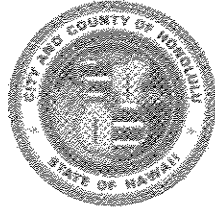


DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813 ☎ (808) 523-4482



EILEEN R. ANDERSON
MAYOR

MICHAEL M. McELROY
DIRECTOR

ROBERT B. JONES
DEPUTY DIRECTOR

LU3/83-1287(JDN)

April 15, 1983

Mr. Roy R. Takemoto, Chairman
Environmental Quality Commission
State of Hawaii
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Mr. Takemoto:

Revised Environmental Impact Statement (EIS)
Ulili & Elepaio Streets Drainage Improvements
Department of Public Works, City & County of Honolulu

In accordance with Section 1:72 of the Environmental Quality Commission EIS Regulations implementing Chapter 343, HRS, we are notifying you of our acceptance of the above as an adequate fulfillment of the provisions of the Chapter.

Please contact John Nakagawa of our staff at 523-4077 if you have any questions.

Very truly yours,

A handwritten signature in black ink, appearing to read "Michael M. McElroy".

MICHAEL M. McELROY
Director of Land Utilization

MMM:s1
attach.

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Revised
Environmental Impact Statement for:

**ULILI & ELEPAIO STREETS
DRAINAGE IMPROVEMENTS**

Kahala, Island of Oahu, State of Hawaii

prepared for:
DEPARTMENT OF PUBLIC WORKS
CITY & COUNTY OF HONOLULU

prepared by:
WILSON OKAMOTO & ASSOCIATES, INC.

OA
299

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CITY AND COUNTY OF HONOLULU
DEPARTMENT OF PUBLIC WORKS

ENVIRONMENTAL IMPACT STATEMENT
ULILI AND ELEPAIO STREETS DRAINAGE IMPROVEMENTS
KAHALA, HONOLULU, OAHU, HAWAII
Tax Map Key 3-5-04 and 3-5-03:39

Submitted Pursuant to Chapter 343, Hawaii Revised Statutes

Responsible Official: *Michael J. Chun* Date: MAR 22 1983
Dr. Michael J. Chun,
Director and Chief Engineer

Accepting Authority: Governor, State of Hawaii
Department of Land Utilization,
City and County of Honolulu

Prepared by
Wilson Okamoto and Associates
Engineers, Planners, and Architects
Honolulu, Hawaii

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SUMMARY

Proposing Agency: City and County of Honolulu
Department of Public Works

Proposed Project: Ulili and Elepaio Streets Drainage Improvements

I. PROPOSED ACTION

A. Ulili Street Relief Drain

A portion of the flow that is collected by the Ulili Street drainage system will be diverted to the Hunakai Avenue drainage system via a new 24-inch relief drainline. The relief line will run a distance of about 600 feet along Aukai Street between Ulili and Hunakai Streets. The new drainline will not be designed to handle the instantaneous peak flows from the Ulili drainage area; however, it will help to reduce the amount of time it takes to drain nuisance ponding.

B. Elepaio Street Drainage Improvements

The proposed improvements to this drainline will be confined to the 10-foot wide easement from Kahala Avenue to the shore, a distance of approximately 300 feet.

The ocean outfall will be abandoned and the existing shoreline manhole will be modified to discharge storm runoff more efficiently at the shoreline. The outlet structure will include two stairways with railings to afford pedestrian access to the shoreline and water. A portion of the existing 42-inch drainline within the beach access easement will be replaced to tie into the outlet structure.

In addition, a new overflow drainage channel will be constructed within the easement over the 42-inch drainline and will serve two functions. The channel will convey storm runoff from Kahala Avenue which cannot be accommodated by the 42-inch drainline to the ocean and also serve as a pedestrian walkway to the beach.

II. DESCRIPTION OF ENVIRONMENT

A. Location

The project site is located in the Waialae-Kahala area of the Honolulu District, Oahu, Hawaii and includes a portion of Aukai Avenue and a 10 ft. wide access easement to the beach, which begins at Kahala Avenue in the vicinity of the Elepaio Street intersection and extends to Kahala Beach.

B. Existing Use

Aukai Avenue is a secondary street that provides access to residential areas. The Elepaio Street easement currently serves two primary functions. It provides public pedestrian access to Kahala Beach and accommodates the existing Elepaio drain system.

III. RELATIONSHIP TO PUBLIC LAND POLICIES AND CONTROLS

A. Land Use Controls

1. State Land Use - Submerged shoreline areas fall within the State Conservation District. Other onshore areas fall within the State Urban District.
2. City and County of Honolulu - The project sites are situated within the Special Management Area and the Diamond Head Historic, Cultural and Scenic District, and County zoning for the sites are R-3 and R-4 residential.

B. Required Clearances

1. Federal
 - o United States Department of the Army, Section 10 General Permit (Corps of Engineers)
2. State
 - o Conservation District Use Permit (Department of Land and Natural Resources)
 - o Permit for Work in Shore Waters (Department of Transportation)
3. County
 - o Special Management Area (SMA) Permit (Department of Land Utilization)

- o Shoreline Setback Variance (Department of Land Utilization)
- o Diamond Head Historic, Cultural and Scenic District (Department of Land Utilization)

IV. ENVIRONMENTAL IMPACTS

A. Beneficial Long Term Impacts

- o Elepaio storm runoff will be conveyed more efficiently to the ocean.
- o Potential health and traffic hazards posed by standing drain water will be reduced.
- o The flood period for the area serviced by Ulili Street drain will be reduced.
- o No offshore construction will be required.

B. Unavoidable Adverse Long Term Impacts

- o Drainage problems of the Ulili Street drain system will be reduced but not eliminated totally.
- o Storm runoff will continue to be discharged at the shoreline for the Elepaio Street drain system, but the potential for beach erosion and undermining of adjacent seawalls caused by the drainage discharge will not be increased.
- o During construction there may be impacts to air and water quality, traffic, safety, ambient noise levels, recreational activities and marine biota.

V. ALTERNATIVES TO THE PROPOSED ACTION

A. No Action

The no action alternative is considered to be unacceptable due to the potential hazards of the existing conditions.

B. Improve Present Systems

Two or three improvement alternatives were examined for each of the drainage systems, including combining systems. In all of these alternatives, most of the existing lines would have to be replaced and extensive improvements would be required throughout each system.

C. Alternative Disposal Systems

Injection wells and flood retention reservoirs were examined as alternatives to the present ocean outfall system.

Injection wells could be located beneath the road system, to dispose of drainage flows. The reservoir alternative would utilize a single large flood control pond to collect and store drainage flows. The stored water could then be slowly and safely discharged through a single ocean outfall over a period of time.

VI. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Impact to the limited environmental resources which will be affected is minimal and of a temporary nature. Proposed improvements could be removed at some future point in time, and the project sites restored to conditions present today.

Labor and capital costs expended on the proposed project would be, for the most part, irretrievable. Construction materials used in the project could be retrieved and recycled.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

I.
Introduction

I. INTRODUCTION

A. Location

The project site is located in the Waialae-Kahala area of the Honolulu District, Oahu, Hawaii (see Figures 1 and 2). The project area includes a portion of Aukai Avenue and a 10 ft. wide drainage and access easement, which begins at Kahala Avenue in the vicinity of the Elepaio Street intersection and extends seaward to Kahala Beach.

B. Land Ownership

The project sites are owned by the City & County of Honolulu and the State of Hawaii. The Department of Public Works, City & County of Honolulu has jurisdiction over the easement from Kahala Avenue to the vegetation line on Kahala Beach, and Aukai Avenue.

The portion of the easement seaward of the vegetation line to the shore is within the State Conservation District and therefore under the jurisdiction of the State Department of Land and Natural Resources.

C. Existing Use

Aukai Avenue is a secondary street that provides access to a residential area. The Elepaio Street easement currently serves two primary functions. It provides public pedestrian access to Kahala Beach and accommodates the existing drain system.

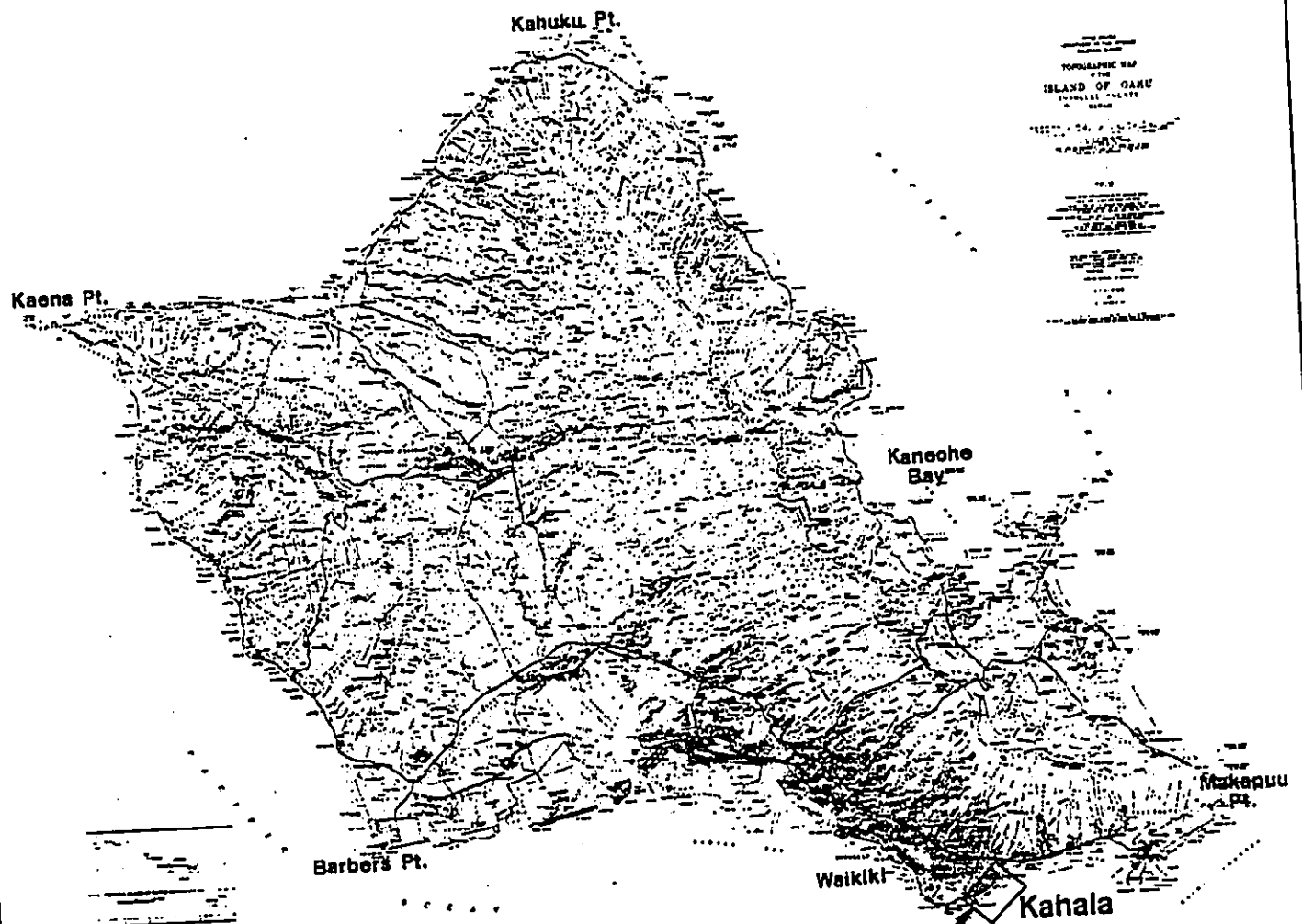
D. Existing Drainage System

The existing drainage systems in the area and their corresponding drainage areas are shown in Figure 3. The Elepaio Street drain was installed in 1953. It is a 42-inch reinforced concrete pipe that runs along the easement and extends about 400 ft. seaward onto the offshore reef. The drainage area served by this line is approximately 53 acres.

The Ulili Street drain is a 54-inch reinforced concrete pipe that was installed in 1955. It extends seaward about 866 ft. onto the offshore reef. The drainage area served by this drainline is about 59 acres.

The Hunakai Street drain is a 48-inch reinforced concrete pipe that extends about 827 ft. seaward onto the offshore reef. It was installed in 1952 and serves a drainage area of about 98 acres.

Project Location



PROJECT LOCATION

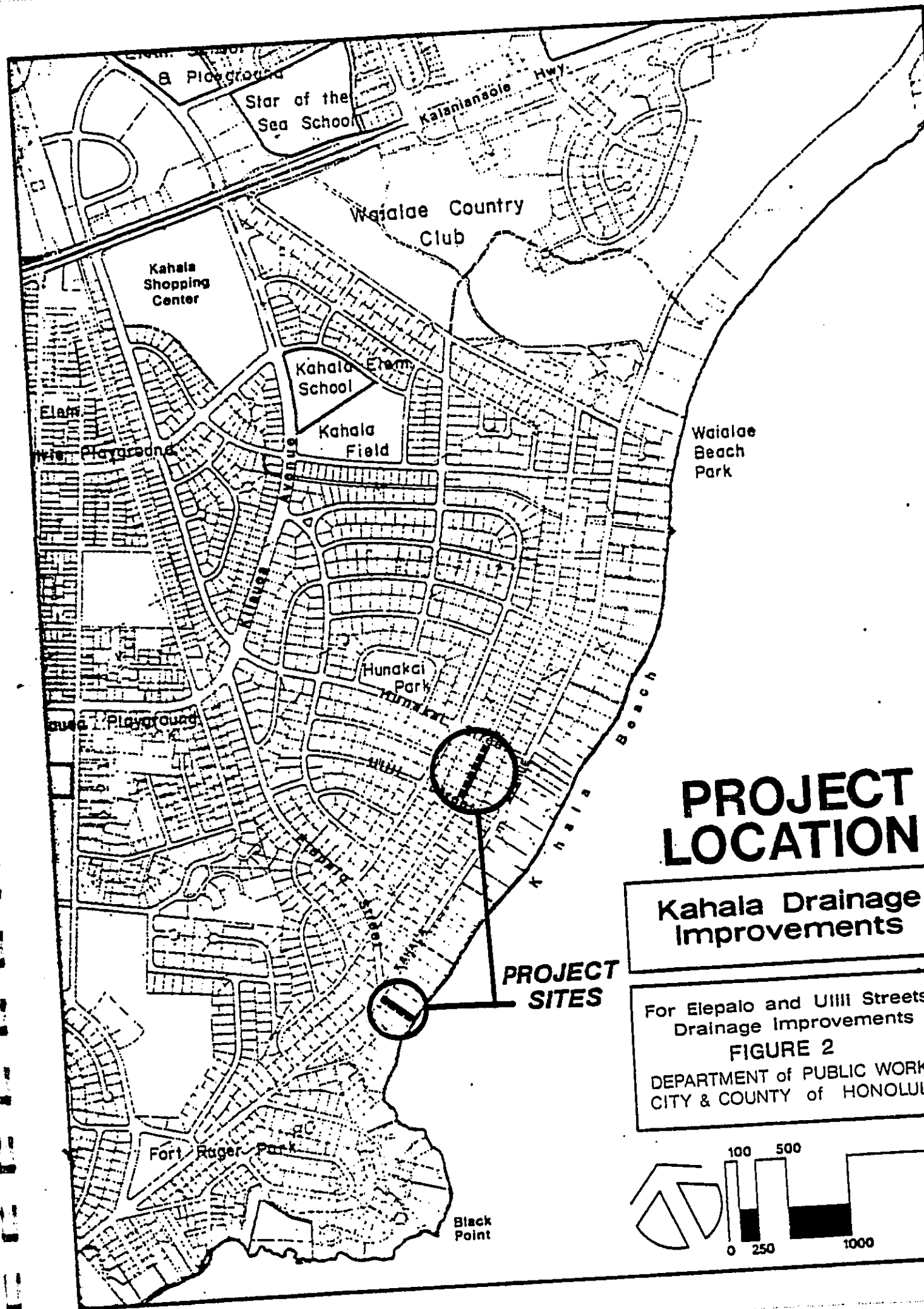


Kahala Drainage Improvements

For Elepaio and Ullili Streets
Drainage Improvements

FIGURE 1

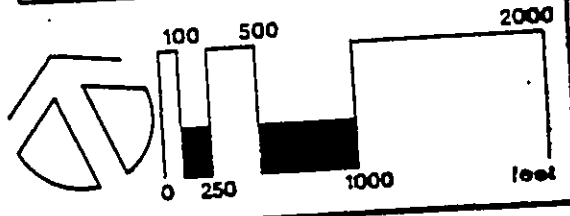
DEPARTMENT of PUBLIC WORKS
CITY & COUNTY of HONOLULU



PROJECT LOCATION

Kahala Drainage Improvements

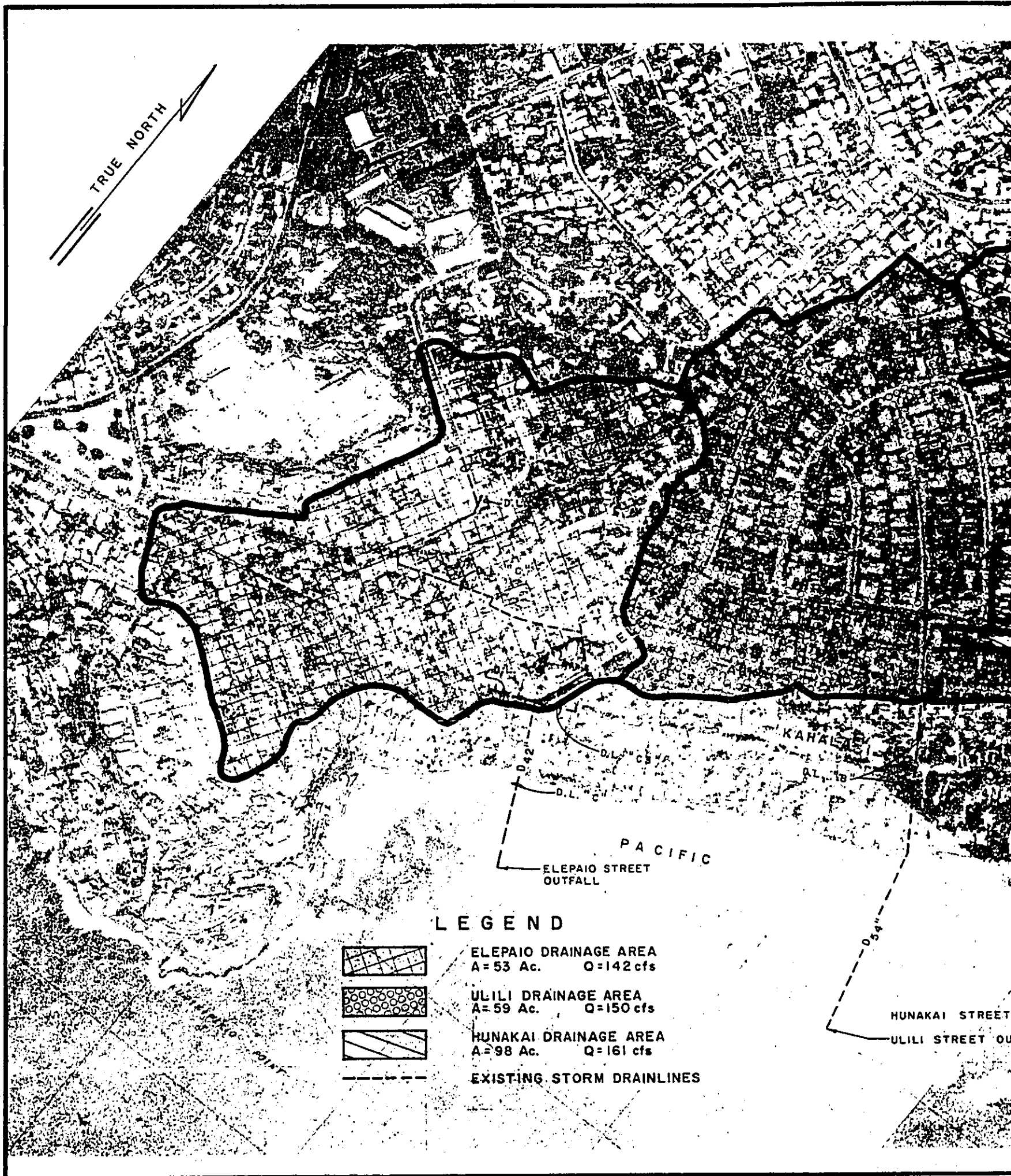
For Elepalo and Ullil Streets
 Drainage Improvements
FIGURE 2
 DEPARTMENT of PUBLIC WORKS
 CITY & COUNTY of HONOLULU



PROJECT SITES

Black Point

RECEIVED AS FOLLOWS



TRUE NORTH

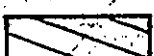
LEGEND



ELEPAIO DRAINAGE AREA
A= 53 Ac. Q=142 cfs



ULILI DRAINAGE AREA
A= 59 Ac. Q=150 cfs



HUNAKAI DRAINAGE AREA
A= 98 Ac. Q=161 cfs



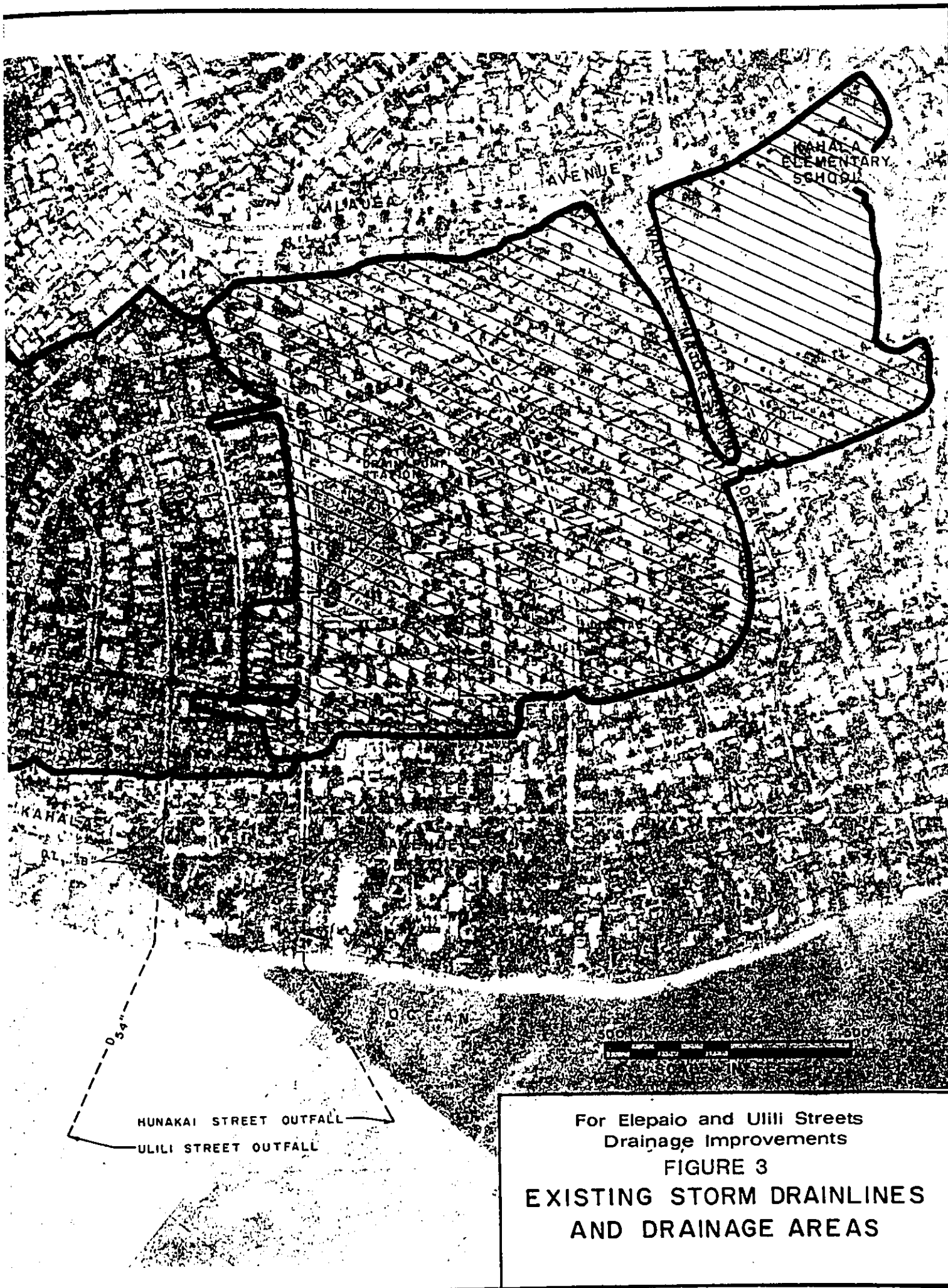
EXISTING STORM DRAINLINES

PACIFIC
ELEPAIO STREET
OUTFALL

HUNAKAI STREET

ULILI STREET OU

RECEIVED AS FOLLOWS



For Elepaio and Ulili Streets
Drainage Improvements
FIGURE 3
EXISTING STORM DRAINLINES
AND DRAINAGE AREAS

12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

II.
Project Description

II. PROJECT DESCRIPTION

A. Need for Proposed Project

The existing Ulili Street and Elepaio Street drain systems were originally installed between 1952 and 1955. These drains have since developed blockages that have rendered them ineffective or inoperative. These blockages are a result of sand infiltration through gaps in the pipe joints, terrestrial sand and siltation, and wave or current driven sand at the outlet. The blockages have caused storm runoff to back up through the system and discharge onto the shore and adjacent residential areas. During periods of heavy rains, flooding has occurred at various locations within the drainage basins. This flooding is more of a nuisance than life threatening. Some property damage has been experienced in the past.

An offshore investigation of the drainlines, including test drillings, was conducted in November 1980. The results of the investigation showed that both ocean outfalls are blocked and have ceased to function. The sediments that form the blockages are composed of primarily ocean sand and a mixture terrestrial sand and grit.

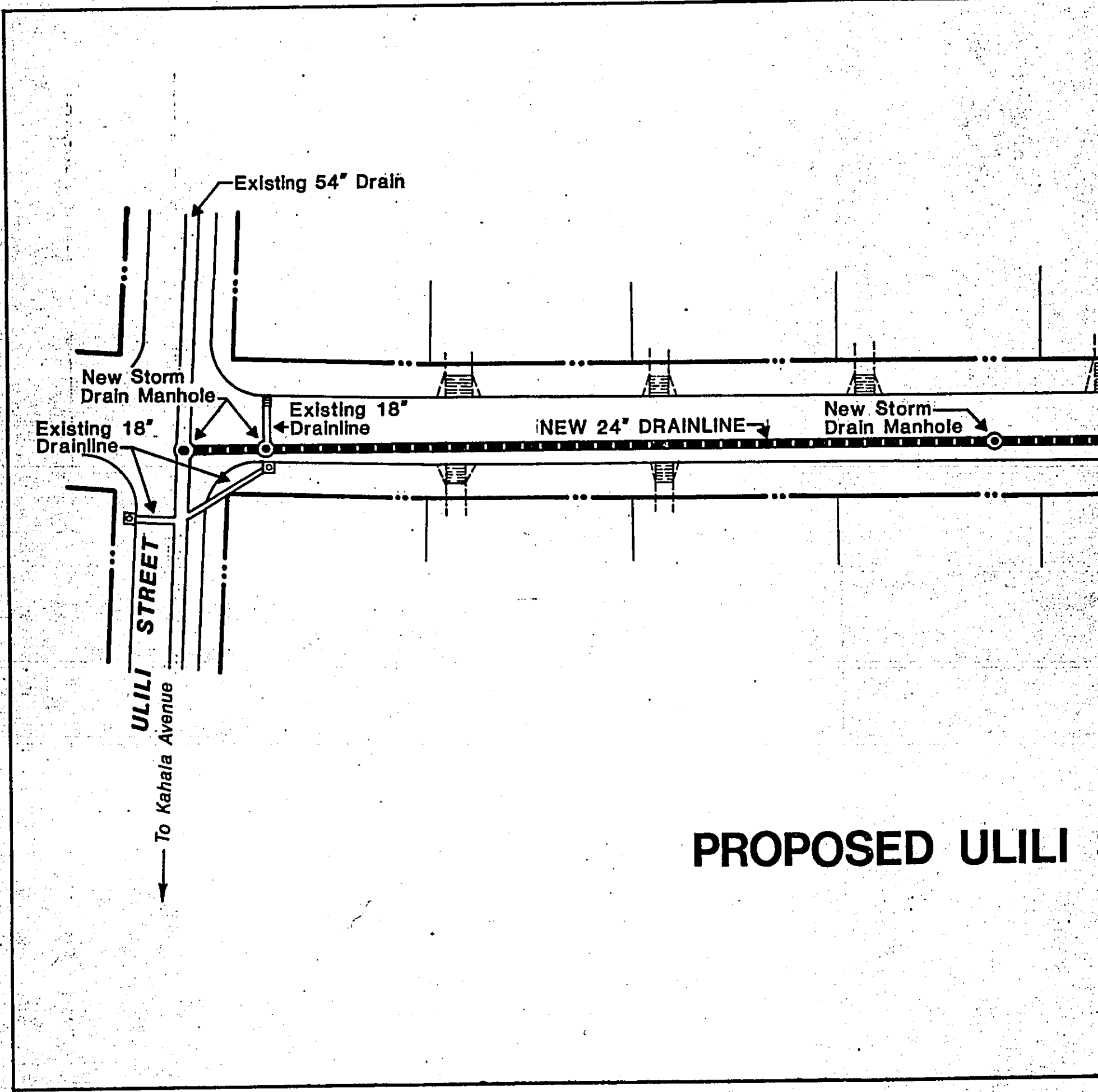
Clearing the sand blockage out of the existing lines will be costly and serve only as a short-term remedy. Many of the pipe joints in the Ulili system have developed gaps that allow sand to infiltrate the line. While the Elepaio system appears to be well constructed with few gaps in the pipe joints, the outfall seems to be poorly sited. Most of the blockage in this line appears to be from wave driven ocean sand. It was therefore determined that merely cleaning out the existing lines would not adequately address the problem and should not be considered as an alternative.

B. Proposed Improvements

1. Ulili Street Relief Drain

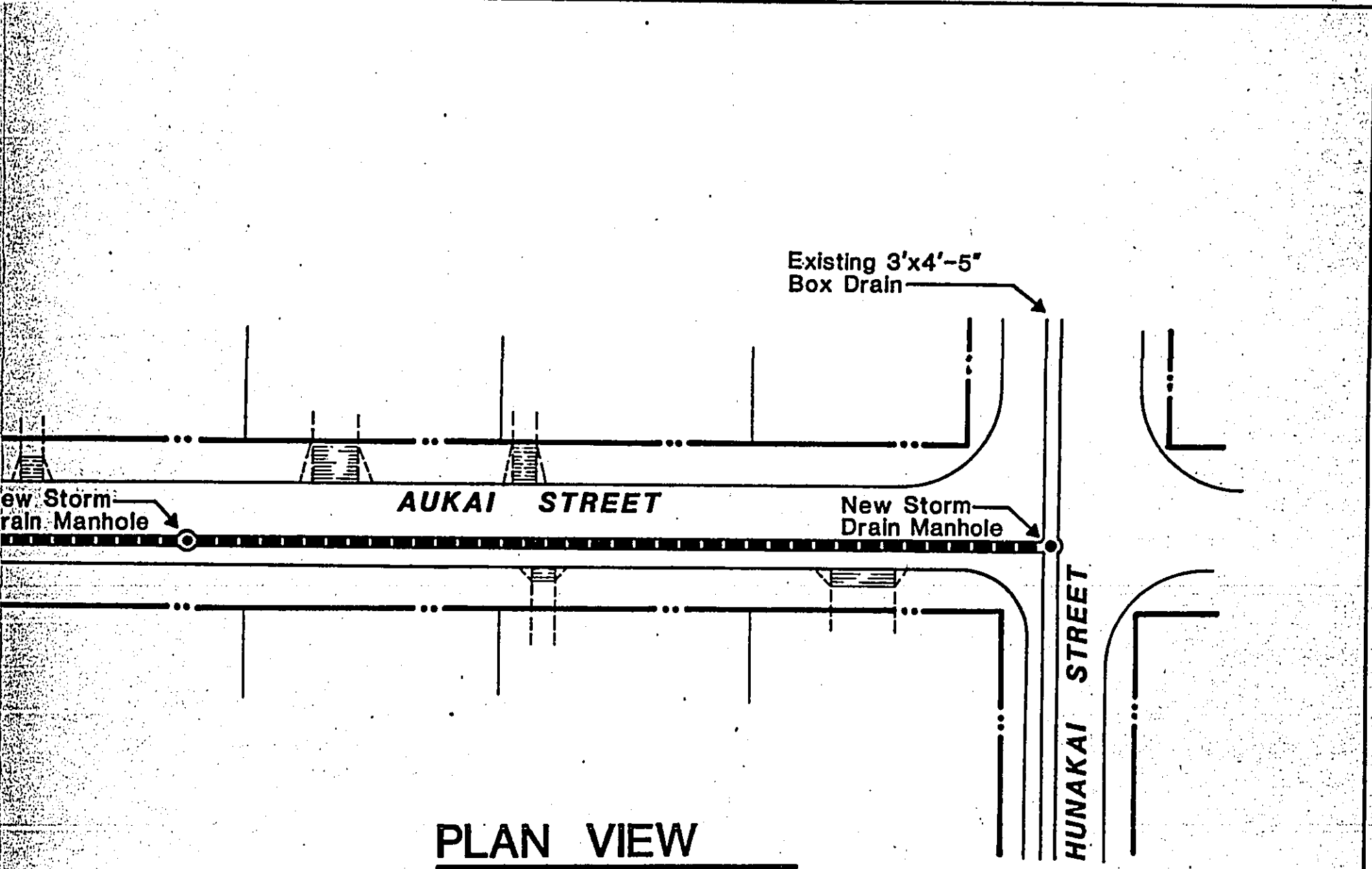
A portion of the flow that is collected by the Ulili Street drainage system will be diverted to the Hunakai Street drain system via a new 24-inch drainline. As shown in Figure 4, the relief line will run a distance of about 600 feet along Aukai Avenue between Ulili and Hunakai Streets. Presently, the Ulili system is completely blocked, causing localized flooding of the surrounding residential area. The new 24-inch drainline will convey a portion of the floodwaters to the existing Hunakai Street system. The new drainline will not be designed to handle the instantaneous peak flows from the Ulili drainage area, however, it will help to reduce the time required for the floodwaters to drain. A flap gate

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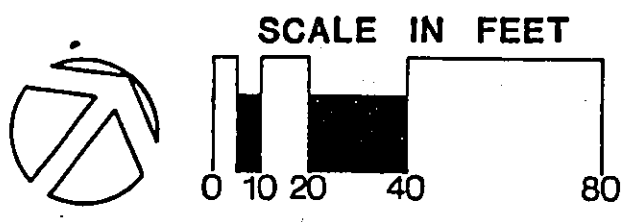


PROPOSED ULILI

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SED ULILI STREET RELIEF DRAIN



Kahala Drainage Improvements

For Elepalo and Ullili Streets
Drainage Improvements
FIGURE 4
DEPARTMENT of PUBLIC WORKS
CITY & COUNTY of HONOLULU

will be installed along the new drainline that will prevent flood flows, collected by the Ulili Street drainage system, from entering the Hunakai Street drainage system until they can be safely conveyed to the ocean outlet.

The cost for the Ulili Street relief drain improvement is approximately \$69,000, and will take about two months to complete.

2. Elepaio Street Drainage Improvements

The proposed improvements will be confined to the 10-ft. wide easement located between Kahala Avenue and the shore, a distance of approximately 300 feet (See Figure 5). The existing ocean outlet is completely blocked with sand and sediments, causing storm flows to discharge from a manhole situated on the shoreline.

The offshore section of the drainline extending seaward from the manhole at the shoreline, to the ocean outlet, will be abandoned. The shoreline manhole which presently functions as an outlet will be modified. The outlet structure will include two stairways with railings to provide pedestrian access along the shoreline and water. A portion of the existing 42-inch drainline within the easement will be replaced to tie into the new outlet structure.

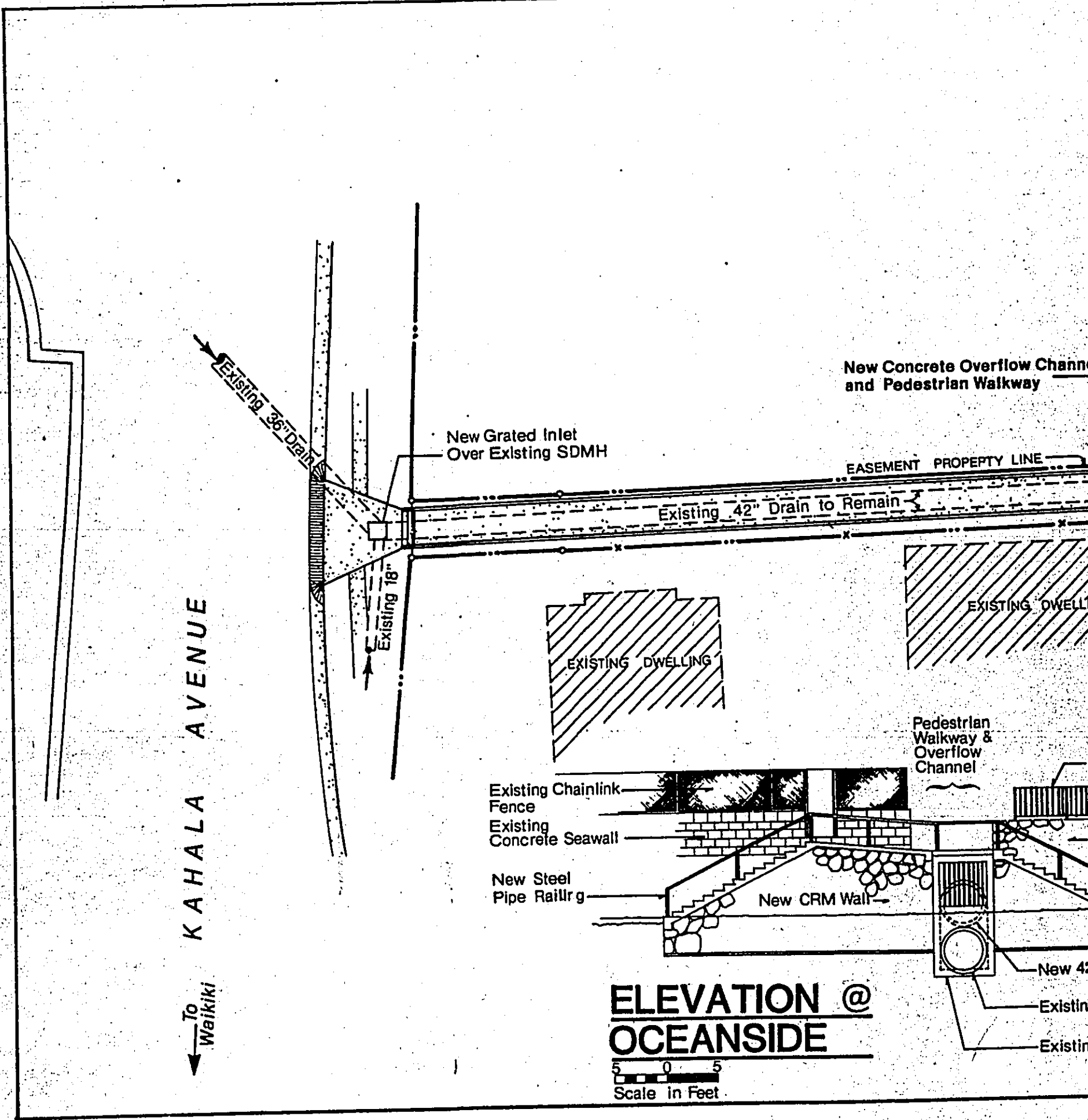
In addition, a new surface overflow drainage channel will be constructed within the easement over the 42-inch drainline. The new channel will serve two functions. First, it will convey storm runoff from Kahala Avenue which cannot be accommodated by the 42-inch drainline, to the ocean. Secondly, it will serve as a pedestrian access to the beach.

The cost for the Elepaio Street drainage improvements is approximately \$159,000, and will take about four months to complete.

C. Selection Rationale

The selection of the proposed improvements over the other alternatives (see section on alternatives) was based on the cost effectiveness of each alternative and the magnitude of any adverse environmental impacts.

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KAHALA AVENUE
To Waikiki

New Concrete Overflow Channel and Pedestrian Walkway

New Grated Inlet Over Existing SDMH

EASEMENT PROPERTY LINE

Existing 42" Drain to Remain

Existing 18"

EXISTING DWELLING

EXISTING DWELLING

Pedestrian Walkway & Overflow Channel

Existing Chainlink Fence
Existing Concrete Seawall

New Steel Pipe Railing

New CRM Wall

New 4"

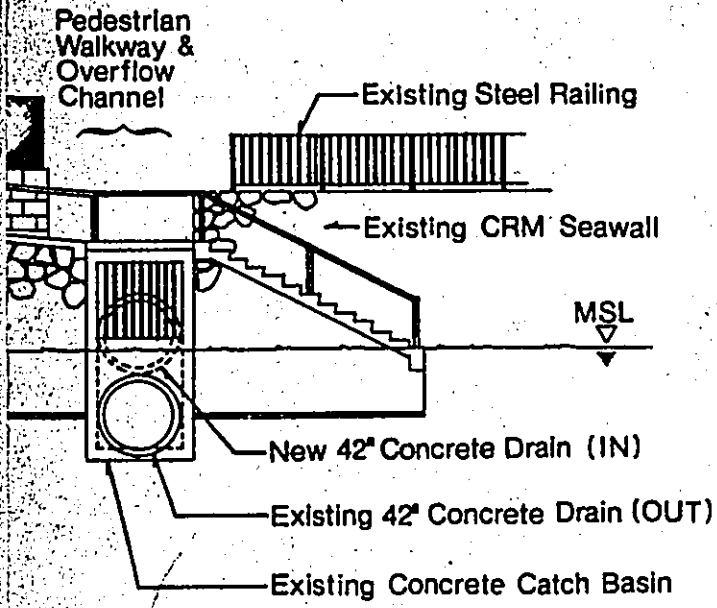
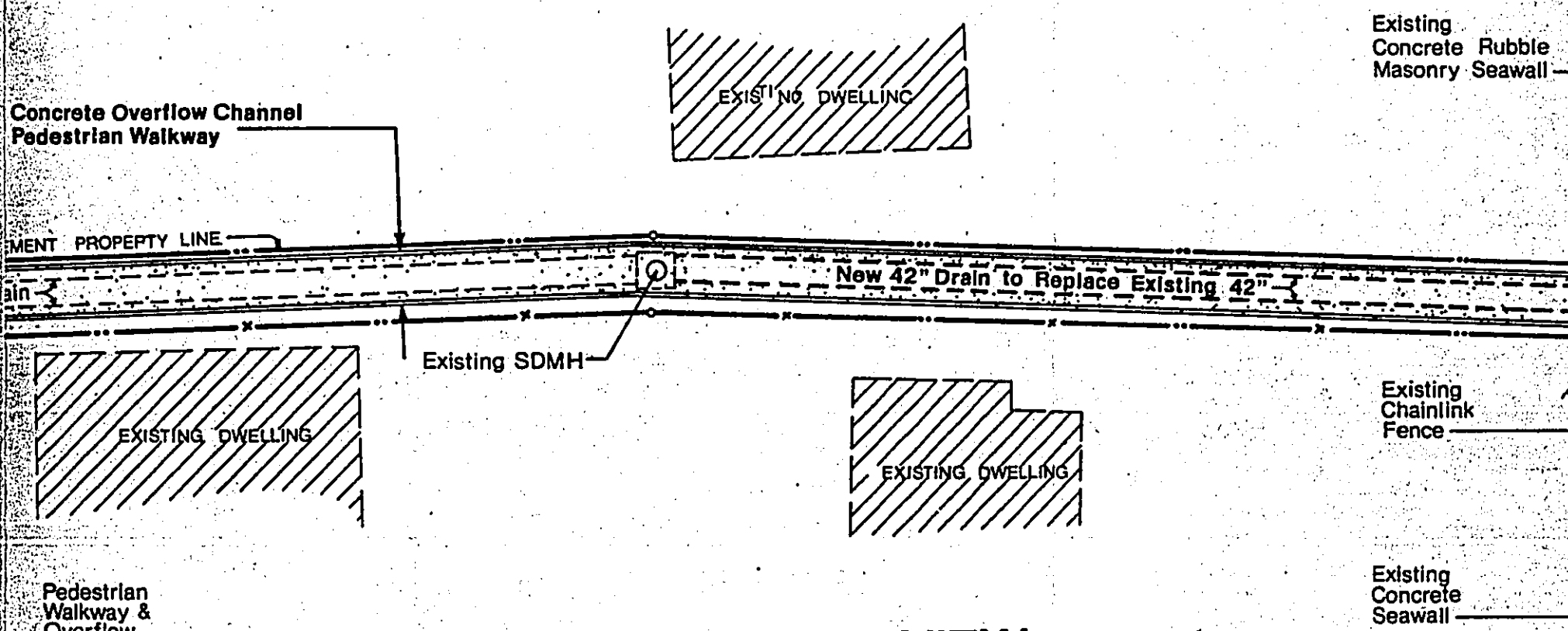
Existing

Existing

ELEVATION @ OCEANSIDE

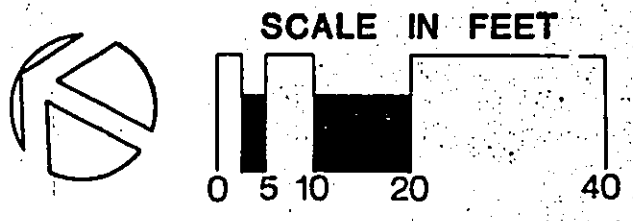
Scale in Feet

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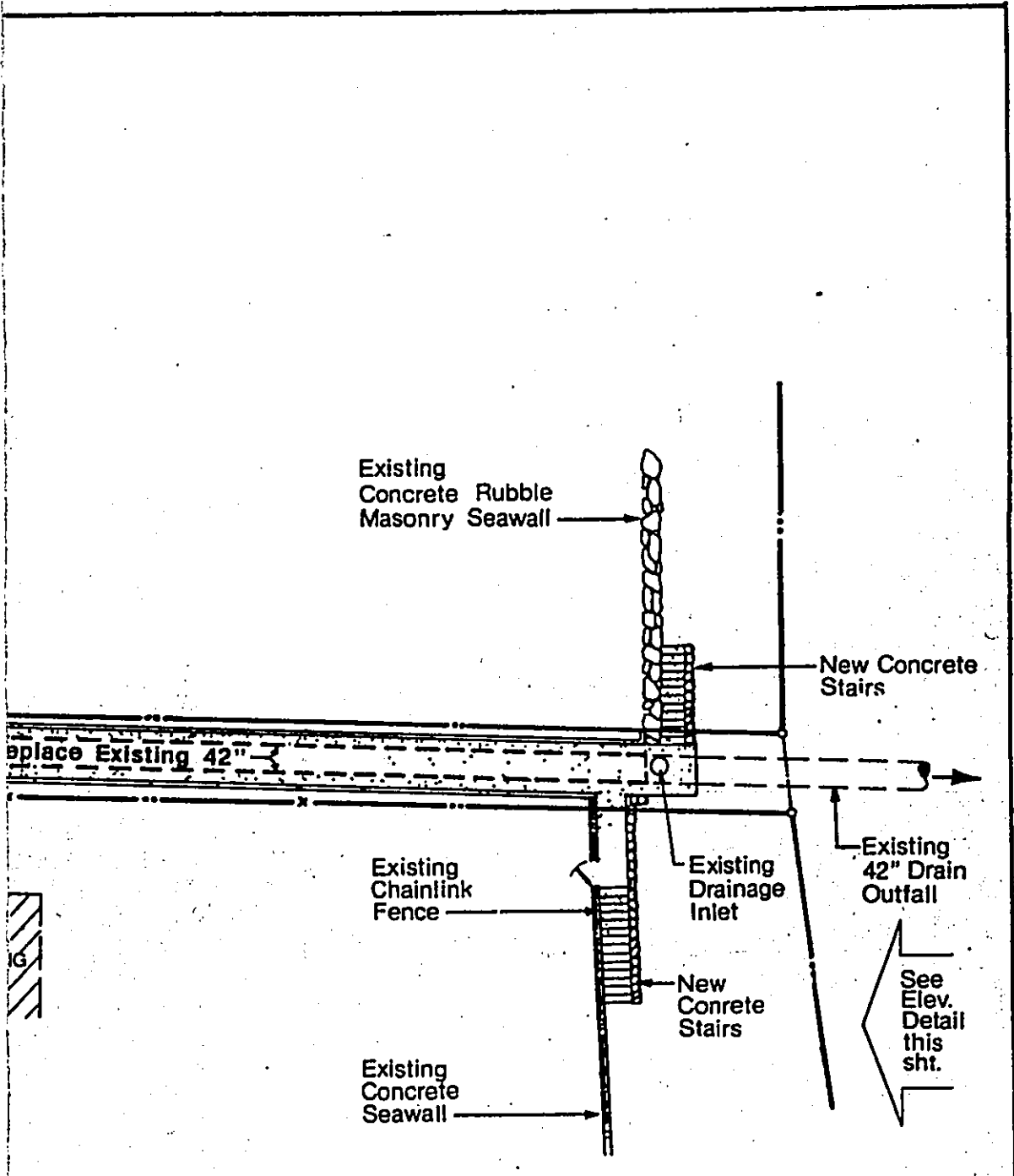
PLAN VIEW

PROPOSED ELEPAIO STREET DRAINAGE IMPROVEMENTS



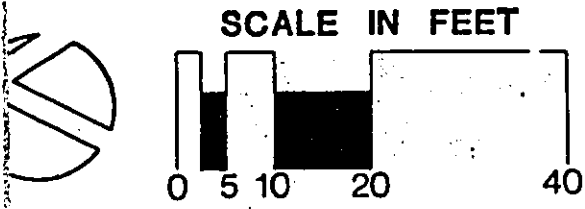
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ELEPALO STREET IMPROVEMENTS

Kahala Drainage Improvements



For Elepalo and Ullili Streets
Drainage Improvements
FIGURE 5
DEPARTMENT of PUBLIC WORKS
CITY & COUNTY of HONOLULU

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III.
Relationship to Public Land
Policies and Controls

III. RELATIONSHIP TO PUBLIC LAND POLICIES AND CONTROLS

A. Land Use Controls

1. State Land Use District - The land areas are within the Urban District. Submerged areas fall within the Conservation District.
2. Special Management Area - The proposed Elepaio Street drainage improvements are situated within the County Special Management Area (Figure 6).
3. Diamond Head Historic, Cultural and Scenic District - The proposed Elepaio Street drainage improvements are within the City and County Diamond Head District.
4. Zoning - The City and County zoning designation for the planning area is single family residential R-3 and R-4 (Figure 7).

B. Clearances and Permits Required

1. Ulili Street Relief Drain

None

2. Elepaio Street Drainage Improvements

a. Federal

- o United States Department of the Army, Section 10 General Permit (Corps of Engineers)

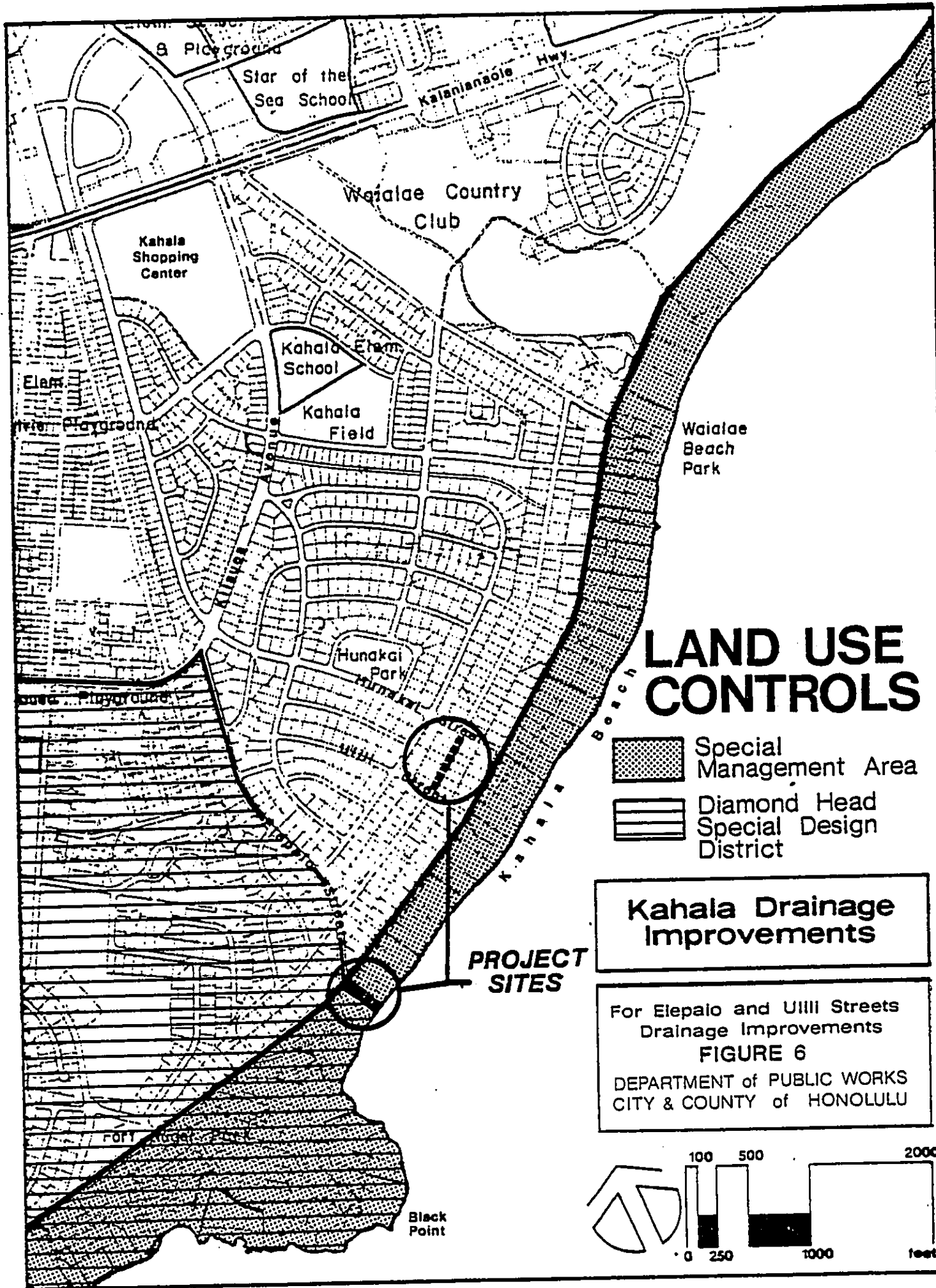
b. State

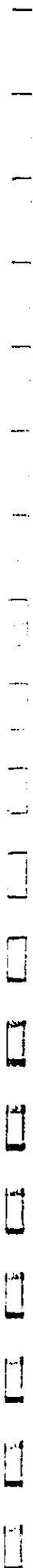
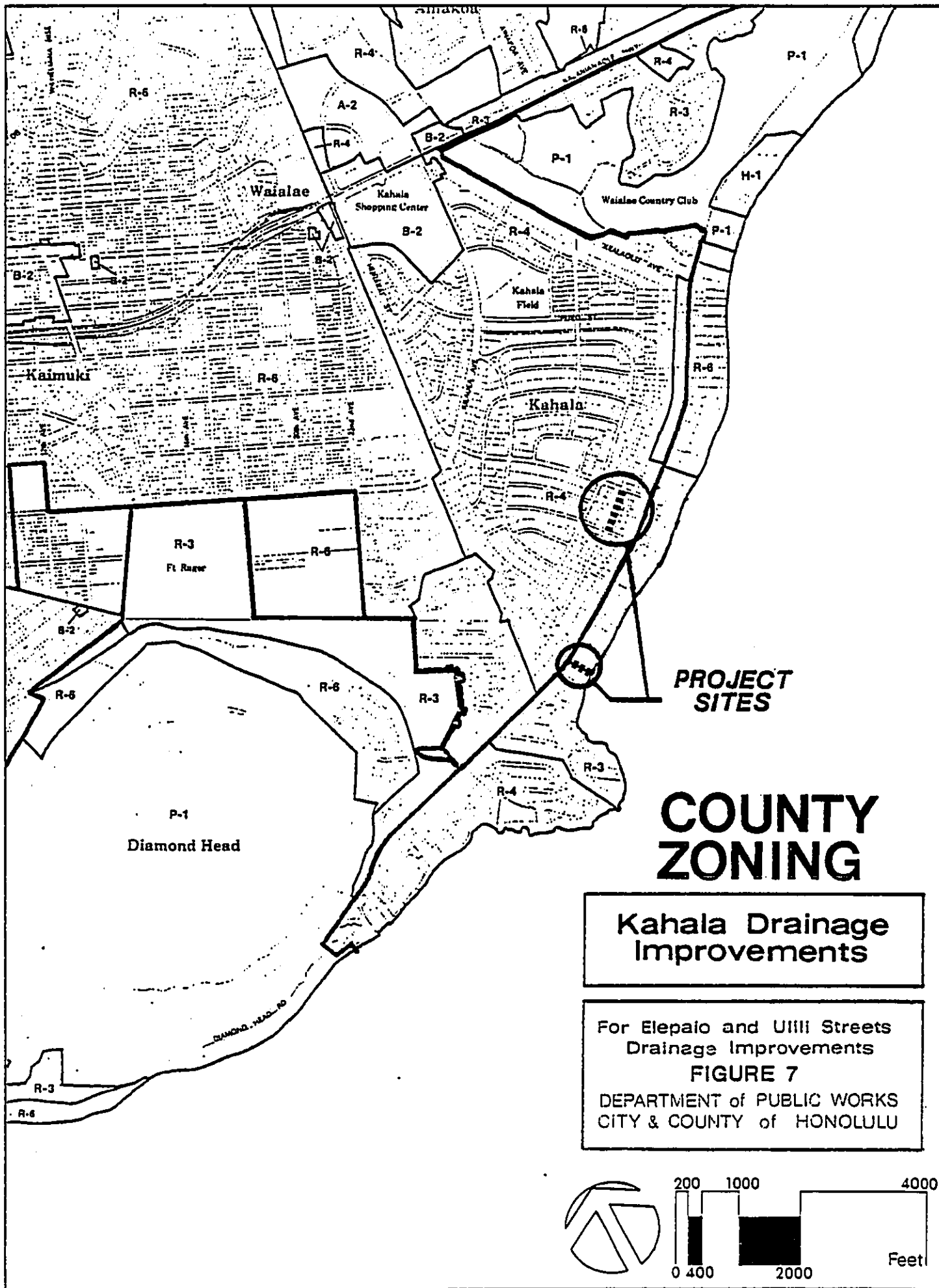
- o Conservation District Use Permit (Department of Land and Natural Resources)
- o Federal Consistency Certification - CZM Act of 1972 (Department of Planning and Economic Development)
- o Permit for Work in the Shore Waters of the State of Hawaii (Department of Transportation). Usually this permit is handled through the combined permit processing under the CDU permit.

c. City and County

- o Special Management Area (SMA) Permit (Department of Land Utilization)

- o Shoreline Setback Variance (Department of Land Utilization)
- o Diamond Head Historic, Cultural and Scenic District (Department of Land Utilization)





**IV.
Existing Environment**

IV. EXISTING ENVIRONMENT

A. Regional

1. Climate

The climate of the State of Hawaii is characterized by two identifiable seasons: summer and winter. The summer season is about 5 months long and the winter season is about 7 months long. Temperatures are mild and uniform throughout the year, with prevailing trade winds from the northeast. Geographic features cause significant local differences in rainfall.

The climate in the Kahala area is fairly typical of the overall State. Annual rainfall averages 25 to 30 inches. Average monthly temperatures recorded at the nearest recording station, 3 miles away in Waikiki, indicate a range from 71.9° F. to 80.6° F.

2. Population and Housing

The project sites are within Census Tract 5 of the City & County of Honolulu. Census Tract 5 is bounded on the west by Elepaio and Hunakai Street, on the north by Waiālae Avenue and Kalanianaʻole Highway, on the east by Wailupe Beach Park, and on the south by the ocean. According to the State of Hawaii Data Book 1981, the resident population of Census Tract 5 was 4,711 people in 1980. This represents a 10.3% decrease in population from the 1970 census count of 5,253. The overall State population increased 25.3% over the same period.

In 1979 there were 1,862 households identified in Census Tract 5. The median household income was \$26,600 for this area while the median household income for Oahu was \$14,139¹. The statistics showed that Kahala had the highest median household income in the State.

3. Access and Recreation

Recreational facilities within the immediate project area are shown by Table 1.

¹The State of Hawaii Data Book 1980, Department of Planning and Economic Development, Honolulu 1980. Income figures were for 1974.

TABLE 1
RECREATIONAL FACILITIES

<u>Facility</u>	<u>Acreage</u>	<u>Use</u>	<u>Distance from Project</u>
Waiialae Country Club	144.9	Golf (Private)	2/3 mile
Kahala Field	8.8	Playfields	1/2 mile
Hunakai Park	4.2	Passive	1/5 mile
Fort Ruger Park	3.2	Passive	1/3 mile
Waiialae Beach Park	4.4	Passive/Swimming	1/2 mile

Kahala Beach is not included in the table because it is not an improved park. However, there are a significant number of people, both from within and outside of the Kahala area, that utilize the beach for sunbathing, swimming, fishing and jogging. Suitable swimming areas that exist along Kahala Beach are protected by an offshore fringing reef. The beach area is narrow and sandy between Waiialae Beach Park and an area just before the Ulili Street drain easement. Coral and rocks predominate along the shoreline west of the drain easement, up until Black Point. This section is less suitable for recreation.

B. Site

1. Soils

The Soil Conservation Service survey indicates that the project sites are composed of Jaucas sand with 0 to 15 percent slopes (JaC). The soil is "single grain, pale brown to very pale brown, sandy, and more than 60 inches deep. In many places the surface layer is dark brown as a result of accumulation of organic matter and alluvium. The soil is neutral to moderately alkaline. Permeability is rapid and runoff is very slow making water erosion hazard slight. Wind erosion hazard is severe where vegetation is absent."

The beach areas are classified Beaches (BS) and are composed mainly of light colored sands derived from coral and seashells. These soils extend from the vegetation line out into the water.

2. Flood Hazard

The Elepaio Street drainage improvements and most of the Ulili Street Relief Drain are in an area of minimal flooding, classified Zone C under the Flood Insurance Study (FIS) for Oahu by a Federal Insurance Administration. A portion of the proposed relief drain on Ulili Street is located in the Waialae Major Drain 100-year floodplain in a shallow flooding area of one foot average depth. This special flood hazard area is designated Zone AO under the FIS. The 100-year flood refers to an event which has a one percent chance of being equalled or exceeded in any given year.

3. Biology

a. Terrestrial

The existing easements have previously been disturbed by construction. In addition, the easements serve as public access ways from Kahala Avenue to Kahala Beach and are heavily trafficked, especially on weekends. It is unlikely that endangered terrestrial plant or animal species exist within the easements.

b. Marine

A marine biological reconnaissance survey (see Appendix A) was conducted on September 21, 1980 by Dr. Ralph L. Bowers Ph.D. of Sea Engineering Services, Inc. Observations were made along the outfall drainlines from the near-shore areas to the outlets and the reef ridge. The survey revealed no endangered marine plant or animal species in the project area. Marine life in the vicinity of the drainlines was, in fact, found to be poorly developed. Wave surge forces coupled with the periodic transport of sand onto the reef has created a relatively flat reef having a lack of habitat.

4. Historical/Archaeological

The proposed project does not effect any historic sites listed on the Hawaii Register or the National Register of Historic Places, or eligible for inclusion on the National Register of Historic Places. However, because no archaeological surveys have been conducted in the vicinity, historical, cultural, architectural, and/or archaeological resources may exist in the project area.

It is unlikely that any historic/orarchaeologic sites will be impacted by the project. The Kahala area has developed over the years into a well established residential neighborhood. Furthermore, the project involves an existing system where previous excavation has already disturbed the project site. Should any previously unidentified sites or remains (such as artifacts, shell, bone, or charcoal deposits; human burials; rock or coral alignments, pavings, or walls) be encountered, the State Historic Preservation Office will be notified immediately at 548-7480 and construction activities will be halted.

5. Surrounding Land Use

Single family residential units surround the project sites. The Kahala area is a desirable residential area with high-priced houses and lots.

The beach area is used for recreational activities such as sunbathing, swimming, fishing and jogging. The offshore areas are used by fishermen, divers, and occasionally by boaters.

V.
Potential Impacts

V. POTENTIAL IMPACTS

The potential impacts of the project are addressed in two sections; the short-term, construction related, impacts and the long-term impacts.

A. Short-Term (Construction Related)

During the construction of the various phases of the project, temporary impacts may occur to air quality, water quality, traffic, safety, ambient noise levels, recreational activities and marine biota. Construction of the Ulili System will take an estimated 2 months and the Elepaio system will take about 4 months. The impacts are discussed below.

1. Air Quality

Fugitive dust produced during clearing, excavation, and grading of the project site, and exhausts from construction machinery may be placed in the atmosphere. Typical late afternoon and evening offshore breezes should remove airborne pollutants from populated areas.

Additionally, precautions such as watering down exposed grounds under construction to minimize dust will be implemented if site conditions warrant such action.

2. Water Quality

Strict compliance with City and County grading, erosion, and sediment control ordinances will be followed to minimize the potential of adverse effects to coastal waters. It is recommended that construction activity take place during periods of low rainfall (March through October).

In the event the City and County funding schedule cannot accommodate the recommended construction schedule, other mitigative measures can be implemented to minimize erosion and sediment transport. These measures include the proper sequencing of work, limiting the length of open trenches, and the utilization of special features such as check dams.

Erosion caused from surface runoff after clearing and grading is expected to be minimal. The land area under construction will not be significant.

Construction activity occurring in the water will produce some increased turbidity. In the event that turbidity becomes a significantly adverse problem, silt screens or coffer dams will be used to reduce levels of suspended sediment.

3. Traffic and Access

Impacts to traffic and access will occur during construction. Once construction is completed, traffic will return to normal.

The arrival and departure of the construction work force will add to the normal traffic load during morning and afternoon peak hours. Also, some additional traffic can be expected throughout the working day as a result of the need to transport machinery and materials.

During construction, the public will not be allowed to use the Elepaio easement to gain access to the beach. Other access easements exist within 100 to 200 yards on either side of the Elepaio easement, which could be used for beach access.

Traffic along Aukai Avenue will be affected during construction. Half of the roadway width may be temporarily closed to traffic during working hours. Street parking would not be permitted so that traffic can be accommodated on the unaffected half of Aukai Avenue.

Access to private residences along Aukai Avenue will be impacted during construction. After working hours trenches will be covered to permit access to these residences.

4. Safety

Construction sites typically pose various safety hazards to the public, particularly during unattended periods when work is not occurring (i.e., evenings, weekends, and holidays).

The contractor will adhere to all safety requirements imposed and is expected to take additional precautions as required to minimize possible hazards. Trenches along Aukai Avenue will be covered during non-working hours. The Elepaio easement will be closed to public access throughout the construction period.

5. Noise

General sitework, operation of construction machinery, and truck traffic will affect ambient noise levels. Typical noise levels are indicated by Table 2.

TABLE 2

CONSTRUCTION EQUIPMENT NOISE RANGES

<u>Equipment</u>	<u>Noise Level (dbA) at 50 Ft.</u>
COMPACTERS (ROLLERS)	72-74
FRONT LOADERS	72-85
BACKHOES	72-94
TRACTORS	77-96
SCRAPERS, GRADES	80-93
PAVERS	87-89
TRUCKS	83-94
CONCRETE MIXERS	75-88
CONCRETE PUMPS	81-93
CRANES (MOVABLE)	75-87
CRANES (DERRICK)	87-89
PUMPS	69-71
GENERATORS	71-82
COMPRESSORS	74-87
PNEUMATIC WRENCHES	83-89
JACK HAMMERS AND ROCK DRILLS	81-98
PILE DRIVERS (PEAKS)	95-106

Note: Based on Limited Available Data Samples

Source: Noise from Construction Equipment and Operations Building Equipment, and Home Appliances, EPA, 1971

Construction activity will be limited to normal working hours during weekdays. The Contractor will be required to adhere to all applicable regulations concerning noise levels. A community noise control permit will be obtained from the State Department of Health prior to commencement of work.

6. Recreation Access

Access to Kahala Beach, near the Elepaio easement, will be inconvenienced during the construction period. Alternate means of access are available, using other nearby access easements, and will be indicated by signs, notices, etc. prior to and during construction.

Street parking will be affected during construction. Again, beach-goers may be inconvenienced.

7. Marine Biota

During construction of the proposed shoreline outlet, an increase in the level of suspended sediment is expected within the immediate vicinity of the shoreline construction area. If turbidity becomes significantly adverse, certain construction methods can be implemented to mitigate the problem. These methods include the use of silt screens and coffer dams.

B. Long-Term

The long-term impacts are those changes to the environment which would persist or occur after construction is completed. Potential long-term impacts are discussed below.

1. Water Quality

The proposed improvements will continue to discharge stormwater into the ocean. The existing drainlines utilize ocean outfalls, however the Elepaio system presently discharges storm waters at the shore. Therefore, discharge of storm waters into the ocean from the shore is not a new, but rather, a continuing impact.

The proposed Elepaio Street drainage improvements will discharge storm waters at the shoreline through a modified outlet structure. Presently, storm waters discharge from the manhole at the shoreline. The new outlet system is not expected to increase impacts to the shoreline area or offshore environment.

2. Biological

No endangered species of plants or animals have been identified, or are known to exist in the area. A marine biological survey revealed marine life in the area to be sparse and consist of common species (Appendix A). The continued discharge of fresh water from the Elepaio ocean outfall is not expected to have any significant impact to the offshore reef environment. Storm waters discharged at the Elepaio drain outlet will be similar in volume and quality to the existing condition.

The Uili Street relief drain improvements involve combining drainage areas and increasing the total discharge at the existing Hunakai outfall. The increased concentration of fresh water at the Hunakai outlet should not have significant impacts to the reef ecosystem since marine life is sparse in the area.

3. Visual/Scenic

The proposed improvements will not have significant adverse impacts to scenic views or vistas since most of the improvements will be underground. The only features that will be visible are the tops of the manholes, and the outlet structure and overflow channel for the Elepaio drain improvements.

4. Recreation

The proposed shore outlet at the end of the Elepaio Street easement will change the use of the beach area. Presently, a manhole structure obstructs the narrow beach. The proposed new outlet structure includes steps and railings to provide safe pedestrian access over the outlet. Shoreline accessibility will not be significantly affected.

5. Safety

Drainage improvements will enhance the safety and welfare of affected homeowners. The new drain outlet for the Elepaio system will improve the hazardous conditions of the existing manhole structure.

6. Littoral Transport

No new structures will be constructed, which would affect littoral transport. The Elepaio outlet can be regarded as similar to the existing manhole structure.

7. Existing Drainage System

The Ulili Street relief drain will not compound existing flooding problems along Hunakai Street. A flap gate will be installed along the new drainline that will prevent flood flows, collected by the Ulili Street drainage system, from entering the Hunakai Street drainage system until they can be safely conveyed to the ocean outlet.

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VI.
Alternatives to
the Proposed Project

VI. ALTERNATIVES TO THE PROPOSED PROJECT

A. No Action Alternative

The no action alternative is considered to be unacceptable because nuisance flooding conditions will continue to persist in residential areas. The existing drainage system is undersized and not functioning properly, causing localized ponding to occur after a storm.

B. Ulili Street Drainline

Two alternative solutions to improve flooding problems associated with the Ulili Street Drainline were examined in addition to the selected alternative.

1. Ulili St. Alternative I:

A new 72-inch line would replace the existing 54-inch relief drainline from Kolohala Street to the shore (see Figure 8). The existing 54-inch ocean outfall would be abandoned in place and three new 48-inch drainlines would be realigned to minimize the impact of surf action on the ocean outfall. A channel or depression would be excavated to a depth of 5 feet below the outlet culvert.

A "manifold" system at the shore including a modified storm drain manhole with silt trap, slide gates, and security housing would be constructed to flush sediments out of the new ocean outfall during periods of low flow.

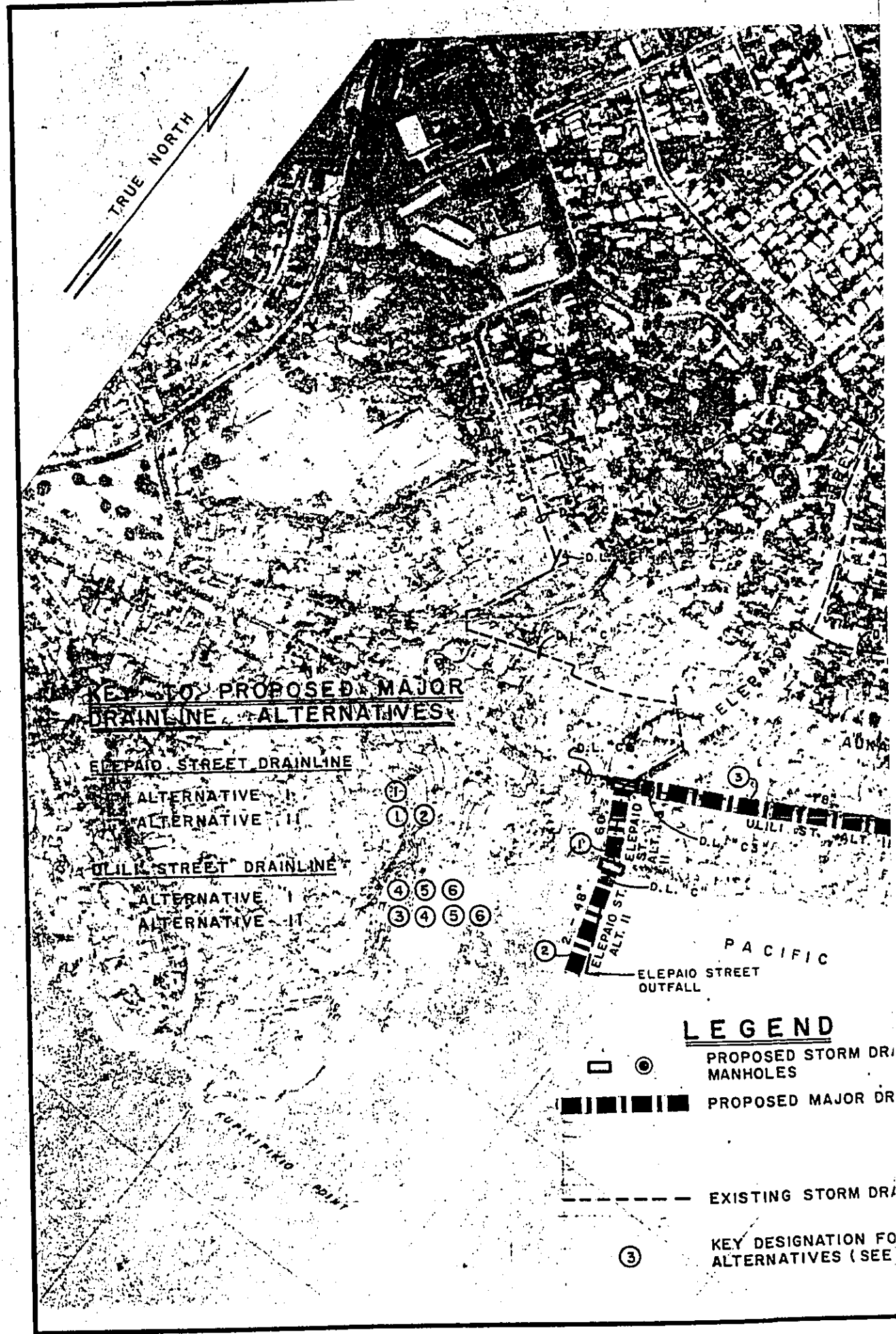
This alternative was not selected, due to the following reasons:

- o difficult operation and maintenance of the slide gates and silt traps
- o ocean outlet may encounter the existing problem of sand intrusion and blockage
- o Construction cost - \$1,145,000.

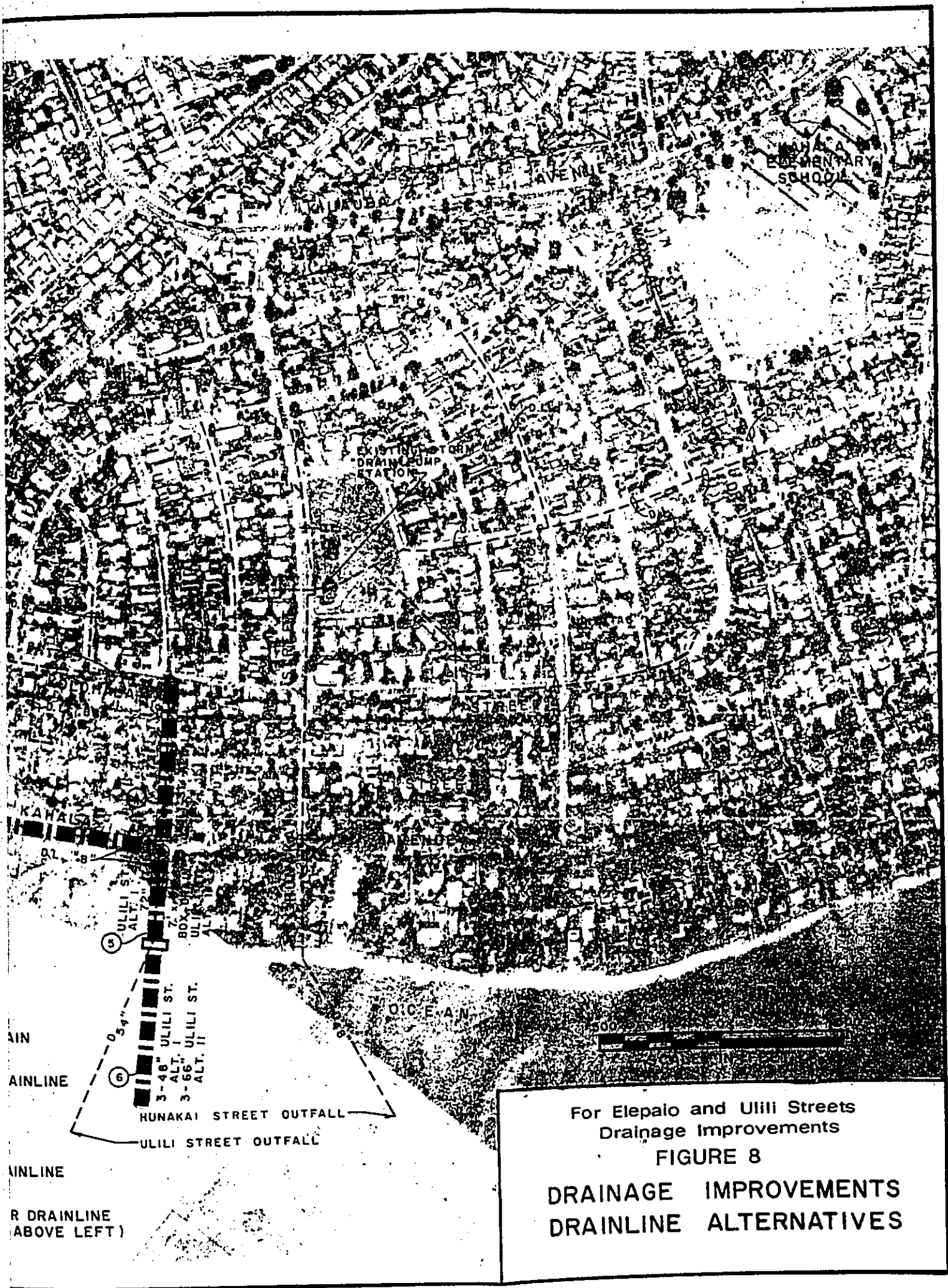
2. Ulili St. Alternative II:

A 72-inch line would replace the existing 54-inch relief drainline from Kolohala Street to Kahala Avenue. A 78-inch interceptor drainline would be constructed along Kahala Avenue between Elepaio Street and Ulili Street to divert 142 cfs from the Elepaio Street drainage system. A 7' x 8' box drain would be constructed to carry both Ulili and Elepaio flows from Kahala Avenue to the shore.

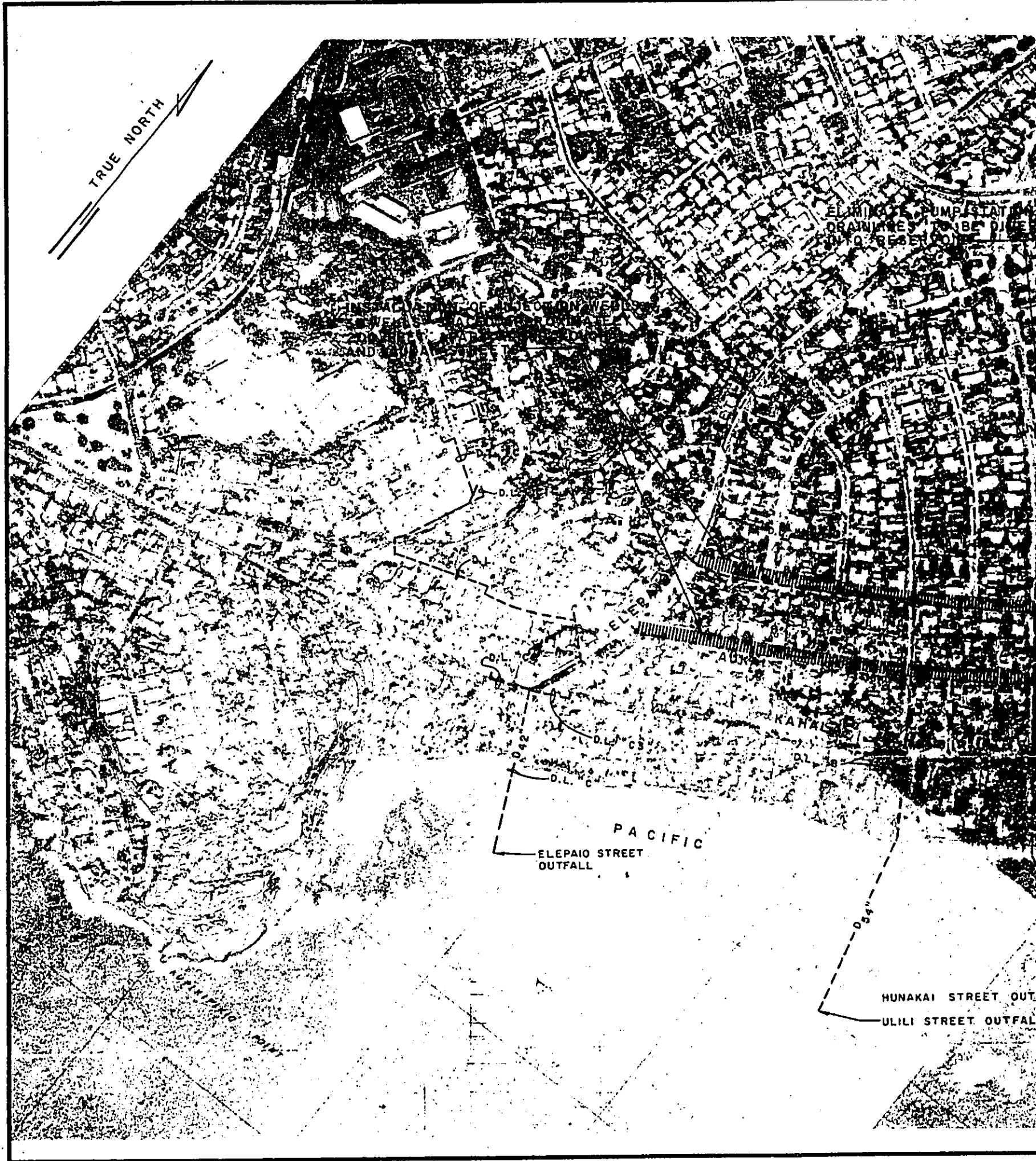
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For Elepaio and Ulili Streets
Drainage Improvements
FIGURE 9
INJECTION WELL AND
RESERVOIR ALTERNATIVES

The existing 54-inch ocean outfall would be abandoned and three 66-inch drainlines would be constructed along a new alignment to minimize the effect of excessive surf action on the pipes.

A similar "manifold" system and excavated ocean outlet as in Ulili St. Alternative I, would also be constructed.

The major advantage to this alternative is the reduced number of outfalls to be maintained by eliminating the Elepaio Street ocean outfall.

This alternative was not selected, due to the following reasons:

- o impact upon existing utilities and traffic flow along Kahala Avenue during construction
- o probable requirement of a construction easement for the 7' x 8' box drain
- o malfunction of the Ulili Street outfall would affect both Elepaio and Ulili systems
- o highest construction cost - \$2,475,000.

C. Elepaio Street Drainline

Two alternatives were investigated to improve the Elepaio Street Drainline, in addition to the selected alternative.

1. Elepaio St. Alternative I:

Two new 42-inch lines would replace the existing 42-inch relief drainline from Kahala Avenue to the shore.

A "manifold" system including a modified storm drain manhole at the Kahala intersection with silt trap and slide gates would be constructed to flush sediments and sand out of the pipe during periods of low flow. A drainage outlet would be constructed at the shoreline, which would include a concrete headwall, stairway with corrosion-resistant railing, and retaining walls to tie into the existing rock walls. The existing 42-inch ocean outfall, which is exposed, would be removed.

Drainage flows presently discharge from an opening in the manhole onto the rocky shore area. Surrounding properties have revetments and seawalls along the ocean frontage.

This alternative was not selected, due to the following reasons:

- o difficult operation and maintenance of the slide gates and silt traps
- o construction cost - \$384,000.00.

2. Elepaio St. Alternative II:

A 60-inch line would replace the existing 42-inch relief drainline from Kahala Avenue to the shore. Two 48-inch drainlines would replace the existing 42-inch ocean outfall and be realigned to minimize the effects of excessive surf action. A channel or depression would be excavated in the reef to a depth of 5 feet below the invert of the outlet.

A "manifold" system similar to the Elepaio St. Alternative I including a modified storm drain manhole with silt traps, slide gates, and housing would be constructed at the shore to flush sediments out of the new ocean outfall during periods of low flow. A new modified storm drain manhole with silt trap would also be constructed at the Kahala Avenue intersection.

This alternative was not selected, due to the following reasons:

- o difficult operation and maintenance of the slide gates
- o the ocean outlet may encounter the problem of sand intrusion and blockage
- o impact to ocean during construction.
- o higher construction costs, including specialized offshore construction - \$528,000

D. Injection Well Alternative

The basic concept of this alternative would be to divert the excess storm flows from the Hunakai, Uili and Elepaio systems, a total of about 285 cfs, into a series of injection wells approximately 200 ft. in depth. These excess flows are the storm flows that are over and beyond the actual capacity of the existing system. The wells should be located in close proximity to the three drainage systems to reduce the cost of interceptor lines.

A central location along Kolohala Street and Aukai Avenue between Elepaio Street and Pueo Street was evaluated in which 38 wells are spaced approximately 200 ft. apart (19 per row) in two rows.

The Elepaio Street and Ulili Street ocean outfalls would be abandoned, and all flows would be diverted into the Hunakai Street Relief Drain. All surplus flow would discharge through this single outfall.

This alternative was not selected, due to the following reasons:

- o percolation tests would be required to verify theoretical well capacities
- o maintenance of wells required to maintain injection rates
- o high construction costs of the injection wells - \$3,541,000.

E. Retention Reservoir Alternative

The basic concept of this alternative would be to divert the total excess storm flow, over and beyond what can safely be conveyed to the ocean, into a 5-foot deep reservoir requiring approximately 3.5 acres of land.

The reservoir would be located at the site of the existing Kahala Storm Pump Station (which would be eliminated), and would include a portion of the surrounding park and residential area. The location was chosen to minimize the amount of occupied residential lands required and to improve the aesthetics of the park.

The Elepaio Street and Ulili Street ocean outlets would be abandoned and all flow would be diverted into the reservoir. The existing Hunakai Street 48" ocean outfall would be retained to carry low and excess flows to the ocean. A new 48-inch drainline would replace the existing 3' x 4.5' box drain from the reservoir site to Kahala Avenue.

The Hunakai Street ocean outfall would be repaired and all flow would be discharge through this single outfall.

This alternative was not selected, due to the following reasons:

- o possibility of the retention reservoir overflowing
- o high cost for land acquisition and construction - \$3,345,000.

VII.

**The Relationship Between
Local Short-term Uses of
Man's Environment and the
Maintenance & Enhancement
of Long-term Productivity**

VII. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The short-term or construction-related impacts will be temporary and localized. The benefits of the proposed drainage improvements to the affected residents outweigh the short-term inconveniences. The proposed improvements can be viewed as repair and replacement of an existing system.

Future options for use of the environment are not precluded as a result of this project. No new long-term impacts will be produced.

The health and safety of residents and beach users is enhanced by this project. Nuisance ponding resulting from storms will be drained sooner. Access along the shoreline will be facilitated by providing stairs and railings in conjunction with the improved Elepaio Street drain outlet. Presently, the manhole which functions as an outlet on the shoreline is an obstacle to access along the shoreline and poses a potential safety hazard.

VIII.

**Any Irreversible and Irretrievable
Commitments of Resources**

VIII. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Impact to the limited environmental resources which will be affected is minimal and of a temporary nature. Proposed improvements could be removed at some future point in time, and the project sites restored to conditions present today.

Labor and capital costs expended on the proposed project would be, for the most part, irretrievable. Construction materials used in the project could be retrieved and recycled.



IX.
Organizations and Persons Consulted
During the Preparation of the E.I.S.

IX. ORGANIZATIONS AND INDIVIDUALS CONSULTED DURING THE PREPARATION OF
THE EIS

FEDERAL

Mr. Kisuk Cheung, Chief
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Honorable Hideto Kono, Director
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Department of Land Utilization

Mr. Robert Masuda, Director
Department of Parks and Recreation

Dr. Willard T. Chow, Chief Planning Officer
Department of General Planning

Mr. Kazu Hayashida, Manager and Chief Engineer
Board of Water Supply

Mr. Roy Parker, Director
Department of Transportation Services

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Mr. Bill Sewell, Chairman
Waialae/Kahala Neighborhood Board No. 3
P. O. Box 10435
Honolulu, Hawaii 96816

Mr. Ken West
4550 Aukai Avenue
Honolulu, Hawaii 96816

Comments and response letters are contained in Appendix B.

X.

Summary of Unresolved Issues

X. SUMMARY OF UNRESOLVED ISSUES

A. Flooding Conditions

The proposed project will not totally eliminate the existing flooding problems in the Kahala area. The problems stem from overall system design deficiencies and system malfunctions, which result in flooding that would persist even if the malfunctioning outfall pipes were replaced. Periodic maintenance to prevent excessive siltation and blocked drainage can help relieve this problem. It should be recognized that flooding is more of a nuisance rather than life threatening. Therefore, the proposed project will only reduce the period of nuisance flooding.

B. Shoreline Outlet

The proposed shoreline outlet for the Elepaio Street Drainage Improvements will have some minimal impact to the quality of beach and near-shore waters. However, this impact will not be any greater than that experienced under existing conditions. The affected shore area is not often used by swimmers or sunbathers since there is very little beach area and the water washes up to the existing seawalls forming the shoreline. The shoreline impact would be intermittent, occurring only during periods of heavy rains and would be similar to present conditions.

A biological survey was conducted for the offshore area in September 1980. It was determined that natural reef conditions and currents are not conducive to sustain a stable marine habitat. Consequently, the surrounding marine environment will not be adversely impacted by drainage discharge at the shore, whether the source of this discharge is from the existing system or from the proposed shoreline outlet, or if the drainage discharge was eliminated all together.

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XI.

List of Necessary Approvals

XI. LIST OF NECESSARY APPROVALS

- A. Department of the Army, Section 10 General Permit - U.S. Army Corps of Engineers
- B. Conservation District Use Permit - Department of Land and Natural Resources, State of Hawaii
- C. Permit for Work in the Shore Waters of the State of Hawaii - Department of Transportation, State of Hawaii
- D. Special Management Area Use Permit - Department of Land Utilization, City and County of Honolulu
- E. Shoreline Setback Variance - Department of Land Utilization, City and County of Honolulu
- F. Diamond Head Historic, Cultural and Scenic District - Department of Land Utilization, City and County of Honolulu

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XII.
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Elepaio, Uili and Hunakai Streets Relief Drain - Phase I Project, Draft Report -- Drilling Results and Biological Survey. Sea Engineering Services, Inc. November 1980.

XIII.
Appendices

**APPENDIX A -
Biological Survey**

OCEAN ENGINEERING AND ENVIRONMENTAL
RECONNAISSANCE STUDY
OF THE
ELEPAIO, ULILI AND HUNAKAI STREETS RELIEF DRAINS
KAHALA, OAHU, HAWAII

Prepared for:

WILSON OKAMOTO & ASSOCIATES
1150 South King Street
Honolulu, Hawaii 96814

February 1981

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INTRODUCTION

Study Scope and Objectives

An engineering and environmental reconnaissance study of the relief drains at Elepaio, Ulili and Hunakai Streets, Kahala, Oahu, Hawaii, was conducted to determine their existing condition and to obtain engineering and environmental information pertinent to the design and assessment of possible relief drain improvements. The study included: (1) a detailed inspection of the existing relief drains from the shoreline seaward to their terminus on the fringing reef flat; (2) a biological reconnaissance in the vicinity of the existing drains to note the substratum type and dominant algae, fishes, corals, and other invertebrates; (3) water quality and circulation measurements on the reef flat during ebb and flood tide and tradewind, Kona, and light and variable wind conditions; and (4) an assessment of design wave conditions.

Study Area

The study area includes the shoreline and reef flat in the vicinity of Kahala, Oahu, between Kupikipikio Point (Black Point) and the Hunakai Street relief drain approximately 4,000 feet east of the point. Water quality and circulation measurements were also made on the reef seaward of the drainage canal and Waialaenui stream east of the primary study area. The general study area is shown on Figure 1, and a detailed vicinity map is shown on Figure 2.

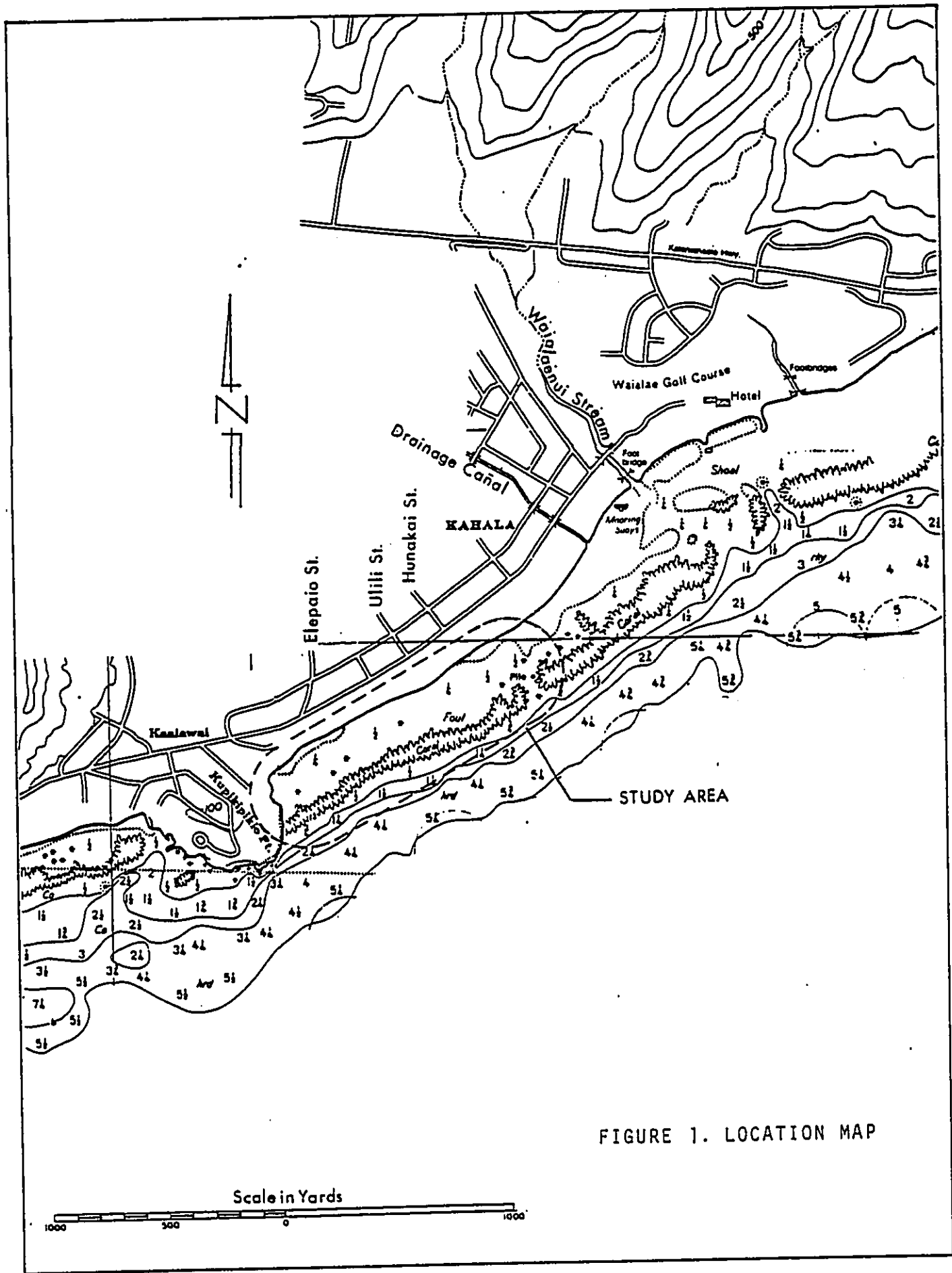


FIGURE 1. LOCATION MAP

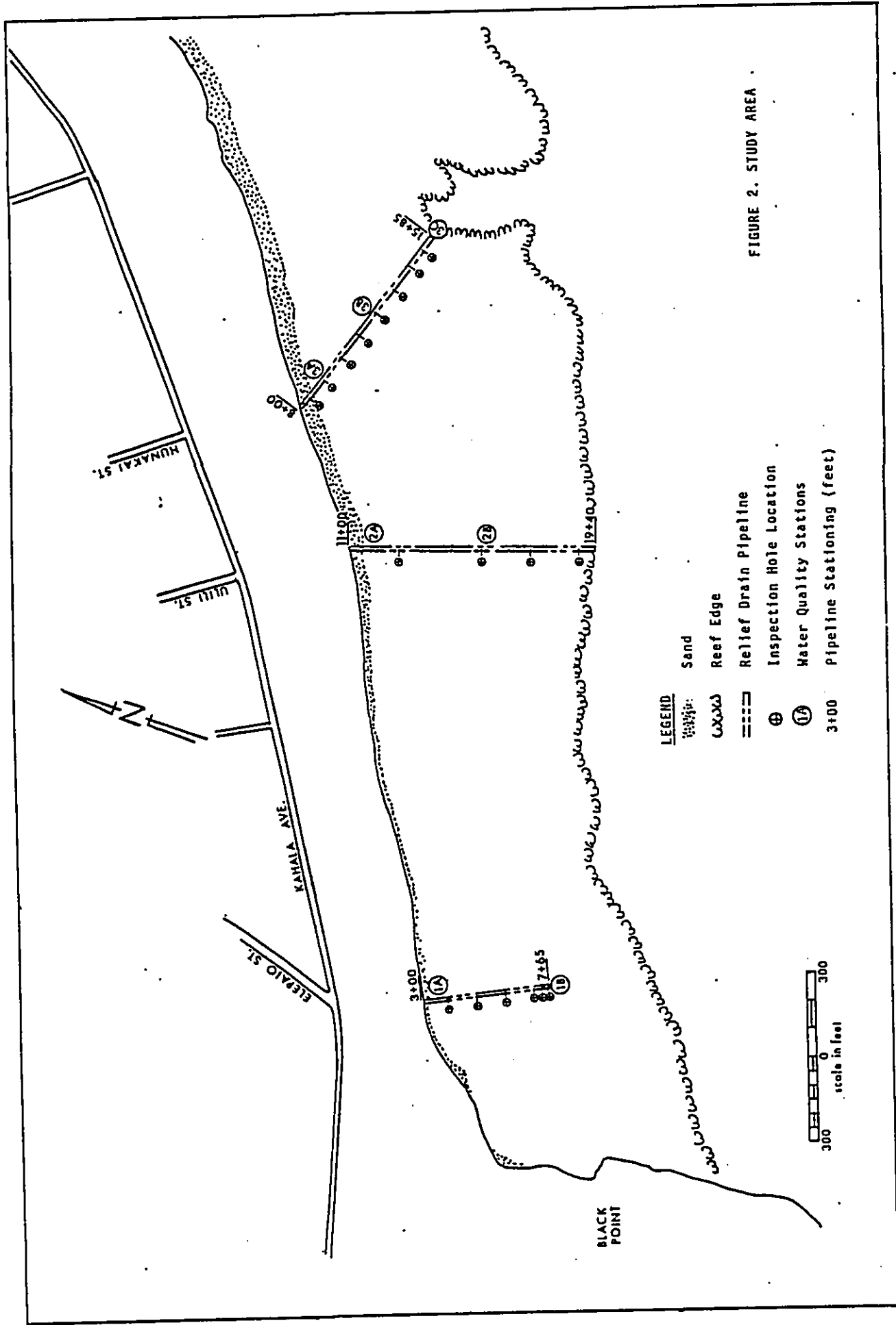
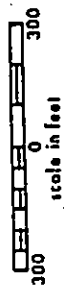


FIGURE 2. STUDY AREA

- LEGEND**
- Sand
 - Reef Edge
 - Relief Drain Pipeline
 - Inspection Hole Location
 - Water Quality Stations
 - 3+00 Pipeline Stationing (feet)



INSPECTION OF EXISTING RELIEF DRAINS

Methodology

Existing stormwater relief drains extend seaward across the reef flat from the public rights-of-way located at the intersection of Kahala Avenue and Elepaio, Ulili, and Hunakai Streets. The drains are constructed of 42 to 54 inch reinforced concrete pipe, with a wall thickness of approximately 7 inches.

The location and extent of sand/sediment blockage in each drain was determined by drilling a series of 1-1/4-inch holes along the length of the concrete pipe. A Stanley HD-20 "Hammer-Drill", with a 1-1/4-inch carbide tipped bit was used. The drill was powered by a small hydraulic power pack. The size of the drill unit and power supply was limited by the necessity to mount the rig on a boat small enough to be pulled onto and over the reef at high tide. A pneumatic system was considered, but was impractical due to the large size of the air compressor required.

Steel reinforcing bars in the concrete pipe were encountered on most holes drilled. The procedure followed was either to shift the location of the hole slightly, or slowly grind through the rebar. The average drilling time per hole was 1-1/2 hours.

After the hole was drilled, a one-inch PVC pipe was inserted into the hole and lowered until resistance was encountered. A point on the PVC pipe even with the top of the concrete pipeline was marked, the PVC pipe was removed and the distance measured. This established the distance from the top of the pipeline to the sediment level. The depth of clear passageway in the drain, or "clear depth",

was then determined by subtracting the drain pipe wall thickness from the measured distance.

A sediment sample was then collected by driving the one-inch PVC pipe further into the drain pipe, to the point of refusal. The PVC pipe was then capped and withdrawn from the drain. The samples were stored in one-quart plastic bags.

The holes in the drain pipe were repaired with "Water-Plug", a quick-setting patching concrete. The concrete is suitable for use underwater and can be used to plug holes even if there is a discharging stream of water. Prior to placing the "Water-Plug", an oversize plastic disc was driven into each hole to form a base for the plug and prevent the plug from extending into the drain pipe.

Inspection Results

Elepaio Street Drain. The Elepaio Street drain is a 42-inch RCP pipe extending approximately 430 feet out from the shoreline. The top of the pipeline is just exposed above the level of the reef flat along most of its length, becoming more exposed with distance from shore.

Six holes were drilled in this pipeline at the locations shown in Figure 2. The results are summarized below.

Drilling Log, Elepaio St. Drain

Hole #	Station	Clear Depth (Inches)	Comments
1	7+45	15	No water flow observed
2	7+25	10	"
3	7+05	3	"
4	6+05	3	"
5	5+05	0	"
6	4+05	0	"

The Elepaio Street drain is completely blocked. The seaward 40 or 50 feet has some clear space at the top of the pipe, but this may be just due to wave scour. No water was observed flowing from any of the drilled holes or from the end of the pipeline. The manhole at the juncture of the drain and the shoreline overflows during heavy rains, however; thus, the drain effectively discharges at the shoreline.

Unlike the other two pipelines, the joints on the Elepaio pipeline appeared to be well-constructed.

The sediment in the pipe ranged from fine calcareous sand at the seaward end to terrestrial sand and grit mixed with calcareous sand at the shoreward end.

Ulili Street Drain. The Ulili Street drain is a 54-inch RCP pipe extending approximately 860 feet from the shoreline. The top of the pipeline is buried approximately two feet below the surface of the reef, except for the seaward 50 feet, which is exposed. The material on top of the pipe consists of coral rubble and calcareous sand and gravel, which had to be removed prior to drilling. This task was best accomplished at low tide and during light to moderate tradewinds.

Four holes were drilled in this pipe at the locations shown in Figure 2, and a pipe joint was cleared for inspection at a fifth location. The results of the drilling are summarized below.

Drilling Log, Ulili St. Drain

Hole #	Station	Clear Depth (Inches)	Comments
1	18+90	5	No water flow observed
2	17+17	22	"
3	15+50	21	"
4	12+60	1	"

The drain is blocked at the seaward end by calcareous sand, evidently carried into the outlet by wave action. The rest of the drain is filled with dark sand/silt which is apparently of terrestrial origin, intermixed with calcareous sand. The material is much finer than that in the Hunakai and Elepaio Street drains.

The sand over a pipeline joint at Station 13+88 was cleared away to expose the joint. The bell and spigot

joint had a gap of approximately two inches, and it was possible to slide one's hand sideways completely through the gap and into the pipe interior. This gap could well have been another source of sand entering the drain. Because of the overburden of sand and rock, the number of defective joints is not known. Since the pipe is buried, apparently stable, and exposed to little wave action along the inner reaches, it is difficult to theorize any causative factor for the gap other than faulty construction.

In summary, the Ulili Street drain is extensively blocked. The pipe was completely filled at two of the four checkpoints. The other two points had some clear space (approximately 21 to 22 inches) in the upper part of the pipe cross-section, but no flow was observed at these locations. The drain can be considered completely blocked, with some gaps where the sediment has not completely filled the pipeline.

Hunakai Street Drain. The Hunakai Street drain is a 48-inch RCP pipe extending approximately 750 feet from the shoreline. The pipe is exposed along most of the length, with approximately one-third to one-half the pipe cross-section above the level of the reef.

Eight holes were drilled in this pipeline at the locations shown in Figure 2. The results are summarized below.

Drilling Log, Hunakai St. Drain

Hole #	Station	Clear Depth (Inches)	Comments
0	8+50	35) Water was observed) flowing through) all drilled holes
1	9+50	38	
2	10+50	37	
3	11+50	36	
4	12+50	33	
5	13+50	32	
6	14+50	33	
7	15+23	34	

The clear depth in the pipe ranged from 33 to 39 inches. There is some sediment deposited at the bottom of the pipeline, but it is not restricting flow through the drain. The sediment is primarily coarse calcareous sand,

with some terrestrial material intermixed. Water was observed flowing through all the drilled holes, as well as out the discharge end of the drain.

There are numerous loose joints in the pipeline, especially seaward of manhole DMH #8 at Station 10+35. The joints are approximately 1 to 1-1/2 inches wide, and freshwater could be seen flowing out through three or four of these joints.

BOTTOM CHARACTERISTICS AND BIOLOGICAL RECONNAISSANCE

General

The general physiography and flora and fauna of the shoreline and fringing reef in the study area is described in the report "Oahu Reef Inventory" (1930) prepared by AECOS, Inc. for the U.S. Army Corps of Engineers. The following general description is extracted from that report, which summarizes the available information supplemented by investigations conducted by AECOS for the reef inventory study.

The Kahala coastal plain is comprised of ancient beach and dune sand, emerged reef, and alluvium. Kahala beach is a long, narrow strip of sand along the shore, which has a history of marked erosion and accretion. The reef flat off Kahala Beach is an area of consolidated limestone separated by large sand deposits. The outer reef margin and upper reef front is a continuous structure undercut by deep sand-bottom channels.

The inner reef flat is dominated by algae, which cover about 40 percent of the hard bottom areas. Seventeen species were noted, with Acanthophora spicifera, Dictyota acutiloba, Dictyota sp., and Lyngbya majuscula being most abundant. Two popular edible seaweeds occur in low abundance. Corals cover less than one percent of the bottom, with coral cover increasing and algal cover decreasing with distance seaward across the reef. Pocillopora damicornis is the most common coral species on the reef flat. Seaward of the reef margin coral coverage is as high as 30 percent, with Porites lobata the dominant species. Only eight species of fish were recorded on the shallow reef platform. Larger fishes are more abundant along the reef face. The Kahala reef area is reported to be heavily utilized for pole and net fishing, torch fishing and squidding. Two popular edible seaweeds, limu

manaua and ogo are collected on the inner reef flat.

Biological Reconnaissance Investigations

On September 21, 1980, qualitative marine biological observations were completed along each of the alignments of the three drain pipes crossing the Kahala reef. Observations of the substratum type, dominant algae, fishes, corals and other invertebrates were recorded on underwater slates while swimming parallel to the pipelines.

Elepaio Street Drain

Near the shoreline the substratum consists of sand, coral rubble and eroded coral blocks that provide relief of approximately one foot. The frondose alga, Ulva, is present in this nearshore area and indicates increased nutrient levels in the water. Other algae common in the area include Padina, Dictyota and a fine filamentous red alga. Very few small fishes belonging to the surgeon (Acanthuridae) and wrasse (Labridae) families were observed associated with the eroded coral blocks and the pipe hold-down straps. Anemone-like soft corals of the genus Palythoa and sea cucumbers of the genus Holothuria were sparsely distributed throughout the area. No live hard corals were observed.

Approximately 100 feet seaward from the shoreline the substratum consists of coral rubble and sand. Little change was noted in the substratum characteristics with increasing distance from shore to the drainage pipe terminus. The alga, Padina, is dominant. The fishes and sea cucumbers are present but few in number. No live hard corals or soft corals were observed adjacent to the drainage pipe or seaward from the pipe terminus.

Ulili Street Drain

The pipeline appears to have been completely buried during construction. Marine biological observations were completed along an alignment indicated by the manholes that extend above the surface of the water.

The substratum near the shoreline and seaward to the first manhole consists of sand and coral rubble. Seaward of the first manhole and continuing to the reef ridge, the substratum is composed primarily of coral rubble with little sand present. The ridge zone consists of relatively large eroded coral blocks that provide relief of up to 8 feet. Sand and coral rubble are present in the depressions between the coral blocks.

The most common frondose alga observed was Acanthophora which was noted on the coral rubble between the two pipe markers. Fishes were extremely sparse from the shoreline to the reef ridge most probably a result of the uniform reef top and lack of habitat space. A few surgeon fishes were observed associated with the coral blocks in the reef ridge zone. Live hard corals and other common reef top invertebrates were noted only rarely. Even in the reef ridge zone where conditions are good for coral growth (hard substratum and good water circulation) only three colonies of Pocillopora meandrina and five colonies of Porites lobata were observed. Sea urchins were the only other invertebrate observed (Echinometra mathaei - three specimens and Echinothrix diadema - one specimen).

Hunakai Street Drain

The pipe is only partially buried and is exposed starting 20-30 feet seaward from the beach. Near the shoreline the substratum is composed of sand and coral rubble. In the general area of the first manhole, the substratum contains a few eroded coral blocks that protrude approximately one foot above the coral rubble and sand thus providing habitat space for a greater variety of marine organisms.

Between the shoreline and the first manhole six genera of algae were commonly observed (Padina, Acanthophora, Ectocarpus, Dictyota, Sargassum and Gracilaria). The dominant algal genera are Padina and Acanthophora. Fishes, although not abundant, were noted from five different families including the surgeon fishes (Acanthuridae), wrasses (Labridae), butterfly fishes (Chaetodontidae), sharp nose puffers (Canthigasteridae) and the lizard fishes (Synodontidae). As noted previously the surgeon fishes and wrasses are the most abundant. Small colonies of two species of hard corals (Pocillopora meandrina and Montipora verrucosa) and one species of soft coral (Palythoa tuberculosa) were observed but are very sparsely distributed. Other invertebrates observed included two cone shells (Conus), one auger shell (Terebra), three sea cucumbers (Holothuria) and approximately 30 sea urchins (Echinometra and Echinothrix).

Continuing seaward to the reef ridge and drain pipe terminus, the substratum is characterized by a greater amount of eroded coral protruding above the coral rubble and sand. The sea urchin, Echinometra mathaei, is very numerous in this area yet fishes, live hard corals and other invertebrates were rarely observed.

The reef ridge zone is similar to that described for the Ulili Street drain. The substratum consists of large eroded coral blocks that provide relief of up to 8 feet. Sand and coral rubble are present in the depressions between the blocks. Within the reef ridge zone, the only organisms noted were several surgeon fishes (Acanthuridae) and three colonies of live hard coral (Pocillopora meandrina).

WIND, WAVES AND CURRENTS

Wind

The prevailing winds in the study area are the north-east tradewinds, which generally are present 80 to 90 percent of the time during the summer season from about April to November with speeds of 10 to 20 mph. During the winter months, there is a general weakening of the trade wind system and the appearance of southerly and westerly winds due to frontal influences from the north temperate zone and local low pressure systems. These westerly winds are known as Kona storms and are often represented by strong winds and high waves from the southwest quadrant. The year-to-year variation in "Kona" conditions is very large, both in frequency and intensity.

The prevailing tradewinds are altered as they cross the island by the irregular Koolau mountains, so that in the Kahala area the wind tends to be somewhat erratic and gusty as it is funneled around the mountain peaks and through the valleys. However, during tradewind conditions the winds are generally offshore, with an alongshore component. During Kona conditions, which may occur as much as 15 percent of the time in the winter months of December to March, the winds generally blow onshore, again with an alongshore component.

Waves

The Kahala reef is exposed to deepwater waves generated from the northeast clockwise to the west. Three primary wave types affect the study area: (1) the prevailing tradewind generated waves from the northeast which refract and diffract around the island; (2) south swell; and (3) Kona storm waves.

Tradewind waves may be present throughout most of the year but are most frequent between April through October, the summer season, when they usually dominate the local wave climate. They result from the strong tradewinds blowing from the northeast quadrant over long fetches of open ocean. Typically, these deepwater waves have periods ranging from 6 to 10 seconds and heights of 4 to 12 feet. Generally, tradewind waves are present from 80 to 90 percent of the time during the summer season and from 60 to 70 percent of the time during the remainder of the year.

South swell is generated by southern hemisphere winter storms blowing over long fetches in the South Pacific and Indian oceans and after traveling over thousands of miles of open ocean arrive at the southern shores of the Hawaiian Islands as long period swell. South swell is most common between April and October and approaches from the sector southeast through southwest. Wave periods typically range between 12 and 22 seconds, and deepwater wave heights are generally one to four feet, although they may be considerably larger.

Kona storm waves are generated by local storms and fronts which generally cause winds and waves from the south through the west. These storms are neither frequent nor consistent; however, they may generate large waves which can directly affect the study area. Commonly, wave periods range from 6 to 10 seconds, with wave heights up to 15 feet. In any year, Kona storms may occur several times or not at all; however, they occur most often in the winter months.

In addition to the primary wave types, infrequent severe tropical storms or hurricanes may generate large waves which strike the Hawaiian Islands. Between 1950 and 1974, twelve hurricanes or near-hurricanes occurred in the vicinity of Hawaii. Hurricane Dot (August 1959) and Nina (December 1957) generated deepwater waves from

the south in excess of 25 feet and are frequently considered "design" storms.

Nearshore wave heights in the study area are controlled by water depth. When designing for a structure on or immediately seaward of the reef flat, such as the storm drain pipeline, the worst case design condition would be experienced by waves breaking directly on the structure. When designing for a breaking wave condition, it is necessary to determine the maximum breaker height to which the structure would be subjected. The design breaker height depends on the water depth at the structure, the bottom slope seaward of the structure, and the incident wave characteristics.

The design water depth at the structure consists of the existing water depth below mean lower low water (MLLW), and the still water level (SWL) rise due to the astronomical tide, storm surge due to wind stress and low barometric pressure, and wave setup due to the mass transport of water by breaking waves. The breaking wave calculations in this report are based on a mean higher high tide level of 1.9 feet, a storm surge water level rise of 0.5 feet, and wave setup of 1.0 feet, for a total SWL rise of 3.4 feet.

A typical nearshore bottom profile, based on the National Ocean Survey chart number 19358 (Waimanalo Bay to Diamond Head), is shown on Figure 3. Water depths on the 800 to 1,000 foot wide reef flat average 1 to 2 feet MLLW, and seaward of the reef edge the average bottom slope is approximately 1V on 30H.

Based on the foregoing parameters, design breaking wave heights on the reef flat, at the reef edge, and 200 feet seaward of the reef edge for incident wave periods of 8, 12, and 16 seconds are shown in Table 1. The breaking wave heights are based on the methodology contained in the Shore Protection Manual (U.S. Army Coastal Engineering Research Center, 1977).

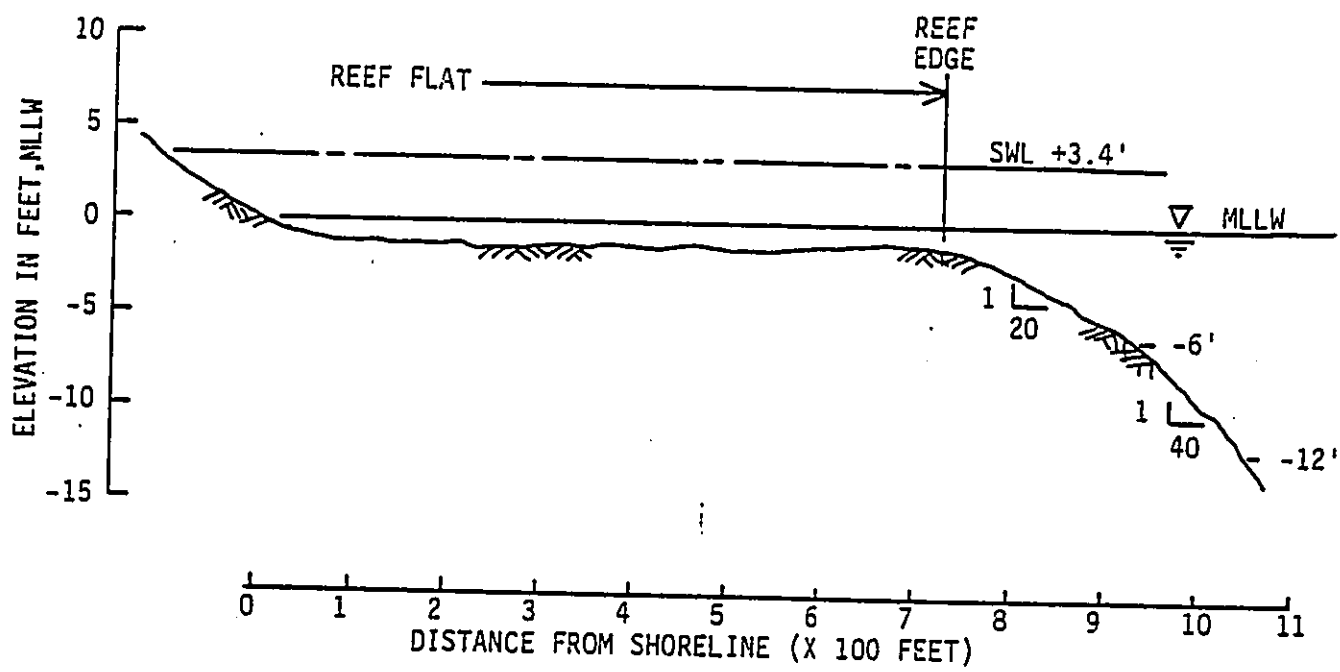


FIGURE 3. TYPICAL NEARSHORE BOTTOM PROFILE

TABLE 1. Design Wave Heights

Location	Depth Below MLLW (feet)	SWL (feet)	Design Depth (feet)	Bottom Slope	Breaker Height, feet		
					8-sec. Wave	12-sec. Wave	16-sec. Wave
Reef Flat	1.5	3.4	4.9	0	3.8	3.8	3.8
Reef Edge	1.5	3.4	4.9	0.05	6.3	6.6	6.8
200' Seaward of Reef Edge	6	3.4	9.4	0.025	8.9	9.6	9.9

Based on Table 1, reasonable design wave heights for prevailing wave conditions in the study area (excluding hurricane conditions) would be breaker heights of 4 feet on the reef flat, 7 feet at the reef edge, and 10 feet seaward of the reef at the -6 foot depth contour.

Currents and Circulation

Current speed and direction and general circulation patterns on the reef flat were measured during typical tradewind, Kona, and light and variable wind conditions, and during ebbing and flooding tides. The current speed and direction was obtained by measuring the time, distance and direction of movement of dye injected into the water. Current measurements were primarily taken in the vicinity of the Elepaio, Ulili, and Hunakai Street drains. The detailed results of the current studies are contained in the Appendix.

The circulation system in the study area is primarily driven by wave setup on the shallow reef flat and is virtually independent of wind direction and tide stage. The mass-transport of water onto the reef flat by wave action is relieved by a rip current setting seaward out the natural channel through the reef at the terminus of the Hunakai Street drain. The typical circulation system is shown on Figure 4. From the approximate mid-point of the study area, the wave setup induces a northeast setting longshore current which then flows seaward as a rip current out the channel at the eastern end of the study area. Current speeds are typically 0.5 to 1.0 feet per second (fps). At the western end of the reef flat, near the Elepaio Street drain and Black Point, the current is less well defined, with large eddies, particularly near shore, and generally flows southwest at 0.1 to 0.5 fps and out through the breakers near Black Point.

The circulation system in the vicinity of the Ulili and Hunakai Street drains is very persistent. The current direction was found to be constant regardless of tide stage and wind direction, and was even found to set directly into strong 20 to 25 mph ENE tradewinds. The current study clearly indicates a uni-directional, nonvariable circulation system, with wind and tide only influencing the current speed. Current speeds ranged from 0.5 to 0.8 fps during 20 to 25 mph ENE tradewinds and 1.0 to 1.2 fps during 10 to 15 mph SW Kona winds.

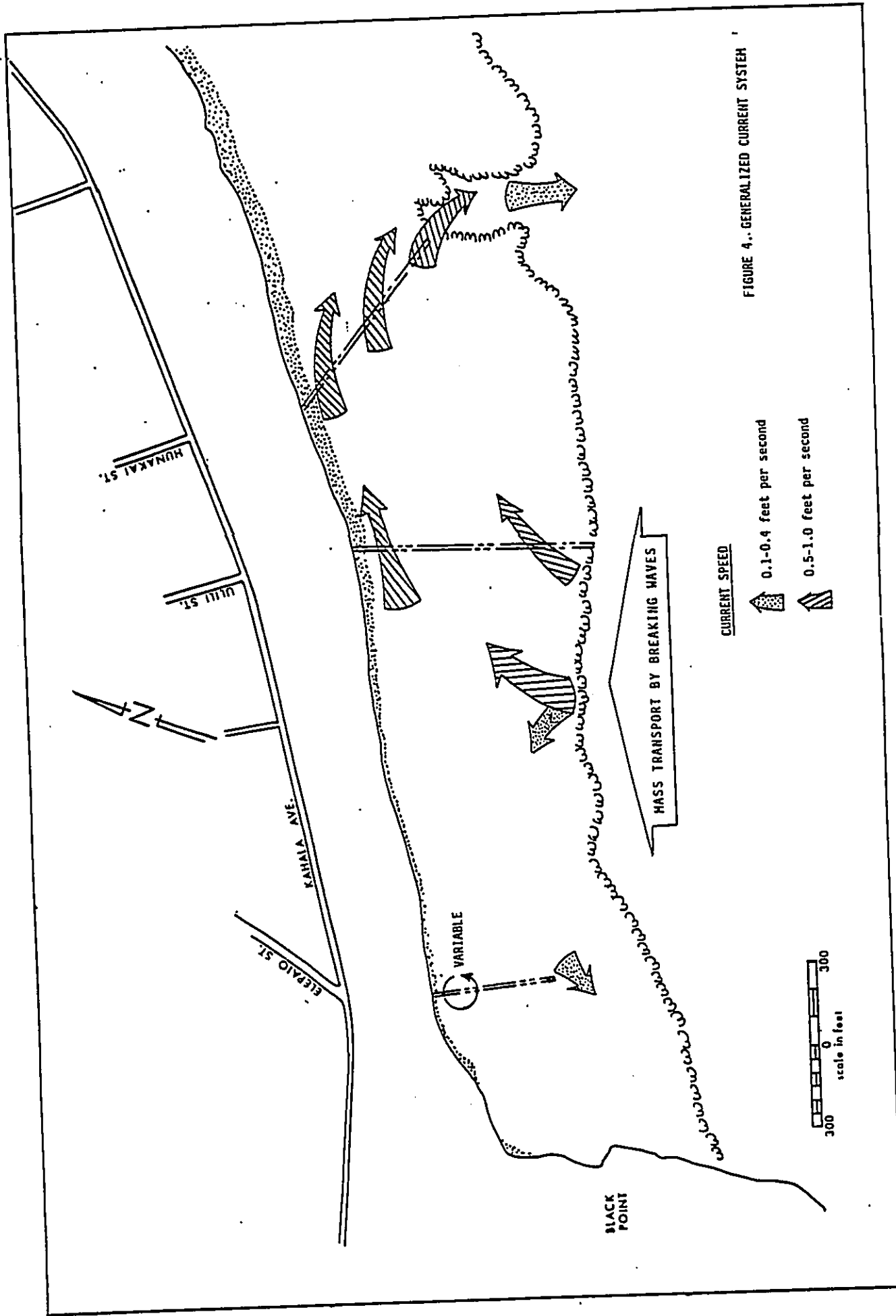


FIGURE 4. GENERALIZED CURRENT SYSTEM

WATER QUALITY

Scope and Methodology

Water quality parameters were measured in the vicinity of the three relief drains during various meteorological conditions in order to characterize the existing water quality on the Kahala reef. Water quality measurements were also made at the mouth of a concrete drainage canal and the Waialaenui Stream, approximately 2,300 and 3,300 feet east of Hunakai Street respectively, in order to measure the existing water quality at points of significant fresh water storm discharge.

The water quality parameters measured included salinity and temperature, dissolved oxygen (D.O.), pH, and turbidity. Salinity and temperature were measured insitu using a Beckman RS-5 portable salinometer, which measures salinity as a function of electrolytic conductivity and temperature using a precision thermister temperature sensor. The measurement accuracy is ± 0.3 percent for salinity and $\pm 0.05^{\circ}\text{C}$ for temperature. Dissolved oxygen was also measured insitu, using a Yellow Springs Instrument Co. Model 57 Dissolved Oxygen meter which measures D.O. in parts per million (ppm). The measurement accuracy is ± 0.1 ppm. Water samples were taken and measured in the laboratory for pH and turbidity. The pH of the water samples was measured using an Orion Research Model 501 Digital Ionalyzer, and turbidity in nephelometric turbidity units (NTU) was measured using a Hach Model 2100A Turbidimeter.

The water quality stations in the study area are shown on Figure 2. Additional measurements were made at the mouth and approximately 100 yards offshore of the canal and stream east of the study area as located on Figure 1.

Measurements were made on three separate occasions as follows:

<u>Date</u>	<u>Meteorological Conditions</u>
12-16-80	Light and variable winds, 4 to 8 mph north-northeasterly (Oahu winds reported 5 to 15 mph from north). There had been heavy rainfall for several days, stopping 24 hours prior to the field measurements. It was clear and sunny on the 16th.
12-22-80	Kona storm conditions, winds 10 to 15 mph from the southwest (Oahu winds reported to be 15 to 25 from southwest). It rained for approximately 12 hours preceeding and during the field measurements.
1-27-81	Typical strong tradewind conditions, winds 20 to 25 mph from the east-northeast (Oahu winds reported to be 15 to 30 mph from northeast). No significant rainfall immediately preceeding the field measurements.

Data Summary

The water quality measurements are summarized and discussed by parameter, station, and meteorological condition in the following paragraphs. Stations 1, 2 and 3 are along the alignments of the Elepaio, Uliuli, and Hunakai Street relief drains, respectively, station 4 is located at the discharge of the drainage canal, and station 5 is at the mouth of Waialaenui Stream. Substation A is near the shoreline, B is located at the approximate mid-point across the reef, and C (Hunakai Street drain only) is located at the drain discharge point. Reference is made to Chapter 37-A, Water Quality Standards, of the State Public Health

Regulations, where applicable. The waters in the study area are classified Class A - open coastal waters.

Salinity and Temperature

Station	Salinity, 0/00			Temperature, °C		
	Light & Variable	Kona Winds	Tradewinds	Light & Variable	Kona Winds	Tradewinds
1A	33.50	33.49	34.24	23.79	26.14	24.85
1B	33.34	34.00	34.30	23.80	25.59	24.06
2A	33.90	33.86	34.15	24.41	25.13	24.01
2B	33.79	34.05	34.12	24.31	24.90	23.73
3A	33.85	34.00	33.99	24.44	25.13	24.04
3B	33.92	34.06	34.22	24.45	24.85	23.95
3C	33.90	33.55	33.82	24.51	24.88	24.00
4A	33.36	19.63	34.02	23.96	25.03	23.88
4B	-	33.95	34.10	-	24.85	23.64
5A	33.53	27.00	-	23.45	24.88	-
5B	-	32.68	33.92	-	24.61	23.85

The salinity in the study area was generally uniform and typical of nearshore coastal waters, regardless of the weather conditions, and varied between about 33.5 and 34.3 0/00. Measurements at the Hunakai Street drain terminus during rainy (Kona) weather with visible freshwater discharge showed no appreciable lowering of the salinity in the vicinity of the discharge point. On the other hand, measurements at the mouth of the drainage canal and Waialaenui Stream under the same conditions showed significantly depressed salinity values in the immediate vicinity of the freshwater discharge into the coastal waters. Measurements offshore within 100 yards of the discharge points showed near normal salinity values, however. The general uniformity of salinity and the apparent rapid absorption of fresh water is indicative of the good mixing and dispersion characteristics of the reef flat waters, which would be expected considering the good circulation system on the reef and exchange with offshore waters as

discussed in the previous section.

The water temperature on the reef showed a greater variability, ranging from about 23.7°C to 25.0°C. A low of 23.45°C was measured at the mouth of Waialaenui Stream during light and variable wind conditions and a high of 26.14°C was measured near the shoreline at Elepaio Street during Kona conditions. The temperature was approximately 1°C higher at all stations during Kona wind conditions than during strong tradewinds and was highest at the Elepaio Street stations during both Kona and tradewind conditions. The water temperature on the shallow reef is likely significantly affected by insolation during the daytime, and the rate of solar heating is directly proportional to circulation and water residence time. The generally higher temperatures at the Elepaio Street (west) end of the study area reflect the slower currents and poorer circulation in this area, and the slightly higher water temperatures during Kona wind conditions mirror the decreased circulation and exchange of nearshore waters on a windward coast.

The State Water Quality Standards require that the salinity shall not vary more than 10% from natural or seasonal changes considering hydrologic input and oceanographic factors, and temperature shall not vary more than 1°C from ambient conditions. Given the generally good circulation system in the study area, this requirement should not pose a problem for stormwater discharge, with the possible exception of the Elepaio Street (west) end of the study area where circulation and flushing of the reef flat is less well defined.

Dissolved Oxygen

Station	D.O., ppm		
	Light & Variable	Kona Winds	Tradewinds
1A	7.0	10.2	8.2
1B	7.1	9.3	7.8
2A	7.1	7.9	7.4
2B	6.7	6.9	7.1
3A	7.4	7.2	7.3
3B	6.8	7.2	7.0
3C	7.0	7.1	8.1
4A	7.0	6.7	6.6
4B	-	6.9	7.0
5A	5.3	3.4	-
5B	-	5.5	7.3

The dissolved oxygen levels in the vicinity of the three storm drains were well above the saturation point of about 5.0 ppm for all three weather conditions. Lower D.O. levels were measured at the Waialaenui Stream mouth during periods of obvious freshwater outflow, and a depressed D.O. level of 3.4 ppm was measured at the stream mouth during Kona conditions. The D.O. level was above saturation within 100 yards of the stream mouth, however. The D.O. level in the vicinity of the Hunakai Street drain terminus was well above saturation even with visible freshwater discharge. The generally high D.O. levels reflect the transport of water supersaturated with oxygen during the wave breaking process onto the reef flat and good reef flat flushing. No difficulty is foreseen in meeting the State Water Quality standard of D.O. being not less than 75% of saturation.

pH

The pH at all the stations during all weather conditions generally ranged between 8.1 and 8.3. A low of 7.79 and a high of 8.42 were measured at the Waialaenui Stream mouth and

station 1B at the Elepaio Street drain, respectively, both during Kona wind conditions. All measurements were within the State Water Quality criteria of no deviation greater than ± 0.5 units from a value of 8.1.

Turbidity

Station	Light & Variable	NTU	
		Kona Wind	Tradewinds
1A	0.87	1.8	0.85
1B	0.82	0.67	1.7
2A	0.65	0.68	1.1
2B	0.50	0.8	1.4
3A	0.68	0.66	1.5
3B	0.35	0.44	1.0
3C	0.62	0.63	1.3
4A	2.3	26.0	2.8
4B	-	0.75	1.7
5A	3.1	5.0	5.1
5B	-	3.0	-

The turbidity in the vicinity of the three storm drains ranged from about 0.4 to 1.7 NTU and was uniformly higher at all stations during strong tradewind conditions. The turbidity during light and variable and Kona wind conditions was generally slightly higher nearshore at the Elepaio Street drain, probably reflecting the poorer circulation in this area. The higher turbidity during tradewind conditions, almost twice as high as the other conditions, was probably a result of fine bottom sediments and algal material temporarily suspended by the wind chop generated by the strong trades blowing almost parallel to shore. There was no significant increase in turbidity at the terminus of the Hunakai Street drain during Kona conditions with visible freshwater outflow.

The turbidity in the vicinity of the canal and stream mouths was significantly higher at all times, reaching a high of 26 NTU at the mouth of the canal during Kona conditions and averaging about 3 to 5 NTU in the vicinity of Waialaenui Stream. The discharge waters of both the canal and stream were visibly very turbid during rainy periods, and a broad "delta" of fine sediments has been deposited on the reef around each discharge point which is easily stirred up by strong winds to make the water turbid even with no canal or stream discharge.

The State Water Quality Standards have two sets of turbidity requirements - "wet" criteria when the open coastal waters receive more than three million gallons per day of freshwater discharge per shoreline mile and "dry" criteria for areas that receive less. The criteria are also stated three ways: (1) geometric mean not to exceed 0.50 and 0.20 NTU for wet and dry areas, respectively; (2) turbidity not to exceed 1.25 NTU (wet areas) and 0.50 NTU (dry areas) more than 10% of the time; and (3) at no time to exceed 2.00 NTU in wet areas and 1.00 NTU in dry areas. It is likely, based on the limited measurements accomplished during this study, that these criteria are presently exceeded in the study area a significant portion of the time, particularly if Kahala is designated a "dry" area.

SUMMARY AND DISCUSSION

1. The Elapaio Street and Ulili Street drains are completely blocked along most, if not all, of their lengths. Only the Hunakai Street drain is flowing freely with no apparent problem with sand blockage. No fresh water flow was observed from any of the inspection holes drilled in the Elepaio and Ulili Street drains. Visual inspection of sediment samples taken from the inspection holes indicated that sediment toward the seaward ends of the pipes was primarily calcareous sand, with increasing amounts of terrestrial sands and silts nearer the shoreline. Poor joint construction was found on two of the pipelines, a 2-inch gap was found in a bell and spigot joint on the Ulili Street drain, and freshwater was observed flowing out through three or four joints on the Hunakai Street drain.
2. There is considerable sand on the reef flat, which is readily transported during periods of high surf and strong longshore currents on the reef flat. Visual inspection of the shoreline and pipelines indicates a predominant west to east sand movement. The Elepaio and Ulili Street drains discharge on the reef into what are apparently dredged holes. However, the inverts of the pipes are located below the adjacent bottom elevation, and it is likely that wave action moves sand off the reef and into the deeper pockets at the pipe ends and then directly into the pipelines. In order to eliminate the potential for sand blockage, the drains should discharge into deeper holes on the reef which are periodically dredged to insure that the sand level is well below the pipe invert, or, more ideally, the drains should discharge seaward of the reef edge with the pipe inverts above

the adjacent bottom elevation. The Hunakai Street drain is a good example of this. It discharges into a natural channel through the reef, with its invert well above the bottom at the discharge point and does not appear to have any problem with sand blockage at the discharge point.

3. Loose pipe joints, as found on the Ulili and Hunakai Street drains, are another point of entry for sand that can increase the likelihood of pipe blockage. Calcareous sand found in the Hunakai Street drain may well have entered through the visible gaps in the pipe joints.
4. Terrestrial sand and silt being transported by storm water runoff through the drains may be a third cause of blockage. The sediment samples obtained at the inspection holes, however, generally have a high percentage of calcareous sand indicating that sand from the reef is the primary problem.
5. An alternative to the drains discharging into deep holes in the reef flat or seaward of the reef edge would be to simply terminate them at the shoreline. At the location of the Elepaio Street drain the shoreline is rocky with little sand, and it may be possible to keep the pipe invert above the elevation of sand movement and eliminate the sand plugging problem. The shoreline at the location of the Ulili Street drains is a sand beach, and it would likely be very difficult to raise the pipe inverts above the elevation of active sand transport. In addition, any shoreline structures in this area may interfere with natural beach stability and sand transport processes. The shoreline is a sand beach in the vicinity of the drainage canal and Waialaenui Stream east of the study area, and very rapid sand plugging was noted following the cessation of heavy storm water discharge.

6. The reef flat substratum is composed of old reef material (consolidated limestone) with considerable sand and coral rubble on the surface and in deeper pockets and channels. The vertical relief is low, generally being less than a foot. The investigations showed the marine biological communities in the vicinity of the storm drain pipelines to be poorly developed. In general the species diversity and abundance is very low, with the possible exception of sea urchins near the Hunakai Street drain. Coral coverage is almost negligible, and few fishes were observed. The poorly developed marine biological communities do not appear to be a result of the construction and subsequent discharge of the storm drains. Observations of shoreline storm drain discharges at other locations on Oahu showed colonies of living coral within 20 to 50 feet of the storm drain discharges, with their size indicating that they were 5 to 10 years old. Live Pocillopora meandrina coral was noted in the vicinity of the Hunakai Street drain discharge. The lack of live corals on the Kahala reef may be the result of strong wave surge forces that dislodge and break up the coral colonies in the reef ridge zone and the periodic transport of sand across the reef top which may abrade and kill small coral colonies or smother them completely.
7. Should the drains be terminated to discharge at the shoreline, the resultant periodic discharge of fresh water across the reef top may cause a shift in the algal constituents such that species more resistant to lower salinities may appear adjacent to the points of discharge. The effects on corals would be negligible since live coral coverage is nearly zero. Motile organisms such as fishes, sea cucumbers and sea urchins would be temporarily displaced during periods of major storm discharge but would migrate back within a relatively short time after the discharge stops.

8. The prevailing winds on the Kahala reef are the northeast tradewinds, which are funneled through the Koolau mountains, and in the study area are generally gusty offshore winds with an alongshore component. The study area is directly exposed to infrequent southerly and westerly winds which tend to blow onshore, again with an alongshore component.
9. The Kahala reef is exposed to tradewind-generated waves, south swell, and Kona storm waves. The nearshore wave heights are controlled by the water depth and design breaking wave heights on the reef flat, at the reef edge, and 200 feet seaward of the reef are 4, 7, and 10 feet, respectively.
10. The current system on the Kahala reef is driven by wave setup on the shallow reef flat and is virtually independent of wind direction and tide stage. From the approximate mid-point of the study area (west of the Ulili Street drain), the wave setup indices a northeast setting longshore current which then flows seaward out the natural channel through the reef at the Hunakai Street drain terminus. Current speeds are typically 0.5 to 1.0 fps. At the western end of the Kahala reef, in the vicinity of the Elepaio Street drain, the current is less well defined, with large eddies near shore, and generally flows southwest at 0.1 to 0.4 fps and out through the breakers near Black Point.
11. Existing water quality in the study area was measured under light and variable wind conditions, rainy Kona wind weather, and strong tradewinds. Water quality was also measured in the vicinity of a drainage canal and Waialaenui Stream, east of the study area. The salinity was generally uniform and typical of nearshore coastal waters, regardless of the weather conditions.

Measurements at the Hunakai Street drain terminus with visible freshwater discharge showed no appreciable lowering of the salinity. Greatly depressed salinity values were found at the mouths of the drainage canal and stream during a period of obvious storm water discharge; however, the fresh water was rapidly dispersed and salinity values were near normal 100 yards of the discharge point. The water temperature showed greater variability and is likely primarily influenced by insolation and water residence time on the shallow reef flat. The water temperature was slightly higher near the shoreline in the vicinity of the Elepaio Street drain, where the circulation is poorer, during both Kona and trade-wind conditions. Dissolved oxygen values in the study area were well above the saturation point during all measurement periods. The high dissolved oxygen levels reflect the transport of super-saturated water onto the reef by breaking waves and the good flushing characteristics of the reef flat. The pH of the water in the study area reflected normal sea water values during all measurement periods. Water turbidity in the study area was highest during strong tradewind conditions as a result of fine bottom sediment and algal material temporarily suspended by the wind chop on the reef. The turbidity during light and variable and Kona wind conditions was generally slightly higher nearshore in the vicinity of the Elepaio Street drain, again reflecting the poorer circulation in this area. The turbidity in the vicinity of the drainage canal and Waialaenui Stream mouths greatly exceeded that in the study area at all times.

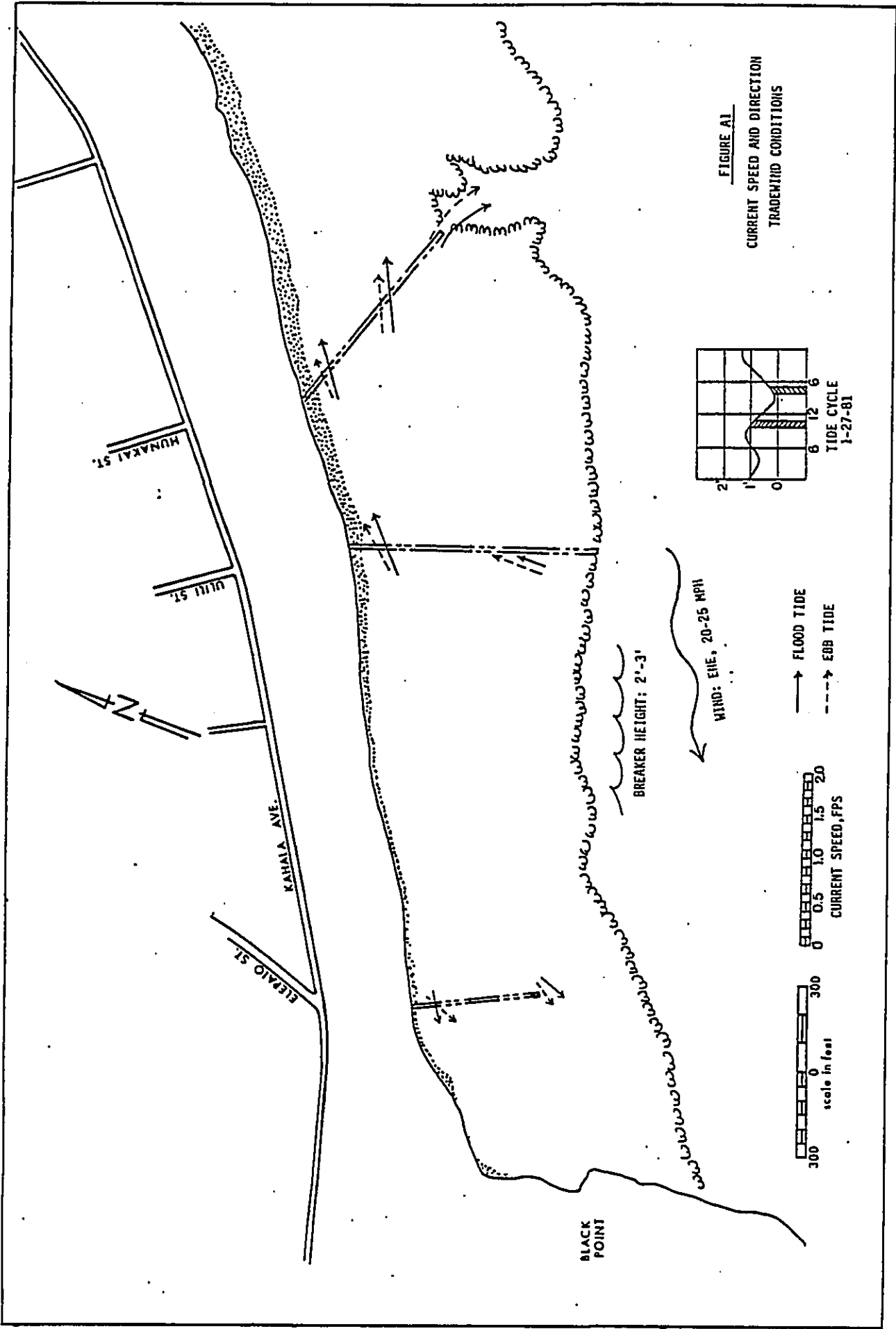
12. General recommendations for the three relief drains are as follows:
 - (a) Elepaio Street Drain. This drain presently terminates in a dredged hole approximately mid-way across

the reef flat and is completely plugged. The amount of sand and loose coral rubble on the reef flat makes it almost impossible to terminate the drain on the reef, even in a deep dredged hole, without regular maintenance to keep the pipe clear of sand. A reasonable alternative would be to simply terminate the drain at the shoreline. This is essentially what presently occurs because the pipe is plugged and the storm water flows out through cracks in the manhole at the shoreline. There is very little sand on the shoreline in the vicinity of the Elepaio Street drain and, provided the pipe invert is at the high water line, there should be no sand plugging problem. Most of the shoreline homes in this area are fronted by rock or concrete retaining walls. Marine life along the shoreline and on the reef flat in this area is sparse and dominated by algae. It is recommended that the capacity of this drain to discharge storm water not be increased because the generally weak current system at the west end of the Kahala reef limits flushing of the reef flat.

(b) Ulili Street Drain. This drain is also extensively plugged. Unlike the shoreline at the Elepaio Street drain, however, the shoreline in the vicinity of the Ulili Street drain is a sand beach. A drain terminating at the shoreline in this area would require regular maintenance to prevent sand plugs and could adversely impact on natural littoral processes (sand movement) adjacent to it. This drain is within about 500 feet of the Hunakai Street drain and a reasonable alternative would be to abandon the Ulili Street drain and divert the storm water to the Hunakai Street drain.

(c) Hunakai Street Drain. This drain is clear and apparently functions effectively as a relief drain. The drain discharges into a natural channel through the reef, with its invert above the existing bottom, and has no problem with sand plugging the end of the pipe. Some sandy sediment was found in the pipe during its inspection, which likely enters through gaps in the pipe joints. This sediment does not appear to be a significant problem and is

likely flushed out during periods of heavy storm water discharge. The drain discharges into a strong and persistent rip current in the channel which very effectively flushes the reef under all weather conditions. The storm water discharge from the drain is rapidly mixed with the receiving water and dispersed seaward. This drain is very well located and its storm water discharge capacity could be increased if necessary with no apparent adverse impact. The drain could be shortened and still discharge into the strong current system. However, it presently terminates at the shoreward end of the natural channel, and any shortening of the pipeline so that it was no longer discharging into the deep channel would likely result in significant sand plugging problems.



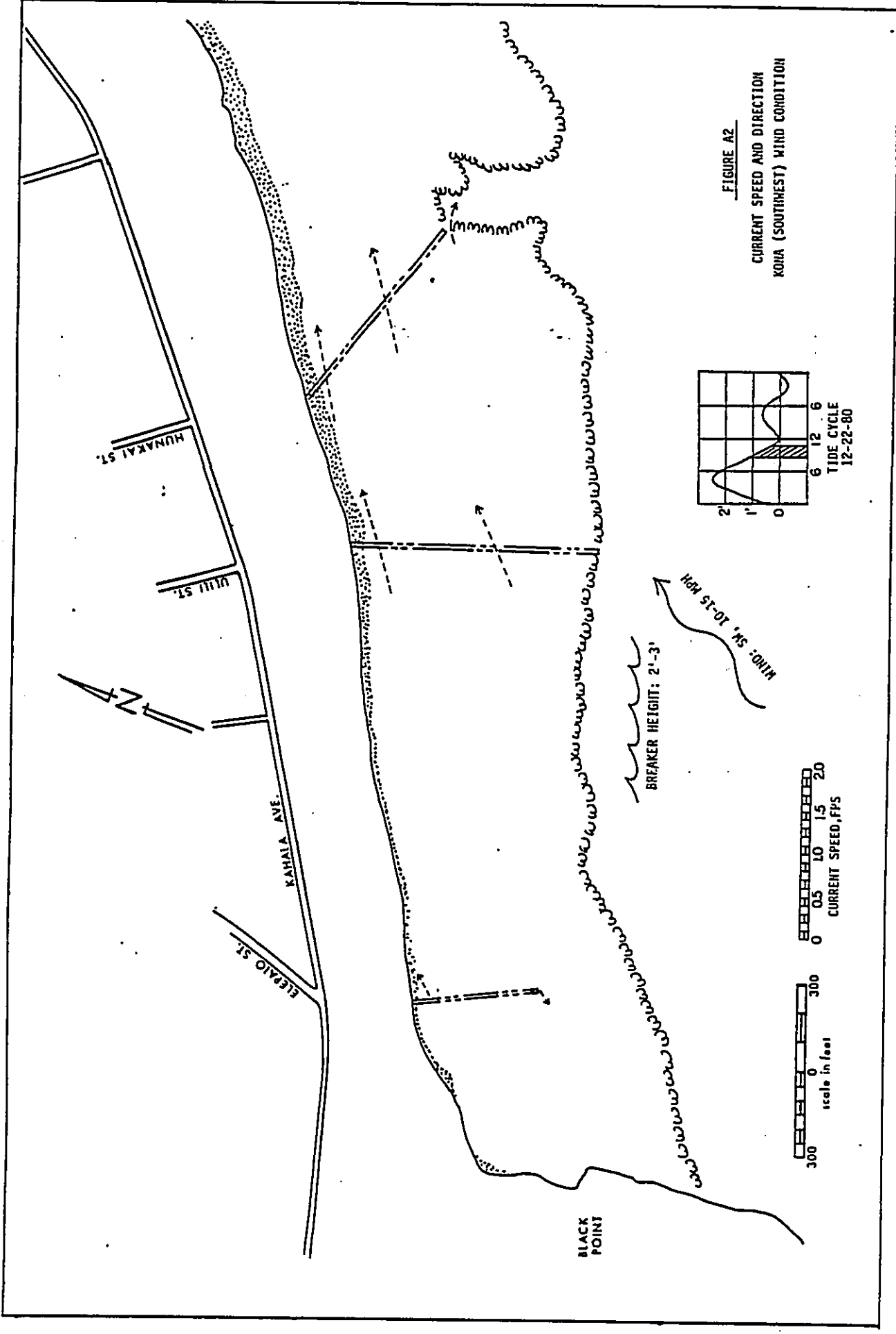
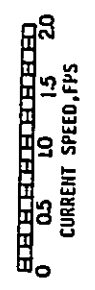
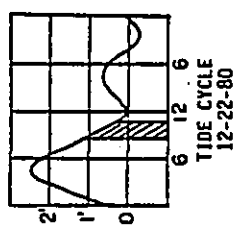
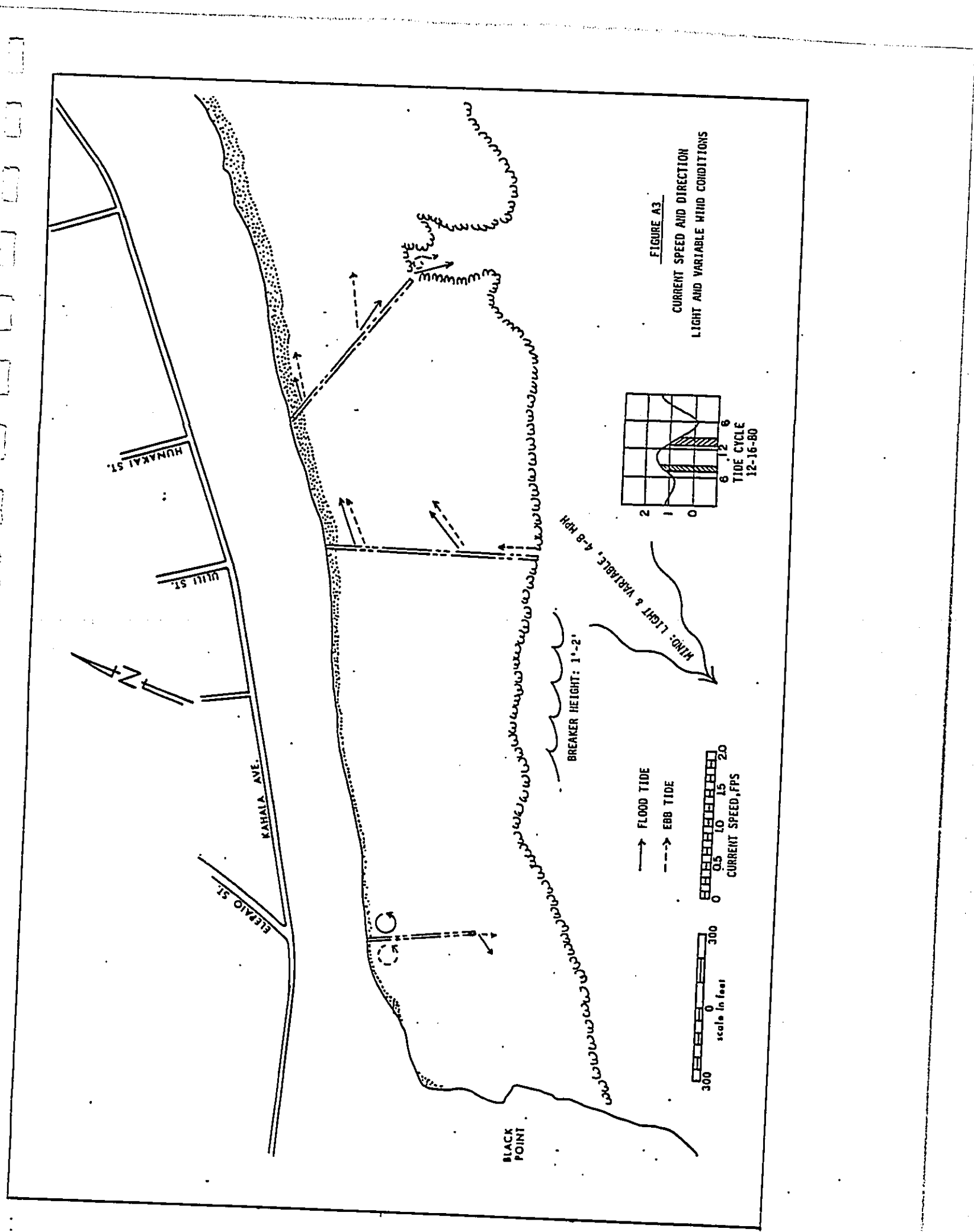


FIGURE A2
CURRENT SPEED AND DIRECTION
KOHA (SOUTHWEST) WIND CONDITION



WIND SW, 10-15 MPH
BREAKER HEIGHT: 2'-3'

BLACK POINT



**APPENDIX B -
Comments and Responses to Preparation Notice**

825502
10/13
PS
ROOM 6307
AUG 26 1982

United States Department of the Interior
FISH AND WILDLIFE SERVICE
300 AKA ROAD'S HONOLULU
HONOLULU, HAWAII 96813



RECEIVED
NOV 30 1982

WILSON CECILIO & ASSOCIATES
Wilson Cecilio & Associates
650 South King Street
Honolulu, Hawaii 96813

Re: EIS Preparation Notice for
11111 and Eleapato Streets
Drainage Improvement Project,
Honolulu, Hawaii

Dear Mr. Chinn:

The subject notice has adequately identified fish and wildlife concerns associated with the proposed action. We recommend that you also consult with the National Marine Fisheries Service during preparation of the Environmental Impact Statement.

We appreciate this opportunity to comment.

Sincerely yours,

Lucian Kramer
Lucian Kramer
Acting Project Leader
Office of Environmental Services

cc: HIFS-HPPO
HIFEM
HINAK
EPA, San Francisco

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RECEIVED
OFFICE OF ENVIRONMENTAL SERVICES

Save Energy and You Serve America!



825502
10/13
PS
ROOM 6307
AUG 26 1982



STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3176
HONOLULU, HAWAII 96813

RECEIVED
AUGUST 25, 1982
NOV 30 1982

WILSON CECILIO & ASSOCIATES
Wilson Cecilio & Associates
650 South King Street
Honolulu, Hawaii 96813

From: Deputy Director for Environmental Health

Subject: Request for Comments on Proposed Environmental Impact Statement (EIS) for Preparation Notice for the 11111 and Eleapato Streets Drainage Improvements Project

Thank you for allowing us to review and comment on the subject proposed EIS. Please be informed that we do not have any comments or objections to this project at this time.

We realize that the statements are general in nature due to preliminary plans being the sole source of discussion. We, therefore, reserve the right to impose future environmental restrictions on the project at the time final plans are submitted to this office for review.

Malvin K. Kotzmin
Malvin K. Kotzmin

WJ:jh

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DEPT OF PUBLIC WORKS

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PAUAIHIA SCHOOLS / BERNICE PAUAIHIA DISHOP ESTATE
SEP 9 11 43 AM '82

DEPT. OF TRANSPORTATION
ENGL



SEP 8 11 10 AM '82

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
MAILING & DELIVERY
1000 BEECHWOOD DRIVE
HONOLULU, HAWAII 96813

SEP 8 8:55 AM

September 3, 1982

RECEIVED
NOV 30 1982

WILSON CRENSHAW & ASSOCIATES

Dr. Michael J. Chun
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Dr. Chun:

EIS Preparation Notice for the
Ulihi and Elepaio Streets
Drainage Improvement Projects

Thank you for the opportunity to comment on the
subject notice.

We have no substantive comments to offer to improve
your document.

Very truly yours,
Ryokichi Higashimura
Ryokichi Higashimura
Director of Transportation

September 7, 1982

RECEIVED
NOV 30 1982

WILSON CRENSHAW & ASSOCIATES

Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Attention: Mr. Michael J. Chun
Director and Chief Engineer

Gentlemen:

Environmental Impact Statement for Ulihi and Elepaio Streets Drainage
Improvement Project, Kalahele Subdivision, Kalahele-mui

This is in response to your letter of August 18, 1982, requesting our review
of and comments on the proposed drain improvement projects within the Kalahele
area.

We have no objection to the proposed project and feel that it will provide a
needed improvement to the existing drainage system in this subdivision.

Thank you for your submittal.

Very truly yours,

Alisa Neves

Alisa Neves
Land Manager

AW:md

SEP 20 2 02 PM '82
DEPT. OF TRANSPORTATION



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DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96805

SEP 13 2 29 PM '82



EMIKO I. KUDO
DIRECTOR
SAM L. KANE
DEPUTY DIRECTOR
DUNCAN T. ABRAHAM
EXECUTIVE ASSISTANT

RECEIVED
SEP 13 10 33 AM '82



STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P. O. BOX 119, HONOLULU, HAWAII 96819

LETTER NO. (P)1824.2

ENVOI
Engy

September 8, 1982

RECEIVED
NOV 30 1982

WILSON OLNEY & ASSOCIATES

TO: MICHAEL J. CHUN, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: EMIKO I. KUDO

SUBJECT: REVIEW OF ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR ULILI AND
ELEPAIO STREETS DRAINAGE IMPROVEMENTS PROJECT, KAHALA,
THK: 3-5-04 & 3-5-03: 39

We have reviewed the above EIS and have no comments to make regarding any existing City and County park facilities or interests in this area.

Emiko Kudo
(Mrs.) EMIKO I. KUDO, Director

EIK:vc

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SEP 13 3 50 PM '82

Dr. Michael J. Chun
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
Honolulu, Hawaii

Dear Dr. Chun:
Subject: EIS Preparation Notice for
the Ulili and Elepaio Streets
Drainage Improvements Project

We have reviewed the environmental impact statement preparation notice for the subject project and have no comments to offer at this time. Thank you for the opportunity to review the EIS preparation notice.

Very truly yours,

VIDEO MURAKAMI
VIDEO MURAKAMI
State Comptroller

0105654
Emill
Engy

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813
SEP 17 11 43 AM '82



ROY A. PARKER
DIRECTOR
MAIL ROOM
ADDRESS DIVISION

TE 8/02-3209

RECEIVED

MAY 30 1982

WILSON CZAPKO & ASSOCIATES

September 13, 1982

Emill
Engy
JULIUS ROSS (Partner)
DIRECTOR
TELEPHONE NO.
348815



RECEIVED
SEP 14 10 32 AM '82

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
150 MAKAHANA ST.
HONOLULU, HAWAII 96813

September 10, 1982

RECEIVED

MAY 30 1982

WILSON CZAPKO & ASSOCIATES

Dr. Michael J. Chun
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street, 11th floor
Honolulu, Hawaii

Dear Dr. Chun:

Subject: EIS Preparation Notice for the Proposed Ullili
and Elepaio Streets Drainage Improvements,
Kahala, Oahu

We have reviewed your preparation notice for drainage
improvements on Ullili and Elepaio Streets and have no
comments to make at the present time since this project
basically involves the replacement of existing drainlines.

Sincerely,

Josephine Farnell
Josephine Farnell
Director

MEMORANDUM

TO: MICHAEL J. CHUN, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: ROY A. PARKER, DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
FOR THE ULLILI AND ELEPAIO STREETS DRAINAGE IMPROVEMENT
PROJECT (REFERENCE: 201-12-0436)

We have reviewed the EIS Preparation notice and have no comments on the
project.

ROY A. PARKER
ROY A. PARKER
Director

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OCT 11 8 45 AM '82
DIVISION OF PUBLIC WORKS



DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

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WILSON CONSULTANTS & ASSOCIATES

September 16, 1982

MICHAEL M. McELROY
DIRECTOR
LUR/82-4817 (JON)

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MICHAEL M. McELROY, DIRECTOR & CHIEF ENGINEER
Page 2

3. Reference: Shoreline Impacts; Summary Section IV. B, Page VI, Chapter V. B1, Page 11, and Chapter X. B, Page 20.

Comment: Measures to mitigate possible potential beach erosion and undermining of the adjacent seawalls from the drainage discharge should be considered. Although discharging of storm water will be a continuing impact, the proposed new point of discharge could have a greater impact upon the shoreline than the old discharge which was made off-shore.

Should you have any questions, please contact John Hakagawa of our staff at 523-4077.

Michael M. McElroy

MICHAEL M. McELROY
Director of Land Utilization

MMH:sl

MEMORANDUM

TO: DR. MICHAEL J. CHUR, DIRECTOR & CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: MICHAEL M. McELROY, DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARATION NOTICE FOR THE ULILI AND ELEPAIO STREETS DRAINAGE IMPROVEMENTS PROJECT KAHALA, MAUI, HAWAII; TAX MAP KEY 3-5-04 & 3-5-05; 39

We have reviewed the subject EIS Preparation Notice and have the following comments to offer:

1. Reference: Required Clearances and Permits; Summary Section III-B, Page v, Chapter III. B, 2C, Page 4 and Chapter XI, Page 21.

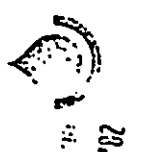
Comment: The Elepaio Street drainage improvements site (Tax Map Key 3-5-03; 39) lies within the Diamond Head Historic, Cultural and Scenic District (DH-HCSD). Therefore, it is subject to review and approval under the requirements of the DH-HCSD (Ordinance Nos. 4507 and 77-123). The Department of Land Utilization is the reviewing agency. This clearance is in addition to those listed.

2. Reference: Public Beach Access; Summary Section IV. B, Page VI and Chapter V. A6, Page 9.

Comment: Since public beach access via the Elepaio Street right-of-way will be temporarily disrupted during construction, alternative access ways should be indicated (i.e., signs, notices).

20113 8h 1 51 22
Sullivan, Michael J. 11/18/82

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
HONOLULU, HAWAII



SEP 15 2 17 PM '82

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813



MICHAEL J. CHIUH, PH.D.
DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS
HONOLULU, HAWAII

SEPTEMBER 13, 1982

RECEIVED
NOV 30 1982

INSON CAJUDO & ASSOCIATES

November 19, 1982

MEMORANDUM

TO: MR. MICHAEL H. McELROY, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: MICHAEL J. CHIUH, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM LUB/82-4817(JMM), DATED SEPTEMBER 16, 1982, RELATING TO THE ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARATION NOTICE FOR THE ULILI AND ELEPAIO STREETS DRAINAGE IMPROVEMENTS PROJECT

TO: MICHAEL J. CHIUH, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: KAZU HAYASHIDA, BOARD OF WATER SUPPLY

SUBJECT: YOUR MEMORANDUM OF AUGUST 18, 1982, ON THE ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE FOR THE ULILI AND ELEPAIO STREETS DRAINAGE IMPROVEMENTS PROJECT

We have no objections to your proposed project. The project will not have any adverse impact on our water system facilities and potable groundwater resources in the area.

Thank you for your comments.
The following are responses to your comments in the same order as submitted.

1. We will include the information in the EIS.
2. Alternative accessways and notices will be mentioned in the EIS and also be included in the construction contract special provisions.
3. The proposed drainage improvements will not have any significant impact on the shoreline environment. The existing drainage system presently discharges storm waters at the shoreline through an existing manhole structure because the offshore system is plugged. The existing manhole will be retained and modified to operate more efficiently. Also, no increase in storm water discharge is anticipated.

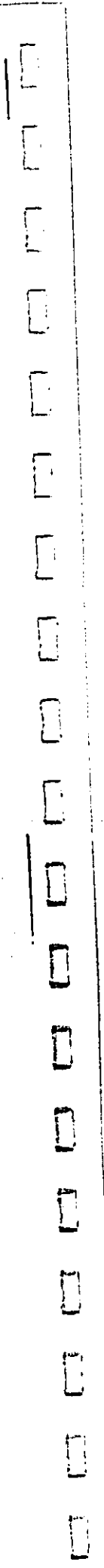
If you have any questions, please contact Lawrence Whang at 548-5221.

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

Michael J. ChiuH
MICHAEL J. CHIUH
Director and Chief Engineer

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\$ 41000 011111 20 1430
11/21/82

File Under... work's records of work





DEPARTMENT OF THE ARMY
ENGINEER DISTRICT, HONOLULU
550 SOUTH KING STREET
HAWAII 96813

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
550 SOUTH KING STREET
HONOLULU, HAWAII 96813



EILEEN R. ANDERSON
SECRETARY

MICHAEL J. CHEUNG, P.E.
ENGINEER AND CHIEF ENGINEER
WILLIAM A. HONOLULU
REPORT ENGINEER

201-12-0578

20 September 1982

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NOV 3 1982

WASH CONSULTANTS & ASSOCIATES

DEPT OF PUBLIC WORKS
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SEP 23 2 02 PM '82

6/25/82
MJC
EJG

Dr. Michael J. Chun
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Dr. Chun:

Thank you for your letter of 18 August 1982 transmitting the EIS Preparation Notice for the Uliuli and Elepaio Streets Drainage Improvements Project. Based on our review, we offer the following comments for your information and use.

- a. The outlet structure is in navigable waters of the U.S. and will require a Department of the Army permit.
- b. The Elepaio Street drainage improvements and most of the Uliuli Street relief drain are not situated in a designated flood plain area, but rather in an area of minimal flooding classified Zone C under the Flood Insurance Study (FIS) for Oahu by the Federal Insurance Administration. A portion of the proposed relief drain on Uliuli Street is located in the Waialae Major Drain 100-year flood plain in a shallow flooding area of one foot average depth. This special flood hazard area is designated Zone AO under the FIS. Inclusion of this special flood hazard area for the Waialae area. The 100-year flood refers to an event which has a one percent chance of being equalled or exceeded in any given year.

c. It appears that the new 24" drain on Aukai Street may reduce the duration of flooding in the area. There is no information, however, on the impact of 3' x 4' - 5" box drain on Hunakai Street. In all areas, periodic maintenance is recommended to prevent siltation and blocked drainage. Infiltration of sediments through new pipe joints in particular may pose future drainage problems and increased potential for flooding.

We look forward to the opportunity to review the Draft EIS for this project upon completion.

Sincerely,

Michael J. Chun
MICHAEL J. CHUN
Chief, Engineering Division

1 Enclosure
As stated

November 22, 1982

Mr. Kisuik Cheung, Chief
Engineering Division
Corps of Engineers
Department of the Army
U. S. Army Engineer District,
Honolulu
Building 230
Fort Shafter, Hawaii 96858

Dear Mr. Cheung:

Subject: Your Letter PODED-PV of September 20, 1982, relating to the Environmental Impact Statement (EIS) Preparation Notice for the Uliuli and Elepaio Streets Drainage Improvements Project

Thank you for your comments:

We will obtain a Department of the Army permit prior to construction.

The 24-inch drainline on Aukai Street will have no drainage impact on the Hunakai Street box drain. The proposed improvement will include a flap gate to prevent water from Uliuli Street from draining into the Hunakai system until after normal flood flow in the Hunakai system diminishes.

Your comments have been noted and will be included in the EIS.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer



Sep 20 10 32 AM '82
University of Hawaii at Manoa

Water Resources Research Center
Huluhos Hall 211 • 2510 Dole Street
Honolulu, Hawaii 96822

21 September 1982

RECEIVED
NOV 30 1982

Dr. Michael J. Chun
Director & Chief Engineer
Department of Public Works
City & County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

WILSON OKAMOTO & ASSOCIATES

Dear Dr. Chun:

Subject: Environmental Impact Statement Preparation Notice for the
Ulili and Elepaio Streets Drainage Improvements Project,
Kalaia, Honolulu - August 13, 1982

We have reviewed the subject EISPI and have no comments to offer at
this time. Thank you for the opportunity to comment. This material was
reviewed by WRC personnel.

Sincerely,

Evelyn S. Murabayashi

Evelyn T. Murabayashi
EIS Coordinator

ETH:jm

cc: Y.S. Fok
H. Gee

AN EQUAL OPPORTUNITY EMPLOYER



Sep 27 11 32 AM '82
University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2514 Campus Road
Honolulu, Hawaii 96822
Telephone (ext) 948-7201

September 22, 1982

RECEIVED
NOV 30 1982

Dr. Michael J. Chun
Director and Chief Engineer
City and County of Honolulu
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

WILSON OKAMOTO & ASSOCIATES

EIS Preparation Notice
Ulili and Elepaio Streets Drainage Improvements Project
Kalaia, Honolulu, Oahu

In response to your request of August 18, 1982 regarding the above cited preparation
notice, we have prepared the following comments for your consideration. The comments
here supplied represent our in-house staff assessment of the types of concerns most frequently
cited for projects of this nature. Our more standard broad based university review will
be prepared at the draft EIS stage.

General areas of concern with regard to the proposed Ulili and Elepaio Streets Drainage
Improvements include the following:

It is our understanding that the drainage to be discharged will be derived primarily
from street run-off. As such one might expect the drainage waters to include lead, oil,
or other deleterious pollutants from automotive exhausts and tires as well as coliform
bacteria, fertilizer or pesticide residues from yards and street gutters. The EIS should
include the results of analyses of the water quality characteristics of the discharge and
a brief discussion of the significance of these analyses in terms of impacts on nearshore
marine life and beach users. The decrease in dilution effects in the proposed near shore
discharge site, due to the relatively poor circulation at the shoreline, as contrasted with
the previous off-shore, off-reef discharge site may have significant effects on the near
shore biota, fisheries, or public recreation in the area. Will the edible seaweeds, limu
manauka and ogo, be affected by the drainage discharge in any way? If so, how? (See
p. 7-8, Appendix-Biological Survey)

Elepaio Drainage Improvement

In the "Appendix-Biological Survey" of the assessment it is noted that the area
surrounding the Elepaio proposed drainage discharge area has "slower currents and poorer
circulation..." (p. 19). Thus any discharge in this near shore area will result in longer term

AN EQUAL OPPORTUNITY EMPLOYER

Dr. Michael J. Chun

-2-

September 22, 1982

degradation of the coastal water quality. It would seem that a seaward extension of the discharge outlet should be considered. The Hanakoi drainage outlet which "extends about 827 feet seaward onto the offshore reef" apparently remains functional. What is the possibility of extending the Elepaio drain to a distance or point "seaward of the reef edge with the pipe inverts above the adjacent bottom elevation," that would be similar or as favorable as the Hanakoi drain outlet point? (Appendix-Biological Survey, p. 23-24) What would be the costs and impacts? This would drain the Elepaio outlet at a more favorable spot, where currents and wave action are far more conducive for mixing.

Is the discharge volume from Elepaio being increased with the additional, "new overflow drainage channel"? If so it would be in conflict with the recommendations made in the Appendix-Biological Survey. It is recommended that the capacity of this drain to discharge storm water not be increased because the generally weak current system at the west end of the Kahala reef limits flushing of the reef flat." (p. 28)

With regard to public usage, we are somewhat concerned as to the efficacy of the proposed dual purpose, beach-access path and open drainage channel. Will mud, silt, and organic debris (coconuts, palm fronds, trash) be periodically deposited on the beach and in the walkway channel thus creating an odor problem or a footing hazard to beach users? Has this potential problem been considered and will there be a need for periodic maintenance? If so, has this cost been included in the economic studies? How will the proposed "new overflow drainage channel" drain into the ocean? (i.e. Over the "CRM Wall" falling straight down onto the shoreline?)

Ulili Drainage Improvement hook-up with Hanakoi Drainage

Is this outlet able to accommodate the combined drainage flow of Ulili and its' own? During the rainy season will there be a significant increase in the amount of sediment that is carried into the ocean at the Hanakoi outlet?

Turbidity

There seems to be a question as to the State Water Quality turbidity standards for the Kahala area. Is the area considered "wet" or "dry"? According to the EIS-Preparation Notice, "if Kahala is designated a 'dry' area" the criteria for turbidity may be exceeded, "a significant portion of the time." (Appendix-Biological Survey, p. 22) What are the turbidity requirements and designations for this area? If the area is designated as "wet", are the turbidity measurements within the State Water Quality standards?

The proposed plan to abandon the existing clogged, off-reef outfalls in favor of a shoreline discharge raises some questions which would be appropriate to address in the draft EIS. What was the original rationale for the construction of the offshore discharges? How has this changed? Have alternative methods, such as use of standard sand-mining suction dredges in a horizontal moile, been cost-evaluated in terms of clearing the clogged drains? Perhaps if the drains were cleared, the existing separations (leaks) in the drain pipe sealed, and some modifications to the hydraulic structure as described by Nishimura and Lau of the University of Hawaii Water Resources Research Center were installed (see copy of paper enclosed), the existing drains could be made permanently functional with minimal expenditure of funds for maintenance. There is no indication of how long

Dr. Michael J. Chun

-3-

September 22, 1982

the existing drains have been clogged or if they were functional for an extended period. We note they were constructed in 1953-55. With the present City and County grading standards and nearly complete development of properties in the drainage area we would expect the land based component of the clogged drain to be greatly reduced in the future. It would seem appropriate to provide at least a first order engineering-cost estimate for removal and modification of the existing drains. It is our understanding that Jack Harmon of SEACO may be able to provide initial estimates on the feasibility of the sand mining drain clearing equipment and American Divers Company and Makai Engineering certainly are nationally recognized for their expertise in underwater pipe construction and repair.

We hope our comments will be useful in the preparation of this EIS and look forward to reviewing the draft document.

Yours truly,

Doyle Cox

Doyle C. Cox
Director

cc: Office of Environmental Quality Control
Jacquelin Miller
Jack Harmon
Pamela Balansen

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
530 SOUTH KING STREET
HONOLULU, HAWAII 96813



MICHAEL J. CHUNG, Ph.D.
DIRECTOR AND CHIEF ENGINEER

WILLIAM A. MURPHY
SENIOR ENGINEER

201-12-0579

November 22, 1982

Mr. Doak C. Cox, Director
Environmental Center
University of Hawaii
2550 Campus Road, Crawford 317
Honolulu, Hawaii 96822

Dear Mr. Cox:

Subject: Your letter (PH:0020) of September 22,
1982, relating to the Environmental
Impact Statement (EIS) Preparation
Notice for the Ullili and Elepaio Streets
Drainage Improvements Project

Thank you for your comments.

We have prepared the following responses in answer to your
concerns.

1. General comments concerning the impacts of storm run-
off on near-shore water quality
The volume of storm water and the impacts to the near
shore environment will not be significantly affected by
the proposed projects. It should be noted that the
proposed projects involve existing systems that are not
functioning according to design. There are no off-
shore discharge sites at present for the two systems
because both of the discharge lines are blocked. Storm
run-off for the Elepaio Street system presently dis-
charges at the shoreline through an existing manhole.
The improvements being proposed for this system will
simply modify this manhole to make it function more
efficiently and provide ease of maintenance.

Mr. Doak C. Cox
-2-
November 22, 1982

2. What is the possibility of extending the Elepaio drain
to seaward of the reef edge?

An extension and realignment of the ocean outfall was
considered as an alternative. This alternative was not
selected because of anticipated maintenance and inspec-
tion difficulties from sand intrusion and blockage as
presently existing. Also considered were higher
construction costs, including specialized offshore
construction, and significant impact on the outer reef.

As mentioned previously, the system presently drains at
the shoreline; and any improvement will only be a
continuation of the present impact.

3. Elepaio Street overflow channel

We do not anticipate a significant change in the
discharge volume from the overflow channel. The
channel's function was not fully explained in the
Notice. The channel will provide a paved footpath to
the ocean from Kahala Avenue. Additional discharge
will be generated from the change in surface percolation,
since concrete will replace the earthen footpath. This
additional runoff is insignificant.

The channel is intended to function as an emergency
outlet only during heavy rainstorms. The shoreline
area is at higher elevation than Kahala Avenue and much
of the mauka areas. With this condition and because
the existing drainlines are plugged and deficient in
capacity, runoff will pond and probably cause severe
property damages. The overflow channel is intended to
alleviate much of the ponding and will be more easily
cleaned and maintained.

4. Can the Uunakai outlet accommodate the combined flows
of its own system and the Ullili system?

No, the proposed improvement is designed with a flap
gate to control the entry of the ponded flood waters
from the Ullili system. The peak discharge of the
Uunakai system will not be increased. Ponding of the
Ullili system will also allow much of the suspended
matter to settle into the existing system, to be
cleaned out later by the maintenance crews as currently
being done.

Mr. Doak C. Cox

-3-

November 22, 1982

5. It appears that the State Water Quality criteria for turbidity may be exceeded a significant portion of the time.

The occasionally turbid conditions in the area represent an existing problem. Although the proposed drainage improvements are not designed to mitigate this condition, the new system will be designed so as not to aggravate the existing problem. Much of the existing turbidity problem is caused by storm flows conveyed by Maialaenui Stream and a nearby canal, which are located just north of the Hunakai drainage system. A broad "delta" of fine sediments has been deposited on the reef around each of these discharge points. These settled sediments are easily suspended by strong winds causing the water to be turbid even when there is no canal or stream discharge. A water quality analysis of the area included turbidity measurements made at these two discharge points. The turbidity contributed by the subject drainlines was found to be only a fraction of the total for the study area.

6. Can the existing ocean outfall be reconditioned and made operable again rather than implementing the proposed shoreline discharge?

This alternative for the Elepaio drainage system was considered in the preliminary phases of the planning process. The steps required to make the ocean outfall operable once again are as follows:

- a. The entire drainline must be cleared of the existing sand blockage (about 400 linear feet);
- b. The outlet site must be improved by dredging a larger hole or extending the drainline an additional 400 linear feet to the reef edge with the pipe invert above the adjacent ocean bottom.

There are a number of problems concerning this alternative. Inspection of the existing drainline indicates that the joints are relatively well constructed and sediment samples indicate the blockage is composed primarily of calcareous sand rather than terrestrial sediments. This means that the sand blockage did not result from leakage through the pipe joints or terrestrial sediments, but rather from sand intrusion through the pipe outlet.

Mr. Doak C. Cox

-4-

November 22, 1982

If a new outlet hole is dredged, periodic dredging would be required to remove accumulated sand from the outlet hole or from the pipe.

Off-shore dredging will be very expensive and the frequency of maintenance required cannot be accurately predicted. If the drainline is extended to the reef edge, its present length from shore to the outlet will have to be doubled. Construction will require cutting into the reef in order to maintain the proper pipe gradient. Any off-shore construction will be very costly and could have significant adverse impacts to the marine and reef environment.

All of your comments have been noted and will be included in the EIS.

Me ka aloha pulehaha,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
 650 SOUTH KING STREET
 HONOLULU, HAWAII 96813

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
 650 SOUTH KING STREET
 HONOLULU, HAWAII 96813



MICHAEL J. CIUNO, Ph.D.
 Director and Chief Engineer
 WILLIAM A. BOWEN
 Deputy Director

September 22, 1982

November 19, 1982

201-12-0573

RECEIVED
 NOV 30 1982

MEMORANDUM

TO: Dr. Michael J. Ciuno
 Director and Chief Engineer
 Department of Public Works

VIA: Mr. Andrew I. T. Chang
 Managing Director

SUBJECT: Environmental Impact Statement Preparation
 Notice for the Ullili and Elepaio Streets
 Drainage Improvements Project

MEMORANDUM

TO: DR. WILLARD T. CIUNO, CHIEF PLANNING OFFICER
 DEPARTMENT OF GENERAL PLANNING

VIA: MR. ANDREW I. T. CIANG, MANAGING DIRECTOR
 MICHAEL J. CIUNO, DIRECTOR AND CHIEF ENGINEER
 DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM DCP8/82-2987, DATED SEPTEMBER 22, 1982,
 RELATING TO THE ENVIRONMENTAL IMPACT STATEMENT (EIS)
 PREPARATION NOTICE FOR THE ULLILI AND ELEPAIO STREETS
 DRAINAGE IMPROVEMENTS PROJECT

We have reviewed the above preparation notice and offer the following comments:

1. There is no delineation of the Kahala sections or lots within the Ullili and Elepaio drainage areas that are subject to flooding. Additionally, provision of rainfall data might be helpful in defining the frequency and severity of stormwater runoff problems that have occurred.
2. An estimate of the duration of the construction period during which affected residents, motorists, and users of the public right-of-way to the beach face "temporary" and "short term" inconvenience would be useful.
3. It might be well to quantify the benefits as well as costs of the two projects which seem to be designed to minimize a problem described as "a nuisance, potentially hazardous to surrounding residents, and poses a threat to property." (Page 2, paragraph 1.)

APPROVED:

Willard T. Ciuno
 WILLARD T. CIUNO

Ralph Kawanoto
 RALPH KAWANOTO
 Planner

Thank you for your comments.

The following are responses to your comments in the same order as submitted.

1. The flooding problems do not affect large contiguous areas that can be shown on a map. The problems consist of localized ponding throughout the study area, mainly at low spots and catch basins, caused by the malfunctioning of the respective drainage systems. Rainfall data are presented in the document in the section on climate. More accurate rainfall or storm data are not available for the area.
2. Construction of the Ullili Street and the Elepaio Street Drainage Improvements will take approximately 2 and 4 months, respectively. This will be mentioned in the EIS.
3. Benefit-cost studies have not been made. There are no records of any monetary losses or damages due to flooding caused by the drains. The two projects are necessary to improve the drainage for the area.

Michael J. Ciuno
 MICHAEL J. CIUNO
 Director and Chief Engineer



STATE OF HAWAII
 DEPARTMENT OF LAND AND NATURAL RESOURCES
 HONOLULU, HAWAII 96813

SEP 21 1982
 Your: 201-12-0416

RECEIVED
 NOV 30 1982
 WMS&A ASSOCIATES

SEP 24 1982
 Hon. M. J. Chun
 C & C of Honolulu Public Works
 Re: Ulukouli & Elepaio Sts. Proj. EIS
 Page Two

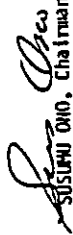
It appears that violation of water quality standards is being deliberately proposed. This is surprising. Finally, the Notice characterizes fish fauna in the affected area as insignificant (pp. 7, 12, 20; App. pp. 8-9, 25), yet "the Kahala reef area is reported to lie heavily utilized for pole and net fishing, torch fishing, and squidding," as well as for limu gathering (App. pp. 7-8).

While there is little basis for objection to the proposed project on grounds of impacts adverse to the aquatic environment and resources, we suggest clarification in the forthcoming EIS of certain apparent inconsistencies.

Historic and Archaeologic Resources

Our records indicate that this project does not occur on historic properties listed on the Hawaii Register or the National Registers of Historic Places, or eligible for inclusion on the National Register of Historic Places.

Due to the lack of archaeological surveys in the vicinity, we are not aware that significant resources exist in the project area. This does not confirm the absence of historical, cultural, architectural, and/or archaeological resources on the property. If any previously unidentified sites or remains (such as artifacts, shell, bone, or charcoal deposits; human burials; rock or coral alignments, pavings, or walls) are encountered, please inform the contractor to stop work and contact our historic sites office at 548-7460 immediately.

Sincerely,

 SUSAN OHO, Chairman
 Board of Land and Natural Resources
 and
 State Historic Preservation Officer

Honorable Michael J. Chun
 Director and Chief Engineer
 Department of Public Works
 City & County of Honolulu
 650 So. King Street
 Honolulu, Hawaii 96813

Dear Dr. Chun:

Thank you for notifying us of the preparation of an Environmental Impact Statement (EIS) covering improvements to the drainage for Ulukouli and Elepaio Streets. We welcome the opportunity to express our interests in this matter.

Aquatic Resources and Shoreline Recreation

In general, the information already provided addresses many aquatic concerns adequately. The applicant undertakes to control construction-related erosion (p. 8) and to utilize silt curtains or cofferdams if necessary to control nearshore turbidity (p. 11). We suggest in addition that sitework be scheduled for periods of low rainfall. The Notice advises that short-term closure of the existing Elepaio Street access way is mitigated by alternate beach accesses on either side, not more than 200 yards distant.

With respect to long-term residual effects, we note certain apparent discrepancies. The need for the proposed project is based on intermittent flooding under existing conditions, resulting in "a nuisance, potentially hazardous to surrounding residents, and . . . a threat to property" (p. 2) yet, "it should be recognized that flooding is more of a nuisance rather than life or property threatening . . . the proposed project will only reduce the period of nuisance flooding . . ." (p. 20). We further note that State water quality standards are already exceeded for turbidity at the Humakai Street outfall (App. p. 2), and may be exceeded for temperature (App. p. 19) and perhaps pH (App. pp. 20-21) following the proposed project, at the Elepaio Street discharge where circulation is relatively poor (App. pp. 15, 19).

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813



WILLIAM W. ANDERSON
DIRECTOR

MICHAEL J. CHUOH, Ph.D.
MANAGING AND CHIEF ENGINEER
WILLIAM A. BURNETT
NATURAL RESOURCES
DIVISION

201-12-0574

Honorable Susumu Ono, Chairman -2- November 19, 1982

We understand your confusion on the discrepancy of our assessment of the existing fish fauna environment. The description at the Kihala Reef area was a generalized description of the area extracted from a Corps of Engineers' report. Fishing and limu gathering activities presently occur along the offshore reef which is located from 800 to 1,000 feet from Kihala Beach. The areas described as having an insignificant fish fauna population are in the vicinity of the existing drainlines and outfalls and the nearshore areas of the reef. The limited habitat environment is attributed to littoral drift that prevents the growth of any new coral that would provide shelter for other organisms.

We hope our explanations have clarified any misunderstanding and inconsistencies in the EIS Preparation Notice. All of the other comments have been noted and will also be included in the EIS.

Ma ke aloha pumehana.

William A. Burnett

MICHAEL J. CHUOH
Director and Chief Engineer

November 19, 1982

Honorable Susumu Ono, Chairman
Board of Land and Natural Resources
and State Historic Preservation
Officer

State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Subject: Your letter of September 24, 1982, relating to the Environmental Impact Statement (EIS) Preparation Notice for the Ullili and Elepano Streets Drainage Improvements Project.

Thank you for your comments.

We are not deliberately proposing a violation of the State water quality standards.

The proposed Ullili Street Drainage Improvement will not significantly increase the turbidity at the Hunakai outfall. The proposed system is designed with a flap gate so that ponded flood waters from the Ullili system will not be released into the Hunakai system until after the normal flood flow within the Hunakai system has diminished. The peak discharge of the system will not be increased. Ponding at the Ullili system will also allow some of the water to percolate into the ground or seep through the existing Ullili system, thereby reducing the total volume of the runoff to the Hunakai system. In addition, ponding will allow much of the suspended material to settle within the existing Ullili system, for later cleaning by our maintenance crews as currently being done.

The proposed improvements to the Elepano Street drainage system should also not have any significant impact on the shoreline environment. The existing system presently discharges storm waters at the shoreline through an existing manhole structure because the offshore system is plugged. The existing manhole will be retained and modified to operate more efficiently. Also, no increase in storm water discharge is anticipated.

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813



GILKEM W. ANDERSON
Mayor

MICHAEL J. CHUN, P.E.
DIRECTOR AND CHIEF ENGINEER

WILLIAM A. RONNICKS
DEPUTY DIRECTOR

201-12-0580

Mr. Ken West

-2-

November 23, 1982

4. Significant environmental impact to ocean during construction.

The proposed improvement is the least costly of all the alternatives considered. The positive aspect is that it will provide a clear drainage line. Based on the type of ponding problems being experienced and the City's financial strait, this is the most feasible solution.

The cost for drainage improvements of this nature is not assessed to individual property owners. It is part of the overall construction budget of the City and as such, must be carefully evaluated to establish benefits and overall program priority.

If you have any questions, please call Albert Miyashiro of our Drainage Section at 523-4931.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

Thank you for your concerns.
Our investigations have determined that the solution to the drainage problem is not as simple as you suggest (increasing the capacity of the storm drain from Kolohala/Ullili Streets intersection to the shoreline). The problem is acute and solutions complex and costly.

The ocean outfall is blocked with calcareous sand. This indicates that blockage is caused by wave action sweeping sand into the pipe. The pipe joints have also separated, further allowing sand to infiltrate. You are experiencing back up and ponding because water can only seep slowly through the sand blockage.

To make this outfall functional would involve clearing and repairing the drainline and extending it beyond the reef or dredging the reef at the outlet. We have considered this alternative, but rejected it for the following reasons:

1. Extremely high construction cost.
2. Maintenance and inspection problems.
3. Ocean outlet may encounter the existing problem of sand intrusion and blockage.

cc: Kahala Community Association



DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

GEORGE B. ARREOLA
DIRECTOR
1500 KALANOAUAVANU
HONOLULU, HAWAII 96813

TELEPHONE: 521-2100 FAX: 521-2101

September 22, 1982

EWJ:ay
E1982

Ref. No. 6402

Dr. Michael J. Chun
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

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NOV 30 1982

WILSON OSAWAJO & ASSOCIATES

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Kear Dr. Chun:

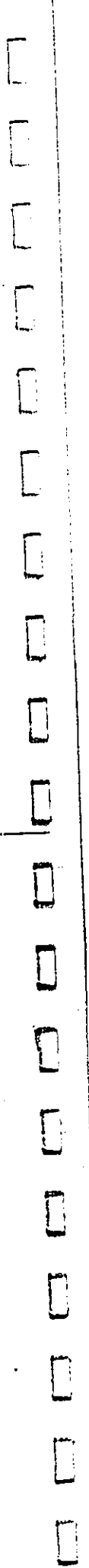
Subject: EIS Preparation Notice for the Uili and Ekepaio Streets Drainage Improvements Project

Thank you for the opportunity to review the above document. We have no comments to offer at this time.

Sincerely,

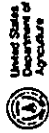
Miletio Kono

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**APPENDIX C -
Comments and Responses to Draft E.I.S.**



Soil Conservation Service

P. O. Box 5004
Honolulu, Hawaii
96850

January 10, 1983

Mr. Michael M. McElroy, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Mr. McElroy:

Subject: EIS for: Uili and Elepaio Streets Drainage Improvements
Kahala, Oahu, HI

We have reviewed the subject environmental impact statement and have no comments to make.

Thank you for the opportunity to review this document.

Sincerely,

Robert K. Drazak

ACTING

FRANCIS C. H. LUK
State Conservationist

cc: Office of Environmental Quality Control
Department of Public Works, City and County of Honolulu
Wilson Olamoto and Associates

The Soil Conservation Service
Department of Agriculture

SO-43-1
4-79



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS (11TH AIR FORCE)
MAIL ROOM (MAIL ROOM)

ATTN: DEEY (Mr. Yasuda, 449-1831)

13 JAN 1983

Subject: Environmental Impact Statement for the Uili and Elepaio Streets Drainage Improvements

re: Office of Environmental Quality Control
550 Kalahele Street, Room 301
Honolulu, HI 96813

1. This office has reviewed the subject EIS and has no comment relative to the proposed project.
2. We greatly appreciate your cooperative efforts in keeping the Air Force apprised of your project and thank you for the opportunity to review the document.
3. We are returning the copy of the EIS.

Robert K. Drazak

ROBERT K. DRAZAK
Acting Chief, Environmental Planning Division
Directorate of Civil Engineering

1 Atch
EIS

Cys to:

Dept of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Wilson Olamoto and Associates
1140 South King Street, Suite 800
Honolulu, HI 96814

Michael J. Chun
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, HI 96813



DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FT. SHAFTER, HAWAII 96814

February 1, 1983

Mr. Roy R. Takemoto
Office of Environmental
Quality Control
530 Haleakala Street
Room 301
Honolulu, Hawaii 96813

Dear Mr. Takemoto:

Thank you for the opportunity to review the Environmental Impact Statement (EIS) for the proposed Ulili and Elepaio Streets Drainage Improvements, Kahala, Oahu, Hawaii, sent to us on January 4, 1983.

The EIS acknowledges receipt of our September 20, 1982 comments regarding Department of the Army permit requirements and floodplain management concerns. We have no additional comments to offer at this time.

Sincerely,

44-7
Kisuk Cheung
Chief, Engineering Division

Copies furnished:

Wilson Okamoto and Associates
1150 South King Street, Suite 800
Honolulu, Hawaii 96814

Michael Chun, Director and
Chief Engineer
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Michael H. McIlroy, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813



United States Department of the Interior

FISH AND WILDLIFE SERVICE

190 ALA MOANA BOULEVARD
P. O. BOX 51817
HONOLULU, HAWAII 96816

MAIL ROOM 51816
ES
Room 6307

JAN 6 1983

Director
Department of Land Utilization
City and County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

Re: Ulili and Elepaio Streets
Drainage Improvements
Kahala, Oahu, Hawaii

Dear Sir:

We have reviewed the subject Environmental Impact Statement (EIS) and have no additional comments to offer at this time.

Sincerely yours,

Ernest Kosha
Ernest Kosha
Project Leader
Office of Environmental Services

cc: Office of Environmental Quality Control
Wilson Okamoto and Associates
Michael Chun, City Department of Public Works



Save Energy and You Serve America!



HEADQUARTERS
NAVAL BASE PEARL HARBOR
PEARL HARBOR, HAWAII 96813

0028:VLL:jal
Ser 50
18 JAN 1983

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

Gentlemen:

Environmental Impact Statement
Ulili and Elepaio Streets Drainage Improvements

The EIS for the Ulili and Elepaio Streets drainage improvements has been reviewed and the Navy has no comments to offer. As this command has no further use for the EIS, the EIS is being returned to the Environmental Quality Commission, by copy of this letter.

Thank you for the opportunity to review the EIS.

Sincerely,

M. M. DALLAM
CAPTAIN, U. S. NAVY
FACILITIES ENGINEER
BY DIRECTION OF THE COMMANDER

Enclosure

Copy to:
Wilson Okamoto and Associates
Department of Public Works, City and
County of Honolulu (ATTN: Mr. H. Chun)
Environmental Quality Commission



DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

COMMANDER (dpl)
Fourteenth Coast Guard District
Pearl Harbor, Hawaii 96813

(808) 546-2861
11000
Serial 501
6 JANUARY 1983

DEP WORK
DEP WORK

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

Dear Sir:

The Fourteenth Coast Guard District has reviewed the Environmental Impact Statement for Ulili and Elepaio Streets Drainage Improvements and has no objection or constructive comments to offer at the present time.

Sincerely,

J. E. Schwartz
J. E. SCHWARTZ
Commander, U. S. Coast Guard
District Planning Officer

By direction of
Commander, Fourteenth Coast Guard District

copy: Office of Environmental Quality Control
Wilson Okamoto and Associates
Michael Chun, Director and Chief Engineer
Department of Public Works

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DEPT OF PUBLIC WORKS

(P)1063.3

Jan 21 1983

Mr. Michael McElroy, Director
Department of Land Utilization
City and County of Honolulu
Honolulu, Hawaii

Dear Mr. McElroy:

Subject: EIS for Uihili and Elepaio
Streets Drainage Improvements
Kahala, Oahu, Hawaii

We have reviewed the subject matter and have no
comments to offer.

Very truly yours,

HIDEO MURAKAMI
State Comptroller

HT:jn
cc: Wilson Okamoto and Associates
Dr. Michael Chun

GEORGE E. LAIYOGH
GOVERNOR



State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. Keea Street
Honolulu, Hawaii 96814

JACK E. EDWA
CHAIRMAN, BOARD OF AGRICULTURE
SUZANNE D. PETERSON
DEPUTY TO THE CHAIRMAN

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822

January 6, 1983

MEMORANDUM

TO: Wilson Okamoto and Associates
Honolulu, Hawaii 96814

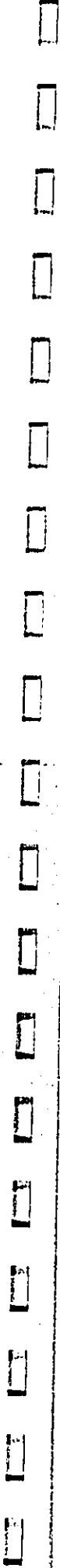
SUBJECT: Uihili and Elepaio Streets Drainage Improvements
Kahala, Oahu, Hawaii

The Department of Agriculture does not have any comments or
suggestions on the drainage improvements at this time.

Thank you for the opportunity to comment.

Jack K. Suga
JACK K. SUGA
Chairman, Board of Agriculture

"Support Hawaiian Agricultural Products"



63-00848

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT
1555 KALANIANA'OLANI BLVD., SUITE 200, HONOLULU, HAWAII 96813
TELEPHONE: 535-2100
FEB 15 1983

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT
1555 KALANIANA'OLANI BLVD., SUITE 200, HONOLULU, HAWAII 96813
TELEPHONE: 535-2100
FEB 15 1983



February 7, 1983

Ref. No. 7053
ENV/LL
ED/GR

RECEIVED
DEPT OF PUBLIC WORKS
FEB 10 2 18 PM '83

Mr. Michael M. McElroy
Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. McElroy:

Subject: EIS for the Ulili and Elepaio Streets Drainage Improvements, Kahala, Oahu

We have reviewed the above environmental impact statement and found that the EIS adequately considered the relevant objectives and policies of the Island Coastal Zone Management Program.

Thank you for this opportunity to review this document.

Sincerely,

Hiroko Shimizu
for Hideto Kano

cc: Office of Environmental Quality Control
Wilson Okamoto & Assoc.
Dept. of Public Works, City & County of Honolulu

State of Hawaii
DEPT. OF PLANNING AND ECONOMIC DEVELOPMENT
OFFICE OF THE PLANNING GENERAL
1555 Kalaniana'olani Blvd.
Honolulu, Hawaii 96813

FEB 1983

SIENS

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

Gentlemen:

Ulili & Elepaio Streets Drainage Improvements

Thank you for providing us the opportunity to review the proposed project, "Ulili & Elepaio Streets Drainage Improvements" Environmental Impact Statement.

We have completed our review and have no comments to offer at this time.

Yours truly,

JERRY W. HAYASHI
Captain, HANS
Contr & Engr Officer

cc: Wilson Okamoto & Assoc.
Dept of Public Works/H. Chum
Env. Quality Commission w/EIS

JAN 1 1983

Office of Environmental Quality Control
Room 301
550 Aliekuwila Street
Honolulu, Hawaii 96813

Gentlemen:

Thank you for the opportunity to review the draft statement of environmental impact of the proposed improvements to the Uliuli and Elepaio drainage systems.

The proposed project inevitably would have adverse effects on aquatic resources. However, these effects would be temporary and would be mitigated by measures provided in the present statement.

Our records indicate that this project does not occur on historic preservation sites listed on the Hawaii Register or the National Register of Historic Places, or eligible for inclusion on the National Register of Historic Places.

Due to the lack of archaeological surveys in the vicinity, we are unsure that significant resources exist in the project area. This does not confine the absence of historical, cultural, architectural and/or archaeological resources on the property. If any previously unidentified sites or remains (such as artifacts, shells, bone, or charcoal) exist, human burials; rock or coral alignments, dailings, or walls) are encountered, please inform the Department of Public Works to stop work and contact our historic sites office at 343-7465 immediately.

Sincerely,
E. J. Wilson
SUSUPO GHO
Chairman of the Board
and
State Historic Preservation Officer

cc: Wilson, Otomoto & Associates
Hon. Michael Chu

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
100 SOUTH KING STREET
HONOLULU, HAWAII 96813



MAILED 10
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JAN 11 1983

301-12-0029

February 6, 1983

Honorable Susupu Gho
Chairman of the Board and
State Historic Preservation Officer
Department of Land and Natural Resources
State of Hawaii
P. O. Box 521
Honolulu, Hawaii 96809

Dear Mr. Gho:

Subject: Your Comments on the FIS, Dated January 28,
1983, for the Uliuli and Elepaio Streets
Drainage Improvement

Thank you for your comments.

In answer to your concerns, we will specify in our construction contract special provisions that all work will be supervised and the historic site office contacted immediately should any item of historical, cultural, architectural and/or archaeological significance be encountered during construction.

Michael J. Chu
MICHAEL J. CHU
Director and Chief Engineer

MJF:jjf

cc: OEQC



STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3079
HONOLULU, HAWAII 96801
January 26, 1983

CHARLES G. CLARK
DIRECTOR OF HEALTH
STATE OF HAWAII
P.O. BOX 3079
HONOLULU, HAWAII 96801

MEMORANDUM

To: Mr. Michael M. McIlroy, Director of Land Utilization
Mrs. Jacqueline Farnell, Director, ORDC

From: Director of Health

Subject: Environmental Impact Statement (EIS) for Ulihi & Elepaio Streets
Drainage Improvements, Eahala, Oahu

Thank you for allowing us to review and comment on the subject EIS. On the basis that the project will comply with all applicable Public Health Regulations, please be informed that we do not have any objections to this project.

We offer the following comments for your information and consideration:

1. If there should be a backyard or stockpile area located adjacent to residences, precautions to reduce the noise in these areas, such as barriers or beams, should be implemented. Contingency plans should be developed in the event that complaints are received regarding noise emanating from these areas.
2. The traffic noise from heavy vehicles traveling to and from the construction site would further increase the ambient noise levels. Measures to minimize the noise from heavy vehicles should be included in plans for the project.

We realize that the statements are general in nature due to preliminary plans being the sole source of discussion. We, therefore, reserve the right to impose future environmental restrictions on the project at the time final plans are submitted to this office for review.

Charles G. Clark
CHARLES G. CLARK

cc: Wilson Okamoto & Assoc. ✓
Mr. Michael Chua

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
450 SOUTH KING STREET
HONOLULU, HAWAII 96813



DEPARTMENT OF PUBLIC WORKS
301-12-0028

February 6, 1983

Honorable Charles G. Clark
Director of Health
State of Hawaii
Department of Health
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Clark:

Subject: Your Comments (CRHS-85), dated January 26, 1983, on the EIS for the Ulihi and Elepaio Streets Drainage Improvements

Thank you for your comments.

The final plans will be submitted to your office for review prior to construction. Measures for noise control shall be included on the plans as part of the general construction notes.

Me ke aloha pūhāhā,

Michael J. Chua
MICHAEL J. CHUA
Director and Chief Engineer

AM:RVD/tpco
cc: ODC

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

550 SOUTH KING STREET
HONOLULU, HAWAII 96813



TELEPHONE NO. 521-2111
TELETYPE NO. 521-2111

301-12-0058

March 4, 1983

Ms. Jacqueline Parnell
Director
Office of Environmental Quality
Control
State of Hawaii
550 HALEKAUWILA STREET, ROOM 301
HONOLULU, HAWAII 96813

Dear Ms. Parnell:

Subject: Your letter of February 7, 1981,
relating to the EIS for the Ullili
and Elepaio Streets Drainage
Improvements

Thank you for your comments.

The existing discharge at the Elepaio Street drain outlet does not meet State water quality standards. The proposed improvements will not correct this, but it will also not alter the existing conditions.

An ocean engineering and environmental reconnaissance study was conducted for the subject project in February 1981 (Appendix A of the EIS). The study showed that the poorly developed marine biological communities do not appear to be a result of construction and subsequent discharge of the storm drains. This condition is due to the physical structure of the reef, the strong wave surge forces that break up the coral colonies, and the periodic transport of sand across the reef top (Appendix A, page 35). Due to sparse marine life in the area, the study indicated that the shoreline outlet alternative will not have any significant adverse impact on the existing marine environment.

We hope our explanation has clarified any misunderstanding and inconsistency in the EIS.

Ue ko aloha pūnahanā,

Michael J. Chun
MICHAEL J. CHUN
Director and Chief Engineer

AN:RVH:ipto



STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
161 MATTHEWS ST.
HONOLULU, HAWAII 96813

Jacqueline Parnell
TELEPHONE NO. 521-2111

February 7, 1983

Mr. Michael J. Chun
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street, 11th floor
Honolulu, Hawaii 96813

Dear Mr. Chun:

Subject: EIS for Ullili and Elepaio Streets Drainage Improvements,
Kahala, Oahu

We have reviewed your draft environmental impact statement and are concerned whether the existing plugged deep water outlet is exceeding the State's near-shore water quality standards at this time. In responding to several comments to your EIS preparation notice on the new drains' exceeding water quality standards, you have stated that the new drains will not have more significant effect on the environment than the existing drainage system which is in disrepair. Does that mean that the existing discharge is now meeting water quality standards or that it does not but at least it won't get worse?

Sincerely,

Jacqueline Parnell
Jacqueline Parnell
Director

cc: DLU
Wilson Okamoto & Associates



University of Hawaii at Manoa

Water Resources Research Center
Holmes Hall 223 • 2540 Duke Street
Honolulu, Hawaii 96822

7 February 1983

Department of Land Utilization
City & County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Gentlemen:

Subject: EIS for UH111 and Elepaio Streets Drainage Improvements
Kahala, Oahu, Hawaii, December 1983

We have reviewed the subject EIS and offer the following comment. If sand carried by ocean currents have caused plugging in the existing outfalls, why should the proposed system work any better? This crucial issue has not been addressed.

Thank you for the opportunity to comment. This material was reviewed by WAC personnel.

Sincerely,

Edwin T. Murabayashi
Edwin T. Murabayashi
EIS Coordinator

ETH:jm
cc: DEQC
Wilson Okamoto & Assoc.
Michael Chun, C & C
Environmental Center, Inc

AN EQUAL OPPORTUNITY EMPLOYER

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

430 SOUTH KING STREET
HONOLULU, HAWAII 96813



EDWIN T. MURABAYASHI
EIS COORDINATOR

MICHAEL J. CHUN, PH.D.
DIRECTOR AND CHIEF ENGINEER

301-12-0057

March 3, 1983

Mr. Edwin T. Murabayashi
EIS Coordinator
Water Resources Research Center
Holmes Hall 283
2540 Dolo Street
Honolulu, Hawaii 96822

Dear Mr. Murabayashi:

Subject: Your letter of February 7, 1983, referring to the EIS for the UH111 and Elepaio Streets Drainage Improvements

Thank you for your comments.

The projects do not propose to clear the plugged outfalls. Presently, water in the Elepaio Street drain line discharges at the shoreline through an existing manhole. It is proposed to modify this manhole to increase its efficiency and to facilitate maintenance to reduce the chances for plugging.

We hope our explanation has clarified any misunderstanding.

Michael J. Chun
Michael J. Chun
Director and Chief Engineer

MICHAEL J. CHUN
DIRECTOR AND CHIEF ENGINEER

AMIR:ryf



University of Hawaii at Manoa

Environmental Center
Crawford 317 - 2500 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 943-7261

February 7, 1983

Mr. Michael McElroy, Director
Department of Land Utilization
City and County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

Draft Environmental Impact Statement
Ulukou and Elepaio Streets Drainage Improvements
Kahala, Oahu, Hawaii

Dear Mr. McElroy:

The Environmental Center review of the above cited document has been prepared with the assistance of Frisbee Campbell, Marine Operations; Brent Gallagher, Oceanography; Hans Kroock, Ocean Engineering; Look Laboratory; and Jacqueline Miller and Pamela Babson, Environmental Center.

In addition to the points raised in our review at the Preparation stage. We have a few additional comments and questions for your consideration.

We note per correspondence in Appendix B between Ralph Kawamoto, Department of General Planning, and William Bonnet, for Michael Chun, Department of Public Works, that "benefit-cost studies have not been made" for the project and that, "there are no records of any monetary losses or damages due to flooding caused by the drains" (in the project areas of concern). How was it, then determined that these improvements are needed?

As proposed, and indicated in your response to our earlier comments, the action should not result in significantly different environmental changes from present conditions. The Ulukou and Elepaio drains will continue to be transported to and through the reef channel by the wave induced circulation. Sediment will continue to be deposited in the near-shore area. Although it would be preferable, with regard to the near-shore water quality, to extend the Elepaio drainage outlet beyond the reef edge, the actual likely degree of improvement in water quality that would result if such an extension were constructed may not be sufficiently significant to justify the high cost. However, without a cost/benefit analysis such a conclusion seems poorly based.

The evaluation of the project in terms of responsible environmental management is seriously impeded, given the questionable efficacy of the project to mitigate flooding problems in the area, by the lack of a cost-benefit analysis, we suggest that such an analysis

AN EQUAL OPPORTUNITY EMPLOYER

Mr. Michael McElroy, Director

Page 2

February 7, 1983

be included in the revised EIS.

We appreciate the opportunity to comment on this DEIS and hope that you will find our comments useful in the preparation of the revised document.

Your truly,

Doak C. Cox
Doak C. Cox
Director

cc: Jacqueline Parnell, Office of Environmental Quality Control
Wilson Okamoto & Associates
Michael Chun, Dept. of Public Works
Frisbee Campbell
Brent Gallagher
Hans Kroock
Jacqueline Miller
Pamela Babson

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

630 SOUTH KING STREET
HONOLULU, HAWAII 96822



TELEPHONE 535-2200

MICHAEL J. COX, Ph.D.
DIRECTOR AND CHIEF ENGINEER

301-12-0053

March 4, 1983

Mr. Doak C. Cox, Director
Environmental Center
University of Hawaii
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Mr. Cox:

Subject: Your Letter of February 7, 1983, to
the Department of Land Utilization
relating to the EIS for the Uili and
Eleaio Streets Drainage Improvements

Thank you for your comments.

The Uili and Eleaio Streets drainage system outfalls are presently totally plugged, which results in nuisance flooding. The standing water could pose potential health and safety hazards. Property damage is usually minor; but residents are inconvenienced by flooding, and numerous complaints have been received by the Department of Public Works.

The nature of flooding and damages in the Kahaia area do not lend themselves to cost-benefit analysis. Flooding problems in the Kahaia area stem from overall system design deficiencies as well as system malfunctions (EIS - Summary of Unresolved Issues). The drainage systems were designed in the early 1950s according to standards at that time. These systems do not, however, meet today's design standards. Improvements to upgrade the system to today's standards will be extensive and extremely costly, and benefits derived from improving any one segment of a system is limited by the overall system deficiency.

The proposed improvements are not designed to totally mitigate the existing flooding problem or drainage deficiencies but rather to reduce the duration of flooding, due to limited

Mr. Doak C. Cox

-2-

March 4, 1983

availability of funds and the higher priority of other drainage projects, the entire system cannot be upgraded at this time, except for the modest works proposed.

The proposed improvements will not provide benefits measurable in dollars from which cost-benefit ratios are derived. As mentioned earlier, the improvements will not prevent flooding but will only decrease the duration of flooding. Cost-benefit analysis for projects of this nature are not appropriate.

Me ke aloha puuhana,

MICHAEL J. COX
Director and Chief Engineer

M:RHM/pto

STP 3-8838

January 26, 1983

Similar letter to:

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

Ms. Jacqueline Farnell, Director
Office of Environmental Quality Control
339 Halekuanila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Farnell:

Environmental Impact Statement
Ulili and Elepaio Streets Drainage Improvements
Kahala, Oahu - TEM 3-3-04 and 3-3-03; JP

Thank you for the opportunity to review the subject
document. We have no substantive comments to offer which
could improve the document.

Very truly yours,

Wilson Okamoto

ALR:ko
Wilson Okamoto
Director of Transportation
Dept. of Public Works,
C&C of Honolulu

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU

410 SOUTH KING STREET
HONOLULU, HAWAII 96813
PHONE 833-3111



GILLEN S. ANDERSON
DIRECTOR

JOSEPH K. COMANT
DIRECTOR
CHARLES C. HONORE
DEPUTY DIRECTOR

January 28, 1983

MEMORANDUM

TO: Michael M. McElroy, Director
Department of Land Utilization

FROM: Joseph K. Comant

SUBJECT: Ulili and Elepaio Streets Drainage Improvements
Kahala, Oahu

We have reviewed the subject EIS and have no substantial comments
to offer.

We will be retaining this EIS for our files.

Wilson Okamoto
WILSON OKAMOTO

cc: Department of Public Works
Wilson Okamoto & Associates

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU



COPY

January 11, 1983

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Subject: Your letter of January 4, 1983, on
The Environmental Impact Statement (EIS)
For Ollili and Kilepalo Streets
Drainage Improvements

We have no comments to add to those previously made on
the EIS Preparation Notice. We return the copy of the EIS to
you with this letter.

If you have any questions, please contact Lawrence Whang
at 548-5251.

Very truly yours,

MADO HAYASHIDA
Manager and Chief Engineer

Attach.

cc: Department of Land Utilization
Department of Public Works
Wilson, Okamoto, and Assoc.

WILSON OKAMOTO & ASSOC.

TE 1/83-52
P. 1003

January 24, 1983

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Subject: Environmental Impact Statement for Ollili and
Kilepalo Streets Drainage Improvements

We have reviewed the EIS and find that the traffic issues have been
adequately addressed.

Sincerely,

WILLIAM A. BORNHET
Director

cc: Wilson Okamoto & Associates
Department of Public Works

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU

150 SOUTH KING STREET
HONOLULU, HAWAII 96813



WILLARD T. CHOW
Chief Planning Officer
HONOLULU, HAWAII 96813
PHONE: 535-4479

DGP/83-4479

MEMORANDUM

TO: Mr. Michael M. McElroy, Director
Department of Land Utilization

VIA: Mr. Andrew I. T. Chang, Managing Director

SUBJECT: Ullili & Eleaio Streets Drainage Improvements
Environmental Impact Statement

We have no further comments on the subject environmental impact statement. Our earlier comments have been acknowledged by the applicant and are discussed in the EIS.

Ralph Kawamoto
RALPH KAWAMOTO
Planner

APPROVED:

Willard T. Chow
WILLARD T. CHOW

cc: OIOC
DPW
Wilson Okamoto & Assoc.

APN-84

JAN 18 1983

Department of Land Utilization
City and County of Honolulu
510 South King Street
Honolulu, Hawaii 96813

Comment:

The Environmental Impact Statement (EIS) for the Ullili and Eleaio Streets Drainage Improvements, Kakaia, Honolulu, Oahu has been reviewed and we have no comments in effect.

There are no Army installations or activities in the vicinity of the proposed project.

Thank you for the opportunity to comment on the EIS.

Sincerely,

Maurice S. Fujitaka
Maurice S. Fujitaka
Acting Director of Engineering
and Housing

Office of Environmental Quality Control
530 Halekanihale Street, Room 301
Honolulu, Hawaii 96813

Wilson Okamoto and Associates
1133 South King Street, Suite 370
Honolulu, Hawaii 96813

Michael Chan, Director and Chief Engineer
Department of Public Works
City and County of Honolulu
530 South King Street
Honolulu, Hawaii 96813

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU

510 SOUTH KING STREET
HONOLULU, HAWAII 96813



HELENE S. JAROSCIAN
DIRECTOR

EMIKO I. KUDO
CHAIRMAN
ROYAL CARL
DIRECTOR
ROBERT S. ALANNA
ASSISTANT DIRECTOR

January 12, 1983

Mr. Roy R. Takemoto, Chairman
Environmental Quality Commission
State of Hawaii
550 Halekanihale Street
Room 301
Honolulu, Hawaii 96813

Dear Mr. Takemoto:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR THE
ULIHI AND ELEPAIO STREETS DRAINAGE IMPROVEMENTS

The proposed drainage improvements will not have any impact on recreation facilities in proximity to the project site.

Thank you for the opportunity to review the EIS.

Sincerely yours,

Emiko I. Kudo
(Mrs.) EMIKO I. KUDO, Director

EIK:vc

BISHOP ESTATE
GENERAL CORRESPONDENCE

January 13, 1983

Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Gentlemen:

Environmental Impact Statement for Ulihi and Elepaio Street Drainage Improvement Project, Lalala Subdivision Extension, Vol. 1, p. 201

This is in response to your letter of January 4, 1983, submitting the Environmental Impact Statement (EIS) for the subject drainage improvements, for our review and comment.

We acknowledge the proposed project and have no objection to the EIS, however, we request such measures as a temporary expedient to the flooding problem and therefore act in the best interest of the public.

Thank you for your continued cooperation in this matter. Should you have any questions on the above, please do not hesitate to call the undersigned at 523-6246.

Very truly yours,

Alla Neves

Alla Neves
Land Manager

cc: Wilson Ganeoto and Associates
Mr. Michael Chun, Director and Chief Engineer
Department of Public Works
Office of Environmental Quality Control

END

CERTIFICATION

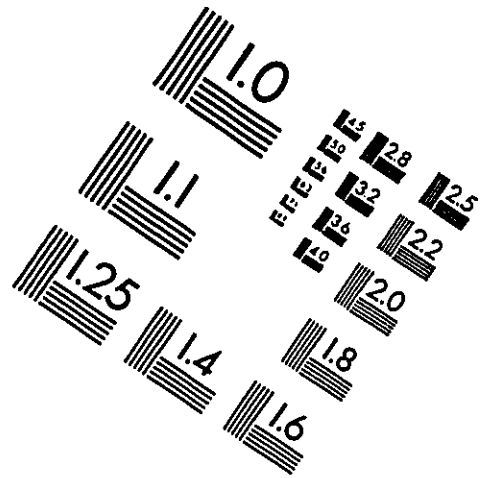
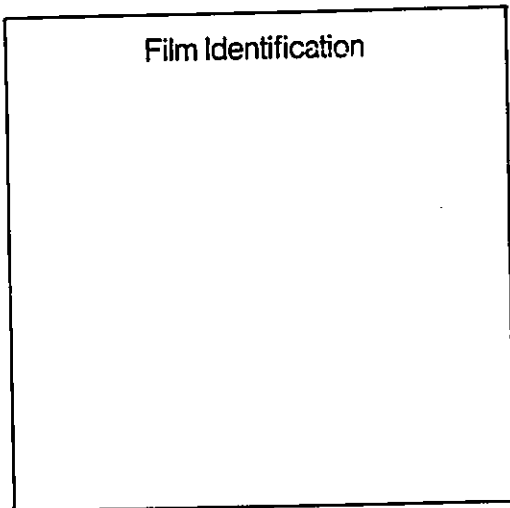
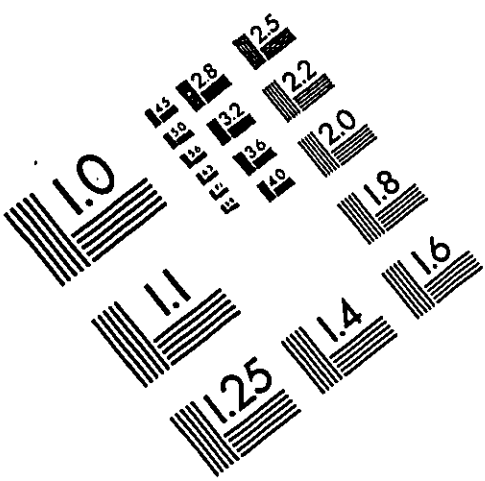
**I HEREBY CERTIFY THAT THE MICROPHOTOGRAPH APPEARING IN THIS REEL OF
FILM ARE TRUE COPIES OF THE ORIGINAL DOCUMENTS.**

2006

DATE

Alfred J. Takacs
SIGNATURE OF OPERATOR

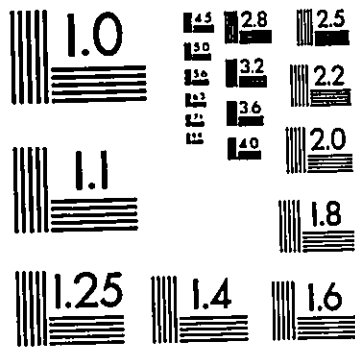
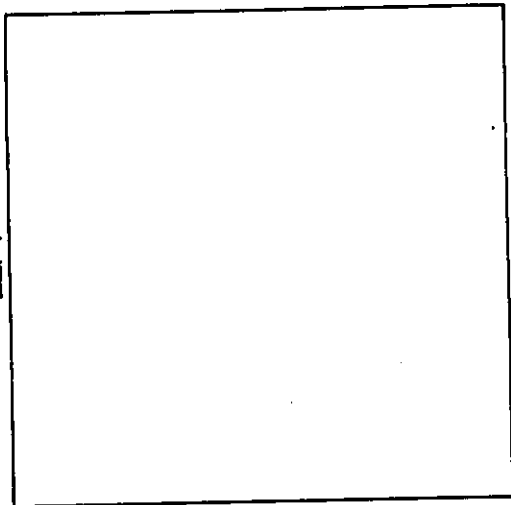
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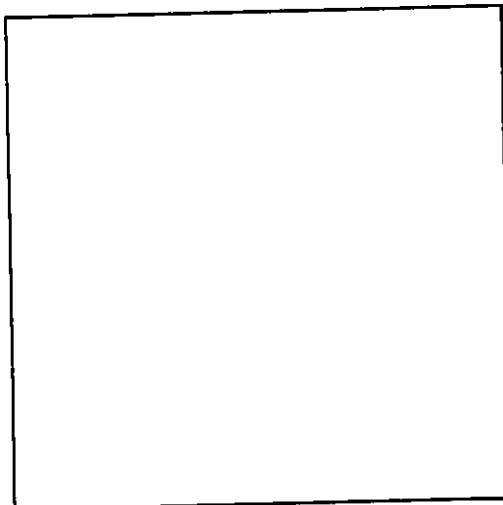
A & P International
715/262-5788 • Fax 715/262-3823
577 Locust Street • Prescott, WI 54021
Web Site <http://www.zimc.com/apintl>

PRECISIONSM RESOLUTION TARGETS

LEFT

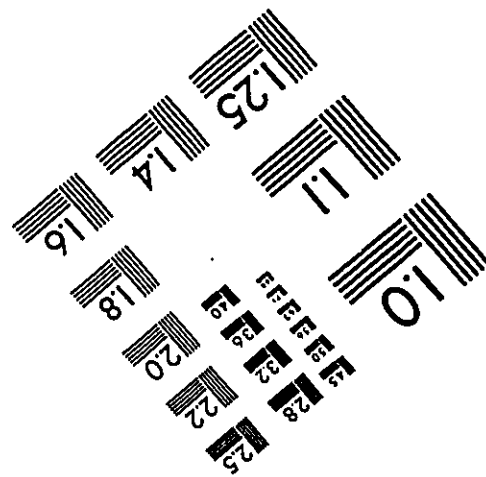
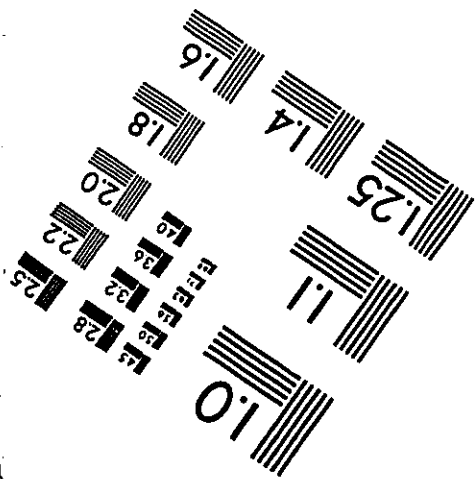


RIGHT



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PA-3 8½"x11" PAPER PRINTED GENERAL TARGET

DENSITY TARGET



ADVANCED MICRO-IMAGE SYSTEMS HAWAII