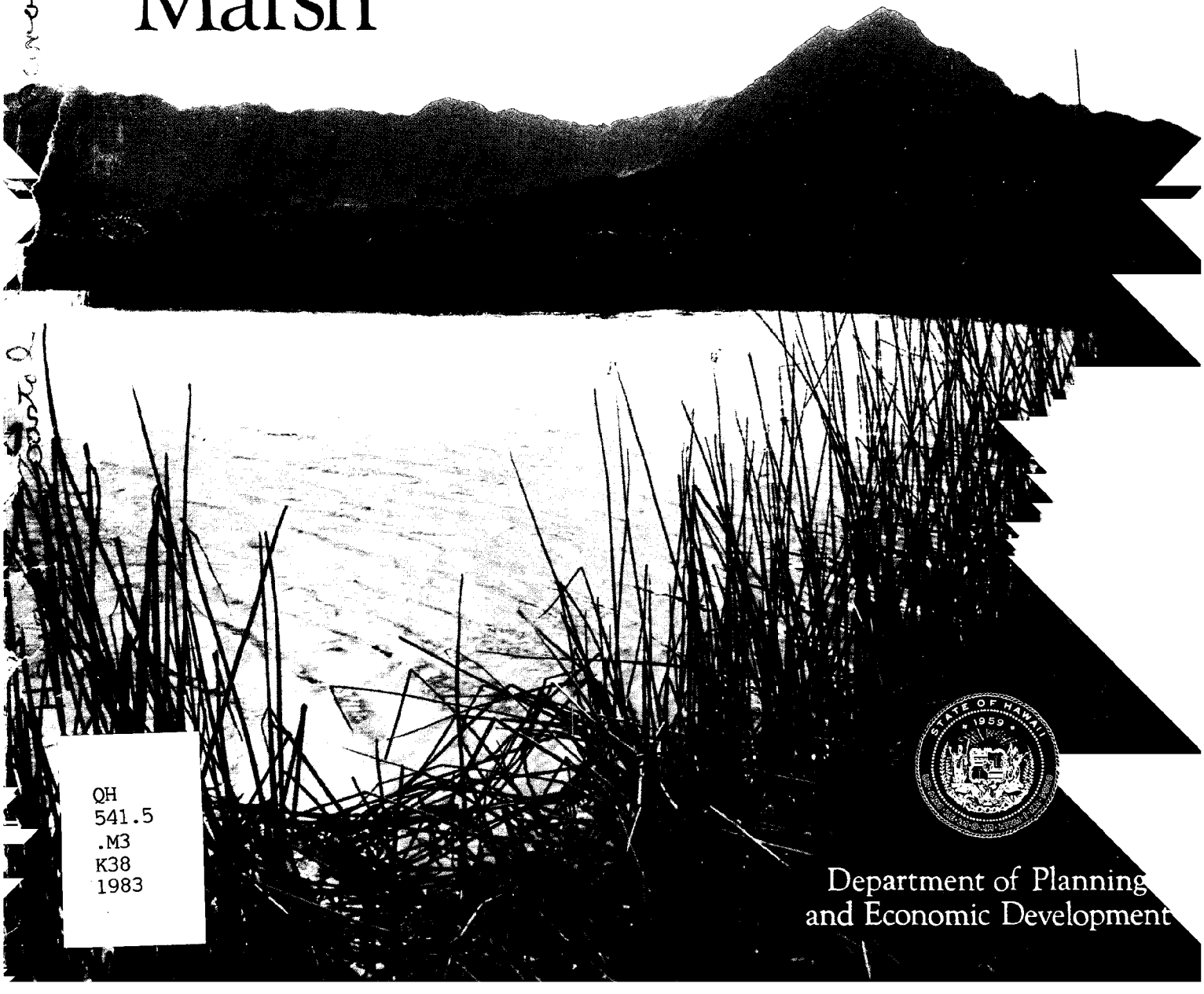
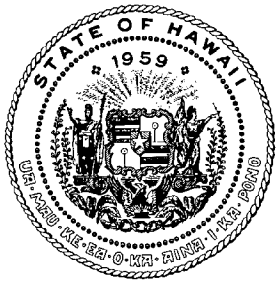
Resource Management Plan for Kawainui Marsh



Department of Planning and Economic Development

KAWAINUI MARSH RESOURCE MANAGEMENT PLAN



Kawainui Marsh Technical and Policy Advisory Committee
Hawaii Coastal Zone Management Program
Department of Planning and Economic Development
State of Hawaii

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March 1983

Cover photo and design by Stew Wastell

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View of the Marsh taken from the Quarry Road slope with Castle Memorial Hospital and the Kukunono Subdivision in the background. Portions of this area of the Marsh are presently used for cattle grazing (Stew Wastell, 1982).

EXECUTIVE CHAMBERS

HONOLULU

GEORGE R. ARIYOSHI
GOVERNOR

FOREWORD

As the people of Hawaii move into the future, it is always satisfying to pause and reflect on our past and our surroundings, at those features of Hawaii which have given us such enjoyment and where nature and man have left an endowment for future generations to appreciate.

Kawainui Marsh is such a place.

I commend the staff of the Department of Planning and Economic Development and the members of the Kawainui Marsh Technical and Policy Advisory Committee for their efforts in preparing this most important resource management plan.

I firmly support the establishment of a natural heritage area at Kawainui Marsh and know that this document will aid us in this endeavor.

George R. Ariyoshi

PREFACE

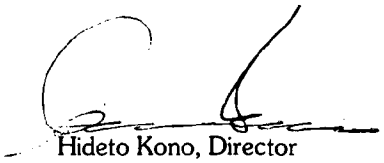
Kawainui Marsh is a thousand acre expanse at the base of the Ko'olau Mountains where time and nature have created what is today the largest remaining wetland in the State of Hawaii. Over the past decade, and more recently through the preparation of this plan, the Marsh has been found to contain resource values beyond the open vistas it affords between sea and mountain. It is also the habitat for four endangered Hawaiian waterbird species, the site of early Hawaiian fishponds and wetland agriculture, and numerous archaeological remains. It serves as a flood basin for protecting Kailua Town and provides recreational and educational potential for the people of Oahu and the State.

This document describes a resource management plan for a natural heritage area at Kawainui Marsh. The plan is presented in four parts, the first of which provides a brief background of the Marsh as a public environmental issue. The second and third parts describe the planning process utilized by the Department of Planning and Economic Development and the Kawainui Marsh Technical and Policy Advisory Committee and offer specific policies and implementing actions through which better resource management can be achieved.

Inasmuch as this plan is but the first step in the establishment of a natural heritage area at the Marsh, part four recommends a means through which multi-resource management can be accomplished and offers a framework through which the plan can be implemented.

We are most grateful to the members of the Committee, without whose perserverance and dedication the formulation of the plan would not have been possible.

Finally, we believe that the inter-disciplinary, multi-organizational participation in the development of this plan has provided the State of Hawaii a valuable experience in the resolution of future environmental issues.



Hideto Kono, Director
Department of Planning and Economic Development

ACKNOWLEDGEMENTS

This plan would not have been possible without the valuable insights and technical comment provided by resource persons in the community throughout the plan formulation process. The technical studies and reports integral to the overall planning process were assisted financially and by in-kind contributions from the Federal Office of Coastal Zone Management, and the U.S. Army Corps of Engineers (COE). Most importantly, the participation and commitment of the Kawainui Marsh Technical and Policy Advisory Committee members are acknowledged and appreciated. The members are:

Hideto Kono, Chairman	Department of Planning and Economic Development (DPED), State of Hawaii
Frank Skrivanek, Co-Chairman	DPED
Ed Marcus, Staff	DPED
Gary Barbano	National Park Service
Sandra Braun	Lani-Kailua Outdoor Circle
Patricia Beggerly*	Department of Land and Natural Resources
Lorrie Chee	Department of Land Utilization
Brian Choy	Department of Health
Edgar Curtis	Ameron HC&D
Tom Fake*	National Park Service
George Houghtailing	Kaneohe Ranch (Consultant)
Kenneth Kupchak	Kailua Neighborhood Board
Bill Lennon*	U.S. Fish and Wildlife Service
James Maragos	Army Corps of Engineers
Earl Neller	Department of Land and Natural Resources
Jacqueline Parnell*	Department of Health
Muriel Seto	Congress of Hawaiian People
Robert Shallenberger	U.S. Fish and Wildlife Service
Gordon Soh	Department of Land and Natural Resources
Yukio Taketa	Department of Parks and Recreation
Ron Walker	Department of Land and Natural Resources

*past members

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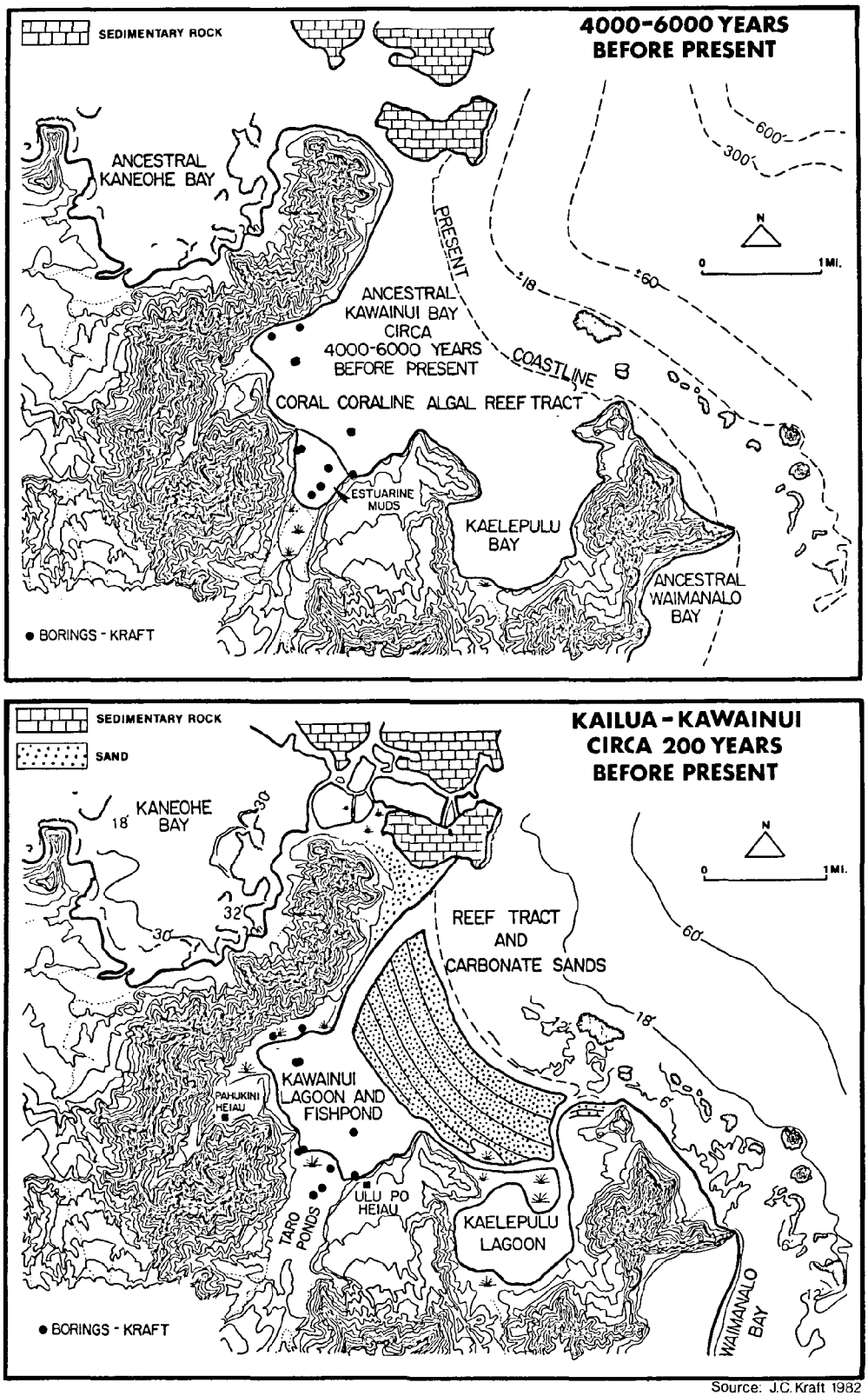


Source: J.C. Kraft 1982

These maps are taken from a forthcoming technical paper on the geomorphology of Kawainui Marsh. (John C. Kraft, University of Delaware)

PART I:
THE MARSH AS A MANAGEMENT PROBLEM

Kawainui Marsh is an established wetland system on the Island of Oahu whose existence and evolution has been investigated and recorded perhaps more than any similar system in the State. The continuing active interest of environmentalists, planners, developers, historians, scientists, and a broad spectrum of public organizations is evidence of its importance as a natural system and its significance as a public issue.

Considering its natural, cultural, and economic resource values, its prime location, and the mix of established and proposed uses, Kawainui Marsh offers a unique opportunity for coordinated long term multiple resource management. The potential exists for restoring and enhancing these values for greater benefit to the public.

This section provides the background for the Marsh as a resource management issue to establish the context within which development of this plan was undertaken

History

Active interest in this century regarding the use of Kawainui Marsh dates to 1939 when Congress instructed the U.S. Army Corps of Engineers to conduct a survey of the Marsh area and to assess its value as a flood control basin. The survey report, completed in 1941, recommended that the Marsh be used to protect the Coconut Grove area of Kailua from flooding. There are reports of major flooding in this area in the years 1921 and 1940. Action did not follow until the report was updated in 1948 and subsequently submitted to Congress. In 1952, one year after another major flood, Congress appropriated funds for the construction of a pilot flood control channel bordering the Marsh. In 1957, the Corps completed the design of the project.

The proposal for the comprehensive flood control project was held in abeyance until the early 1960s when Federal assistance for the acquisition of lands became available. The Federal legislation provided $360,000 to the City and County of Honolulu to purchase the Marsh basin. These lands were identified in a study by the City Planning Commission as desirable for a flood storage basin and a large open park.

As the City deliberated the purchase, however, private developers (Centex-Trousdale, Inc.) alternately devised a plan for the development of 4,000 homes on 200 acres, a 50-acre park and a 40 acre pond for the area. Dames and Moore, a soils engineering consulting firm, was contracted by Centex-Trousdale, Inc. to prepare a preliminary site investigation for development in and around the Marsh. The report indicated that a cautious approach was necessary for any development in the basin. The Centex-Trousdale initiative gained some support among the neighboring residents in view of the numerous complaints about the health dangers of the "malodorous" Marsh. The development proposal underwent a series of alterations in response to public reaction.

In 1964, however, the City and County of Honolulu decided to purchase, with Federal aid, 749 acres of the Marsh land from the Centex-Trousdale Corporation at a price of $1.2 million. The Corps of Engineers subsequently completed the flood control project by creating a 640-acre flood storage basin in Kawainui Marsh with the construction of a protective dike on the makai side of the Marsh and the widening of the channel to Kailua Bay.

The City's Department of Parks and Recreation conducted a series of public meetings during 1967 and 1968 with conservationists, recreationists and the general public to discuss and develop a master plan for the Marsh. A conceptual plan evolved from these meetings for a water-oriented recreational area with a 300-400-feet-wide channel, approximately three miles in circumference, around a Marsh wild life sanctuary. The periphery of the Marsh was proposed for fill to create active and passive recreational areas which could be inundated during a storm in order to satisfy the Corps of Engineers requirement for 3,000 acre-feet of flood storage capacity. Acquisition of 250 acres was proposed to expand the park from 749 acres to approximately 1,000 acres.

A General Plan amendment was initiated in 1969 to designate 1,000+ acres for park use in and around Kawainui Marsh. This amendment was discontinued as a result of a State Supreme Court decision in Dalton vs. City and County, wherein it was ruled that a comprehensive and long range plan was required to amend the General Plan. A subsequent application for amendment in 1973 was also precluded by a Circuit Court injunction against processing amendments until rules and regulations were adopted.

The Department of Public Works proposed that the filling of portions of Kawainui Marsh for recreational purposes should be accomplished with sanitary landfill. A pilot project was initiated in 1969. A consultant from the University of Hawaii monitored the effects of the landfill on the water quality of the Marsh. After three years of testing, he reported that, "the sanitary landfill did not increase the pollution of the water in the swamp".

In 1972, private developers filed a "letter of intent" to construct a shopping complex on 63 acres of Marsh land that had been targeted as the site for silting basins for the flood control project. In response, community groups actively voiced their objections against the proposed development and the use of the Marsh for sanitary landfill. The Ad Hoc Committee of the Outdoor Circle developed a slide show to generate public interest in

preservation of the Marsh as a wildlife sanctuary and nature park and organized an islandwide effort to gather support for their position. High school groups contributed funds to assist in renewed efforts to amass broader public support for the park alternative. At the same time, the City implemented its earlier plans for a large sanitary landfill project on the Western slope of the Marsh and developed a model airplane flying facility on previously reclaimed land on the Marsh floor.

In April, 1974, the State Legislature responded to this public concern by adopting resolutions urging the City to take "immediate action" on the regional park plan. Upon approval by the State Department of Land and Natural Resources (DLNR) for an application to use 750 acres of conservation land for recreation, the City resubmitted its proposal for a General Plan amendment to change 1,000 acres, including the 250 acres of privately-owned urban lands, from conservation to recreational use. In response, the landowners obtained an injunction against the proposed amendment.

In October 1974, the Land Use Commission initiated action to reclassify 224 acres of peripheral Marsh lands from urban to conservation. While the City Planning Commission recommended approval of the petition, the City's Chief Planning Officer opposed it on the basis that the boundary change would move the land out of City control.

Discussions in early 1975 between the City and community groups indicated that the City wanted to proceed with General Plan amendments that would support a broad range of land uses. The City agreed to compile limited baseline studies for an environmental impact statement. In conjunction with this, special interest groups combined to pursue an evolutionary plan from the studies and environmental assessments. The environmental information was not compiled nor were acquisition funds released.

As a result, the Outdoor Circle's Ad Hoc Committee sought technical assistance in pursuit of the development of a regional park. Its direction and interest differed from that of the City in the intended use of the lands within the 1,000 acres. The citizen effort focused principally on the area's use as a natural preserve with passive recreational and educational use, while the City pursued a plan for more active and diverse recreational uses and civic amenities.

The 1970s witnessed recurring efforts to return urban lands surrounding the Marsh to their earlier conservation designation. During the 1974 District Boundary Review, the Land Use Commission reclassified 50 acres near Kapaa Quarry (Docket 074-8) from the Urban to the Conservation District on the basis that the property was not suited for urban development, and would more appropriately be designated in the Conservation District. In 1978, the State Department of Planning and Economic Development petitioned the Land Use Commission for reclassfication of an additional 234 acres. While the petition was initially denied, an appeal led to the reclassification of 71 acres. Approximately 180 acres of urban zoned and privately owned land immediately adjacent to the Marsh basin remain and are proposed for residential development.

In July 1979, the National Registrar for Historic Places issued a "Determination of Eligibility Notification." The report found that the Marsh basin and peripheral slopes were eligible for listing in the National Register for Historic Places.

While the City denied a Special Management Area permit for a residential subdivision development on 181 acres in 1978, it subsequently approved a scaled down version for the development of 39 acres between the existing Kukunono subdivision and the Marsh basin in 1981. This prompted special interest organizations to seek redress through the court. Meanwhile, the developer has submitted a formal request for subdivision of the 39 acre site. The request cannot be accepted until conditions of the SMA permit have been met. As of October 1982, the conditions relating to archaeology have not been met and the subdivision request has been returned to the applicant.

The Olomana-Maunawili sewer collector project, initiated in the mid-seventies, resurfaced in 1980. It involves the construction of a 10,200-foot sewer line within a trench excavated along the east end of Kawainui Marsh to serve existing and future residents of the area. Since a U.S. Army Corps of Engineers permit was required, consistency with the objectives and policies of the Hawaii Coastal Zone Management Program was also necessary. As administrator of the Federal consistency provisions of the National Coastal Zone Management Act of 1972, as amended, the Department of Planning and Economic Development issued a conditional concurrence of the project. The conditional concurrence would have disallowed the proposed collector from serving or supporting further urbanization of lands surrounding the Marsh within the primary study area of the plan. The DPED concurrence was predicated to a large extent on the Memorandum of Agreement between the U.S. Army Corps of Engineers, the Environmental Protection Agency, and the State Historic Preservation Officer, Department of Land and Natural Resources to protect and mitigate for archaeological loss of resources in the proposed construction area. As the result of new information contained in the baseline studies of this plan, the DPED has recently informed the City and County and the Corps that the proposed Marsh alignment of the sewer collector is inconsistent with the objectives and policies of Chapter 205A. In September of 1982, the Corps of Engineers denied the wetland permit. Their decision took into account the Marsh's importance as a wetland, a wildlife refuge, historic and prehistoric agricultural setting and its symbol of traditional Hawaiian culture.

Significant National Legislation

A history of the forces affecting the use of Kawainui Marsh would be incomplete without reference to national legislative initiatives which provided substantive and fiscal basis for much of the renewed efforts to protect and manage Kawainui Marsh.

Title VII of the Housing Act of 1961 provided financial assistance to the City for acquisition of 750 acres of the Marsh floor. While the Federal government's initial approval for acquisition was for park and recreational use, the authorizing resolution of the City Council in 1963 was for open space.

The National Historic Preservation Act of 1966 established a national Advisory Council on Historic Preservation to review Federal project impacts on historic sites. It also provided for the establishment of an historic preservation office and review board in each state. The Act provided a 50 percent reimbursement program to the State to help cover the costs for preparing State inventories, proposing nominations and pursuing acquisition of historic sites. Additionally, the American Indian Religious Freedom Act of 1978 expanded on the definition of historic sites to include those sites having religious significance.

In 1969, Congress passed the National Environmental Policy Act which required environmental impact statements for Federally assisted actions with potential environmental impacts. The objectives of this Act were: to create and maintain. . . productive harmony (between) man and nature; to establish a Council on Environmental Quality which among other things is to review the environmental impact of all Federal programs; and to require detailed statements of environmental impacts of proposed activity.

The Water Quality Improvement Act of 1970 provided direct sanctions and techniques for the control of discharges of particular pollutants and other hazardous substances. The Clear Air Act of the same year established rigid deadlines for auto emissions and provided standard-setting authority to the Federal government and the States. It also included a provision for the establishment of noise management criteria.

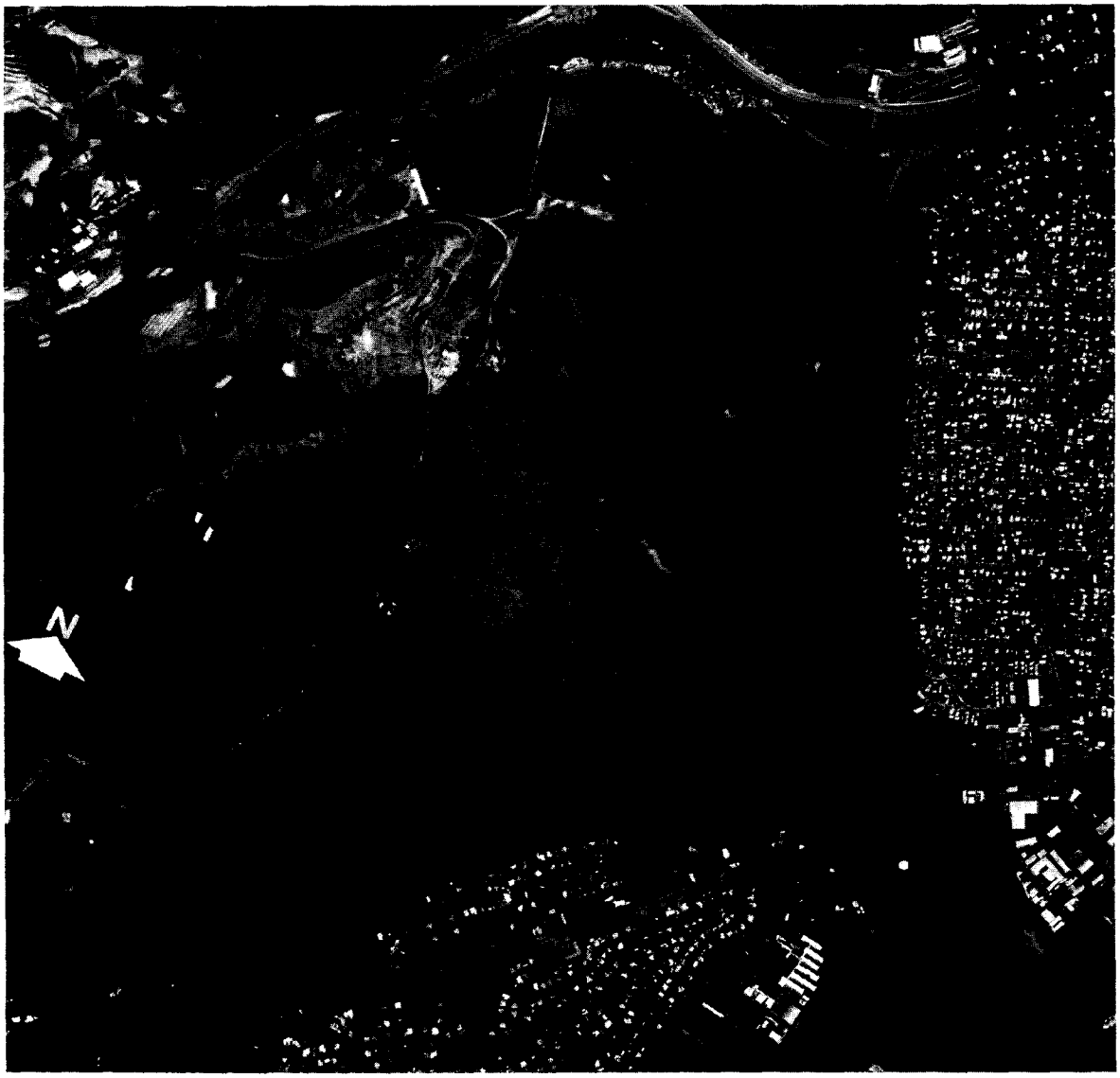
In 1972, Congress enacted sweeping amendments to the Federal Water Pollution Control Act. Chief among these were the National Pollutant Discharge Elimination System and the establishment of a construction grants program to build municipal sewage treatment plants.

The Coastal Zone Management Act of 1972 focused its policies on previous environmental legislations dealing with the Nation's coastal zone. National policy was declared: 1) to preserve, protect, develop, and where possible to restore or enhance the resources of the Nation's coastal zone for this and succeeding generations; 2) to encourage and assist the States to achieve wise use of the land and water resources of the coastal zone giving full consideration to ecological, cultural, historic, and aesthetic values as well as the needs for economic development; 3) to encourage the preparation of special area management plans which provide for increased specificity in protecting significant natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, and improved predictability in governmental decision making; and 4) to encourage the participation and cooperation of the public, state and local governments. . . in carrying out the purpose of the Act. Funding provided by this Act was expended for the preparation of this plan.

The Endangered Species Act of 1973 recognized a nationwide need to protect endangered species. It defined criteria to guide Federal action with respect to impacts on endangered species. It also established the criteria and means for future cooperation between States and the Federal government and offered Federal funds to conduct State programs and develop management plans. In carrying out the intent of the Act, the U.S. Fish and Wildlife Service defined a program for the establishment of wildlife recovery teams at State and interstate levels to develop recovery plans for identified endangered species. Hawaii's teams were organized in 1975, and thus far, two recovery plans have been prepared and approved. In the Waterbird Recovery Plan, Kawainui Marsh is identified as a high priority recovery area.

These environmental management programs included provisions to encourage or require the participation of the various States. Hawaii elected to participate in all of these federally initiated programs and has established offices, divisions and programs to carry out these mandates. State programs were established within two to three years after passage of the National Laws. (Statutory references, including implementing ordinances of the City and County, are provided in Appendix D.)

The aerial photos on this and the following page provide evidence of the extensive urbanization around Kawainui Marsh during the period 1945-1981.The absence of open water in the earlier photo is attributable to the pumping and transport of Marsh water to Waimanalo for agricultural irrigation—a practice discontinued in the early fifties (U.S. Army Corps of Engineers, Pacific Division).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The Planning Process

Formulation of a Technical and Policy Advisory Committee

In April 1979, the Outdoor Circle submitted a proposal for funding to the Department of Planning and Economic Development's (DPED) Hawaii Coastal Zone Management (CZM) Program to develop a management plan for Kawainui Marsh. The intent of the proposal was to follow the "evolutionary" concept espoused by the Ad hoc Committee for Kawainui Marsh five years earlier.

The State CZM Program met with the Outdoor Circle and other government agencies to decide on a three-year program for the preparation of a resource management plan for Kawainui Marsh. To assist in this effort, a multi-disciplinary advisory body representing a broad spectrum of special interests was created by the Director of DPED. It consisted of representatives from the three levels of government, community organizations, land owners and principal industrial interests in the Marsh area.

Committee Process

The goals and objectives of the Committee process were initially defined and subsequently modified as follows:

Goal: Develop and obtain approval for an effective and implementable resource management plan that reconciles existing conflicts and resolves principal resource management issues that have been identified in past discussions and current resource studies of the Marsh.

Objective: Complete technical studies of the Marsh which are identified as essential to the completion of a plan.

Objective: Develop specific management strategies for the Marsh resources incorporated in the resource management plan, including:

- Specific strategies which recognize and are coordinated with identified resource values.
- Related land use indicators, including permissible or non-permissible uses of land.
- Identification of the geographic area to be included in specific resource management plans.
- Recommended changes in property ownership or control.
- Specific implementation measures relative to authority and regulation of management measures.
- Procedures for the ongoing monitoring and enforcement of the management program.

Objective: Consensus among Committee participants and the public on recommendations submitted to the Governor.

The initial task of the Committee was to compile and review a vast amount of existing reports and technical studies on the various resources of the Marsh. This task was done by organizing the Committee into three groups: scientific/environmental, cultural, and economic/planning. Each group identified information gaps in available resource data and defined specific studies that were essential to the completion of the goals and objectives of the Committee process.

Although a long list of studies and information needs was developed, funding limitations required a distinction between those studies that were essential and those that could be deferred. The studies selected and completed were:

1. "Nutrient and Suspended Solids Budget for Kawainui Marsh," by AECOS, Inc.—survey of nutrient budget and net primary production.
2. "Historical Study of Kawainui Marsh Area," by Marion Kelly and Barry Nakamura, Bishop Museum—archival search of written cartographic and photographic records.
3. "Archaeological Excavations in Kawainui Marsh," by Jane Allen-Wheeler, Bishop Museum—pre-and post-contact archaeological exploration on the Marsh floor.
4. "A Survey of Waterbirds of Kawainui Marsh," by Sheila Conant, Ph.D.—population density and distribution of birds.
5. "An Analysis of the Aesthetic Significance and Potential of Kawainui Marsh," by Nick Huddleston—summary of aesthetic values and viewplanes.
6. "Appraisal Report for Kawainui Marsh," Mitsuo Shimizu—real estate appraisal of private lands surrounding the Marsh floor.
7. "Photo Base Map, Kawainui Marsh Area," Scale 1" = 300', 1981, R.M. Towill for Army Corps of Engineers—ortho-photo basemapping of primary area compiled from recent aerial photography.
8. "Summary of Federal, State, and County Statutes, Regulations, and Ordinances Applicable to Marsh Management," Department of Planning and Economic Development—review and summary of laws and regulations.

The studies were completed in 1981 and circulated for review and comment. The subsequent plan development process included presentations and reactions by the contractors. Each contractor discussed the

activities and values in their particular study area in terms of the geographic boundaries and sites important to management considerations.

In order to organize the results of the studies and compile and present the recommendations of the consultants, the information was presented in two formats:

- Graphically, through resource maps which were overlaid on the new base map, and
- Narratively, through abstracts and summary recommendations developed from each report.

The Committee derived its recommendations with the aid of composite resource overlays. The primary study area was described in terms of singular resource values, combined resource values, and areas where incompatible resource values were indicated. Particular focus was given to those land/resource areas where incompatible use values were identified.

Resolution among conflicting resource values was accomplished mainly through the preparation of a list of all potential uses and a corresponding list of alternative solutions which encompassed the range of conflict. The alternatives were ranked. The resultant compilation has been used as the basis for the Committee's management recommendations in areas where existing or allowable uses are incompatible. Twelve geographic areas with incompatible resource values were identified.

The plan development process was initially conceived as one in which the Committee could reach a full consensus on their recommendations through mediation proceedings. Prior to ranking the alternative solutions, the Committee members from both government and community organizations expressed concern that their participation and individual ranking should not be construed as a representation of their respective organization positions with respect to pending permits or approvals. Without the authority to represent their organizations it was not possible to follow mediation procedures, and therefore, the body of policies and recommended actions were achieved through negotiations and represent only a general consensus.

In order to formulate management policies for the major resource components of the management plan, the Committee was divided into three subcommittees. Each was asked to draft management policies based upon the Committee's ranking of preferred alternate actions with respect to the 12 geographic areas, the information provided in past and current studies, and recommendations of the consultants.

PART II:
OVERVIEW OF THE MARSH SYSTEM

At the outset, planning for the Marsh was viewed from three perspectives: economic, ecological and cultural. Each constitutes a component of this plan.

While the plan does not provide all of the technical information desirable for multiple resource management, it provides the basis for near term implementation of management measures and identifies areas where longer term studies and monitoring should be focused.

Economic

The Marsh chronology during the fifties and onward, indicates a reoccurring interest in urban development of the Marsh floor and surrounding upland slopes. Reclamation of the wetlands was viewed as a means for providing land for housing and other urban uses for an expanding suburban population in a desirable coastline community. The issues during this early period were focused on housing development versus open space and park use. In the Sixties and Seventies, however, following landmark Federal legislation relating to open space, endangered species, water quality, historic resources and coastal zones, the Marsh debate took on greater meaning and complexity.

This complexity is reflected in the records. As a result of this broadened perspective, the issues evolved from maximum utilization of a resource versus preservation of open space to a question of incremental development versus careful assessment and management of multiple resources. Economic issues relating to land and water use still remain central to a broader development perspective. Land and water use, however, are strongly influenced by the ecological and cultural components of the plan.

Although there was a desire to compile cost/benefit analyses for alternative land uses, particularly for housing, commercial, and industrial uses, this was not done. Prior studies on land reclamation (Dames & Moore) indicated that extensive reclamation would be expensive and ill-advised in areas within the wetland. Given the mounting evidence and emphasis of other resource values and the availability of other lands for urban uses, the approach shifted to evaluating the impact of existing uses and assessing the merits of urban expansion versus enhancement and preservation of other resource values.

The economic component is not a typical land use plan outlining and detailing land use areas. Rather, it provides economic policy guidance from a broad perspective and establishes a basis for subsequent development plans, zoning, and development codes that impact the Marsh area.

Ecological

The ecological component of the plan provides detailed and specific policies for management of the natural resources within the study area. The largest volume of existing data pertained to elements of the ecological component, much of which was derived from earlier studies in the form of environmental assessments and impact statements. Because some of the data were dated or incomplete, it was necessary to update the information on waterbird and other wildlife habitat, to examine available data on water quality, and to develop a definitive overview of the nutrient budget.

The records indicate that environmental and ecological concerns surrounding the Marsh span perhaps 20 years. Although very little has been done to alter the impacts on wetlands and habitat, it appears that the established value of the Marsh as a flood basin has contributed to its preservation.

Among the three components of this plan, the ecological aspect has been most subject to change. There are indications that this change has been accelerated in the last several decades. The count and distribution of waterbirds, for example, have been reduced. In addition, the surface of the Marsh has been altered by sedimentation and accelerated plant growth stemming principally from the input of nitrogen and phosphorus by sewage treatment plants.

These changes can be decelerated by implementing some of the management policies offered in this plan. There is also the potential for reversing the past alteration of the Marsh surface, particularly with respect to improving wildlife habitat. The success of these measures cannot be assured; however, it is clear that deceleration of the buildup of nutrients which support rapid vegetation growth in open water areas, for example can be accomplished by discontinuing the dumping of sewage effluents directly into the Marsh. Because certain impacts on the ecological elements are not easily reversed, the management policies of the ecological component have an immediacy not present in other components of the plan.

The policies and recommended implementing action are provided in five elements of the ecological component. They relate generally to habitat protection, enhancement, and management and to quality and quantity of Marsh waters which are crucial to the Marsh's survival.

Cultural

The cultural component has benefited greatly from research, field surveys, and studies compiled within the last decade and especially during the period of the plan process. The body of cultural information has also been augmented not only by specific studies commissioned by the DPED, but through privately funded research related to development activities within the district as well. While the cultural data are not complete (policies of this component call for additional study) there are new data on carbon dating from early Hawaiian sites, uncovered artifacts, and emerging perspectives of cultural systems that were not previously available.

Through fortuitous research and study by a renowned geologist, there is additional information on the geomorphic evolution of the Marsh and its surrounding area. There is now evidence that the Marsh was once a bay open to the Pacific Ocean. The ancestral Kawainui Bay of some 4,000 to 6,000 years ago altered to a lagoon somewhere between the third and sixth century A.D. With this information, it has been theorized that the early Hawaiians may have accelerated Kawainui's evolution from lagoon to marsh through the construction of fish ponds and taro walls to impede the flow and ebb of both fresh and sea waters through the lagoon. While the walls of the fish pond have not been located, further research could add to the mounting evidence of the presence of the early Hawaiians and their manipulation of the environment.

This research led to the identification of three areas of interest for further archaeological study: 1) the nature of the early inland occupation around the Marsh; 2) the nature of the environment at the time of the initial occupation; and 3) changes in settlement and land use over time as a result of human occupation in the Kawainui vicinity.

While this information is more significant to management of the cultural component of the plan, it also provides basic knowledge which can be useful in the ecological and land use components.

Interrelationships Among Components

Over the years that the Marsh has been viewed as a planning and management issue, the interrelationships among the resources of the Marsh have become more evident and complex. For example, it was assumed that sewage effluent played a dominant role in the rapid vegetative overgrowth in the open water areas. Accordingly, a nutrient budget was developed by measuring total inputs to and outflows from the Marsh (black box method). This study provided specific information about the relationship between nutrients and vegetative growth, which in turn led to the formulation of management policies in two components of the plan. Because of similar interrelationships in other resource areas, it was clear that a study of the Marsh resource values would require exchange and coordination among the investigators.

Coordination among the various resources addressed in the plan benefited from the diverse composition of the Committee. This composition itself essentially reflects an interdisciplinary approach to Marsh management. During the planning process, subgroups were formed to organize pools of related skills and backgrounds. The output was discussed by the entire Committee and, invariably, modifications were made to reflect the perspectives of the other subgroups.

In the final phases, it was evident that the ecological and cultural components of the plan were reasonably compatible. Management policies for one could often be stated in similar terms for the other. Conflict in the economic component was understandably the most evident. It was clear that expanded urban development in the primary study area would in many cases preclude present and future management opportunities for ecological and cultural resources. Therefore, the major thrust of the management policies contained in this plan is directed toward preservation and management of ecological and cultural resources.

PART III:
THE MANAGEMENT PLAN

BOUNDARIES OF THE MANAGEMENT PLAN

The Kawainui Marsh system consists of numerous resource values. Most of the known resources are concentrated in and around the Marsh floor. As part of a larger system, however, the Marsh should be viewed as a focal point for the Kawainui Watershed—easily impacted ecologically, economically and culturally by activities within the watershed and to a lesser extent the Koolaupoko District.

For this reason, two areas and two levels of management are envisioned.

Primary Area

The policies of this plan apply principally to the primary area. The geographic boundaries of this area are defined as all lands bounded by Kapaa Quarry Road on the West and North, the Coconut Grove Drainage Canal on the East, and Kailua Road—from the bridge crossing the Canal to its junction with Kapaa Quarry Road—on the South.

Secondary Area

The land area outside of the primary area and within the Kawainui Watershed is defined as the secondary area.

It is evident that the quality of the water regime that supports the Marsh, and upon which other resources are dependent, is influenced by activities in the watershed above the Marsh. In turn, the Marsh impacts upon the receiving waters of nearby Kailua Bay.

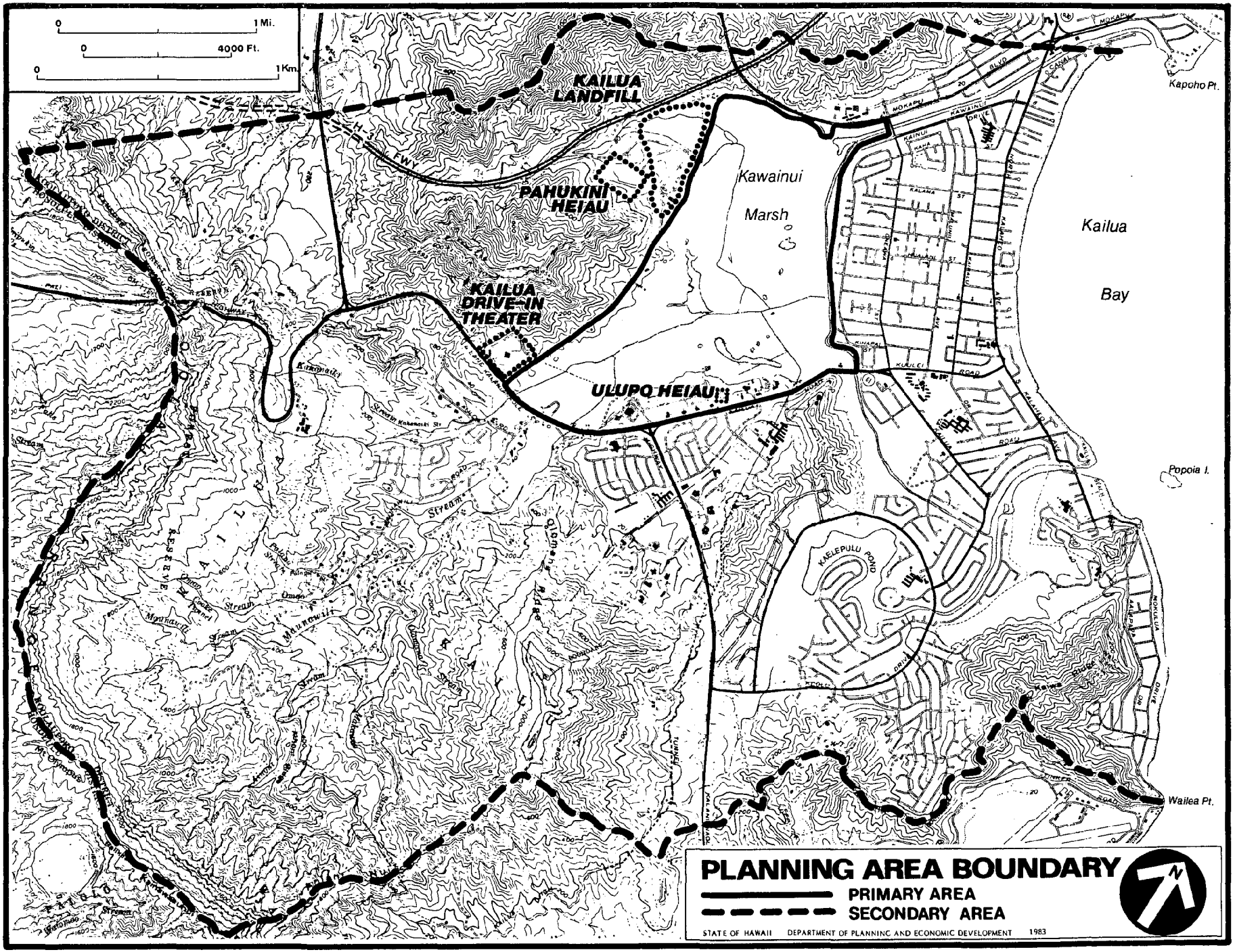
This broader system approach gains additional importance from recent research on the geomorphic origins of the Marsh. It is further supported by the strong interrelationships in both the cultural and biological systems of the primary area and the remaining watershed.

BROAD GOALS AND OBJECTIVES OF THE PLAN

The formulation of the broad goals and objectives for the Kawainui Marsh Resource Management Plan was evolutionary. Part I described the process goal and objectives through which the Committee evaluated the need and parameters for a resource management plan. The Committee concluded that the overall function of the plan was to: "Characterize and manage the primary area of the Marsh and where appropriate, the secondary area, as a natural heritage area which is to be acquired, zoned, and utilized for its intrinsic recreational, cultural/ archaeological, religious, educational, open space, wildlife and economic values."

The formulation of the substantive goal and objectives of Part III evolved from the resource assessments and defined values in each resource area.

Goal:	Provide for short- and long-term protection, enhancement, and use of identified natural, cultural, and economic resources of Kawainui Marsh in a manner consistent with the greatest public good.
Objective:	Provide a comprehensive and coordinated land and water management plan which is consistent with the economic values of Kawainui Marsh.
Objective:	Protect, maintain, and enhance identified wildlife species, their habitats, and related ecological systems.
Objective:	Protect, preserve, and enhance cultural, educational, and recreational values at Kawainui Marsh.
Objective:	Provide ongoing coordination, review, and implementation of the policies and implementing actions of the plan in a manner consistent with the objectives and policies of Chapter 205A (HRS).


0 1 Mi.
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KAILUA LANDFILL
H-3 FWY
PAHUKINI HEIAU
KAILUA DRIVE-IN THEATER
ULUPO HEIAU
Kawainui Marsh
Kailua Bay
Kapoho Pt.
Popoia I.
Wailea Pt.
KAELEPULU POND
PLANNING AREA BOUNDARY
PRIMARY AREA
SECONDARY AREA
STATE OF HAWAII DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT 1983

OBJECTIVES, POLICIES AND IMPLEMENTING ACTIONS OF THE PLAN

The objectives, policies, and implementing actions of this plan are organized under the three broad resource components: economic, ecological and cultural. The policies and implementing action under each component are essential to ongoing management of the Marsh. While some of the policies and implementing actions provide for the protection and preservation of specific existing resources, others relate to resource enhancement for the improved enjoyment and use by the public.

Economic Resources

The economic component provides a general perspective of the overall management concerns of the plan. The policies and implementing actions relate to land uses, sources and controls of contributing waters, land ownership, recommended acquisition of private lands deemed essential to the protection and management of resources identified in the other components, an assessment of the existing authorities and controls, and the recommended administrative measures for plan implementations.

Objectives

- Protect compatible natural, cultural, and economic resources through management and control of existing and future land uses.
- Provide for public use and enjoyment of the existing and potential resources of the Marsh.
- Provide for a centralized and consistent means for reviewing and regulating land use and development in the primary study area.

Management Elements

A. Land and Water Use

Problems, Needs, Opportunities

The Marsh and its peripheral areas are currently used for flood control, a wildlife sanctuary, scenic and open space vistas, recreation and education, and historical and cultural values. It is a unique ecosystem that requires preservation, protection, management, and regulation. Competing or conflicting uses (either existing, proposed or presently permissible) include cattle grazing, an auto dump, landfill, sewage discharge, a collector sewer, housing development, and limited recreation, research, and education.

There is a need to resolve existing and potential conflict among the identified and proposed uses and to develop a plan to ensure survival of the Marsh and its various values to the community. An integrated approach to management is necessary, therefore, to ensure that the existing resource values are maximized to their fullest potential in a manner which benefits a full range of uses for the public.

Policies

1. Existing housing, churches, the hospital, and the YMCA which are within the primary study area, are recognized as established uses. Expansion of these facilities should not be permitted where they are in conflict with the policies and implementing actions of this plan.
2. Existing economic activities within the primary area that are incompatible with recommended land uses of this plan should be removed.
3. Wetland agricultural use of the Marsh should be encouraged where it would serve to promote historic restoration or improve the waterbird habitat.
4. Public recreational use of the Marsh should be encouraged consistent with the protection of wildlife and habitat and cultural resources.
5. Development of the Marsh should combine active and passive uses associated with the public enjoyment of open space, wildlife, flora, and cultural experiences.
6. To minimize predation of ground nesting birds, open land in the primary area should not be planned or zoned for residential, or other uses which support expanded domestic or feral animal populations.

Recommended Actions

1. Remove the auto dump from the primary area.
2. Relocate existing industrial uses situated on the Marsh side of the Quarry Road.
3. Establish 200-foot primary buffer zones surrounding existing and proposed wildlife habitats on the Marsh side of the Quarry Road and adjacent to Ulupo Heiau.

Kawainui Marsh is framed by Mokapu Blvd. and the incomplete H-3 on the left and bottom of the photo. The auto wrecking operation extends along the north boundary (bottom) and into the wetland of the Marsh. The Kawainui Drainage Canal begins at the left center of the photo (U.S. Army Corps of Engineers, Pacific Division, July 1982).

4. Establish 50-foot secondary buffer zones along the remaining perimeter of the primary study area.
5. Restore identified early Hawaiian taro patches (fields) in the areas near Ulupo Heiau and between Maunawili and Kahanaiki Streams.
6. Explore the economic viability of taro production in the wetland portions of both the primary and secondary areas.

B. Controls and Coordination

Problems, Needs, Opportunities

Under current regulatory controls, all three levels of government have direct regulatory authority within and around the Marsh. There is also a clear geographic overlap of authority. As an example, at the Federal level the Corps of Engineers has direct review and approval authority for activities which result in the discharge of dredged or fill materials into wetlands. It should be noted that the jurisdictional boundaries of the wetland have not been precisely or completely delineated. The wetland, however, appears to lie entirely within the Special Management Area (SMA) boundary administered under Coastal Zone Management (CZM) related ordinances by the City and County of Honolulu. Similarly, the State has specific regulatory authority over the State Conservation District which is also situated within the SMA boundary. In addition, the State is also responsible for monitoring a broad range of activities for compliance with the legislative CZM objectives and policies. The geographic boundaries for this latter responsibility encompass the entire primary and secondary areas.

The vast array of governmental responsibilities in resource management have not been coordinated nor enforced systematically in the management of the Marsh resources, nor is there an inter- or intra-departmental forum through which multi-resource management can take place. Effective plan implementation will require adequate provisions for the proper coordination and enforcement of these regulatory activities, including the simplification and streamlining of procedures for reviewing and processing activity proposals within the Marsh area. More importantly, there is a need to provide a centralized coordinative mechanism through which consistent protection, enhancement, and use of Marsh resources can be assured.

Policies

1. No structures in the primary area, above or below grade should be allowed, unless such structure is specifically identified as an implementing action of this plan.
2. In opening freshwater areas within the Marsh, consideration should be given to the effects of dry weather on stream flow and evaporation rates.
3. Opening or enlarging of brackish or saltwater areas should be minimized to prevent saltwater intrusion into the Marsh and resulting adverse effect on present estuarine areas.
4. To avoid a reduction in the flood retention capacity of the Marsh basin, landfilling should not be permitted.
5. The integrity of the Marsh as a flood control and sedimentation basin must be maintained to the maximum extent feasible to protect the Kailua town area from flooding and to maintain the quality of near-shore waters.
6. Development on the slopes overlooking the Marsh and Kapaa Valley should be examined for potential adverse impacts on a case-by-case and cumulative basis in conjunction with the resource values identified in the policies of the Plan.
7. Specific land areas within the Marsh should be maintained for the protection and propagation of endangered birds.
8. The present stream flow into the Marsh should not be diverted where such diversion will negatively impact the resource management opportunities encompassed by the policies and recommended actions of this Plan.

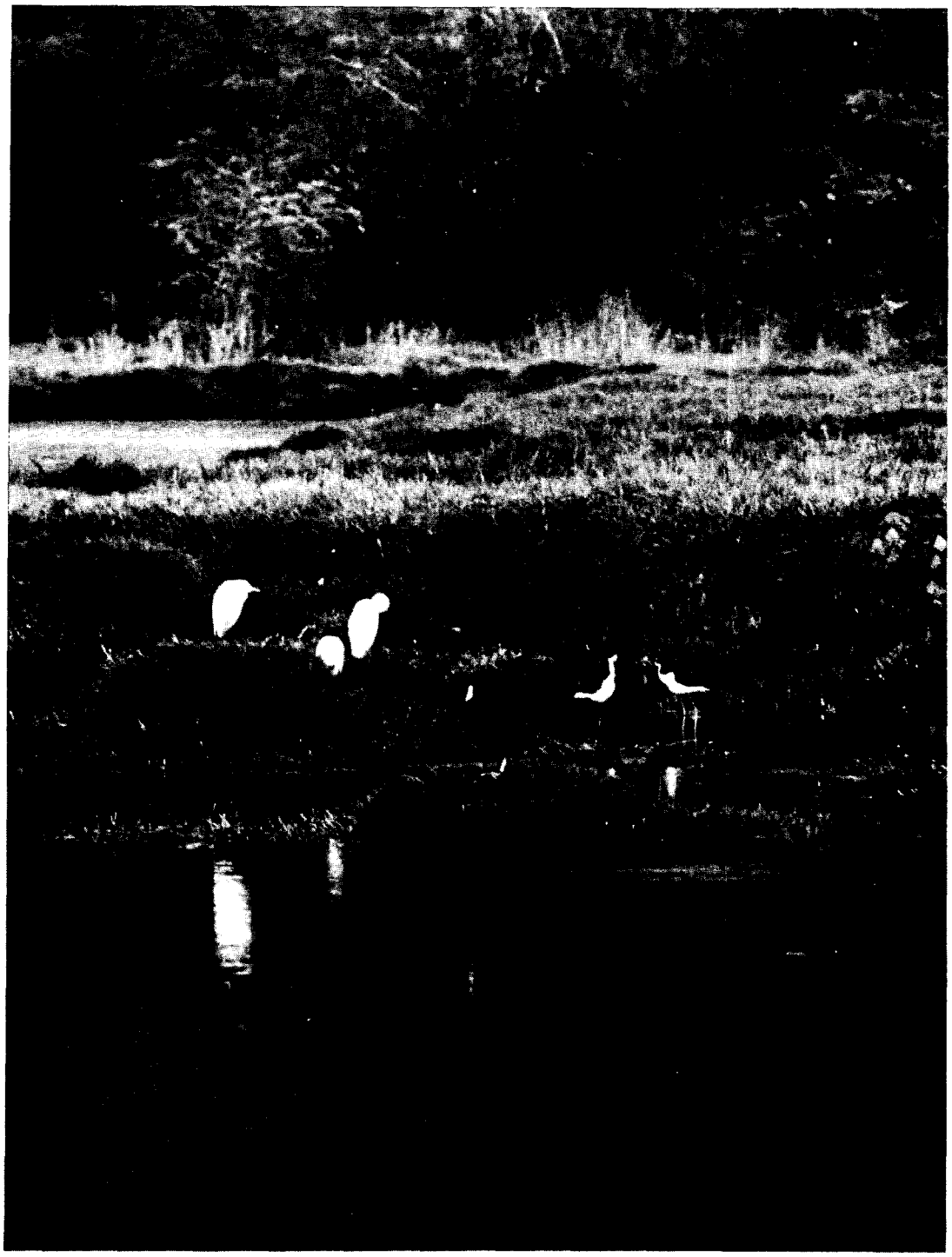
Recommended Actions

1. Purchase all privately-owned land within the primary area, with the exception of the existing subdivisions and hospital, and reclassify them to conservation or preservation use.
2. Exchange, transfer, or by other means give authority over all publicly owned lands within the primary area to the State for its administration.
3. Clear Marsh publicly owned lands of trash, hazards, and other debris, and maintain such a program.
4. Create a security system for the Marsh area to assure peaceful enjoyment by the public.
5. Construct and properly maintain perimeter fences along the Quarry Road to discourage dumping, illegal activities, and predators, and to control unauthorized entry into the Marsh.
6. Investigate the technical feasibility and land use consistency of establishing a specific sedimentation area in the Marsh basin.
7. Delineate the entire wetland boundary of the Marsh.

This photo was taken after a period of heavy rain and captures the resultant increase of silt-ladened water flowing through the Marsh. This area, usually choked with vegetation during drier periods, is recommended as a principal water-bird habitat.
(U.S. Army Corps of Engineers, Pacific Division, July 1982).

8. Acquire those lands in the secondary area that will fulfill the other policies and implementing actions of this plan, including an access trail to Pohukini Heiau and lands related to other historic sites.
9. Investigate the feasibility of realigning the Northeast portion of the Quarry Road in order to maintain access to existing landfill and quarry operations and improve public access and use of other recommended features of this plan.
10. Appoint a multi-sector Kawainui Marsh Advisory Committee to monitor implementation of the Marsh management plan by the lead agency and assisting agencies and to provide continuity from the planning phase through the implementation phase of the project. In addition this body would assist in the evaluation of management plan policy additions or revisions arising from its own initiatives or those of public agencies and organizations.

Two of the four species of endangered Hawaiian waterbird found at Kawainui Marsh—the alae ke'o ke'o (coot) and the ae'o (stilt)—pose for an unknown photographer as if on cue. The white bird is a cattle egret.



Ecological Resources

The ecological component primarily addresses the technical aspects of restoring, protecting, and enhancing the Marsh as a habitat for identified flora and fauna. Water quality is an important element of the ecological component. The policies and implementing actions address both quantity and quality of fresh water entering and circulating through the Marsh. They also address potential overlaps and coordinative opportunities with elements of the other components, particularly with regard to education, recreation, interpretive uses, and agriculture. Five principal elements are identified and addressed.

Objectives

- Protect waterbird species and enhance their habitats.
- Protect identified stream, estuarine, and terrestrial wildlife and fish and enhance their habitats.
- Improve and maintain the water quality of the Marsh.

Management Elements

A. Waterbird Habitat: Primary Endangered Wildlife Areas

Problems, Needs, Opportunities

Kawainui Marsh presently provides an important habitat for four endangered species of native Hawaiian waterbirds. The Marsh has nearly unlimited potential for improvement as a waterbird habitat, partially because of its large size. Problems which limit existing and potential waterbird use include: vegetation/aquatic weed encroachment into valuable open water areas, human disturbance, predation, fluctuating water levels, limited access to food, public attitudes, and sedimentation. There is a need to restore and enhance existing habitats, develop new ones, and insure that competing or disturbing activities are located away from them.

Public use areas should be separated from waterbird areas which are designated as primary and sensitive in order to facilitate both the wildlife and human uses of the Marsh which are proposed in this plan.

Policies

1. The natural water levels in the Marsh basin should be maintained in order to protect waterbird habitat and support potential agricultural activity.
2. Human access should be regulated in order to minimize disruption of identified habitats.
3. Preferential measures should be established to enhance habitat for endangered species, especially koloa, gallinule, and coot.
4. Growth of food species preferred by waterbirds should be encouraged.

Recommended Actions

1. Reestablish existing waterbird habitat by removing excess vegetation to create 20 acres of open water (total of 40 acres of habitat, including vegetated nesting and escape areas).
2. Conduct an ongoing program for the control of water hyacinth and water lilies through ecologically acceptable chemical or mechanical means.
3. Control by mechanical means California grass in areas surrounding water hyacinth.
4. Implement mechanical measures to control cattails along primary drainage areas that are not part of primary waterbird habitats.
5. Enlarge waterbird habitat (described in No. 1 above) by removing additional excessive vegetation to create a total of 50 acres of open water (total of 100 acres of habitat including vegetated nesting and escape areas).
6. Implement predator control measures (moats, traps, fencing, etc.).
7. Design and implement a program for the protection of wildlife through posting and surveillance of habitats.
8. Expand the waterbird habitat to 150 acres by clearing areas that extend from the 50 acres of open water (described in No. 5 above) toward the floating mat at the Eastern end of the Marsh (total of 300 acres of habitat including vegetated nesting and escape areas).
9. Establish an access route to Na Pohaku O Hauwahine (Kridler's Rock) for observing waterbirds and other compatible cultural uses.
10. Develop waterbird habitats in conjunction with interpretative uses in areas such as Hamakua Drive, the ITT parcel, and other areas.
11. Incorporate interpretive waterbird habitat features into taro/agriculture areas.
12. Develop nature walks along the flood control levee and other areas.

B. Terrestrial Wildlife and Vegetation Habitat

Problems, Needs, Opportunities

Upland areas adjacent to Kawainui Marsh provide habitats for many terrestrial plants and animals, most of which are non-indigenous species. It was generally agreed that improvement of the terrestrial habitat to support indigenous and Polynesian introduced plants and other indigenous and non-indigenous birds should be pursued. Improved areas could provide study areas for ethnobotanical plants and enhance the aesthetics of scenic, agricultural, and recreational areas. Terrestrial vegetation also provides acoustic and visual barriers within buffer areas. In general, there should be a program to control undesirable species, accommodate desirable ones, and integrate terrestrial species within appropriate components of the plan.

Policy

1. Desirable terrestrial vegetation and wildlife species should be promoted and accommodated in recreation/park areas, agricultural lands, interpretive centers, buffer zones, educational displays and scenic/aesthetic resources and viewing areas to complement the objectives and policies of this plan.

Recommended Actions

1. Develop an ethnobotanical garden adjacent to proposed taro fields and within the old landfill area occupied in part by the model airplane field.
2. Koa haole and other undesirable species should be removed in areas where they pose a nuisance or compete with other more desirable species and resource values such as scenic view points and view planes.

C. Stream Habitat

Problems, Needs, Opportunities

For over a century, the quality of habitat for streams discharging into Kawainui Marsh has been significantly and in part irreversibly degraded. Indigenous stream fauna and vegetation have been replaced by exotic species, and endemic migratory (diadromous) species can no longer utilize Kawainui Marsh for access to and from the ocean. In recent decades, two sewage treatment plants began discharging into Maunawili Stream, which flows into Kawainui Marsh. Considerable quantities of sediments have been transported by Maunawili and Kahanaiki Streams into the Marsh basin. The middle reaches of the streams have been channelized. Despite the severity of these changes, the potential for improving the water quality and public use/value of the contributing streams still exists. In particular, the streams could be incorporated as part of an overall interpretation concept involving the Marsh and its hydrological inputs and outputs.

Policies

1. The quality of habitat of streams discharging into the Marsh should be improved to encourage the natural recovery of the Marsh and passage of endemic migratory species.
2. Existing grading and erosion control ordinances should be enforced and special conditions applied to minimize sedimentation impact from urban development in the Maunawili Heights area.

Recommended Actions

1. Expand stream courses by removing vegetation from their entrance into the Marsh downstream to connect with open water habitats.
2. Clear the accumulations of high grass at the stream mouth between the Kailua Road bridge and the small City and County park upstream to improve habitats.

D. Estuarine Habitat

Problems, Needs, Opportunities

At present, the Oneawa Channel and the immediate upstream portion of the Marsh adjacent to the channel is presently an estuarine habitat. This habitat has potential value for recreational fishing (aholehole, mullet, barracuda, o'opu, lizard fish) and has existing value as a habitat for stilt, a flood-way for the existing flood control project and a watering area for seabirds (frigate birds). Factors limiting the abundance and distribution of species in the habitat include: bathymetry, tidal circulation, growths of emergent vegetation, and freshwater discharge rates from the marsh into the canal. In particular, emergent vegetation or floating vegetative mats serve as a barrier to increased mixing of marine waters within the marsh. The estuarine habitat could be expanded to improve opportunities for recreational fishing and other uses. On the other hand, the increased intrusion of salty marine waters into the Marsh could inhibit the growth of certain emergent vegetation intolerant to salt water and reduce feeding and other habitat areas for waterbirds.

Policies

1. Any alteration of estuarine habitat which may impact emergent fresh-water vegetation should be preceded by impact assessments.
2. Alteration of estuarine habitat should not impact existing or proposed waterbird habitats identified in this plan.
3. The present balance between fresh and marine waters in the Marsh should not be altered by mechanical or unnatural means unless supported by other policies of the plan

Recommended Actions

1. Implement studies to determine feasibility of developing interconnecting boating trails between fresh and marine water areas.
2. Place a ban on any additional freshwater withdrawal from Kawainui Marsh.
3. Explore opportunities for enhancing recreational opportunities in the estuarine area of the Marsh.

E. Water Quality

Problems, Needs, Opportunities

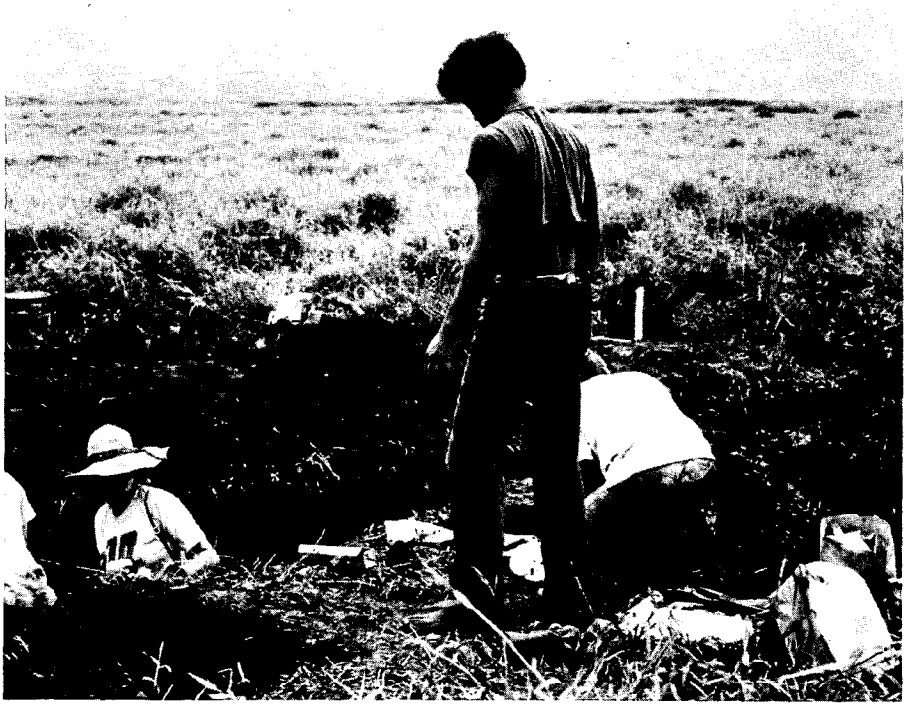
In recent years, Kawainui Marsh has served as the receptacle for sewage effluents discharged directly from two sewage treatment plants, indirectly from two additional plants and for accumulating sediments transported by streams and direct surface runoff. Heavy urbanization of the Kailua region is the indirect cause of both of these undesirable water quality trends. The sewage effluent often contain pathogens harmful to aquatic life and wildlife. At the same time, they also contain nutrients which stimulate the growth of vegetation, which in turn contributes to the acceleration of encroachment of aquatic weeds into open water habitats important to endangered waterbirds. The discharge of sediments into the Marsh also contributes nutrients and accelerates the rate of the Marsh shoaling and conversion to upland habitat. A sizeable portion of the upstream watershed has already been urbanized and covered over with pavement and vegetation. There still remain large open tracts presently in agricultural use or watershed that are important to Marsh water quality. Future uses in this area, however, should be closely monitored. The construction of housing on sloped lands immediately adjacent to the marsh could add considerable undesired sediments to the Marsh.

Policies

1. Existing grading and erosion control ordinances should be enforced and special conditions applied to minimize the sedimentation impacts from development.
2. The chemical parameters contributed by agricultural uses within the watershed should be defined.
3. In order to resolve potential water quality problems, leachate monitoring requirements should be applied to any landfill activity within the drainage area of the Marsh.

Recommended Actions

1. Develop criteria for monitoring discharge of sediments into the Marsh.
2. Discontinue direct discharges of treated sewage effluent into the Marsh and into streams subsequently discharging into the Marsh.
3. Develop and maintain a system to monitor the quality and quantity of influent streams and overland flows to the Marsh.



Above - Volunteers assist Bishop Museum archaeologists in the excavation of a trench and test pits near the Kukunono-Pohakupu Slope.

Below - Basalt, prehistoric artifacts uncovered in the archaeological survey and excavation work of Bishop Museum. (Photos by Jane Allen-Wheeler)

Cultural Resources

The various elements of the cultural component encompass the existing or potential resource values that are related to Hawaii's history and cultural legacy. While there are strong interrelationships with the ecological and land/water use components, this component specifically addresses those activities that are uniquely human in terms of past and present impacts and benefits. These activities include the study of history, archaeological research and analysis, educational and recreational programs and facilities, and identified cultural values and related activities at Kawainui Marsh.

The information base for the cultural component is the result of recent historical, geomorphic and archaeological studies which were either conducted under the public funded planning process or through privately funded research. The research provided additional information on the geopmorphic evolution of the Marsh, the cultural history of the area, the Marsh's potential for different kinds of archaeological research, and the need for preservation and development of some of the area's archaeological sites.

Objectives

- Protect and preserve identified historic and pre-historic sites and districts within the primary and secondary areas which are listed or eligible for listing on the National and State registers.
- Promote traditional cultural values through the development and use of important archaeological sites in the Marsh area.
- Provide for the enhancement and use of the primary area as a learning resource for educational institutions.
- Identify, enhance, and preserve aesthetic qualities of the primary and secondary areas, including vistas, view planes and site-specific features and elements.
- Provide for recreational activities in the Marsh area.

Management Elements

A. Historical

Problems, Needs, Opportunities

Kawainui, the Kailua area, and the Koolaupoko district are significant in the history of the Hawaiian people. The area, favored for settlement by the Hawaiian *ali'i*, contained an extensive system of taro patches and was well known because of its large fishpond. It became an important rice growing area in the late 1800s as well as a settlement for people of Chinese ancestry. During more recent historic times, it was also the source of fresh water for Windward sugarcane plantations and diversified agricultural produce.

While the Bishop Museum published a recent study of the area and has others in preparation, there is no consistent and complete record available. In this regard there is a need to develop a chronology of this rich history for wide dissemination to the public.

Policy

1. The formal nomination of Kawainui Marsh to the National Register of Historic Places should be pursued.

Recommended Actions

1. Publish a report on the history of the Marsh area which is based on existing reports and a thorough archival search of records.
2. Prepare a chronology of historic events for public use.
3. Define specific boundaries of the eligible historic district for nomination to the National and State Registers of Historic Places.

B. Archaeological

Problems, Needs, Opportunities

Archaeological studies have identified a number of significant sites in the Kawainui Marsh area: Ulupo Heiau, Pahukini Heiau, Kawainui Pond, the buried lo'i in the alluviated lowlands of Kailua, the grinding stone in the Kukunono area and sites 32 and 33 below Pahukini Heiau. All of the areas surveyed so far have contained previously unknown sites with research potential. Archaeologists have recommended preservation for some sites and salvage excavations for others. The sites recommended for preservation require protection and maintenance for continuing public use.

Policies

1. All significant archaeological sites on private land within the primary area should be acquired and preserved for public use.

Rock mound recorded in a 1977 archaeological survey and found along the Kukunono-Pohakupu Slope (U.S. Army Corps of Engineers, Pacific Division, 1977)

2. Implementing actions of this Plan which propose activities such as construction of trails and recreation areas, or landscaping and restoration of historic sites, should be preceded by archaeological surveys.

Recommended Actions

1. Acquire lands necessary to provide visual corridors and trail linkages between Ulupo and Pahukini Heiaus.
2. Implement and fund programs for the landscaping and maintenance of existing historic sites, including the heiaus, Site 33, the grinding stone, and other identified sites.
3. An archaeological research design to investigate the history of the primary area of this plan and to identify all significant sites should be formulated. Such research design should address the five recommendations for future research listed in the Bishop Museum archaeological report by Jane Allen-Wheeler.

C. Hawaiian Heritage

Problems, Needs, Opportunities

The Kawainui Marsh area is an important wetland, a refuge for wildlife and endangered species, a place of importance for both historic and pre-historic agricultural systems, and a symbol of traditional Hawaiian culture.

There appears to be potential for further identifying historic linkages between these important elements through the interpretation of Hawaiian folklore and legend. There is, however, sufficient existing data to establish interpretive centers to restore and demonstrate portions of this heritage.

Policies

1. All identified archaeological sites within the primary study area should be viewed from a cultural-system perspective.
2. Interpretation of Hawaiian heritage should address agriculture, aquaculture, habitation, folklore, and other traditional systems.

Recommended Actions

1. Establish trails and overlook systems to connect principal cultural features such as heiaus, and interpretive centers with wildlife overlooks.
2. Develop secluded areas where ceremonial practices and performances can be conducted.
3. Investigate and record the sacred nature and cultural significance of the birds of Kawainui, particularly where such values relate to proposed wildlife management recommendations of this plan.

D. Aesthetics

Problems, Needs, Opportunities

Current land use in parts of the Marsh area distract from the wilderness character of the Marsh and its surrounding areas. These uses diminish scenic and open space areas important to the Marsh's use as a cultural park. The drive-in theater, the land-fill operation, the auto junkyard, and the currently permitted and proposed urban uses of the surrounding lands are incompatible with the visual qualities and natural area potential of the Marsh.

Policies

1. The wilderness character of the Marsh and the surrounding area should be promoted through rehabilitation, landscaping, and management.
2. To the extent feasible, landforms, views and vistas of the natural landscape should be reconstructed.

Recommended Actions

1. The existing sanitary landfill site, following closure, should be graded and landscaped.
2. The auto junkyard should be cleared and the area restored to an appropriate natural area setting.
3. The opportunities for removal or modification of the Kailua drive-in theater screen should be explored in order to improve view planes toward and from the Marsh.

E. Educational

Problems, Needs, Opportunities

The Marsh area is presently the locale for field studies related to natural environment and cultural heritage. Current use by students from all educational levels is limited by the absence of established trails and sites which highlight selected Marsh features.

Policies

1. Features of the Marsh basin that are important to educational programs including historic sites,

habitat overlooks, interpretive centers, interconnecting trail systems between the above features and access trails to Marsh overlooks, should be developed.

2. The educational opportunities that are present in the Marsh, including those that have been utilized in past educational programs and more recently described in the guidebook "Ho'ona'auao No Kawai Nui" should be supported so long as such use is not counter to the resource protection and management policies identified in this plan.

Recommended Actions

1. Prepare learning modules based on previous and proposed basic research.
2. Develop interpretive educational programs and centers which demonstrate the interrelationship of early Hawaiian cultural, agricultural, recreational and social systems.

F. Recreational

Problems, Needs, Opportunities

The peripheral slopes surrounding the Marsh floor and certain areas of the wetlands, have recreational potential appropriate to the intrinsic values of the area.

There are no similar natural and cultural resource areas that are readily accessible to the public anywhere on the Island of Oahu or elsewhere in the State.

Policies

1. Passive recreational opportunities, including picnicking and camping sites, should be established at appropriate points so they will not disrupt or conflict with policies within other resource areas.
2. Open fields for active recreational activities should be provided in locations consistent with other policies of the management plan.

Recommended Actions

1. Create or establish safe hiking paths and jogging trails in perimeter areas of the Marsh.
2. Provide scenic and wildlife overlooks in places consistent with identified scenic and habitat values.
3. Study the potential for expanding the estuary for fishing and boating activities.
4. Establish or create access routes, trails, and facilities for nature studies.
5. Prepare a comprehensive recreational plan for Kawainui Marsh which encompasses the primary area and portions of the secondary area, and which addresses existing uses and uses proposed within this document. The plan should integrate recreational activities so that they are consistent with the resource protection and management policies of this document.

PART IV:
PLAN IMPLEMENTATION

The preceding chapters of this plan address only the first stage in the establishment of a permanent natural heritage area at Kawainui Marsh. Through its preparation, new baseline data have been completed and a bibliography and chronology of the Marsh have been prepared. The planning process provided a forum for an interdisciplinary overview and conceptual framework for assessing the significant cultural, natural, and economic resources of the Marsh.

While the recommended policies and actions of the management plan provide specific guidance for the establishment and ongoing management of the area, the fulfillment of the plan will unquestionably require the subsequent commitment of financial, technical, and administrative resources and planning for the detailed implementation and operation of a natural heritage area.

It is not the intent nor within the capacity of this Resource Management Plan to provide detailed plans for the implementation and operation of a multi-resource area such as the Marsh. It is, however, desirable and within the scope of the document to provide general recommendations for the completion of these important stages of the project.

Land Acquisition and Management

During the course of the planning process, the Committee recognized that existing land ownership patterns and controls would make broad multi-resource management most difficult. The policies and actions of the plan address this concern by recommending that all private lands adjacent to the Marsh basin that have natural and cultural resource values be acquired. Similarly, in order to facilitate centralized management, the plan recommends that County owned lands within the Marsh basin be exchanged for other lands owned elsewhere by the State. The Legislature and the Governor have endorsed both of these recommendations with legislative measures providing acquisition funds and supporting land exchange.

It is recommended that both acquisition and exchange of lands should proceed expeditiously. The suggested priorities for the acquisition of private lands are dictated to a great extent by their imminent development and the negative impact that such development would have on the natural resource values of the Marsh. The Committee has provided its recommendations for acquisition priorities. It appears likely that the exchange of lands between the two levels of government will require supporting legislation.

The Division of Land Management of the Department of Land and Natural Resources has statewide responsibilities related to land matters and should prepare a schedule for the acquisition of identified private lands around the Marsh consistent with budgetary and fiscal constraints of the State.

Implementation and Operation

During the two year period in which the Committee deliberated the prospects and parameters of Marsh management, it was equally apparent that divided resource management responsibilities among many levels of government would make multi-resource management in a defined area most difficult. While the foregoing Resource Management Plan does not provide specific identification of agency assignments, it is difficult to discuss policy and action without some concept of the probable or preferred agency that would assume the implementing responsibilities. In this regard, virtually all of the identified resource values for which the plan proposes management are found within the various divisions of the Department of Land and Natural Resources. These activities include not only acquisition and management of State lands, but as well the management of wildlife preserves; the protection of endangered species; the identification, registration, and protection of historic properties; and the management of State parks and recreational facilities and other related activities.

It is the recommendation of this plan that the Governor direct the Department of Land and Natural Resources to be the lead agency for the implementation of the policies and recommended actions contained herein, and that the Department of Land and Natural Resources assume responsibility for ongoing operation of the natural heritage area.

In order to implement this resource management plan the Department of Land and Natural Resources should prepare a plan for implementation which contains:

- A description of the organizational structure through which this plan can be implemented;
- An evaluation of the existing and additional staff resources required to implement this plan;
- The identification of and provisions for continued participation by other government agencies and private organizations in the implementation of this plan;
- A conceptual diagram which depicts the management and operation of the district;
- A program for the maintenance and protection of instream uses in keeping with the provisions of Act 185;
- Identification of applicable rules and regulations that would guide management (Appendix D); and
- A preliminary assessment of implementation and ongoing operational costs of the primary area.

An Advisory Body for Plan Implementation

An indication of past interest in Kawainui Marsh is provided in the introductory chapters of this plan. The great numbers of hours of time and technical assistance that has been provided by many sectors of the community in the compilation of this document is further evidence of this interest.

Chapter III of this plan recommends that an advisory body be named to provide assistance to the lead agency in the implementation of this plan. While the detailed functions of such a group are not fully described, it is recommended that the lead agency for implementation further consider and describe the means by which the technical and advisory skills of such persons could provide important continuity during the implementation of the plan.

It is recommended that the DPED participate in the implementation of this plan as a member of the advisory body.

APPENDIX A

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APPENDIX B

Kawainui Marsh
Chronology of Events

DATE	EVENTS
1921	Major flooding at Coconut Grove.
1923	Kawainui waters pumped to Waimanalo for agricultural irrigation. Continued into the 1950s.
1923	Coconut Grove area subdivided.
1941	U.S. Corps of Engineers recommends flood control levee and channel in its: *Report on Survey Flood Control, Kawainui Swamp, Kailua District, Island of Oahu, Territory of Hawaii.*
1949	Auto wrecking operation starts.
1949	Congress authorizes "Kawainui Swamp Flood Control Project" in Section 204 of the Flood Control Act. Funding not provided.
1951	Major flood at Coconut Grove; 250 persons evacuated.
1952	Pilot flood control channel, 67 feet wide and nine feet deep, constructed by the Territory.
1952	Ameron HC&D takes over quarry operation. Quarry Road constructed.
1956	Owner of Kaneohe Ranch drains Marsh for use as pastureland. Water level dropped four feet.
1957	Development of subdivisions around Marsh begins. Completed by 1965. Four sewage treatment plants which presently flow into the Marsh were constructed during this period.
1957	Pali Highway to Kailua completed. Alignment transects mauka portion of Marsh.
1957	U.S. Corps of Engineers updates earlier 1941 report. Publishes *Design Memorandum, Kawainui Swamp.* Study completed the design of the flood control project using 750 acres of the Marsh basin for storing and diverting flood waters around Coconut Grove.
1959	City Planning Commission completes report, *Preliminary Study of Kailua-Lanikai Area.* Report indicated possible park use and water storage areas in Kawainui Marsh. Proposed the use of more than 1,000 acres of the Marsh floor and peripheral slopes.
1959	City Planning Commission reviews the Territorial Highway Department's proposal for an easement along the Dike Road as part of a defense system linking Kaneohe Marine Corps Air Station to Pali Highway. (Interstate Route H-3) Report also indicates alternate route of extending Kalanianaole Highway to Kapaa Quarry Road and Mokapu Boulevard. Later in 1964 this alternate was officially adopted in the *Oahu General Plan.*
1959	City Planning Commission report makes reference to a Territorial Senate Bill for the acquisition of Kawainui to provide water for Waimanalo development. Honolulu Board of Water Supply decides to pump water from Waihee instead; Kawainui water said to be of poor quality.
1961	Dames and Moore completes its preliminary site investigation for proposed land development in Kawainui. Report estimated the extent of sand, depth of various soil types and expected settling.
1961	Centex-Trousdale proposes to develop a 200-acre subdivision along three sides of the marsh. (Centex-Trousdale owned development rights to Kaneohe Ranch lands.)
1961	City and County Board of Parks and Recreation recommends park development at Kawainui.
1961	U.S. Congress authorizes Federal financial assistance to States and local governments for acquisition of Open Space Land and Urban Beautification under Title VII of the 1961 Housing Act.
1962	Honolulu City Council adopts a *General Plan for Kailua* (Ordinance 2408).
1962	Centex-Trousdale subdivision disapproved. (TMK 4-2-13:22; 4-2-16:1)
1964	Centex-Trousdale properties included in Conservation District by State Land Use Commission.

1964	750 acres of Kawainui acquired from private owners for $1.2 million financed jointly by Federal Housing and Home Finance Agency and City. Managed by City and County Parks and Recreation Department.
1964	Honolulu City Council adopts *Kailua Detailed Land Use Maps* (DLUM) (Ord. 2473).
1964	Tests made for proposed Olomana sewer trunkline.
1965	H-3 Spur constructed.
1966	U.S. Corps of Engineers completes flood control improvements for Kawainui—includes widening Oneawa Channel construction of dike and flow control device.
1967	Consultant Sanford Hill completes Master Plan proposals for City and County Department of Parks and Recreation. Report recommends acquisition of two parcels: 76 acres on which Centex-Trousdale proposed a residential subdivision and 74 acres for a silting basin. Other parcels with less priority were also recommended for acquisition.
1968	City and County/Citizen planning sessions for regional park are held.
Aug. 1970	Michael Baldwin Trust, John Baldwin Trust, James Castle Trust, and James McIntosh proposed subdivision approved. (TMK 4-2-15:4,6)
Oct. 1970	Tests made for Maunawili Trunk Sewer.
June 1971	Kaneohe Ranch Company subdivision disapproved. (TMK 4-2-14:2; 4-2-15:1,4; 4-2-17:1)
Aug. 1971	Ulupo and Pahukini Heiaus nominated to National Register of Historic Places.
Aug. 1971	City and County Department of Public Works acquires Kapaa Quarry site through eminent domain.
Nov. 1971	Edward K. Pipi, Jr. subdivision deferred. (TMK 4-2-13:16)
Dec. 1971	ITT applies for General Plan Amendment.
Mar. 1972	R.M. Towill completes *Hydrology Drainage Study for Kawainui Regional Park.*
April 1972	Castle Estate subdivision approved. (TMK 4-4-34:25)
May 1972	*Kaneohe-Kailua Origin and Destination Traffic Study* completed by A.M. Voorhees for City and County Traffic Department. Report projects traffic flow to the year 1995.
June 1972	City opens Kapaa landfill operation below Pahukini.
Oct. 1972	City park plan completed. Includes recommendations for acquisition of peripheral private lands.
Nov. 1972	Dillingham files letter of intent to construct shopping center at northeast corner of Marsh.
Dec. 1972	Dr. Nathan C. Burbank of University of Hawaii Environmental Health and Sanitary Engineering Department completed *Kawainui Water Quality Study* for City and County Department of Parks and Recreation. Report indicated that the sanitary landfill did not increase the pollution of the water in the swamp.
June 1973	Castle Estate subdivision approved. (TMK 4-2-15; 4-2-17)
Nov. 1973	City and County Department of Parks and Recreation applies for General Plan Amendment for park designation of properties. A 1,045-acre park is proposed.
Dec. 1973	City and County Department of Public Works applies for General Plan Amendment for the proposed Kapaa Landfill and Corporation Yard.
April 1974	Hawaii State Legislature requests City and County to develop Kawainui Regional Park.
June 1974	Honolulu City Council provides $100,000 in its Capital Improvements Program for a model airplane field at the former landfill area in Kawainui.
June 1974	R.M. Towill completes *Twenty-Year Incremental Development Plan for Kawainui Regional Park* for City and County Department of Parks and Recreation.
July 1974	Paul Bienfang completes *A Description of the Environmental Conditions of the Kawainui Marsh Ecosystem* for U.S. Bureau of Sport Fisheries and Wildlife.
July 1974	Dillingham Corporation presents its plans for the proposed 88-acre Kawainui Shopping Center.
Sept. 1974	Dillingham Corporation drops its plans for Kawainui Shopping Center.

Dec. 1974	Land Use Commission reclassifies 50 acres from Urban to Conservation. (TMK 4-2-14:2)
Feb. 1975	State Senators Anderson, George, Hulten introduce a bill for a $2 million appropriation for the development of Kawainui Park.
Feb. 1975	State Representatives Ajifu and Evans introduce a bill for a $100,000 appropriation for scientific studies of Kawainui.
April 1975	State Legislature passes HB 223 requesting the Department of Land and Natural Resources to study Kawainui as a National Historic site.
April 1975	Shoreline Protection Act (205A) approved as interim measure.
April 1976	State House of Representatives adopts a resolution to support the nomination of 1,000 acres of the Marsh and its periphery as a National Historic District.
April 1976	State Legislature requests City and County Department of Parks and Recreation to develop comprehensive plan for the development of Kawainui adding that no major development should take place until such a plan is completed.
Oct. 1976	City and County requests permit to construct Olomana/Maunawili Interceptor Sewer in the southeastern fringe of Marsh floor. Not actively pursued.
Oct. 1976	Department of Planning and Economic Development petitions State Land Use Commission to reclassify 234 acres to conservation. Petition denied.
Jan. 1977	Public hearing held on Olomana/Maunawili Interceptor Sewer. Determination made that E.I.S. would be required.
April 1977	Hawaii State passes Coastal Zone Management (CZM) Act (Act 188).
June 1977	*Marsh Waterbird Recovery Plan* completed.
April 1978	Department of Planning and Economic Development (DPED) appeals Land Use Commission decision. Seventy-one acres subsequently reclassified.
April 1979	Outdoor Circle submits a proposal to DPED CZM program for funding to propose a management plan for Kawainui Marsh.
June 1979	Kawainui Marsh designated as a Special Planning Project for the Coastal Zone Management Office under the Department of Planning and Economic Department.
July 1979	National Register of Historic Places, Heritage, Conservation, and Recreation Service completes *Determination of Eligibility Notification.* Report indicates that the Kawainui Marsh is eligible for listing in National Register of Historic Places.
Aug. 1979	U.S. Corp of Engineers (COE) delineates wetland boundary (with exception of eastern border).
Oct. 1980	Olomana/Maunawili Sewer project reactivated. COE completes DEIS.
Dec. 1980	Hawaiian Papaya applies for a Shoreline Management Permit (SMP) for 39-acre residential subdivision on Kukunono Slope.
April 1981	Honolulu City Council passes resolution approving SMP for Hawaiian Papaya subdivision.
	Congress of Hawaiian People, and others enter complaint against Council and Department of Land Utilization.
April 1981	Resource studies funded by the Office of Coastal Zone Management are initiated.
Nov. 1981	Development Plan for Koolaupoko revised and approved by Honolulu City Council.
Nov. 1981	Development Plan for Koolaupoko vetoed by Mayor Anderson.
Jan. 1982	Resource studies completed.
April 1982	Hawaii State Legislature appropriates $6.0 million for land acquisition.
April 1982	Public hearing for Olomana/Maunawili sewer collector.
April 1982	1982 Hawaii State Legislature passes resolution approving land exchange between State and the City and County of Honolulu.

APPENDIX C

Hawaii Coastal Zone Management Program
Department of Planning and Economic Development

ABSTRACT

Historical Study of Kawainui Marsh Area
Island of O'ahu

Marion Kelly and Barry Nakamura
Bernice P. Bishop Museum
Department of Anthropology

January 1982

This report is the product of a contract to conduct historical research on land uses and resources of the Kawainui Marsh area.*

Both published and unpublished historical materials were researched. Published materials included books, reports, newspaper and magazine articles. Unpublished materials ranged from legal land documents, such as 19th century Land Commission Awards, government leases and boundary records, and private land sales and leases; archival materials such as tax, school and census data, journals, letters and probate records; to various contemporary reports for projects such as flood control and urban development. Additionally, maps, photographs and other graphic materials were researched.

This report is organized chronologically with footnotes and a bibliography. The authors have tried to present facts objectively and in such a way that readers can, if they wish, consult the original reference sources.

Significant Findings

Kawainui Marsh is favorably located yet little understood area of about 1,000 acres. Kawainui is located within the windward *ahupua'a* (Hawaiian land division running from the mountains to the sea) of Kailua, which has a rich tradition of legends, was a favored locale of ruling *ali'i* (chiefs) in pre-contact (pre-1778) Hawai'i, and was a productive agriculture and aquaculture area.

Legends associated with Kawainui Marsh include: *Menehune,* a legendary people who accomplished great works at night; a *mo'o,* guardian spirit of Kawainui fishpond who took the shape of a large lizard; and, the *makalei,* a supernatural, fish-attracting tree.

Among the famous *ali'i* who lived at Kailua and in the Kawainui area, dating back to the 16th century, were Kakuhihewa and Kuali'i. In 1795, Kamehameha I, during his struggle to unify the Hawaiian Islands, utilized the resources of Kawainui to feed his army.

At present, in spite of historic modifications in land use, Kawainui preserves some integral parts of native Hawaiian society from the pre-contact and early post-contact periods. These include the 440-acre fishpond, 250 areas of taro *lo'i* (pondfields) and *'auwai* (irrigation ditch systems), *heiau* (Hawaiian religious temples), and habitation and *kula* (dry-land) agricultural areas along the slopes, all of which combine to form a rich and valuable Hawaiian cultural resource complex.

With the decline of Hawaiian population in the post-contact period, many of these resources at Kawainui were abandoned. However, the agricultural resources, in particular, were revitalized in the last half of the 19th century by Chinese farmers who developed rice into the second most important industry in Hawai'i, the first being sugar. Thus, Kawainui also adds an important chapter to the early cultural history of the Chinese in Hawai'i.

Kawainui has been established as an area of early human occupation in pre-contact Hawai'i. Roughly 1,500 years ago, a site along the southern portion of Kawainui,near Ulupo *heiau,* was occupied by Hawaiians, according to archaeologists. Geological studies suggest that Kawainui was, at that time, an open lagoonal embayment with access from and to the sea. Thus, Kawainui is significant in our understanding of prehistoric Polynesian migration, settlement and cultural development.

Recommendations

Perhaps as much as any area in Hawai'i, Kawainui has the potential to further our understanding of Hawaiian natural and cultural history. This potential should be preserved, especially when one considers that on O'ahu very

*A previous study, "Kawainui Marsh, O'ahu: Historical and Archaeological Studies," by M. Kelly and J. Clark, published by and available from Bishop Museum, Department of Anthropology, September 1980, is recommended reading.

few areas remain which present such unusual opportunities to study our past.

Kawainui Marsh and its environs are central features of an important Hawaiian *ahupua'a* complex at Kailua. As such, the Kawainui Marsh area can provide meaningful cultural, historical and environmental information about a specific windward valley settlement commuity as well as about the general history of Hawai'i. And, the Kawainui Marsh area can satisfy many of the needs of our people, the young and old of all ethnic groups, for cultural education and understanding. Therefore, no further obliteration of the remaining cultural resources at Kawainui Marsh and adjacent areas should be permitted.

Hawaii Coastal Zone Management Program
Department of Planning and Economic Development

ABSTRACT

Archaeological Excavations in Kawainui Marsh, Island of O'ahu

Jane Allen-Wheeler
Department of Anthropology, Bishop Museum

January 1982

Under contract to the DPED, staff of the Department of Anthropology, Bishop Museum, conducted archival and field research to elucidate the nature of archaeological sites located in the southern portion of the floor of Kawainui Marsh, windward O'ahu. The project was designed to provide background information to be used in planning future land-use in and around the Marsh.

Research addressed three general questions: (1) What was the nature of the early inland occupation around Kawainui Marsh? (2) What was the nature of the environment at the time of initial occupation? (3) What changes occurred in the valley during human occupation around the Marsh, and how did the settlements and land use of the Marsh vicinity change over time? Field survey was designed to check the present status of sites, such as walls and canals, that appear on historic maps and aerial photographs of the area, and to determine which areas offered the greatest potential for archaeological excavation.

Field survey uncovered few surface signs of structural features. Four trenches and two test pits were excavated, revealing evidence that suggests that most of these features were buried under at least 50 cm of soil, deposited through rapid on-going sedimentation.

In two trenches the full sedimentary sequence was exposed down through rice and taro soils, into an underlying peat layer and a basal coral-rubble/sand/seashell layer. This coralline layer was once the floor of an open bay, prior to the accumulation of the accretion sand barrier that underlies Kailua town today. Formation of the barrier changed the bay into a lagoon; a fringing and floating vegetal mat then developed in the basin, and the Marsh floor gradually filled with soils and sediments as alluvial materials were blocked behind the barrier. The evidence indicates that the sedimentation rate in the basin increased markedly after the initiation of agriculture on the surrounding slopes; presumably, this led to increasing slope erosion into the Marsh.

Soil samples recovered during excavation were analyzed for particle size and other physical properties as well as for presence of pollen and other floral and faunal materials. Identifications of the corals and molluscs present in the coralline layer suggest quiet, clear, marine waters in the immediate area during earlier times.

Samples of carbon from the coralline, peat, and agricultural layers were dated by the radiocarbon method. The results indicate that the basal peat formed after A.D. 650 in the areas tested, and that soil did not fill the basin until after A.D. 1300.

When the slopes surrounding the Marsh were first occupied (ca. A.D. 500), agriculture in the Marsh floor would not have been possible. The earliest occupants apparently lived beside a lagoon or open bay, probably relying on dryland slope agriculture and fishing and shellfish exploitation for subsistence. The area was probably not densely populated until the late prehistoric or early historic period; by that time much of the Marsh floor was in wetland taro cultivation.

The Kawainui data are compared with data from other Hawaiian sites, and specific future research projects are suggested. The results of this project support the archaeological significance of Kawainui Marsh. Data recovered from the current research relate to several questions of importance in Hawaiian archaeology, including, windward adaptations during the initial settlement period, the evolution of Hawaiian agricultural systems, and the interaction of cultural and geomorphic processes in the creation of today's landscape.

Hawaii Coastal Zone Management
Department of Planning and Economic Development

ABSTRACT

Nutrient and Suspended Solids Budget
for Kawainui Marsh, Oahu, Hawaii

AECOS, Inc.

January 1982

Introduction

This report is the product of a contract study whose object was to quantify the amount of nitrogen, phosphorus, and suspended solids that enter and leave Kawainui Marsh during various climatic conditions. It provides information as to the marsh's present capacity to process significant influxes, and estimates the effects of changes in these influxes on vegetative growth, fill-in of standing water areas, and potential for impacting other marsh and nearshore resources.

Methodology

In order to quantify the influxes into and discharges from Kawainui Marsh without having to quantify the complex internal processes, the investigators have followed the conceptual mode which views the Marsh as a "black box", i.e., a system in which inputs and outputs and are measurable, but for which the sum of the internal processes is taken as the difference between the inputs and outputs.

Fluxes of nutrients and suspended solids were determined on a mass basis, which requires knowledge of volume flow and concentration. Major volume flows into the marsh are stream flow and rainfall, and out of the marsh, evaporation, transpiration and flow into the Kawainui Canal. Four waste water treatment plants (WWTP) are the major sources of nutrient inputs.

Calculations of mass balance (mass input minus mass discharge equals internal processes) under wet and dry conditions resulted in determinations of processing capacity for the Marsh.

Summary Findings

The investigators determined that the year could be divided into a 36 day wet weather period and a 329 day dry period. The investigators also found that the loss of water through evaporation and transpiration during dry weather nearly balanced the volume of water flowing into the marsh from the principal contributing sources (streams and WWTP's). This condition results in low flow through the marsh, contributes to the high retention rates of inorganic nutrients, and is the cause of saltwater intrusion into the lower end of the marsh during high tide.

Data for dry and wet weather indicate the more than 95% of the nitrogen and phosphorus that flows into the Marsh during dry weather is retained. Retention rates are lower during wet weather, especially for organic nitrogen and phosphorus.

Suggested Management Alternatives

The investigators believe the removal of the WWTP effluents would have relatively little immediate effect on the rooted vegetation of the Marsh, in view of the large amounts of nutrients stored in the sediments. Over the long term, however, the rooted vegetation could be expected to decrease.

The investigators caution that the removal of the existing vegetation by chemical or mechanical means, without removal of the WWTP effluents, would decrease the Marsh's capacity to process the effluents and could result in the possible disruption of the nearshore marine environment.

The report also concludes that under a "No Change" alternative, the natural processes in the Marsh would continue at the present rates, removing the majority of the nutrients and suspended solids, and contributing to the continued and rapid coverage of the open water. The processes of sedimentation and deposition of dead plant material would gradually fill the standing water areas, and eventually the Marsh would become a grassland. The natural rate of input of sediment would complete this process in approximately 7,000 years; the additional input of dead plant material and increase in sediment input load due to grading and construction would shorten this period.

Hawaii Coastal Zone Management Program
Department of Planning and Economic Development

ABSTRACT

A Survey of the Waterbirds of Kawainui Marsh
Sheila Conant, Ph.D.

January 1982

This report is the product of a contract survey to determine current population density and distribution of waterbirds and predatory and pestiferous animals of Kawainui Marsh in relationship to physiographic factors.

The report begins with a review of pre-contact and early historic references to Kawainui waterbirds. It asserts that waterfowl species increased dramatically after Polynesian settlement in Hawaii. The investigator believes that the presence of the 440-acre fishpond attracted large numbers of native and migratory waterfowl.

The investigator reports that the systematic recordation of data on Marsh avifauna was initiated only in the last two to three decades. She identifies the sources of the data, much of which is unpublished, and references Shallenberger's literature review as the best historical overview of the avifauna of Kawainui Marsh. She also believes that the lack of consistent and adequate coverage during past bird counts has resulted in underestimates of waterbird populations.

Using aerial photos taken at intervals during the period of 1940 to 1981, the report presents evidence of habitat alteration. The cumulative effect of sedimentation and rapid vegetative growth have led to substantial alteration and loss of open water areas. These changes, the author believes, have had the greatest impact on the waterbirds of Kawainui.

The report describes the study methods employed and documents the observations made over time. Physiographic features of the Marsh are mapped and evaluated according to waterbird resource values.

Recommendations

The report suggests various means by which the habitat can be enhanced through mechanical, herbicidal, or biological control. The absence of a permanent waterflow through the marsh is credited as the most influencing factor for the rapid vegetative growth, sedimentation and subsequent reduction of open water. The reduction or elimination of sewerage effluent and the control of run-off, including pesticides, fertilizers and sediment from adjacent lands, are considered to be two important measures for establishing a high quality wildlife resource.

The report also recommends that development on peripheral lands should be buffered from identified wildlife habitats with heavily vegetated zones of 150 to 300 feet in width.

While the report expresses the need for protection and management of the habitats, it recognizes the potential for multiple uses of the marsh and peripheral lands. These are identified as education, recreation, and agriculture.

The report further recommends the continuous monitoring of waterbird population, breeding activity, and distribution, and provides a method for carrying out this monitoring function.

In conclusion, the report provides some thought and guidance for long-term management of wildlife resources of the Marsh. While the indicated counts of some species are not relativey numerous, the report emphasizes habitat restoration and improvement through control of plant growth, the maintenance of open water, and the establishment of full-time management program to control predation and human disturbance, and to coordinate recreational and agricultural use of the marsh.

Hawaii Coastal Zone Management Program
Department of Planning and Economic Development

ABSTRACT

An Analysis of the Aesthetic Significance and
Potential of Kawainui Marsh

Nick Huddleston

January 1982

This report was prepared in response to the Kawainui Marsh Technical and Policy Advisory Committee's concern that intangible resources, such as vistas, viewplanes, open space, scenic attractions and cultural values in and around Kawainui Marsh need to be identified and evaluated. The author, a graduate student in architecture at the University of Hawaii, developed a methodology based on established techniques in order to identify and record economically intangible resources. Guidance in this effort was provided by the Department of Planning and Economic Development CZM Program.

Methodology and Scope

The author's approach to assessing aesthetic values of the Marsh and watershed was based on techniques or approaches developed in the following documents:

Visual Management System, U.S. Department of
Agriculture, Forest Service
Design with Nature, Ian McHarg
A Pattern Language, Christopher Alexander

The report describes a concept of aesthetic values and relates the values to planning and preservation.

Existing conditions in and around the Marsh are distinguished as assets and liabilities as they relate to the enhancement of the Marsh's aesthetic resources. The author believes that the elements considered as sources of aesthetic stimulation in the Forest Service report are applicable to the Marsh and its environs. He employs the approach of Alexander which asserts that certain places are special and should be preserved regardless of accessibility or number of viewers. He offers as an example the historic use of the Marsh as a Hawaiian settlement and its potential for re-establishment.

Identification of Specific Viewpoints

Viewpoints are identified with respect to quality—both existing and potential—from four perspectives: distant views, mid-distant views, Marsh border views, and views from within the Marsh. The viewpoints, vistas and features are mapped, identified and demonstrated with photographic slides to support the value assessments.

Conclusions and Recommendations

On the basis of his investigation, the author concludes that the Marsh is a significant multi-faceted resource. He suggests a list of activities to preserve and improve its aesthetic character. Among others, he offers the following:

1. Open up water areas to encourage their use as a wildlife habitat.
2. Locate and interpret historic sites and improve access to these sites.
3. Improve access and development of trails.
4. Establish viewpoints and passive recreation areas.
5. Preserve the Marsh's natural state and permit future use of the periphery for public purposes.
6. Eliminate the drive-in and auto dump, and stabilize and reuse the sanitary fill area for future enhancement of aesthetic qualities.

APPENDIX D

REGULATORY AUTHORITIES AFFECTING KAWAINUI MARSH
Geographically Determined Controls

Purpose/Authority

Wetlands and Other Waters of the United States
(Dredge and Fill Permit)

Reflecting the national concern for both the protection and utilization of important resources, the U.S. Army Corps of Engineers regulatory program seeks to maintain the quality of the nation's water by controlling dredge and fill activities under Section 404 of the Clean Water Act (33 USC 1344).

Responsible Agency

U.S. Army Corps of Engineers.
The Corps' District Engineer is required to consult with various Federal and State agencies prior to issuing a permit. These include:

a) the State Historic Preservation Officer and, if applicable, the National Advisory Council for Historic Preservation;
b) the U.S. Fish and Wildlife Service;
c) the National Marine Fisheries Service; and
d) the State's fish and wildlife management agency.

Each application is also reviewed by the Environmental Protection Agency.

A CZM consistency certification must be approved by the State's CZM lead agency, the DPED, prior to permit approval.

Uses Subject to Management

The placement of any material in an aquatic area which will replace that area with dry land or change the bottom elevation of the waterbody.

The excavation or dredging of any material from water of the United States (33 CFR 323.2).

Criteria for Determining Permitted Uses

The Corps' review is conducted in accordance with guidelines established by the Environmental Protection Agency (EPA). In general, it must be found that public benefits outweigh any detrimental impacts resulting from the proposed activity (33 CFR 320.4).

REGULATORY AUTHORITIES AFFECTING KAWAINUI MARSH
Geographically Determined Controls

Purpose/Authority	Responsible Agency	Uses Subject to Management	Criteria for Determining Permitted Uses
Conservation District (Conservation District Use Boundary) Controls the development and utilization of natural and scenic resources within the District for their protection and preservation so as to ensure optimum long-term benefits for the people of the State of Hawaii. Under the State's Land Use Law (Chapter 205, HRS), the Land Use Commission delineates Conservation District boundaries. Uses are permitted in accordance with State Department of Land and Natural Resources Rules developed under Chapter 183, HRS. Title 13, Chapter 2, Administrative Rules, Department of Land and Natural Resources specifies procedural and substantive permit review requirements.	Board of Land and Natural Resources issues or denies a CDUA permit. Dept. of Land and Natural Resources processes and evaluates permit applications, recommending approval or denial to the Board.	Any new, change in or expansion of uses within the District including those permitted uses listed in the administrative Rules and other conditional uses granted at the Board's discretion. Permitted uses, depending upon the Subzone category designation, include: research, habitat enhancement, recreational use, restoration of archaeological sites, flood or erosion control projects, aquaculture, and removal of vegetation.	Permitted Use - those listed in the Rule by Subzone category, e.g. "Protective," "Limited," "Resource," and "General." Conditional Use - A proposed activity must demonstrate consistency with the appropriate subzone objective.

REGULATORY AUTHORITIES AFFECTING KAWAINUI MARSH
Geographically Determined Controls

Purpose/Authority	Responsible Agency	Uses Subject to Management	Criteria for Determining Permitted Uses
Coastal Zone Management (Consistency and compliance requirements) State compliance - The CZM objectives and policies and any guidelines enacted by the Legislature are binding upon actions within the coastal zone management (CZM) area by all agencies (§205A-4(b), HRS). Federal consistency - Federal planning, management, development and regulatory activities must be conducted in a manner consistent with Hawaii's CZM Program (16 USC 1456).	All State and County agencies whose actions affect or occur in the State's coastal zone. The Department of Planning and Economic Development, the State's CZM "lead" agency, is responsible for monitoring agency actions for compliance with the State's CZM law. In addition, the DPED reviews Federal actions and must find them consistent with CZM program policies before the Federal agency implements them. This includes the granting of a Federal license or permit, e.g., the Corps' Section 404 Dredge and Fill Permit.	All land and water uses within the State's coastal zone management area and those occurring outside the CZM area which directly affect it. Of particular concern are those activities which impact upon the resources covered by the State's CZM objectives, policies, and implementing network of laws and regulations.	Conformance with the CZM objective, policies, and management network.

REGULATORY AUTHORITIES AFFECTING KAWAINUI MARSH
Geographically Determined Controls

Purpose/Authority

Special Management Area Permit (SMA Permit)

Places special management controls on *development* to avoid permanent losses of valuable resources and foreclosures of management options.

County permit authority is granted under the State's Coastal Zone Management law, Chapter 205A, Part II, County's Ordinance No. 4529 delineates the SMA boundary and specifies permit processing regulations.

Responsible Agency

City Council issues or denies an SMA use permit.

Dept. of Land Utilization processes and evaluates permit applications, recommends approval or denial to the City Council.

Uses Subject to Management

"Development" as defined by §205A-22(3)(A), HRS includes:

a) the placement of any solid material or any gaseous, liquid, solid, or thermal waste;
b) grading, dredging or extraction of any materials;
c) change in the density or intensity of use of land;
d) change in the intensity of use of water, ecology, related thereto, or of access thereto; and
e) construction, reconstruction, demolition, or alteration of the size of any structure.

Exempted activities are listed in §205A-22(3)(B), HRS.

Criteria for Determining Permitted Uses

The County must find that the development:

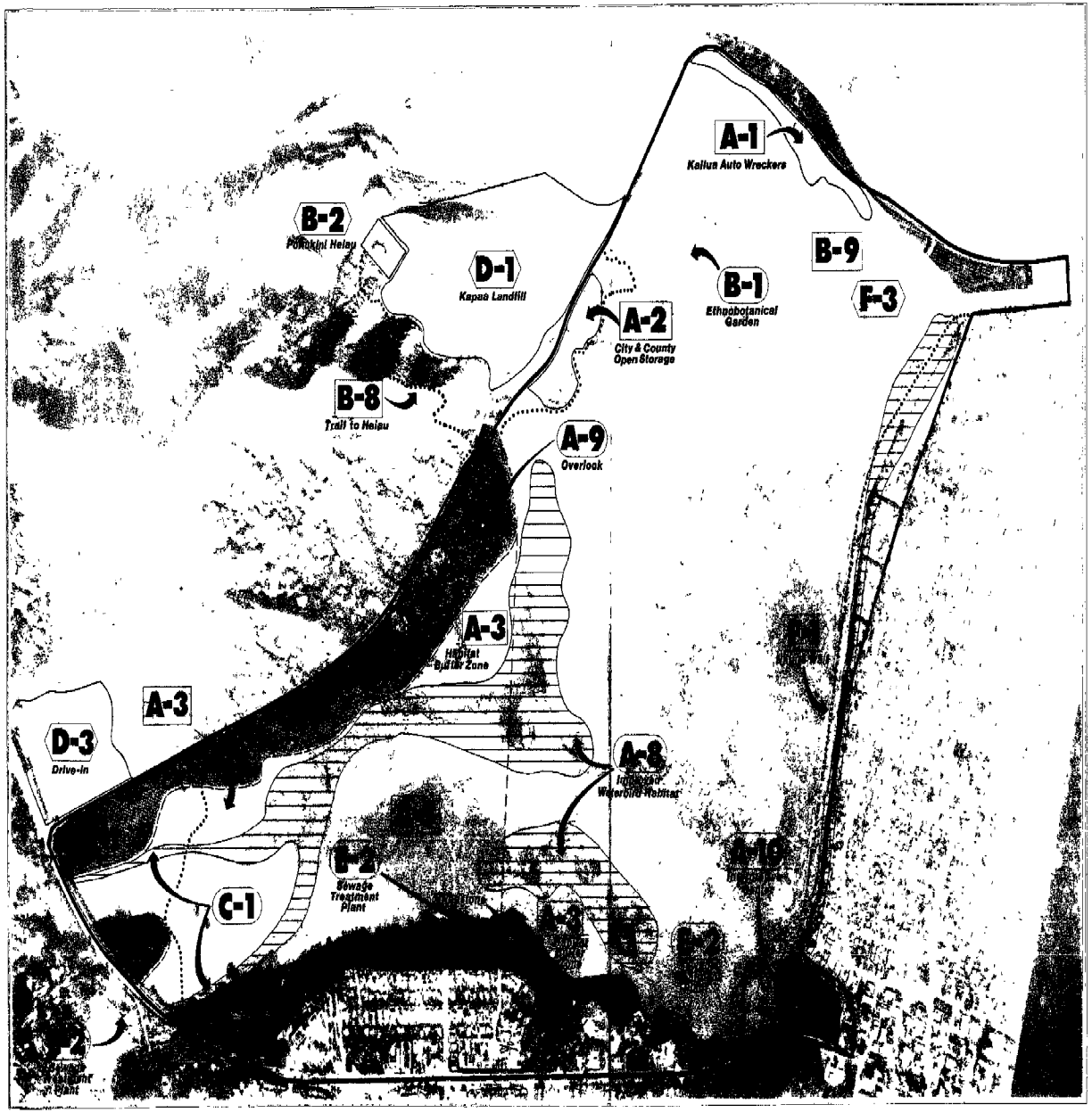
a) will not have any substantial adverse environmental or ecological effect, except as such adverse effect is minimized to the extent practicable and clearly outweighed by public health, safety, or compelling public interests;
b) is consistent with CZM objectives, policies and SMA guidelines, and
c) is consistent with the County general plan, zoning, and subdivision codes.

REGULATORY AUTHORITIES AFFECTING KAWAINUI MARSH
Resource Determined Controls

Resource	Responsible Agency	Controlled Activities
Historic Objects, Chapter 6, HRS, Chapter 6, HRS	Department of Land and Natural Resources	All development and any activity having an impact on eligible or nominated National or State Historic Site.
Title 13, Subtitle 8. Administrative Rules, Department of Land Natural Resources, Chap. 198.	The Chairman of the Board of Land and Natural Resources is also the State Historic Preservation Officer	
Rules Governing the Hawaii and National Register of Historic Places Program.	The Hawaii Historic Places Review Board adopts and administers the Administrative Rule.	
33CFR Part 305	National Advisory Council U.S. Army Corps of Engineers	
Wild birds and endangered species	Department of Land and Natural Resources	Special permits are required for the taking of wild birds for educational or scientific purposes.
Chapter 124, Title 3, Subtitle 5, Part 2, Department of Land and Natural Resources Administrative Rules.	Board of Land and Natural Resources permit.	
Endangered Species Act (16 USC §1540)	U.S. Fish and Wildlife Service	
Soil	Department of Public Works	Grading, grubbing and stockpiling may only be conducted under permit. To get a permit one must meet certain standards in conducting the grading, grubbing and stockpiling activity.
Ordinance 3968, City and County of Honolulu		

REGULATORY AUTHORITIES AFFECTING KAWAINUI MARSH
Resource Determined Controls

Resource	Responsible Agency	Controlled Activities
Water Quality and Waste Disposal	Department of Health	Degradation of water quality may only be conducted under permit (NPDES).
Chapter 55, Title 11, Department of Health Administrative Rules - Water Pollution Control	"	Best management practices must be in place if a private wastewater plant is to be used.
Chapter 54, Title 11, Department of Health Administrative Rules - Water Quality Standards	"	
Chapter 58, Title 11, Department of Health Administrative Rules - Solid Waste Management Control	"	
Chapter 57, Title 11, Department of Health Administrative Rules - Private Wastewater Treatment Plants	"	
Flood Basin	Building Department, Department of Land Utilization	Construction activities and development are limited from certain areas depending on the flood hazard. Design of structures is prescribed by the County's building code.
State law County Ordinance Federal Flood Insurance Program	HUD	

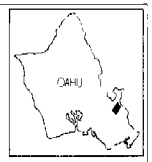


KAWAINUI MARSH RESOURCE MANAGEMENT PLAN

SCALE IN FEET

Prepared by
STATE OF HAWAII
DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT
1983

LEGEND



- PRIMARY AREA*
- ECONOMIC FEATURE
- ECOLOGICAL FEATURE
- CULTURAL FEATURE
- PROPOSED TRAIL*
- SITE 7*
- PRIVATELY OWNED LAND*
- IMPROVED WATERBIRD HABITAT*

*Approximate

KAWAINUI RESOURCE MANAGEMENT PLAN - OBJECTIVES, POLICIES, AND IMPLEMENTING ACTIONS

ECONOMIC

OBJECTIVES:

- PROTECT COMPATIBLE NATURAL, CULTURAL, AND ECONOMIC RESOURCES THROUGH MANAGEMENT AND CONTROL OF EXISTING AND FUTURE LAND USES.
- PROVIDE FOR PUBLIC USE AND ENJOYMENT OF THE EXISTING AND POTENTIAL RESOURCES OF THE MARSH.
- PROVIDE FOR A CENTRALIZED AND CONSISTENT MEANS FOR REVIEWING AND REGULATING LAND USE AND DEVELOPMENT IN THE PRIMARY STUDY AREA.

POLICIES

A. LAND AND WATER USE

1. Existing housing, churches, the hospital, and the YMCA which are within the primary study area, are recognized as established uses. Expansion of these facilities should not compromise the implementing policies of this plan.
2. Existing economic activities within the primary area that are incompatible with recommended land uses of this Plan should be removed.
3. Wetland agricultural use of the Marsh should be encouraged where it would serve to promote historic restoration or improve the waterbird habitat.
4. Public recreational use of the Marsh should be encouraged consistent with the protection of wildlife and habitat and cultural resources.
5. Development of the Marsh should combine active and passive uses associated with the public enjoyment of open space, wildlife, flora, and cultural experiences.
6. To minimize predation of ground nesting birds, open land in the primary area should not be planned or zoned for residential use, or other uses which support expanded domestic or feral animal populations.

B. CONTROLS AND COORDINATION

1. No structures in the primary area, above or below grade should be allowed, unless such structure is specifically identified as an implementing action of this Plan.
2. In opening freshwater areas within the Marsh, consideration should be given to the effects of dry weather on stream flow and evaporation rates.
3. Opening or enlarging of brackish or saltwater areas should be minimized to prevent saltwater intrusion into the Marsh and resulting adverse effects on present estuarine areas.
4. To avoid a reduction in the flood retention capacity of the Marsh basin, landfilling should not be permitted.
5. The integrity of the Marsh as a flood control and sedimentation basin must be maintained to the maximum extent feasible to protect the Kailua Town area from flooding.
6. Development on the slopes overlooking the Marsh and Kapaa Valley should be examined for potential adverse impacts on a case-by-case and cumulative basis in conjunction with the resource values identified in the policies of the Plan.
7. Specific land areas within the Marsh should be maintained for the protection and propagation of endangered birds.
8. The present streamflow should not be diverted where such diversion will negatively impact the resource management opportunities encompassed by the policies and recommended actions of this Plan.

RECOMMENDED ACTIONS

1. Remove the auto dump from the primary area.
2. Relocate existing industrial uses situated on the marsh side of the Quarry Road.
3. Establish 200 foot primary buffer zones surrounding existing and proposed habitats on the marsh side of the Quarry Road and adjacent to Ulupo Heiau.
4. Establish 50 foot secondary buffer zones along the remaining perimeter of the primary study area (see map).
5. Restore identified early Hawaiian taro patches (fields) in the areas near Ulupo Heiau and between Maunawili and Kahanaiki Streams.
6. Explore the economic viability of taro production in the wetland portions of both the primary and secondary areas.

1. Purchase all privately owned land within the primary area, with the exception of the existing subdivision and hospital, and reclassify them to conservation or preservation use.
2. Exchange, transfer, or by other means give authority over all publicly owned lands within the primary area to the State for its administration.

   Clear publicly owned lands of trash, hazards, and other debris, and provide continued maintenance.
4. Create a security system for the Marsh area to assure the peaceful enjoyment by the public.
5. Construct and maintain perimeter fences along the Quarry Road to discourage dumping, illegal activities, and predators, and to control unauthorized entry into the Marsh.
6. Investigate the technical feasibility and land use consistency of establishing a specific sedimentation area.
7. Delineate the entire wetland boundary of the Marsh.
8. Acquire those lands in the secondary area that will fulfill the other policies and implementing actions of this Plan, including an access trail to Puhukini Heiau and lands related to other historic sites.
9. Investigate the feasibility of realigning the Northeast portion of the Quarry Road in order to maintain access to existing landfill and quarry operations and improve public access and use of other recommended features of this Plan.
10. Appoint a multi-sector Kawainui Marsh Advisory Committee to monitor implementation of the Marsh management plan by the lead agency and assisting agencies and to provide continuity from the planning phase through the implementation phase of the project. In addition, this body would assist in the evaluation of management plan policy additions or revisions arising from its own initiatives or those of public agencies and organizations.

ECOLOGICAL

OBJECTIVES:

- PROTECT WATERBIRD SPECIES AND ENHANCE THEIR HABITATS.
- PROTECT IDENTIFIED STREAM, ESTUARINE, AND TERRESTRIAL WILDLIFE AND FISH AND THEIR HABITATS.
- IMPROVE AND MAINTAIN THE WATER QUALITY OF THE MARSH.

POLICIES

A. WATERBIRD HABITAT: PRIMARY ENDANGERED WILDLIFE AREAS

1. The natural water levels in the Marsh basin should be maintained in order to protect waterbird habitat and support potential agricultural activity.
2. Human access should be regulated in order to minimize disruption of identified habitats.
3. Preferential measures should be established to enhance habitat for endangered species, especially koloa, gallinule, and coot.
4. Growth of food species preferred by waterbirds should be encouraged.
5. Enlarge waterbird habitat (described in No. 1 above) by removing additional excessive vegetation to create a total of 50 acres of open water (total of 100 acres of habitat including vegetated nesting and escape areas).
6. Implement predator control measures (moats, traps, fencing, etc.).
7. Design and implement a program for the protection of wildlife through posting and surveillance of habitats.
8. Expand the waterbird habitat to 150 acres by clearing areas that extend from the 50 acres of open water (described in No. 5 above) toward the floating mat at the Eastern end of the Marsh (total of 300 acres of habitat including vegetated nesting and escape areas).

B. TERRESTRIAL WILDLIFE AND VEGETATION HABITAT

1. Desirable terrestrial vegetation and wildlife species should be promoted and accommodated in recreation/park areas, agricultural lands, interpretive centers, buffer zones, educational displays and scenic/aesthetic resources and viewing areas to complement the objectives and policies of this Plan.

C. STREAM HABITAT

1. The quality of habitat of streams discharging into the Marsh should be improved to encourage the natural recovery of the Marsh and passage of endemic migratory species.
2. Existing grading and erosion control ordinances should be enforced and special conditions applied to minimize sedimentation impact from urban development in the Maunawili Heights area.

D. ESTUARINE HABITAT

1. Any alteration of estuarine habitat, which may impact emergent freshwater vegetation should be preceded by impact assessments.
2. Alteration of estuarine habitat should not impact existing or proposed waterbird habitats identified in this plan.
3. The present balance between fresh and marine waters in the Marsh should not be altered by mechanical or unnatural means unless supported by other policies of the Plan.

E. WATER QUALITY

1. Existing grading and erosion control ordinances should be enforced and special conditions applied to minimize sedimentation impacts from development.
2. The chemical parameters contributed by agricultural uses within the watershed should be defined.
3. In order to resolve potential water quality problems, leachate monitoring requirements should be applied to any landfill activity within the drainage area of the Marsh.

RECOMMENDED ACTIONS

1. Reestablish existing waterbird habitat by removing excess vegetation to create 20 acres of open water (total of 40 acres of habitat, including vegetated nesting and escape areas).
2. Conduct an ongoing program for the control of water hyacinth and water lilies through ecologically acceptable chemical or mechanical means.
3. Control by mechanical means California grass in areas surrounding water hyacinth.
4. Implement mechanical measures to control cattails along primary drainage areas that are not part of primary waterbird habitats.
9. Establish an access route to Na Pohaku O Hauwahine (Kridler's Rock) for observing waterbirds and other compatible cultural uses.
10. Develop waterbird habitats in conjunction with interpretative uses in areas such as Hamakua Drive, the ITT parcel, and other areas.
11. Incorporate interpretive waterbird habitat features into taro/agricultural areas.
12. Develop nature walks along the flood control levee and other areas.

1. Develop an ethnobotanical garden adjacent to proposed taro fields and within the old landfill area occupied in part by the model airplane field.
2. Koa haole and other undesirable species should be removed in areas where they pose a nuisance or compete with other more desirable species and resource values such as scenic view points and viewplanes.

1. Expand stream courses by removing vegetation from their entrance into the Marsh downstream to connect with open water habitats.
2. Clear the accumulations of high grass at the stream mouth between the Kailua Road bridge and the small City and County park upstream, to improve habitats.

1. Implement studies to determine feasibility of developing interconnecting water trails between fresh and marine water areas.
2. Place a ban on any additional freshwater withdrawal from Kawainui Marsh.
3. Explore opportunities for enhancing recreational opportunities in the estuarine area of the Marsh.

1. Develop criteria for monitoring discharge of sediments in the Marsh.
2. Discontinue direct discharges of treated sewage effluent into the Marsh and into streams subsequently discharging into the Marsh.
3. Develop and maintain a system to monitor the quality and quantity of influent streams and overland flows to the Marsh.

CULTURAL RESOURCES

OBJECTIVES:

- PROTECT AND PRESERVE IDENTIFIED HISTORIC AND PRE-HISTORIC SITES AND DISTRICTS WITHIN THE PRIMARY AND SECONDARY AREAS WHICH ARE LISTED OR ELIGIBLE FOR LISTING ON THE NATIONAL AND STATE REGISTERS.
- PROMOTE TRADITIONAL CULTURAL VALUES THROUGH THE DEVELOPMENT AND USE OF IMPORTANT ARCHAEOLOGICAL SITES IN THE MARSH AREA.
- PROVIDE FOR THE ENHANCEMENT AND USE OF THE PRIMARY AREA AS A LEARNING RESOURCE FOR EDUCATIONAL INSTITUTIONS.
- IDENTIFY, ENHANCE, AND PRESERVE AESTHETIC QUALITIES OF THE PRIMARY AND SECONDARY AREAS, INCLUDING VISTAS, VIEWPLANES AND SITE SPECIFIC FEATURES AND ELEMENTS.
- PROVIDE FOR RECREATIONAL ACTIVITES IN THE MARSH AREA.

POLICIES

A. HISTORICAL

1. The formal nomination of Kawainui Marsh to the National Register of Historic Places should be pursued.

B. ARCHAEOLOGICAL

1. All significant archaeological sites on private land within the primary area should be acquired and preserved for public use.
2. Implementing actions of this Plan which propose activities such as construction of trails and recreation areas, or landscaping and restoration of historic sites, should be preceded by archaeological surveys.

C. HAWAIIAN HERITAGE

1. All identified archaeological sites within the primary study area should be viewed from a cultural-system perspective.
2. Interpretation of Hawaiian heritage should include agriculture, aquaculture, habitation, folklore, and other traditional systems.

D. AESTHETICS

1. The wilderness character of the Marsh and the surrounding area should be promoted through rehabilitation, landscaping, and management.
2. To the extent feasible, landforms, views and vistas of the natural landscape should be reconstructed.

E. EDUCATIONAL

1. Features of the Marsh basin that are important to educational programs including historic sites, habitat overlooks, interpretive centers, interconnecting trail systems between the above features and access trails to marsh overlooks, should be developed.
2. The educational opportunities that are present in the Marsh, including those that have been utilized in past educational programs and more recently described in the guidebook "Ho'omalu'ao No Kawai Nui" should be supported so long as such use is not contrary to the resource protection and management policies identified in this Plan.

F. RECREATIONAL

1. Passive recreational opportunities, including picnicking and camping sites, should be established at appropriate points so they will not disrupt or conflict with policies within other resource areas.
2. Open fields for active recreational activities should be provided in locations consistent with other policies of the management plan.

RECOMMENDED ACTIONS

1. Publish a report on the history of the Marsh area which is based on existing reports and a thorough archival search of records.
2. Prepare a chronology of historic events for public use.
3. Define specific boundaries of the eligible historic district for nomination to the National Register of Historic Places.

1. Acquire lands necessary to provide visual corridors and trial linkages between Ulupo and Puhukini Heiaus.
2. Implement and fund programs for the landscaping and maintenance of existing historic sites, including the heiaus, site 33, the grinding stone, and other identified sites.

1. Establish trails and overlook systems to connect principal cultural features such as heiaus, and interpretive centers with wildlife overlooks.
2. Develop secluded areas where ceremonial practices and performances can be conducted.
3. Investigate and record the sacred nature and cultural significance of the birds of Kawainui, particularly where such values relate to proposed wildlife management recommendations of this Plan.

1. The existing sanitary landfill site, following closure should be graded and landscaped.
2. The auto junkyard should be cleared and the area restored to an appropriate natural area setting.
3. The opportunities for removal or modification of the Kailua drive-in theater screen should be explored in order to improve view planes toward and from the Marsh.

1. Prepare learning modules based on previous and proposed basic research.
2. Develop interpretive educational programs and centers which demonstrate the interrelationship of early Hawaiian cultural, agricultural, recreational and social systems.

1. Create or establish safe hiking paths and jogging trails in perimeter areas of the Marsh.
2. Provide scenic and wildlife overlooks in places consistent with identified scenic and habitat values.
3. Study the potential for expanding the estuary for fishing and boating activities.
4. Establish or create access routes, trails, and facilities for nature studies.
5. Prepare a comprehensive recreational plan for Kawainui Marsh which encompasses the primary area and portions of the secondary area, and which addresses existing uses and uses proposed within this document. The plan should integrate recreational activities so that they are consistent with the resource protection and management policies of this document.