

DRAFT  
ENVIRONMENTAL STATEMENT

BEACH EROSION CONTROL IMPROVEMENTS  
WAIKIKI BEACH, OAHU, HAWAII  
(KAPAHULU STORM DRAIN TO THE ELKS CLUB)

Prepared by

U.S. ARMY ENGINEER DIVISION, PACIFIC OCEAN

9 November 1972

BEACH EROSION CONTROL IMPROVEMENTS  
WAIKIKI BEACH, OAHU, HAWAII  
(KAPAHULU STORM DRAIN TO THE ELKS CLUB)

Draft

Final Environmental Statement

Responsible Office: U.S. Army Engineer Division, Pacific Ocean

1. Name of Action:  Administrative  Legislative

2. Description of Action: The plan of improvement provides for the construction of three new groins, placement of approximately 46,000 cubic yards of sand, and the demolition of the Waikiki Natatorium.

3. Environmental Impacts: The sand placement will add approximately 132,000 square feet of beach in the area between the Natatorium and the Queen's Surf Pavilion, resulting in increased shoreline recreation area and improved access along the beach. The three groins are designed to stabilize the reconstructed beach, allowing it to shape itself parallel to the alignment of the dominant wavefront.

a. Adverse Environmental Effects Which Cannot be Avoided: Unavoidable effects include temporary impacts during the construction period, permanent loss of the Natatorium and its use, some reduction of swimming area in the deep channel north of the Natatorium, and increased traffic to some extent.

4. Alternatives: Alternatives considered include additional sand placement between the Kapahulu Storm Drain and the Queen's Surf Groin, protected by an offshore breakwater; retention of the Natatorium and incorporation of it with the proposed plan; and preservation of the existing conditions with no beach restoration provisions.

5. Comments Requested:

U.S. Department of Commerce  
U.S. Department of Interior  
U.S. Environmental Protection Agency  
U.S. Department of Health, Education, and Welfare  
Office of Environmental Quality Control  
(Clearinghouse for State and County Agencies)

6. Draft Statement to CEQ \_\_\_\_\_.

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1. Project Description.

The beach erosion control improvements for the sector of Waikiki Beach between the Kapahulu Storm Drain and the Elks Club are presently in the preconstruction planning stage and are the subject of this environmental statement. This sector represents about 30 percent of the total shoreline considered in the Waikiki Beach Erosion Control Project which was authorized by the River and Harbor Act of 1965 following a study conducted by the Honolulu District, Corps of Engineers, at the request of the State of Hawaii in 1959.

The purposes of the erosion study were to review the effectiveness of the existing beach erosion control measures and to determine the most practical and economical method of restoring an adequate recreational beach and providing continued stability to the shore. The total project authorized by Congress provides for placement of about two miles of beach from the Duke Kahanamoku Beach (northwest end of Waikiki) to the Elks Club at the south end with the addition of new groins, modification of existing groins, and consolidation or modification of associated drainage structures. Under this authority, beach restoration of the Kuhio Beach sector was accomplished by the State in 1972. Improvements to the Fort DeRussy sector were completed in 1970 with military non-appropriated funds. Two final sectors of Waikiki Beach, one lying between the Fort DeRussy area and Kuhio Beach and the second at Duke Kahanamoku Beach remain unimproved, and they will be considered following completion of plans for the Kapahulu Storm Drain to Elks Club sector.

As shown on Figure 1, Waikiki Beach is located on the eastern end of Mamala Bay on the south coast of the island of Oahu. The 3,800-foot long sector under consideration at this time is shown on Figure 2. The plan of improvement is confined to a 1,400-foot reach within this sector, shown on Figure 3, and provides for the construction of three new groins, placement of approximately 46,000 cubic yards of sand, and the demolition of the Waikiki Natatorium.

The 300-foot southernmost groin will be placed at the present location of the south wall of the Natatorium. The other two groins, each about 340 feet long, will be spaced about 500 feet apart, one to be built near the Waikiki Aquarium and the other near the south end of the Queen's Surf Pavilion.

The proposed groins will be constructed of stone. The shoreward section will extend about 1/2 foot above the berm at 6 feet above MLLW of the

proposed beach fill. The center section of the groins will slope from near the crest of the berm down to an elevation of about 3 feet above MLLW near the toe of the foreshore. Then, they will be tapered to an elevation of 0 feet MLLW at the seaward third of the groin. The remaining part of the groin will be constructed to an elevation of 0 MLLW.

The width of the new beach areas, measured to the mean lower low water mark, will vary from 90 feet to 210 feet. The foreshore of the proposed beach fill will have a slope of about 1 vertical to 10 horizontal. The sand placement will add about 132,000 square feet of beach to the existing 181,000 square feet of beach within the sector. The average dry beach width will be 120 feet. An economic evaluation of the improvements to this sector has determined a benefit-cost ratio of 9.4.

## 2. Environmental Setting Without the Project.

Between the Kapahulu Storm Drain and the Queen's Surf groin, a seawall extends the entire length of about 1,000 feet. Seaward of this wall there is a narrow beach, generally less than 20 feet wide at low tide, and coralline rock and rubble floor the shallow nearshore area. Immediately south of the Queen's Surf groin, there is a sand beach of about 200 feet in width. Proceeding towards the Natatorium this sandy beach tapers until it is less than 20 feet in width in the vicinity of the Waikiki Aquarium. A seawall extends the full length of the reach between the groin and the Natatorium. Waves frequently strike the seawall along the stretch between the aquarium and the Natatorium and erode this portion of the beach to a gravel or rubble constituency. The Natatorium extends along 400 feet of the shoreline and projects seaward about 200 feet. South of the Natatorium, to the project limit at the Elks Club, there is a sandy beach varying in width between about 40 and 100 feet. There are limited boating facilities located at the private Outrigger Canoe Club.

Along the areas of sandy beach, there is generally sand in the nearshore areas, extending seaward 50 to 200 feet, and an irregular reef flat surface further seaward which is composed of coralline rock, rubble, and occasional sand patches. Parallel to the shore and about 200 feet offshore, a dredged channel extends northward from the Natatorium to the vicinity of the Queen's Surf Pavilion. This channel has a water depth in excess of 6 feet and a maximum depth of 11 feet below MLLW. The outer edge of the channel is an abrupt escarpment which rises to the general level of the reef flat, into which the channel was dredged. The bottom of the channel is covered with sand or gravel.

The proposed improvements would be confined to a single reach of the project area which is 1,400 feet in length and which extends from the south wall of the Natatorium north to a proposed groin in the vicinity of the Queen's Surf Pavilion. This reach constitutes 37% of the project sector and 13% of the entire Waikiki Beach. The groin constructions would extend seaward from the seawall to a maximum distance of 340 feet which is about 20 feet seaward of the outer escarpment of the dredged channel. The placement of sand would terminate against this escarpment and at the outer limits of the Natatorium.

In addition to the existing seawall, Natatorium, groins, drains, and dredged channel, other man made structures are known to have previously existed, and sand has been added to the beach within the project sector. The natural environment has therefore been extensively modified by actions of man.

To assist with planning further modifications which are intended to improve man's use of Waikiki Beach, several investigations have been completed. Two Federal reports are a Beach Erosion Control Report on Cooperative Study of Waikiki Beach, 1950, (House Document No. 227, 83rd Congress, 1st session) and Waikiki Beach, Oahu, Hawaii, Beach Erosion Control Study, 1963, (House Document No. 104, 89th Congress, 1st Session). To further extend the extent of marine ecological investigations a Marine Environment Study of Waikiki Beach was contracted with the University of Hawaii in October 1971 by the U.S. Army Corps of Engineers. Several other scientific and engineering studies have been made and reported and others are in progress.

The reef flat fronting the project area extends seaward for about 1/2 mile. At this distance the bottom depth is about 30 feet and beyond it the bottom slopes down more rapidly. Living coral and algae are relatively more abundant on the reef slope where the amount of the bottom covered by live coral is generally less than 25%. On the reef flat, living coral is patchily distributed and near the Natatorium covers less than 3% of the bottom. In the same area algae covers 20 to 40% of the bottom; both fleshy types of algae, such as Sargassum, Dictyosphaeria, and Failemeda, and coralline algae, Prolithon, being present. Patches of coralline rubble and sand cover 25 to 50% of the reef flat. Dead coral heads frequently occur on the solid substrate areas of the flat. Within the specific portion of the project area where construction is proposed, sand covers 85% or more of the sea floor, excepting the area included in the Natatorium. The sand is of a medium grain size and well sorted; because of artificial nourishment much of it may not be of local origin. The diurnal tidal range between lower low water and higher high water is 1.88 feet. A current flowing seaward with the ebbing tide has been occasionally observed in the Sans Souci channel.

Due to wave refraction occurring as waves cross the reef flat, waves approach the beach from the south to southwest nearly 100% of the time. South-southwest is the dominant wave direction. These waves cause sand to move northward along the beach, and this has resulted in the greater width of the beach on the south side of the Queen's Surf groin. Some sand bypasses the groin. The average annual loss of sand from this project sector is estimated to be 2,000 cubic yards.

The surface water currents inside the surf zone generally also flow northward. When conditions occur which are associated with a Kona wind (from the southwest quarter) or a southern swell, the current pattern can be confused. Then water may pile up along shore and form seaward moving currents, or rip currents. During such conditions, these have been observed off the Queen's Surf groin, near the south end of the Queen's Surf pavilion, and in the Sans Souci channel (south of the Natatorium).

The seaward movement off the Queen's Surf pavilion where a 50-foot wide beach lies opposite the current has not been observed to cause any reshaping of the beach, or to transport a significant amount of sand across the offshore dredged channel and across the reef flat. The beach near the Queen's Surf Pavilion is about 100 feet wide and is part of the gentle arc of sand extending east from the Queen's Surf Groin. It shows no reshaping due to the rip current and no significant amount of sand appears to be transported seaward.

The results of transect studies extending from the shore to a distance of 250 yards have shown fish life to be generally sparse at an average density of 20 pounds per acre. Studies of nocturnal fish around the Natatorium showed a density about double that figure. The habitat provided by the escarpment on the seaward side of the dredged channel in the project area results in densities of fish similar to those occurring around the Natatorium. This assortment of reef fish includes individuals from over 60 species. Echinoderms and infaunal invertebrates, plus the coral and algae previously discussed, complete the sparse faunal assemblage of the project area. No rare or endangered species are known to be present.

The ownership classification of the shore property fronting the entire 10,800-foot length of Waikiki Beach is private 31%, non-Federal public 52%, and Federal 17%. The entire reach considered in the proposed project sector is in a non-Federal public portion associated with the Kapiolani Park.

The project area presently serves multiple recreational uses. Swimming, wading and sunbathing are done within the area intended for improvements as well as swimming at the Natatorium. Seaward of the project limits there are surfing sites. Picnicking and other park uses are made of Kapiolani Park and two beach centers exist within it. Boating is done at the Outrigger Canoe Club area.

According to the Water Quality Standards of the State of Hawaii, the waters of Waikiki Beach are to be protected for recreational uses including fishing, swimming, bathing and other water-contact sports and aesthetic enjoyment. The State Department of Health routinely tests the waters along the shore to determine coliform density. Although occasional counts at certain parts of the beach following rainstorms have exceeded the acceptable parameters, the effects are quickly dissipated, and usability of the beach throughout the year for recreation is not impaired by water pollution.

The Natatorium was built in the 1920's and dedicated as a war memorial. A plaque listing those from Hawaii who served in World War I is mounted in Kapiolani Park facing the Natatorium entrance. The circulation of fresh sea water into the Natatorium is inadequate to keep the waters clear, and considerable silt and fine organic debris has accumulated on the bottom of the pool. There has been deterioration of the Natatorium's sea walls and of internal structures resulting in the present need for extensive

renovation. Use of the facility is low compared with that made of nearby beach areas. The Natatorium has been surveyed but not nominated for inclusion in the Registry of Historic Sites, State of Hawaii.

No historic or archaeological sites are known to exist within the limits of the proposed project.

### 3. The Environmental Impact of the Proposed Project.

Because the project is intended to improve a beach area already modified and heavily used for human needs, the environmental impact on both natural and social conditions are discussed in the following paragraphs. The impact on the natural setting will be further separated into considerations of the project's permanent effects and of its temporary effects caused by the construction activities.

The placement of 46,000 cubic yards of sand will add approximately 132,000 square feet of beach in the area between the Natatorium and the Queen's Surf Pavilion. This will increase the amount of beach within the project reach by about 73%. The construction specifications will require that the sand be clean natural sand similar to the existing sand and meeting detailed gradation requirements. The source of this sand will be the responsibility of the successful bidder for the construction contract. It is most likely to come from some source within an emergent, fossil, beach deposit which is not part of any present shoreline system. Natural areas for such a source exist along the north coast of Oahu and along the west coast of Molokai. One sand mining operation presently supplying sand is in west Molokai.

Placement of the sand is to include filling the offshore dredged channel and areas presently within the Natatorium to a depth of -5 feet MLLW. This will cover some holes and other habitations of fish along the seaward escarpment of the channel. Other fish habitats will be lost when the walls of the Natatorium are removed. No habitat on the reef flat should be altered by the sand placement. The infauna presently living in some sandy bottom areas will be covered and killed but an equivalent assemblage should establish itself in the new sand deposits.

The three groins to be constructed will extend seaward a sufficient distance to cover small areas of the reef flat. These groins will provide some habitat for fish and some substrate for benthic growth, but not to a sufficient extent to replace that lost by the removal of the Natatorium walls. The groins will be faced with stone, permeable, and rest on firm foundation.

These three groins are designed to stabilize the reconstructed beach. The beach between the groins should shape itself parallel to the alignment of the dominant wavefront, and the groins act to restrict the longshore drift of sand to the north. This is expected to retain the full area of the widened beach and reduce the average annual loss of sand. Some sand will bypass each of the new groins and finally enter the beach area

north of the Queens's Surf groins. The new groins will influence any longshore pile up of water, distributing tendencies for offshore rip currents to form and reducing the loss of sand seaward or around the Queen's Surf groin. The effect of these improvements should be a reduction in the sand transport onto the reef flat and a reduction of damage to areas of living coral, seaward of the entire project reach.

During construction of the groins and the placement of the new sand some material will go into suspension in the water. All of this groin material and sand will be sufficiently well sorted and of a large enough average particle size to settle quickly. No extensive or persistent turbidity should result.

The muck on the floor of the Natatorium will be removed prior to any demolition of the seawalls. This material will be disposed of on land. No extensive turbidity is expected to result from the destruction of the Natatorium structure itself. Some dust and considerable noise will occur. No incineration will be permitted at the project site. Environmental protection measures will be included in the construction contract to assure that these disturbances are kept minimal and that compliance with these specifications can be investigated by the construction inspectors serving the contracting office. The construction work will be phased in such a manner as to minimize restrictions on beach use. The south wall of the Natatorium will not be demolished until a protective groin is in place immediately to the south to prevent sand moving northward from the Sans Souci beach.

The Statewide Comprehensive Outdoor Recreation Plan (Department of Planning and Economic Development, 1972) identified six uses for the Kapiolani Park Beach, and rated the existing conditions as average. It made an evaluation of future expansion and found this desirable and without adverse environmental impact. The proposed improvements will not interfere with any surfing areas.

Completion of the proposed project will increase the beach area and increase total use of this sector. The increased beach width along the reach north of the Natatorium will reduce the swimming area in the dredged channel by 35%. It will increase the safety of swimming in this area by reducing the depth below MLLW to a maximum of 5 feet and reducing the bottom slope along the shoreward edge of the channel. The groins will interrupt the movement of people along the beach and the visual continuity of a single beach strip. Steps will be provided to ease the crossing of the groins. Removal of the Natatorium will improve the movement of people along the sand beach all the way from the Queen's Surf beach to the Sans Souci beach. At present it is necessary to surmount the seawall near the aquarium and follow a pathway behind the Natatorium in making this walk. The sand which will be placed on the beach will come to within about two feet of the top of the seawall. Steps and ramps will be added to the seawall to facilitate crossing that structure to reach the beach.

The use of the Natatorium as a salt water swimming pool will be lost and nearshore ocean swimming will replace it at this locale. This is the only salt water pool in Hawaii and is considered the largest one in the



United States. Its water quality is poor, as judged by the eye and nose, but does not constitute a health hazard. Both the State and County governments are in favor of the destruction of the Natatorium in the interests of providing more beach land and improved access along the beach. The Department of Parks and Recreation, City and County of Honolulu, presently maintains seven other swimming pools on Oahu, including one 50 meter pool; twenty-one more pools are planned for future construction. The demand for beach space in this area exceeds the supply and the counts at the Natatorium are low as compared with the beach areas. There is some use of the Natatorium by life-saving classes, individuals, and people seeking the therapeutic aspects of salt water pool swimming.

Increased beach size and beach use will increase traffic to this district of Waikiki. No additional parking space is provided by the project. It is sufficiently far from residential areas and hotels to expect that most people will come by private or public conveyance. One small parking lot exists within Kapiolani Park. Some additional parking is available along Kalakaua Boulevard. The largest available parking area is about 1/4 mile away near the Waikiki Shell. The parking space available is inadequate for peak demand periods and greater use of mass transit facilities must be expected to be encouraged for future users.

#### 4. Adverse Environmental Effects Which Cannot Be Avoided Should the Project be Implemented.

Temporary adverse effects associated with the construction period will be minimized through the construction specifications, however, some turbidity, inconveniences to the public, noise, and dust will be unavoidable over the approximately eleven-month construction period.

In terms of its uniqueness as a salt-water pool and for those who regularly swim there, the permanent loss of the Natatorium will be an unavoidable adverse effect of the project. As discussed in the impact section, the decision made by the local sponsors of this project is based upon the present limited use of the facility, its poor condition, and the pressing need for beach land.

#### 5. Alternatives to the Proposed Action.

The development of alternatives for the sector under consideration was guided by the objectives of restoring the sandy beach area and assuring that the sand placement is retained. Initially, restoration of the shoreline along the entire sector was considered. Evaluation of the existing shoreline showed that the beach fronting the Queen's Surf area is of adequate width and in stable condition. The one fronting the Sans Souci-Elks Club area has limited public access. Therefore, no improvements were planned for these portions.

The beach between the Kapahulu Storm Drain and the Queen's Surf Groin is no more than 50 feet wide. Engineering studies have indicated that the predominant movement of sand in this section is in an offshore direction. The

most effective method of retarding this type of sand movement is construction of an offshore breakwater. Such a structure would protect a restored sand beach and provide a calm swimming area. Together with the proposed improvements described previously, this alternate plan would create the greatest amount of additional sandy beach space. This alternate plan was not recommended, and no changes are proposed for this portion of the beach for three reasons. First, the location of the offshore breakwater would interfere with a popular surfing area. Second, during coordination and review of the project with the public, there were expressions of opposition to offshore structures, which stressed their visual intrusion on the shoreline scenery. Third, though the beach is narrow, additional erosion that might endanger parkland or structures behind the beach is not anticipated.

Another alternative explored the feasibility of retaining the Natatorium and incorporating it with a beach improvement plan. This alternate would provide less than half of the additional beach land that the proposed plan would create. The Natatorium which is unique as a salt-water swimming pool would remain in its present state, and any adverse effects associated with its demolition, as described in the impact section, would be avoided. Overall construction activity would be reduced, as well as the requirement for natural sand for restoration.

The local government has no plans at this time to rehabilitate the deteriorated structure, and its condition would probably continue to worsen in the future. The City's Department of Parks and Recreation has stated that the greatest demand facing the Department is for beach land. On Oahu, the number of City-constructed swimming pools is growing and will continue to increase (7 completed, 8 proposed, 13 in the funding stage). Both the local sponsor of the beach erosion project (State of Hawaii) and the operators of the Natatorium (City and County of Honolulu) have recommended the demolition of the Natatorium. Based upon the determination of recreation needs and priorities, they believe that the benefits gained by the increased beach land would outweigh the value of saving and rehabilitating the Natatorium. In addition, demolition of the structure is supported by several citizen groups who also cite the increased open space and view to the sea from the park area that will be achieved.

The final alternative is to forego any beach restoration proposals and retain the existing conditions. The existing sandy beach areas along this sector are stabilized, and no additional significant erosion is expected to occur. The present uses of the shoreline would continue, and the Natatorium would remain. Temporary adverse effects such as turbidity and inconveniences to the public during construction would be avoided. On the other hand, the pressing need for beach land is expected to continue and will not be reduced in the near future by improvements to this sector. The proposed improvement for the final 3,000-foot sector that remains in the Waikiki Beach Erosion Control Project (between Fort DeRussy and Kuhio Beach) are still under consideration and may eventually be constructed in the future, providing some additional beach land. However, the land along this sector is primarily privately owned. Public access to the beach and the land ownership pattern have created considerable controversy, and the resolution of these difficulties does not appear imminent.

6. The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity.

The present and future uses of Waikiki Beach are to serve as a major recreational center for the State of Hawaii, providing the setting and facilities for swimming, fishing, surfing, sunbathing, picnicking, and other related activities. The proposed project will increase the beach land available for water-related activities as well as increase accessibility to the shoreline. No long-term adverse impacts to the project area are anticipated and the project would enhance the long-term productivity of the site as an attractive beach for both residents and visitors to the islands. The present use of the environment in view of its current use and condition. The long-term advantages of increased beach land should benefit a greater number of beach users than preservation of this short-term use.

7. Any Irreversible and Irretrievable Commitments of Resources Which Would Be Involved in the Proposed Action Should it be Implemented.

Implementation of the plan will result in the loss of some fish habitat due to sand placement, but primarily by the removal of the Natatorium walls. The loss will be compensated to some extent by the habitat provided by the groins. The loss of the Natatorium structure and its recreation uses will be another permanent effect of the project. Sand placement would require the commitment of about 46,000 cubic yards of natural sand.

8. Coordination With Others.

(1) Public Participation.

A public meeting was held on 13 October 1972 to present the plan of improvement. In addition to a discussion of the significant features of the plan, the University of Hawaii research group presented their findings on the biological and oceanographic study of Waikiki Beach and the anticipated environmental impact were reviewed. Two major objections raised by those who testified at the meeting dealt with the demolition of the Natatorium and the effectiveness of the plan itself.

Those who opposed demolition of the Natatorium pointed out its uniqueness as a salt-water pool, its potential uses if rehabilitated, and its significance as a training pool in the past for some of Hawaii's famous swimmers. Those who swim there regularly state that there is no comparable place for them to go should the structure be demolished.

In criticizing the plan itself, opponents questioned the stability that the design provides and the uncertainties of the effects of structural improvements. They believe that no alterations should be made until additional information on the littoral processes and shoreline usage are obtained. The information that might be gained from other studies now in progress are not expected to appreciably affect the design. Hydraulic model studies were

suggested. There are two types of hydraulic models for investigation of littoral processes, movable bed models, which include in their simulation the sediment transport, and fixed bed models, which do not scale model the sediment but do simulate wave action and water currents. Since the proposed project is designed to widen and stabilize a sand beach, the movable bed type of model would be the appropriate one to use. The movable bed models have met with little success to date, and the state of the art does not justify its use for the project sector of Waikiki Beach. In fixed bed modeling, which is useful in design of navigation projects such as harbors and channels, topographic and hydrographic features are reproduced at a small scale in the model by use of mortar and concrete. The data to be gained is not considered to warrant the cost and difficulty of obtaining reliable measurements for a wide shallow reef and thin layer of water covering the shallow reef.

In other testimony, the priority given to this sector was questioned, and it was stated that the sector between Fort DeRussy and Kuhio Beach should be constructed first.

Following the meeting and evaluation of the comments, both the State of Hawaii and the City and County of Honolulu officially supported the plan of improvement as proposed.

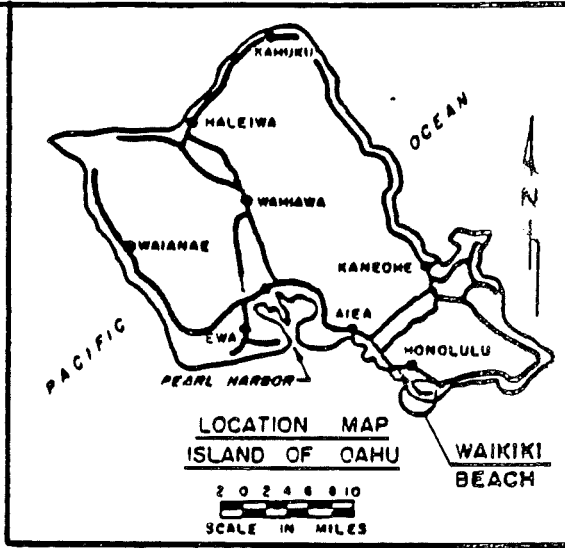
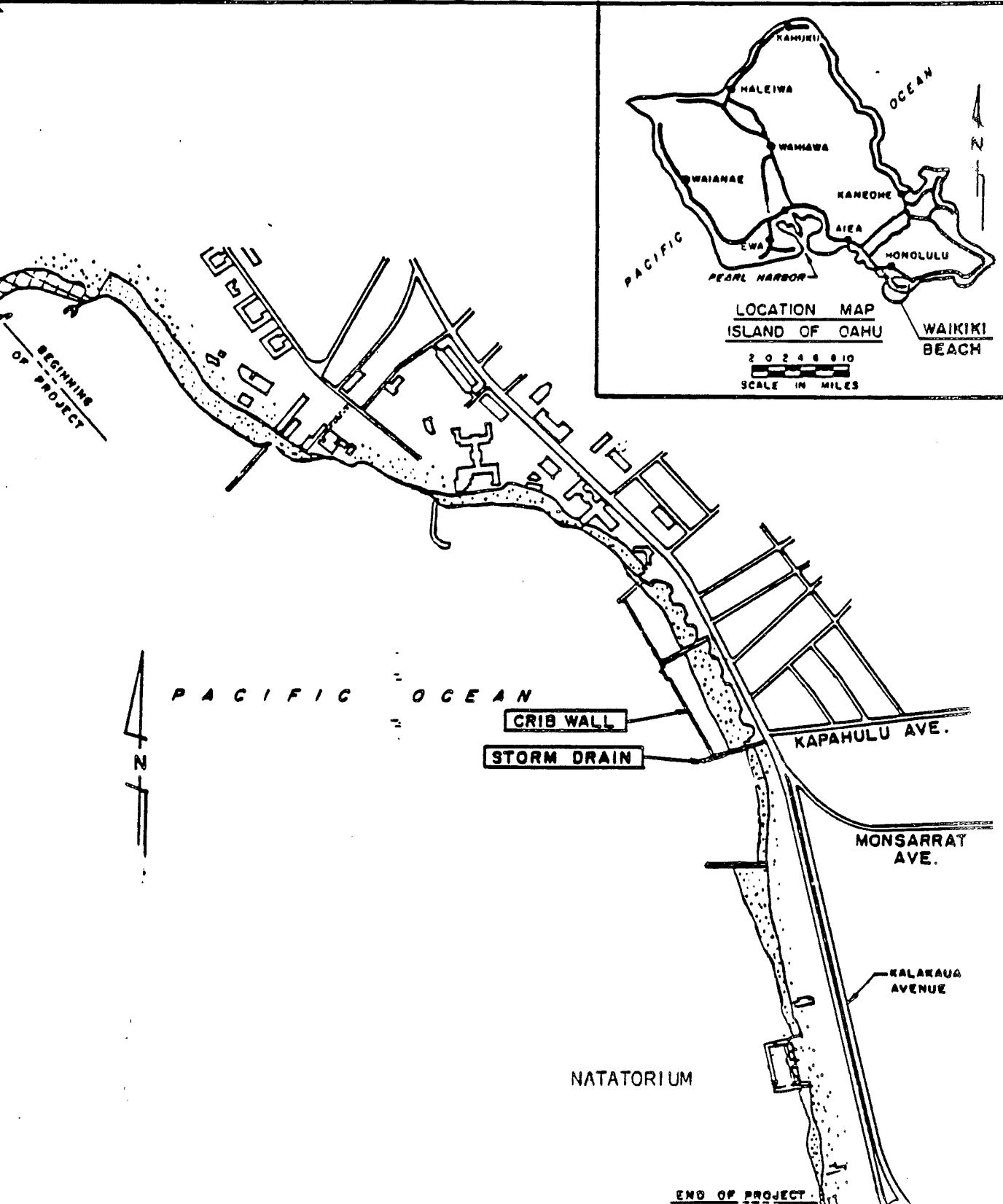
There has been considerable public participation in planning for the Waikiki Beach improvements over the years, particularly for the Kuhio Beach Sector which was completed in 1972 by the State of Hawaii. The final design for that sector was developed by an eight-member Kuhio Beach Advisory Committee appointed at the direction of the Governor and including tourist industry representatives, surfers, a water safety expert, an oceanographer, and high school students. The citizens' committee met for eight months with various interest groups. The Committee was formed following numerous meetings with the general public, special interest groups, and government agencies in an effort to resolve the divergent views on the improvements.

#### (2) Government Agencies.

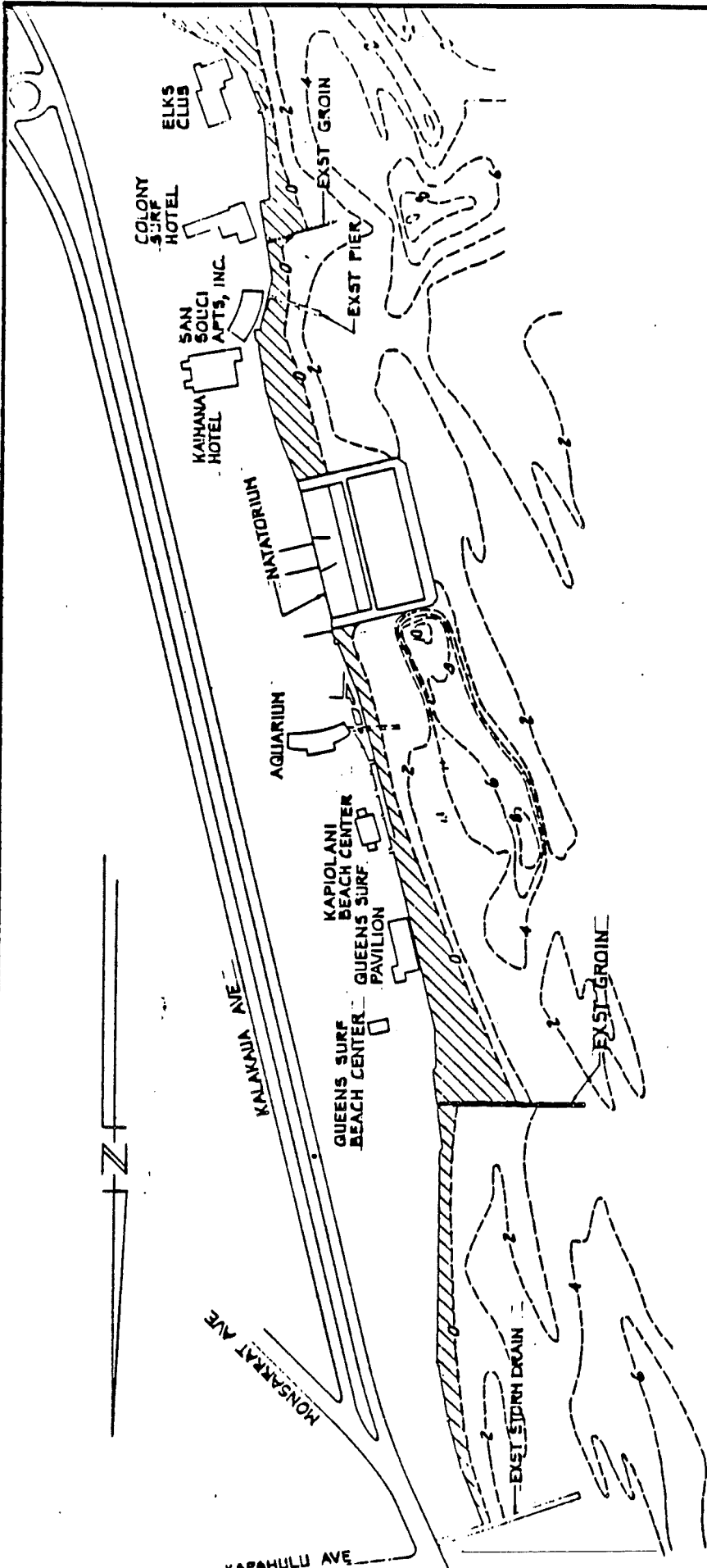
Extensive coordination of the plan with State and County agencies, including the State Office of Environmental Quality Control, Harbors Division, Department of Land and Natural Resources, Department of Health, and the City's Planning Department, and Department of Parks and Recreation has been conducted. These and other agencies will be reviewing the environmental statement and their comments will be summarized in the final statement. Thus far, no objections to the project have been stated.

#### (3) Citizen Groups.

Several meetings were held with the Chamber of Commerce of Hawaii, representatives of the Conservation Council, Outdoor Circle, Life of the Land, Outrigger Canoe Club, Hawaii League of Conservation Voters, Save Our Surf, and residents of the Waikiki area. Response to the project ranges from full support to opposition of any improvements to the area although most of the groups generally support the plan.



BEACH EROSION CONTROL  
 FIG. WAIKIKI BEACH  
 OAHU, HAWAII  
 1  
 EXISTING CONDITIONS  
 REVISED 30 JUN 1972  
 800 0 500 1000  
 SCALE IN FEET  
 U. S. ARMY



KAPAEHULU STORM DRAIN TO  
ELKS CLUB SECTOR

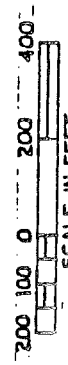
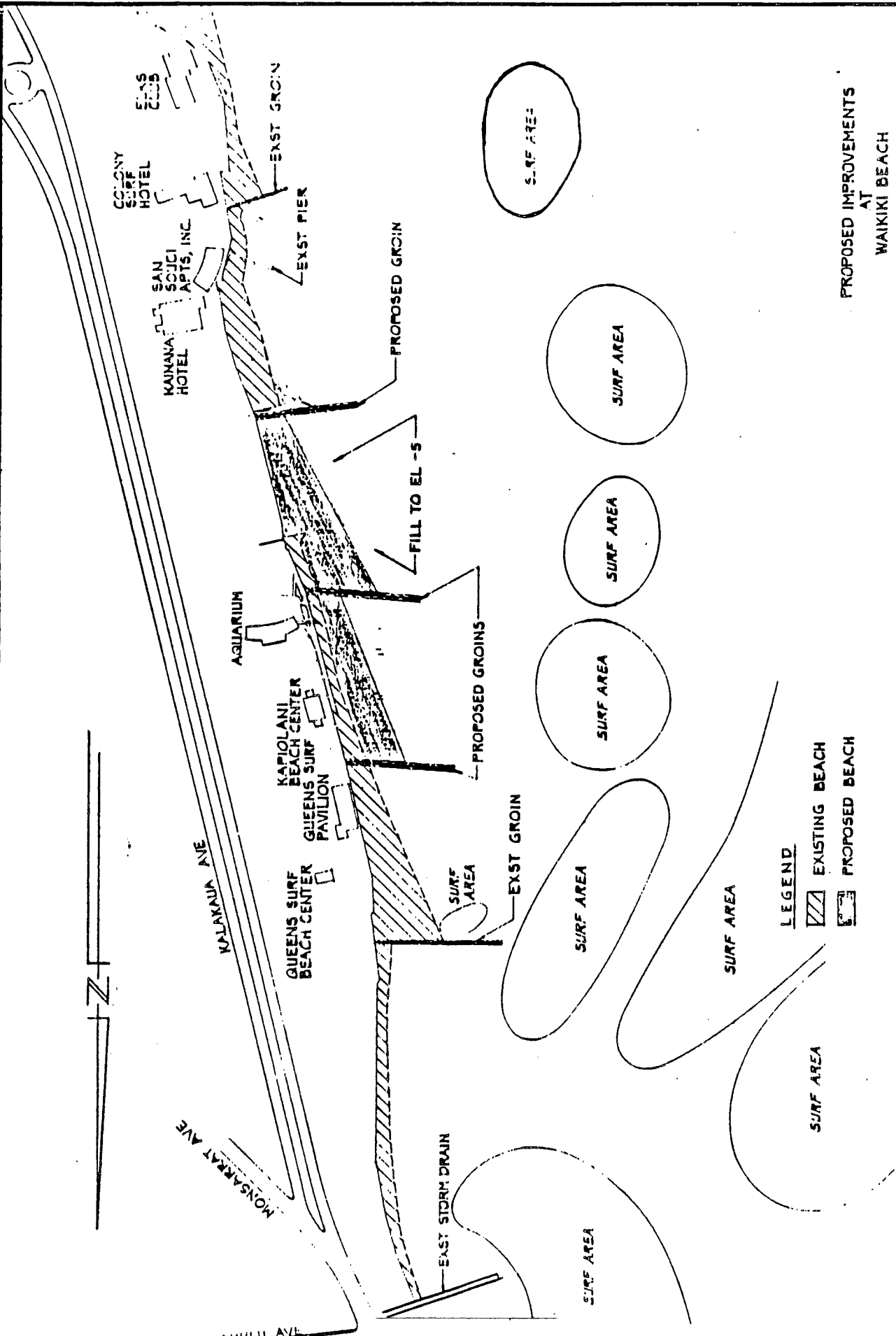
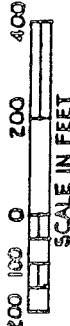


FIGURE 2



PROPOSED IMPROVEMENTS  
AT  
WAIKIKI BEACH

FIGURE 3



LEGEND  
 [Hatched Box] EXISTING BEACH  
 [Solid Line Box] PROPOSED BEACH