breakwater afford the most economical disposal of surplus material and would be fully utilized. All surplus material not disposed of in this manner or incorporated in the breakwater must be hauled to sea.

54. Access during construction would require right-of-way over land now owned or to be acquired by the Territory for wharf and storage facilities. The entire Federal project would be seaward of the present high-water line. There are no bridge or utility facilities to be relocated. Alteration of shore grading and drainage as required would be provided by the Territory.

55. *Other plans considered.*—Several other plans of harbor improvement for Kawaihae were considered and rejected. These plans varied in dimensions and in location of the entrance channel. Also considered was a harbor consisting of an entrance channel and an exit channel with docking facilities between. These plans were rejected because the existing hydrographic and the geologic features did not favor them, or because they were more costly for comparable facilities.

AIDS TO NAVIGATION

56. A plan showing the location and the proposed improvement at Kawaihae Harbor was transmitted to the commandant, Fourteenth Coast Guard District, Honolulu, T. H., and his views and comments relative to the feasibility and cost of the establishment by the Coast Guard of suitable aids to navigation were requested. The commandant stated that buoying the proposed improvement is considered feasible, and estimated the cost of establishing suitable aids to navigation at approximately $51,000 and $2,000 thereafter annually for operation and maintenance. Locations of the proposed aids are shown on the accompanying plan.

SHORE-LINE CHANGES

57. The coast line for more than 10 miles each side of Kawaihae Bay is rocky and precipitous except for a few very small beaches in deep coves. Since the harbor is proposed to be located within the coral reef structure, it is considered that no consequential interruption to littoral drift will be created. For these reasons no shore-line changes are anticipated.

ESTIMATE OF FIRST COST

58. *Federal first cost and investment.*—The total first cost to the United States for the most practicable plan of improvement is presented in appendix B [1] and is summarized as follows (costs include contingencies and governmental costs):

Dredging entrance channel and harbor basin	$4, 707, 100
Constructing 3,200 lineal feet of revetted breakwater	800, 000
Grading 1,200 lineal feet of unrevetted breakwater (placed as part of hydraulic dredging operation)	18, 400
Estimated expenditure by the Corps of Engineers	5, 525, 500
Estimated expenditure by U. S. Coast Guard	51, 000
Total Federal first cost	5, 576, 500
Interest during construction (3 percent for 8 months on $5,525,500)	110, 500
Gross Federal investment	5, 687, 000

[1] Not printed.

59. *Non-Federal investment.*—Local interests will expend in excess of $1,400,000 for construction of port facilities and land, upon the adoption and construction of this project by the Federal Government. Benefits will accrue during the period of construction of the following items:

Reinforced concrete wharf	$360, 000
Storage sheds	120, 000
Bulk sugar storage silos	400, 000
Bulk sugar handling facilities	400, 000
Molasses tanks and lines	50, 000
Contingencies and miscellaneous	80, 000
Land acquisition	68, 000
Total non-Federal first cost	1, 478, 000

ESTIMATE OF ANNUAL CHARGES

60. In computing annual charges, it is assumed that about 16 months would be required to accomplish the Federal portion of the proposed improvement and that the cost would be amortized over a period of 50 years. The annual charges for the most practicable plan of improvement and the cost of maintenance thereafter for Federal and non-Federal items are computed as follows:

TABLE 5.—*Annual charges*

Total Federal investment (including navigation aids)		$5, 687, 000
Federal annual charges:		
Interest at 3 percent	$170, 600	
Amortization at 3 percent	50, 400	
Harbor maintenance	10, 000	
Maintenance and operation of navigation aids	2, 000	
Total Federal annual charges	233, 000	
Non-Federal investment		1, 478, 000
Non-Federal annual charges:		
Interest at 3½ percent	$51, 700	
Amortization at 3½ percent	11, 300	
Maintenance and operation	2, 000	
Total non-Federal annual charges	65, 000	
Total combined annual charges		298, 000

ESTIMATES OF BENEFITS

61. Annual tangible benefits to be derived from the proposed improvement of Kawaihae Harbor are presented in detail in appendix C[1] and are summarized as follows:

Reduction in handling cost of sugar by bulk methods in lieu of sack method	$198, 794
Reduction in transportation costs of sugar and other commodities	83, 547
Elimination of costs at several small ports	94, 146
Reduction in handling cost of petroleum products	29, 088
5 percent interest on value of enhancement of property values	5, 000
Benefits from potential increase in commerce	153, 780
Subtotal	564, 355
Less increased hauling costs from the more distant port areas	52, 236
Net total annual benefits	512, 119

[1] Not printed.

62. Indeterminable benefits would accrue from stimulation of development of the tributary area, reduction of dependency on the mainland for agricultural produce, encouragement of commercial fishing, development of the town of Kawaihae, provision of greater convenience for tourist trade, increasing tax revenues, and from the provision of a second deep-sea, all-weather port for the island during national and local emergencies.

COMPARISON OF BENEFITS AND COSTS

63. The estimated total annual determinable benefit that would result from the proposed harbor improvement, as estimated above, is $512,119. The estimated total of the Federal and non-Federal annual charges are estimated at $298,000. The benefit-cost ratio is therefore 1.72 to 1.

PROPOSED LOCAL COOPERATION

64. *Local cooperation offered.*—Responsible local interests have expressed their willingness and ability to cooperate in any harbor development project that may be recommended by the Federal Government at this location. The Territory of Hawaii, by authority of its legislature would assume through the Territorial Board of Harbor Commissioners full sponsorship of the project. The Territory has offered (1) to provide all lands and rights-of-way necessary for the construction of the project; (2) to construct all shore structures relative and germane to the improvement of the harbor; and (3) to maintain such structures at Territorial and local expense. The legislature of the Territory, by Act 95 Session Laws 1947, authorized the Territorial Board of Harbor Commissioners to expend $1,000,000 for harbor facilities at Kawaihae, upon approval and adoption of the project by the Federal Government. The Kohala Sugar Co. would abandon its wholly owned subsidiary, the Mahukona Terminals, Ltd., which represents a substantial investment, and is prepared to participate jointly with other sugar companies to finance the installation of bulk sugar handling facilities at Kawaihae.

65. *Local cooperation required.*—The proposed harbor improvement at Kawaihae requires the following local cooperation:

(*a*) Furnish without cost to the United States all lands, easements, and rights-of-way necessary for the construction, maintenance, and operation of the project. This includes specifically the properties landward of the harbor basin and breakwater, from the shore line to the paved public highway;

(*b*) Hold and save the United States free from damages arising from the construction and maintenance of the project;

(*c*) Provide and maintain adequate public terminal and transfer facilities open to all on equal terms; and

(*d*) Accomplish without expense to the United States alterations as required in water supply, sewerage, drainage, and other utilities.

ALLOCATION OF COSTS

66. *Federal allocations.*—All initial costs and annual maintenance charges for the entrance channel, harbor basin, breakwater, and aids to navigation have been allocated to the Federal Government for reasons stated in the following paragraphs:

(*a*) In the interest of navigation and in accordance with Federal policy, the costs of the above-mentioned items of improvement should be borne in their

entirety by the United States, inasmuch as all benefits that would be derived are of general and national scope.

(*b*) The cost of establishing suitable aids to navigation and their operation and maintenance would be borne by the United States Coast Guard in accordance with Federal policy.

(*c*) The improvement, upon its completion, would be adopted as a Federal project and be subject to Federal maintenance.

67. *Non-Federal allocations.*—All initial costs and annual operation and maintenance charges for the reinforced concrete wharf, storage sheds, storage silos, bulk sugar handling equipment, molasses tanks, and freight-handling facilities have been allocated to local interests. Also all costs for lands and rights-of-way necessary for the construction and operation of the harbor facilities are allocated to local interests. The Territorial Board of Harbor Commissioners is empowered to administer and operate all the commercial harbors in the Territory.

COORDINATION WITH OTHER AGENCIES

68. In addition to the data obtained at the public hearing, there were several conferences with local interests. The plan of improvement was developed with due consideration for the views and comments of Federal agencies, Territorial officials, sugar companies, shipping organizations, and harbor masters and pilots. The desires of local interests have been coordinated in the proposed plan of improvement. The ability and willingness of responsible local interests to meet the proposed requirements of cooperation have been ascertained.

DISCUSSION

69. Kawaihae Harbor has long been known as the best potential anchorage on the west coast of the island of Hawaii. The harbor is centrally located for the north and west Hawaii trade and will benefit the entire area. Its natural features make it the most logical location for developing a deep-water, all-weather port. The existing pier and facilities are inadequate and are inoperable during unfavorable weather. Factual data show that a deep-water, all-weather port with wharfage, storage, and handling facilities is essential to the economy and needs of the communities of North and West Hawaii.

70. *Most practical plan of improvement.*—The natural protection by the island from the north and east winds and by the coral reef from the south and southwest winds make this location an ideal one from the standpoint of navigation. It is centrally located with respect to the trade area to be served. The plan of improvement at this location includes an entrance channel facing the sea in a northwesterly direction in order to take advantage of the direction of least disturbance. Experience at other Hawaiian Island ports indicates that a 13-foot-high breakwater will provide adequate protection. By building the breakwater on the proposed alinement, full advantage would be taken of the reef structure as a foundation. A portion of the breakwater, where the roughest water is anticipated would be revetted with stone. The portion in quieter water would not require stone protection. The basin area proposed would be adequate for the berthing, turning, and anchorage of ships up to 500 feet in length. The basin can be lengthened, if needed, at a later date. However, it is uneconomical to provide area for widening the project at a future time.

71. Disposal of the dredged material is most economically accomplished ashore and in the breakwater. This is proposed to the fullest extent possible. The remainder must be hauled to sea at somewhat higher cost.

72. *Other plans of improvement.*—Southwesterly entrance and two-entrance harbors were studied, with several minor variations. The south-entrance harbor posed special hazards to standard, single-screw vessels during entry. The cost of the two-entrance harbor would be greatly in excess of that of the proposed development.

73. *Tangible benefits.*—The savings effected by the reduction in cost of handling sugar, molasses, cattle, vegetables, fish, and general cargo would be expected to be passed on to the consumers, as these fields are sufficiently competitive to insure against excessive profits. The reduction in handling costs would probably bring more land areas into productive use. The benefits derive principally from the more efficient handling of cargo over a wharf directly to vessels rather than by lighters or aerial cableway to vessels anchored off shore in the open sea. The total annual benefits are estimated to be $512,119.

74. *Indeterminable benefits.*—Benefits beyond those susceptible of estimation in monetary terms include the reduction of direct dependence upon the mainland for agricultural produce, increase in the ability of the area to support a larger population, increase of tax revenues, creation of a haven for recreational craft in time of storm, and stimulation of the fishing industry and trade in the town of Kawaihae and the entire tributary area.

75. *Cost of improvements.*—The costs of the proposed dredging were estimated by conference with contract dredging officials and were compared with dredging costs with Government plant and hired labor, recently performed in the Territory of Hawaii, to determine the reasonableness thereof. The costs of filling and of revetting with stone were estimated from the recent experience of this district in the reconstruction of the breakwaters at Hilo and Kahului Harbors. The Federal first cost is estimated to be $5,576,500. The non-Federal first cost is estimated to be $1,478,000. The annual Federal and non-Federal charges are $233,000 and $65,000, respectively. The ratio of annual benefits to annual charges is 1.72 to 1.

76. *Local cooperation required.*—In accordance with Federal law and policy it is proposed to require that local interests provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction, operation, and maintenance of the project. In order to assure that ample facilities are available to all on equal terms, it is also proposed to require the Territory to acquire and/or retain all properties landward of the harbor basin and breakwater from the shore line to the paved public highway. This land would thus be available for cargo storage and for installation of wharves and cargo-handling equipment including bulk sugar equipment, bulk molasses equipment, and fuel lines. It is further proposed to require local interests to hold and save the United States free from all claims for damages arising from the construction and maintenance of the project and to accomplish without cost to the United States, alterations as may be required in water supply, sewerage, drainage, and other utility facilities.

77. *Allocations of costs.*—All initial costs and maintenance charges for harbor improvements located offshore are allocated to the Federal

Government since the benefits to be derived from the improvements are of general or national scope. The project, upon completion, would become a Federal project and be subject to Federal maintenance. The cost of establishing suitable aids to navigation and their operation and maintenance are allocated to the United States Coast Guard in accordance with Federal policy.

78. All initial costs and operation and maintenance charges for structures and facilities located on shore and germane to the improvement of Kawaihae Harbor are allocated to local interests. The Territorial legislature has authorized the Territorial board of harbor commissioners to expend $1,000,000 for harbor facilities.

79. *Coordination of plan improvement with local desires.*—The desires of local interests have been fully satisfied in the proposed plan of improvement for Kawaihae Harbor.

CONCLUSION

80. It is concluded that a deep-water, all-weather port located at Kawaihae would be advantageous to the United States and is essential to the economy and needs of the communities of north and west Hawaii. It is further concluded that the most suitable plan of improvement of Kawaihae Harbor includes the dredging of an entrance channel and harbor basin, the construction of a revetted breakwater with an unrevetted breakwater extension, and the installation of certain port facilities. The disposal of a portion of the dredged material on the shore area adjoining the proposed harbor would facilitate use of that land for wharfage and facilities. All excess dredged material for which there is no spoil area ashore would require disposal at sea.

81. The total first cost of harbor improvements to be expended by the Corps of Engineers is estimated at $5,525,500. If the initial expenditure is authorized for fiscal year 1950, $70,000 should be provided for detailed borings, advanced planning, and final plans and specifications. The remainder should then be provided in 1951. However, if the initial appropriation is for 1951 or later the entire amount should be appropriated in a lump sum to assure bidders of work continuity and thus permit minimum unit price bids, should the bidder be prepared to process the work at a rate greater than assumed for Government estimating purposes.

RECOMMENDATIONS

82. The district engineer recommends:

(*a*) That the United States adopt a project for the improvement and maintenance of Kawaihae Harbor at a total initial expenditure by the Corps of Engineers of $5,525,500 with estimated annual maintenance charges of $10,000.

(*b*) That the improvement consist of:

(1) An entrance channel 400 feet wide and approximately 2,900 feet long to a depth of 40 feet below mean lower low water, with side slopes as required;

(2) A harbor basin 1,250 feet square to a depth of 35 feet below mean lower low water, with side slopes as required;

(3) A revetted fill breakwater approximately 3,200 feet long, to a maximum elevation of 13 feet above mean lower low water, with a seaward side slope of 1½ to 1, except at the 100-foot end sections where the seaward side slope will be 2 to 1; and

(4) An unrevetted breakwater extension in the quieter water behind the reef approximately 1,200 feet long from the end of the revetted fill to shore.

83. The district engineer further recommends that the project be made subject to the condition that local interests provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction, maintenance, and operation of the project, to include specifically the properties landward of the proposed harbor basin and breakwater from the shore line to the paved public highway; that they hold and save the United States free from all claims for damages arising from the construction and maintenance of the project, provide and maintain adequate public terminal and transfer facilities open to all on equal terms, and accomplish without expense to the United States alterations as required in water supply, sewerage, drainage, and other utilities.

B. M. HARLOE,
Colonel, Corps of Engineers,
District Engineer.

[First endorsement]

OFFICE, DIVISION ENGINEER,
WESTERN OCEAN DIVISION,
CORPS OF ENGINEERS, UNITED STATES ARMY,
Sausalito, Calif., February 15, 1949.

To: The Chief of Engineers, United States Army, Washington, D. C

1. The construction of a deep-water, all-weather port located at Kawaihae, island of Hawaii, T. H., would be advantageous to the United States and is essential to the present needs and future development of the communities of north and west Hawaii.

2. The tangible navigational benefits, as estimated by the district engineer, would average $512,119 a year during the economic life of the proposed project. The division engineer finds these benefits to have been conservatively estimated and believes that they will be realized if the proposed project is constructed.

3. The intangible benefits that would result from a deep-water, all-weather port at Kawaihae include the reduction of direct dependence upon the mainland for agricultural products by encouraging further development of the fertile agricultural lands in the Kohala, Waimea and Kona Districts; increase in the ability of the area to support a larger population; creation of a haven for recreational craft in time of storm; and stimulation of trade in the town of Kawaihae and the entire tributary area.

4. The estimated annual charges for the proposed improvement are $298,000. The ratio of tangible benefits to cost, therefore, is 1.72 to 1. The division engineer is of the opinion that, considering the effect of the intangible benefits, the actual justification is somewhat greater than the ratio indicates.

5. The division engineer, therefore, concurs in the conclusions and recommendations of the district engineer.

For the Acting Division Engineer.

D. T. JOHNSON,
Colonel, Corps of Engineers, Deputy Division Engineer.

LIST OF APPENDIXES MADE IN CONNECTION WITH THE DISTRICT REPORT

(These are not printed)

A. Commerce.
B. First costs.
C. Benefits.
D. Supplemental design data.

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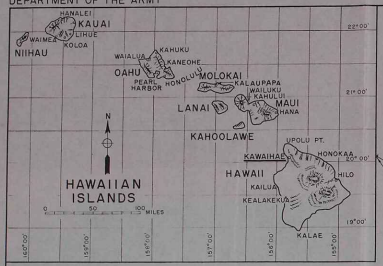
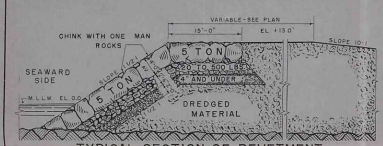
DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS





TYPICAL SECTION OF REVETMENT

STATION 1+00 TO 31+00

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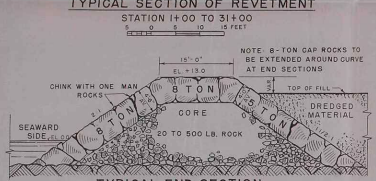
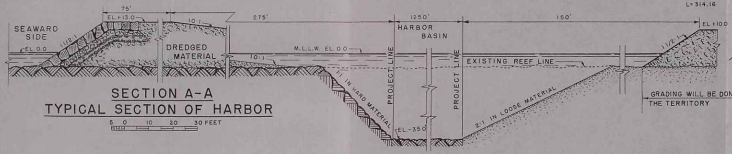


TYPICAL END SECTION

STATION 0+00 TO 1+00 AND 31+00 TO 32+00

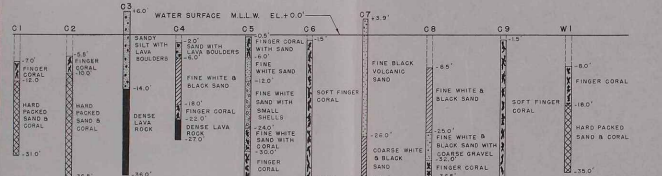
5 0 5 10 15 FEET



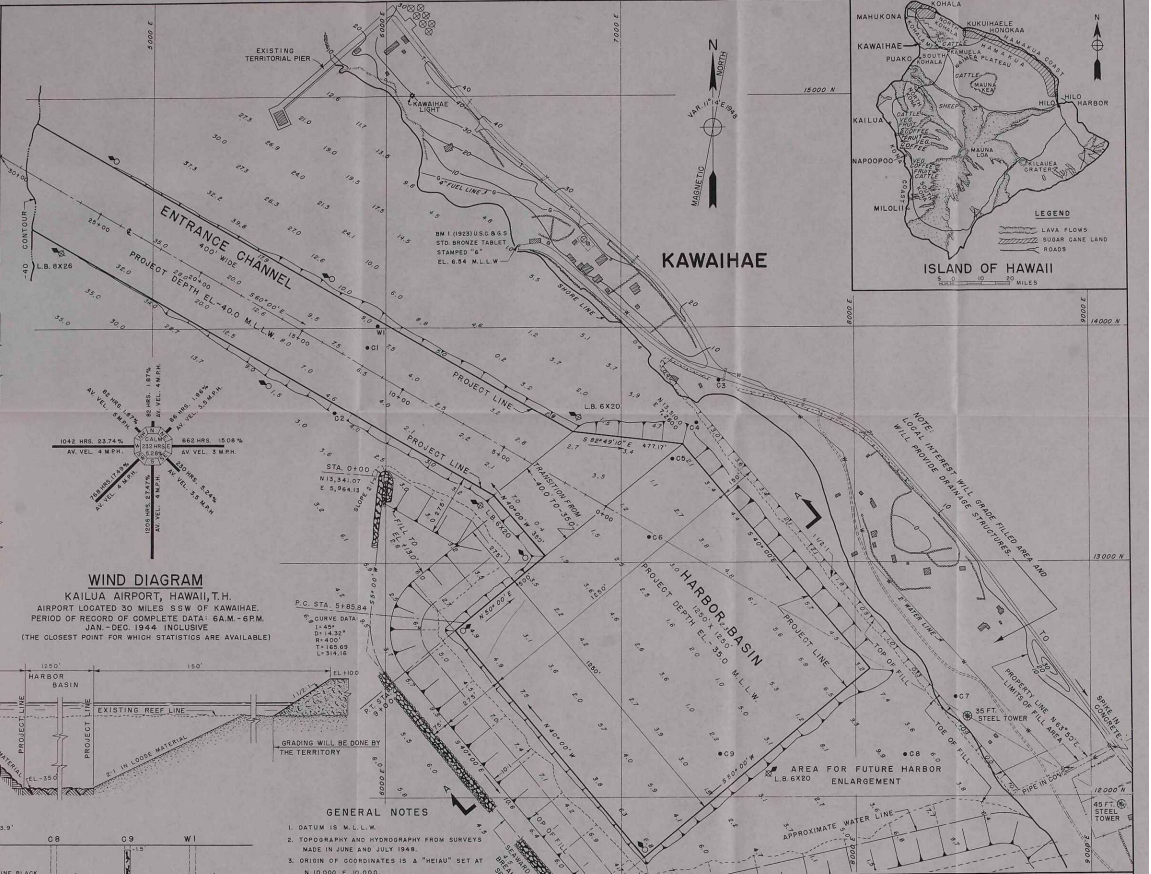
SECTION A-A

TYPICAL SECTION OF HARBOR

6 0 10 20 30 FEET



LOG OF TEST BORINGS



WIND DIAGRAM

KAILUA AIRPORT, HAWAII, T.H.

AIRPORT LOCATED 30 MILES SSW OF KAWAIHAE.
PERIOD OF RECORD OF COMPLETE DATA: 6A.M.-6P.M.
JAN.-DEC. 1944 INCLUSIVE
(THE CLOSEST POINT FOR WHICH STATISTICS ARE AVAILABLE)

ISLAND OF HAWAII

GENERAL NOTES

1. DATUM IS M.L.L.W.
2. TOPOGRAPHY AND HYDROGRAPHY FROM SURVEYS MADE IN JUNE AND JULY 1948.
3. ORIGIN OF COORDINATES IS A "HEIAU" SET AT N 10,000 E 10,000.
4. C NUMBERS REFER TO TEST BORINGS. (CORE DRILLS)
5. W1 IS A WASH BORING.
6. AIDS TO NAVIGATION

1ST LIGHT BUOY ○ 2ND CLASS SPAR BUOY ⊛ RANGE LIGHT ON TOWER

PLAN

SCALE: 1:4000

50 0 100 200 300 400 FEET

SURVEY FOR NAVIGATION

KAWAIHAE HARBOR
ISLAND OF HAWAII, T. H.
RECOMMENDED IMPROVEMENT

SCALE: AS SHOWN | IN 1 SHEET | SHEET NO. 1

HONOLULU DISTRICT, CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY.

SUBMITTED	APPROVED IN COMPLIANCE	APPROVED
CHIEF, CIVIL WORKS BRANCH	CHIEF, ENGINEERING DIVISION	COLONEL, CORPS OF ENGINEERS DISTRICT ENGINEER

DRAWN A.L.W.E.D | TO ACCOMPANY REPORT OF SURVEY | FILE NO.

TRACED A.C. | CHECKED R.Y.P. | DATED: 15 JANUARY 1949

RH-100/4

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