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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF STATE PARKS
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August 24, 1995

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RECEIVED
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OFC. OF ENVIRONMENTAL QUALITY CONTROL

Mr. Gary Gill, Director
Office of Environmental Quality Control
220 S. King Street, 4th Floor
Honolulu, Hawaii 96813

Dear Mr. Gill:

Subject: Negative Declaration for Huilua Fishpond Restoration and Revitalization, Kahana Valley, Oahu

The State did not receive any comments during the 30-day public comment period which began in the July 8, 1995 OEQC Bulletin. The Department has determined that this project will not have a significant environmental effect and has issued a negative declaration. Please publish this notice in your next OEQC Bulletin.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the final EA. Please contact Mr. Bill Gorst at 587-0294 if you have any questions.

Aloha,

for MICHAEL D. WILSON

Enclosures

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1995-09-08-OA-FEA-Huilua Fishpond Restoration and Revitalization

Environmental Assessment and Restoration/Revitalization Plan for Huilua Fishpond Kahana Valley State Park Koolauloa, O'ahu

September 8, 1995

prepared for
Division of State Parks
Department of Land and Natural Resources
State of Hawaii

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ACKNOWLEDGEMENTS

Mahalo to the following individuals and agencies:

Kahana residents: Pondkeeper Jose' Gaceta, Aunty Lydia DelaCerna, Ron Johnson, Adella Johnson, Bea Soga, and Ululani Bierne have shared their perspectives and memories of Huilua fishpond. Ron Johnson developed a plan for moving heavy foundation stones. Other Kahana residents and interested persons have attended open community meetings to explore options, share opinions, and expressed their concern about Huilua fishpond's future. Numerous people have offered to volunteer in the rebuilding and restoration process. James Wyban and Tai Wyban assisted in data collection.

The following Federal, State, and County agencies and individuals have reviewed the plan and provided comments which were incorporated into the plan.

Federal :

Benton Ching, Michael Lee, and Ruby Mizue of the Army Corps of Engineers.
Brooks Harper and Michael Ritter of the Fish and Wildlife Service.
Dr. Richard Brock of Seagrant College Program.

State of Hawaii:

Department of Land and Natural Resources: Archaeologists Alan Carpenter and Martha Yent have been essential to the development of this plan. Kahana Valley State Park Manager, Al Rogers and State Parks Planner, Bill Gorst have guided the path of this project. Archaeologist Tom Dye of the State Historic Preservation Division, Steve Tagawa of Office of Conservation and Environmental Affairs, and Ed Chen of the Clean Waters Branch of the Department of Health have reviewed the plan and provided comments.

City and County of Honolulu

Melissa Anderson Rayner, Ardis Shaw-Kim, and Art Challacombe of the Department of Land Utilization.

1. SUMMARY

1.1 Description and Objectives of the Proposed Action

It is the intention of Kahana Valley State Park to restore, rebuild, and revitalize Huilua fishpond in Kahana Bay for interpretive purposes. The fishpond is a historic site on both the Federal and State Registers of Historic Landmarks. The fishpond is a focal point of the living cultural park concept at Kahana Valley State Park. The site is particularly valuable because of the wealth of information still available about its operations in the 1920s. Oral history and remembrances of Kahana residents will provide interpretive lessons for the public about conscious use of water resources and the aquaculture of the ancient people of this land. The fishpond will be operationally consistent with traditional management of the 1920s era. Huilua is the only fishpond on O`ahu connected to an intact *ahupua`a,* (ancient land and water division.)

Actions to restore and revitalize the fishpond for educational purposes are:

* collection of historical, cultural, and community information
* involvement of Kahana Valley Community
* development of interpretive materials
* archaeological investigation/development of model wall
* environmental data collection
* description of site and adjacent water and land resources
* development of restoration/revitalization plan
* restoration of wall
* dredging of pond accretion
* restoration of *makaha* (sluice gates)
* stocking of fish
* maintenance of site
* guided tours
* self-guided tours
* harvest of fish

1.2 Description of the Affected Environment

Huilua fishpond is on the Northeast coast of the island of Oahu. It is adjacent to Kahana Bay and Kahana Stream. The fishpond is 7 acres in area including water and berms of sand accretion. It is often classified as a *kuapa* fishpond (ocean reef flat enclosed by a seawall) however, it has similarities to the inland ponds built behind sand dunes which are known as *pu`uone* ponds. The pond is roughly the shape of a right triangle with its 90 degree angle at the Northwest corner. West and North walls define the fishpond borders from the adjacent water resources of Kahana Stream and Kahana Bay. Huilua is presently a deteriorated pond; walls are damaged by the forces of nature and altered by modern machinery.

Currently the walls are submerged at the highest of high tides. A break in the Northwest wall is a channel for migration of sand into the fishpond which is a major source of pond degradation. The curve of the land defines the *mauka* inland borders of the fishpond along the South and East shores. Within the pond are freshwater springs. Formerly Kahana Stream was connected to Huilua by two *makaha* (sluice gates) located in the Southwestern section of pond. The sluices are now filled in with sand, silt, and debris.

1.3 Relationship of Proposed Action to Area's Land Use Plans and Policies

The two main Federal regulations important to this project are Section 10. the Rivers and Harbor Act and the Clean Water Act. Kahana Valley State Park prohibits boating in the fishpond for purposes other than research and maintenance.

Huilua will be managed as an extensive-style aquaculture system traditional to the 1920s era, producing an estimated 1,000 lbs of product per year. This level of production is one hundred times less than the 100,000 lbs per year production limit set by the National Pollutant Discharge Elimination System (NPDES) guidelines. This project therefore is well within the NPDES restrictions.

The adjacent waters of Kahana Bay are Class AA and Kahana Stream is classified 1.a , the highest and most restrictive classifications. For these reasons and the park concern for conscious resource management, utmost attention has been given to the protection of the water resources in the sequencing and procedures outlined in this plan. The dredging of the fishpond directly concerns the Clean Water Act and Section 10 Rivers and Harbors Act. These concerns are addressed in this plan in Sections 8 through 14. They are also addressed in Section 1.4 of the Summary, and Section 12 on Proposed Mitigative Measures.

In State and County plans and policies, Kahana Valley is designated as a State Conservation (C) District in the Resource (R) subzone. Permitted activities within the (C) District includes use as a park and (R) subzone can be used for aquaculture. As part of the State Coastal Zone Management Program, the County has designated Kahana Valley as a Special Management Area (SMA). In keeping with the SMA, the proposed actions will provide access to the publicly owned site; "avoid the permanent loss of valuable resources; the foreclosure of management options and to ensure adequate access by dedication or other means, to public owned or used beaches, recreation areas, and natural reserves"

1.4 Probable Impacts of the Proposed Actions and Proposed Mitigative Measures/Best Management Practices

Through the restoration/revitalization process, the relationship of Huilua fishpond to Kahana Stream and Kahana Bay will be restored to its centuries-old historic status which was interrupted in recent times through environmental degradation. Connection between pond and stream through the *makaha* sluices will be regained. Once this relationship is re-established, exchange of water from the fishpond into the stream and out into the bay will be minimal compared to that which currently occurs at high and low tide over the submerged walls. The pond basin which has evolved to a wave-scoured tidal basin will revert back to a brackish water silt-bottomed fishpond as some of the silt which currently flows from Kahana Stream and into the bay will move into the fishpond through the sluices. The particulate matter will settle on the pond bottom. The springs which are currently covered in sand and coral will be recovered. Measures will be taken to protect historic and environmental aspects of the site. Documentation of the site and studies of fishpond design were conducted in literature and on site. Procedures will involve the following mitigative Best Management Practices:

Identified Zones for Special Treatment

Huilua has unique resources and areas of the pond interface with the stream, bay, springs, and historic features. To attend to the important environmental and historic concerns, ten zones are identified for special consideration and treatment. Each zone includes an environmental description, historical information, and a proposed restoration/revitalization with special attention to protect the specific environmental and historic features (see Section 9).

Development of Model Wall for Proper Procedural Approach

A ten meter model wall section was excavated and rebuilt in the archaeological investigation to recover information on historic wall design. The process of model wall building served to develop wall building procedures and to identify appropriate building materials. The procedures outlined in the archaeology and wall repair section of this plan were developed to preserve the historic aspects of the fishpond and to mitigate negative environmental impact (sections 2.3 and 10).

Limited Use of Machinery

Machinery used in this project will move upon sections of the completed pond wall. The main use of the bulldozer is to move the materials to the new section to be worked upon. Use of the dredging equipment will occur within the pond basin only after the completion of the wall (sections 10 and 11).

Use of Clean Materials

Stream washed rock which are gathered from river clearing projects in Kahana and scattered rock which were once a part of the pond wall will be used in wall construction. These rocks are of various sizes and will be supplemented with dead coral within the pond basin which will be used in the fill (section 10).

Working in Proper Weather Conditions

Wall building will take place on days with calms seas, low wind conditions and at low tide (section 10).

Sequencing of Tasks

Restoration and revitalization will take place in ten identified zones according to a sequence designed to protect adjacent stream, bay, springs, and pond biota. For example, dredging will take place after the wall restoration is complete and temporary sand berms are built. This sequencing protects the bay with the wall buffer and protects the springs and existing pond biota from pollutants associated with dredging activities (section 12.1).

Hand-building of the Wall

Rebuilding the 1,000 ft pond wall is estimated to take 4 years. This time frame takes into consideration the lengthy process of hand-building, good weather conditions and low tide for placement of stones. At most, the area disturbed will involve a 10 meter section per week. Impact to ambient conditions will be considerably less than existing silt scouring that takes place in the pond basin from daily wave action and movement of tidal exchange through the pond basin (section 2.3 and 10).

Temporary Sand Berms

For the dredging phase, temporary sand berms will be built within the pond basin to isolate the dredging activities and protect adjacent areas from pollutants. The berms will serve to protect springs and pond biota from environmental degradation (section 12.3).

Silt Curtain

Only after the pond wall has been rebuilt and dredged will the *makaha* and the sand accretion of the stream be cleared. A silt curtain will be used within the adjacent stream area to isolate the impact of these activities. The clearing of the *makaha* will take place from inside the pond outward to the stream. This area is the most likely of the entire restoration area to contain silt deposits.

If silt is stirred in the process, the silt curtain will contain the particulate matter. For the clearing of the *makaha*, the incoming water from the stream will push the silt back into the pond basin rather than into the stream (section 12.4).

Water Quality Monitoring

Water quality monitoring will take place on a quarterly basis for the wall rebuilding phase and a weekly basis for the dredging phase. Laboratory analysis will take place before and during the project period (section 12.5).

Supervision by an Archaeologist

Work in culturally and environmentally sensitive areas such as the *pua* pond, Northwest corner of the wall, identified springs, *makaha* and the North bank will be supervised by an archaeologist knowledgeable of the historic and environmental conditions of the fishpond and is familiar with the details of the restoration/revitalization plan (section 9).

2. HISTORICAL ASPECTS

2.1 Introduction

Huilua fishpond is situated in the Southeastern portion of Kahana Bay on the Northeast coast of O'ahu (Figure 1).

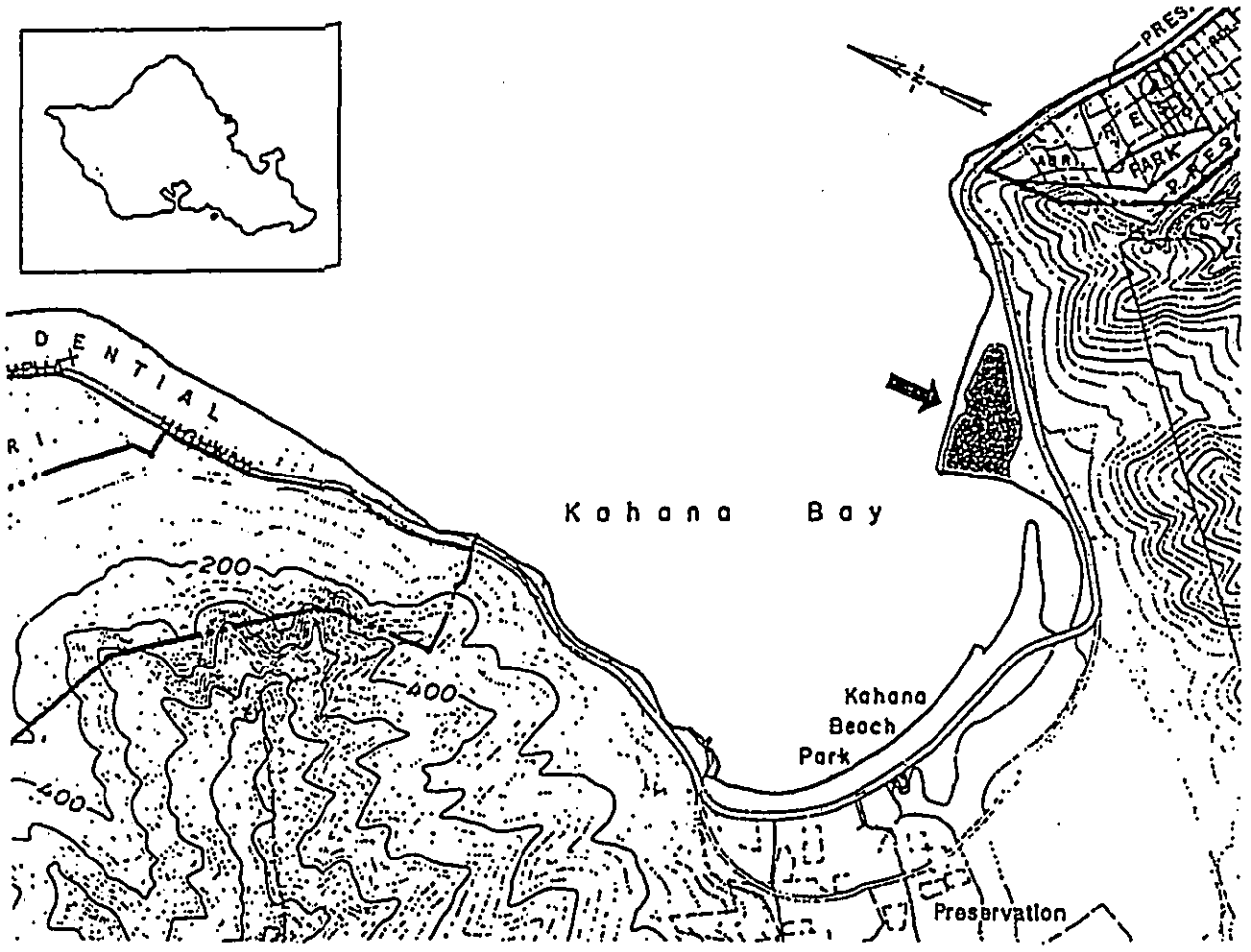

Figure 1. Huilua fishpond in Kahana Bay

Huilua is one of three fishponds known to exist in Kahana Valley. Vestiges of a *loko wai*, or freshwater pond known as Wailua exists within Kahana Stream inland from Kamehameha Highway. Another pond, known as Pukoko was a *pu'uone*, inland pond, located *mauka* of the highway and inland of West Kahana Bay. Figure 2 shows the location of the three fishponds.

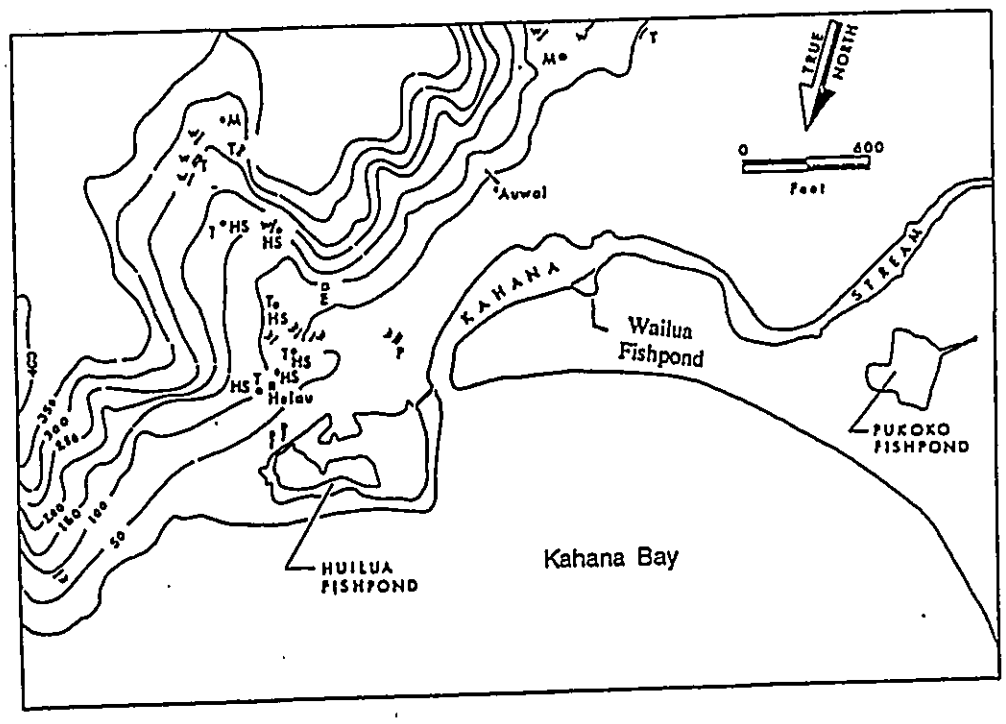

Figure 2. Adapted from Kikuchi 1973 shows the location of the fishponds and associated archaeological sites.

Of the three ponds, Huilua fishpond is the largest and most visible. The pond's history is well documented. McAllister reported information about the fishpond in a 1933 report. Apple and Kikuchi included Huilua in a State-wide study of fishponds in conducted in 1975. In 1979, Marion Kelly conducted an anthropological study on Huilua fishpond and in 1990 Carol Wyban conducted a feasibility study.

According to legend, Huilua was built by *Menehune*, mythical beings who worked in rock and completed construction of any site within the course of one night. Two Hawaiian deities associated with the pond are a *mo'o* and a *mano*. *Mo'o* were large lizards which were often regarded as *'aumakua* or ancestral spirits. *Mo'o* were often the guardians of fishpoinds. The *mano* was a mythical shark known to have frequented the area and dug a large hole in the fishpond.

In 1980 Rothwell and Madden also developed a theory of Huilua's origination. They proposed that sand deposition in Kahana Bay created a berm which enclosed a portion of the bay. This sand berm was adapted by Hawaiians to create the fishpond. Observation and adaptation of natural resources are basics in design, construction and maintenance of fishponds by ancient Hawaiians. See Figure 10 in Section 2.5.

Over centuries, natural disasters such as storms and tsunamis have had destructive impact on the fishpond. As a consequence Huilua has been built and re-built with continuous modification in design. Following a tsunami in 1957, heavy machinery was used in efforts to restore the fishpond. The forces of nature, use of machinery, the break in the Northwest wall and subsequent sand migration into the fishpond have altered Huilua fishpond's features considerably.

The planning process for restoration and revitalization involves integrating the present environmental conditions with appropriate methods to restore the fishpond in keeping with its historic status and environmental concerns. Each fishpond has unique features adapted to resource-specific aspects of the site. Huilua has many unique features and environmental conditions which are incorporated into the development of this plan.

Because of the importance of proper documentation and recovery of historic information this plan was developed in conjunction with an archaeological study conducted by Alan Carpenter and Martha Yent of the Department of Land and Natural Resources, State Parks Division. The recovery of information regarding the design features of Huilua has been a valuable base of information in the development of this plan.

Complete physical restoration of the fishpond to its original design is impossible. Pond design has changed over time and adjoining bay, stream, springs, and upland areas have also changed. In ancient days when a natural disaster destroyed parts of the pond and altered the environment, rebuilding required adaptation to environmental changes. The intent of this plan is not to replicate an irretrievable past. When possible design features will be restored to replicate historic design, in other areas the design is adapted to the specific needs and characteristics of the existing environment. General construction and design features of ancient fishponds have been useful and are included in this plan.

2.2 Fishpond Wall Construction

According to Kikuchi (1973) fishpond walls were traditionally built in a double-wall construction with a center fill (Figure 4). The length of the stone was placed into the wall for strength and stability. This practice required more rock, but resulted in stronger rock facings (Apple in Wyban 1991b). The foundation stones (*pohaku ho`okumu*) are the largest and heaviest stones which gave stability to the wall structure. The rocks are set in an interlocking fashion (*ho`oniho*) to form the two facings of the wall. Ancient fishponds have wall facings which are usually one rock thick. Apple states that irregular sized rocks, unsuitable for facings and small rocks go into the fill between the two walls. When outer facings are two to three rocks high, the fill is placed between the facings. Fill often consists of rock, cobble, coral, and sometimes dirt. (Note: dirt will not be used in Huilua's restoration.) The following Hawaiian terms are related to fishpond wall construction:

* *kupono.* use of the natural shape of the rock

* *hakahaka.* interstitial spaces to allow for circulation

* *hio.* wall is wider at the bottom than at the top, leaning in on the fill, provides stability against wave action

* *ho`oniho.* To lay stones in an interlocking fashion

* *po haku ho`okumu.* Foundation stones

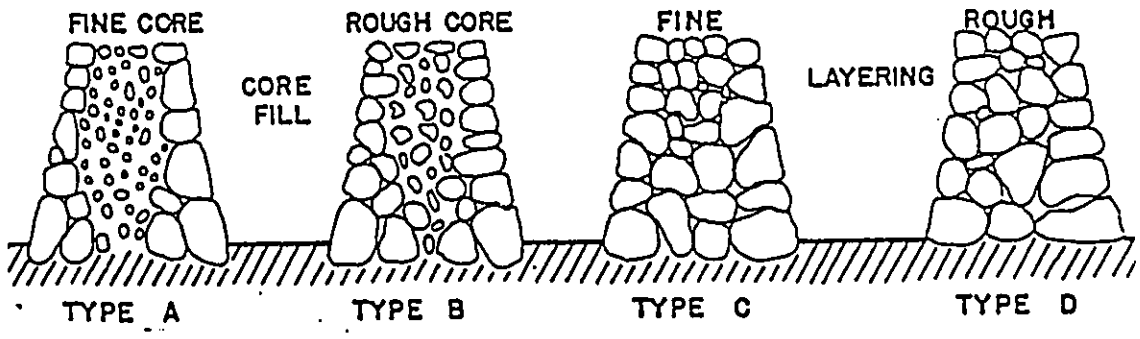

Figure 3. Kikuchi, 1976 cross-section of double-wall construction with fill.

Kikuchi states that the permeability of the walls greatly reduces wave energy. He noted that walls were constructed with sloped facings. The seaward facings have more slope than the inward facings (see Figure 5). The function of the slope is to enable the wall to withstand wave energy. Kikuchi states that wall widths of O`ahu ponds averaged 5 feet and heights averaged from 3 to 4 feet. Regarding wall height, McAllister (1933) stated that the water may approach the top of a wall but never covers the wall completely. Fishpond wall design evolved over centuries of building, rebuilding, and adaptation to the changing environment.

Pua ponds (fingerling ponds) are described by Kikuchi as secondary and tertiary walls which are constructed within the confines of a fishpond in order to compartmentalize the pond for the protection and raising of fry. He observed that these walls were typically of loose construction.

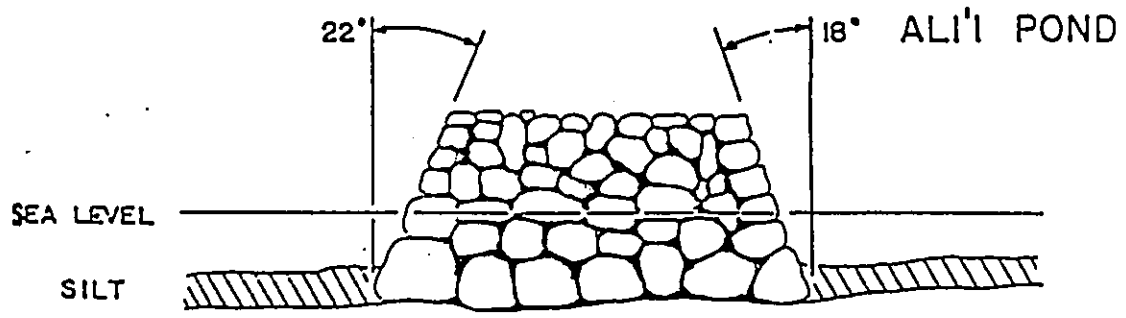

Figure 4. Kikuchi 1976. Slope of a fishpond wall.

The distinctive and unique feature of the Hawaiian fishpond is the *makaha*, or sluice grate. The sluice grate was used for circulation of water, stocking of fingerlings and the harvest of fish when they reached maturity. The ancient *makaha* was a stationary grate. In post-European contact times, the design changed with modern materials. Concrete and metal fixtures were used to a create multiple-gate systems with an internal channel for harvesting and storage of fish. The gates in the post-European contact design were moveable and were lifted up and down in concrete gate slots. Figure 5 shows examples of the ancient and modern *makaha*.

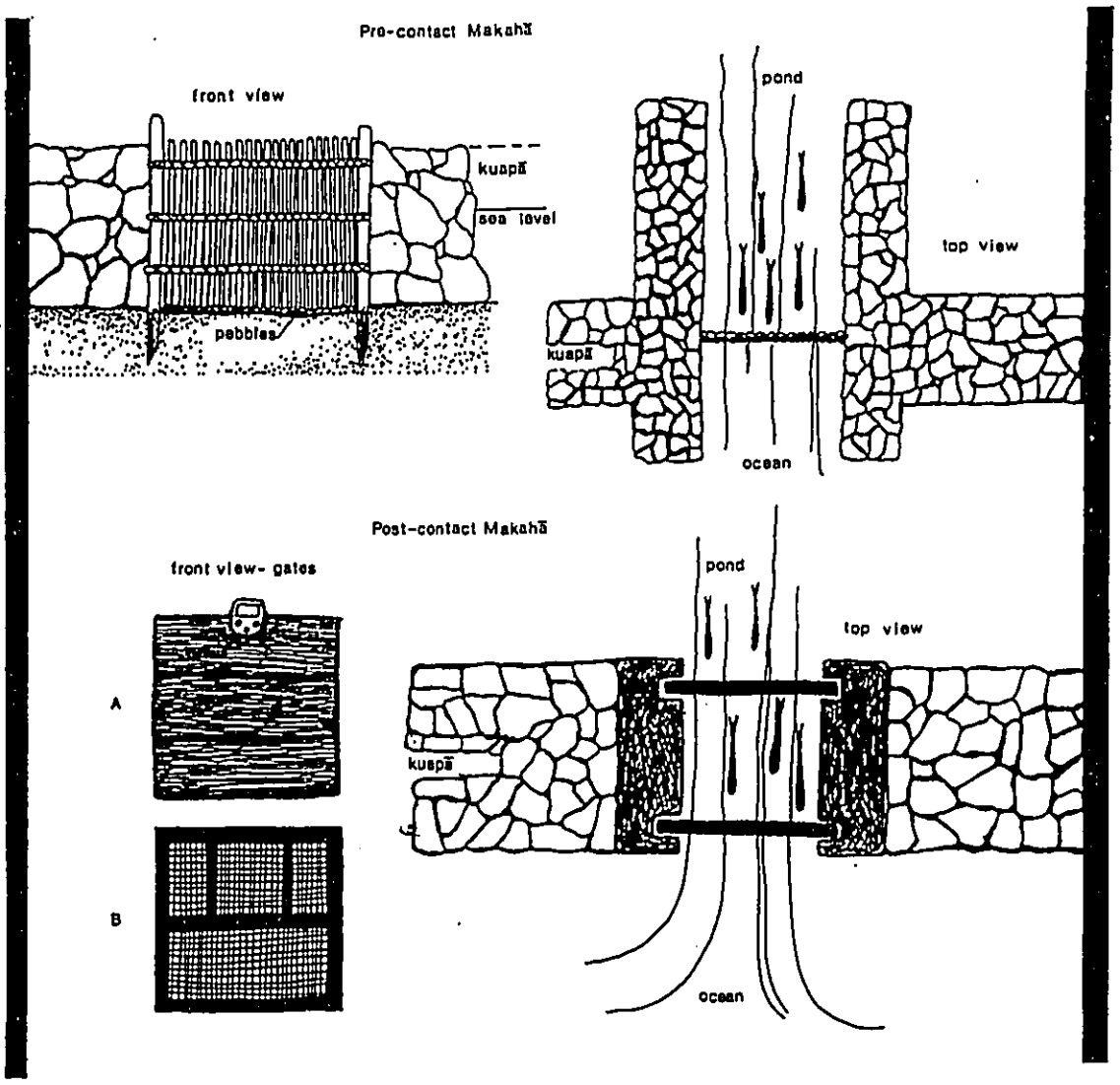

Figure 5. Wyban 1992. (Top) Ancient, Pre-contact *Makaha* (Bottom) Modern, Post-contact *Makaha*

2.3 Archaeological Studies of Huilua Fishpond

In the 1970s there were three archaeological studies of Huilua fishpond. More recently, from 1990 to the present, an archaeological study has been conducted in conjunction with the development of this plan. A brief summary of the four studies are presented here:

1971, Bishop Museum Archaeological Survey of Kahana Valley, Koolauloa District, Island of Oahu by Robert J. Hommon and William M. Barrera, Jr., Bernice P. Museum

Huilua was one of sixteen survey areas in the study where a total of 114 sites were surveyed. The survey gives a general description of the fishpond and more detailed information about Sites 1544 near the Southwest corner of the pond and 1546 located on the North Bank of Huilua fishpond.

Site 1544: The area consisted of two walls on the opposite sides of a dry streambed. An intermittent spring existed below the one wall which was terraced.

Site 1546: The cultural deposit consisted of four strata with flecks of charcoal, large mammal bone fragment, and a coral file. The site was eroding out of a sand-dune deposit at the North end of the bank and may extend several meters southward. This site was the only known stratified site in Kahana Valley and was identified as a site for more intensive excavation in Phase II.

1972, Excavations in Kahana Valley, Oahu by Robert J. Hommon and Robert F. Bevacqua, Department of Anthropology, Bernice P. Bishop Museum

Site 1544 (described above) was determined to be of natural origin.

Phase II excavation of Site 1546 was continued. The site is described as a low mound consisting of beach sand overlain by fine sand, light-gray to grayish-brown in color. It was determined that this overlay was dredged from the bottom of the pond, evidenced by color, location and high incidence of White Tellin, a mollusc. The site was mapped, gridded and pond dredgings were removed. A one meter square test pit was excavated in the eroded seaward face. Auger test holes indicated that the cultural layers extended as far as the perimeter of the mound. Eight strata were identified, five of which were cultural layers. Human activity was indicated by kukui nut shells, fire-blackened rocks, artifacts, charcoal concentrations, fireplaces, mollusc shell concentrations, mammal bones and teeth and a human bone. Artifacts included two basalt flakes, a small basalt *ulu maika*, a small basalt adze and a bone pick. Radiocarbon dates and estimates of the occupation revealed dates that range between 1657 and 1850.

The study concludes that Site 1546 was a series of temporary campsites at which human activities were limited to the simple gathering and preparation of food. It is possible that it was used by those who were charged with the maintenance of Huilua fishpond. Recommendations were made for the protection of the site and further intensive excavations.

The study also describes and maps an alteration in the wall design of the Northwest corner by David Cox. The channels were intended to convey water in and out of the pond with the high tide and to arrest or reverse the sand accretion.

1979 Archaeological Pre-Stabilization Assessment of Huilua Fishpond by Aki Sinoto, Bernice P. Bishop Museum

Aki Sinoto of the Bernice P. Bishop Museum conducted an archaeological assessment of Huilua fishpond in 1979. The field objectives were to determine the existing conditions of the pond, assess changes since 1972, and to supervise and monitor backhoe trenching to determine the nature and relationships of various components of the pond (walls, sand-spits, *makaha*).

The study discusses the general deterioration of the fishpond including progressive deterioration of stone walls, damage at the Northwest corner, formation of a sand spit on the Western bank, erosion of the pond bank and fill at the Northern tip of the West bank. Aerial photos were examined for observation of sand build-up, changes in vegetative growth, erosion and large scale dredging.

The results of archaeological trenching were largely negative, or non-conclusive, citing the effects of repeated modern modification as the cause for the lack of prehistoric construction. The study states the likelihood that prehistoric features have been obliterated and recommends that no further archaeological work at the site with the exception for Site 1546. More geologic and marine-oriented studies are recommended. The final recommendation states that as one of the few surviving fishponds on Oahu, Huilua merits preservation and restoration. The study states that since historic information for the 1920 period is available from informant material and photos, providing the basis of traditions and spiritual aspects of pond operation.

1993. Report on Archaeological Investigations at Huilua Fishpond, Kahana Valley, Koolauloa, O`ahu TMK: 5-2-05-21 by Alan Carpenter and Martha Yent, State of Hawaii Department of Land and Natural Resources, Division of State Parks.

Information about Huilua fishpond's design, construction, and alteration has increased considerably due to this work. In addition to recovery of information, the work included restoration of a portion of excavated wall. This portion of restored wall serves as an accurate model for future restoration/revitalization of

Huilua fishpond. Information recovery and application is particularly valuable since pondkeeper Jose Gaceta was able to work with archaeologists and gain hands-on experience.

Previously, descriptions of Huilua have a wide range of acreage estimates. Pukui, Elbert and Mookini in 1974 lists Huilua at 200 acres, Kikuchi in 1975 lists the pond at 14 acres, and Rothwell and Madden in 1980 estimate the pond size at 4.5 acres. In December of 1991, mapping by Yent and Carpenter utilizing a transit and stadia rod revealed an acreage of approximately 7 acres.

Carpenter and Yent affirm the likelihood that a sandbar was utilized in developing the fishpond. It is probable that in areas of the pond wall, a natural sand berm was fortified by rocks to create part of the pond enclosure. However, portions of the pond wall, particularly the Southwest wall, was built in a double-wall construction typical to Hawaiian fishponds and particularly characteristic of *kuapa* type ponds. The report documents the existence and the disappearance of fishpond-related structures such as buildings, *pua* pond, and a stone-walled enclosure. They describe changes in pond structure due to natural forces and human modification which are included in the following chronology.

To gain an understanding of original pond wall construction and associated features, eight test trenches were excavated along the West side of the pond and one along the North Wall see Figure 6 for location of trenches. Trenches were dug by hand using shovels, trowels and brushes. Information from each trench is summarized in the next five pages.

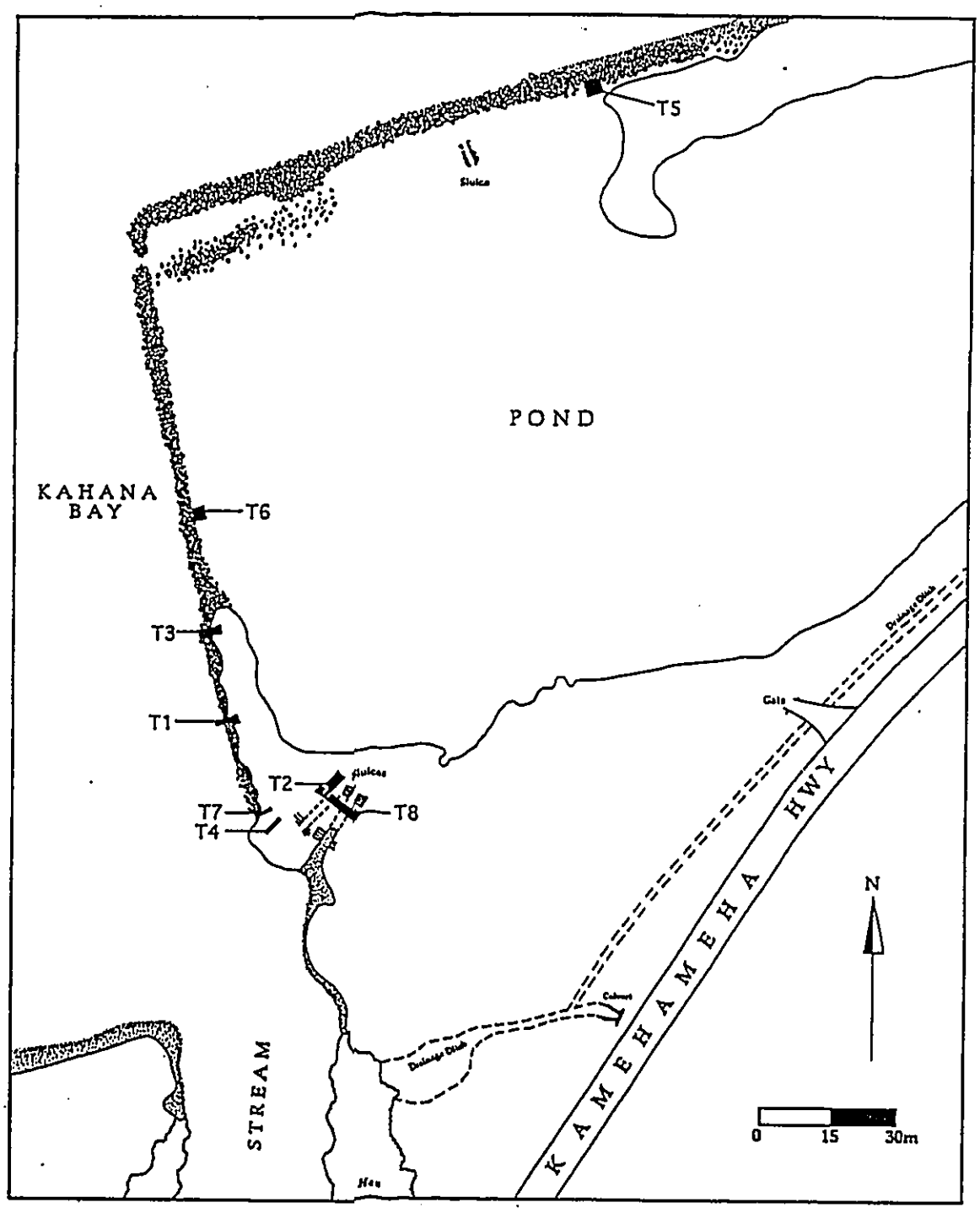

Figure 6. Map by Carpenter shows the location of the archaeological trenches.

Trench 1 identified three phases of wall construction, the earliest phase appears to sit atop sand, basalt, and coral rubble. Section is 1-2 stones high of large to medium sized boulders. Middle wall construction phase, built atop the first, consists of stacked medium to small sized boulders, 2-3 stones high. Final wall construction phase sits atop second and consists of stacked large to small-sized boulders from 1-3 stones high. Trench 1 was extended to gain further information. Interior and exterior wall facings were left intact. Fill between the facings consisted of small boulders, occasional medium boulders, cobble, sand, coral, and basalt pebbles.

Trench 2 was intended to expose a section of the *pua* pond which was located in the area. Results were inconclusive. Stratigraphy shows a sequence of natural sand deposition interrupted by a large dredge deposit attributed to the 1950s when the pond was altered with machinery.

Trench 3 at the Northernmost end of the West bank was intended to confirm results of trench 1 and provide a starting point from which the model wall restoration could begin. The trench revealed a stratigraphy which resembled Trench 1 and a section of buried wall remnant was found, however middle construction phase was not evident. (Findings in Trench 1 may have represented localized repair.) Exterior wall in Trench 3 was well defined extending below sand deposit. The width of the wall base in 3.4 meters (about 11 feet). Width of wall at the top could not be determined since much of it was collapsed, however it is unlikely that it was approximately 4 feet or less as described an informant in Kelly, 1978. The work determined that the Southern portion of the West wall was man-made in entirety. The Northern portion of the West wall has undergone some modification. The Northwest corner and Western end of the North wall appear to be a major human modification based on historical evidence and archeological remnants. Remainder of the North wall has undergone modification but extent and age of modification is unclear.

Trench 4 was intended to show the connection between the West wall and the sluices. Despite modern disturbance to the area, there is some evidence of the former stone wall at this point, which appears to have been modified following tsunami damage.

Trench 5 located at the point where the North wall meets the Northern pond bank. The effort was unproductive because very large boulders in the area were immovable by hand.

Trench 6 located 25 meters North of Trench 3 along the West wall measured 5 meters. Results were inconclusive.

The wall facings were hand-placed using large boulders weighing sometimes in excess of 50 lbs. They were then filled and levelled in the center core by adding smaller stones, coral heads, coral debris. Seawater was poured over the core as it was being built to aid smaller coral and rock to filter down and solidify the wall. This action replicates the wave action which naturally washes over the area. The top of the wall was fitted with flat-topped stones. A detailed description of the Model Wall construction is presented in the Study by Carpenter and Yent. Figure 7 shows the excavated Trench and Figure 8 shows the completed section of the model wall.

Figure 7 Excavated trench.

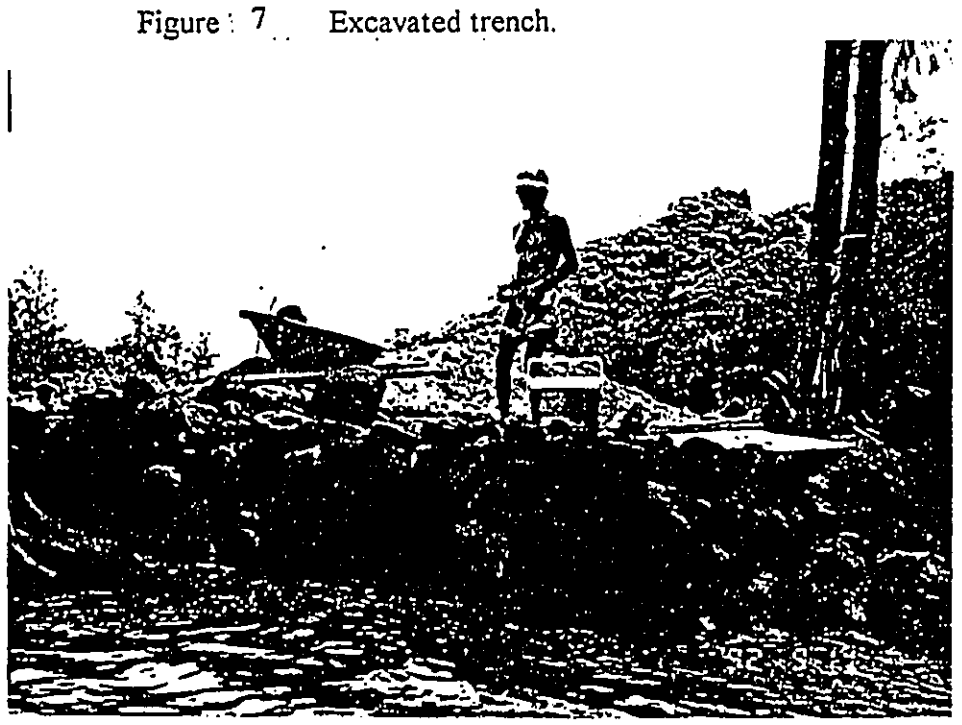

Figure 8 The completed outer face of the model wall.

Carpenter and Yent have made the following conclusions and recommendations in their report which have been utilized in this plan:

West wall: Follow the existing piled rock alignment toward the Northwest corner, utilizing the same construction design as the model wall. From the point of the model wall back to the sluices, the overlying bank should be removed, and buried stone wall remnants should be restored in the same manner as the model wall.

Northwest Corner: Build the wall higher and wider at this corner, with a much more dramatic slope on the exterior face. This is necessary due to the history of damage sustained in this corner because of its exposure to direct wave impact. It is also historically accurate based on the earliest photographic evidence.

North Wall: There is no evidence that any portion of this wall was double-faced (except for the extreme West end which is considered part of the Northwest corner). Best evidence suggests that the wall consisted of a naturally formed sand bank reinformed by very large stones. The sand bank no longer exists for the Western half of this North wall. It is recommended that a double-faced wall be constructed similar to the West wall but wider and higher in order to withstand greater force of waves.

***Makaha*:** Deteriorated and damaged areas of mortared wall can be rebuilt using the design of the adjacent wall facing. M1 or Mauka Southeastern Sluice's *mauka* wall can be rebuilt using the mortared wall stone design of the sluice's *makai* wall. Bottom of the channels can be cleaned. If a concrete bottom is located it may be repaired.

More information from the trenches and model wall construction is incorporated into Section 10 on wall repair. Recommendations of Carpenter and Yent have been incorporated in Section 9 on specific fishpond zones and their restoration and revitalization.

2.4 Chronology of Environmental Conditions and Descriptions of Huilua

1884 Map by George E. Gresley-Jackson shows vegetation in Eastern portion of fishpond. Large stone enclosure is noted next to the *makaha* (see Figure 9).

1910-1918 Kai`apa and Pua are caretakers of the pond, granddaughter Hattie Au resides with them at the fishpond.

1918 Louis Kawehi is pondkeeper, niece Liliana Vincent resides at the pond from 1918-1922.

1923 Tsunami damages the wall of the pond. Kawehi leaves the fishpond.

1924 Pua Ha`aheo becomes pondkeeper. Concrete is added to the *makaha.*

1930 McAllister visits Huilua interviews Ha`aheo, notes the remnants of the *ko`a,* a line of 3 foot-stones at the fishpond.

1946 Tsunami damages the fishpond and sweeps away Pua Ha`aheo's three grandchildren, Ha'aheo leaves Kahana.

1946 Joseph Kekona leases the fishpond and repairs wall by hand.

1957 Tsunami damage. Kekona brings in heavy equipment to make repairs. Caterpillar-bulldozer is used to push the big boulders back into alignment along the North wall. Dragline used to take sand and debris out of the pond. Dredge placed on the West Wall, Southeastern section of the pond, and on the Eastern border of the pond along the road near the springs.

1960 Tsunami damage. No report of repair.

1965-1966 Rainstorm floods fishpond, weakens Northwest corner from the inside, creates breach in the wall. Storm from the ocean erodes pond wall from the outside.

1969 Joseph Kekona leaves the fishpond.

1969 Harrison Thurston leases the fishpond/Dave Cox does repair and alteration to Northwest corner.

1975 Harrison Thurston leaves the fishpond.

1979 Marion Kelly visits site, interviews informants, describes *makaha.*

1980 Guy Rothwell and William Madden (Oceanic Institute) conduct Prestabilization Survey.

1980 Aki Sinoto (Bishop Museum) conducts Archaeological Assessment

1990 Carol Wyban completes Feasibility Study

1991 Carol Wyban completes Interpretive Plan

1993 State archaeologists Alan Carpenter and Martha Yent complete Archaeological Report

1994 Carol Wyban completes Environmental Assessment and Restoration/Revitalization Plan

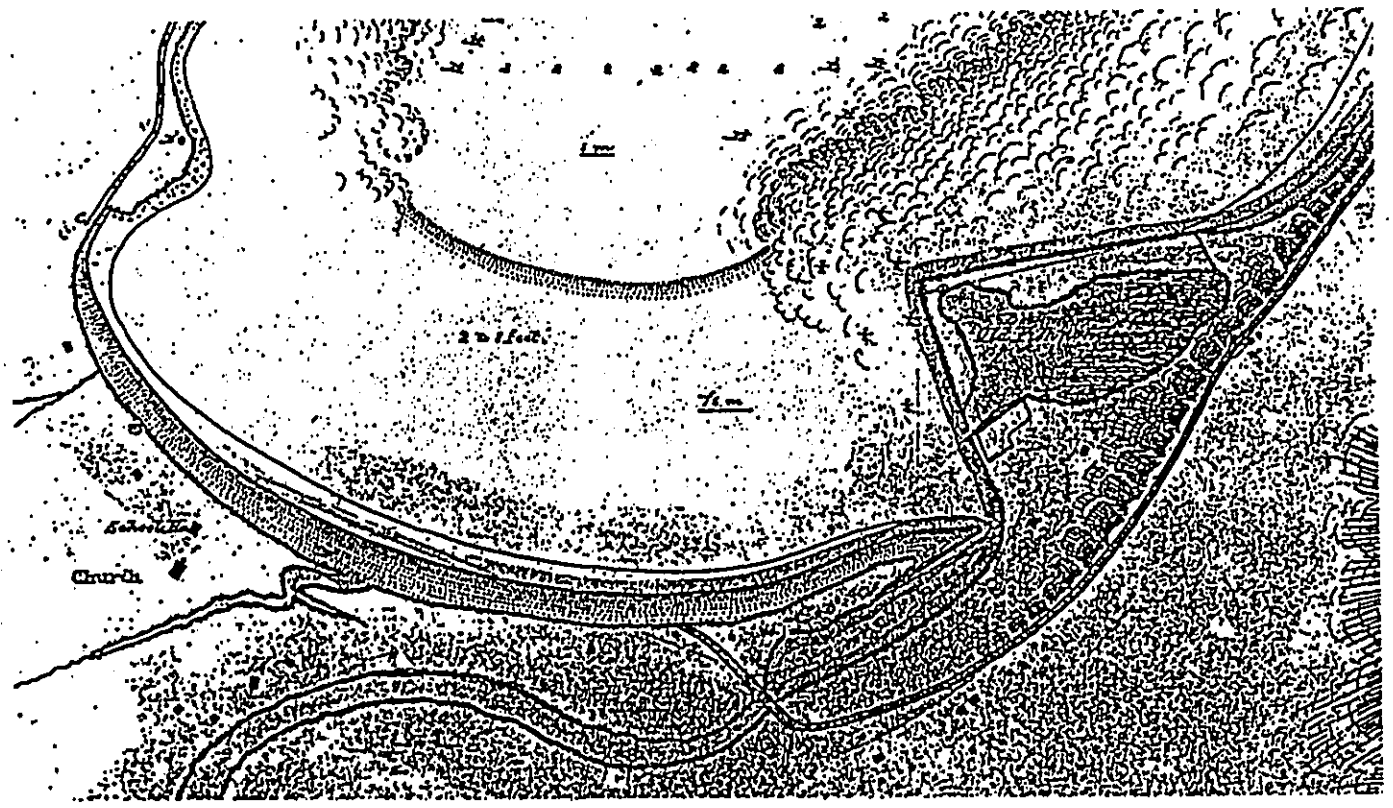

Figure 9 . 1884 Map by George E. Gresley-Jackson

2.5 SAND MIGRATORY PATTERN/ORIGIN OF HUILUA FISHPOND

According to legend, Huilua was created by the Menehune in a single night. Within the context of this study, however, we are tracing the physical evidence and relating it specific aspects of pond development. In a 1980 study by Oceanic Institute, Rothwell developed a theory on the origin of Huilua fishpond. He states that the sand berm occured naturally and this berm was augmented to facilitate the enclosure of the pond. This process of development is illustrated in Figure 10.

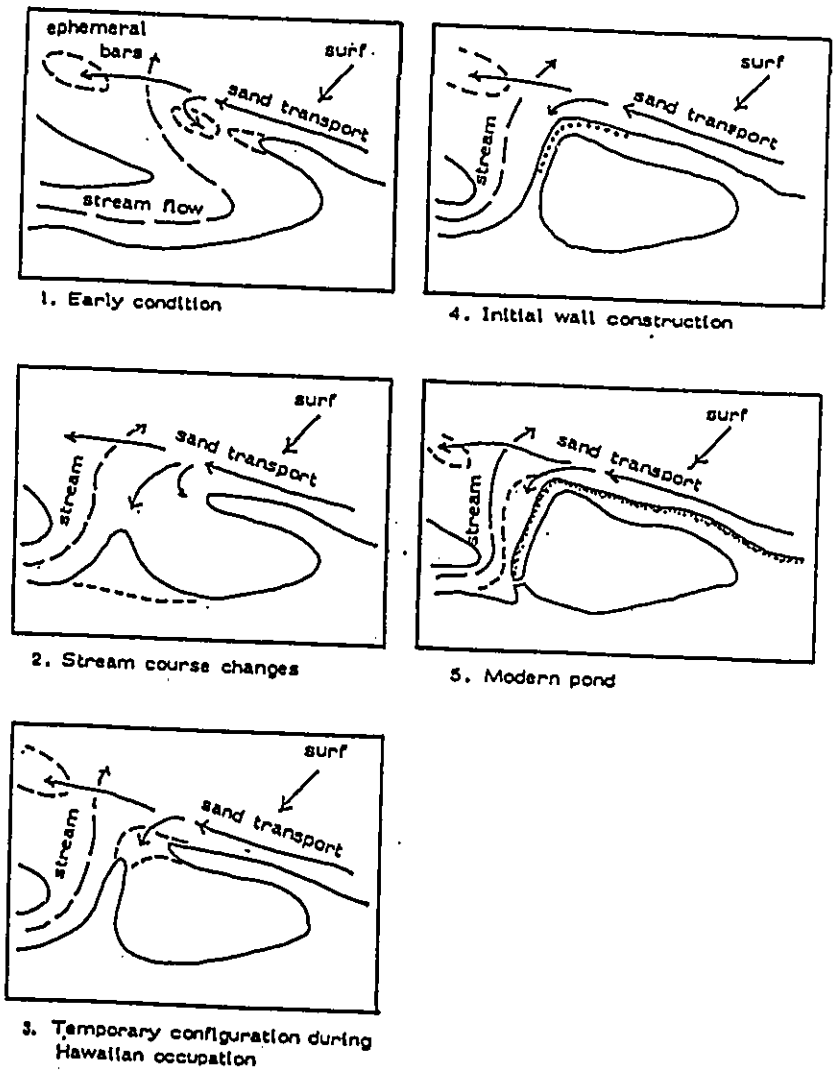

Figure 10. Rothwell and Madden 1980. Historic Sand Migration and Proposed Theory of Huilua Fishpond Origin.

3. RELATIONSHIP OF PROPOSED ACTION TO LAND USE PLANS, POLICIES, AND CONTROLS FOR THE AREA

3.1 Tax Map Key: 5-9-05:21

3.2 **Historic Registry:** Huilua Fishpond has been on the National Register of Historic Places since 1966 and the State Register since 1979.

3.3 **Identification of Applicant:** Kahana Valley State Park, State Parks Division, Department of Land and Natural Resources, State of Hawaii

3.4 **Identification of Regulatory and Approving Agencies**

Please Note: Regulatory Review Comments on the Draft Environmental Assessment and Restoration- Revitalization Plan dated *6/94* are included in the Appendices of this document.

Jurisdiction	Federal	State	County
Authority	Section 10 Rivers and Harbors Act, 1899 (33 USC 403) and Section 401 of the Clean Water Act (33 USC 401)	Coastal Zone Management Act of 1972, as amended 916 USC 1451 et seq,) and HRS 183, Title 13 Ch 2 and Section 401 of the Clean Water Act (33 USC 401)	Special Management Areas-HRS 205A, Part II , as amended
Agency	Army Corps of Engineers	Coastal Zone Management and Office of Conservation and Environmental Affairs (CDUA) and Dept. of Health , Clean Waters Division	City and County of Honolulu, Planning Dept.

Table I. Regulatory and Approving Agencies

Federal: Army Corps of Engineers and Environmental Protection Agency

Dredging of the fishpond requires a permit from the Department of the Army administered by the Army Corps of Engineers. Issuance of a permit is based on a "public interest review" which evaluates the probable impacts of a project, including its cumulative impacts and its intended use. Factors which may be relevant to a proposed activity are required to be considered including, but not limited to, conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion, and accretion, recreation, water supply, water quality, energy needs, safety, property ownership, and in general, the needs and the welfare of the people. No "point source" discharge of pollutants into any waterways is permitted without a permit issued under National Pollutant Discharge Elimination System (NPDES) guidelines. The Environmental Protection Agency (EPA) has set up specific discharge standards for aquaculture activities. In 1979 NPDES regulations for concentrated aquatic animal production facilities were redefined, exempting from NPDES permits on a case-by-case basis warm water facilities producing less than 100,000 pounds of animals per year. Production at Huilua will be well under the 100,000 lb limit, producing at most 1,000 lbs per year under traditional extensive-style management.

State of Hawaii: Conservation District

Kahana Valley is designated by the State Land Use Commission as a Conservation District. The area is further designated by the Department of Land and Natural Resources as a Resource (R) subzone.

Administrative Rules of the Dept. of Land and Natural Resources pursuant to Chapter 183-41 of the Hawaii Revised Statutes states that "Conservation district" means those lands within the various counties of the State bounded by the conservation district line as established under the provisions of Act 187, SLH 1961, and Act 205, SLH 1963, or future amendments thereto."

13-2-10 Boundaries.

(a) The boundaries of subzones within the conservation district:
  (1) Shall follow natural or fixed physical features; or
  (2) Shall be defined by a series of straight lines; or
  (3) Where coterminous with forest reserve boundaries shall be determined by metes and bounds descriptions or the forest reserve.

(b) Any uncertainty regarding the location of the subzone boundaries shall be resolved by the board whose determination shall be final.

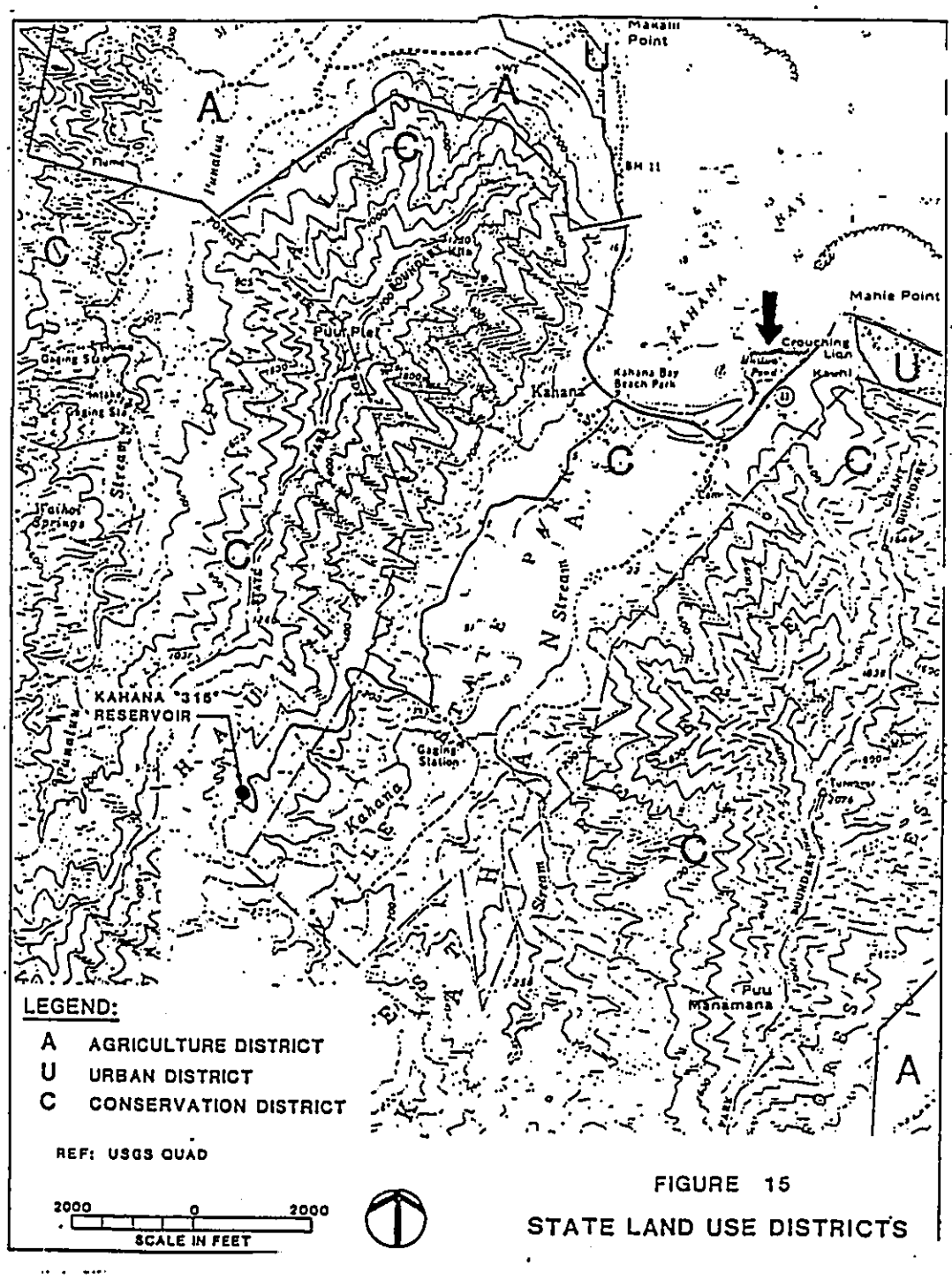

Figure 11. Huilua is in the Conservation Zone

13-2-13 Resource (R) Subzone.

(a) The objective of this subzone is to develop, with proper management, areas to ensure sustained use of the natural resources of those areas.

(b) The boundaries for the (R) subzone shall encompass:

(1) Lands necessary for providing future parkland and lands presently used for national, state, county, or private parks;

(2) Lands suitable for growing and harvesting of commercial timber or other forest products.

(3) Lands suitable for outdoor recreational uses such as hunting, fishing, hiking, camping, and picnicking;

(4) Offshores islands of the State of Hawaii, unless placed in a (P) or (L) subzone;

(5) Lands and territorial waters below the upper reaches of the wash of waves, usually evidenced by the edge of vegetation or by the debris left by the wash of waves, unless placed in a (P) or (L) subzone;and

(6) All territorial water not expressly assigned to any subzone shall be in the (R) subzone

(c) The following uses are permitted in the (R) subzone:

(1) All permitted uses in the (P) and (L) subzone;

(2) Aquaculture

(3) Artificial reefs; and

(4) Commercial fishing operations.

City and County of Honolulu

As part of the State's Coastal Zone Management Program, Hawaii's four counties are required to designate Special Management Area (SMA) boundaries and provide special controls on development in these areas. This process is intended to avoid the permanent loss of valuable resources and the foreclosure of management options and to ensure adequate access by dedication or other means, to public owned or used beaches, recreation areas, and natural reserves."

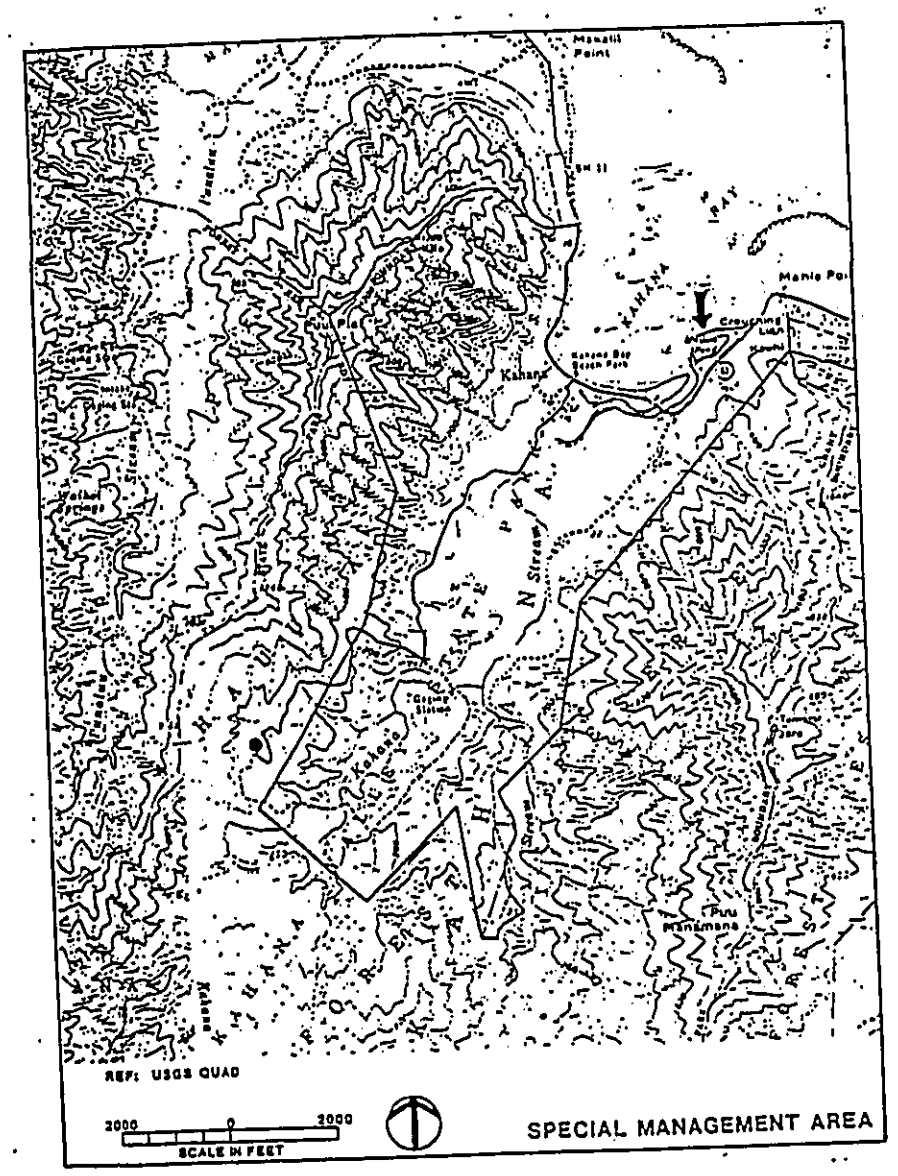

Figure 12. Huilua is in the City's Special Management Area (SMA)

3.5 Approved Policies for the Implementation of the Kahana State Park Development Plan, March 27, 1992.

Published Park Goals

"That Kahana State Park be:
a) a center for the interpretation of the Hawaiian *ahupua`a* system;
b) a center for the related interpretation of the ecology and history of Kahana; and
c) Used for the education, enjoyment, and appreciation of the citizens of the State of Hawai`i." *Kahana State Park Development Plan, Kahana Valley Advisory Council, Draft 7, December, 1985.*

"Kahana Valley State Park is conceived as a low-intensity multi-purpose park that incorporates compatible aspects of the resource based recreation activities; research activities; environmental education programs and an operation and maintenance program that will involve close working relations between State Parks Division and the Valley residents. The park will place particular emphasis on an environment where Hawaiian values and culture will be embodied in a "living park concept". *Kahana Valley State Park Revised Environmental Impact Statement, October 30, 1978.*

4. SOCIAL AND ECONOMIC CHARACTERISTICS

Regarding the socio-economic aspects of Huilua, Marion Kelly (1979) states:
"Huilua fishpond was an important part of the socio-economic lifestyle of the residents of Kahana Valley up until fairly recent times. Perhaps as a result of the formation of a *hui* (Hui Ku`ai `Aina o Kahana) in the latter half of the 19th century, residents were able to retain the continuity of cooperation among Kahana families, including the operating and sharing of the resources of the fishpond. Thus Huilua fishpond may be one of the last remnants of Hawaiian culture to function as part of the *`ohana* food distribution system. As such, the fishpond was part of a three sided exchange of resources involving also the taro gardens of the valley and the *akule* fishing in the bay."

Commercial activities took place in 1946-1960 when Joseph Kekona was pondkeeper. At this time, fish were taken to market and sold, however, commercial activity was not consistent.

Oral history of the fishpond has been collected by McAllister in 1933, Kelly in 1978 and Wyban in 1990. Kahana Valley Residents have fond memories of the fishpond and close ties to historical aspects of the fishpond as well as a site for a hula *halau*. Residents have expressed interest in restoring Huilua fishpond back to productivity. The fishpond was an important part of the community life in Kahana and residents wish to renew and expand their relationship with the fishpond.

They have developed plans for the restoration and revitalization of the fishpond which are summarized in section 10 of this report. They have also given their input and shared their knowledge of the fishpond and adjacent stream and bay environment. Their input appears in the text of this plan as part of the vision of the restoration and revitalization of Huilua fishpond.

At times, efforts were made to stabilize the pond. Resident Ulu Bierne and her family have gathered and stacked stones on the pond wall. On occasion, Jim Woolsey, former Kahana Advisory Council member, has cut back some of the mangrove. These efforts were offset by the amount of consistent labor necessary to accomplish the work and a lack of archaeological information on pond wall construction.

Recent archaeological studies have filled the need for technical information and given insight to wall construction and design. With the hiring of a pondkeeper, rebuilding efforts can be approached with more consistent effort than has been available in the recent past, however a work crew is needed to fulfill the long-term tasks of restoration/revitalization.

Huilua fishpond is one of the main targets for restoration in the Kahana Valley Park Plan and in the plan developed by Kahana valley residents. As a community focal point there are many positive aspects of restoration which can benefit the community. It is a highly visible component to the park and as in ancient times, an important symbol of unity and productivity that can serve as inspiration for the revitalization of other components in Kahana Valley State Park.

For visitors and school children, the fishpond serves as highly visible aspect of the Hawaiian *ahupua`a* which is one of the major themes in Kahana Valley State Park. The mountain-to-ocean land division and the conscious use of the watershed is vividly evident at the fishpond. The freshwater stream, the brackish water springs, and saltwater ocean meet at Huilua. For interpretive purposes, the fishpond serves as a vital reminder of the adaptation by Hawaiians of natural resources for the expansion of food resources. Park programs emphasize classroom visits with hands-on activities.

Currently there are no standard tours or guides at these fishpond visits. Training for residents as interpretive guides in programs for visitors and school children at the fishpond will be provided in the future. Elementary students who visit the fishpond can relate the fishpond experience to standard fourth grade Hawaiian studies contained in the Hawaii Public School Curriculum. The activities at the fishpond bring to life the relevance of classroom studies in Hawaiian culture and the Hawaiian environment. The introduction to pond ecology inspires young people to study science and marine biology. The Park has interpretive materials which develops these concepts and encourages further independent library studies.

Kahana Valley State Park is also investigating the possibilities of Youth programs and the Prison Programs for cooperative efforts to train participants through fishpond revitalization efforts. Fishpond work can instill an interest in Hawaiian culture, marine biology, and ecosystems.

Visitors from out of state also have much to experience at the fishpond. At Huilua they learn of the land and water practices of the indigenous people of Hawaii. The Hawaiian culture is integrally tied to the conscious use of land and water. Resources were carefully protected and conservation was a basic principle in old Hawaii. These principles are ecologically sound and practical lessons with philosophical implications for today. The learning of land and water use practices of ancient Hawaii is not available within the standard tourist experience.

An economic by-product of the restoration/revitalization of the fishpond is the potential for high quality low scale eco-tourism which enables visitors to develop a deeper understanding of the Hawaiian environment and culture.

5. ALTERNATIVES CONSIDERED IN THE PAST:

Studies, proposals and plans of the last twenty years have recommended several alternatives for Huilua fishpond. Options for the fishpond ranged from no action to stabilization, preservation, restoration, revitalization and one study (DHM inc) recommended converting the fishpond into a boat marina. With the exception of the DHM study, researchers placed high value on the fishpond as a cultural education site for the interpretation of aquaculture in ancient Hawaii.

5.1 1974. Kahana Valley State Park, Oahu Hawaii by H. Mogi Planning and Research

The study explored the bio-physical and cultural aspects of Kahana Valley and outlines programs, activities, and facilities. The fishpond is addressed in the following statement:

"Huilua pond will be reconstructed and used both as a striking visual symbol and as a place to demonstrate traditional Hawaiian aquacultural practices. The ironwood and *hau* that have softened its outline will be removed, the walls rebuilt where necessary, and the accumulation of silt removed from its center. It will be stocked with *`ama`ama* (mullet), *awa* (milkfish), and other species traditionally raised in such *loko kuapa* (enclosed seashore fishponds.)

A grassy space at the end of the pond will serve as a teaching area where visitors can learn techniques used by valley fishermen on the bay and stream as well as operation of the fishpond. Simple, open-sided rain shelters and storage sheds will provide protection for both visitors and equipment."

5.2 1975. Ancient Hawaii Shore Zone Fishponds: An Evaluation of Survivors for Historical Preservation by Apple and Kikuchi

The purpose of the study was to identify for public and private interests those surviving fishpond remnants worthy of preservation as part of the cultural heritage of the State of Hawai`i and the United States of America. Highest value is given to those surviving remains judged to have deviated least from their conditions when in operation, i.e. about 1800. Kikuchi and Apple searched the coasts of all the major Hawaiian islands by helicopter and identified the remains of 157 fishponds and several larger fishtraps. All 157 sites were visited. 101 of the 157 ponds were then eliminated from consideration since they did not possess sufficient integrity to merit preservation. The remaining 56 ponds were evaluated. Huilua was amongst the fishponds evaluated and recommended for preservation.

5.3 1977. The Potential for Mullet and Milkfish Culture in Hawaiian Fishponds by Madden and Paulsen

The scope of the study was to survey the biological condition of the existing Hawaiian fishponds in the State for the development of coastal aquaculture; to determine their suitability for aquaculture based upon their present physical state of repair; to recommend some basic management practices to establish or increase fish production in the ponds; and to indicate some expected levels of production based on known yields. Sixty-seven ponds were considered in the survey. Huilua was assessed as having potential for traditional subsistence culture

5.4 1979. The Living Park Plan of Kahana's People by the Kahana Valley 'Ohana Unity Council

The plan was developed to address the needs of the Kahana resident community. The plan, submitted by the `Ohana Unity Council is made up of all the Kahana Valley organizations. It is developed to give a clearer picture of the community than has been presented by any of the state plans prepared by outsiders.

The plan stresses that Huilua is one of few ponds left on Oahu. It states that the knowledge of the fishpond is retained by the `Ohana of Kahana, some residents used to live at the pond and shared the work of the fishpond. The plan states: "We want to restore Huilua. We want to bring life back to Huilua, the way it was when we remember it.

There are those among us who know how the fishpond and the hidden freshwater spring within it should be restored, and how it should be run and maintained. We will teach the younger generation our knowledge. We will show visitors to the park how a fishpond should be managed and maintained. In this way future

generations will know this important part of Kahana *Ahupua'a*. This is part of our plan for Kahana State Park."

5.5 1980. Prestabilization Survey of Huilua Fishpond by Guy N. Rothwell and William D. Madden of the Oceanic Institute

In this study, alternatives considered for Huilua fishpond were no action, stabilization and stabilization compatible with historic restoration.

Primary reason for the no action alternative stemmed from funding issues, at the time of the study, the level of State funding for restoration was zero and the author stated "if no effort is expended over the next ten to twenty years, progressive deterioration of the pond walls may be expected, with eventual destruction of the pond itself."

The stabilization alternative involved the North and West walls to a minimum stable condition and refitting the existing makaha. The plan involved use of small machinery with a loading bucket to move sand to the Northwest corner of the pond, creation of a sand berm along the North and West walls with rocks facing the exterior, use machinery to remove sand and soil from the makaha, repair of makaha gates and concrete bulkheads and removal and destruction of mangrove. For stabilization compatible with historical restoration, steps are similar as the stabilization alternative and included the removal of the third makaha, installation and pegging of filter cloth, placement of gravel, revetment, coral facing of sand berm surface and dredging of the fishpond.

5.6 1985. Kahana State Park Development Plan Draft 7 by Kahana Advisory Council

The plan outlines the process and requisite needs for restoration and preservation of Kahana's sites and culture. It states the vision of restored trails, irrigation systems, taro *lo'i*, fishpond, houses, and canoe *halau*. The plan describes the evolving series of settlements and the living park which continues in evolution and will serve all of the people of Hawai'i in the future. The plan stresses resource management for study and obtaining of permits so that the pond can be restored, restocked, and operated.

Huilua is designated as a secondary use zone because of less intensive use by public. The plan suggests a carrying capacity of 25 people at any one time. The duration of stay, one hour, and a daily carrying capacity of 250 people.
Visits are projected to be longer and more cultural, historical, and educational in content. The plan states that "the fishpond will require a major construction project. After the pond has been restored, the area around it must be cleared, parking space constructed, security provided (by a resident family) and interpretive

displays established. Day-to-day concerns will include the operation of the pond, maintenance of the wall, park-keeping for the surrounding area and security."

5.7 1989. Kahana Valley Preliminary Project Plan, Fishpond Restoration by the Kahana Advisory Council

The goal is to have producing fishponds in Kahana Valley. It states the objective of restoring Huilua as a producing loko kuapa. The project proposes to survey the pond area, identify repair work needed for the walls, makaha, and the inner pond area; to clear encroaching vegetation, particularly mangrove; to restore the pond walls to their former height and width; restore the original depth; restore original flow patterns and repair the makaha; and to stock the pond with mullet and awa or to see if the pond will stock naturally.

5.8 1989. Hawaiian Fishpond Study, Islands of O`ahu, Moloka`i and Hawai`i by DHM Planners Inc

The purpose of the study was to create an inventory of Hawaiian fishponds for O`ahu, Moloka`i and Hawai`i from before the time of western contact to the present, assign classification to each pond, develop in-depth reports, assess and recommend use designations for selected fishponds. Huilua was one of the ponds selected for in-depth report and for which recommended use was presented. DHM Planners states that "based upon anticipated future need for water-related recreational facilities on the windward side, Huilua be used as a recreational boat harbor".

5.9 1990. Feasibility Study and Implementation Plan for Huilua Fishpond, Kahana, O`ahu by Carol Araki Wyban

The scope of work for this study included a literature search, site visits, evaluation, meeting with the Kahana Advisory Council, gathering information from residents and developing recommendations and an implementation plan. Recommendations were made for an archaeological study of the pond to include trenching to uncover remains of the original wall design, accurate mapping of walls, pond, grounds and input for the restoration plan. It was recommended that a pondkeeper be hired and trained, cooperative program with OCCC prison work team be established, a model section of the pond wall be restored and applications be made for necessary permits. Following approval of permits, rebuilding of wall and dredging of pond were to take place. The study stressed interpretive needs and the need for ongoing management of the fishpond.

The fishpond's deterioration is weighed against the value of the fishpond as one of the few remaining fishponds on O`ahu owned by the State of Hawai`i. It is one of the few fishponds which remained actively productive until the late 1950s, and for interpretive purposes, much of the historical background has been recorded. As

earlier noted, there have been several archaeological studies on the fishpond which also lend themselves for interpretation. An added benefit to the educational aspects of Huilua is the resident population who have remembrances of the fishpond in its productive years. The fishpond is a major feature to the *ahupua`a*, and the setting of the fishpond within a 5,000 acre *ahupua`a* park is a rare opportunity to explore the land-to-ocean resource management developed by ancient Hawaiians.

6. DESCRIPTION OF THE ENVIRONMENTAL SETTING

6.1 Climate

The climate in Kahana Valley is characterized by wet and dry seasons. Kahana has mild and fairly uniform temperatures and extreme geographic variations in rainfall. The rainfall ranges from 60 inches per year at the coast to over 300 inches per year at the crest of the Ko`olau Range.

6.2 Kahana Stream

Kahana Stream is the main water course in Kahana Valley. The stream channel ranges from very steep, narrow and rocky in the back of the valley to wide, nearly level and heavily vegetated on the flood plain of the lower Valley. The streams and tributaries of Kahana Valley are classified as inland waters and as such are given the designation of Class 1.a which is the highest and most restrictive classification for inland waters in State regulations. Average discharge at the gaging station is 353 c.f.s. and over 30 mgd for the entire watershed. As a result of the withdrawal of water through the Waiahole Ditch/Kahana Development Tunnel, all of the stream channels above 800 feet are dry except during moderate to heavy rains. Estuarine portion of Kahana Stream extends about 3/4 of a mile up into the Valley, above which point there is no detectable salinity or tidal movement. Peak flows that occur during times of winter storms flush debris and sediment from the estuary (Mogi, 1978).

A picture of the annual trend of sand deposition in the area was described by Kahana Resident Ron Johnson who states that the sand migrates into the Kahana stream mouth and builds up annually until a heavy rain pushes the sand out of the river mouth. This area of build-up near the river mouth has also affected the *makaha* (sluice gates and channels) of the fishpond. The sand and sedimentation from the stream has completely filled in the channels which once connected the fishpond to the stream.

6.3 Kahana Bay

Kahana Bay is a seaward extension of Kahana Valley. It is from 2,400 to 4,000 feet wide and nearly 3/4 of a mile long. The waters in it and in the estuary of Kahana Bay are designated Class AA under the State's water quality regulations.

The AA classification is the most restrictive in the regulations and the limited data available suggest that even under the existing natural conditions the bay does not meet all of the standards set in the regulations (Mogi, 1978).

Conditions in Kahana Bay have changed over time and the migration of sand over the centuries has contributed to the development and the degeneration of the fishpond; the latter due to sand intrusion through a break in the Northwest corner of the pond. Historical trends of sand deposition was shared by Kahana Resident Bea Soga who resides on the shoreline adjoining the stream and bay, Bea states that the bay was deeper in former times and the sand deposition in the bay has continuously built up over the years.

6.4 Soils

The U.S. Soil Conservation Service has identified seventeen different types of soil in Kahana Valley. The makai end of the floor of the lower valley contains sand derived from coralline reefs and the soils found in the flood-plains adjacent to all the major watercourses has a relatively high organic content. The soil of the fishpond area is identified as Jaucas loamy sand described as excessively-drained loamy sand underlain by water or wind laid coral sand which occurs on the coastal plain adjacent to the ocean.

6.5 Terrestrial Biota of Adjacent Land Area

The following species were identified on field visits.

VEGETATION

Native/Endemic

(Ipomoea pes-capare) beach morning glory, *pohuehue*
(Schoenoplectus lacustris) great bulrush, *'aka'akai*
(Scaevola taccada) Beach *Naupaka, naupaka-kahakai*

Hawaiian Introductions
(Aleurites mouccana) candlenut, *kukui*
(Artocarpus altilis) breadfruit, *ulu*
(Cocos nucifera L.) coconut, *niu*

(Cordyline fruticosa) ti, *ki*
(Hibiscus tiliaceus) *hau*
(Pandanus tectorus) *hala*
Thespesia populena) *milo*
(Morinda citrifolia) Indian mulberry, *noni*

Modern Introductions

(Alocasia macrorrhiza) *`ape*
(Alpinia purpurata) red ginger, *`awapuhi `ula`ula*
(Brassais actinophylla Endl.) octopus plant
(Carica papaya L.) papaya
(Casuarina glauca) saltmarsh or longleaf ironwood
(Clusia rosea) autograph tree
(Crinum Asiaticum L.) spider lily
(Cynodon dactylon) Bermuda grass
(Leucaena leucocephala) *koa haole*
(Musa L.) banana, *mai`a*
(Paspalum vaginatum Swartz) seashore paspalum
(Philodendron micans) philodendron
(Phymadtodes scholopendrium), a fern, *lauа`e*
(Plumeria L.) plumeria
(Rhizophora mangle) mangrove
(Shinus terebinthifolius) Christmas berry
(Syzygium cumani) Java or Jambolan plum
(Terminalia catappa) false kamani
(Tournefortia argentea) tree heliotrope

BIRDS/MAMMALS

In former days, before the overgrowth of mangrove encroached the fishpond and there was more bulrush, the *`alae `ula* (Gallinula chloropus sandvicensis) and the *`alae ke`oke`o* (Fulica americana alai) were commonly seen at Huilua. According to residents, it has been years since any of these birds have been sighted at the fishpond. The following list is compiled from observations made on 5/6/93 and 8/26/93. Additions were made to the basic list on various other site visits by the author in 1993 and 1994. Identified species were not quantified.

Vertebrates, Birds

(Arenaria interpres) ruddy turnstone, ‘akekeke
(Acridotheres tristis) mynah
(Himantopus himantopus knudseni) Hawaiian stilt, *aeo* (one bird on one occasion)
(Passer domesticus) sparrow
(Pluvialis dominica fulva) golden plover, kolea

(Nycticorax nycticorax) black crowned night heron. *`Auku`u*

Vertebrates, Mammals

(Herpestes auropunctatus) mongoose

6.6 Aquatic Biota of Huilua Fishpond

The following list is developed from numerous site visits as well as interviews with the pondkeeper Jose' Gaceta who has frequented the fishpond for several decades. Along the mauka edge of the fishpond, schools of fingerling mullet, *aholehole*, and tilapia can be seen in the shallows. In the interior of the pond, where the water is deeper, schools of larger mullet, *aholehole* and tilapia can be seen. According to Gaceta, the population of fish within the pond has changed over the decades. Species such as *awa* (Chanos chanos), and the tilapia (Oreochromis mossambica) were common to the pond are no longer present. Another type of tilapia (Sarotherdon melanotheron) is prevalent. The following species have been observed at the fishpond.

NATIVE ENDEMIC FISH

(Acanthurus dussumieri) *palani*
(Acanthurus sandvicensis) convict tang, *manini*
(Arthron hispidus) puffer fish, *opu hue*
(Awaous stamineus) *`o`opu nakea*
(Caranx ignobilis) crevally, *papio*
(Kuhlia sandvicensis) silver perch, *aholehole*
(Mugil cephalis) striped mullet, *`ama`ama*
(Sphyraena barracuda) barracuda, *kaku*

Modern introductions
(Sarotherodon menlanotheron) tilapia
(Chelon engli) summer mullet

SEAWEED

Within the Pond
(Enteromorpha prolifera) *limu ele`ele*
At North Wall Ocean Interface
(Cordium arabicum)
(Galaxaura fastigiata)
(Lynghya majuscula)
(Padina australis)
(Sargassum echincarpum) *limu kala*

INVERTEBRATES

(Balanus amphitrite) barnacle
(Cellana exarata) `opihi
(Grapsus grapsus tenuicrustatus) rock crab
(Neritia picea) pipipi
(Ocypode ceratophtalina) ghost crab
(Palaemon debilis) *`opae*
(Scylla serrata) Samoan crab
(Thalamita cerata) blue pincher crab

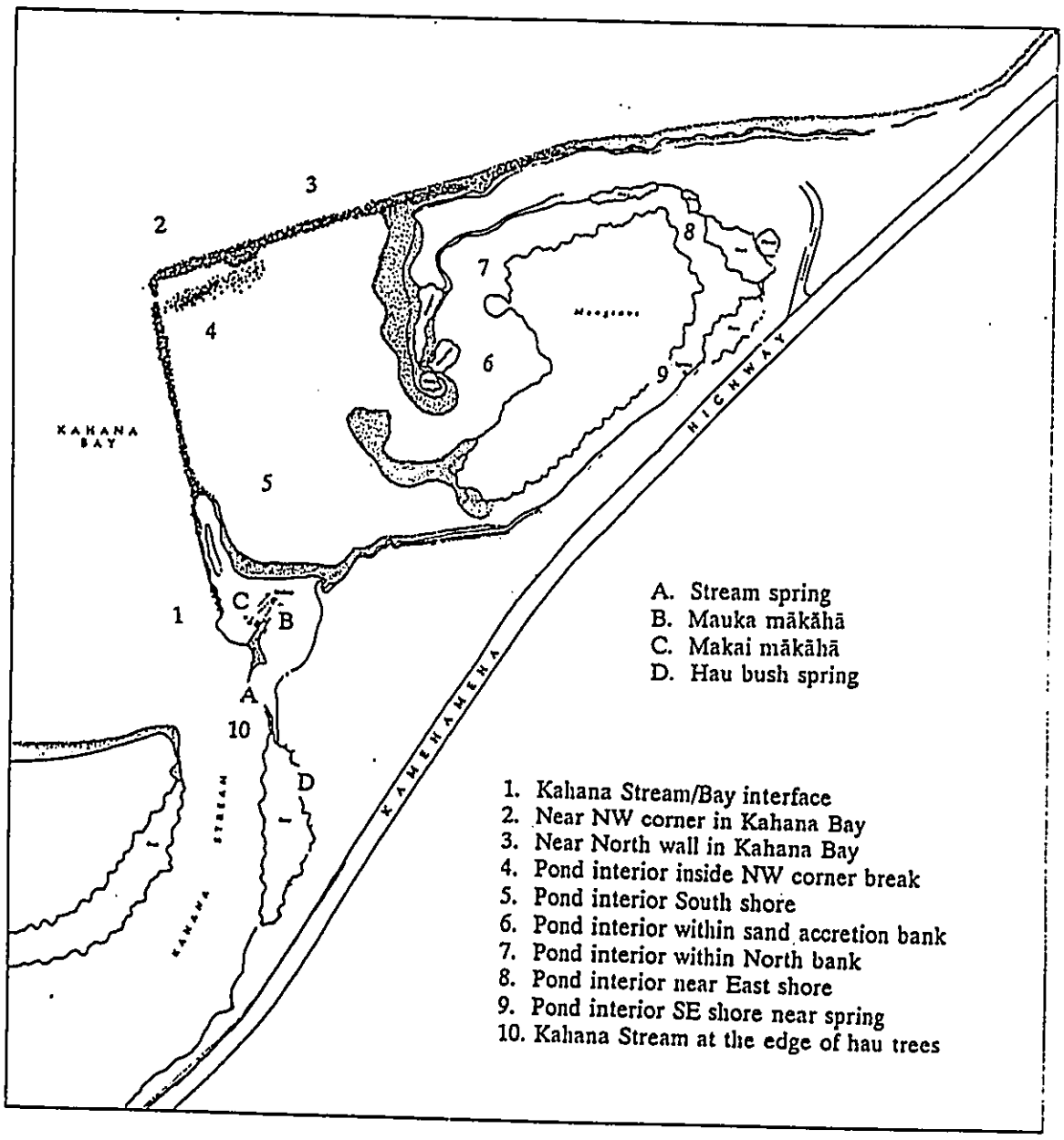

Figure 13. Sampling stations for salinity and depth measurements.

Table 2A
Salinity and Depth Data Collected at Huilua Fishpond (4/7/93)

	Low tide	High tide	Low tide	High tide
	9: 20 am	1:30 pm	9: 20 am	1:30 pm
STATION	SALINITY	SALINITY	DEPTH	DEPTH
	(ppt)	(ppt)	(cm)	(cm)
#1	19	30	25.4	99.1
#2	28	35	22.9	---
#3	32	35	38.1	96.5
#4	20	35	27.9	73.7
#5	29	30	35.6	---
#6	15	15	83.2	94.0
#7	15	15	76.2	78.7
#8	10	14	101.6	119.4
#9	10	14	61.0	88.9
#10	8	30	---	106.7

Table 2 B SELECTED SITES AT LOW TIDE	SALINTY (ppt)	DEPTH (cm)
A.Streamside Spring	10	1.3
B. Mauka makaha	8	49.5
C. Makai makaha	8	40.6
D. Hau bush spring	5	15.2

6.8 Description of Dredge Materials

According to Rothwell and Madden in 1980, mud was thickest in the Southwestern corner nearest the *makaha* and in the Eastern third of the fishpond where the current speeds were lower and the water was deeper. The study states that the fishpond were being scoured by waves and the result is that the pond was being scoured of mud. The study also states that the fishpond is in transition from a brackish water pond to a tidal lagoon with nearly complete exchange of water and vigorous mixing.

Today, more than twenty years later, the break in the fishpond wall has continued to degenerate and sand accretion has continued to build up, particularly in the North, South and Western portions of the pond. The Eastern portion remains somewhat protected due to an existing sand berm. The scouring process that removes deposition of mud has continued and has extended to the Southern inland shoreline of the fishpond. As predicted in the 1980 study, the North, South and Eastern sections of the fishpond resemble a sand-bottomed tidal pool.

To confirm the assumption that the wave action has scoured the mud, samples of sand accretion on the interior of the fishpond were taken on 4/30/93. Site 1 was selected based on closeness to tidal action and distance from the makaha, which in the 1980 study was the area of highest accumulation of silt deposit. Conversely, Site 2 was chosen for its distance from tidal action and closeness to the *makaha*.

Method:

A three foot length of two inch pvc pipe was pounded into the sand berm in two locations shown in Figure 12. The pipe was then dug out of the ground and a plunger was used to extrude the core from the pipe. One sample was taken on the sand berm on the interior of the fishpond near the ocean and the other was taken on the pond-side of the sluices. Sample sites were chosen to give the widest range of variability in relation to tidal action and river accretion. A Munsell color chart was used to determine color.

Figure 14. Location of sites for core samples

Table 3 Stratigraphic Sequence of Core Sample from Pond Interior: Sample 1 from top to bottom

Layer	Thickness (cm)	Description
I	13	Loose, coarse-grained coralline sand, coral rubble, bits of shell, 2 water-worn basalt gravel bits, non-sticky, dry, very pale brown (10YR 7/3)
II	14	Loose, coarse-grained coralline sand, coral pebbles, bits of shell, moist, yellow (10YR 7/3)
III	9	Loose, coarse-grained coralline sand, coral pebbles, dark gray, slightly silty sand, mottled in color with lighter colored sand, bits of shell, non-sticky, wet (10YR 4/1)
IV	8	Loose, coarse-grained coralline sand, coral rubble, slightly silty, light gray sand, mottled in color with lighter colored sand, bits of shell, non-sticky, wet (10YR 6/1)
V	5	Loose, coarse-grained coralline sand, coral rubble dark gray, slightly silty sand , non-sticky, wet, mottled in color with lighter colored sand and bits of shell (10YR 4/1)

Table 4 Stratigraphic Sequence of Core Sample from Pond Interior: Sample 2 from top to bottom was one consistent layer

Layer	Thickness (cm)	Description
I.	61	Loose, medium-grained coralline sand, small pebbles of coral and shell, consistent in texture, light yellowish-brown (10YR 6/4) upper layer area dry, lower section wet, non-sticky.

7. ALTERNATIVES CONSIDERED IN THIS PLAN

After a site assessment, literature review, interviews with interested residents and park administrators, public meetings at Kahana Valley State Park, and attendance at several the Kahana Advisory Council meetings, only two alternatives were considered in this plan:

1. No Action
2. Restoration/Revitalization.

New uses for Huilua such as a marina/boat harbor as mentioned in the 1989 DHM study are not viable or appropriate due to the cultural value and historic status of the pond. Stabilization as described in the 1980 Oceanic Institute study is not a practical option. Environmental information reveals that the fishpond is located in a dynamic area of shifting sands, moving water, and the interface of stream and sea. Stabilization would require as much effort and maintenance as a full-scale restoration and revitalization project. The No Action alternative was based on the limitations of capital and labor.

Capital costs and the labor are still considerations in the chosen alternative, however, sequencing of tasks, long-term planning, and use of unique methods of acquiring labor spread out over a ten year term for project completion creates a viable approach. The Restoration/Revitalization Plan is based on the existing conditions of the site, economic considerations, the wealth of oral history and cultural lore, the value of the fishpond in relation to the *ahupua'a*, past and present archaeological surveys, and the studies and proposals presented in Section 5. In addition, an important feature of Huilua is its relationship to the people of the land who are available to provide an interpretive voice for the fishpond

8. APPROACH: RESTORE, REBUILD, REVITALIZE

Because of the cultural significance of Huilua fishpond, an accurate picture of its construction, reconstruction and alteration was vital to the development of the restoration plan. It was decided that an archaeological study precede the development of this plan. The study was conducted by State Parks Archaeologists Martha Yent and Alan Carpenter. Information gathered in that study served as a basis for the development of structural restoration plans. Huilua has been the subject of other archaeological studies which are summarized.

As part of a living cultural park, the fishpond is also focal point of fond memories. Residents of Kahana Valley are naturally protective of the site. Some residents have strong familial ties to the fishpond. Their input was necessary to ensure that the plan was developed with the proper respect and sensitivity to people of the land.

Best Management Practices which are designed to protect the environment of the fishpond include:

* Appropriate sequencing of tasks
* Work in good weather conditions
* Use of clean rock
* Hand-building of wall
* Limited use of machinery
* Use of a silt curtain
* Water quality monitoring

Restoration and rebuilding refer to the physical aspects of the site. Revitalization refers to activities within the functional operations of the fishpond. The following are definitions and associated activities related to these terms.

8.1 Restore: refers to rebuilding of a site to replicate a physical state duplicating a previous period in history. For example, to restore wall foundations, it is necessary to remove the surface rock and sand to look for vestiges of foundation stones. In areas where foundation exists, as in the model wall restoration, the alignment and wall design will be followed and replicated.

8.2 Rebuild: refers to building and reinforcement of the physical integrity of the site. Features of the design may differ from those of previous history due to environmental changes within the resource and adjoining areas. If in process of wall repair, a foundation is not found or in areas which were formerly sand berm, the wall foundation will be placed in similar design and boulder size consistent with archaeological findings. Rocks will be gathered onsite or moved to the area with cable and rigging or small machinery.

8.3 Revitalize: refers to bringing the site back to productivity in terms of seafood production and establishing an activity that was in existence in a previous era, however, all aspects of the revived activity may not be possible to duplicate because of changes in the environment and existing society. The main activities at Huilua will consist of maintaining the pond, stocking, growing and harvesting fish. Other activities which were not part of the traditional use of fishponds include walking tours and interpretive demonstration of fishpond practices.

Aquaculture: Aquatic species traditionally stocked in Huilua fishpond such as *`ama`ama* (mullet), *aholehole* (silver perch) and *awa* (milkfish) will be stocked, fed and harvested as part of Kahana Valley State Park Programs.

Planting: Native plant species and Hawaiian Introductions will be planted and encouraged to grow in adjacent land areas.

If circumstances require removal of native and Hawaiian introduced plants from their existing location, they will (when possible) be transplanted to other areas of the pond or to other areas of the park.

Interpretive: As recommended in previous studies, the 1920s era is chosen for interpretation. An abundance of information from that period exists, and it is a time that some Kahana residents can recall from memory. Programs about life and work at the fishpond will be presented by Kahana residents. As recommended by resident Adella Johnson, signage, structures, trash cans and other aspects of park facilities should utilize natural rock and wood. Signage and facilities should be educational with Hawaiian words ie *opala kini* for trash cans etc. Note: there are plans to develop a facility in the future.

The fishpond is identified as a low-intensity use area. Current fishpond visits by groups of school children consist of 125 visitors per day, however, group visits to the fishpond are infrequent. In the future, daily use will increase in frequency but the maximum capacity of 125 people per day is likely to continue.

8.4: Operation and Maintainence of the fishpond once the rebuilding and dredging has been completed will follow the practices of the interpretive era of the 1920s. During this period, production was non-commercial providing enough for the pondkeeper, Pua Ha'aheo, his family, and friends. The pondkeeper did not rely on the fishpond for all of his and the community needs for as the fishing *konohiki* (headman, leader) he was also known to conduct community fishing expeditions (*hukilau*) in Kahana Bay. The fishpond operations at this level of production operated at an extensive level with little or no inputs, depending upon the natural productivity of the pond for feeding the fish.

The fishpond wall will be regularly maintained by replacing any fallen rock upon the pond wall. Activities such as hand clearing of vegetation, removal of debris and rubbish and mangrove sprouts will take place. Nutrient inputs to the fishpond such as fertilizers will be prohibited. Fish will depend largely on the natural primary productivity of the fishpond for most of their food, however handfuls of feed may be broadcast in the pond during interpretive tours, the amount will be minimal, not to exceed 20 lbs of fish feed per month. In the 1920s era, fish were so plentiful in Kahana Bay that the pond was self-stocking, through the *makaha*, however, today a not so plentiful supply may require stocking of fingerling fish, *'ama'ama* (mullet) and *awa* (milkfish) which were the traditional crops.

9. DESCRIPTION OF ZONES AND PROPOSED ACTIONS

Huilua is a shallow brackish water enclosure situated in the Southeastern portion of Kahana Bay on the Northeast coast of O`ahu. The fishpond is bordered on the Southwest by Kahana Stream, on the Northwest and North by Kahana Bay, on the East by a sand bank and the South by adjacent land areas and Kamehameha

Highway. The wall which has been modified considerably by natural forces and modern machinery is currently a line of irregularly stacked basalt rock approximately aligned to the configuration of the former pond wall. Except for a few high spots, the wall is submerged at high-tide. The fishpond and adjacent areas include a varied environment, which for assessment and planning, has been divided into 10 different zones. See Figure 13 for location of the ten zones. The managment of Kahana Valley State Park has stated an intent to develop a parking lot and restroom facility in the future. As of this time, site, design, and location of facility are not developed.

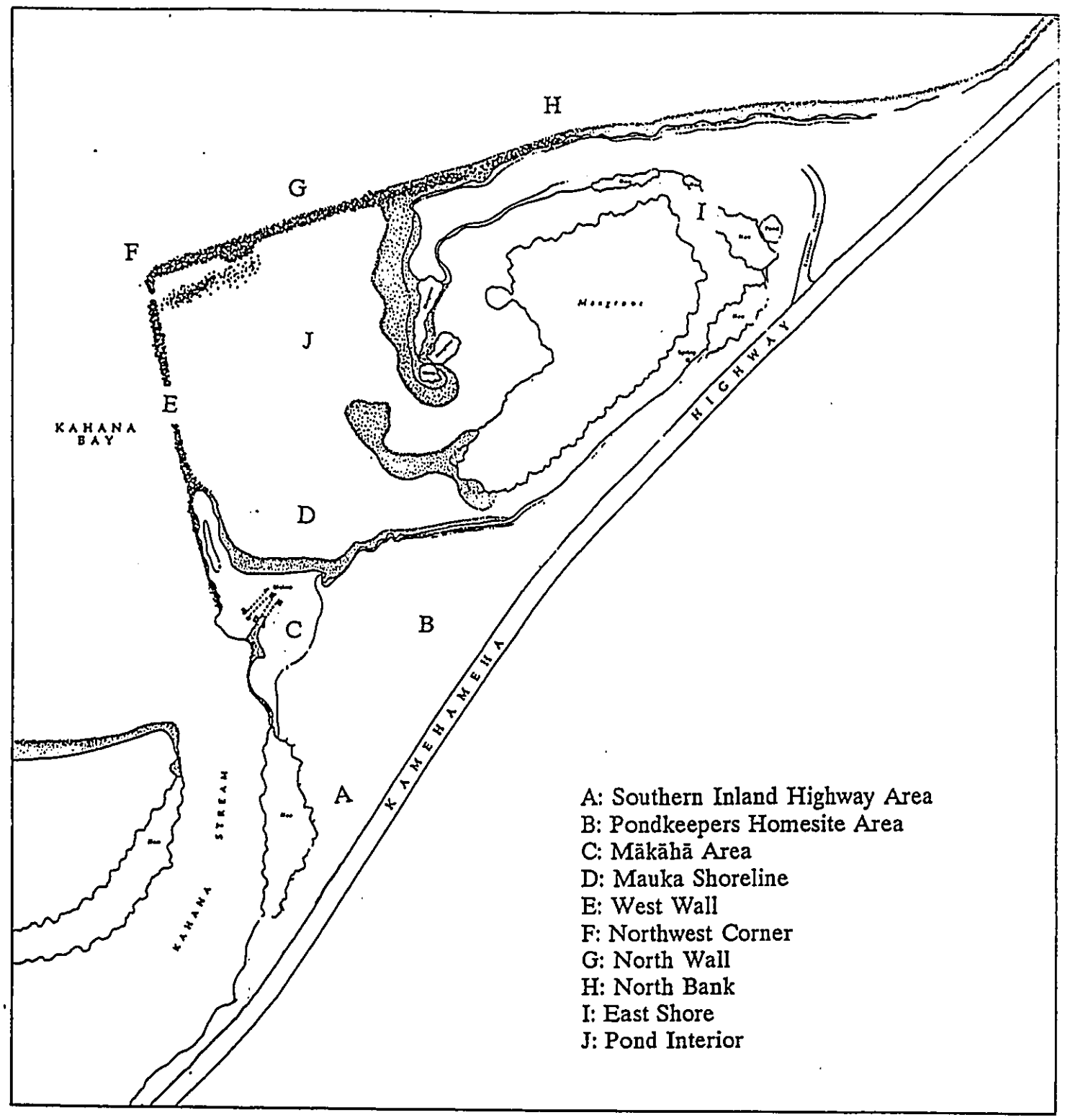

Figure 15. Location of the 10 restoration/revitalization zones

9.1 Zone A: Southwest Inland Highway Area

This area is roughly triangular in shape. Elevations range from 14 feet in the center to 10 feet in the North and the East. The Western border slopes to an 8 feet elevation. Zone A is bordered on the West by a growth of *hau* which separates the site from *makaha* and Stream. On the North the area is enclosed by a drainage ditch which runs Southwest along the highway and West into Kahana Stream. The Southern section of this zone is delineated by Kamehameha Highway. The dominant species of this area are false *kamani*, *kukui*, java plum, *hau*, and a groundcover of philodendron. See Figure 17.

Significant Historic Features:

Kahana residents state that this area was the former entryway into the pond area.

Proposed Restoration/Revitalization:

At present there are no plans for this area, however future plans for a parking facility with restrooms and interpretive kiosks may affect this area.

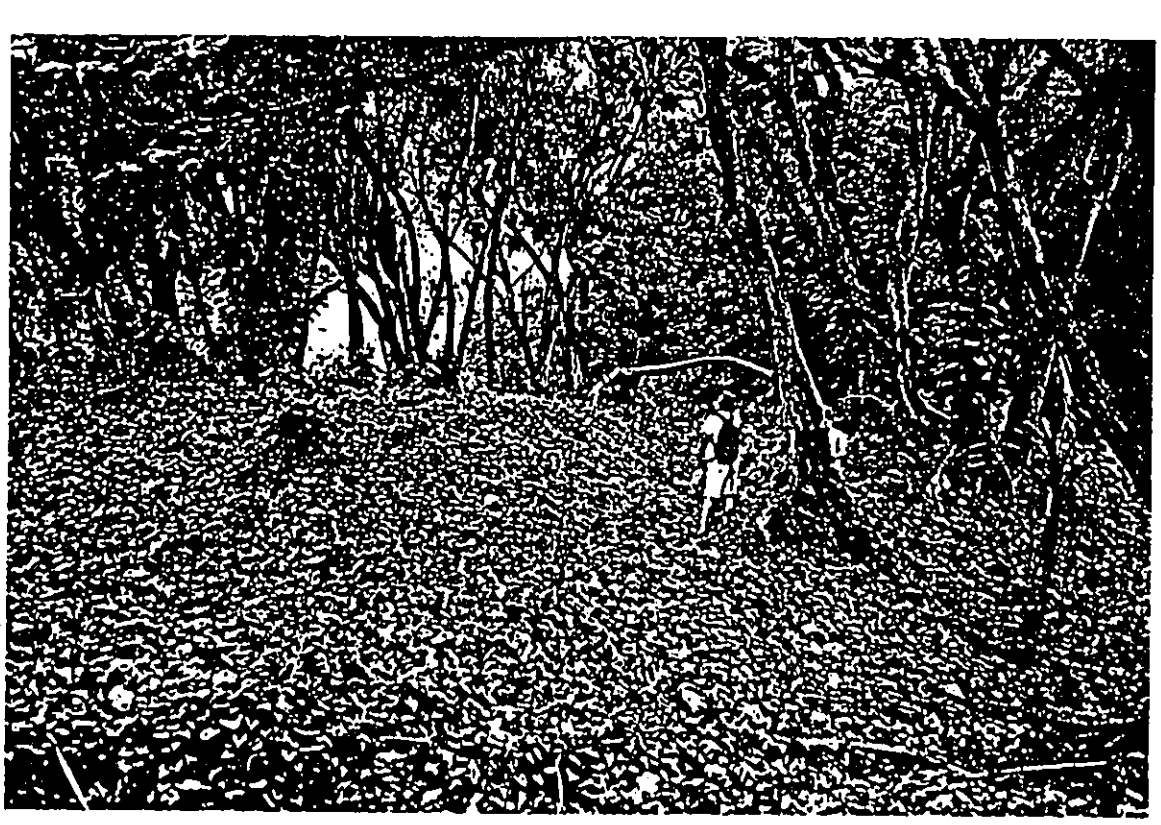

Figure 16. Zone A: Southwest Inland Highway Area

9.2 Zone B: Pondkeeper's Homesite

Zone B is bordered along the South and East by a drainage ditch which runs along Kamehameha Highway and cuts across between Zones A and B in a Westerly direction into Kahana Stream. The highway-side of the zone has a 12 foot elevation gradually descending to 2 feet near the *makaha.* The area is well-tended with a mowed grass lawn. Ornamental plants, edibles and domestic plants such as coconut, banana, ti, and *noni* are planted. A concrete cap of a cesspool is located in this area.

Figure 17 Zone B Site Pondkeeper's homesite.

Significant Historic Features:

Three burials indicated by stone markers are located in this zone. Residents know nothing other than the burials are Chinese. This is the location of the pondkeeper's home and net house. There are several pondkeepers connected with this site, Kai`apa, Pua and grandaughter Hattie Au resided there. Louis Kawehi and niece Liliana Vincent were residents. In later years Sam Pua Ha`aheo was pondkeeper and had a hula *halau* onsite. Ha`aheo was also the *konohiki* and pondkeeper. Ha'aheo organized the *akule* fishing in Kahana Bay in traditional Hawaiian style using the two *kilo* sites, one above the fishpond the other across the bay to direct fishermen in surrounding the akule in the net and then conducting a *hukilau.* Traditionally, the pondkeeper was also the *kilo i`a,* who watched for the schools of fish in the bay, directed fishing and allocated portions of fish.

Proposed Restoration/Revitalization:

Presently there is no intention to rebuild structures, however this site is the main interpretive area of the fishpond. In the future a rainshelter consistent in design with the 1920s area may serve as a interpretive area and in keeping with the spirit of former times as a hula *halau*. Future plans for a parking facility may impact the highway side of this zone.

9.3 Zone C: *Makaha* Area

The remnants of two sluice gates or *makaha* are located in this area. The sluices once connected Huilua to Kahana Stream and were used for stocking of juvenile fish, circulation of water, and harvesting of adult size fish. Oral history of the fishpond collected by McAllister and Kelly describe activities of stocking and harvesting at the *makaha*. Currently the sluices are filled in with sand, sedimentation and areas close to the sluices are filled dredge materials from modern alteration with machinery due to repairs made by Kekona following the 1957 tsunami. The gates are identified by the terms *mauka* (inland or toward the mountain) and *makai* (toward the sea).

Figure 18 Zone C *Makaha* Area

Significant Historic Features:

In 1918-1922 the channels of the *makaha* were lined with *hau* logs. Wooden gates slid up and down on wooden runners. Gates were at both ends of the channel. The *mauka* sluice, wider and shorter is to "feed the pond" (presumably with water and fingerlings). Gates were opened to let the water and fingerling fish into the pond. The *makai* gate was longer and narrower. It was used to catch the fish. In 1923-1946 concrete was added to the channels. An *imu* (ground oven) was located near the *makaha,* according to Pua Ha`aheo's account to McAllister. Recent talks with Boy Garvida, grand-nephew of Ha`aheo confirms the presence of an *imu* and states that his uncle often cooked taro in the *imu* and fed the taro scraps to the fish as he pounded *poi.*

Between 1946-1969 concrete gate runners are added and the bottoms of both channels were concreted. The depth was 4-5 feet deep. The outer gate was of solid wood and the inner gate had screen or grating. In 1980 Rothwell and Madden stated that the *makai* gate is 10 ft longer than the *mauka* one. Both channels have mortared stone walls and framed concrete gates. The *mauka* channel is completely filled with sand, debris and vegetation, particularly *hau* and mangrove. Both *makaha* were connected to the pond but were closed in on the estuary side by sand accretion approximately 20 feet from Kahana Stream.

Stone enclosure/*ko`a:*

1884 Map by George E. Gresley-Jackson shows large stone enclosure next to the *makaha.*

1933 McAllister states that "on the land side of the outlet (*makaha*) was a fishing shrine (*ko`a*) formed of 3-foot stones...Most of the shrine has been moved, but a line of these large stones remains. In size and position (end to end) they resemble those of Kapaeleele fishing shrine (Site 298)." No visible signs of the fishing shrine remain in the area.

According to archaeologist Alan Carpenter, it is possible that the *ko`a* described by McAllister are remnants of the stone enclosure noted by Jackson.

Spring:

Recently pondkeeper, Jose Gaceta discovered a rock-lined spring within the Northern section of the *hau* bush which adjoins Kahana Stream. The spring salinity was measured at low tide at 5 ppt and 13 ppt at high tide. The spring is shallow, 6 inches at low tide.

Proposed Restoration/Revitalization:

The *makaha* is the most significant technological feature of a fishpond. It is the center for stocking, harvesting and feeding. It is recommended that the *makaha* be restored to its 1920s design with wooden gates on the exterior gate slots and screen gates on the interior slots. Excavation should be supervised by archaeologists to assure the proper procedures are taken in the event that any cultural deposits or portions of the *ko`a* are uncovered. Channels, gate runners and mortared walls are to be repaired. The sand accretion on the interior and the exterior of the channels are to be removed to restore the relationship between the fishpond and the stream.

9.4 Zone D: Mauka Shoreline

The Southern shoreline of the pond extends approximately extends 850 feet in an irregular line parallel to Kamehameha Highway. The Southwestern section shore just pond-side of the *makaha* consists of yellowish-brown, loose, medium-grained coralline sand and small pebbles of coral and shell. This shore has intermittent springs which appear following times of heavy rain.

The main spring located on the Southeastern shore, marked by an ironwood tree was visited on 4/7/93. The area was filled with fine silt with no indication of stone enclosure. It was relatively consistent in depth and salinity during low and high tide. Salinity was 15ppt and the water was 2 feet six inches deep. At high tide salinity was 15 ppt and the area was 2 feet 7 inches deep. It is likely that deposition of dredge materials and highway development have altered this area.

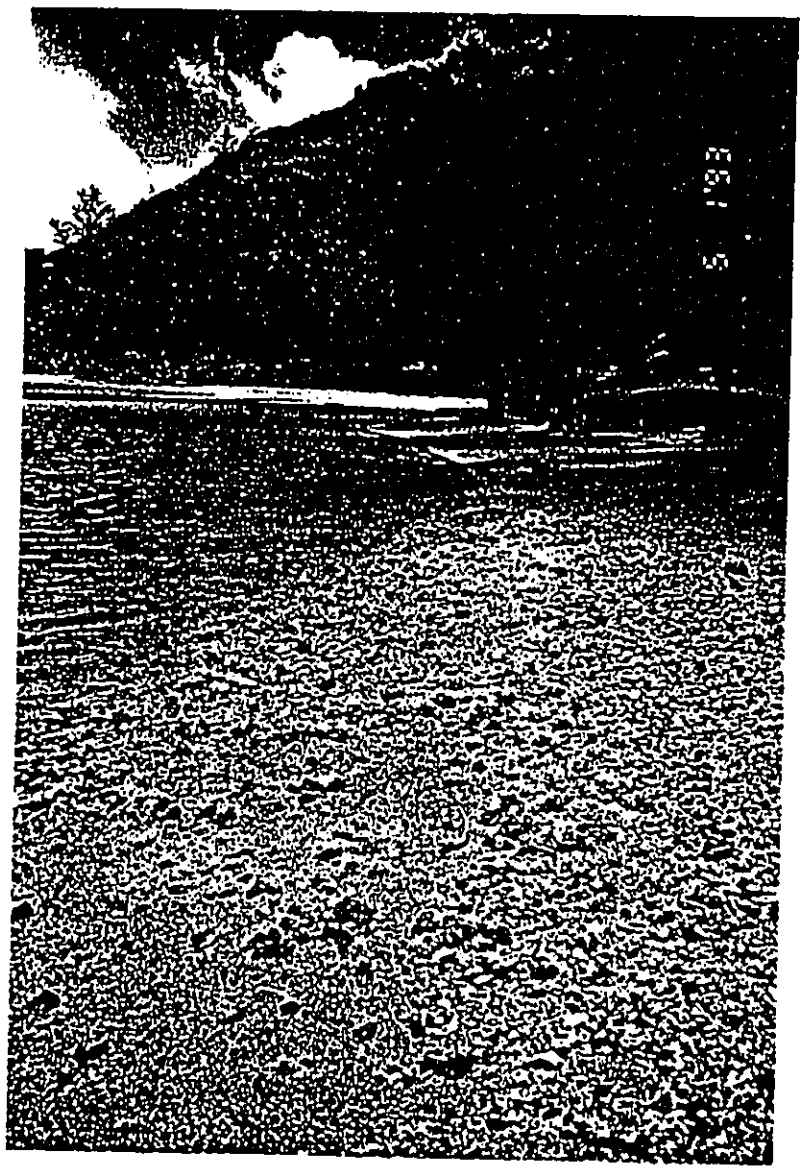

Figure 19 Zone D *Mauka* Shoreline

A shallow slope gradually descends from 2 feet to sealevel from adjacent land to pond on the West shore. Dominant species along the Western shore are the *naupaka* and beach morninglory. The Eastern shore has a steeper, elevated bank and exposed roots of ironwood trees. The area is eroding due to wave action. The eroding materials of this elevated bank consist of dredge materials from the Kekona reconstruction period. Current entryway to the area is parallel to this shoreline. Automobiles currently drive along this bank and park at the former homesite of the pondkeeper.

Significant Historic Features:

Informant Liliana Vincent stated that two springs about two feet apart were lined in stone. The springs supplied water for home use. The source of water is Kukui`ula valley and the water moves underground and bubbles up at the fishpond. At one time, taro and ginger were grown adjacent to the spring.

A *pua* (fingerling) pond was located on the Northwest shore, adjacent to the makai makaha. Kekona informed Kelly in 1979 that the wall was between 20 and 30 feet long. The wall appears in a 1936 aerial photo in Figure 21. in which the wall length appears to be well over 100 feet long. Kekona never used the pond and never caught *pua* to put into the pond. He states that fingerlings came into the pond naturally, through the *makaha.* The area is currently filled with dredge material from the dragline excavation following the 1957 tsunami when the spoils were dumped into the area. The *pua* pond according to Rothwell and Madden is estimated to have had an area of 2,500 square feet and 150 feet of wall.

Figure 20 1936 Aerial photo, note the pua pond near the SW shore.

Restoration/revitalization of this area will take place after the walls of the fishpond have been restored and the pond has been dredged.

The *puа* pond will be rebuilt. Sand accretion within the *makaha* and stream will be removed. The conncection of pond and stream will be restored. The adjacent shoreline which slopes from 2 feet to sealevel will be supplemented by plantings of the existing species of *naupaka* and beach morning glory. Sections of the shore which are eroding due to wave action will be leveled and sloped to gradually meet the shoreline along the interpretive area. Eroding ironwood trees will be replaced with *milo* where appropriate. The main spring of the fishpond will be investigated and assessment will be made as to the feasibility of restoring the spring. This activity should be supervised by an archaeologist. The stretch of land closely paralleling Kamehameha Highway will essentially be left alone.

9.5 Zone E: West Wall

The Southern portion of the West wall consists of a peninsula consisting of sand, dredge materials from the dredge of the late 1950s, and ironwood trees. This peninsula is eroding from wave action. Several of the ironwood trees have toppled when the waves have washed away the berm to expose roots. On the streamside of the peninsula, portions of the exterior wall facings are relatively intact and portions of the interior wall facings have been uncovered in archaeological investigations by Yent and Carpenter (Trenches 1 and 3, see page 13 of this report). The wall section in Trench 3 was rebuilt to develop a section of model wall. Beyond the model wall area is a rubble of basalt rock which delineates the West wall. Barnacles, rock oysters and *pipipi* are common to the West wall.

Significant Historic Features:

As described above, some remnants of the wall foundation are intact.

Proposed Restoration/Revitalization:

The rebuilding process will follow the existing line of rock following the design established in the model wall i.e. double-wall construction with center fill of stone, and coral. Wall restoration will include building back from the model wall to the *makaha*, which will involve removal of the ironwood trees and uncovering and rebuilding of the existing remnant wall enclosed in the current bank.

Hand-building is expected to move at a slow pace due to the laborious tasks of moving rock and materials, as a result, it is anticipated that a 10 meter section of foundation can be laid in one week. This slow process mitigates environmental degradation as well as impact to biota on the pond wall.

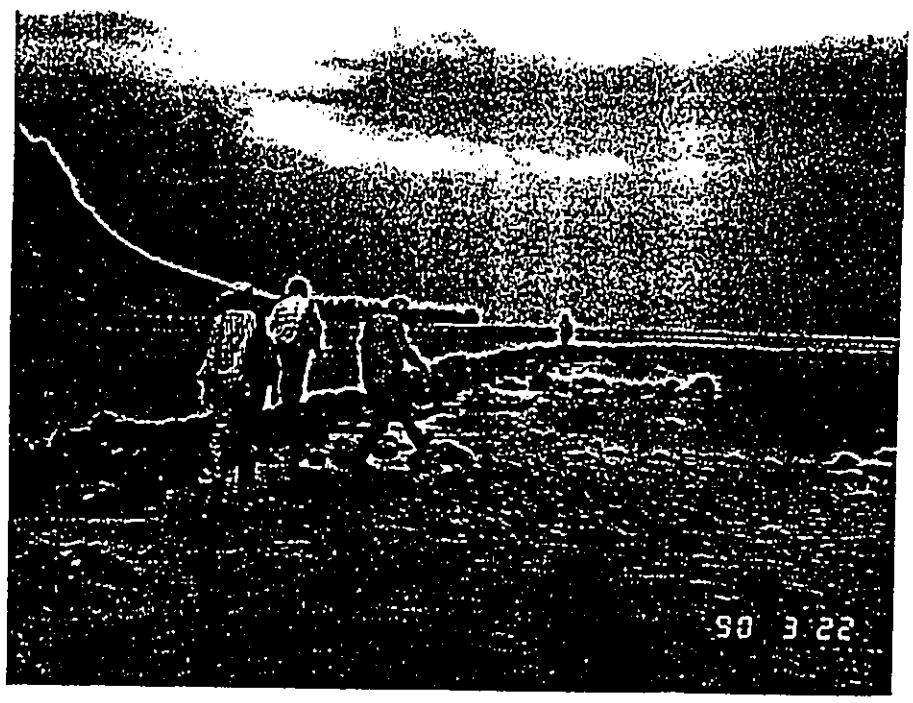

Figure 21 Zone E. West wall

9.6 Zone F: Northwest Corner

This zone is the most dynamic site of the pond. Water moves in and out through this corner deteriorating vestiges of pond wall and fans of migratory sand that has created berms in the interior of the fishpond. Much of the pond deterioration is attributed to the weakening of this corner. Approximately 24 feet from the corner is an area abundant with medium sized, mullet, known as *kahaha,* and medium sized *aholehole* which congregate in the alignment of rock. Salinity measurements taken on 4/7/93 indicate a lower salinity, (Site #4) measured at 20 ppt, compared to a station further towards the pond interior, (Site #5) which measured 29 ppt.

Figure 22 Zone F: Northwest corner.

Significant Historic Features:

Dave Cox who worked on the fishpond in the late `60s and early `70s states that the corner of the fishpond wall had a high outer wall, 4 to 5 feet above the mean high tide. Cox made efforts to repair the damage to the pond wall and designed a system of channels to redirect the sand and water out of the fishpond with the outflow of the tide.

Liliana Vincent states that her grandmother told her stories of a *mo`o,* living in a spring located in the area where the West wall and North wall meet. A *mo`o* is a

large lizard guardian spirit worshipped by Hawaiians as protectors of fishponds. The drop in salinity in a seaward section of the fishpond indicates the existence of a brackish water spring in the area. The existence of a spring explains the mass of fish in the area since fish are attracted to waterflow.

Proposed Restoration/Revitalization:

The design of the West wall will be extended, as the rebuilding reaches this corner. As recommended by archaeologists and indicated by oral history, the wall will be constructed wider and taller with more slope than the West wall. The gradual width and height increase will begin 30 feet from the corner to strengthen the wall in areas which may have underwater seepage from the springs. The inner and outer walls will have a greater slope than the West wall to reduce the wave energy. The waves move in a Southwesterly direction and has a direct impact on this corner. Restoration of the pond wall in this area requires careful supervision and perhaps design alteration due to the possible existence of a spring.

9.7 Zone G: North Wall

The North wall has been altered considerably. The line of basalt stones in this zone approximates the area of the sand berm which once formed the boundary of the fishpond from the ocean. This wall receives the most wave activity from waves which move in a Southwesterly pattern.

Figure 23 Zone G. North Wall.

At one time a sand berm peninsula extended out from East to West comprising portions of this wall. Areas were reinforced with rock. Following tsunami of 1957, this wall was damaged extensively and repaired by machinery.

Significant Historic Features:

Liliana Vincent states that wall was 3-4 feet wide and made up of large stones. Outside the wall there was sand but not on the inside. Wall on the outside was at least 4 feet higher than the usual high tide.

Kekona states that sand, coral rubble and other debris were used to fill the wall between inner and outer stone facings, he states that surf action has moved the fill into the pond and left behind the heavy boulders of the outer facing.

Proposed Restoration/Revitalization:

As recommended in the archaeological survey by Carpenter and Yent, the double faced rock wall with fill of stone and coral will be built in the alignment of the North wall. This basic design is consistent with the one established on the West wall, however, to withstand the wave action, the wall will be higher, wider, and have more of an exterior slope than the West wall.

9.8 Zone H: North Bank

The site is consists of beach sand overlain by fine sand, light-gray to grayish-brown in color. The overlay was dredged from the bottom of the pond, evidenced by color, location and high incidence of White Tellin, a mollusc. Informants state that rock scattered along the shoreline makai of the bank eroded from the pond wall and have slowly migrated over the years along this shoreline.

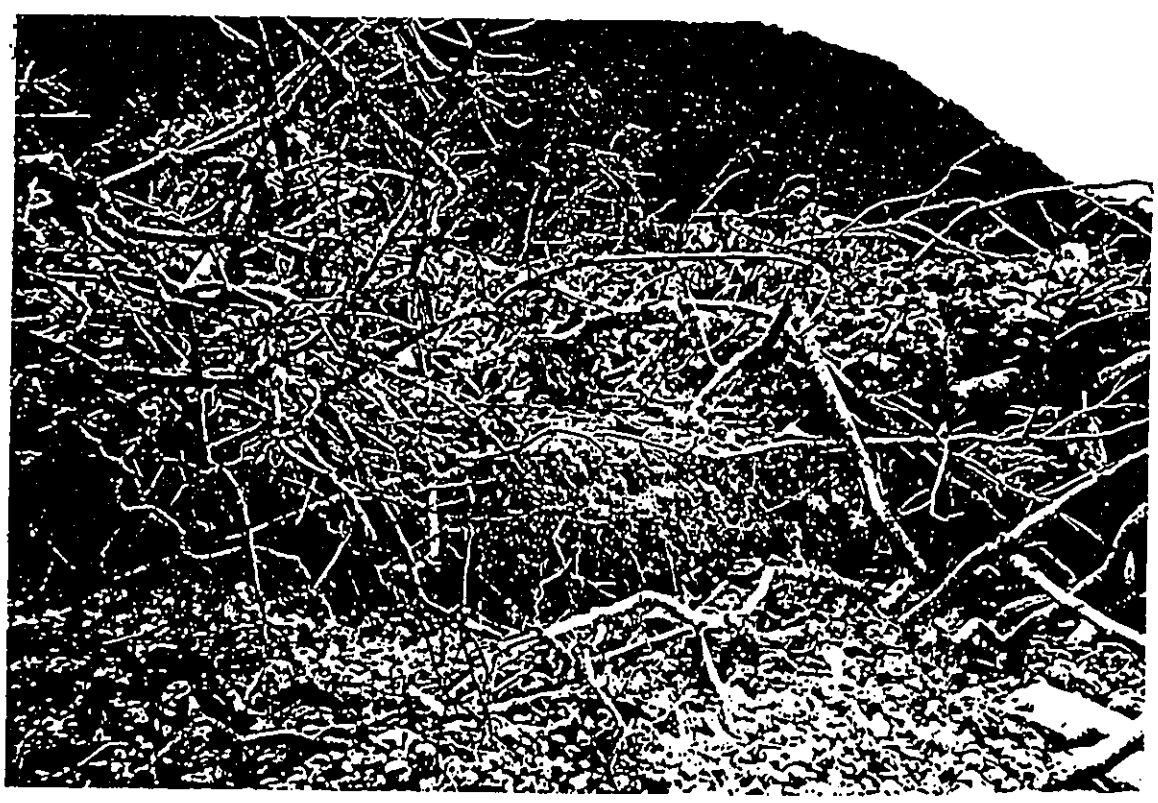

Figure 24 Zone H, North Bank

Significant Historic Features:

In 1971, Hommon and Barrera excavated this zone and discovered cultural deposits identified as site 1546 in the studies. In 1972, Hommon and Bevacqua continued excavations. Eight strata were identified, human activity was indicated by artifacts, charcoal concentrations and fireplaces. Radiocarbon dates and estimates of the occupation revealed dates that range between 1657 and 1850. The study concluded that this area was used as a series of temporary campsites at which human activities were limited to the simple gathering and preparation of food. It is possible that it was used by those who were charged with the maintenance of Huilua fishpond. Recommendations were made for the protection of the site and further intensive excavations. See archaeological section of this report for more details.

Proposed Restoration/Revitalization:

It is recommended that this area be stabilized for future archaeological investigations. The site was visited on 5/1/93 with archaeologist Alan Carpenter. Cultural deposits associated with site 1546 are visible in the eroded bank. Carpenter recommended the planting *naupaka* with stabilizing net along the bank, and well above the high water mark to stabilize to protect the area for future excavations. Netting is to be removed when the planting has taken root.

9.9 Zone I: East Shore

In all maps and photos of the fishpond this border of the pond is enclosed by the natural curve of the land and vegetation. Most prominent in the area are *hau* trees. This area adjoins the modern houses which are currently occupied.

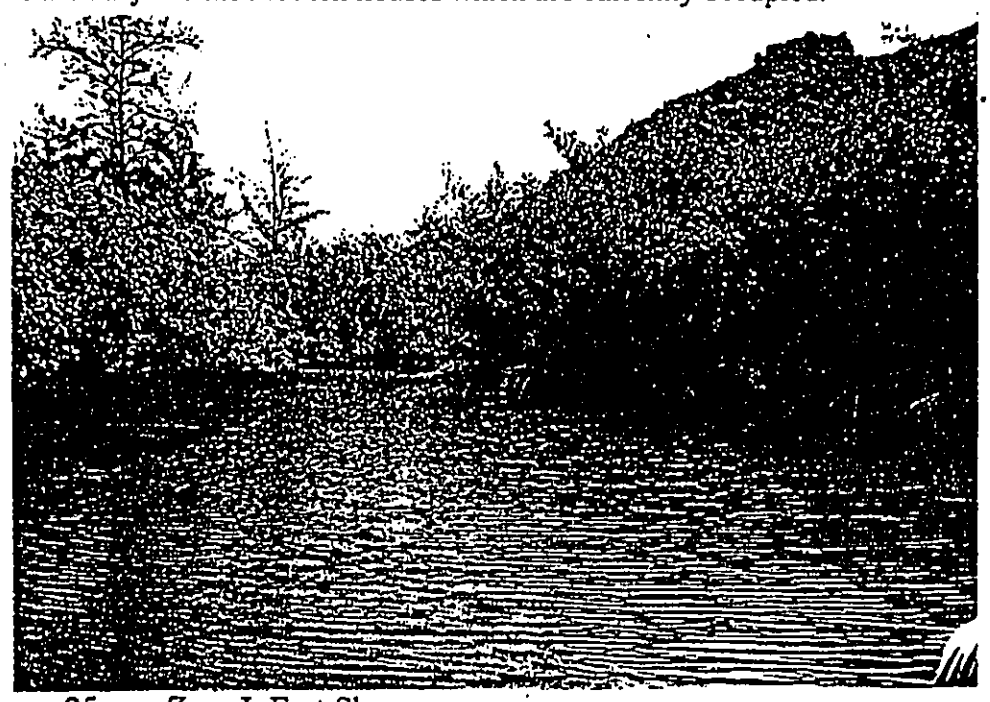

Figure 25. Zone I: East Shore

Significant Historic Features:

Kahana resident Adella Johnson recalls that the Makanoa house was a cook house with a sand floor. She says that the sand floor was clean and raked. This area of habitation exhibited a lifestyle of subsistence and self-sufficiency for the Makanoa family which was once the way of life in the old days. The family kept a small pond adjacent to Huilua which was stocked with *Aholehole* and mullet. Kahana resident Ron Johnson remembers visiting the home and fondly recalls the *limu* and squid that were gathered from the ocean and the fish that were growing in the little pond. He states that the history of the area and the lives of people that lived there should not be forgotten.

pond. He states that the history of the area and the lives of people that lived there should not be forgotten.

Proposed Restoration/Revitalization:

While currently in housing, the State of Hawaii and residents in this area have signed contracts for lease of housing space in other areas of the park. When the area becomes available, an assessment of future use of the area should be made and the Makanoa house should be considered for restoration and preservation.

9.10 Zone J: Pond Interior

Areas of the fishpond are exposed during low tides. Due to the tidal activity along the North wall, the pond bottom adjacent to the wall is scoured of mud through continuous wave action. The calcareous sands from the bay are continually depositing in the area. The sand includes shell fragments and coral debris which have accumulated since the break in the Northwest wall. The fishpond depth has decreased due to the accretion of sand from the adjoining bay. The increased circulation from the break in the pond wall and the high tides that breach the wall has increased water exchange and removed muds and lighter organic materials from the pond. This reflects an ongoing transition from an adapted man-made brackish water fishpond to an open tidal pond predicted by Rothwell and Madden in 1980.

The Eastern area of the pond is submerged during high and low tides and somewhat protected by a sand berm.. Because the areas are submerged, they have not been subject to the wave scouring of areas closer to the North and West walls. The pond bottom in these areas is a mix of calcareous sands and terriginous muds.

Salinity is lowest along the Southeast section of the pond. Bulrush grows at the Southeastern edge of the mangrove near the spring, which was known to be more prevalent in times past before the introduction of mangrove. The water was fresh enough in McAllister's time to grow goldfish. During that period, there were also *'alae' ula*, the Hawaiian gallinule and *'alae ke'ok'eo*, the Hawaiian coot. These birds have not been seen at the fishpond in recent years.

Sand accretion has increased noticeably within the past 4 years. At low tide the Western interior of the pond is exposed. The water channel which connected the Southern area of the pond to the Eastern spring as recent as a year ago is closed by the accretion of sand. At the highest high tides, most of the wall is submerged and the outline of the wall is barely visible.

Figure 26. Zone J. Pond Interior

Significant Historic Features:

Oral histories indicate the existence of a large hole in the pond which was said to have been dug by a shark. The hole is said to be connected to an underground channel which leads to Moli`i fishpond in Kualoa. The hole appears on a map by Kelly, Figure 27. Pondkeeper Jose Gaceta has worked in the area and affirmed the existence of the hole.

Sometime between 1946-1957 Kaluna, friend of Kekona built a third *makaha* near the North wall. The sluice was built above sea level and never functioned. Vestiges of the sluice remain in the pond interior. See Figure 27.

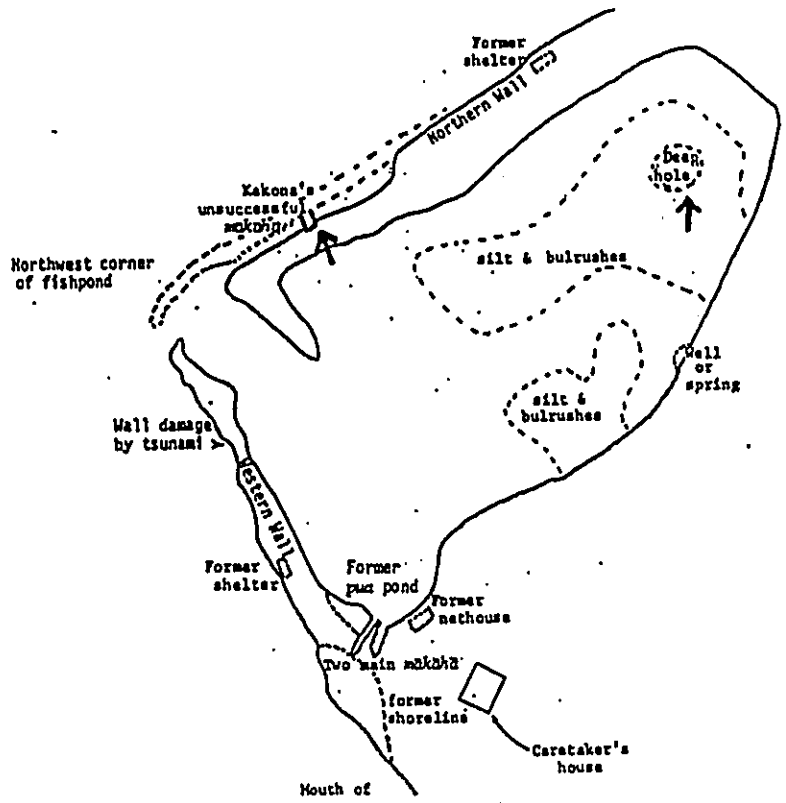

Figure 27 Kelly, 1979. Note: hole in the Southeast and the third, non-functional makaha near the North wall.

Proposed Restoration/Revitalization:

The pond interior will be dredged to be an average of 3.5 feet deep at the mean high tide. This depth will not likely be achieved consistently throughout the pond due to specific features and resources such as springs which need special treatment and protection. The non-functional third *makaha* will be removed. During dredging, environmentally sensitive areas and historic areas of the pond will be carefully protected by sectioning off the areas with sand berms prior to dredging. Some of the submerged areas may not require dredging because of existing depth that already supports a diversity of aquatic life.

Work within the pond will be supervised by an archaeologist to assure protection of the pond's special resources. These areas include the Southwestern section where the *pua* pond is to be rebuilt, the spring along the Southern border of the fishpond, the sand berm connected to the North bank, and the areas surrounding the legendary hole located in the Eastern section of the pond.

In one of the earliest maps of Huilua, (Gresley-Jackson, 1884, Figure 10) vegetation is indicated in the Eastern section of the fishpond. Sections of the island in the Southeastern section of the pond can remove recent accretion of sand, however, portions of the island which consist of mud and bulrush adjacent to the legendary hole will be left intact to avoid destruction or deterioration of this special feature and to protect the possible nesting grounds of the Hawaiian stilt.

10. WALL REPAIR

10.1 Materials

Materials for the project are, rocks which were formerly part of the fishpond wall, rocks from the maintenance of Kahana Stream and dead coral from within the fishpond basin and reef flats.

According to past history of the fishpond, the 1946, 1957 and 1960 tsunamis caused great damage to the fishpond wall. One informant of the 1946 tsunami stated that the waves came into the valley through the bay but the outsurge moved through the stream and out along the fishpond wall. The outsurge pulled rocks from the pond wall leaving them strewn along the outer border of the fishpond wall. At low tide these rocks can be seen along the exterior of the pond wall and the adjacent Eastern shore. These have been identified as possible rock sources.

To maintain the park, the State must also maintain the stream, at times of stream clearing, rocks from the streambed often need to be removed. These rocks are of appropriate size, shape, and form as those of the fishpond. All rock used will be clean. Rock will be stored at the same site as the dredge deposition which is located on the map in Figure 33.

There is an abundance of dead coral which migrates into the fishpond with the sand. The adjacent sandy flats have an abundance of coral.

10.2 Method

*small boulder 10"-15" across-for facings and fill
*medium boulder 15"-25" across for facings
*large boulder greater than 25" across for foundation

The work is to begin in Zone E at the model wall continuing the process developed by archaeologists Alan Carpenter and Martha Yent The foundation work will take place at low tides during good weather conditions. Excavation begins with a search for vestiges of original wall foundation stones. Sand and rock will be removed along the wall alignment by shovel and hand tools. As much as can be determined, original alignment will be followed and existing foundations will be used. In areas where foundation stones have obviously shifted, they will be placed in proper alignment.

Where foundation stones are missing, large boulders will be placed to replicate the original design. Because portions of the West wall and North wall were once natural sand berms fortified with rock, it is inevitable that areas will lack foundation stones which will need to be strategically placed. When questions arise

Facings will consist of large to medium-sized boulders. They will be placed in the traditional mortarless, interlocking fashion called *ho`oniho.* To interlock the boulders, shape, weight, angle and slope of the facings are all to be considered. Observing archaeologist Alan Carpenter and pondkeeper Jose Gaceta in action, one notes that the foundation and facing stones have a stable and firm relationship when the wall is properly built. The right rock must be placed in the right configuration. Achieving a solid wall takes time and proper placement of the right sized rock in the right alignment. Carpenter and Gaceta have developed an eye for shapes of rock and how shifting the right rock into the wall at the proper angle achieves "the right fit". Hawaiians had many words for the classification of rock and since it was their basic building material, one can see how the building craft can be relearned through investigation and effort to duplicate the building process.

Fill between the two facings will consist of medium to small sized boulders, coral and cobble. The fill adds to the stability of the pond wall and as demonstrated by the model wall building, rocks can be placed in an interlocking fashion on the interior of the facings to add strength to the wall structure. Spaces between the facings can be filled from the inside with the larger face of the rock on the interior. When a wave rolls back from the wall these rocks cannot be pulled out from the wall because the larger part of the rock is placed in the wall's interior. The medium to small sized boulders create spaces in the fill which are filled with small cobble and bits of coral. As water is poured over the fill or waves wash over it, the cobble and coral bits work their way into the wall to create a tighter fill.

Slope is based on investigations and recommendations of Carpenter and Yent for interior and exterior slopes of the West and North Walls. The walls have related design features and are both part of one contiguous wall, however, they have differing environmental conditions and thus differing design needs. The Northwest corner and North wall are vulnerable to waves which enter the Bay from the Northeast. This location requires a greater width, taller height, and lager slope to withstand the hit of the waves. The West Wall is adjacent to the Kahana Stream and faces the Western curve of the Bay. It does not suffer the hit from wave action and therefore the width, slope and height requirements are less.

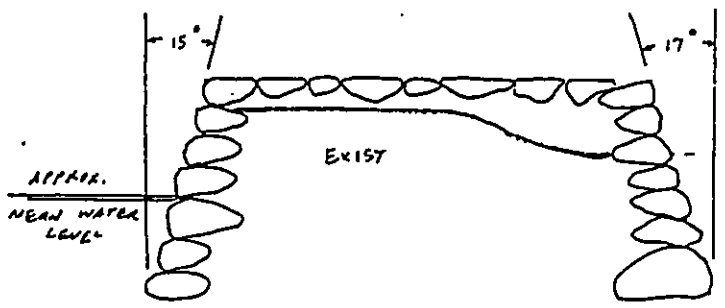

Figure 28. Carpenter 1993. Slope of West Wall

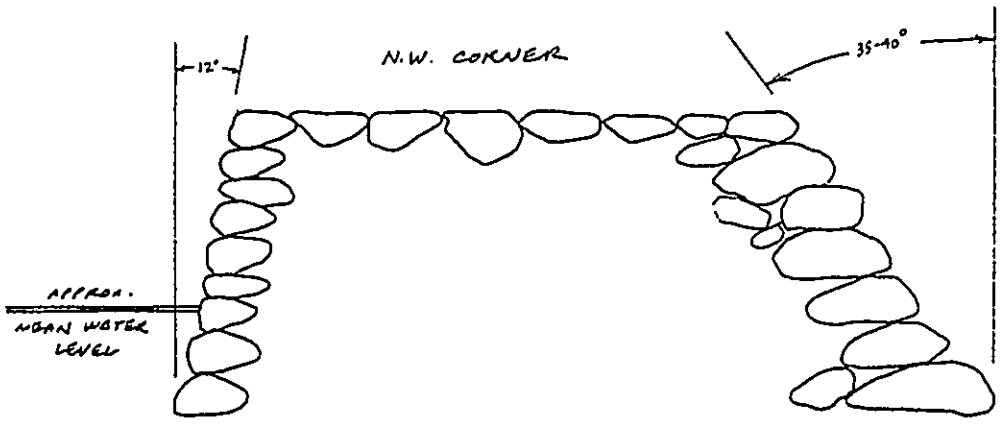

Figure 29 Carpenter 1993. Slope of Northwest corner

10.3 Technical Alternatives for Moving Foundation Stones

The State of Hawaii has stated its intention to restore, revitalize and develop Huilua fishpond as an educational site, however, recent fiscal cutbacks prohibit the expenditure of funds in DLNR State Parks to develop this site with high-cost alternatives. Therefore, several low-cost, hands-on alternative methods have been proposed by Kahana resident, Ron Johnson and Kahana Valley State Park Manager, Al Rogers for transporting materials to the worksite:

A. Cable/Rigging Method

Kahana Resident, Ron Johnson developed this system as a temporary, minimal cost method of moving the larger foundation stone and possibly other materials to be used in the Huilua fishpond restoration. The largest anticipated load is estimated at 300 lbs. The foundation stones will be moved one at a time attached by hooks and chain and lifted by a come-along. This line will be moved by a snatch block pulley along a cable strung across two 4" X 4" sixteen foot tall posts. Horizontal cable will be held in tension by a second come-along. A tag line (or possibly two depending on the weight of the stone) attached to the stone line will be used to walk the stone along to the site where the stone is to be used. As the stone is lowered and the tension released from the come-along the stone can be fitted relatively close to the position in which it will be placed in the wall.

Temporary uprights may be inserted along the span if sag in the cable is excessive. The system was demonstrated by Ron at Huilua using an improvised set-up to demonstrate the basic concept. Archaeologists Martha Yent and Alan Carpenter, Jose' Gaceta and Carol Wyban were present for the demonstration. It was determined that the system is a feasible means of moving large stones along the pond wall, however some experimentation will be needed to developed a consistent, safe and viable methods for larger stones than were used in the demonstration.

Concerns regarding the pvc casings in which the 4"X4" posts are to be inserted and the concrete bases which anchor these casings were fielded with the archaeologists. It was determined that the casings and bases could be recorded and buried within the pond wall leaving no visible components on the wall exterior.

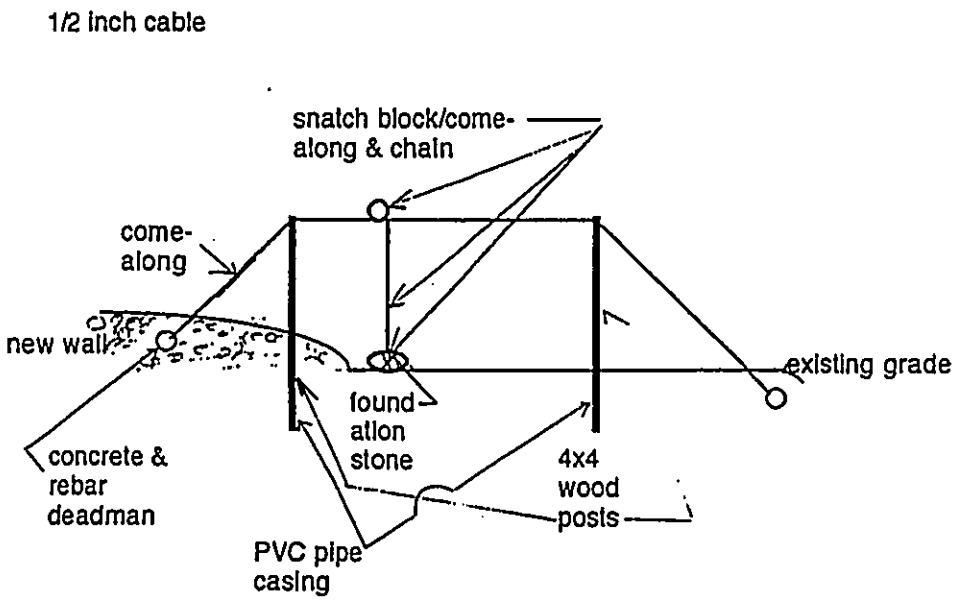

Figure 30 Cable and rigging method developed by Ron Johnson.

Materials List:

* (1) 100 foot length of stainless steel 1/2 inch stranded cable
* (2) cable come-alongs 1 ton with 12 foot pull $45.44 each
* (1) 10 foot length of 3/8 inch chain
* (2) 4X4 16 foot posts
* (4) 20 foot lengths of 5/8 inch reinforcing bar
* (1) 20 foot length of 6 inch pvc pipe
* (4) cable clamps
* (4) bags of redi-mix concrete
* (1) 9 inch all metal snatch block pulley
* (1) 10 foot length of 1/2 inch nylon rope
* (1) 2 foot length of 1/4 inch by 3 inch strap steel

Safety Measures:

1. Daily inspection of cable and rigging system.

2. Maintenance and replacement of components due to corrosion must take place regularly.

3. The tag lines used to pull the rock along the cable ensure that workers are not under any part of the load or rigging until absolutely necessary such as when raising and lowering the load.

4. Workers should wear hard hats when using this method.

B. Bobcat 2410

An alternative to the cable-rigging method is the use of modern machinery that can move large stones and other materials to areas along the pond wall. Kahana State Park Manager, Al Rogers has suggested the Bobcat 2410 Multiple Tool Carrier with the capability to move needed materials on top of the pond wall to bring them to the building area. Depending upon attachments and load, the machine weighs from 9,000-12,000+ pounds. The machine has a 70 inch base from wheel to wheel which is a mere 12 inches less than the width of the model wall. The machine must be driven in reverse to back out of the wall. The carrying capacity of a fishpond wall is unknown. Maneuvering of the machine on the wall must be carefully orchestrated . Machine will be fueled elswhere to avoid fuel spills.

C. Bobcat 1600

An alternative machine is the Bobcat 1600 with a carrying capacity of 1600 lbs and an operating weight of 6,050 lbs bringing the total weight on the pond wall at any given time to 6,650 lbs. The wheel base is 59 inches leaving excess width of the wall to 24 inches. The machine will as in alternative 10.1B, be driven along the pond wall to transport materials to the construction area. Machine will be fueled elsewhere to avoid fuel spills.

11. DREDGING

Technical Approach

It is estimated that the dredging phase will take 6 months from start to completion. There are many special features to the pond interior described in Section 9 that must be handled properly for recovery of important historic features.

Areas of the pond will be sectioned off by temporary sand berms (Figure 31) to protect the existing pond biota and minimize impact of the activity to adjacent areas. The sand berms are to be hand built with shovels from the sand existing in the area (accretions to be dredged). Sandberms will section off the water of the ponded area which contains springs from the area of the pond which is currently a wave-scoured tidal basin. Berms will be built during high tide in the interior portion of the accretion so as not to disrupt particulate matter in the fishpond. Please note that this is to take place after the wall has been builit.

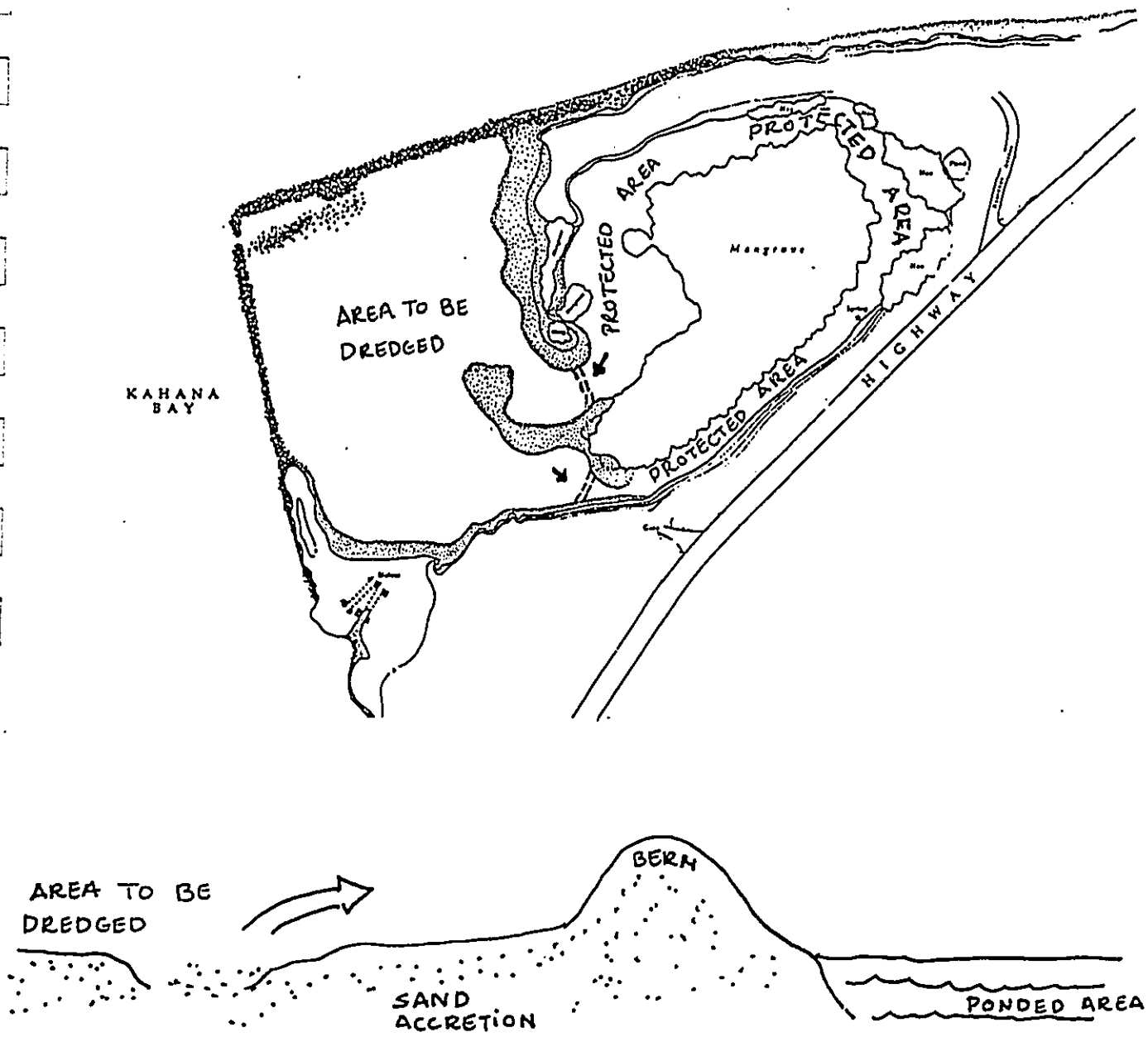

Figure 31. Dotted lines show the two areas where temporary sand berms will be built to protect the springs and ponded areas.

The sand is to be dredged with 3 inch and 6 inch pumps into a de-watering area which is located in Figure 32. The area is approximately 50 feet in diameter and was chosen for the following characteristics:

- -It is a pre-existing pile of dredge spoils from a previous dredging episode in this century. Placing spoils atop this will not affect any buried cultural deposits.
- -It is separated from the pond by another berm along the shore which will prevent runoff of water back into the pond.
- -It is separated from known archaeologically sensitive areas around the pond including site 1546, the former caretaker's house area, the sluices,and known burials.
- -It is in an area which will minimize vehicle impact to the interpretive and pond area.

Sand berms will be built by hand and hand tools to define the dewatering site and to prevent the waters from running off into State Waters. The berms will be built at a height to allow the percolation of dredged water through the porous substrate. After the dredge materials are dewatered and and able to be transported, they will be moved to a site in Kahana Valley.

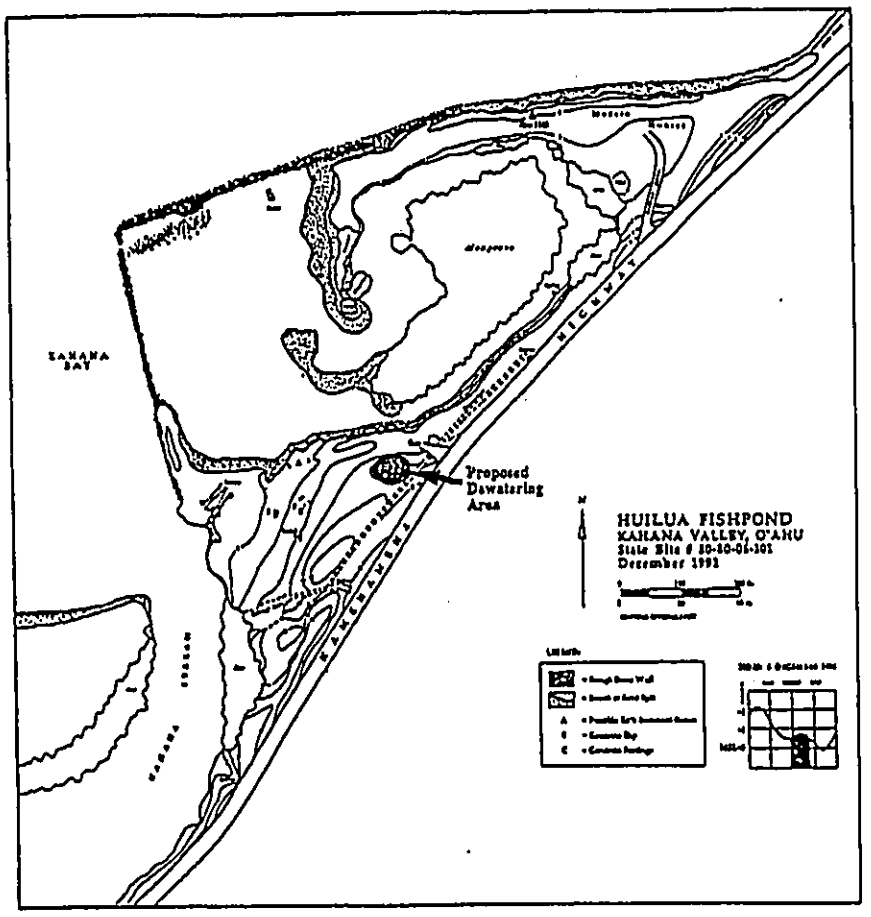

Figure 32. Drewatering Area

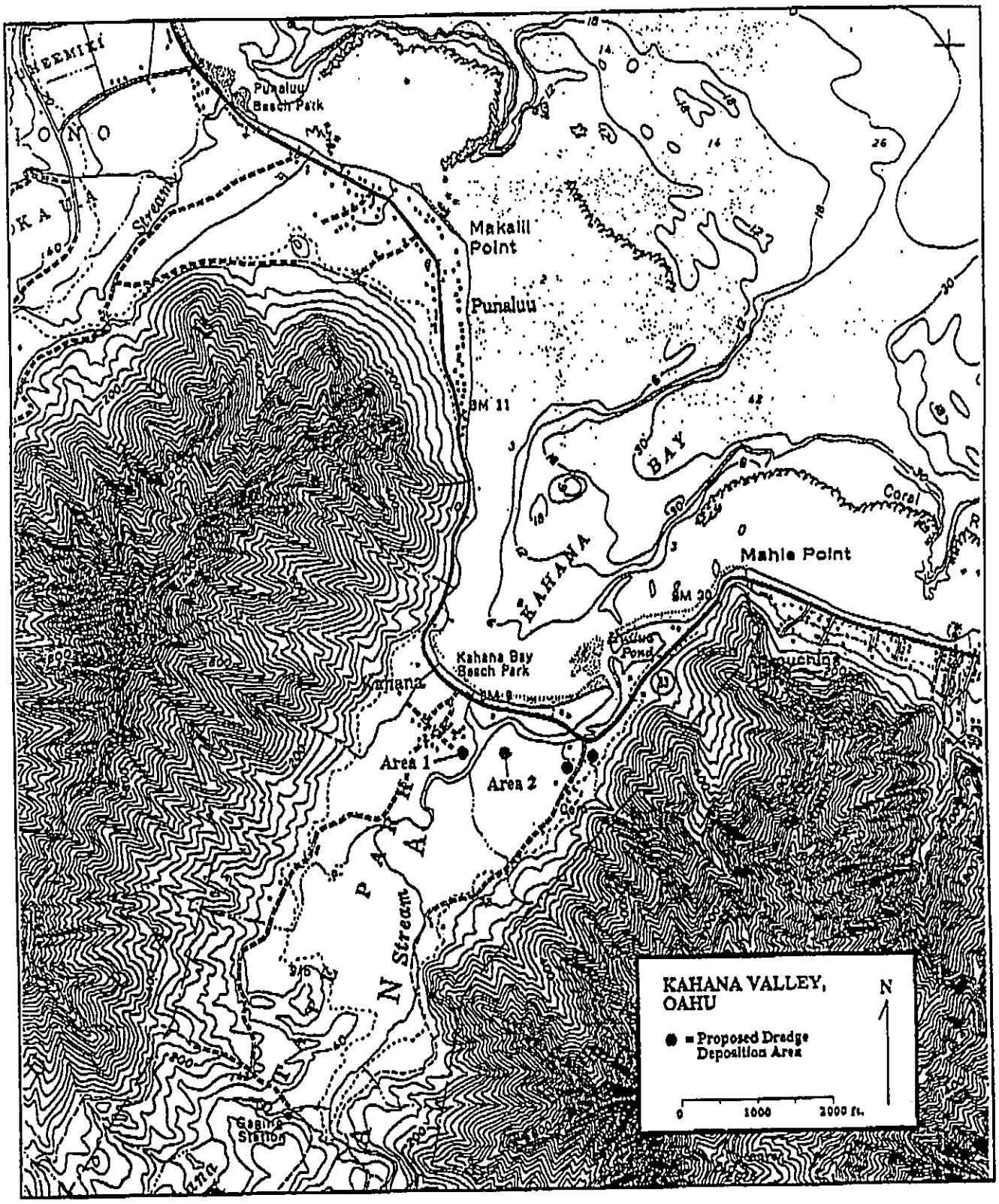

Figure 33 . Proposed Locations for Deposition of Dredge Materials/Stockpile

ZONE X

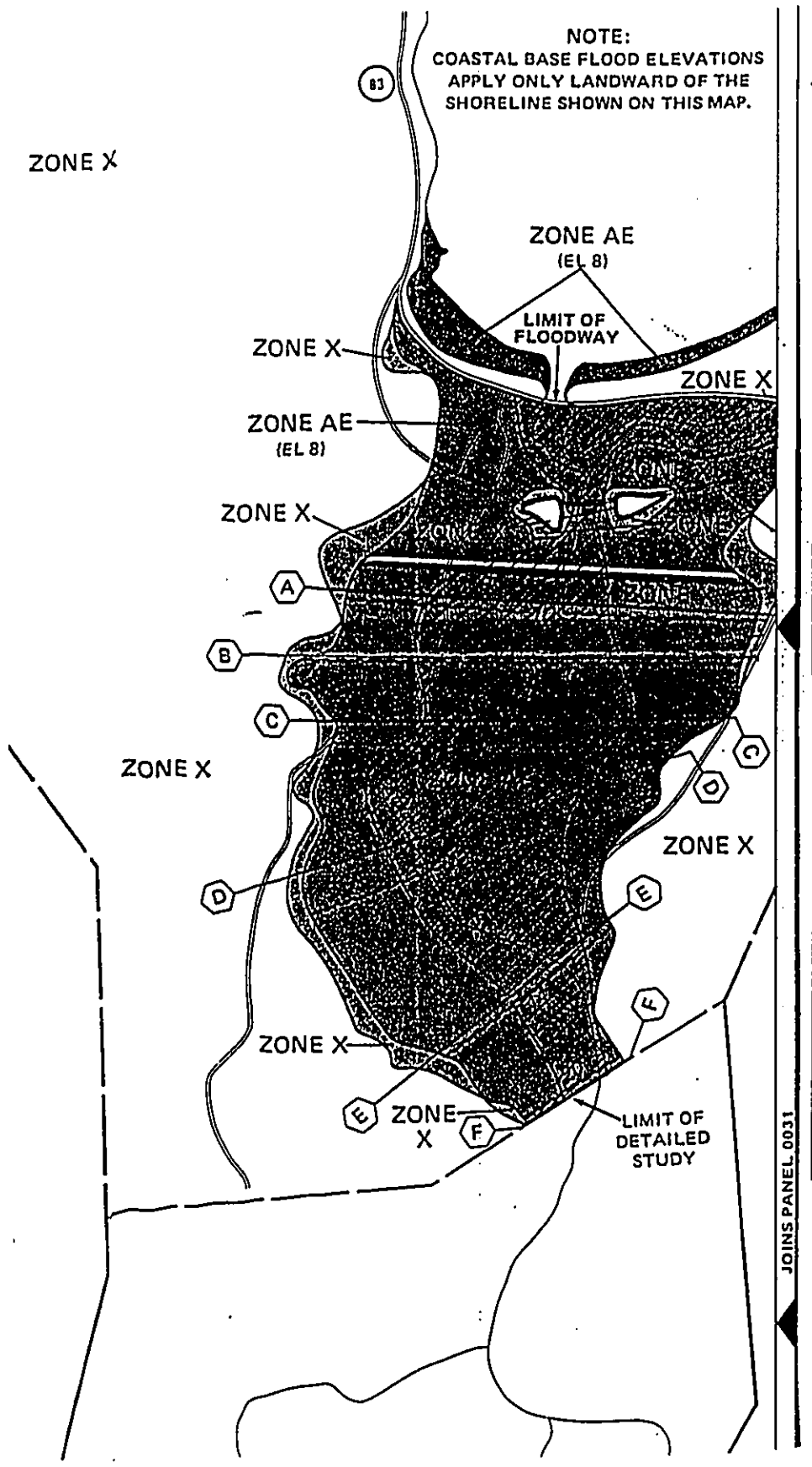

Figure 34. 100 Year Flood Hazard Areas. Note chosen sites are white areas.

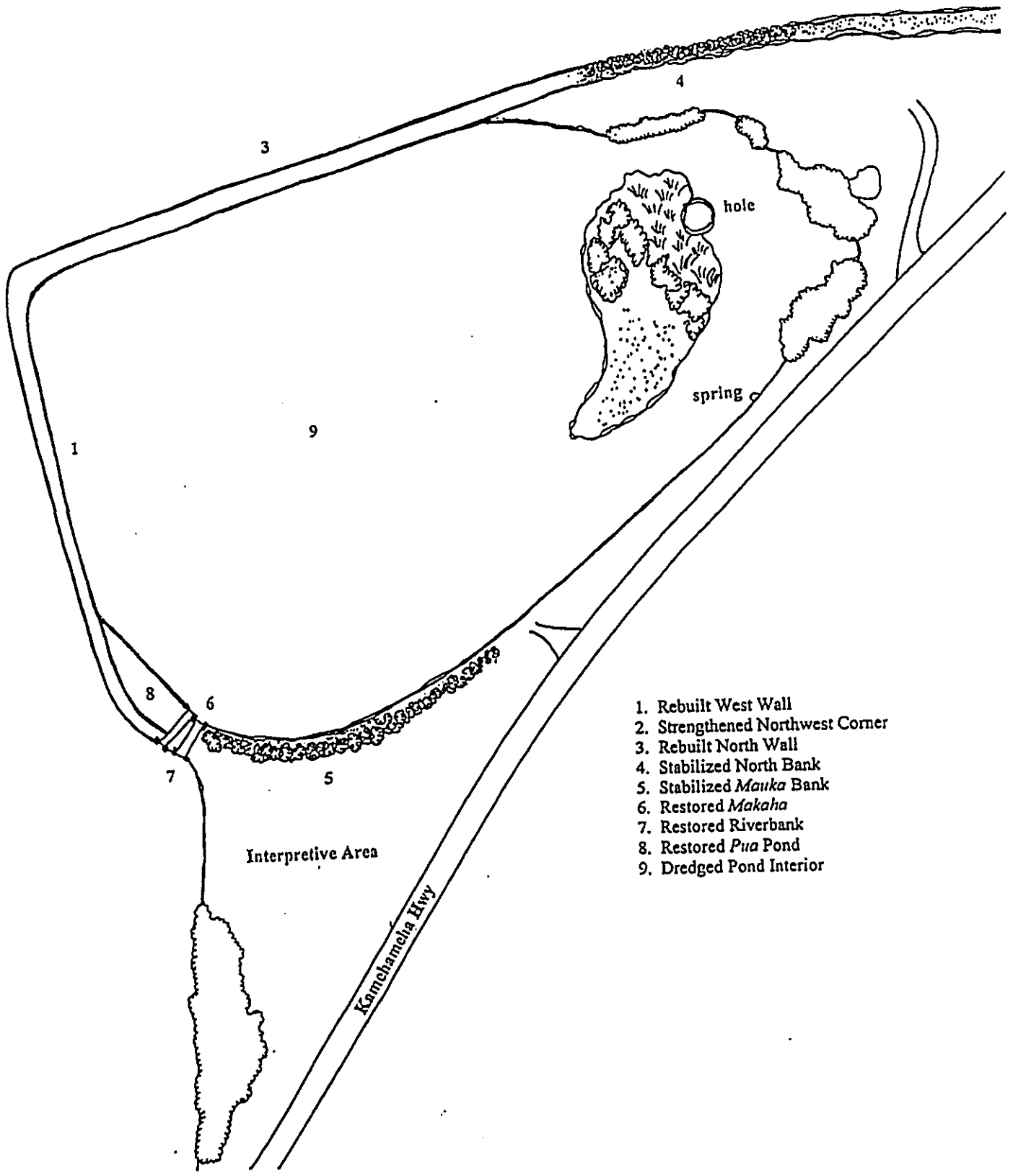

Figure 35. Map of the restored, rebuilt fishpond.

12. PROPOSED MITIGATION MEASURES AND BEST MANAGEMENT PRACTICES

Mitigative measures for each specific zone are described in Section 9. The main concerns are protection of historical features of the site, water quality protection of adjacent resources i.e. stream, bay, interior springs and pond biota. These mitigative measures are to address the Clean Water Act but just as important is the need to protect and preserve water resources. If Kahana Valley State Park intends to teach environmental and cultural consciousness it must teach by conscious actions.

12.1 Sequencing of Tasks

To prevent any negative impact to water quality from dredging, the first phase of the project will involve the rebuilding of the West and North walls. The rebuilt pond walls provide a barrier from the pond to the bay and stream. The barrier serves as a buffer to contain silt from dredging activities which are scheduled in the next phase. The sequence of tasks in the described zones are as follows:

1. Zone E. West Wall
2. Zone F: Northwest Corner
3. Zone G. North Wall
4. Zone H: North Bank
5. Zone D: Mauka Shoreline
6. Zone J: Pond Interior
7. Zone C: Makaha Area and Streamside Sand Accretion

Proposed activities in Zones A,B, and I have no effect on water resources.

12.2 Hand-building of Wall

Reconstruction of the fishpond wall requires hand-building. For a 1,000 foot wall, this process is time consuming. Wall building takes place during good weather i.e. low winds, sunny, and low tides. Thus activity does not occur daily in an intensive fashion and the negative impact of the process is minimal. Use of water-washed rock assures a limited impact. The wall building phase is expected to take 4 years based on estimates by archaeologist Alan Carpenter and pondkeeper Jose Gaceta. The estimate is based on the following assumptions:

-rebuilding 1 foot a day
-working at low tide
-working during good weather conditions
-placing a maximum of 10 meters of foundation stones in one week

12.3 Temporary Sand Berms

Temporary sand berms will be built in the pond prior to the dredging phase. This procedure allows the settling of particulate matter within the pond basin in isolated sections at a time. The berms will be designed to protect the pond biota and the unique springs of the fishpond, blocking off the habitat areas from dredging activities. The areas to be dredged will be sectioned off and done a portion at a time. The berms will be built by hand using tools such as shovels and wheelbarrows. The rebuilt wall and the berms provide a double-barrier which will buffer dredging activities from the bay and stream. As noted by Rothwell and Madden, and core samples of 4/30/93, there is little or no silt in the upper layers of the sand accretion due to scouring by wave action. The existing wave condition scours the silt out of the pond on a daily basis. This activity is particularly evident at high tide.

The dredging activity must be supervised by an archaeologist to look for special historic features such as the *pua* pond and rock-lined springs. The work will be time consuming, areas will be allowed to settle and new sand berms built to protect special features. This is not a commercial project. The intent is to properly implement the project for historic recovery.

12.4. Silt Curtain

In 1980, mud was noted in the Southwestern corner nearest the *makaha*. Today, the surface area near the makaha shows clean sand. The lower levels may still contain a layer of mud, therefore, the removal of sand deposition in the *makaha* will proceed from within the pond outward towards the stream to allow any stirring of mud in the excavation to wash back towards the pond and settle in the pond basin. The removal of sand in the stream on the exterior of the *makaha* will include the use of a silt curtain. The clearing of the *makaha* will take place after the dredging phase in complete, suspended particulate matter within the pond has settled and the pond environment is stabilized.

This area is both culturally and environmentally sensitive. Archaeological trenching has not defined a clear line of the pond exterior for Zone C. It is recommended that the removal of the sand deposition be conducted under the supervision of an archaeologist. The work will include searching for historic features. If necessary, dredging will be postponed to allow for proper recovery of historical features. As a special site for fishpond interpretation, the site will have special attention and work will proceed in accordance to archaeological investigation, assessment and recommendation. If needed, the silt curtain can also be used as a containment device to separate active use of machinery atop the pond wall from the Bay.

12.5 Water Quality Monitoring

Prior to onset of monitoring, determination will be made as to whether "wet" or "dry" standards are applicable. Water quality monitoring will be collected in three phases:

1. Baseline data will be collected for two years prior to project commencement. Data will be collected on a quarterly to include seasonal variations. Eight sets of data will be collected during this phase.

2. The wall rebuilding phase will include the same quarterly schedule for the duration of work. Data will be collected while work is in process, one meter from the activity.

3. The dredging phase is anticipated to take six months. Monitoring will be intensified to a monthly schedule for the duration of the work. Data will be collected within one meter of the silt curtain containment device which will be strung along the sluice gates.

The following parameters set forth in Hawaii Administrative Rules Title 11 Department of Health Chapter 54 Water Quality standards will be the basis for data collection:

Parameter	Geometric mean not to exceed the given value	Not to exceed the given value more than ten percent of the time	Not to exceed the given value more than two percent of the time
Total Nitrogen (ug N/L)	200.00* 150.00**	350.00* 250.00**	500.00* 350.00**
Ammonia Nitrogen (ug NH4-N/L	6.00* 3.50**	13.00* 8.50**	20.00* 15.00**
Nitrate & Nitrate Nitrogen (ug[NO3+NO2]-N/L)	8.00* 5.00**	20.00* 14.00**	35.00* 25.00**
Total Phosphorus (ug P/L)	25.00* 20.00**	50.00* 40.00**	75.00* 60.00**
Chlorophyll a (ug/L)	1.50* 0.50**	4.50* 1.50**	8.50* 3.00**
Turbidity (N.T.U.)	1.50* 0.40**	3.00* 1.00**	5.00* 1.50**

* "Wet" criteria apply when the average fresh water inflow from the land equals or exceeds one percent of the embayment volume per day.

** "Dry" criteria apply when the average fresh water inflow from the land is less than one percent of the embayment volume per day.

13. SUMMARY OF IMPACTS

13.1 Water Quality/Siltation

Restoration and revitalization of Huilua in the process described in this plan will have minimal effects especially when compared to the periodic and episodic events which occur regularly in nature during storm conditions and rainy weather when for weeks at a time, the waters are brown and turbid. (These conditions have been observed annually by Kahana residents on an annual basis and by Dr. Richard Brock of Seagrant who is a water quality specialist.) In addition, the tidal movement of water into and out of the existing wave-scoured tidal basin (the deteriorated fishpond) delivers silt regularly into Kahana Bay. This observation was initially made by Rothwell, 1980. Core samples taken on 4/30/93 (Section 6.8) support Rothwell's observation that the silt is presently scoured by the vigorous wave activity and moved out into the Bay. With the wall in place, and the continuing accretion of sand on the wall exterior, the daily event of wave scouring of the fishpond basin will cease to occur.

The enclosure will increase the residence time of water in the fishpond. This will increase the microbiotic life, and typical for brackish water fishponds and increases the growth of diatoms which are ideal fishfood. The water which exits the fishpond into Kahana Stream from the sluices may be slightly enriched, however, compared to the daily wave scouring of the existing deteriorated fishpond basin, the effect will be minimal. Currently, 1,000 feet of deteriorated pond wall allows the inflow and outflow of water. With the pond repaired, approximately 5 feet open space in the makaha (once the gates and bulkheads are in place) are open to the stream and Bay.

Most of the work is to be done by hand and and when machinery is used, Best Management Practices are designed to minimize the negative impact to adjoining waters. The pond wall, temporary (hand built) sand berms and silt curtains will be used (See Section 12 for details). The operation and maintenance will as much as possible duplicate that of the 1920s interpretive era which was non-commercial and low production of an extensive style production system. Weekly maintenance of the pond wall includes replacement of fallen rocks by hand, hand removal of encroaching vegetation, and hand removal of mangrove sprouts. It is anticipated that these activities will have little impact on water quality. Since the fishpond will be operated at an extensive, low-level production with little inputs, negative impact to water quality will not occur. This is a non-commercial project and the primary intent is not production. The primary goals are to create a cultural and environmental experience within the State Park. The plan has been designed to improve environmental conditions and it is anticipated that with increased fish population, reviving of springs, and renewal of bird habitat, that the natural environment will be protected, enhanced and improved.

At times, silt from Kahana stream will enter the fishpond through the sluices. With the walls enclosed, the silt will settle in the pond and it will revert from a wave scoured marine tidal basin to a brackish water fishpond. It is possible that the fishpond's restoration/revitalization may actually improve the water quality in Kahana Bay.

13.2 Sand Migration

Rothwell and Madden (section 2.5 of this report) and Carpenter and Yent (section 2.3 of this report) have documented and affirmed the migratory sand pattern that directly impacts the fishpond. The historic sand migration consistently moved in a Westerly pattern and assisted in the prehistoric formation of Huilua fishpond. The breach in the Northwest corner which began in the mid-1960s diverted this pattern and allowed the sand to deposit in the pond basin. Once the wall is rebuilt, the sand migration will revert to its former pattern of movement and will deposit along the exterior of the Northern pond wall. The re-establishment of this historic sand migration pattern will help to stabilize and protect the rebuilt the pond wall.

13.3 Habitat for Wildlife

Once the process is completed, the fishpond will be a habitat for a rich ecosystem of aquatic, plant, and birdlife. The fishpond with an enclosed wall, will revert back to a brackish water zone for an abundance of traditional aquatic crops such as mullet, *aholehole* and milkfish.

The restoration and revitalization will reclaim valuable wetland habitat which was destroyed in previous years. The ability of the pond basin to increase residence time of brackish water, increases areas of breeding and habitat for species which were once abundant in the area. One of the main problems of Hawaiian aquatic birds is the loss of native habitat and the loss of native foliage. This is a rare opportunity to reclaim a native habitat. It is anticipated that the replacement of introduced species of plants with native species will be an attractant to birdlife, as has been demonstrated at Kaloko fishpond when mangrove was removed. Mangrove removal takes place as a part of ongoing fishpond maintenance. The mangrove has been hand chopped and sprouts are removed by hand. At times a weed wacker with a blade has been used, howwever, most of the work has been by hand.

13.4 Potential Impact of Dredge/Fill Activities to Wildlife

The following is an excerpt from An Ornithological Survey of Hawaiian Wetlands, Volume Two by Ahuimanu Productions for the US Army Engineer District, Honolulu by Robert J. Shallenberger, December 1977 pg 255:

"Although the Kahana wetlands are currently of limited significance to waterbirds, care should be exercised to avoid further deterioration of the habitat as a result of fill deposition. Excessive and prolonged turbidity in the stream and lower marsh would further limit the development of sumergent vegetation. Siltation in the lower marsh would reduce circulation, accelerate the encroachment of mangrove, and smother much of the currently available feeding habitat...It may also be possible to improve the condition of Huilua Fishpond by restoration of the wall to reduce filling with sand."

The study ranks the Wetlands in the Kahana Bay area as "secondary" in importance. Sites surveyed did not support a large number of resident or migratory bird species and nestin by any species was not evident. It states that in 20 years the habitat conditions were likely deteriorating due to disturbance by humans, dogs, and other predators. It states that mangrove was encroaching onto the few suitable resting and potential nesting sites in the lower mash and fishpond. It had been determined in this study that mangrove had filled in former wetland areas and shrunk the stream drainage to a fraction of its former size.

Restoration/revitalization of the fishpond would restore a valuable wetland area to Kahana Valley. The removal of vegetation encroachment and the replanting of native species will serve to restore valuable habitat for native and migratory bids.

Continued maintenance to the area would reduce the amount of habitat disturbance from dogs, humans, and predators. Only limited access would be allowed in restored nesting grounds for the hand clearing of mangrove. Visitors would be restricted to the interpretive area of the fishpond.

The wall restoration would decrease the amount of fill which is cited by this study as an ongoing problem which deteriorates the wetland habitat. Dredging of the fishpond will have temporary impact due to sound and environmental disturbance, however with the building of temporary sandberms which separate the springs and brackish water empoundment from the dredging activities, (see Figure 31) the water and habitat will be protected.

13.5 Culture and Tradition

There are few places where the traditional work of fishponds exist in Hawaii. There are no sites that provide a mountain to ocean panorama of Hawaiian traditional works of food production. The fishpond is a focal point of traditional life in Kahana Valley and part of the long term vision of cultural renewal for the park. The traditions are continued with the involvement of valley residents who remember the fishpond as a functional part of their community.

13.6 *Educational Benefits*

The benefits of Huilua fishpond and the process of restoration/revitalization are shared with the community and the State of Hawaii. The fishpond is a site for studies in Hawaiiana, nature, history, aquaculture and brackishwater polyculture. Kahana Valley State Park has already developed interpretive materials for the benefit of school children and teachers. Site visits are already part of the Park program. With a year round educational program and a volunteer program, visitors can track and participate in the process of fishpond restoration.

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17. APPENDICES

Review comments and responses from the following regulatory agencies:

- Army Corps of Engineers, US Department of Defense
- Fish and Wildlife Service, US Department of the Interior
- Clean Waters Branch, Board of Health, State of Hawaii
- Department of Land and Natural Resources, State of Hawaii
- Department of Land Utilization, City and County of Honolulu

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

05 OCT 1994

REPLY TO
ATTENTION OF

CEPOD-CO-OR
REGULATORY BRANCH

Ms. Carol Wyban
PO Box 1095
Kurtistown, HI 96760

Dear Ms. Wyban:

The following comments are provided after review of your Environmental Assessment for the Huilua Fishpond. An individual Department of the Army (DA) permit is required for the fishpond reconstruction and restoration. Potential Permit No. 90-087 was assigned to this project.

a. In relation to navigation in the fishpond, Section 10, River and Harbor Act is applicable to the project. The issue of navigational servitude is not correctly discussed in the document on page 2, Section 1.3, and should be deleted or revised as attached.

b. There is no assessment of the impacts of the project on endangered and threatened waterbirds.

c. The dredged material disposal areas should be surveyed for wetlands, which should not be used for disposal sites.

d. The water quality assessment needs some consideration of increased water residence time and its impact on water chemistry. Water exiting the makaha may contain higher nutrients than the stream or coastal waters. Don't forget that a water quality certification is needed prior to the issuance of a DA permit.

e. The State Historic Preservation Officer needs to make an effect determination based on your data. The determination will determine the need for a Memorandum of Agreement with the Corps and the Advisory Council on Historic Preservation.

Please contact the undersign should you have any questions.

Michael T. Lee
Chief, Regulatory Branch

Carol Araki Wyban P.O. Box 1095 Kurtistown, Hawaii 96760
Phone/Fax: (808) 982-9163

Michael T. Lee
Chief, Regulatory Branch
US Army Engineering District, Building 230
Fort Shafter, Hawaii 96858-5440

Sept. 8, 1995

Dear Mr. Lee,

Thank you for your comments on the **Draft Environmental Assessment and Restoration/Revitalization Plan for Huilua Fishpond, Kahana Valley State Park, Koolauloa, Oahu.** (Potential Permit No. 90-087)

We have revised the EA/Plan to address the comments you have made in your attached letter dated 10/05/94. The Section # and page of the plan which addresses the issue/concern has been included below for your convenience:

a. Section 1.3 page 2 was revised to reflect the proper suggested wording.

b. Section 13.3, page 81 includes statements regarding the long-term benefits of reclaiming a former brackish water wetland (the fishpond) to native fish and wildlife.

c. Dredged materials will be stockpiled for future use in Kahana Valley State Park. The site is within the Valley located in an area outside the 100 year floodplain, Figure 33, page 74 and Figure 34, page 75.

d. Increased water residence time and impact on water chemistry is addressed in Section 13.1, page 80. I have met with Ed Chen to develop a schedule of water quality monitoring which is included in Section 12.5, page 79. Operations and Management is explained in Section 8.4, page 46.

e. State Historic Preservation Division (SHPD) represented by O'ahu island archaeologist, Tom Dye has been active in the development of the archaeological aspects of this project. The archaeological plan and subsequent report have undergone several reviews by SHPD.

   In correspondence, SHPD states that adequate measures for historic concerns have been addressed and that the project will have "no adverse effect on Huilua Fishpond."

Our goal at Kahana Valley State Park is to create a unique environmental and cultural education site. As we move towards that goal, it is important to care for our valuable natural resources. Thank you for your input in helping us care for important water quality issues. If you have any questions, please call me at (808) 982-9163.

Sincerely,

Carol Araki Wyban

cc: attachment

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Ecoregion
300 Ala Moana Blvd, Room 6307
P.O. Box 50167
Honolulu, Hawaii 96850

In Reply Refer To: MWR

AUG 26 1994

Ms. Carol Araki Wyban
P.O. Box 1095
Kurtistown, Hawaii *96760*

Re: Draft Environmental Assessment and Restoration/Revitalization Plan for Huilua Fishpond, Kahana Valley State Park, Koolauloa, Oahu, Hawaii

Dear Ms. Wyban:

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Environmental Assessment and Restoration/Revitalization Plan (Plan) for the Huilua fishpond. The primary objective in restoring and revitalizing Huilua fishpond is to provide Kahana Valley State Park with an interpretive center for the traditional management and harvest of traditional aquatic crops such as milkfish (*Chanos chanos*) and mullet (*Mugil cephalis*).

The proposed action would involve reconstruction of approximately 305 meters (m) [1,000 feet (ft)] of fishpond walls, dredging of the pond interior to an average depth of 1.07 m (3.5 ft) at mean high tide, and sluice gate reconstruction. The majority of the work would be accomplished manually, but heavy equipment would be used to facilitate the repair of some wall sections and during dredging operations. It is anticipated that the proposed project would be completed by the year 2000. The Service offers the following comments for your consideration.

The Plan adequately describes the cultural significance of and environmental conditions within and adjacent to the proposed project site. Maps in the Plan illustrate that existing mangroves will be removed, but the method(s) for accomplishing this action are not identified. The Plan also identifies the presence of two migratory shorebirds, ruddy turnstones (*Arenaria interpres*) and golden plovers (*Pluvialis dominica fulva*), and two native waterbirds, the black-crowned night-heron (*Nycticorax nycticorax*), and the endangered Hawaiian stilt (*Himantopus mexicanus knudseni*). The Plan does not identify when this information was recorded, the methodology used, or the number of individuals of each species recorded. This information would aide the Service in addressing potential adverse impacts to these species, particularly endangered Hawaiian stilts, when the loss or modification of existing wetland habitat occurs during dredging and mangrove removal.

The Service recommends that the U.S. Army Corps of Engineers be contacted for information on permit requirements for mangrove removal and dredging. The Service would not object to these actions provided that the loss or degradation of shoreline and shallow water habitats for federally endangered Hawaiian waterbirds and migratory shorebirds is minimized.

The Service recognizes that the restoration/revitalization of the Huilua fishpond would reestablish traditional practices consistent with native Hawaiian culture. We appreciate the opportunity to provide comments on this Plan and are willing to further discuss our project-related concerns with you. If you have any questions regarding these comments, please contact Fish and Wildlife Biologist Michael Ritter at 808/541-3441.

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

cc: COE, Honolulu
DOH, Honolulu
CZMP, Honolulu
NMFS, Honolulu
DOFAW, Honolulu
EPA, San Francisco

Carol Araki Wyban P.O. Box 1095 Kurtistown, Hawaii 96760
Phone/Fax: (808) 982-9163

Brooks Harper, Field Supervisor
US Department of the Interior
Fish and Wildlife Service
PO Box 50167
Honolulu, Hawaii 96850

Sept. 8, 1995

Dear Mr. Harper,

Thank you for reviewing the **Draft Environmental Assessment and Restoration/Revitalization Plan for Huilua Fishpond, Kahana Valley State Park, Koolauloa, Oahu.** In the final EA/Plan dated 9/8/95, we address the comments and issues stated in your attached letter. Below is a point-by-point synopsis:

1. Section 13.3, page 81 includes statements regarding the long-term benefits of reclaiming former brackish water wetland (the fishpond) to native fish and wildlife. This section includes method of mangrove removal by hand tools, machete and weed-wacker with blade, and hand removal of new sprouts.

2. Section 6.5, page 35 now includes dates and method of data collection.

3. Army Corps of Engineers has reviewed the draft and made comments which have also been responded to. If requested, a copy of comments and response will be sent to you.

In addition, information from Shallenberger (1977) An Ornithological Survey of Hawaiian Wetlands has been included in Section 13.4, page 81. The survey assesses Huilua and the potential impact of dredge/fill activities to wildlife.

Our intention at Kahana Valley State Park is conscious resource management and cultural education. Thank you for your input in helping us reach that goal. If you have any further questions or issues of concern, please call me at (808) 982-9163. Mahalo.

Sincerely,

Carol Araki Wyban
Project Consultant
cc: attachment

JOHN WAIHEE
GOVERNOR OF HAWAII

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

Peter A. Sylvester, Ph.D.
DIRECTOR OF HEALTH

In reply, please refer to:
File: EMD / CWB

August 31, 1994

P0801EC

Ms. Carol Araki Wyban
P.O. Box 1095
Kurtistown, Hawaii 96760

Dear Ms. Wyban:

Subject: Environmental Assessment and Restoration/Revitalization Plan for Huilua Fishpond, Kahana Valley State Park Koolauloa, Oahu, Hawaii

Thank you for the opportunity to review and comment on the Environmental Assessment (EA) and Restoration/Revitalization Plan for the subject project. The following are our comments:

1. Existing Receiving Water Quality

Adequate receiving water quality data should be attached to support the statement that "Under the existing natural conditions the bay does not meet all of the standards set in the regulations", as stated on Page 35 of the EA.

2. Scope of Work

Page 9 of the EA states that "Complete physical restoration of the fishpond to its original design is impossible." Therefore, the adequacy of using the term "restoration" needs to be reevaluated.

3. Typographical Errors Contained in Subsection 3.4

Federal statutes authorizing the Water Quality Certification (WQC) processing is Section 401 of the Clean Water Act (CWA), not Section 404. The Clean Water Branch of the Environmental Management Division, Department of Health, will process the Section 401 WQC application.

4. National Pollutant Discharge Elimination System (NPDES) Permitting Requirements

The operation and maintenance (O&M) of the fishpond will have direct long-term environmental impacts on the receiving water. Without adequate information, the Department is unable to assess the potential impact on water quality resulting from the O&M of the fishpond. Nor can the Department determine whether an NPDES permit is required for the fishpond operation, in accordance with §11-55-04 of the Hawaii Administrative Rules (HAR) and §122.24 of Title 40, Code of Federal Regulations (CFR).

5. Best Management Practices (BMPs) Plan

The BMPs Plan shall detail the methods, measures or practices selected for pollution control in order to meet applicable water quality standards. The BMPs shall be site specific and construction method specific. This BMPs Plan shall include, but not be limited to, structural and non structural controls and O&M procedures. The BMPs shall be applied before, during and after pollution-producing activities to reduce or eliminate the introduction of pollutants into the receiving waters. The BMPs Plan shall also include, but not be limited to, control and mitigative measures to reduce, minimize and isolate the construction, operation, and maintenance of the facility from degrading the receiving water quality.

The EA discusses the general BMPs Plan proposed for the project construction in many areas. We feel that discussions in the following areas are also needed and will be required as part of the Section 401 WQC application package:

a. Dredged spoil dewatering processing.

Size, design and location of the proposed dewatering site shall be discussed. Utilizing the existing fishpond interior area or within State waters as a dredged spoil dewatering processing/treatment site is prohibited. The dredged spoil dewatering site shall be located in an area where there will be no overflow and/or any spills from the site, or if the overflow and/or spill does happen, the effluent will not reach State waters.

b. Runoff from the dredged spoil salt content washdown site.

Please see 5.a. above.

c. Runoff from the dredged spoil stockpiling site.

Where will the construction material be stockpiled? Stockpiling of construction materials on public beaches or in State waters may be prohibited.

d. Temporary sand berm construction.

e. North bank stabilization.

f. Runoff from the construction material stockpiling site.

g. Solid waste disposal.

6. Water Quality Monitoring

A more detailed water quality monitoring plan will be required as part of the Section 401 WQC application package. Early consultation with the Department in this regard is encouraged.

7. Potential Impacts

a. As identified in the EA, changes in the patterns of beach accretion or erosion will occur after completion of the fishpond wall. The potential impact to the existing beach resulting from the change of sand movement should be discussed.

b. The long-term impact from the O&M of the fishpond was not discussed.

Should you have any questions, please contact Mr. Edward Chen, Engineering Section of the Clean Water Branch, at 586-4309 or toll free number at 1-800-468-4644, Ext. 64309.

Sincerely,

THOMAS E. ARIZUMI, P.E., CHIEF
Environmental Management Division

EC/rm

Carol Araki Wyban P.O. Box 1095 Kurtistown, Hawaii 96760
Phone/Fax: (808) 982-9163

Thomas E. Arizumi
Chief, Environmental Management Division
State of Hawaii, Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Sept. 8, 1995

Dear Mr. Arizumi,

Mahalo for reviewing the Draft of the **Environmental Assessment and Restoration/Revitalization Plan for Huilua Fishpond, Kahana Valley State Park.**

The numbered comments in your attached letter, dated 8/31/94 have been incorporated into and addressed in the Environmental Assessment and Plan dated 9/8/95. Below is a point-by-point response to the stated concerns. If the issue is a lengthy one, the Section number and page # where the issue has been addressed in the EA/Plan is referenced:

1. The quote is taken from the Kahana Valley State Park, Revised Environmental Impact Statement, 1978, H. Mogi Planning and Research, Inc. Since the data in the EIS was taken in 1978, and needs further study, the statement has been removed.

2. The word "restoration" does not stand alone in the title, approach and implementation of this project. It is part of a three-pronged approach explained in Section 8, page 44, which describes, restoration, rebuilding, and revitalization. Using of the term "restoration" is a vital component of this project. Huilua is a significant historic site listed on the National and State registry of Historic Places and any effort to develop the pond must adequately address the historic design aspects. It is our intent as much as possible, to accurately restore those sections of the pond which are capable of being restored. To that purpose, years have been spent in studies by archaeologists to gather and interpret information to accurately restore portions of the pond wall.

3. Typographical error has been corrected to section 401 instead of 404.

4. Operations and Management of the fishpond has been added as Section 8.4, page 46. O&M will harken back to the 1920s era which has been chosen for interpretive purposes. The activities of this era were very simple and replication of the era does not require high input of nutrients into the pond. The basic activities are:

- stocking of traditional crops ie fingerling mullet and milkfish
- replacing rocks which have fallen from the pond wall
- hand removal of rubbish from pond interior and adjacent land areas
- hand-cutting of encroaching vegetation
- hand-removal of new mangrove sprouts

Park activities at the sites will include walking tours through the interpretive area and occasional harvest of fish. Fish will feed mainly from the natural productivity of the pond. Pelletized feed will be used for interpretive programs, not to exceed 20 lbs per month.

5. BMPs are included in the plan in Sections 1.4, page 3 and Section 12, page 77 of the plan. Mitigation measures include appropriate sequencing of tasks, hand-building of wall, limited use of machinery, sand berms as containment, silt curtains and water quality monitoring. Cultural integrity is assured by ongoing participation of the State Parks' staff archaeologists.

a. Dredged spoil dewatering processing has been added as Section 11.1 page 71.

b. Dewatering area, Figure 32, page 73 will be contained within a sandberm and water will percolate down to sealevel.

c. Stockpiling site is located inland at the same site for dredge spoils which is located out of the 100 year floodplain, Figure 33, page 74.

d. Sandberms will be built by hand, using shovels and wheelbarrows Section 12.3, page 78.

e. North bank stabilization will consist of planting naupaka above the high water mark on an existing sand berm. The plants will be held stable by plastic netting, when the roots are established and the plants have grown sufficiently, the netting will be removed Section 9.8 page 62.

f. Construction materials (rocks) will be stored at the same location as the dredged spoils, Figure 33 page 74 and will be moved to the pond by the

truckload as needed. Materials will be used quickly and not stockpiled.

g. No solid waste is anticipated in this project. All materials ie rock, sand, dredge spoils, coral rubble are useful materials that will be used in this park project or in other park projects.

6. Water Quality Monitoring

Monitoring schedules based on Hawaii Administrative Rules Title 11 Chapter 54 Water Quality standards will be implemented. Parameters for embayments will be monitored on a quarterly basis for the wall building phase and a weekly basis for the dredging phase, Section 12.5 page 79.

7. Potential Impacts

a. Sand migration and accretion patterns are described in Section 2.5 page 22 and shown in Figure 10, pg 22. The historic accretion pattern is one which was exploited as part of the pond wall design centuries ago. Impact of the project to sand migration patterns are discussed in Section 13.2, page 81. With the pond wall rebuilt, the sand will build up on the exterior of the North wall.

b. Operations and Management explained in Section 8.4 page 46. Impact on the environment is discussed in Section 13 page 81. The main impacts will be increased habitat for endangered birds, increased habitat for fish and aquatic species, and a revitalization of a valuable cultural resource. The pond also serves as a settling basin for particulate matter that is washed down during stormy weather conditions and the pond basin will divert some siltation from moving into Kahana Bay.

Kahana Valley State Park is intended as an educational springboard to teach and perpetuate conscious use of natural and cultural resources. My thanks to you and to Ed Chen for your kokua in developing an appropriate approach to the important water quality issues. If you have any questions, please call me at (808) 982-9163.

Sincerely,

Carol Araki Wyban
Project Consultant

cc: attachment

JOHN WAIHEE
GOVERNOR OF HAWAII

KEITH W. AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JOHN P. KEPPELER, II
DONA L. HANAIKE

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

P. O. BOX 621
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AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

REF:OCEA:DKP

FILE NO.: 94-729
DOC. ID.: 4725

Ms. Carol Araki Wyban
P.O. Box 1095
Kurtistown, Hawaii 96760

AUG 9 1994

Dear Ms. Wyban:

SUBJECT: Draft Environmental Assessment (DEA): Restoration/Revitalization Plan for Huilua Fishpond, Kahana Valley State Park, Koolauloa, Oahu; TMK: 5-9-05: 21

We have reviewed the DEA information for the subject project transmitted by your memorandum dated June 28, 1994, and have the following comments:

Division of Aquatic Resources

The Division of Aquatic Resources (DAR) comments that the project is not expected to adversely impact aquatic resources so long as mitigation measures described in the subject document are implemented by the applicant. Since the adjacent waters of the Huilua fishpond have the highest and most restrictive classifications (Kahana Bay is Class AA and Kahana Stream is classified 1.a), DAR suggests these and other mitigation measures such as preventing construction materials, petroleum products, and other potential contaminants from falling, blowing or leaching into the aquatic environment be made a part of the conditions of any permit required to implement the project.

We will forward any Historic Preservation Division comments as they become available.

We have no other comments to offer at this time. Thank you for the opportunity to comment on this matter.

Please feel free to call Steve Tagawa at our Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Very truly yours,

KEITH W. AHUE

2225

JOHN WAIHEE
GOVERNOR OF HAWAII

KEITH W. AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JOHN P. KEPPELER, II
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WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

REF:OCEA:DKP

AUG 15 1994

FILE NO.: 94-729
DOC. ID.: 4804

Ms. Carol Araki Wyban
P.O. Box 1095
Kurtistown, Hawaii 96760

Dear Ms. Wyban:

SUBJECT: Draft Environmental Assessment (DEA): Restoration/Revitalization Plan for Huilua Fishpond, Kahana Valley State Park, Koolauloa, Oahu; TMK: 5-9-05: 21

The following are our additional comments on the subject project which supplement our previous letter dated August 9, 1994:

Division of Land Management

The Division of Land Management (DLM) recommends that the applicant strictly adhere to comments by the Division of Aquatic Resources, that all uses are in compliance with Executive Order No. 3518 setting aside Kahana Valley to the Division of State Parks and that the applicant obtain the necessary Federal, State and County permits prior to initiating any work.

Historic Preservation Division

The Historic Preservation Division (HPD) comments that the restoration and revitalization of Huilua Fishpond are being carried out in conjunction with archaeologists at the Division of State Parks. Their historical and field investigations have revealed a great deal of the pond's history, and have provided excellent information with which to guide restoration activities. The continued involvement of archaeologists in the restoration/revitalization of the pond ensures that information on the pond's history will not be inadvertently destroyed during renovation. HPD believes that this project will have a "no adverse effect" on Huilua Fishpond. Please note that section 2.5 is missing, and that the National Register of Historic Landmarks referred to on page 23 is the National Register of Historic Places.

We have no other comments to offer at this time. Thank you for the opportunity to comment on this matter.

Please feel free to call Steve Tagawa at our Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Very truly yours,

KEITH W. AHUE

Carol Araki Wyban P.O. Box 1095 Kurtistown, Hawaii 96760
Phone/Fax: (808) 982-9163

Mr. Mike Wilson
Department of Land and Natural Resources
PO Box 621
Honolulu, Hawaii 96809

9/8/95

Dear Mr. Wilson,

Subject: Thank you for the DLNR review of the **Draft Environmental Assessment and Restoration/Revitalization Plan for Huilua Fishpond, Kahana Valley State Park, Koolauloa, Oahu.**

The 9/8/95 Environmental Assessment and Restoration-Revitalization Plan has incorporated and responded to the comments in the attached letters dated 8/9/94 and 8/15/94. The issues are found in the following sections on the cited pages.

Division of Aquatic Resources

Mitigation measures listed in Section 12 page 77 will be strictly adhered to in the process of restoration-revitalization. Petroleum products will be minimized by the use of light machinery under highly supervised conditions, Section 10, page 67 and Section 11 page 71. The wall is to be primarily hand built, Section 12.2 page 77. The materials are rock and coral, Section 10.1, page 67. In comparison the impact of storm conditions and the daily wave-scouring of silt from Kahana stream, this project is low-impact.

Division of Land Management

DAR issues are addressed above. The purpose of this EA/Plan is to comply with the Federal, State, and County permits, Section 3, page 23.

Historic Preservation Division

Our thanks to Tom Dye and SHPD for being an active participant in this project. We have met and discussed this plan and Mr. Dye has reviewed several drafts of the plan. Section 2.5 has been included, page 22. The plan is revised to show the National Register of Historic Places Section 3.2 page 23.

Thank you for your input. The potential for environmental and cultural education at Kahana Valley State Park is tremendous. Huilua fishpond depicts the "living science" and the "living culture" of the ancient people of Hawaii. If you have any questions, please contact me at (808) 982-9163.

Sincerely,

Carol Araki Wyban

cc: enclosures

DEPARTMENT OF LAND UTILIZATION
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JEREMY HARRIS
MAYOR

DONALD A. CLEGG
DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

94-04149 (MAR)

September 28, 1994

Carol Araki Wyban
P.O. Box 1095
Kurtistown, Hawaii 96760

Dear Ms. Wyban:

Environmental Assessment for Huilua Fishpond
Kahana Valley State Park, Koolauloa, Oahu

Thank you for allowing us to review the Environmental Assessment (EA) for the restoration and revitalization of the Huilua Fishpond. We have the following comments to offer:

As cited in the assessment, the project is within the Special Management Area (SMA), Chapter 25, Revised Ordinances of Honolulu. The project is consistent with SMA objectives, which is to preserve, protect and, where possible restore the natural, cultural and recreational resources of the Coastal Zone of Oahu. It should be noted, however, that a SMA permit must be obtained prior to the commencement of any restoration activities.

Furthermore, the proposed activity is subject to the Shoreline Setback, Chapter 23, Revised Ordinances of Honolulu. The restoration of Huilua Fishpond will require a Shoreline Setback Variance because the proposed activities are located within the shoreline setback. The appropriate construction application must be submitted for review and processing prior to restoration activities.

Of primary concern to the Department is the water quality during the dredging and restoration phases of the project. It is unclear how the temporary sand berms will preserve the water quality (page 74). Illustrations and sectional drawings would be helpful to clarify this point.

The Department is also concerned about the collection and disposal of materials dredged from the fishpond. The EA, (page 71), cites a de-watering area for the stockpiling of material. In addition, three alternative sites are identified as possible locations for the deposition of dredged material. Two of these locations appear to be located within the floodway district (an area designated by

the Federal Flood Insurance Rate Map (FIRM) to be within the 100-year flood plain). Article 7.10-5(b) of the Land Use Ordinance, states that within the Floodway District:

> "Temporary or permanent structures, fill, storage of material or equipment or other improvements which affect the capacity of the floodway or increase the regulatory flood elevations shall not be allowed."

Consequently, these sites would be inappropriate for the deposition of the dredged material. The EA should explain more fully the location of these sites, their relationship to the flood zone, and the potential impacts related to their use.

We look forward to your response. If you have any questions, please contact Melissa Anderson Rayner of our staff at 527-5038.

Very truly yours,

Donald Clegg

DONALD A. CLEGG
Director of Land Utilization

DAC:st

G:fishpond.mar

Carol Araki Wyban P.O. Box 1095 Kurtistown, Hawaii 96760
Phone/Fax: (808) 982-9163

Donald A. Clegg
Director of Land Utilization
City and County of Honolulu
650 South King St.
Honolulu, Hawaii 96813

Sept. 8, 1995

Dear Mr. Clegg,

Thank you for reviewing the Draft Environmental Assessment and Restoration/Revitalization Plan for Huilua Fishpond, Kahana Valley State Park, Koolauloa, Oahu.

The issues which were raised in your attached review dated 9/28/95 have been addressed and incorporated in the EA/Plan dated 9/8/95. A summary of responses is included below. The Section number and page where the issue is addressed in the EA/Plan is referenced:

1. A water quality monitoring schedule based on parameters of the Department of Health, Clean Waters Branch has been developed in Section 12.5, page 79. This schedule includes 2 years of baseline data prior to project commencement and quarterly monitoring during the wall building phase. The schedule changes to a monthly monitoring for the dredging phase.

2. Temporary sand berms to protect pond biota and springs are simple hand built sand berms using shovels and wheel barrows. The requested description of the berms is included in Section 12.3 page 78. The requested location of the berms and cross-sectional drawing are in Figure 31, pg. 72.

3. The dewatering process has been included in Section 11 on pg 71.

4. New stockpiling sites have been chosen which are out of the 100 year floodplain. These sites are shown in Figures 33 on pg. 74 and Figure 34 on pg 75.

Kahana Valley State Park is intended to be an environmentally conscious cultural park. Thank you for your input in assisting our planning and development of Kahana Valley's unique park resources. If you have any questions. Please call me at (808) 982-9163.

Sincerely,

Carol Araki Wyban

cc: attachment