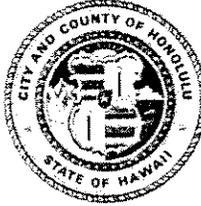


DEPARTMENT OF LAND UTILIZATION  
**CITY AND COUNTY OF HONOLULU**

650 SOUTH KING STREET  
HONOLULU, HAWAII 96813 • (808) 523-4432



FRANK F. FASI  
MAYOR

JOHN P. WHALEN  
DIRECTOR

BENJAMIN B. LEE  
DEPUTY DIRECTOR

89/SMA-80(bwm)

September 27, 1989

Mr. George L. Kekuna, Director  
Oahu Civil Defense Agency  
City & County of Honolulu  
Honolulu, Hawaii

Dear Mr. Kekuna:

MINOR PERMIT--SPECIAL MANAGEMENT AREA  
CHAPTER 33, REVISED ORDINANCES OF HONOLULU

Project	:	<u>Installation and operation of a water level</u> <u>sensor in Kawainui Marsh (\$63,000)</u>
Applicant	:	<u>C&amp;C, Oahu Civil Defense Agency</u>
Location	:	<u>1560 Mokapu Blvd., Kawainui Marsh, Kailua, Oahu</u>
Tax Map Key	:	<u>4-2-16: 01</u>

We have reviewed your proposal and find that it lies within the Special Management Area (SMA) established in Chapter 33. We find that your proposed development has a valuation of less than \$65,000 and will have no significant effect on the SMA. Therefore, a Minor Permit is hereby issued.

A copy of this letter should accompany your application(s) for construction permits. If the accepted valuation of the proposed work exceeds \$65,000, the project will be returned to the Department of Land Utilization for further review under Chapter 33.

Please contact the Environmental Affairs Branch at 523-4077 if you have any questions.

Very truly yours,

  
JOHN P. WHALEN  
Director of Land Utilization

JPW:s1

1990-01-23-0A-12A

February 1983

Kawaiiru Installation Operator  
Water Level Sensor

# FILE COPY

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

FOR DLNR USE ONLY

Reviewed by \_\_\_\_\_  
 Date \_\_\_\_\_  
 Accepted by \_\_\_\_\_  
 Date \_\_\_\_\_  
 Docket/File No. \_\_\_\_\_  
 180-Day Exp. \_\_\_\_\_  
 EIS Required \_\_\_\_\_  
 PH Required \_\_\_\_\_  
 Board Approved \_\_\_\_\_  
 Disapproved \_\_\_\_\_  
 Well No. \_\_\_\_\_

## DEPARTMENT MASTER APPLICATION FORM

(Print or Type)

I. LANDOWNER/WATER SOURCE OWNER  
(If State land, to be filled in by Government Agency in control of property)

Name City and County of Honolulu  
Address 650 So. King St.  
Honolulu, Hawaii  
96813

Telephone No. 523-4121

SIGNATURE [Signature]  
Date September 22, 1989

II. APPLICANT (Water Use, omit if applicant is landowner)

Mr. George L. Kekuna  
Name Oahu Civil Defense Agency  
Address 650 So. King St.  
Honolulu, Hawaii  
96813

Telephone No. 523-4121

Interest in Property Flood Hazard

Mitigation. See Atch 1 For Evidence  
(Indicate interest in property; submit written evidence of this interest)

\*SIGNATURE [Signature]  
Date September 22, 1989

\*If for a Corporation, Partnership, Agency or Organization, must be signed by an authorized officer.

III. TYPE OF PERMIT(S) APPLYING FOR

- ( ) A. State Lands
- (x) B. Conservation District Use
- ( ) C. Withdraw Water From A Ground Water Control Area
- ( ) D. Supply Water From A Ground Water Control Area
- ( ) E. Well Drilling/Modification

IV. WELL OR LAND PARCEL LOCATION REQUESTED

District Windward  
Island Oahu  
County C&C of Honolulu  
Tax Map Key 4-2-16:1  
Area of Parcel 599.559 Acres  
(Indicate in acres or sq. ft.)  
Term (if lease) N/A

## ADDITIONAL INFORMATION

### I. DESCRIPTION OF PARCEL

- A. Existing Structures/Use - The only prominent structure in the project area is an earthen levee 6850 feet long with a maximum crest elevation of 9.5 feet. The levee separates Kawainui Marsh from a residential area of the Kailua Community called "Coconut Grove". See Attachment 2.
- B. Existing Utilities - There are no utilities in the project area.
- C. Existing Access - Access to the project site is gained via a crushed gravel road (approximately 10 feet wide which sits astride the full length of the levee) through a controlled entry point on Kailua Road just West of Kainalu Drive. See Attachment 2. The levee road is owned and maintained by the City and County of Honolulu.
- D. Vegetation - Kawainui Marsh may be divided into two major types of vegetation communities. In the ponding basin is a bulrush marsh with floating mats of live vegetation and peat deposition. In the drier parts is found a bog meadow of California grass, resting on mineral soil rather than peat. Both communities are stream fed. Smith (1978) noted about 199 plant species occurring in the two communities of which eight were native species, and 24 occurred within the marsh. No endangered plant species were observed. See Attachment 3 for a map showing vegetation locations.
- E. Topography - Kawainui Marsh is the largest remaining wetland in the State of Hawaii. Located at the base of the Ko'olau Mountains on the Island of Oahu, it consists of approximately one thousand acres.

Coconut Grove is the most prominent urban feature in the area. It lies directly East of Kawainui Marsh, between the marsh and Kailua Bay. The Coconut Grove houses are built on low-lying coral sands with those closest to the marsh generally in soggy, less permeable soil.

Castle Memorial Hospital is the most prominent landmark in the area clustered around the intersection of Kalaniana'ole Highway and Kailua Road to the south of the marsh. Castle Hospital is at a higher elevation

than Coconut Grove and is not affected by the level of water in the marsh.

A third urban area lies outside of the marsh but has considerable effect upon it. This is Maunawili subdivision, located in Maunawili Valley south and upgradient of the marsh. This area is drained by the two streams that flow into the marsh, Kahanaiki and Maunawili.

Rising above the marsh to the south, west and northwest are the remnants of the Ko'olau volcanic dome characterized mainly by precipitous cliffs with slopes between 45 to 85 degrees. The highest points along the crestline are in excess of 2000 feet.

- F. Shoreline Area - Not applicable.
- G. Existing Covenants, Easements, Restrictions - Special Management Area Permit required from the City and County of Honolulu in accordance with Chapter 33, ROH.
- H. Historic Sites Affected - None. See map at Attachment 4 for the location of archeological resources in Kawainui Marsh.

## II. DESCRIPTION OF PROPOSED ACTIVITY

As a flooding mitigation action incident to the December 10, 1987 - January 2, 1988 Presidentially-declared disaster within the Kailua, Hawaii community, the City and County of Honolulu proposes to install and operate a water level sensor system to provide real time data on water levels in Makawao Stream and Kawainui Marsh.

This request addresses only that portion of the sensor system that will be installed in Kawainui Marsh.

The basic system will consist of two (2) event reporting remote stations that collect sensor data and transmit the data via line of sight radio transmitters. The primary gage location will be immediately adjacent to the Kawainui Marsh levee fronting Kihapai Street. The secondary gage site will be at the U. S. Geological Survey Makawao Stream gage station 2540. The central receive site for the system will be located at the Kailua Police Station. See Attachment 5 for maps depicting the operating areas.

The central receive site will be equipped with a microcomputer and multi-tasking software to allow simultaneous acquisition and validation of received data, data storage and retrieval, and the evaluation of water level changes within the marsh. An audible alarm will be sounded at the receive site whenever preselected thresholds

are exceeded to alert duty personnel. The receive site microcomputer will be equipped with an autodial modem to enable remote accessing of the data and system operations.

No inherent stand-alone flood prediction capabilities are provided within the proposed system. The water level sensor system will be compatible with the National Weather Service Western Region Automated Local Evaluation in Real Time (ALERT) criteria, to allow ready integration with possible future basin- and area-wide hydrologic sensor systems. Recurring maintenance may be required at each sensor site two or three times annually involving minor equipment adjustments or replacement of a battery or transmitter.

III. COMMENCEMENT DATE: November 1, 1989  
COMPLETION DATE; February 8, 1990

IV. TYPE OF USE REQUESTED

1. Permitted Use (exception occasional use);  
DLNR Title 13, Chapter 2, Section \_\_\_\_\_; Subzone \_\_\_\_\_.
2. Accessory Use (accessory to a permitted use):  
DLNR Title 13, Chapter 2, Section \_\_\_\_\_; Subzone \_\_\_\_\_.
3. Occasional Use: Subzone \_\_\_\_\_.
4. Temporary Variance: Subzone \_\_\_\_\_.
5. Conditional Use: Subzone P/L.

Area Of Proposed Use - Approximately 100 Square Feet

Name and Distance of Nearest Town or Landmark  
Coconut Grove, Kailua, Hawaii - One Tenth Mile  
East

Boundary Interpretation - None. Kawainui Marsh Sensor  
Site totally within the Conservation District.

Conservation District Subzone - Protective/Limited  
County General Plan Designation - Preservation

V. SUBZONE OBJECTIVE

The proposed project is consistent with the Conservation District Subzones (Protective/Limited) in that it will in the longer term assist in protecting watersheds, water sources and supplies. The project does not affect historical or archaeological sites and will have minimal impact on native plants, fish or wildlife. The project will involve the monitoring of water flows and in time be the basis for an emergency warning system. It is a necessary

project to protect the health and welfare of the public.

# **INTERAGENCY FLOOD HAZARD MITIGATION REPORT**

**IN RESPONSE TO THE JANUARY 8, 1988  
DISASTER DECLARATION  
(FEMA-808-DR-HI)**

**COVERING THE CITY AND COUNTY OF HONOLULU  
OAHU, HAWAII**

**PREPARED BY THE FEMA REGION IX  
INTERAGENCY FLOOD HAZARD MITIGATION TEAM**

**FEBRUARY 1988**

**ATTACHMENT 1**

INTERAGENCY  
FLOOD HAZARD MITIGATION REPORT

IN RESPONSE TO THE JANUARY 8, 1988  
DISASTER DECLARATION  
(FEMA-808-DR-HI)

PREPARED BY THE FEMA REGION IX  
INTERAGENCY FLOOD HAZARD MITIGATION TEAM

COVERING THE CITY AND COUNTY OF HONOLULU  
OAHU, HAWAII

FEDERAL AGENCIES  
ARMY CORPS OF ENGINEERS  
FEDERAL EMERGENCY MANAGEMENT AGENCY  
FLOOD INSURANCE ADMINISTRATION  
FISH AND WILDLIFE SERVICE  
GEOLOGICAL SURVEY  
HOUSING AND URBAN DEVELOPMENT  
SMALL BUSINESS ADMINISTRATION  
SOIL CONSERVATION SERVICE  
NATIONAL WEATHER SERVICE

STATE OF HAWAII  
CIVIL DEFENSE  
COASTAL MANAGEMENT PROGRAM  
LAND AND NATURAL RESOURCES

CITY AND COUNTY OF HONOLULU  
CIVIL DEFENSE  
BUILDING DEPARTMENT  
GENERAL PLANNING  
LAND UTILIZATION  
PUBLIC WORKS  
WATER SUPPLY

FEBRUARY 1988

## EXECUTIVE SUMMARY

A summary of the Interagency Hazard Mitigation Team Report (IHMT) for the January 8, 1988 Presidential Disaster Declaration (FEMA-808-DR-HI) must be prefaced by several important points. Many of the areas damaged in the New Year's Eve flooding have a history of recurrent flooding. What may be unusual in this instance is the very heavy rainfall, the landslides, and the extensive damage caused by debris flows.

Rainfall and flood damage varied between locations. Preliminary analysis indicates that rainfall exceeded a 100-year frequency at two gaging stations in adjacent windward watersheds, and in nearby locations. A new record may have been established in one of the locations. Flood damage occurred throughout the watersheds, in mapped flood hazard areas and in unmapped areas. The heavy rains also caused flooding, landslides and debris flows in areas with no recorded history of flood damage. This type of damage may be attributed to the exceptional December rainfall that preceded the flood event.

Final analysis of rainfall and streamflow data has not yet been completed. When the official data is available, it may have an effect on some of the conclusions drawn from the disaster and on some of the issues addressed by the State in its Hazard Mitigation Plan. However, for the purpose of IHMT Report, the Team was still able to identify several short and long-term opportunities for flood hazard mitigation. Specific recommendations were developed into four categories: The Coordinated Management of Flood Risks; Increased Public Awareness, Education, and Information; Individual Floodproofing and Repair; and the Promotion of Flood Insurance.

Detailed description the twelve recommendations included under these categories begins on Page 14 of this report.

### Coordinated Management of Flood Risks

1. Interagency Task Force
2. Flood Warning for "Coconut Grove"
3. Cooperative Agreement for Waimanalo
4. SCS Emergency Streambank Protection
5. Emergency Assessment of Landslide Potential
6. Development Controls and Engineering Design Standards

### Public Awareness, Education and Information

7. Hydrometeorological Gage Network and Automated Local Flood Warning System
8. Flood Awareness Week
9. NOAA Weather Radio

### Individual Floodproofing and Repair

10. CDBG Funded Flood Proofing and Repairs

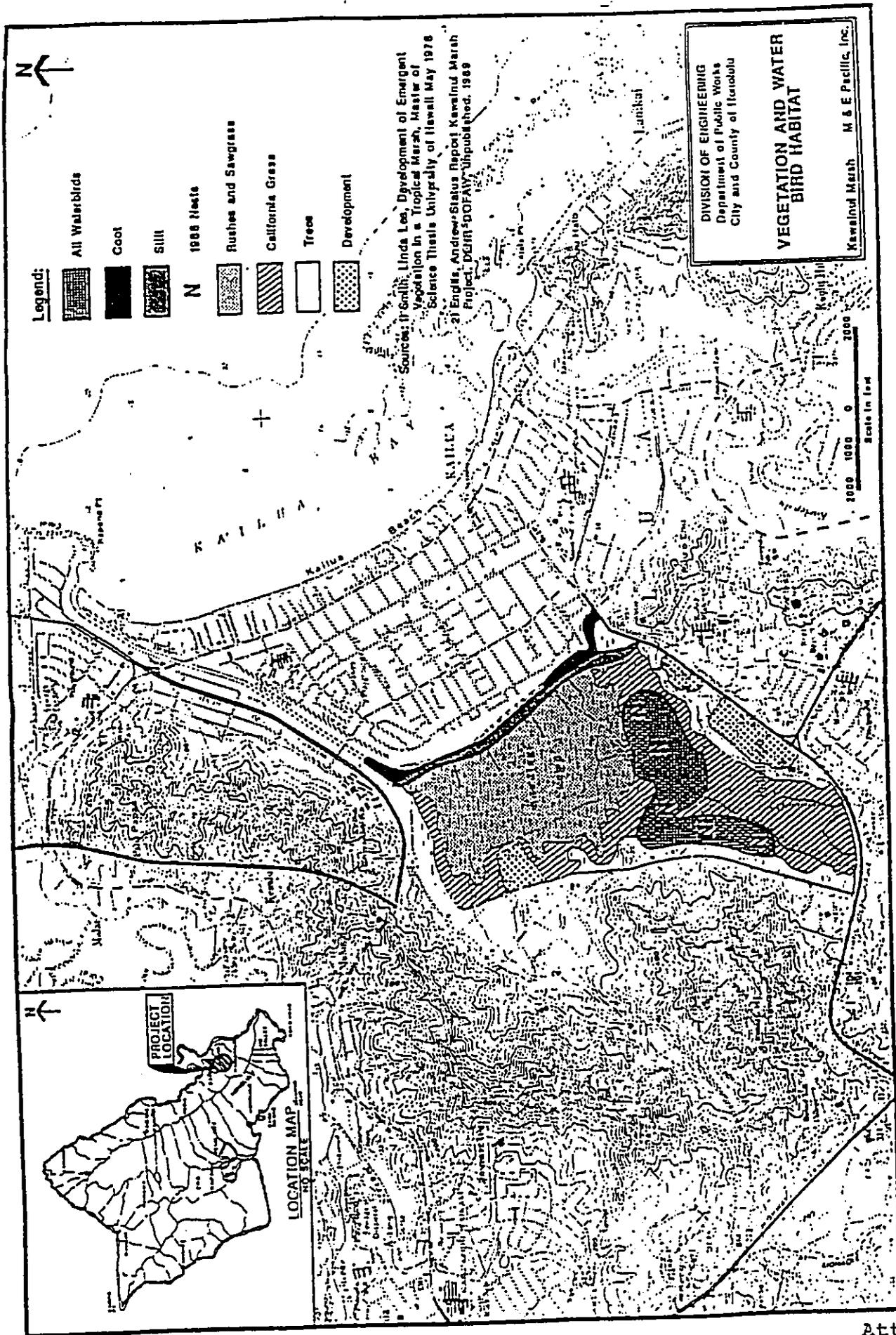
### Flood Insurance

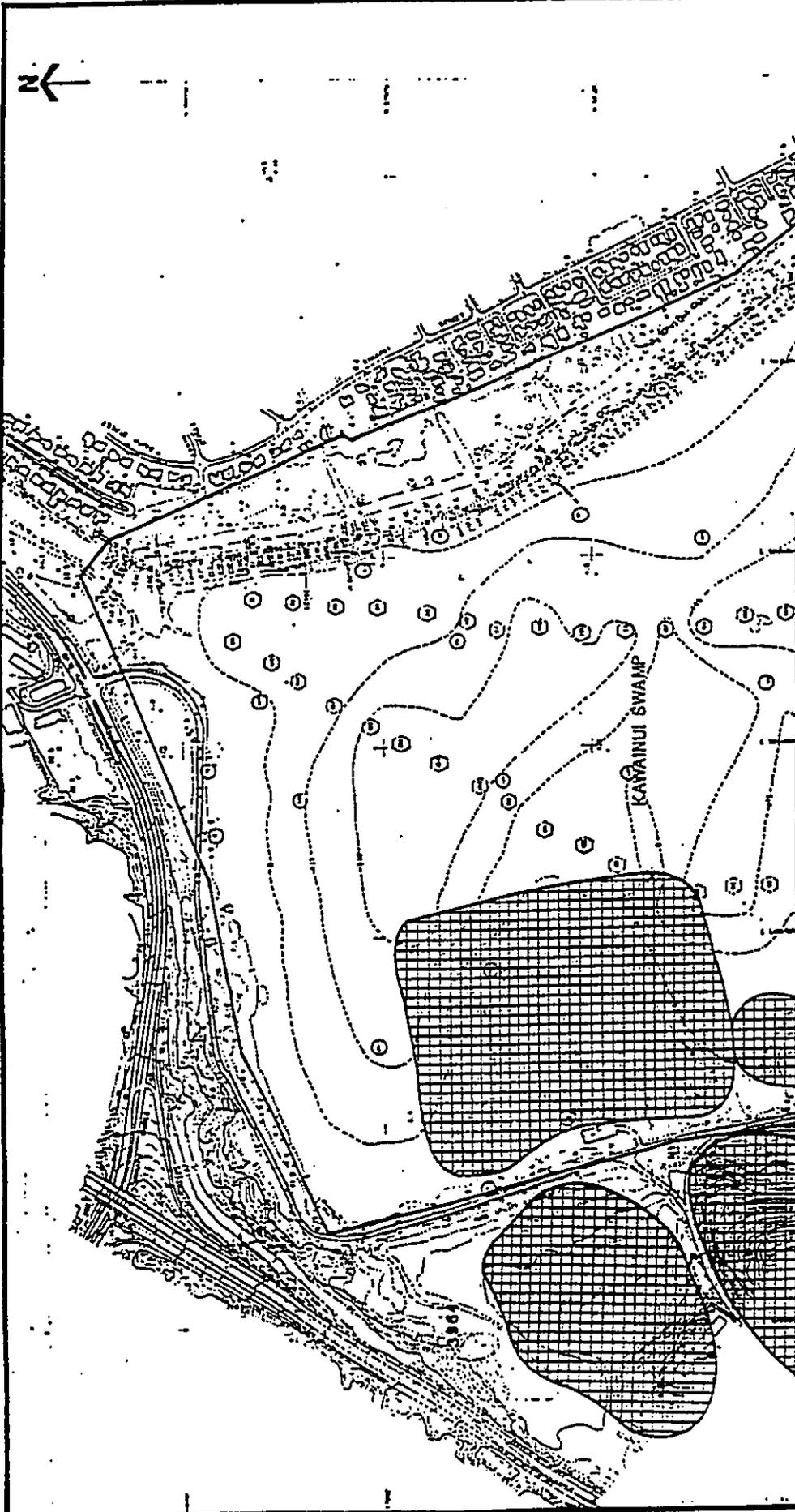
11. Flood Insurance Workshops
12. Flood Insurance Rate Map Revisions



1. <u>Drainage area, sq. mi.</u>	11.2	Station 90+00	-6.2
2. <u>Hydrologic and hydraulic data</u>		Station 94+65	-0.2
Design flood, second-feet inflow to swamp	18,100	Slope of channel invert	
Maximum flood of record		Station 0+00 to 90+00	0.07%
Date	26-27 March 1951	Station 90+00 to 94+65	1.2%
Discharge, second-feet inflow to swamp	12,300	Elevation of top of banks, feet, HSL	6.0 to 10.5
Standard project flood, second-feet inflow to swamp	18,100	Side slopes	
Channel capacity, second-feet outflow from swamp	7,370	Shoreline to Sta. 16+00	
Freeboard for design flood		Horizontal to vertical	2:1
Channel, feet (minimum above design water surface)	2.0	Sta. 16+00 to Sta. 94+65	
Swamp levee, feet (minimum above design water surface)	3.15	Horizontal to vertical	3:1
Velocity of flow, design flood		Bank stabilization	Riprap
Maximum, feet per second	6.9	Control structure	
Minimum, feet per second	3.9	Trapezoidal weir with trapezoidal cross-section and manually operated slide gates	
Maximum stage at upper end of channel, feet, HSL	6.7	Length (crest), feet	262
Maximum swamp stage, feet, HSL	7.35	Width (crest), inches	4
3. <u>Definite project plan</u>		Crest height, feet, HSL	3.0
Channel		Flap gates with auxiliary manual control	8 - 24"
Length, feet	9,465	Culvert with flap gate which has auxiliary manual control	1 - 24"
Depth, feet	14--10	Levee	
Bottom width, feet	110 & 80	Compacted earth fill	
Invert elevation, feet, HSL		Combined length, feet	6,340
Station 0+00	-8.0	Height, feet (above base)	0--16
		Elevation of crown, feet, HSL	10.5
		Crown width, feet	10
		Side slopes	3:1
		Relocation	
		Power lines	3

**PERTINENT DATA FROM CORPS OF ENGINEERS DESIGN REPORT (KAWAINUI)**  
Table 2-1

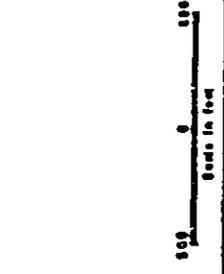




DIVISION OF ENGINEERING  
 Department of Public Works  
 City and County of Honolulu

**ARCHAEOLOGICAL  
 RESOURCES**

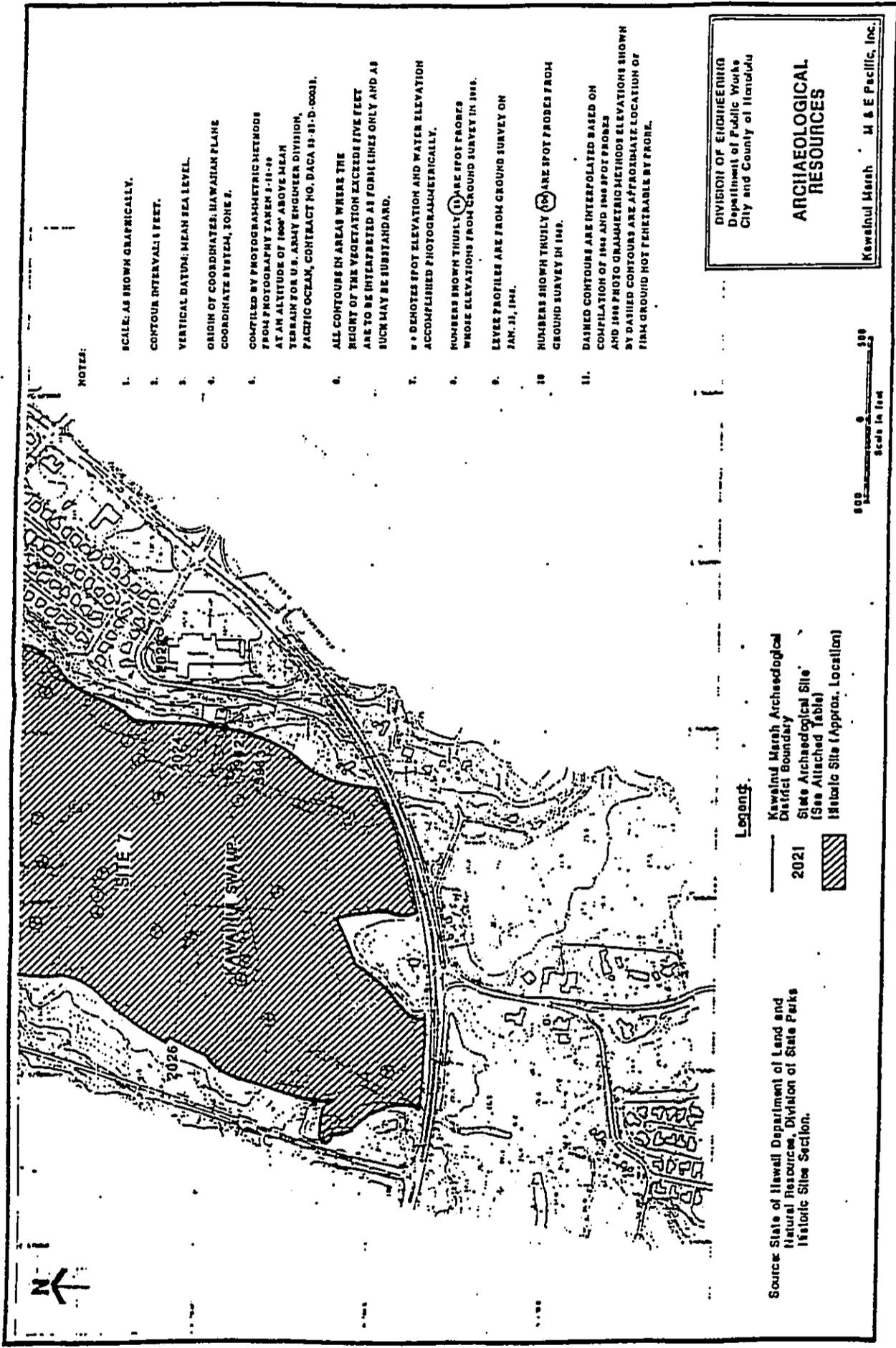
Kawaiulu Marsh M & E Pacific, Inc.



**Legend**

- Kawaiulu Marsh Archaeological District Boundary
- 2021 State Archaeological Site (See Attached Table)
- Landfill Quarry (Maunaloa)

Source: State of Hawaii Department of Land and Natural Resources, Division of State Parks Historic Sites Section.



NOTES:

1. SCALE: AS SHOWN GRAPHICALLY.
2. CONTOUR INTERVALS: FEET.
3. VERTICAL DATUM: MEAN SEA LEVEL.
4. ORIGIN OF COORDINATES: HAWAIIAN PLANE COORDINATE SYSTEM, ZONE 2.
5. COMPILED BY PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY TAKEN 8-15-49 AT AN ALTITUDE OF 1000' ABOVE MEAN TERRAIN FOR U.S. ARMY ENGINEER DIVISION, PACIFIC OCEAN, CONTRACT NO. DACA 12-81-D-0003.
6. ALL CONTOURS IN AREAS WHERE THE HEIGHT OF THE VEGETATION EXCEEDS FIVE FEET ARE TO BE INTERPRETED AS FORM LINES ONLY AND AS SUCH MAY BE SUBSTANDARD.
7. \* DENOTES SPOT ELEVATION AND WATER ELEVATION ACCOMPLISHED PHOTOGRAMMETRICALLY.
8. NUMBERS SHOWN THUSLY (1) ARE SPOT PROBES WHOSE ELEVATIONS FROM GROUND SURVEY IN 1949.
9. LEVER PROFILES ARE FROM GROUND SURVEY ON JAN. 31, 1949.
10. NUMBERS SHOWN THUSLY (2) ARE SPOT PROBES FROM GROUND SURVEY IN 1949.
11. DAINED CONTOURS ARE INTERPOLATED BASED ON COMPILATION OF 1949 AND 1948 SPOT PROBES AND 1948 PHOTOGRAMMETRIC METHODS ELEVATIONS SHOWN BY DASHED CONTOURS ARE APPROXIMATE LOCATION OF FIRM GROUND NOT PENETRABLE BY PROBE.

DIVISION OF ENGINEERING  
 Department of Public Works  
 City and County of Honolulu

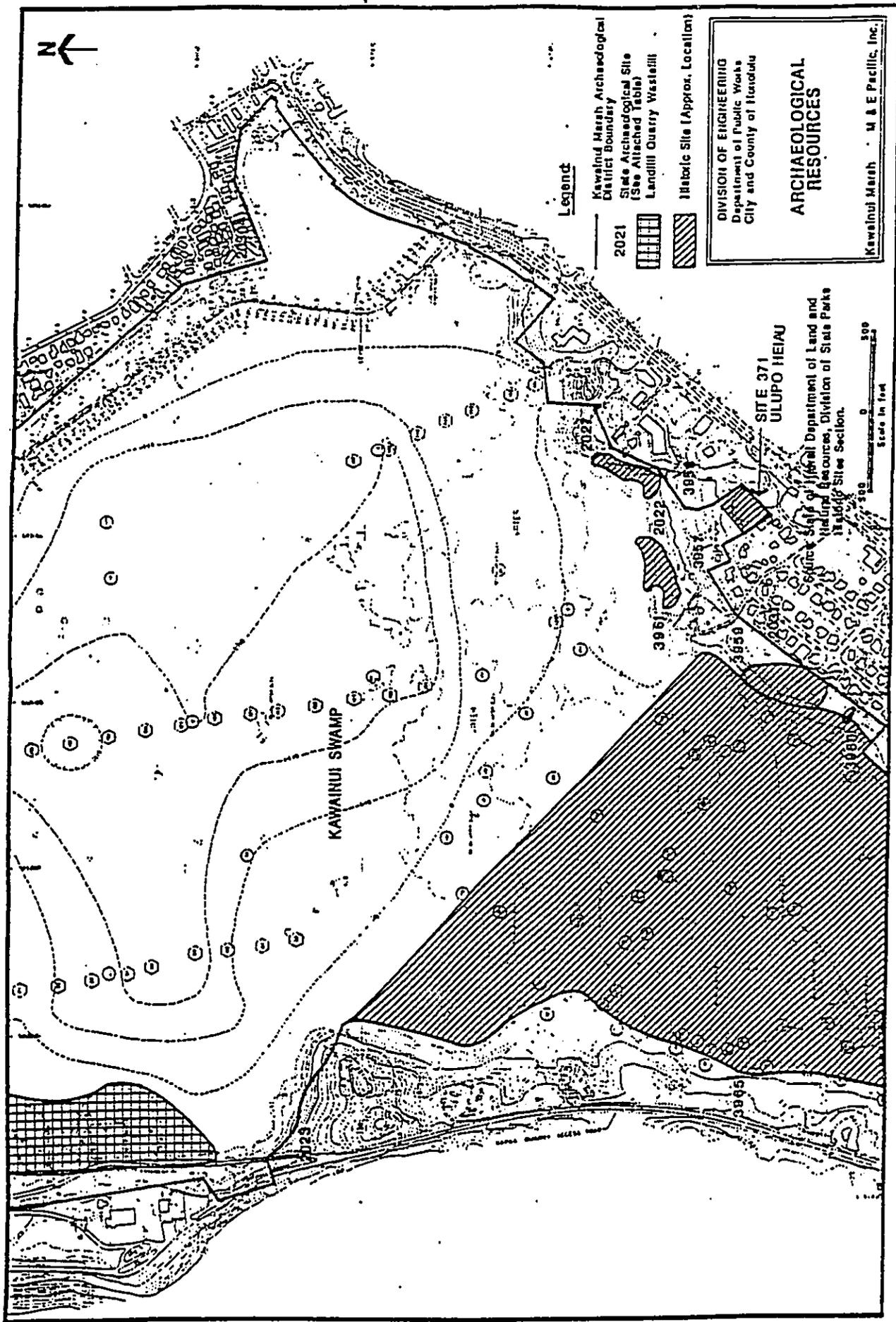
**ARCHAEOLOGICAL RESOURCES**

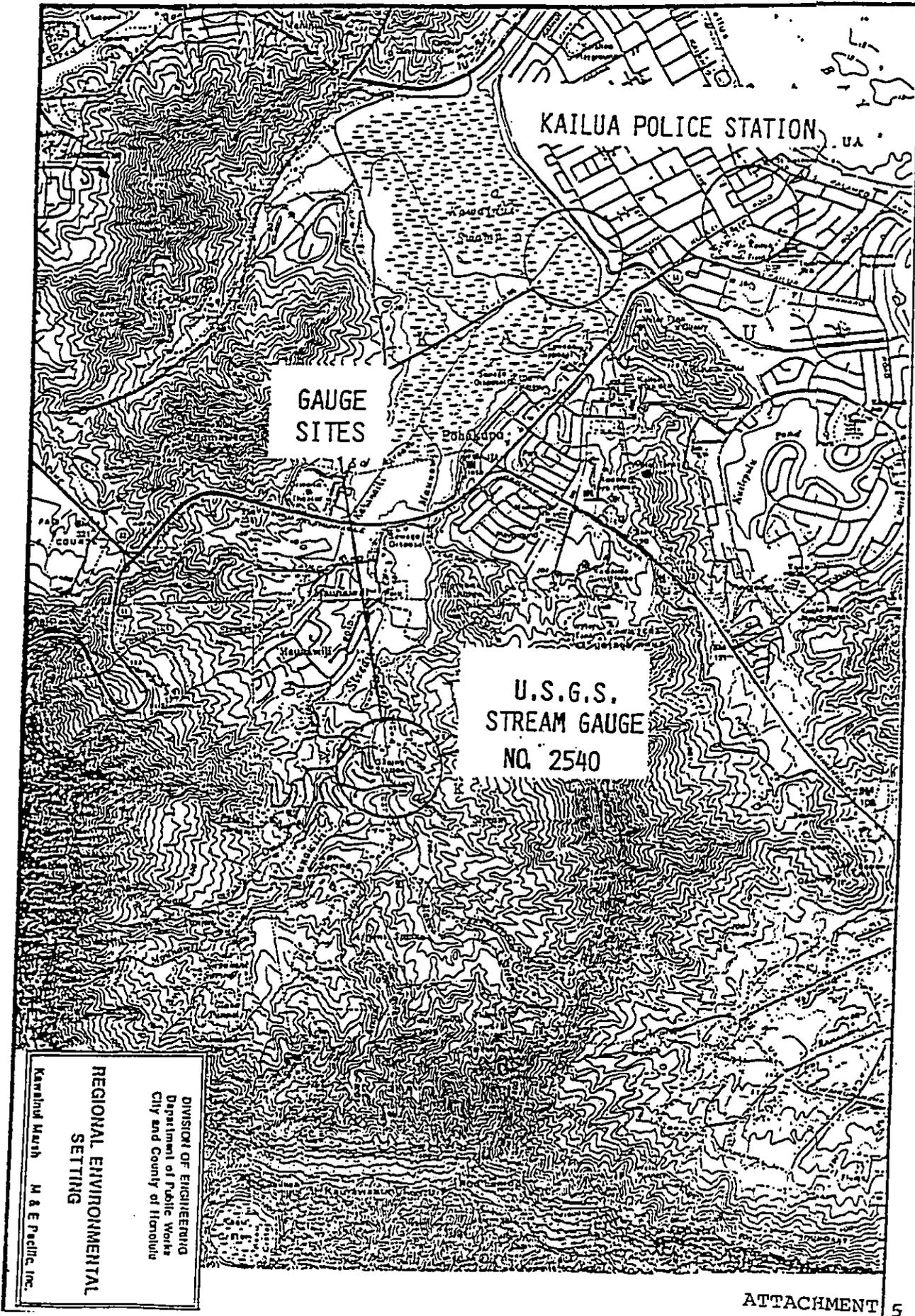
Kawaihi Marsh M & E Pacific, Inc.

Legend:

- Kawaihi Marsh Archaeological District Boundary
- 2021 Site Archaeological Site (See Attached Table)
- ▨ Historic Site (Approx. Location)

Source: State of Hawaii Department of Land and Natural Resources, Division of State Parks Historic Sites Section.







ENVIRONMENTAL ASSESSMENT  
IN ACCORDANCE WITH  
CHAPTER 343, HAWAII REVISED STATUTES  
KAWAINUI MARSH MITIGATION PROJECT  
WATER LEVEL SENSOR SYSTEM

Prepared By  
OAHU CIVIL DEFENSE AGENCY  
650 South King Street  
Honolulu, Hawaii 96813

September 22, 1989

ENVIRONMENTAL ASSESSMENT

CHAPTER 343, HAWAII REVISED STATUTES

**PROJECT:** Kawainui Marsh Water Level Sensor System

**LOCATION:** Kawainui Marsh, Kailua, Oahu  
TMK 4-2-16:1

**PROPOSING AGENCY:** City and County of Honolulu  
Oahu Civil Defense Agency

**APPROVING AGENCY:** State of Hawaii  
Department of Land and Natural Resources

**AGENCIES CONSULTED:** City and County of Honolulu  
- Department of Land Utilization  
- Department of Public Works  
State of Hawaii  
- Department of Defense, Civil Defense Division  
- Department of Land and Natural Resources (DOWALD)  
Federal Government  
- U. S. Army Corps of Engineers  
- National Oceanic and Atmospheric Administration

### SUMMARY OF PROPOSED USE

As a flooding mitigation action incident to the December 10, 1987 - January 2, 1988 Presidentially-declared disaster within the Kailua, Hawaii community, the City and County of Honolulu proposes to install and operate a water level sensor system to provide real time data on water levels in Makawao Stream and Kawainui Marsh.

This Environmental Assessment addresses only the portion of the sensor system that will be installed in Kawainui Marsh, which falls in the Special Management Area and the State Conservation District.

The proposed project consists of two (2) event reporting remote stations that collect sensor data and transmit the data via line of sight radio transmitters. The primary gage location will be immediately adjacent to the Kawainui Marsh levee fronting Kihapai Street in Kailua. The secondary gage site will be at the U. S. Geological Survey (USGS) Makawao Stream gage station 2540. The central receive site for the system will be located at the Kailua Police Station. See TABs A and B for maps identifying site locations.

The central receive site will be equipped with a microcomputer and multi-tasking software to allow simultaneous acquisition and validation of received data, data storage and retrieval, and the evaluation of water level changes within the marsh. An audible alarm will be sounded at the receive site whenever preselected thresholds are exceeded to alert duty personnel. The receive site microcomputer will be equipped with an autodial modem to enable remote accessing of the data and system operations.

No inherent stand-alone flood prediction capabilities are provided within the proposed system. The water level sensor system will be compatible with the National Weather Service Western Region Automated Local Evaluation in Real Time (ALERT) criteria, to allow ready integration with possible future basin- and area-wide hydrologic sensor systems.

The proposed project is located on City-owned land and will utilize City funds.

## TECHNICAL, ECONOMIC, SOCIAL AND ENVIRONMENTAL CHARACTERISTICS

### KAWAINUI MARSH WATER LEVEL SENSOR SYSTEM

- All remote equipment will be designed and tested to operate over a temperature range of -10 degrees C to +60 degrees C. (See TAB C, Pages 1-3, for a depiction of a typical system configuration, as well as schematics of the precipitation and water level sensors.)
- The precipitation sensor will be an incremental (tipping bucket) type with resolution of 0.01 inches. The contact closure will be magnetic reed type. The exposed parts will be corrosion-resistant or painted with epoxy enamel.
- The water level sensor may be either pressure transducer type, or stilling well with float and shaft encoder.
  - The shaft encoder will be an incremental type providing discrete pulses or events for each one-hundredth revolution of the pulley or 0.01 foot resolution for a one-foot circumference pulley. The shaft encoder will rotate with the up and down motion of a float attached to a pulley on the shaft encoder through a steel tape.
  - The pressure transducer will be of the strain gage type with construction suitable for continuously submerged operation. The sensor range will be 25 feet, with a resolution of 0.2% of full scale. The pressure transducer will be mounted within a protective enclosure to reduce vandalism.
- The data transmitter will be completely enclosed in a water-tight, non-corrosive container. It will include all the electronics, including the radio transmitter, and rechargeable batteries. Data will be transmitted at 300 or 1200 baud rates in binary format.
- The power supply will be a maintenance-free 12 volt power system. The system will power all sensors, the collection and telemetry equipment. The battery will be a rechargeable gel cell type with capacity to make at least 35,000 transmissions before recharging, or a shelf life of 12 months. The battery will have provisions for recharging from both a solar panel and an AC charger. The solar panel will be corrosion resistant, lightweight, and rugged; have power regulation and blocking diode; a tempered glass cover; at least 6 watts peak power; and be compatible with the battery and battery charging characteristics over temperature.
- The sensor enclosure for the gage station may be either a self-enclosed standpipe assembly or a separate gage house

with chain link fencing and an entry gate. The enclosure and supporting structure for the rain gage station will be constructed of a non-corrosive and termite resistant materials. The design of the sensor enclosure will be visually unobtrusive and vandal resistant. No ground level doors or openings shall be provided in order to discourage vandalism. If a standpipe enclosure is used, it will be equipped with a means of hoisting any hardware components housed within it.

- The antenna(s) will be of a directional whip configuration with a three wire ground plane.
- The receiver at the Kailua Police Station will be a synthesized, multi-channel receiver covering the VHF and UHF bands in 12.5 kHz steps. Sensitivity shall be 1.0 microvolts, nominal. It will operate at 115 vac/60 Hz. The receiver will be able to concurrently receive both 300 and 1200 baud data rates.
- The estimated in-place cost of the water level sensor system with two remote automated gages and the single receive site in Kailua is \$63,000.

## DESCRIPTION OF THE ENVIRONMENT

Maunawili Valley is part of the remnant of the volcanic dome, the Koolau Range, which constitutes the eastern three-fourths of the island of Oahu.

Kawainui Marsh is the largest remaining wetland in the State of Hawaii. Located at the base of the Koolau Mountains, it consists of approximately one thousand acres. The marsh contains resource values beyond the open vistas it affords between sea and mountain. It is 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 as a nutrient and sediment sink to protect the waters of Kailua Bay. It also provides recreational and educational potential for the people of Oahu and the State.

Coconut Grove is the most prominent urban feature in the project area, and the area most susceptible to flooding. It lies directly east of Kawainui Marsh, between the marsh and Kailua Bay. The community measures approximately one and a half miles long in a north-south axis and slightly less than a mile wide in an east-west axis. The houses are built on low-lying coral sands derived from dune formations along the coast that were leveled to construct house lots. The houses closest to the marsh generally are in soggy, less permeable soil with higher organic content at slightly lower elevations compared to more seaward portions of Coconut Grove.

Lying outside and above the marsh is the Maunawili subdivision. This area is drained by two streams, Kahanaiki and Maunawili, that flow directly into the marsh and have a considerable impact upon it. Two additional streams flow into Maunawili Stream - Makawao and Olomana. It is just below the confluence of Makawao and Olomana that a portion of the proposed project is located. A golf course is planned for construction in the Maunawili area.

Kawainui Marsh was determined eligible for inclusion on the State and National Register of Historic Places in 1979. The marsh as a whole was a significant prehistoric occupation area as evidenced by Hawaiian legend, extensive agricultural systems, ceremonial sites, burial sites, and habitation areas. (See TAB D, Pages 1-3, for a depiction of archaeological resources.)

The City and County of Honolulu owns approximately 750 acres of the marsh interior, while the periphery is State and privately owned. The State of Hawaii has acquired or has in condemnation approximately 182 acres scattered around the marsh and has identified another 65 acres to be acquired in the future. For all discussions concerning flood-control, the City and County has both ownership and responsibility. (See TAB E for Flood Hazard Information.)

The soil conditions within the marsh vary considerably with depth from the surface. Borings taken in the marsh (Dames and Moore, 1961) indicate that a thick blanket of roots and peat overlay this area. The geologic formation underlying the marsh has been identified (Stearns, 1938) as unconsolidated calcareous marine sediments, chiefly cream colored and light tan, which consist of very permeable beach sand of grains of worn coral, coralline algae, and shells with appreciable amounts of foraminifera and other marine organisms.

Spatial and temporal distributions of rainfall are pronounced in the Kawainui area. In general, the orographic effect of the Koolau Range produces the most intense rainfall in the area nearest the ridgeline's summit. The result of the strong uplifting of tradewinds is a maximum precipitation point for the Island of Oahu just slightly leeward of the crest. Rainfall patterns for individual storms also reflect this topographic influence. The annual rainfall cycle is generally recognized by climatologists as wet period, October to April (7 months) and dry period from May to November (5 months). Mean annual rainfall over the Maunawili drainage basin is estimated (Takasaki et al, 1969) at 86 inches.

Kawainui Marsh may be divided into two major types of vegetation communities. In the ponding basin is a bulrush marsh with floating mats of live vegetation and peat deposition. In the drier parts is found a bog meadow of California grass, resting on mineral soil rather than peat. Both communities are stream fed. The grass community is interspersed with honohono grass (*Commelina diffusa*). California grass in general, is located around the Southeastern and Southwestern perimeter of the marsh. The central area is dominated by the *Scirpus*. The surface of the emergency (flood control) canal is sporadically covered with "water lettuce," *Pistia stratiotes*. (See TAB F for vegetation locations.)

All four endangered Hawaiian waterbird species nest and breed in Kawainui Marsh: Hawaiian Stilt (*Himantopus mexicanus knudsenii*), Hawaiian Coot (*Fulica americana alai*), Hawaiian Gallinule (*Gallinula chloropus sandvicensis*), and Hawaiian Duck (*Anas wyvilliana*). In addition, the Blackcrowned Night Heron, the Great Frigatebird and a variety of seasonally migratory waterfowl are prevalent in the marsh. The peak nesting seasons must be left undisturbed and any work done in the marsh should avoid this time. Although the breeding/nesting season occurs year round, March through September is the period of peak nesting. It would therefore be advisable to keep work limited to the months of October and November, and possibly December. (See TAB F for waterbird habitats.)

The open waterways are nearly always eutrophic and are dominated by exotic warm water species such as tilapia and mosquitofish.

Freshwater turtles occur in the Hamakua Drive canal; however, their existence in Kawainui Marsh has not been well documented.

The lower Maunawili and Kahanaiki Streams are dominated by exotic species: Chinese catfish, Cuban limia, swordtails, smallmouth bass and koi. Louisiana crayfish, as well as frogs, toads, and snails are also found.

### MAJOR IMPACTS

Recognizing the various environmental factors outlined earlier in this Assessment, the placement of a water level sensor in close proximity to the existing Kawainui Marsh levee will do little in the near or long terms to disturb existing wildlife habitats, water quality or noise levels. No archeological sites will be affected and views will be unimpeded because the outline of the sensor system will be masked and/or absorbed by the levee. Recurring maintenance may be required two or three times annually involving minor equipment adjustments or replacement of a battery or transmitter.

### ALTERNATIVES

The only available alternatives to the automated water level sensing system include a no-action option with continued reliance on visually monitored water level measuring posts currently positioned in three locations mauka of the Kawainui Marsh levee; manually-read stream gages such as the U.S.G.S. Makawao Gage Station; or the National Weather Service's (NWS) automated rain gages in areas not directly related to the Maunawili drainage basin.

No Action/Use of Measuring Posts - The use of visually monitored water level measuring posts is a labor intensive method of estimating water stage along the levee. To be effective, they require the dispatch of observers to the levee whenever heavy rain or flooding is forecast and continuous monitoring of the water levels at the posts until the threat of those rains or flooding has subsided. It should be noted that observers would not necessarily be present on the levee for unforeseen rain patterns which might develop, nor do the posts provide the observer, when present, with flow volumes into the marsh from rain occurring at higher elevations. Without information on input flows, determinations on water stage at the levee may well be inaccurate and make evacuation recommendations untimely.

Manually-Read Steam Gage - Provide after the fact stream flows and volumes when recorded data can be retrieved and interpreted. Manually operated gages do not satisfy the real-time requirements required to collect and analyze water stage data so that evacuation recommendations can be easily formulated.

National Weather Service (NWS) Automated Rain Gages - As noted above, NWS has several automated rain gages in the vicinity of Kawainui Marsh. None at the present time can provide the data needed for accurate flood warning in the Kailua/Coconut Grove area. NWS has no plans to install dedicated gages in the area for the foreseeable future. NWS will, however, have access to

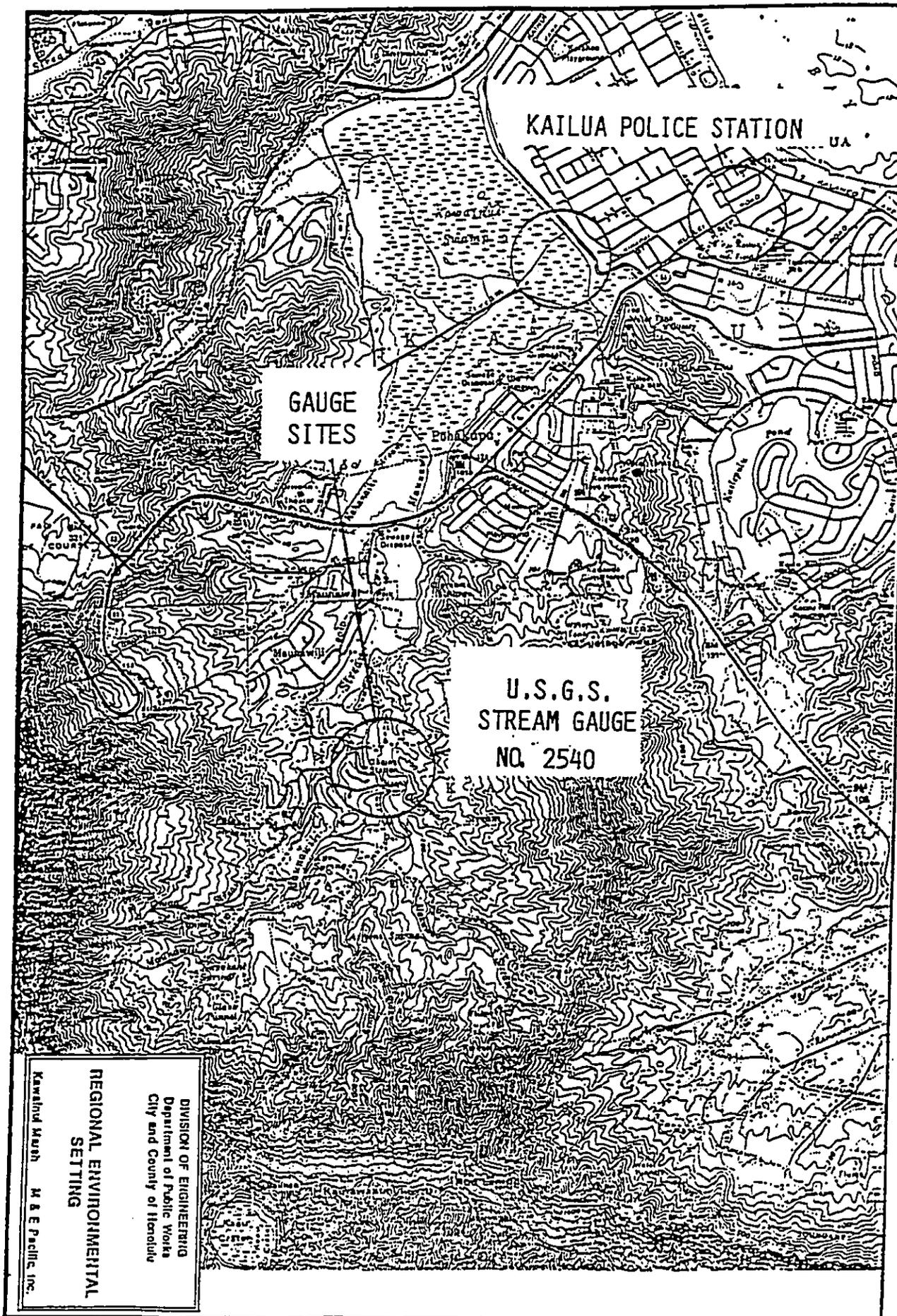
the proposed Water Level Sensor System. Use of the system will assist both NWS in issuing flooding Watches and Warnings and City emergency managers in formulating evacuation decisions for the Kailua community.

#### DETERMINATION

The Oahu Civil Defense Agency of the City and County of Honolulu has determined that the proposed Kawainui Marsh Water Level Sensor System will have no significant impact on the environment.

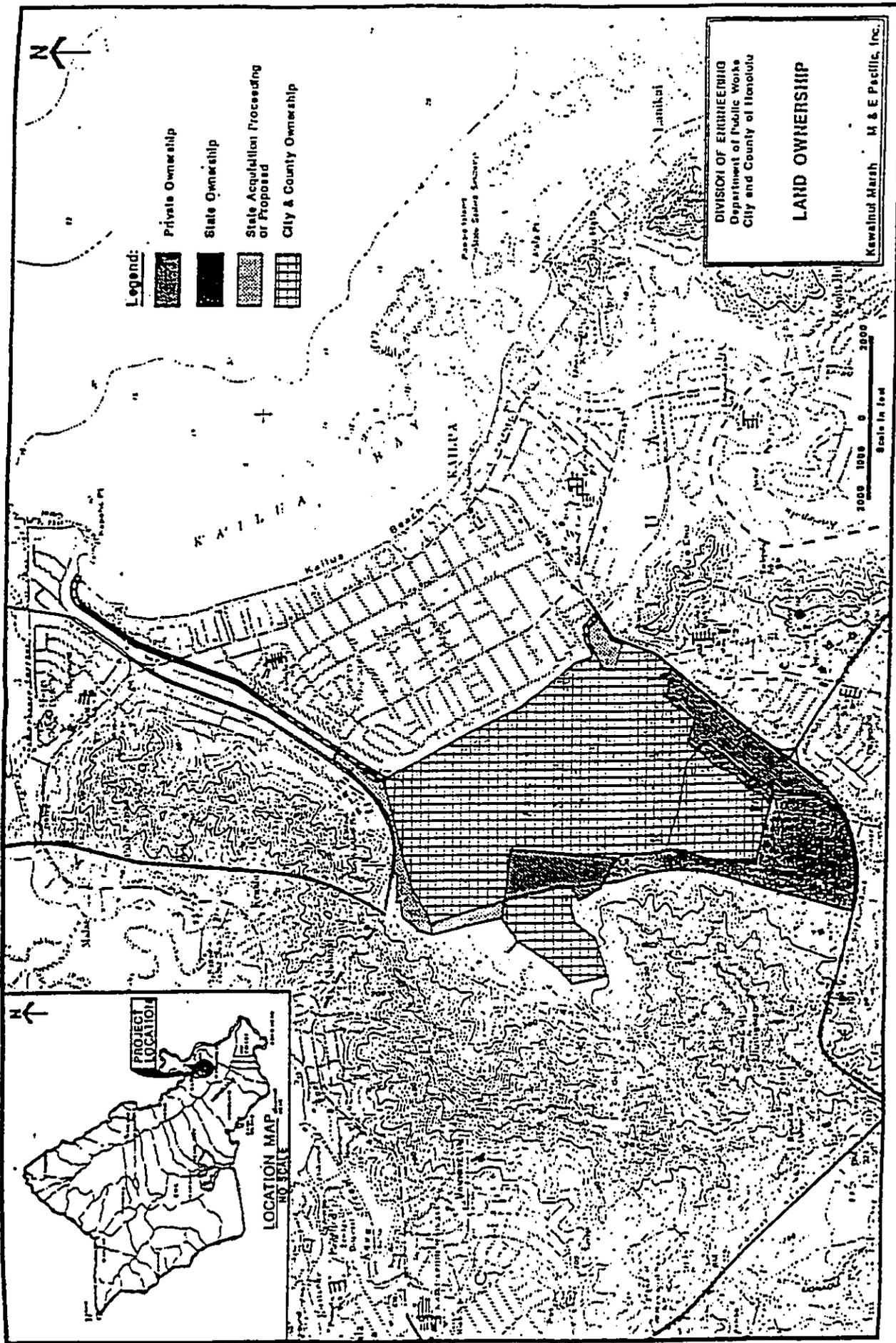
Careful examination of sensor placement in the Marsh reveals it will be in generally open water in close proximity to the levee where the Department of Public Works has previously removed vegetation as an emergency flood control measure. The sensor site will not impinge on any archaeological resources and avoids the nesting areas of endangered species.

In summary, the proposed project does not involve an irrevocable commitment to loss or destruction of any natural or cultural resource, nor does it curtail the beneficial uses of the environment. It does not conflict with State or County long-term environmental policies or goals and does not affect the economic or social welfare of the community. There is no effect on public health or facilities, nor any substantial degradation of environmental quality.



TAB A

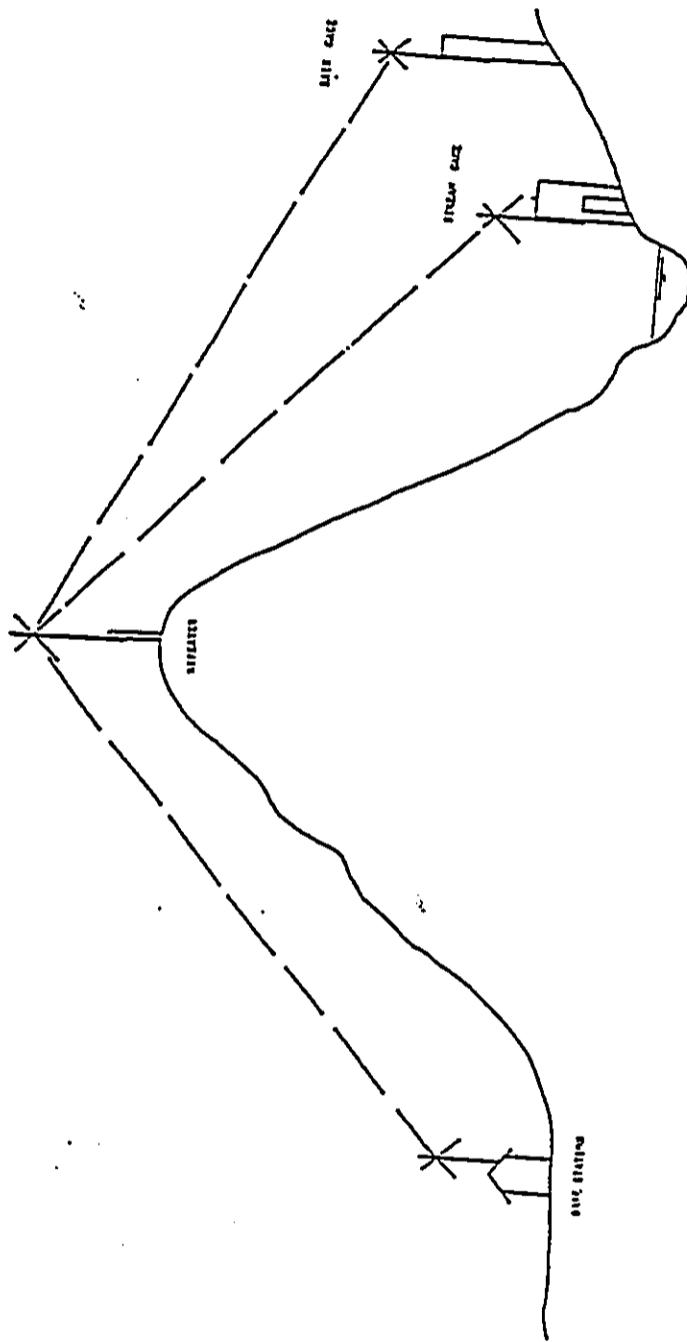




TAB B

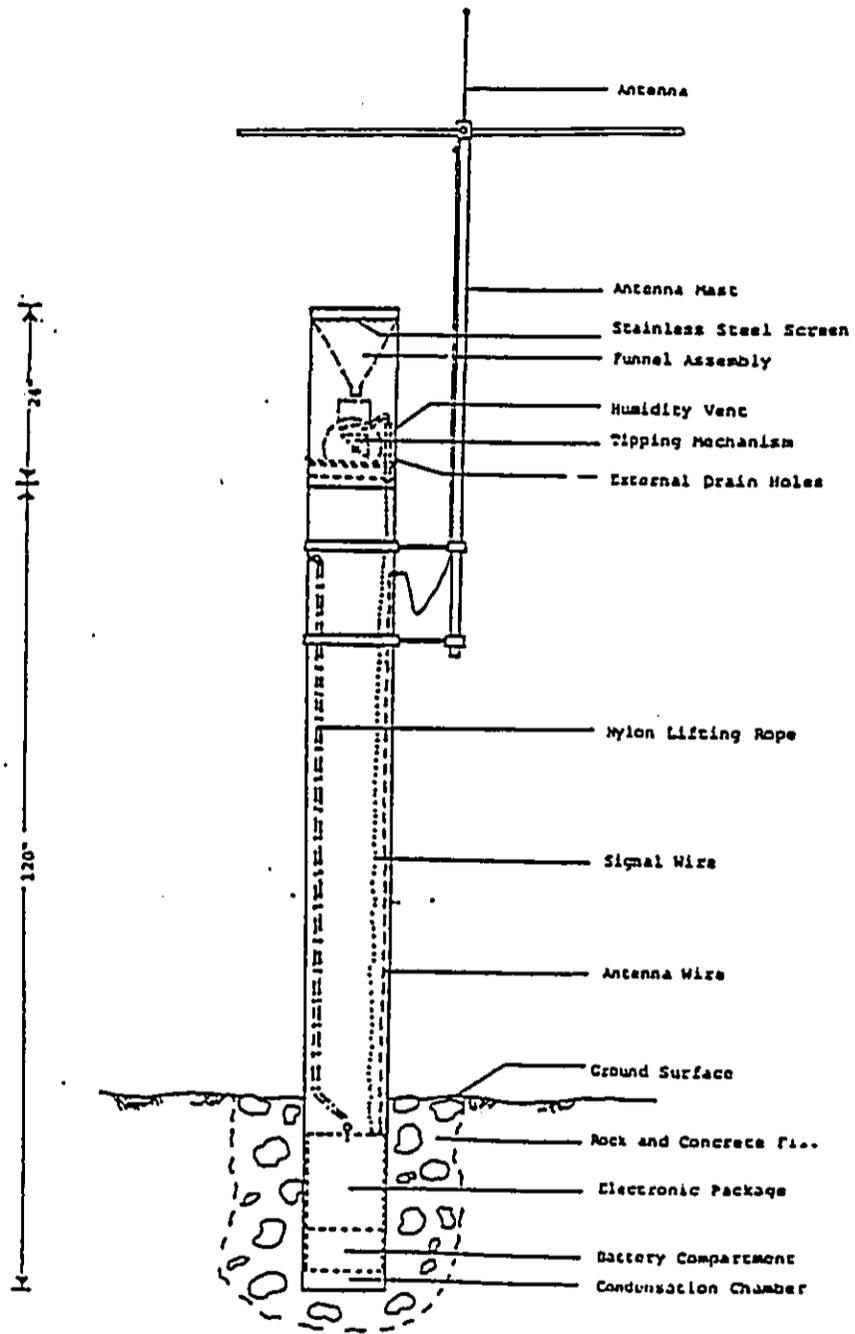


For informational purpose only.



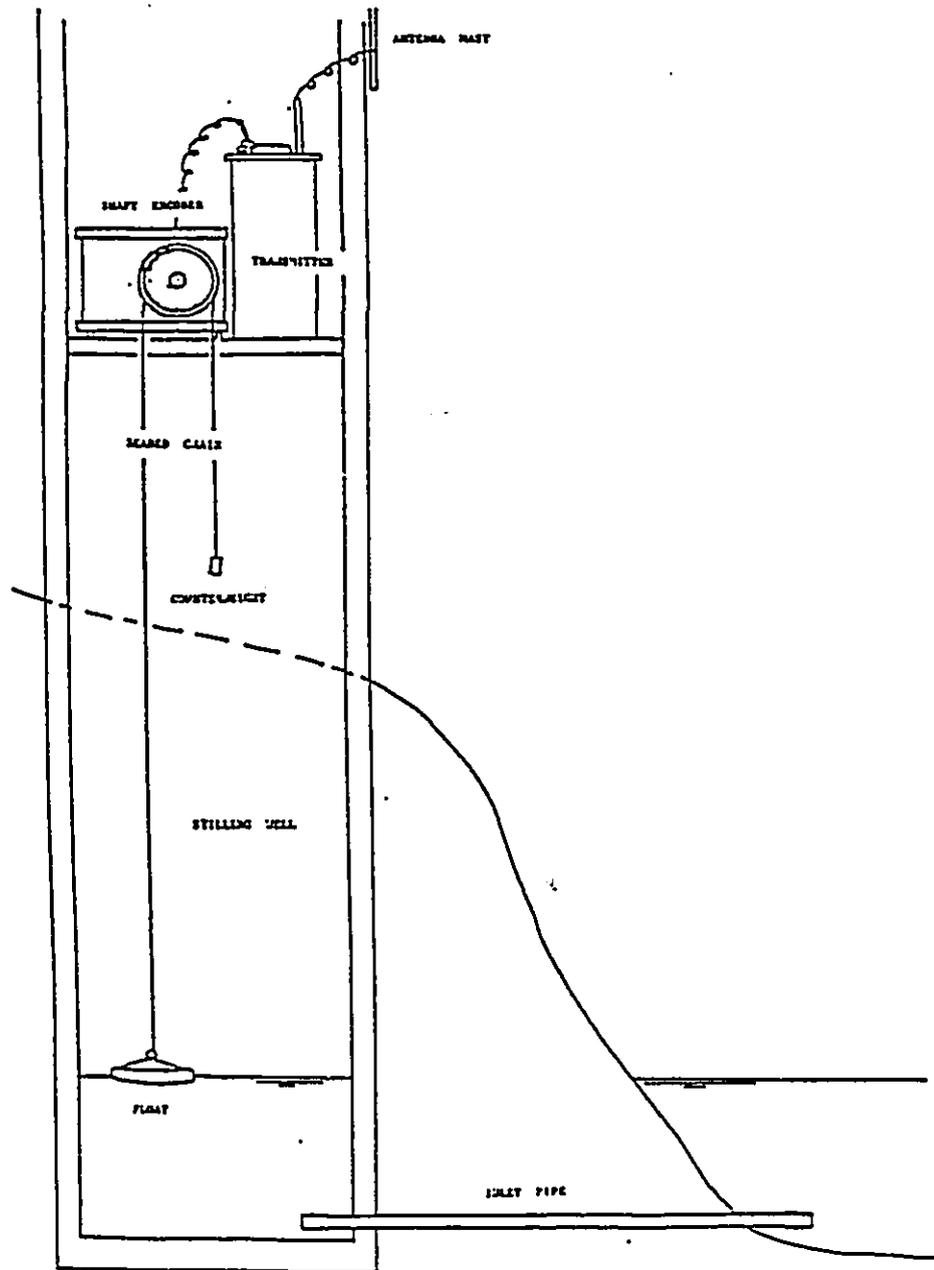
Typical ALERT Configuration

For informational purpose only.

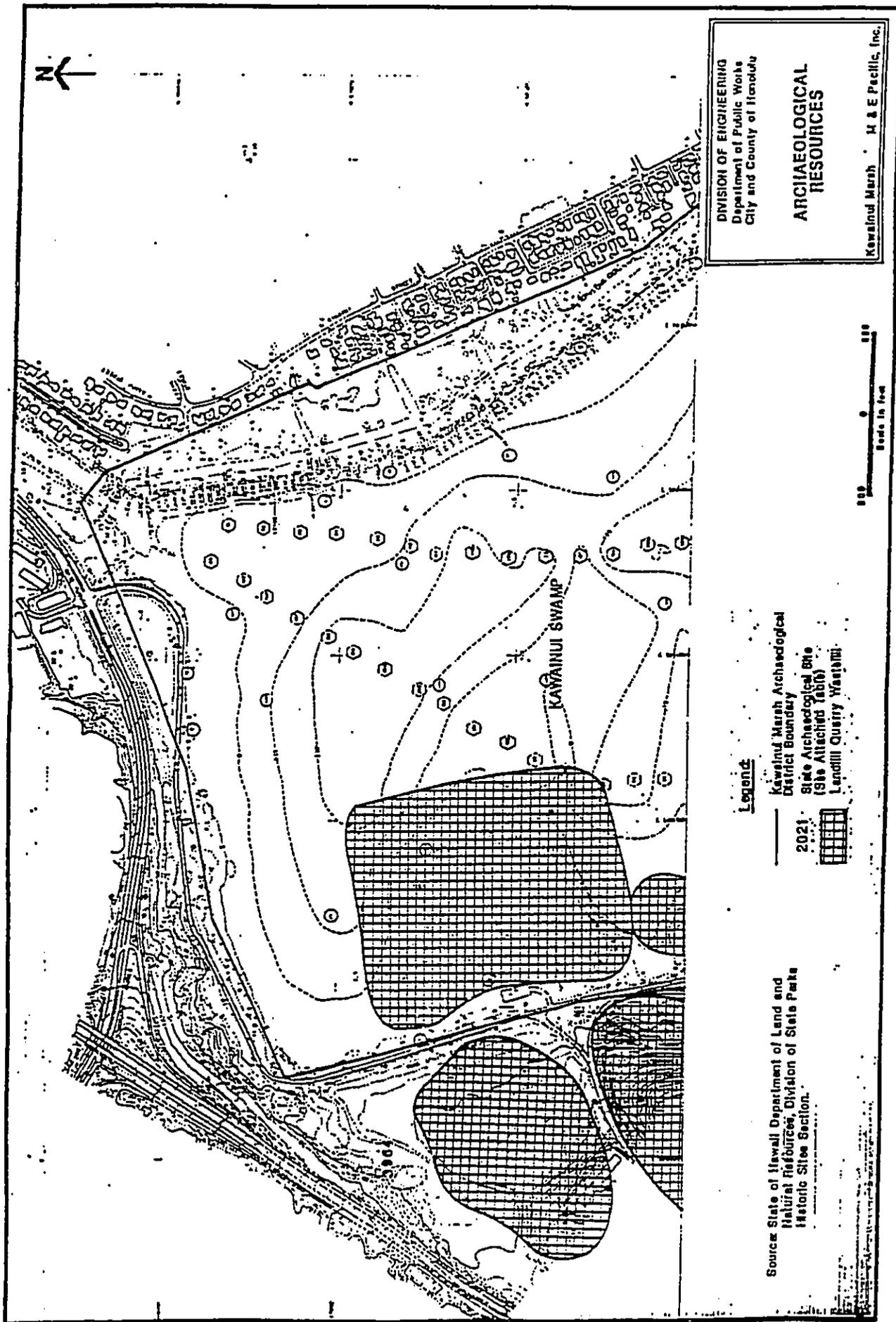


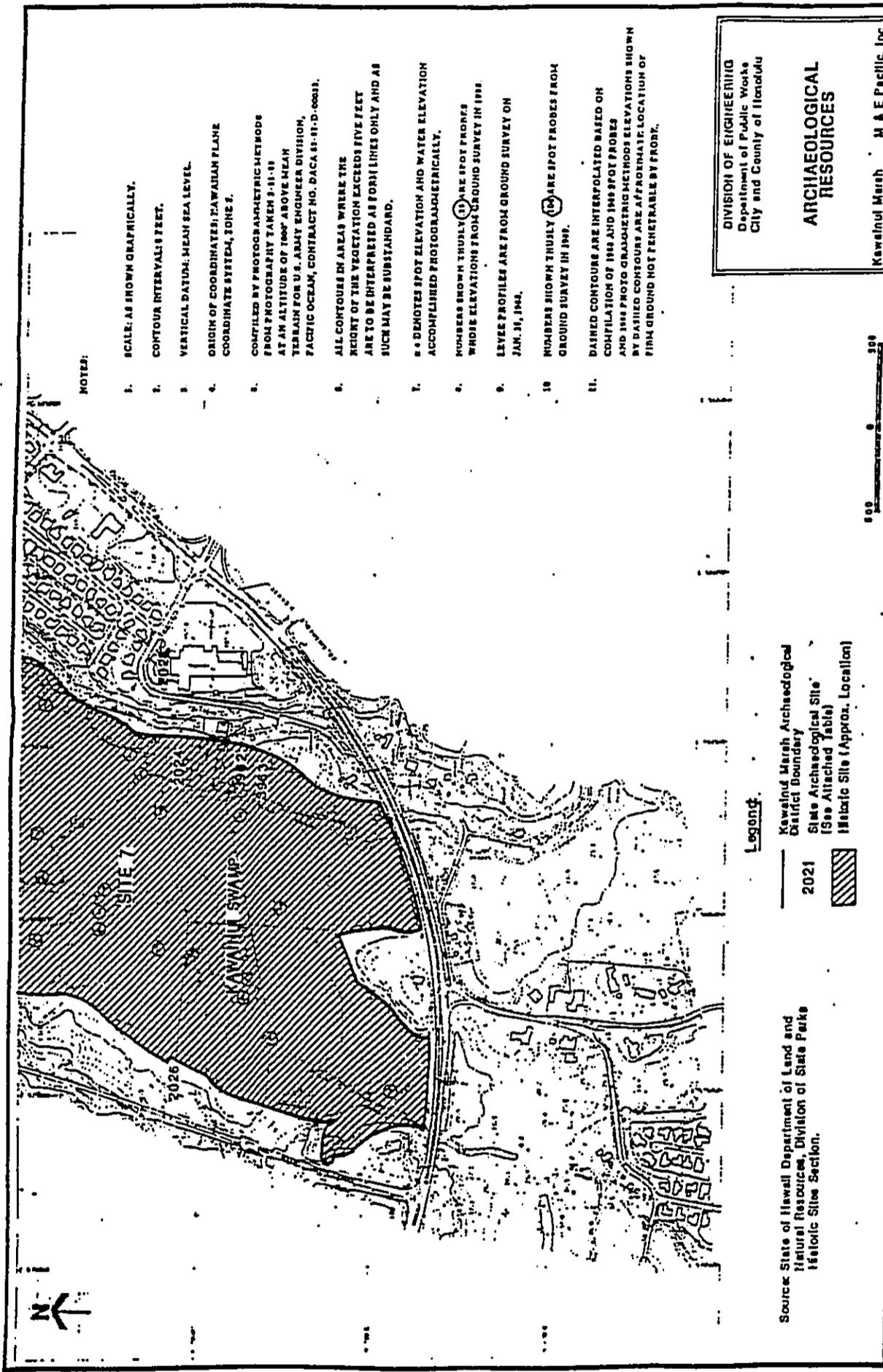
Schematic Diagram of Installed Precipitation Gauge

For informational purpose only.



Schematic Diagram of River Level Sensor





NOTES:

1. SCALE AS SHOWN GRAPHICALLY.
2. CONTOUR INTERVAL: 5 FEET.
3. VERTICAL DATUM: MEAN SEA LEVEL.
4. ORIGIN OF COORDINATES: KAWAILUA PLANE COORDINATE SYSTEM, ZONE 7.
5. COMPILED BY PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPH TAKEN 9-11-58 AT AN ALTITUDE OF 1000' ABOVE MEAN TIDE PLANE FOR U.S. ARMY ENGINEER DIVISION, PACIFIC OCEAN, CONTRACT NO. DACA 33-51-D-00033.
6. ALL CONTOURS IN AREAS WHERE THE HEIGHT OF THE VEGETATION EXCEEDS FIVE FEET ARE TO BE INTERPRETED AS FORM LINES ONLY AND AS SUCH MAY BE SUBSTANDARD.
7. 8 & 9 DEMOTES SPOT ELEVATION AND WATER ELEVATION ACCOMPLISHED PHOTOGRAMMETRICALLY.
8. NUMBERS SHOWN THUSLY (1) ARE SPOT PROBES WHOSE ELEVATIONS FROM GROUND SURVEY IN 1958.
9. LEVEL PROFILES ARE FROM GROUND SURVEY ON JAN. 31, 1948.
10. NUMBERS SHOWN THUSLY (10) ARE SPOT PROBES FROM GROUND SURVEY IN 1948.
11. DASHED CONTOURS ARE INTERPOLATED BASED ON COMPILED OF 1948 AND 1958 SPOT PROBES AND 1958 PHOTOGRAMMETRIC METHODS ELEVATIONS SHOWN BY DASHED CONTOURS ARE APPROXIMATE; LOCATION OF FIRM GROUND NOT PENETRABLE BY PROBE.

DIVISION OF ENGINEERING  
 Department of Public Works  
 City and County of Honolulu

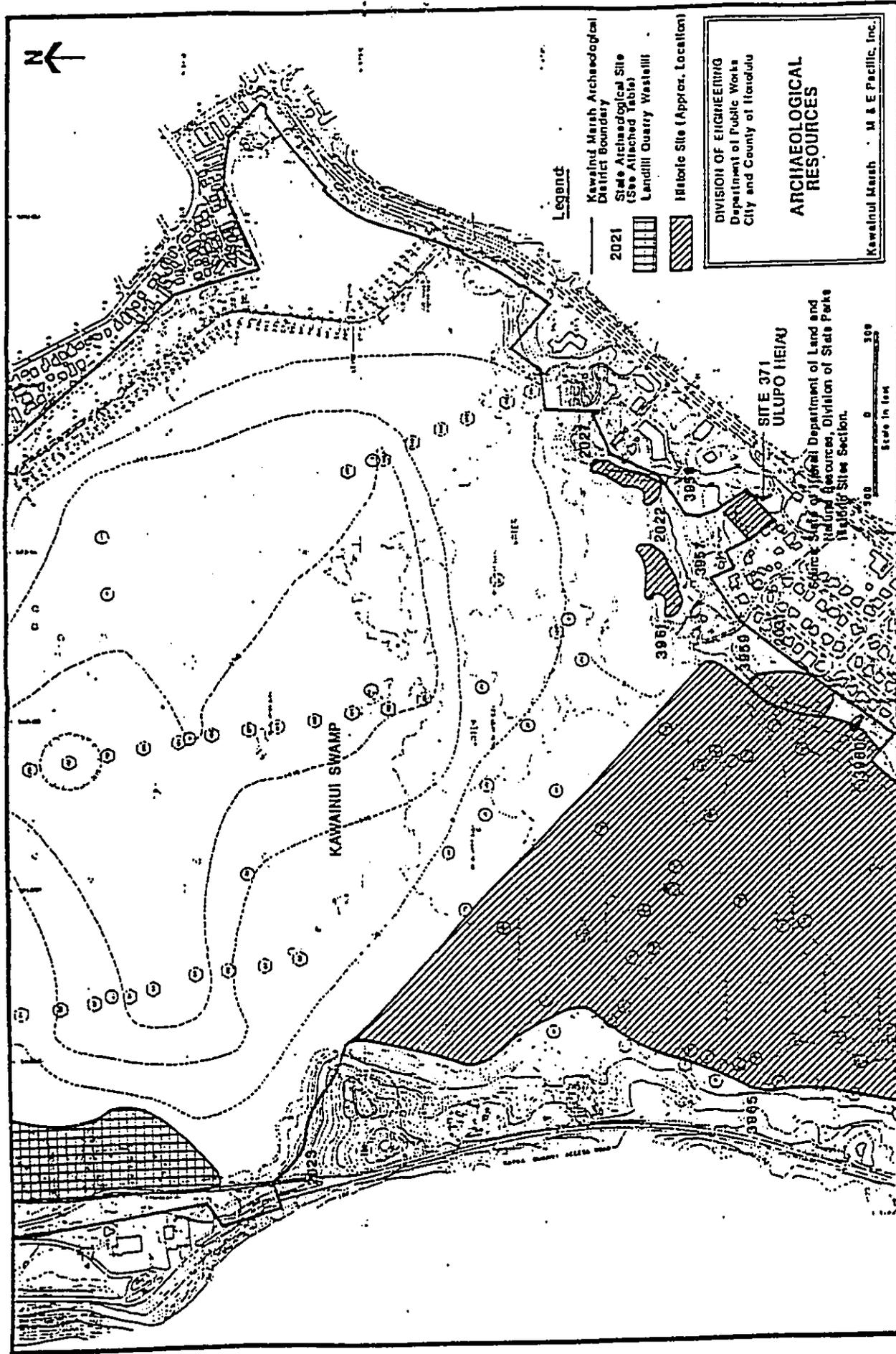
**ARCHAEOLOGICAL RESOURCES**

Kawailua Marsh M. A. E. Pacific, Inc.

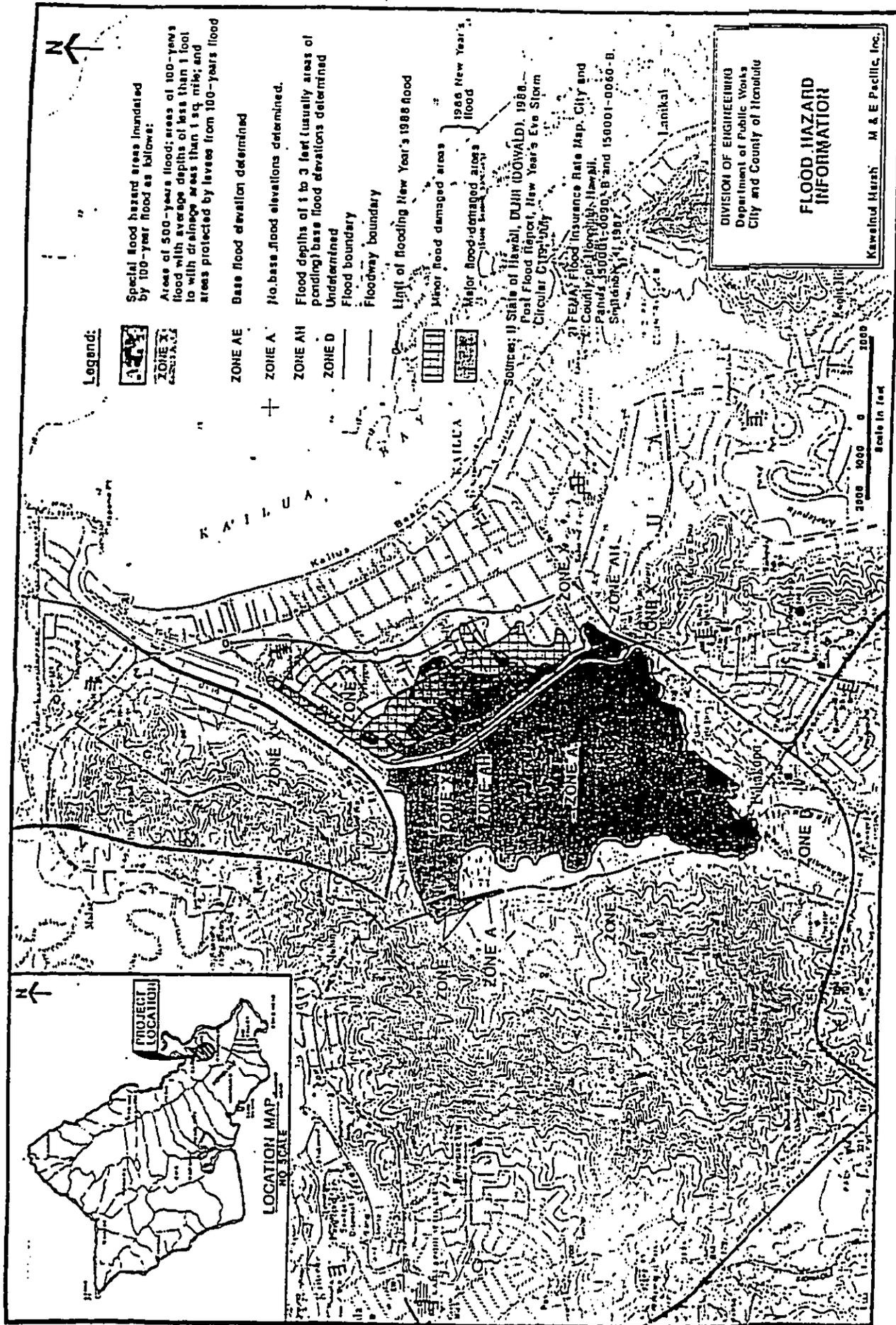
Legend:

- Kawailua Marsh Archaeological District Boundary
- 2021 State Archaeological Site (See Attached Table)
- ▨ Marsh Site (Approx. Location)

Source: State of Hawaii Department of Land and Natural Resources, Division of State Parks Historic Site Section.



TAB D  
Page 3



TAB E



1990-12-23-0A-PBA

**FILE COPY**

ENVIRONMENTAL ASSESSMENT  
FOR  
KAWAINUI MODEL AIRPLANE FIELD IMPROVEMENTS \*

OCTOBER 1990

RECEIVED

'90 DEC -6 P2:01

I. GENERAL INFORMATION

PROPOSING AGENCY: Department of Parks and Recreation  
City and County of Honolulu  
650 South King Street  
Honolulu, Hawaii 96813

CONTACT PERSON: Walter M. Ozawa, Director  
Department of Parks and Recreation  
650 South King Street  
Honolulu, Hawaii 96813  
Telephone: 523-6343

ACCEPTING AGENCY: Department of Land Utilization  
City and County of Honolulu  
650 South King Street  
Honolulu, Hawaii 96813

TAX MAP KEY: 4-2-16: 1

LOT AREA: 599.559 acres

FEE OWNER: Department of Parks and Recreation  
City and County of Honolulu

LAND USE DISTRICT: Conservation (Protective subzone)

ZONING: P-1

SPECIAL LAND USE CONTROLS: The property is within the Special Management Area.

II. DESCRIPTION OF THE PROPOSED ACTION

A. Location

Kawainui Model Airplane Field is located makai of Kapaa Quarry Road on a portion of a City sanitary landrill abutting Kawainui Marsh.

The general location of the Model Airplane Field is shown in Figure 1. The entire site is within the City Special Management Area (SMA) and State Conservation District.

DEPARTMENT OF PARKS AND RECREATION  
HONOLULU, HAWAII  
80 6 00 12 10 06

# CORRECTION

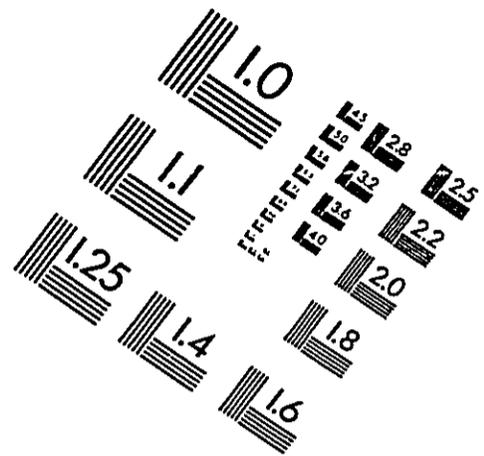
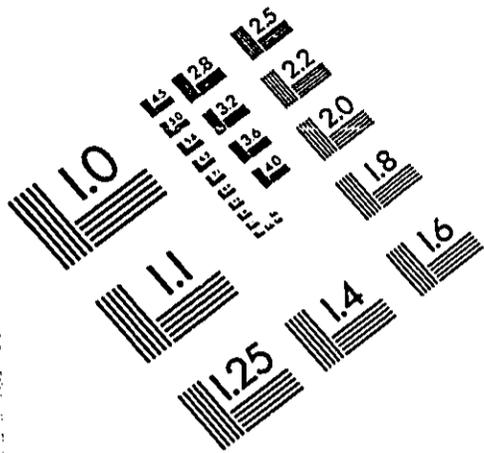
THE PRECEDING DOCUMENT(S) HAS  
BEEN REPHOTOGRAPHED TO ASSURE  
LEGIBILITY  
SEE FRAME(S)  
IMMEDIATELY FOLLOWING



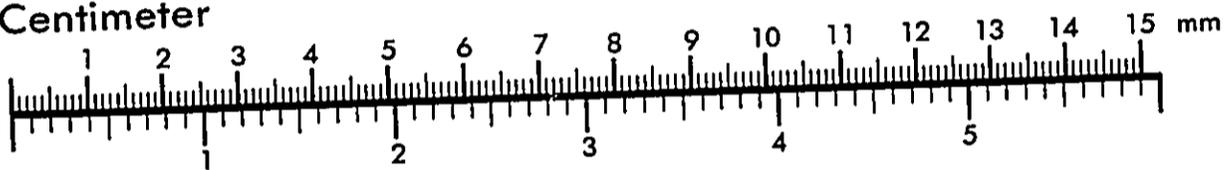
**AIM**

**Association for Information and Image Management**

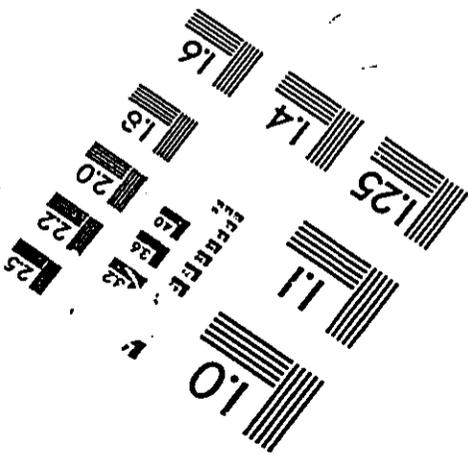
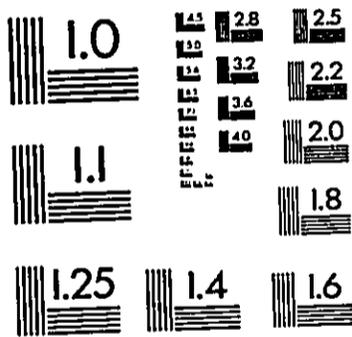
1100 Wayne Avenue, Suite 1100  
Silver Spring, Maryland 20910  
301/587-8202



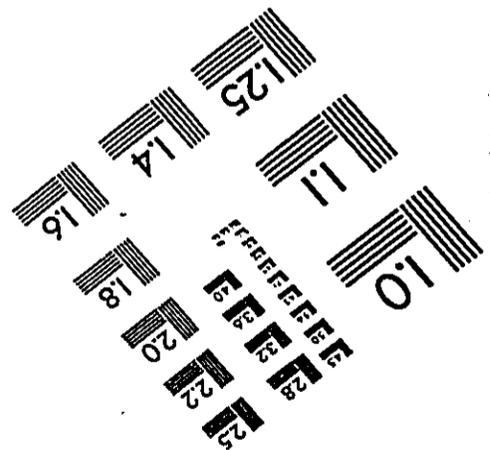
Centimeter



Inches



MANUFACTURED TO AIM STANDARDS  
BY APPLIED IMAGE, INC.



**REEL  
NUMBER**

35

# **TITLE OF WORK**

**State of Hawaii  
Office of Environmental  
Quality Control**

**Final Environmental  
Assessment Documents**

**ADVANCED MICRO-IMAGE SYSTEMS HAWAII, INC.**

## VENDOR CERTIFICATE OF AUTHENTICITY

This is to certify that the images appearing on  
this Film-file are accurate and complete

reproductions of the records of:

**STATE of Hawaii**  
**Office of Environmental Quality Control**

These records were delivered in the regular  
course of business for photographing.

Date Microfilmed: **May & June 2004**

Company Name: Advanced Micro Image Systems Hawaii, Inc.  
525 Kokea Street, Unit B-1  
Honolulu, Hawaii 96817

**START**