EXECUTIVE CHAMBERS

HONOLULU

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JOHN WAIHEE
GOVERNOR

March 1, 1988

Marvin T. Miura, Ph.D
Interim Director
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

FILE COPY

Dear Dr. Miura:

Based upon the recommendation of your office, I am pleased to accept the Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan as satisfactory fulfillment of the requirements of Chapter 343, Hawaii Revised Statutes. This environmental impact statement will be a useful tool in the process of deciding whether the action described therein should be allowed to proceed. My acceptance of the statement is an affirmation of the adequacy of that statement under applicable laws, and does not constitute an endorsement of the proposed action.

When the decision is made regarding the proposed action itself, I expect the proposing agency to weigh carefully whether the societal benefits justify the environmental impacts which will likely occur. These impacts are adequately described in the statement, and together with the comments made by reviewers, provide a useful analysis to the proposed action.

With kindest regards,

Sincerely,

JOHN WAIHEE

cc: Department of Public Works

FINAL
ENVIRONMENTAL IMPACT STATEMENT
WAIALUA-HALE'IWA WASTEWATER
FACILITIES PLAN

Prepared For:

DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

Prepared By:

BELT COLLINS & ASSOCIATES
Engineers • Planners • Landscape Architects

FINAL

ENVIRONMENTAL IMPACT STATEMENT

WAIALUA-HALE'IWA WASTEWATER

FACILITIES PLAN

Tax Map Key: 1st Division, Zone 6
This Environmental Document is Prepared
Pursuant to Chapter 343, HRS

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

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

Responsible Official: Sam Callejo, for Director and Chief Engineer — Date: 5-22-87

Prepared For: Division of Wastewater Management
Department of Public Works
City and County of Honolulu

Prepared By: Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

ERRATA SHEET

1. Proposed flood map revisons dicussed Chapter III of this report (Figures III-6 and III-7) have been officially adopted by the Federal Emergency Management Adiminstration (FEMA) as of September 4, 1987.

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Chapter IV

SUMMARY

SUMMARY

A. PURPOSE

The need for improved wastewater collection, treatment, and disposal facilities in the Waialua-Hale'iwa area (see Figure 1) was identified in the 1972 Water Quality Plan for Oahu and in the 1980 Water Quality Management Plan for the City & County of Honolulu (the "208 Plan"). These reports note that:

- The great majority of the homes and businesses in the Waialua-Hale'iwa area are served by cesspools.

- 15 to 20 percent of the cesspools have failed and require pumping on a frequent basis, and 60 percent have had to be pumped at least once in their life-times.

- Even when working properly, cesspools remove only a small percentage of the pollutants contained in domestic sewage, with groundwater carrying the remainder into the ocean.

- There is a resulting potential for health problems as a result of the heavy recreational use of shoreline waters in this area.

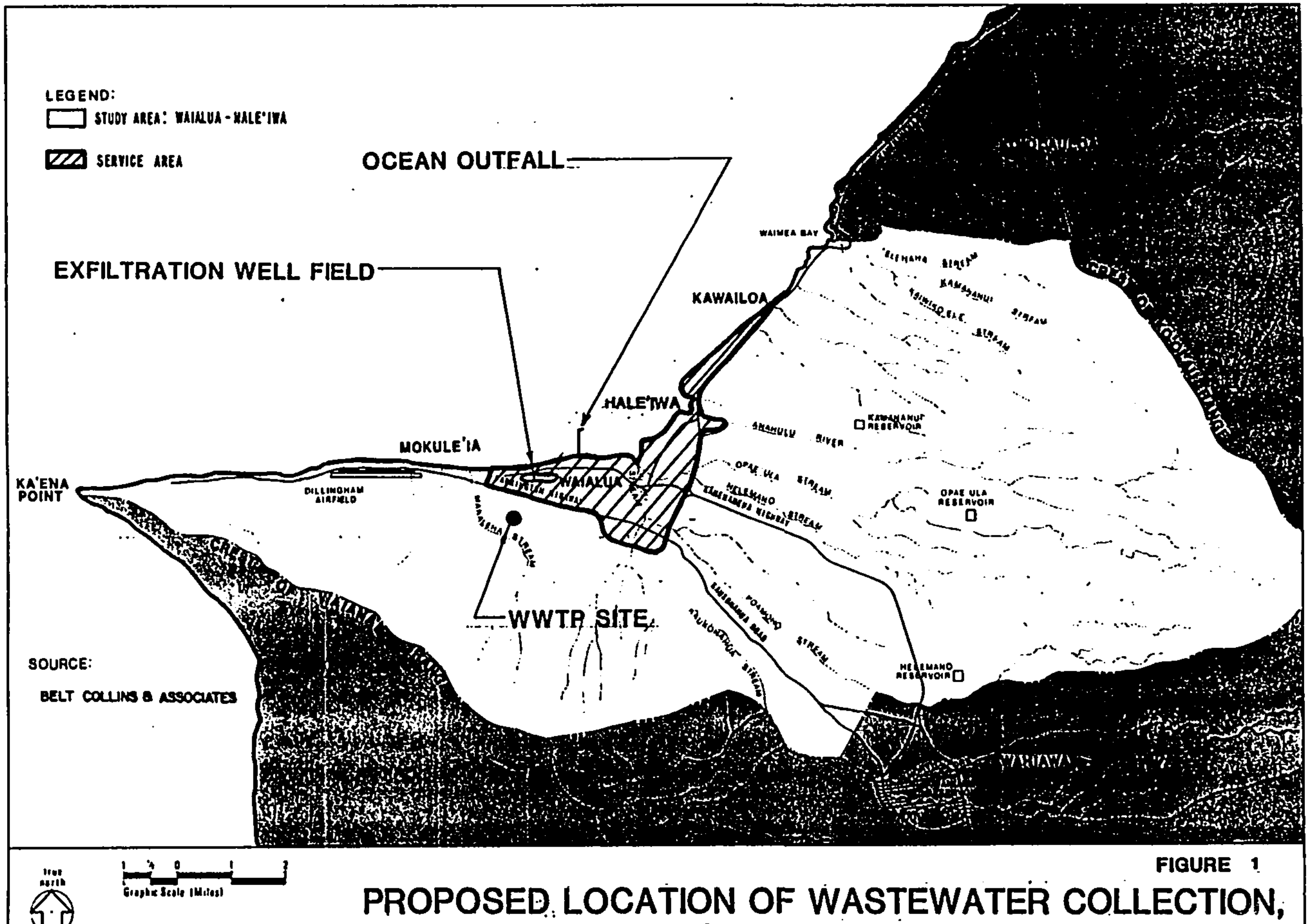


FIGURE 1

PROPOSED LOCATION OF WASTEWATER COLLECTION, TREATMENT, AND DISPOSAL FACILITIES

The Waialua-Hale'iwa Wastewater Facilities Plan (herein identified as Facilities Plan) identifies steps that are required to solve the wastewater treatment and disposal problems taking into consideration protection of public health, economic feasibility, water quality objectives, potential beneficial and adverse environmental effects, and other pertinent factors.

B. DESCRIPTION OF THE PROPOSED ACTION

The Facilities Plan recommends, as shown in Figure 1, a centralized wastewater treatment system (collection and conveyance system, treatment plant, and effluent disposal by means of exfiltration wells and/or an ocean outfall) for the urban core of the Waialua District. Rural areas would continue to rely on individual wastewater treatment units up to the year 2000. At that time, a re-evaluation should be conducted to determine the feasibility of expanding the service area of the plant to the lower density urban fringe areas. This evaluation is needed because of the State's goal of prohibiting the construction of new cesspools beyond the year 2000.

The proposed action involves construction of a single 1.4 million gallon per day capacity wastewater treatment plant (WWTP) west of the town of Waialua (see Figure 1). The proposed treatment plant site is located on existing sugarcane land approximately 1,800 feet south of Farrington Highway; it is about 1/3 of a mile from the nearest residential parcel. An underground pipe collection system would be installed allowing the plant to serve the entire urban core. A secondary level of wastewater treatment would be provided. Effluent disposal would initially be via exfiltration wells (which require no artificial pumping head) followed by a new ocean outfall.

C. SIGNIFICANT BENEFICIAL AND ADVERSE IMPACTS

C.1 Beneficial Effects

Implementation of the recommended wastewater collection, treatment and disposal program would have three *principal* beneficial impacts:

(1) It would reduce the volume of pollutants from domestic sources entering ground, coastal and surface waters in the study area, thereby improving both groundwater and coastal water quality.

(2) It would provide for a more significant and reliable wastewater treatment and disposal system for the heavy concentration of people in the Waialua-Hale'iwa urban core, while taking advantage of the economics of individual wastewater treatment systems in the less densely populated fringe areas.

(3) Direct construction expenditures would produce almost \$22 million in construction worker income and an average of 280 construction industry jobs on Oahu if spread over a hypothetical 3-year construction period. The total induced economic effects statewide would be about \$49 million in personal income and more than 2,720 person-years of employment (a person-year is one person for one year).

C.2 Adverse Effects

C.2.1 Short-Term (Construction)

Most of the significant adverse construction impacts of the recommended alternative are associated with the collection system. This is because it involves extensive excavation along many of the area's roadways, whereas the wastewater treatment plant is situated on a more isolated site away from existing structures. These short-term construction impacts would include increased noise levels, dust and other air pollutants, and traffic disruptions when motorists are routed around trenching operations. Some offshore trenching through the reef would occur during construction of the ocean outfall. Finally, property owners in the sewered area may also be required to pay an improvement district assessment, to arrange and pay for connecting existing structures to the wastewater collection lines, and to backfill their abandoned cesspools.

C.2.2 Long-Term (Operational Phase)

The recommended wastewater facilities would have relatively few adverse long-term impacts. Construction of the wastewater treatment plant would remove approximately 10 acres of prime agricultural land from production. Additional land would be required for the disposal wells (6 acres) and the sewage pump stations. Owners of property in the sewered area, who are not currently paying anything for the use of their cesspool, would have to pay a monthly wastewater system user fee. The recommended plan has been developed to address the potential problems sometimes associated with wastewater treatment facilities. The measures utilized to reduce or eliminate adverse noise, air quality, and other impacts are described in Section D, below.

D. PROPOSED MITIGATION MEASURES

Numerous considerations have been evaluated and incorporated into the recommended plan for the purpose of preventing or minimizing potential adverse impacts associated with wastewater treatment facilities. The following are among the more important steps that have been taken to avoid and/or reduce potential problems:

- The recommended wastewater treatment plant site is located in agricultural fields well away from existing structures and urban-zoned land. The site also is at a location where the normal wind trends would impact the least number of people. As a result, the impact of potential adverse noise or odor generated in the event of a system malfunction has been greatly reduced.

- The recommended treatment facility shall be designed to minimize its visual impact on the surrounding area. The plant layout and facilities have been selected to have the least visual impact. And where required, the facilities shall be screened from public views.

- A site free of rare/endangered species or other valuable flora or fauna, known archaeological/historical remains, and known flooding has been chosen for the WWTP.

- Odor prevention and control systems shall be incorporated in the WWTP and the collection system.

- Where possible, the sewage pump stations have been sited outside flood hazard areas; where this was not feasible, plans call for floodproofing to the elevation of the 100-year flood.

- Treated wastewater is disposed of initially through exfiltration wells which would not affect potable water sources; the ocean outfall which would ultimately be built extends out from the shoreline sufficiently far to insure adequate disposal of the treated wastewater.

E. ALTERNATIVES CONSIDERED

A wide range of alternatives was formulated and evaluated during the wastewater facilities planning process. One of these, the "No-Action" alternative, assumes the area's residents and businesses will continue to dispose of their sewage through cesspools, private wastewater treatment plants, and other individual wastewater units. Other alternatives consisted of one plant, two plants, and community-type centralized wastewater treatment plants together with associated collection and disposal systems. The service areas, WWTP treatment processes utilized and total treatment capacity of the various alternatives initially considered were comparable to that of the recommended alternative. Analyses conducted as part of the facility planning process indicated that the recommended alternative was superior to other alternatives with respect to minimizing the impacts on the environment.

F. UNRESOLVED ISSUES

Evaluation of effluent disposal alternatives indicated that effluent from the wastewater treatment plant be should ultimately disposed of via an ocean outfall. However, the final alignment, discharge depth, length, and diffuser characteristics of the outfall have not yet been determined. A study must be conducted to determine the best design to minimize the effects of the effluent on the marine environment and to acquire the necessary permits/approvals. Consequently, exfiltration wells will be used as an interim effluent disposal method until the outfall becomes operational.

The proposed wastewater treatment plant contains an innovative and alternative (I/A) technology as the secondary biological wastewater treatment process. The wastewater treatment flow scheme was developed around this I/A technology. Although performance data gathered thus far has shown favorable treatment results, information on this I/A process is still rather limited. This is due to the recent introduction and limited use of this process. Therefore, the wastewater treatment processes may change as additional information is obtained. If changes in the treatment process are made, the wastewater treatment facility will still be required to provide a secondary level of treatment - thus, not changing the environmental impacts of the proposed project.

G. COMPATIBILITY WITH LAND USE PLANS AND POLICIES

The wastewater facilities plan is in accordance with public land use policies and plans. It will help achieve the environ mental quality objectives expressed in the State Plan, the City and County of Honolulu General Plan, the North Shore Development Plan, and other applicable land use controls. It is designed to upgrade service to existing settlement; consequentially, it will not stimulate growth beyond that provided for in these plans.

H. NECESSARY PERMITS AND APPROVALS

Implementation of the recommended plan will require the permits and approvals listed below. None of these have been applied for as yet, and permit applications will be submitted only at such time as a firm decision has been made to proceed with construction of the facilities. Further engineering and environmental analyses will be undertaken in the process of finalizing the design and preparing construction drawings.

Approving Agency or Body	Permit/Approval Needed
I. CITY AND COUNTY	
Dept. of Land Utilization	Special Management Area Use Permit
Dept. of Land Utilization	National Flood Insurance Program Conformance
Dept. of Land Utilization	Shoreline Setback Variance
Dept. of Public Works	Grading Permit
Dept. of Public Works	Drainage Plan Approval
Board of Water Supply	Water Connection Approval
Board of Water Supply	Fire Hydrant Installation Plan Approval
Building Department	Building Permit
Dept. of General Planning	Development Plan Public Facilities Map Designation
II. STATE	
Department of Health	Conditional Use Permit for Construction Activities
Department of Health	National Pollutant Discharge Elimination System
Department of Health	Section 401 Water Quality Certification
Department of Health	Underground Injection Control Permit
Dept. of Land & Natural Resources	Historic Sites Peview
Dept. of Land & Natural Resources	Conservation District Use Permit
Dept. of Land & Natural Resources	Leasing

	Approving Agency or Body	Permit/Approval Needed
	Dept. of Land & Natural Resources	Drilling Wells Permit
	Dept. of Transportation	Permit to Perform Work Within State Highways
	Dept. of Transportation	Permit for Work in Shore Waters of the State of Hawaii
	Department of Business and Economic Development	Hawaii Coastal Zone Management Program, Consistency Determination
	State Surveyor, Land Court	Approval for Subdivision of Land
III.	FEDERAL	
	United States Environmental Protection Agency	Wastewater Treatment Facility Construction Grant
	United States Corps of Engineers	Section 10 Permit - for ocean outfall
	United States Corps of Engineers	Section 404 Permit - for stream crossings and wetlands
IV.	Hawaiian Electric Company	Electrical Connection Approval
V.	Hawaiian Telephone Co.	Telephone Connection Approval

I. THE PROPOSED ACTION

CHAPTER I

THE PROPOSED ACTION

1.1 NEED FOR THE PROPOSED ACTION

In 1972, the City and County of Honolulu published the ten-volume Water Quality Program for Oahu (WQPO). The program was designed to maintain and enhance water quality through a program of source controls and treatment of potentially harmful pollutants. In the same year the U.S. Congress approved major changes to the Federal Water Pollution Control Act (FWPCA), (Public Law; PL 92-500). Congress's goal was to eliminate the discharge of pollutants into the nation's waters, thereby restoring their chemical, physical, and biological quality and preserving them as a source of food and recreation. This goal closely matches those of the WQPO.

The FWPCA calls for the establishment of area-wide wastewater treament management plans designed to insure adequate control of pollutant sources. The specific requirements for the development and contents of these plans are contained in Section 208 of the Act; hence, they have become known as "208 Plans". Published in October 1978 and amended in December 1980, the 208 Plan for Oahu is entitled Water Quality Management Plan for the City & County of Honolulu. It provides a framework for ongoing City and State water quality programs on Oahu.

Chapter 10 of the 208 Plan addresses issues associated with municipal sewerage and household wastewater disposal systems. It notes that many parts of the island, including the Waialua-Hale'iwa area, lack municipal wastewater treatment facilities, relying instead on individual cesspools and other private systems. The 208 Plan lists the following broad categories of problems and potential problems associated with this reliance on individual disposal systems:

- Many of the systems have failed;
- Many produce seepage that pollutes coastal waters;
- There is an inefficient division of authority between the State and County, contributing to the use of cesspools in areas where they are inappropriate; and
- Cesspool pumping by government agencies involves a questionnable subsidy to the owners of failed cesspools, eliminating the monetary incentive needed to induce owners to change to a more efficient system.

The City-operated Pa'ala'a Kai treatment plant is the only modern wastewater treatment facility in the Waialua-Hale'iwa area. This system services only 307 single family units. Most of the other homes and businesses rely on cesspools; the 208 Plan notes that about 60 percent of these have failed at least once. Each of the small apartment complexes located along the shoreline in Waialua and Mokule'ia is served by its own private wastewater treatment plant, many of which have performed poorly due to untrained operators and inadequate maintenance programs. The 208 Plan observes that cesspools remove only a small percentage of the pollutants contained in domestic sewage, and notes that the seaward movement of groundwater has the potential to carry most of the remainder into coastal waters, particularly when they are located near the shoreline. It also notes that, while adverse effects of cesspool seepage on water quality are not well documented, it is possible that there may have been a gradual and undetected impact on coastal waters because of cesspool use over many decades, especially where fringing reefs tend to restrict circulation in nearshore waters. In view of the existing cesspool-related problems discussed in the 208 Plan and the increasing continuation of potential contamination from aging cesspools through the year 2000, the 208 Plan recommends that the Waialua-Hale'iwa area be sewered.

In response to the recommendations contained in the 208 Plan, the City & County of Honolulu applied for and received a grant from the U.S. Environmental Protection Agency (EPA) to prepare a "Facilities Plan" for the Waialua District in accordance with the Federal Water Pollution Control Act of 1972 (PL 92-500) and Clean Water Amendments of 1977 (PL 95-217) and 1981 (PL 97-117). Facilities Plans are conceptual planning documents that result from a multi-phase planning process addressing the requirements outlined on Table I-1. They are conducted to insure that solutions to perceived wastewater treatment problems take into consideration economic feasibility, water quality objectives, potential beneficial and adverse environmental effects, and other pertinent factors. This Environmental Impact Statement (EIS), in conjunction with the Facilities Plan, evaluates alternatives and selects the appropriate solution for protecting the environment by minimizing/eliminating existing problems and is aimed to mitigate future environmental impacts.

Table I-1. Stages in the Facilities Planning Process.

Stage 1. Identify Applicable Effluent Limitations

(a) Municipal permits under National Pollutant Discharge Elimination System
(b) Receiving water quality standards

Stage 2. Assess Current Situation

(a) Boundaries, political jurisdictions, physical characteristics
(b) Organizational context
(c) Demographic and land use characteristics
(d) Water use and quality
(e) Other environmental conditions
(f) Existing wastewater flows and treatment systems
   - o description
   - o performance/problems

Stage 3. Assess Future Situation

(a) Demographic and economic projections for the planning area
(b) Land use projections
(c) Forecast of future wasteloads and flows
(d) Projection of future conditions if no improvements are made

Stage 4. Develop and Evaluate Alternatives

(a) Optimize performance of existing facilities
(b) Construct regional system
(c) Develop alternative waste treatment systems
   - o treatment and discharge
   - o treatment and re-use
   - o land application

(d) Evaluate alternatives on the basis of:
   - o monetary costs
   - o environmental effects
   - o other considerations

(e) Re-configure alternatives (if necessary) and re-evaluate as under 4(d)
(f) In designing and evaluating alternatives, consider:
   - o institutional arrangements
   - o flow and waste reduction
   - o necessary sewer system
   - o sludge disposal provisions
   - o location
   - o phasing/flexibility
   - o reliability

Stage 5. Select Plan

(a) Public meeting to discuss alternatives
(b) Using results of Stage 4 and public input, select a plan

Stage 6. Prepare Preliminary Design of Treatment Works

(a) Physical plans for facility (preliminary engineering designs)
(b) Operation and maintenance requirements
(c) Costs
(d) Time schedule

Stage 7. Develop Implementation Plan

(a) Financial program
(b) Legal agreements

Source: Belt, Collins & Associates based on U.S. Environmental Protection Agency (May 1975).

1.2 PROPOSED ACTION

The proposed wastewater collection, treatment, and disposal system serves the Waialua-Hale'iwa planning area with a centralized wastewater treatment plant (WWTP) for the urban core and the continued reliance on cesspools for the rural area up to the end of the planning period of this study (the year 2000). The urban and rural areas of the Waialua-Hale'iwa study area are shown in Figure I-1.

1.2.1 Rural Area

The proposed action for the rural areas of the Waialua-Hale'iwa planning area is "No-Action". This alternative proposes the continued use of existing wastewater systems. This recommendation is based upon the low population and density of the rural areas. Due to the limited projected population increase through the year 2000, continued use of cesspools will have little or no detrimental effects on the environment and the potential for public health hazards appears minimal. The incorporation of a septage receiver station at the new WWTP will provide a much more convenient and less expensive means of septage disposal than at the Wahiawa WWTP and helps to justify the continued use of cesspools.

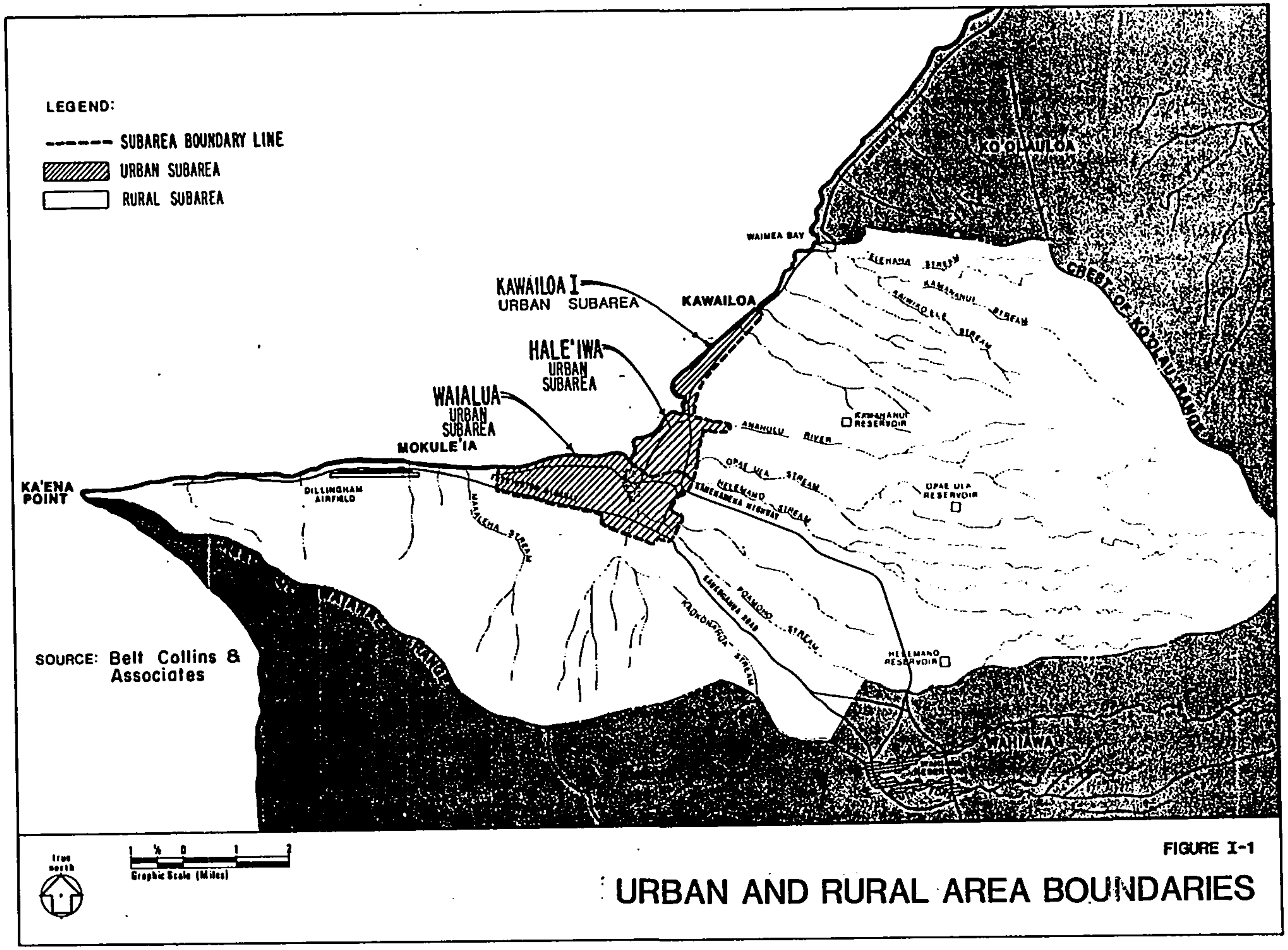


FIGURE I-1

URBAN AND RURAL AREA BOUNDARIES

1.2.2 Urban Area

The potential environmental problems arising from either existing or future conditions, as mentioned in the "208 Plans" in the Waialua-Hale'iwa area, is most likely to occur in the urban areas of the planning area. The proposed action involves the collection and conveyance of wastewater to a secondary-level wastewater treatment plant (WWTP) in Mokule'ia. The secondary treated effluent is disinfected as required prior to disposal by an ocean outfall. The need for the necessary permits/approvals for the outfall requires a very comprehensive environmental evaluation and is very time consuming. Therefore, exfiltration wells will be used as the effluent disposal method until the outfall is constructed. (Exfiltration wells also will require that the secondary treated wastewater be filtered prior to well disposal.)

Collection and Conveyance System. The recommended collection and conveyance system, consisting of gravity sewers, force mains, and pump stations for the urban areas are shown in Figures I-2 and I-3. The approximate pipe diameters and pump station capacities also are depicted.

WWTP Facility. The proposed Waialua-Hale'iwa WWTP facility's site is located in Mokule'ia, within Waialua Sugar Company's Gay 2 cane field, south of Farrington Highway, and is found in parcel TMK 6-8-07 (see Figure I-2).

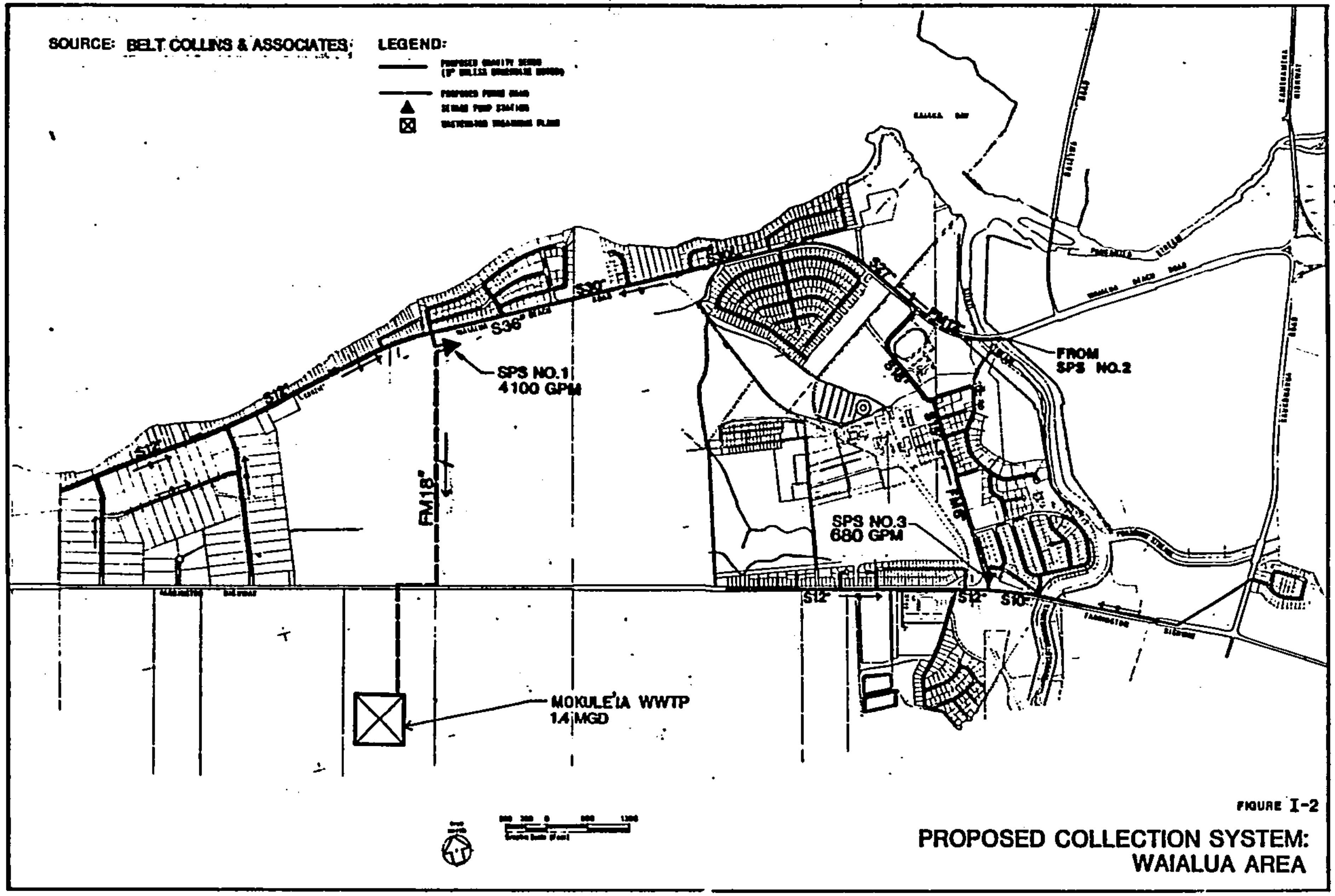


FIGURE I-2
PROPOSED COLLECTION SYSTEM: WAIALUA AREA

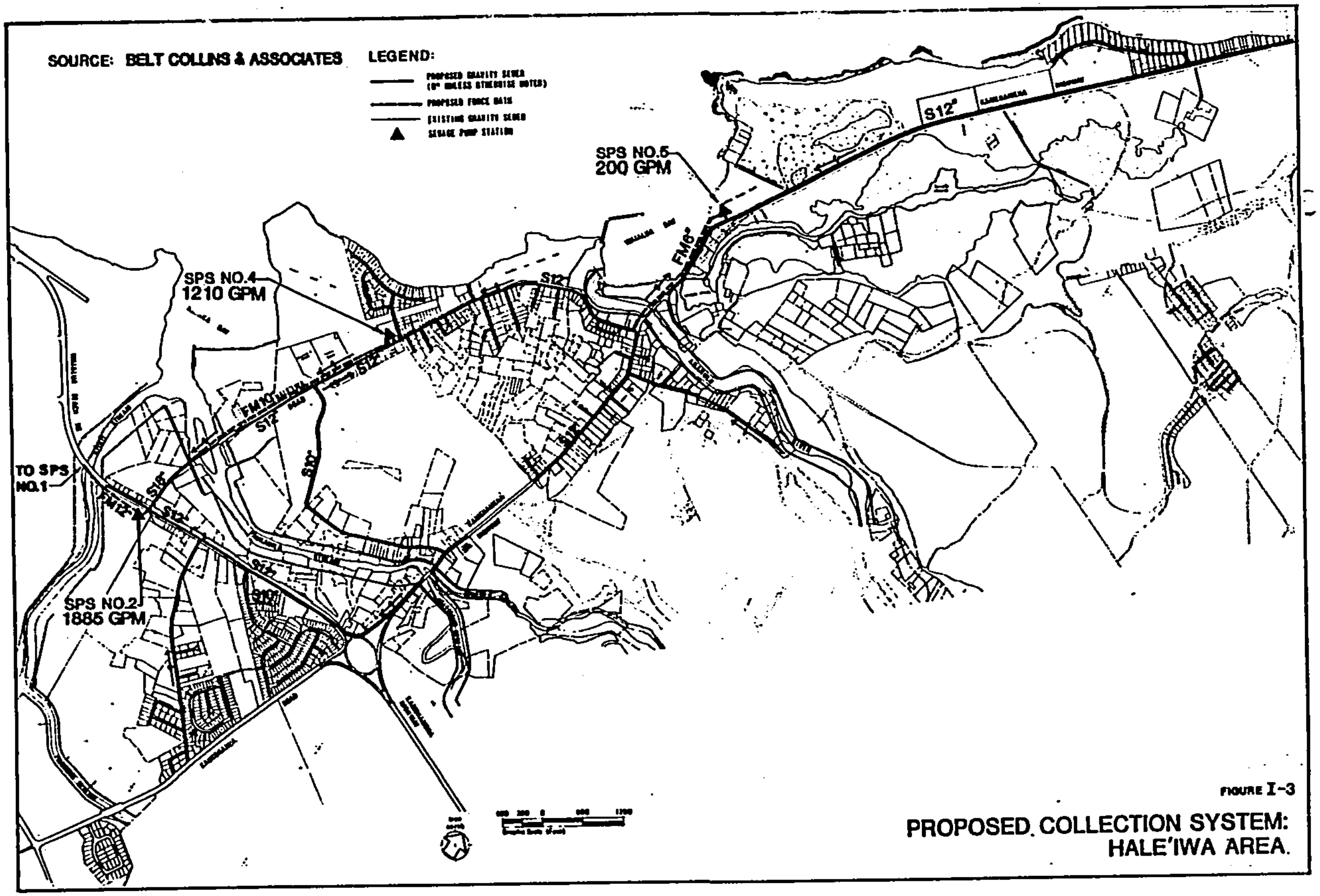


FIGURE I-3

PROPOSED. COLLECTION SYSTEM:
HALE'IWA AREA.

The proposed WWTP facility is comprised of the following treatment processes:

- Bar Screens and Aerated Grit Chamber;
- Rotary Screens;
- Pre-Aeration Basins;
- Sequential Batch Reactor (SBR);
- Interim Rapid Sand Filters;
- Interim Chlorination; and
- Exfiltration Wells/Ocean Outfall.

A process flow sheet of the proposed WWTP facility is shown schematically on Figure I-4.

The influent raw sewage will be coarsely screened, degritted and finely screened; by the bar screens, grit chambers, and rotary screens, respectively. Pre-aeration basins are proposed after the rotary screens for hydrogen sulfide (H_2S) stripping. The pre-aeration basin and aerated grit chambers will be covered to assist in the collection of the waste gases. The bar screens and rotary screens will be partially covered and air intake ducts will collect the air from these units. Provisions for chlorine injection at the headworks will be provided to oxidize aqueous H_2S in an attempt to limit downstream aqueous H_2S to less than 1 mg/L. Approximate chlorinator dosing capacity of approximately 280 pounds of chlorine to 470 pounds of chlorine per day is recommended based on oxidizing influent aqueous H_2S

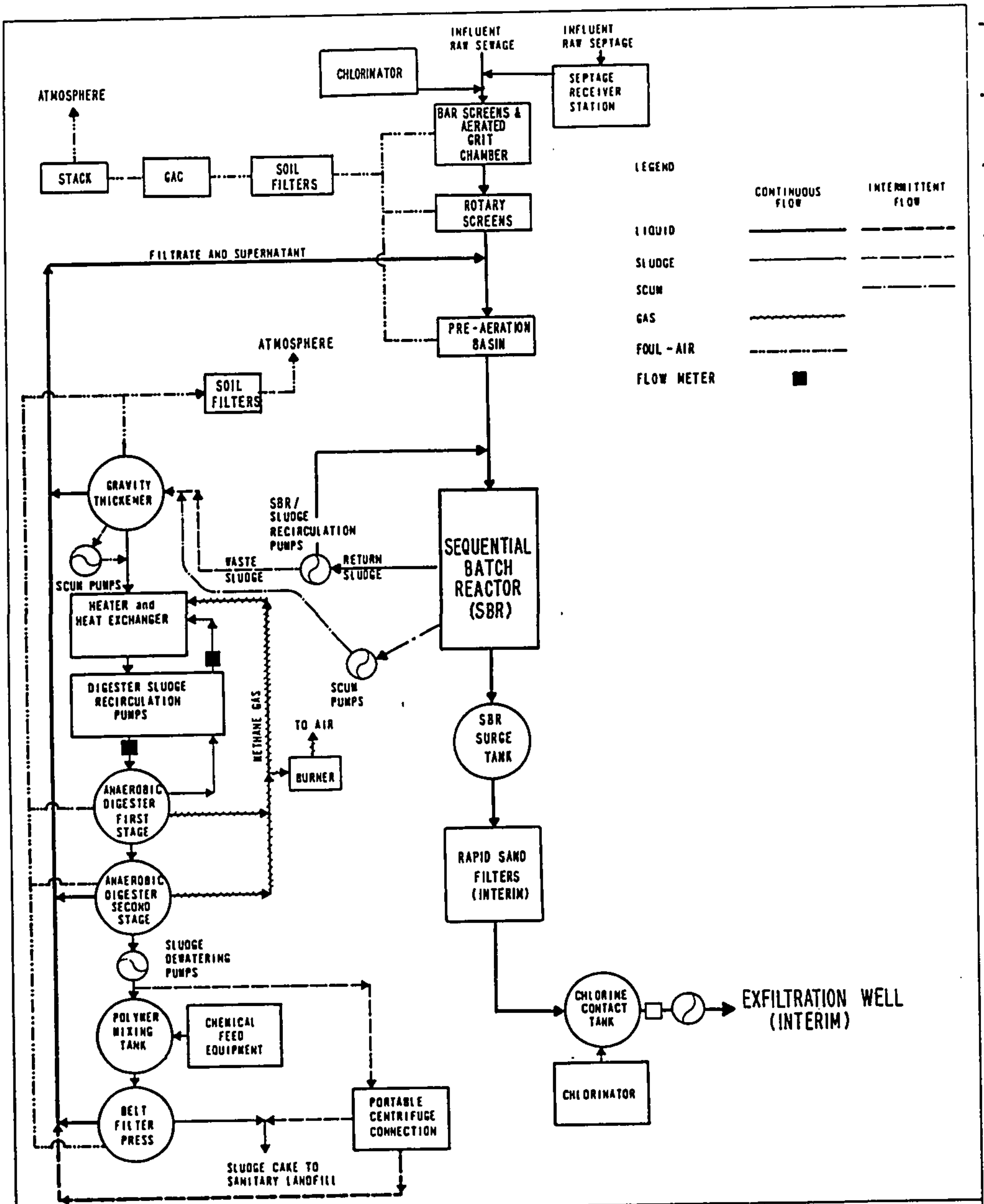
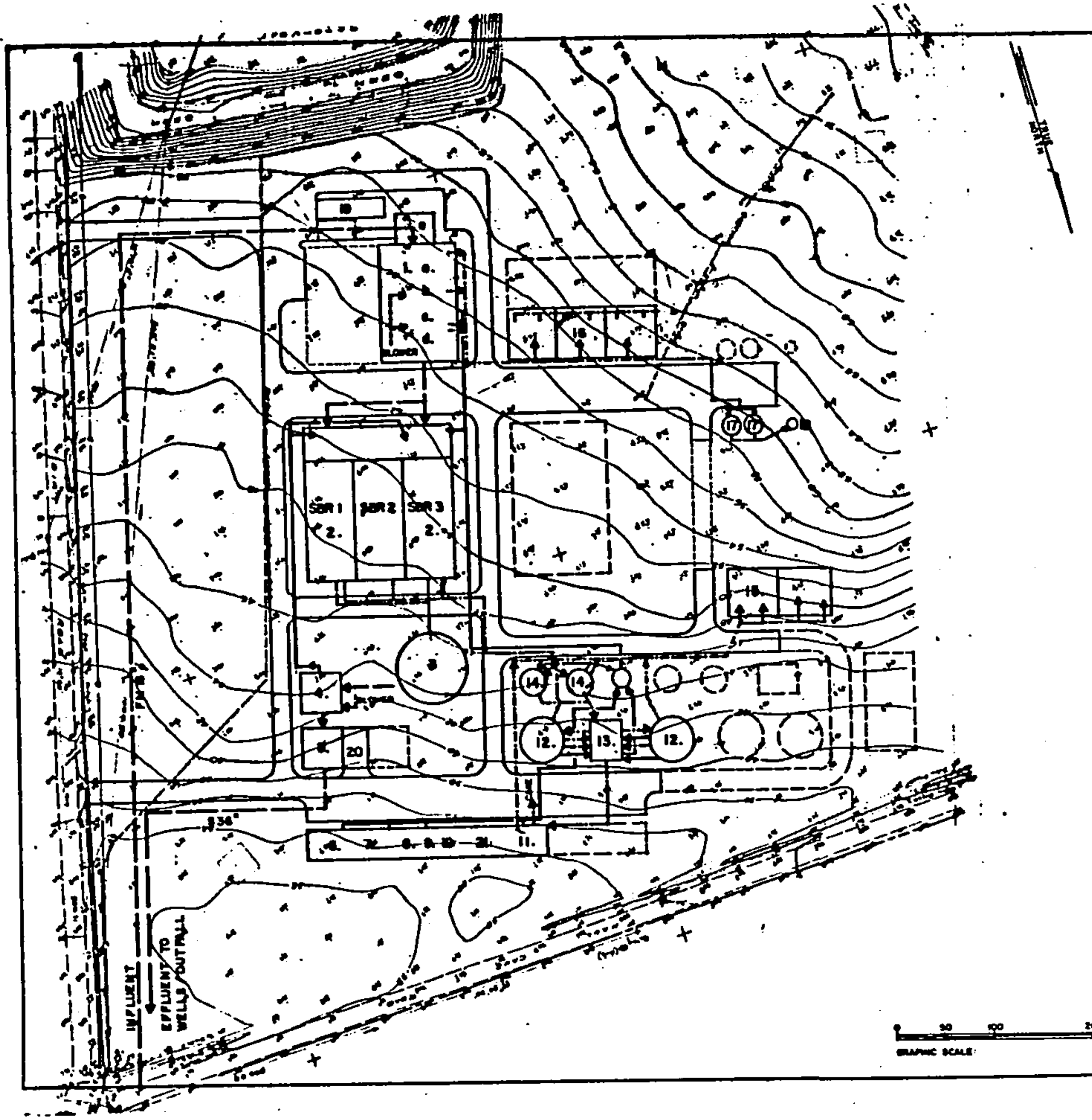


FIGURE I-4

TYPICAL SCHEMATIC PROCESS FLOW DIAGRAM FOR THE PROPOSED WAIALUA – HALE'IWA WWTP.

concentrations of 4 mg/L (as sulfur) and 6 mg/L (as sulfur) down to the 1 mg/L desired concentration. Following pre-aeration, the wastewater will gravity flow to the sequential batch reactors (SBP) for biological treatment and solids separation. During the initial operation of the treatment facility, the effluent from the SBR will be filtered, disinfected and disposed by exfiltration wells. Once the ocean outfall becomes operational, effluent will be chlorinated as required, and the filters and exfiltration wells will be removed from service and placed on an emergency standby basis. Figure I-5 shows the preliminary site layout of the proposed WWTP.

Effluent Disposal. Initially, the effluent from the WWTP will be disposed by exfiltration wells that are located on the oceanside of the UIC line, just south of Crozier Drive/Waialua Beach Road. The well field will be approximately 6 acres and accommodate 80 wells. Each well is designed to accept 100 gpm of filtered and chlorinated effluent. Well tests (pumping and injection tests) were conducted to obtain the necessary data for establishing the basis of design (Geolabs, 1987). In the meantime, the necessary permit/approvals will be sought to clear the way for the construction of the ocean outfall for long term effluent disposal. An initial study recommended that locating the outfall diffuser in the Kaiaka Channel at a depth of 80 feet would provide adequate dilution and dispersion of secondary treated wastewater (P.M. Towill, 1967). To achieve the required 80-foot depth, the outfall will extend approximately 3600 feet



WWTP FACILITY SITE LAYOUT

STRUCTURE SCHEDULE

1. PRELIMINARY TREATMENT BUILDING
   a. BAR SCREEN
   b. AERATED GRIT CHAMBER
   c. ROTARY FINE SCREEN
   d. PRE-AERATION BASIN
   e. PRECHLORINATION CONTACT BASIN
2. SEQUENTIAL BATCH REACTORS 1, 2 & 3
3. SEQUENTIAL BATCH REACTOR SURGE TANK
4. RAPID SAND FILTER
5. CL_2 CONTACT BASIN
6. OFFICE
7. CONTROL CENTER
8. SHOWER / TOILET
9. LABORATORY
10. GENERATOR
11. SLUDGE DEWATERING
    a. BELT FILTER PRESS
12. ANAEROBIC DIGESTER 1 & 2
13. PUMP AND HEATER BUILDING
14. GRAVITY THICKENERS 1 & 2
15. GRAVITY THICKENERS / ANAEROBIC DIGESTER
    2-SOIL FILTERS .5000 FT^2 (TOTAL)
16. ODOR CONTROL GREENHOUSE
    a. 3-SOIL FILTERS-7500 FT^2 (TOTAL)
17. GRANULAR - ACTIVATED CARBON 1 & 2
18. OFF - GAS STACK
19. PRECHLORINATION BUILDING
20. CHLORINATION BUILDING
21. MAINTENANCE SHOP

SEWER
SLUDGE
PROCESS AIR
SUPERNATANT
FOUL AIR
FUTURE EXPANSION BEYOND 1.4 MGD

GRAPHIC SCALE: 0 50 100 200

FIGURE I-5

PROPOSED 1.4 MGD WAIALUA-HALE'IWA WWTP FACILITY AT MOKULE'IA offshore. The wealth of accumulated data on existing operational outfalls (such as Sand Island, Mokapu, Hawaii Kai, Waianae, and Honouliuli) continues to provide valuable information on the inter-relationship that exists between the discharge of primary or secondary treated wastewater into the marine environment. Both of these factors, the R.M. Towill study and the ongoing performance of operational outfalls, led to the selection of the proposed outfall location (identical to the R.M. Towill recommendation). Additional detailed studies are needed to determine the exact outfall alignment, select design parameters, and to obtain the necessary permits/approvals. The approximate locations of the ocean outfall and exfiltration well field are shown in Figure I-6. (Note: A supplemental EIS pertaining to impacts directly related to the ocean outfall will be prepared upon completion of the supplemental oceanographic studies.)

Sludge Handling, Treatment, and Disposal. The sludge handling system will include gravity thickening, a two-stage anaerobic digestion process, followed by polymer conditioning prior to dewatering by a belt filter press. Disposal of the dewatered sludge will be to one of the City's sanitary landfill sites. At this time, it appears that the dewatered sludge will be disposed at the Kapaa landfill, which is approximately 40 miles from the WWTP site. A connection for a portable centrifuge will also be provided as a standby measure. The digester, thickener, and filter press supernatants will be recycled back to the headworks, as well as the centrate from the portable centrifuge.

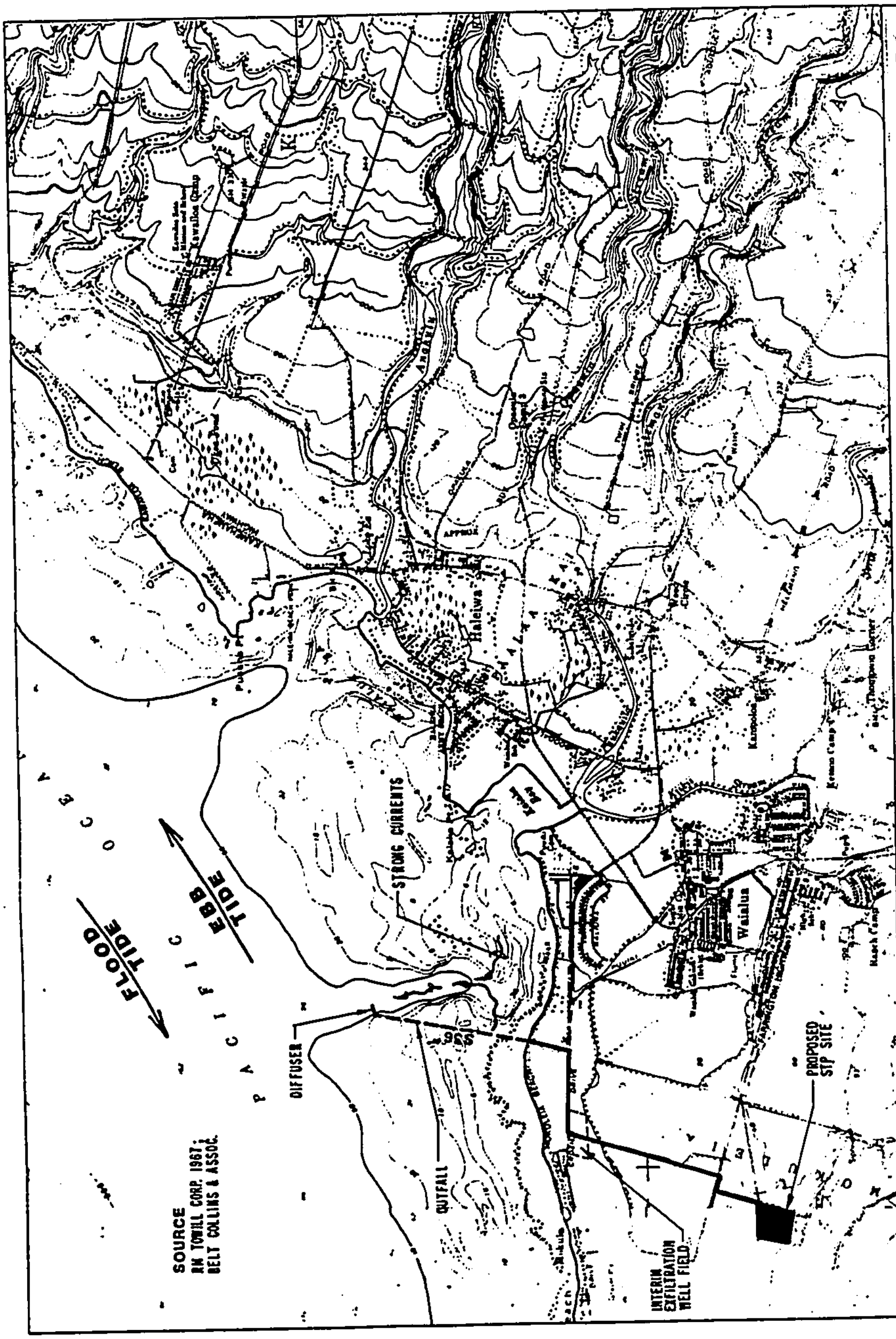


FIGURE I-6
OUTFALL AND INTERIM EXFILTRATION WELL FIELD LOCATIONS.

Septage Receiver Station. A septage receiving station at the front of the plant before the grit chamber and screens also is provided. The receving station will be sized such that the septage collected over a day's period may be slowly fed into the system for treatment. As it is fed into the inflow, the septage will be degritted, screened, and allowed to aerate with the influent before entering the treatment system.

Support Facilities. Support facilities will primarily be contained in several buildings, one of which will house office, laboratory, personnel room, generator, controls, and a miscellaneous storage area. SBR pumps and blowers will be located with the SBR tanks. Sludge transfer pumps and digester heaters and controls will be located by the gravity thickeners and anaerobic digesters. The chlorinators will be located in separate buildings, one is adjacent to the chlorine contact tank and the second is adjacent to the preliminary treatment building.

Odor Control. All wastewater treatment facilities, regardless of how well the plant is designed, operated and maintained, will emit some odors. Usually, the undesirable odors are caused by hydrogen sulfides, mercaptans, skatoles, indoles and amines, all by-products of anaerobic biodegradation. The intensity of odors generated depends on site specific conditions.

The recommended odor control management plan will to control odors with a combination of up-stream controls and foul-gas scrubbing at the WWTP. Chlorine injection at the headworks also is recommended.

At the present stage of planning, it is difficult to predict the severity of odors which will be emanating from the proposed wastewater collection and treatment facility. The specific odor control management practice should be developed based on actual site specific data. The selection of soil filters, as the primary foul-gas scrubbing unit, is limited to smaller air flow rates (less than 5,000 cfm) or when no restrictions are placed on land availability and climatic conditions. The review of literature and consultation advice indicates that soil filters alone would be sufficient and that Hawaii's climate definitely would be an added benefit. However, as a conservative measure, a greenhouse over the soil filters and granular-activated carbon (GAC) units have been included. Condensation and heating equipment also are recommended to control condensate formation and fouling of the GAC units. GAC units are recommended for the preliminary treatment building foul-gas system. The recommended gravity thickener and anaerobic digester foul-gas treatment system would consist only of soil filters because of its small airflow rate (500 cfm) and intermittent use. A greenhouse also has been provided should the filters require a subsequent polishing step. Heaters in the off-gas stack also are recommended to consistently elevate and effectively disperse the treated gas under variable climatic or atmospheric conditions.

1.3 IMPLEMENTATION SCHEDULE

The three major steps involved with the implementation of this project are: (1) Preliminary Engineering Report (includes the ocean outfall studies), (2) Step 2 - Plans and Specifications, and (3) Construction. The service area has been broken down into smaller improvement districts and are listed in order of priority - those areas that exhibit poorly-operating cesspools and/or that threaten to contaminate the groundwater or coastal waters being serviced in the earlier phases of construction. (See Figures I-7 and I-8 for improvement districts.) The tentative schedule of events to implement the proposed action is chronologically listed in Table I-2.

Incremental installation of the collection and conveyance system has been planned to allow construction to progress as funds becomes available. This allows distribution of the cost of the system over a period of years.

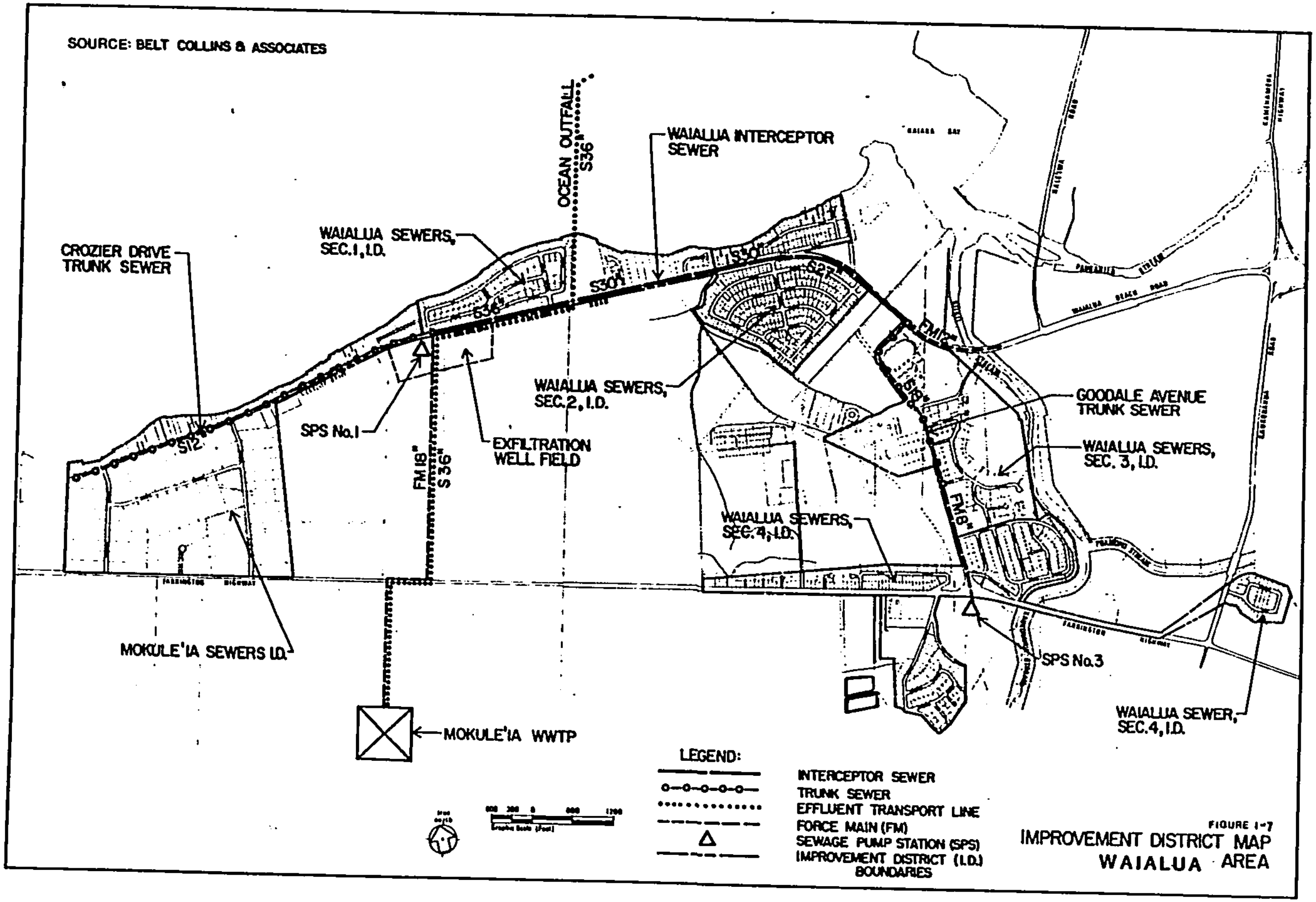


FIGURE I-7
IMPROVEMENT DISTRICT MAP
WAIALUA AREA

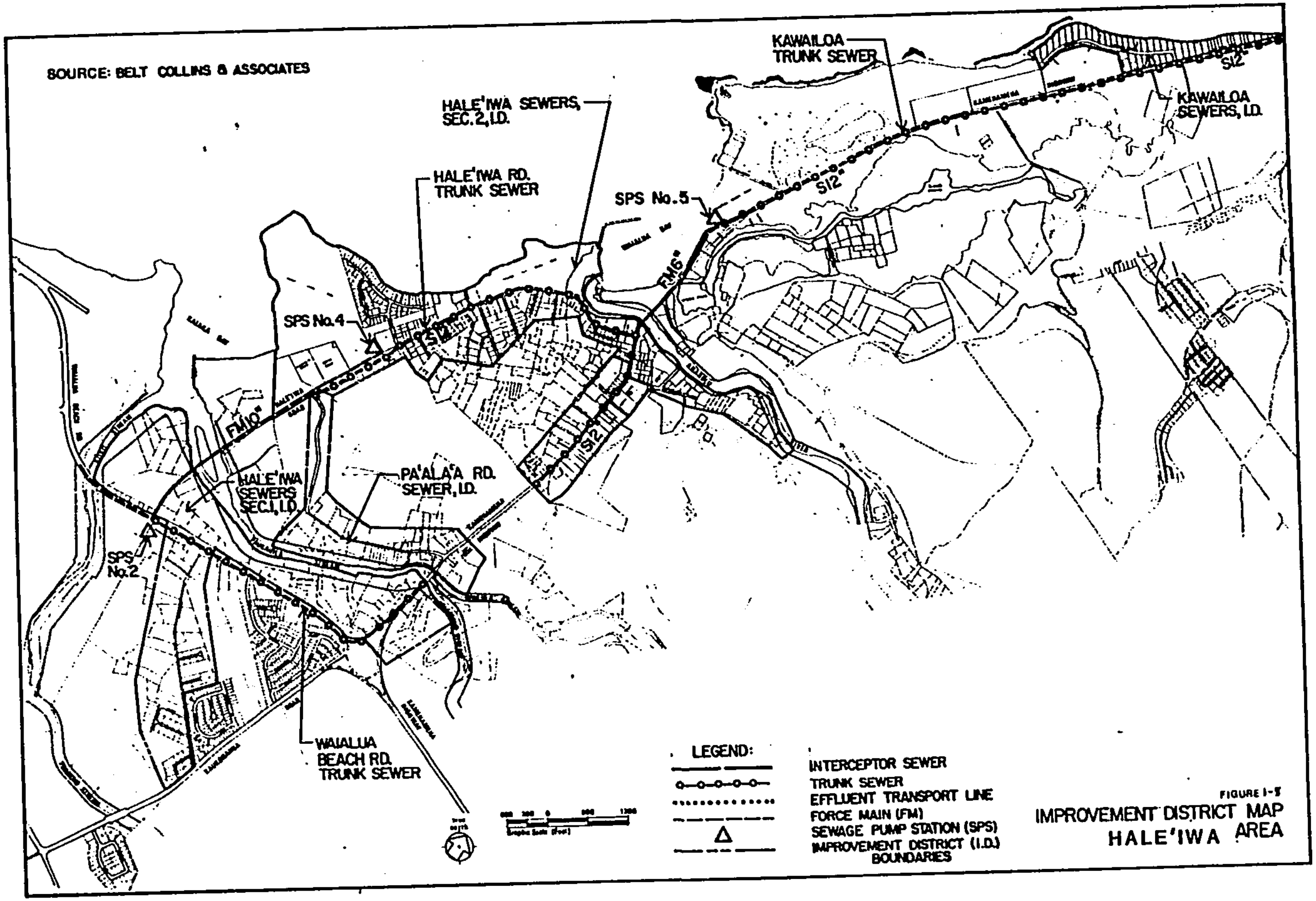

SOURCE: BELT COLLINS & ASSOCIATES
KAWAILOA TRUNK SEWER
S12"
KAWAILOA SEWERS, I.D.
HALE'IWA SEWERS, SEC. 2, I.D.
HALE'IWA RD. TRUNK SEWER
SPS No. 5
FM6"
SPS No. 4
S12"
FM10"
HALE'IWA SEWERS SEC. 1, I.D.
PA'ALA'A RD. SEWER, I.D.
SPS No. 2
WAIALUA BEACH RD. TRUNK SEWER
LEGEND:
INTERCEPTOR SEWER
TRUNK SEWER
EFFLUENT TRANSPORT LINE
FORCE MAIN (FM)
SEWAGE PUMP STATION (SPS)
IMPROVEMENT DISTRICT (I.D.) BOUNDARIES
FIGURE I-5
IMPROVEMENT DISTRICT MAP
HALE'IWA AREA

Table I-2. Implementation and Funding Priority List.

Priority	Item	Quantity	Construction Cost[a] ($1000)	Implementation Dates (FY)	Additional Comments
I	PRELIMINARY ENGINEERING REPORT	--	--	--	To be completed by FY 91.
II	STEP 2 - PLANS AND SPECIFICATIONS	--	--	--	To be completed by FY 93.
III	STEP 3 - CONSTRUCTION	--	--	--	Construction begins FY 94.
1	Mokule'ia WWTP and Disposal System, Increment 1 (40 exfiltration wells)	LS	14,700	1994	
2	SPS No. 1 and Force Main 18-inch force main	LS	2,834	1995	
3	Waialua Interceptor Sewer 27-, 30- and 36-inch pipe, in place complete, including manholes, paving, backfilling, etc.	7,400 lf	2,769	1996	
4	Waialua Sewers, Sec. 1, I.D. 8- and 10-inch pipe, in place complete, including manholes, paving, backfilling, etc.	7,300 lf	929	1996	
5	Waialua Sewers, Sec. 2, I.D. 8- and 10-inch pipe, in place complete, including manholes, paving, backfilling, etc.	12,750 lf	1,630	1997	
6	Goodale Avenue Trunk Sewer	1,700 lf	489	1998	

Table I-2. Implementation and Funding Priority List. (continued)

Priority	Item	Quantity	Construction Cost[a] ($1000)	Implementation Dates (FY)	Additional Comments
7	Waialua Sewers, Sec. 3, I.D. 8- and 15-inch pipe, in place complete, including manholes, paving, backfilling, etc.	9,200 lf	1,309	1998	
8	SPS No. 3 and Force Main 8-inch force main	LS	1,143	1998	
9	Waialua Sewers, Sec. 4, I.D. 8-, 10- and 12-inch pipe, in place complete, including manholes, paving, backfilling, etc.	23,100 lf	3,351	1999	
10	Mokule'ia WWTP and Disposal System, Increment 2 (40 exfiltration wells)	LS	12,800	1999	
11	SPS No. 2 and Force Main 12-inch force main	LS	1,771	2000	
12	Waialua Beach Road Trunk Sewer 12-inch pipe, in place complete, including manholes, paving, backfilling, etc.	7,900 lf	1,708	2000	
13	Hale'iwa Sewers, Sec. 1, I.D. 8- and 10-inch pipe, in place complete, including manholes, paving, backfilling, etc.	9,400 lf	1,194	2000	

Table I-2. Implementation and Funding Priority List. (continued)

Priority	Item	Quantity	Construction Cost[a] ($1000)	Implementation Dates (FY)	Additional Comments
14	SPS No. 4 and Force Main 10-inch force main	LS	1,591	2002	
15	Hale'iwa Road Trunk Sewer 12- and 15-inch pipe, in place complete, including manholes, paving, backfilling, etc.	7,450 lf	1,579	2002	
16	Hale'iwa Sewers, Sec. 2, I.D. 8-inch pipe, in place complete, including manholes, paving, backfilling, etc.	11,100 lf	1,404	2002	
17	Pa'ala'a Road Sewer, I.D. 8- and 10-inch pipe, in place complete, including manholes, paving, backfilling, etc.	4,100 lf	629	2003	
18	SPS No. 5 and Force Main 6-inch force main	LS	807	2003	
19	Kawailoa Trunk Sewer 12-inch pipe, in place complete, including manholes, paving, backfilling, etc.	8,800 lf	1,822	2003	
20	Kawailoa Sewers, I.D. 8-inch pipe, in place complete, including manholes, paving, backfilling, etc.	3,500 lf	443	2003	

Table I-2. Implementation and Funding Priority List. (continued)

Priority	Item	Quantity	Construction Cost[a] ($1000)	Implementation Dates (FY)	Additional Comments
21	Crozier Drive Trunk Sewer 12-inch sewers, in place complete, including manholes, paving, backfilling, etc.	5,300 lf	1,097	2004	
22	Mokule'ia Sewers, I.D. 8-inch sewers, in place complete, including manholes, paving, backfilling, etc.	6,500 lf	822	2004	

[a] Construction Cost includes 15% contingency.

Note: Construction steps shall be installed as funds become available.

II. DESCRIPTION OF ALTERNATIVES

CHAPTER II

DESCRIPTION OF ALTERNATIVES

2.1 INTRODUCTION

This chapter includes brief descriptions of the various alternatives available for correcting wastewater related problems and deficiencies identified in the planning area. This chapter has been organized to include a review of the general requirements for all wastewater treatment works followed by identification and evaluation of the types of technologies available for collecting, treating, and disposing of the wastewater and by-products (such as sewage sludge and spent chemicals). A description and discussion of the selected wastewater management scheme is included in the last portion of this chapter.

2.2 GENERAL REQUIREMENTS FOR ALL WASTEWATER TREATMENT SYSTEMS

All wastewater systems must perform four primary functions. First, wastewater must be <u>collected</u> from the point of generation (i.e., houses, businesses, and industries) and transported to a location for treatment and disposal. Second, wastewater must be <u>treated</u>, i.e., remove pollutants and other undesirable constituents, to a level such that it can be disposed of without creating health, environmental, or aesthetic problems. Third, it must dispose of the treated effluent to receiving body of water in a safe and environmentally sound manner. Finally, they must provide for the safe disposal of the solid residuals of the treatment process (e.g., sewage sludge, chemicals, etc.).

2.3 CENTRALIZED WASTEWATER SYSTEMS

The centralized wastewater system (CWS) alternative evaluated the requirements needed to treat wastewater, generated in the Waialua-Hale'iwa planning area, at a single centralized WWTP. CWS requires a collection and conveyance system (gravity sewers, force mains, and pump stations) to transport wastewater to a wastewater treatment plant (WWTP). The technical and economic feasibility of CWS has always been related to the population density to be sewered. Naturally, the higher population density of developmental areas which CWS serve, the lower the cost per unit served.

In this regard, only those parts of the Waialua-Hale'iwa District which lie within the urban core, as shown in Figures II-1 and II-2, were considered for connection to the centralized WWTP. The low density urban fringe areas were not sewered because of the high costs, low population density and low potential for environmental impact.

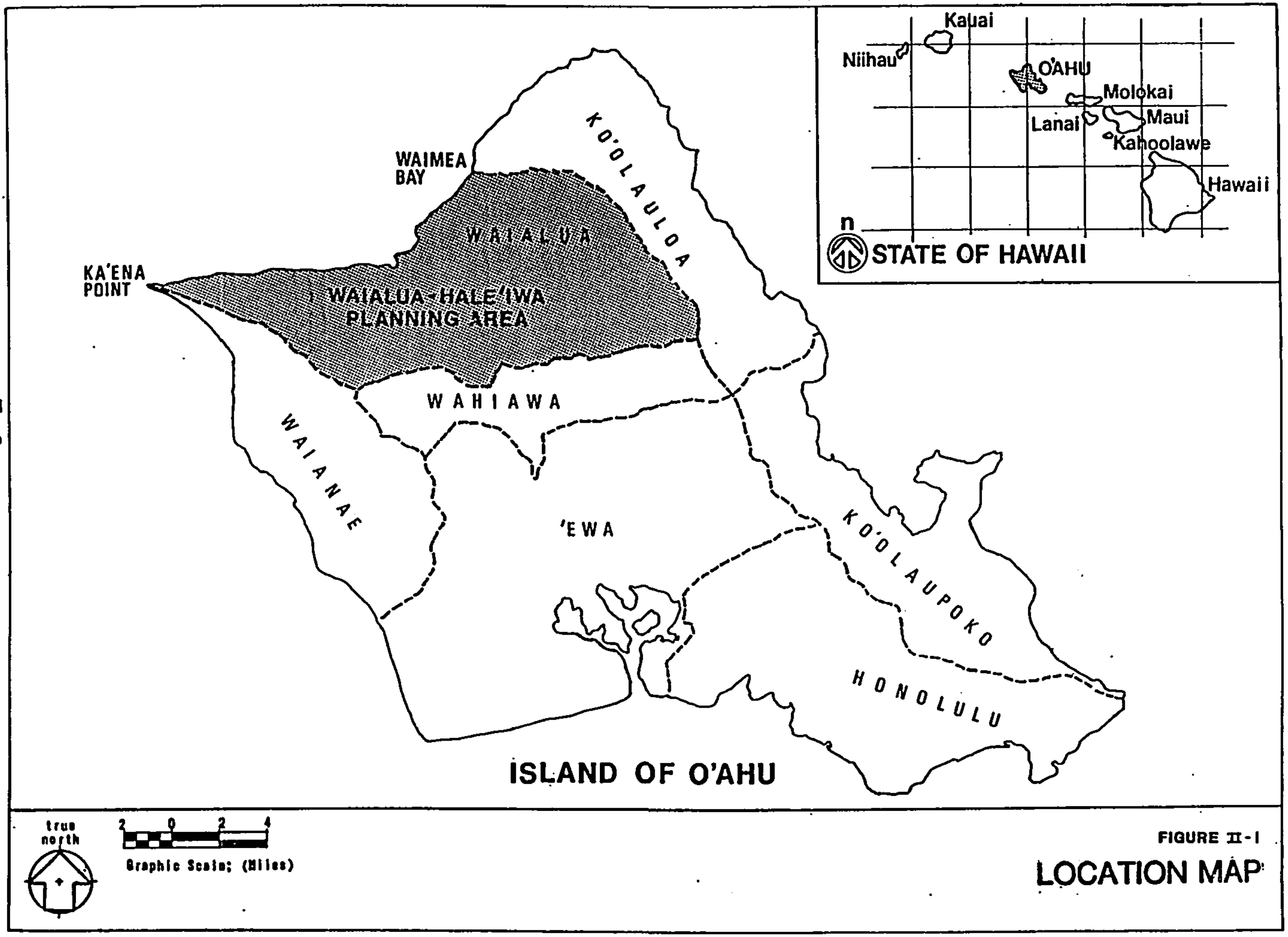


FIGURE II-1
LOCATION MAP

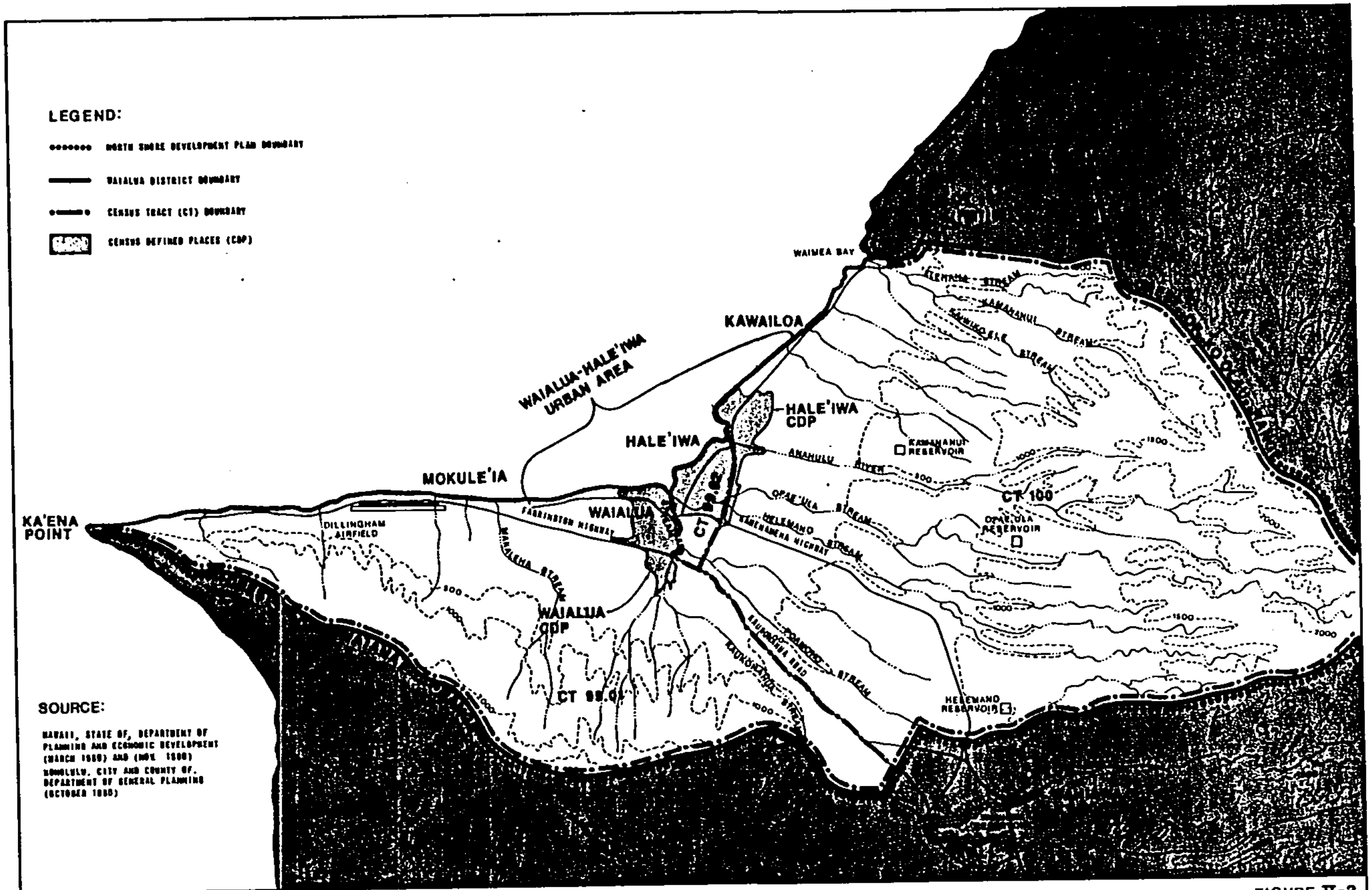


FIGURE II-2

RELEVANT PLANNING AND STATISTICAL AREA BOUNDARIES

2.3.1 Collection System

There are three proven types of collection systems. In gravity systems, wastewater is carried through a pipe network from its point of origin to a wastewater treatment plant. This is the type of system most commonly used on Oahu.

Low pressure collection systems utilize individual grinder pumps at each household connection to macerate large particles, thereby making it feasible to use smaller-diameter pipes without the threat of clogging. This approach has the advantage of lower initial capital costs as compared to gravity systems. However, such systems involve more mechanical equipment and, consequently, higher operation and maintenance costs and responsibilities. Low pressure systems also tend to be less reliable than gravity systems while costing about twice as much to operate.

Vacuum collection systems employ a central vacuum source to draw sewage through the pipes. A special valve isolates each household from the remainder of the system. The advantage of vacuum collection is that it reduces the volume of wastewater generated within each household, but such systems are even more expensive to construct, operate, and maintain than are low pressure systems, and they are less reliable.

For the Waialua-Hale'iwa area, low pressure and vacuum systems involve higher construction, operation, and maintenance costs than gravity systems without offering significant offsetting benefits. Consequently, all of the centralized wastewater treatment alternatives evaluated in depth rely on gravity collection.

2.3.2 Treatment Systems

Wastewater treatment plants contain several distinct unit processes, each of which performs a particular treatment function (e.g., separation of solids, removal of soluble organic materials, solids handling, and disinfection). Table II-1 summarizes the types of treatment units which were evaluated for the Waialua-Hale'iwa area. Based on an analysis of the volume and type of sewage generated in the study area and considering the intent to dispose of treated effluent initially through exfiltration wells and ultimately through an ocean outfall, the system portrayed graphically in Figure II-3 was tentatively selected as the most appropriate. This treatment scheme was utilized for all alternatives involving a centralized wastewater treatment plant (see Section 2.6).

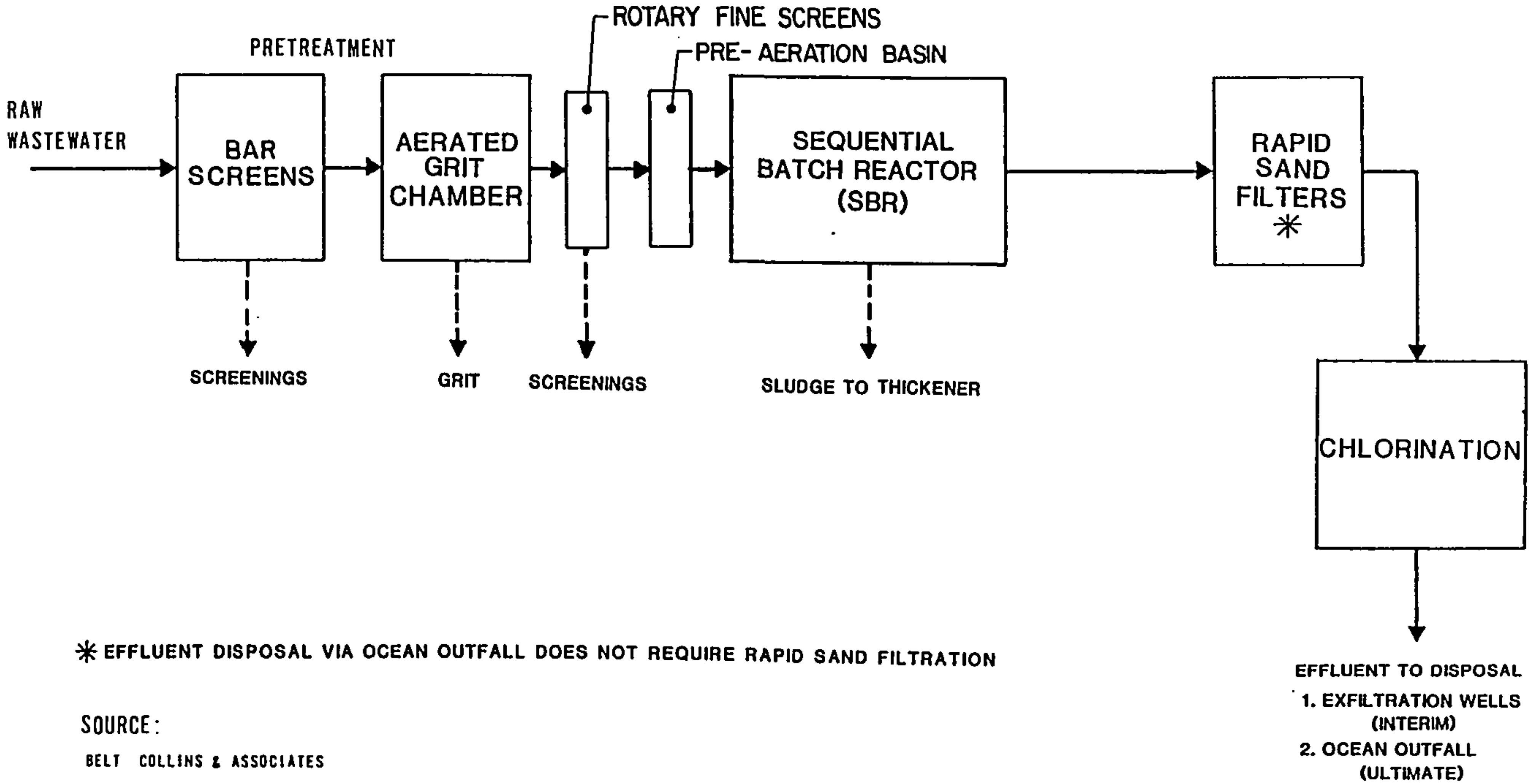
2.3.3 Effluent Disposal System

Treatment processes are typically designed to provide a level of treatment appropriate for the disposal method that will

Table II-1. Treatment Units Most Suitable for Centralized Wastewater Systems in the Waialua-Hale'iwa Area.

Treatment Type	Treatment Unit
Preliminary:	(1) Mechanically Cleaned Bar Screen (2) Comminutor (3) Mechanical Grit Chamber (4) Aerated Grit Chamber (5) Static Screen (6) Flow Equilization
Primary:	Primary Clarifier
Advanced Primary:	Dissolved Air Flotation
Secondary:	(1) Low-Rate Trickling Filter with Rock Media (2) Conventional Activated Sludge with Diffused Aeration (3) High-Rate Trickling Filter with Rock Media (4) Packed-Bed Trickling Filter with Plastic Media (5) Rotating Biological Contactors
Secondary Clarification:	Conventional Secondary Clarifier
Combined Primary and Secondary:	(1) Facultative Lagoons (Stabilization Ponds (2) Oxidation Ditch
Combined Flow Equilization, Primary, Secondary and Secondary Clarifier:	Sequential Batch Reactor
Disinfection:	(1) Clorination (2) Ozonation

Source: Belt Collins & Associates



* EFFLUENT DISPOSAL VIA OCEAN OUTFALL DOES NOT REQUIRE RAPID SAND FILTRATION

SOURCE:
BELT COLLINS & ASSOCIATES

FIGURE II-3

WASTEWATER HANDLING SCHEME FOR 1.4 MGD PLANT (ALTERNATIVE I) be used. In developing the alternatives for the Waialua-Hale'iwa Wastewater Treatment Facilities Plan, five different disposal possibilities were evaluated: ocean outfall, injection/exfiltration wells, irrigation reuse/land application, stream discharge, and infiltration/percolation ponds.

Initial evaluation of these alternatives indicates that irrigation reuse/land application, stream discharge, and infiltration/percolation ponds would not be viable long-term effluent disposal alternatives for this case. The basis for this judgement is summarized in Table II-2.

Of the two remaining effluent disposal alternatives, it was determined that an ocean outfall would provide the most reliable long-term disposal. A preliminary study conducted by the R.M. Towill Corporation (1967) places the outfall at the 80-foot contour in the Kaiaka Channel, approximately 3600 feet offshore. The design of the outfall cannot be based solely on the findings and results of the 1967 report. Additional detailed oceanographic studies must still be conducted to update and expand on the 1967 report, and to provide accurate design information. In addition, a supplemental EIS would have to be prepared to discuss the impacts specifically related to the constrution and operation of the ocean outfall.

While these supplemental studies and the supplemental EIS are being prepared, it is recommended that exfiltration wells be constructed and utilized. The use of exfiltration wells would allow construction and operation of the initial phases of the wastewater treatment plant to proceed without the outfall disposal system being in place.

Well tests conducted at the well field site indicate that each well should have a design disposal capacity of approximately 100 gallons per minute. The use of exfiltration wells, however, is not recommended as the ultimate long-term disposal method primarily since performance of disposal wells indicate that the disposal capacity of wells may slowly diminish over time.

2.3.4 Sludge Treatment and Disposal

The solids removed during the course of treating the wastewater is collected thickened, stabilized, conditioned, and dewatered before it is safely disposed of in a sanitary landfill. After reviewing available technology, it was determined that the sludge handling schemes shown in Figure II-4 would be the most appropriate for the respective flow conditions. Anaerobic digestion could not be economically justified at flows of 1 mgd or smaller and therefore aerobic digestion was selected for the 0.4 mgd and 1.0 mgd alternatives. The aerobically digested

Table II-2. Summary of Reasons Why Other Effluent Disposal Methods Were Not Recommended.

Effluent Disposal Method	Reasons Why Disposal Method Was Considered Inappropriate
1. Crop Irrigation	1. In this effluent disposal alternative, effluent would be used for the irrigation of crop lands (i.e. sugarcane or California grass). In general, disposal of effluent through the use of irrigation requires the construction of a large holding pond and a complete backup disposal system for storage and disposal of effluent during periods when effluent cannot be utilized. Additional land area would be required in order to accommodate these storage and backup disposal requirements. This option may also require the purchase of additional land area (if irrigation of a crop other than sugarcane is selected). The potentially large amount of land areas that would have to be purchased by the City (between 5 and 130 acres) and the inconsistent rate of demand for the effluent make this alternative less desirable than the ocean outfall option. The uncertainty of the long term viability of the sugar industry makes disposal of effluent via sugarcane irrigation questionable, especially as a long term disposal alternative.
2. Effluent Disposal in Streams	2. It is the policy of the Department of Health to discourage effluent discharges to streams. In the present instance, the water quality in streams in the Waialua-Hale'iwa area appears already to exceed state water quality standards. Hence, stream discharge was deemed impractical.
3. Infiltration/ Percolation Ponds	3. In this disposal method, treated effluent is piped into an unlined pond and allowed to percolate through the bottom. It would require about eight acres of land, but is extremely inexpensive to construct and operate. Such ponds are likely sources of odors and mosquitoes, tend to clog due to algae growth, and require regular maintenance. Largely because of the environmental problems associated with them, they were judged unacceptable for the Waialua-Hale'iwa area.

Source: Belt Collins & Associates

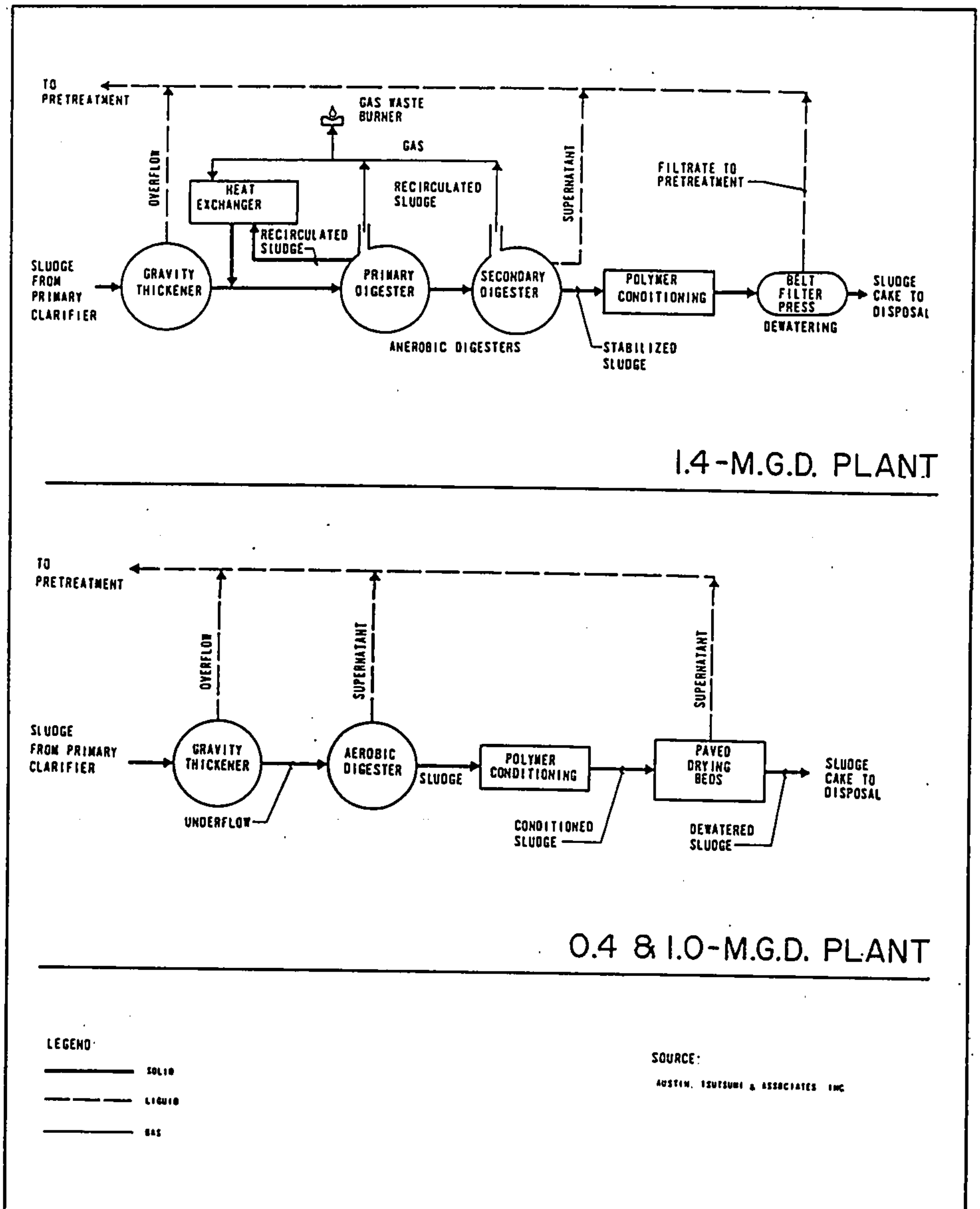


FIGURE II-4

ALTERNATIVE SLUDGE HANDLING SCHEMES

sludge requiring the selection of paved drying beds over the belt filter press for the smaller plants, 0.4 mgd and 1.0 mgd.

2.3.5 Odor Control Systems

The evaluation of literature and communication with experienced personnel suggests that air stream treatment will be necessary regardless of the liquid stream control techniques employed. Minimizing the amount of sulfates that enter the waste stream would assist in reducing the amount of H_2S generated; however, this is virtually impossible when sewers are laid along the coastal areas where the water table is sufficiently high enough to allow water to infiltrate into the gravity sewers.

The selection of an odor control system also becomes complicated with the proposed DOH ambient H_2S air quality standard of 0.1 ppm_v (139 ug/m^3).

Upstream treatment methods can also be utilized. The three most effective chemicals for upstream treatment are chlorine, sodium hydroxide, and iron compounds. Chlorine injection oxidizes aqueous H_2S. Sodium hydroxide injection attempts to destroy the micro-organisms responsible for generating H_2S. However, sodium hydroxide slugging requires special wastewater handling, at the WWTP, from its resulting high pH. Iron, either as ferric chloride of ferric nitrate (ferrous ions also can be used), will react with H_2S to form an iron sulfide precipitate which is no longer able to be stripped into the atmosphere. However, iron compounds are not readily available in bulk quantities here in Hawaii. At this point in time, it is recommended that field monitoring and testing be conducted after the conveyance system is installed to determine the most appropriate chemical.

An evaluation of available air pollution technology for controlling odors emanating from sewage pump stations and WWTP showed that the primary mechanisms most appropriate in reducing hydrogen sulfied (H_2S) emissions consisted of chemical, biological, or a combination of both. Chemical methods include granular-activated carbon (GAC) absorption, chemical solubilization (NaOH), and chemical oxidation (chlorine, hydrogen peroxide, metal catalysis reactions, etc.). Biological oxidation of H_2S and other organic off-gases is usually accomplished by diffused air biological reactors or packed-bed reactors with the latter being the preferred biological alternative.

Another technology, which utilizes both chemical and biological processes is a soil filter. Soil filters are widely used in Seattle, Washington, Sweden, Finland, and Australia and have performed excellently in controlling odors. Seattle's soil filters have been performing adequately throughout its 18-year history. They are especially suited for smaller air flow rates and where land is readily available. The primary advantage of soil filters is the low operating cost as compared to the chemical scrubbers and GAC units. Removal efficiencies of soil filters have been extremely effective achieving performances equal to or greater than other comparable processes and effluent gases have been below threshold concentrations.

The alternatives that were evaluated consisted of API's LOCAT scrubber (Iron-chelate), Calverts CGAS scrubber (atomizing mist scrubber), GAC column, and the soil filter systems. The problems operators experience with chemical scrubbers required a second look at these systems although their removal efficiencies (when operating properly) are very high. GAC units are highly discouraged as the primary (or only) odor control process because of the difficulty and operating expense required in rejuvenating spent GAC and should only be considered for smaller air flow rates (less than 1000 cfm) and relatively low concentrations of H_2S (<1 ppm_v).

A cost comparison was conducted, analyzing 4 system alternatives, in treating a foul-gas stream with a flow rate of 2000 cubic feet per minute and a H_2S concentration of 50 ppm_v. Three alternatives require two treatment steps while the fourth only employs soil filters. A summary of the present worth cost of each alternative is presented in Table II-3 on the following systems:

Table II-3. Present Worth Cost Analyses of Odor Control Systems.[a]

System	Capital $	Annual O & M $	Present[b] Worth O & M $	Present Worth Cost $
ARI LOCAT - GAC	1,420,000	185,000	1,904,000	3,324,000
Calvert CGAS - GAC	1,350,000	146,000	1,503,000	2,853,000
Soil Filters 2 + 2 standby	380,000	30,000	309,000	689,000
Soil Filters - GAC w/Greenhouse	2,410,000	65,000	669,000	3,079,000

[a]Design Basis: Qair = 2,000 cfm, H_2S in = 50 ppm_v, 1986 dollars.

[b]Present Worth Factor = 10.292 (i = 7-3/8%, n = 20 yrs.)

1. ARI-LOCAT/GAC system;
2. Calvert-CGAS/GAC system;
3. Soil filters; and
4. Soil filters/GAC system.

The results of the cost analysis clearly favors soil filters. However, the limited knowledge and experience in the design and operation of these filters in Hawaii makes it difficult to justify without additional documentation. Soil filters are common, however, Hawaii's exposure to it has been limited. The applicability of soil filters for odor is very promising especi- ally when air flow rates are less than 5,000 cfm. Soil filters eliminate essentially all odor causing gases virtually to levels below threshold concentrations.

A conservative approach will be taken in this report on the selection of odor control systems. For air flows of 5,000 cfm or less a combination of soil filters followed by GAC polishing is proposed. Air flow rates greater than 5,000 cfm (PBTF system) the Calvert CGAS scrubber followed by GAC is proposed. The ARI LOCAT system is not proposed because of the uncertainty in the life of the GAC units which depend on the ARI LOCAT performance efficiency. This observation is based on its higher present worth cost (see Table II-3), LOCAT's scrubbing only H_2S and not the volatile organic gases, and the operational problem of condensate formation in the effluent gas stream fouling the GAC units.

The proposed odor control unit for the sewage pump stations (SPS) consists of GAC canisters (35-gallon to 55-gallon canisters) to scrub odorous gases generated or released in the wet well. An emergency ventilation unit also will be provided should maintenance be required in the wet well. Upstream chemical injection, to reduce the loading to the GAC canisters at the wet well, is proposed.

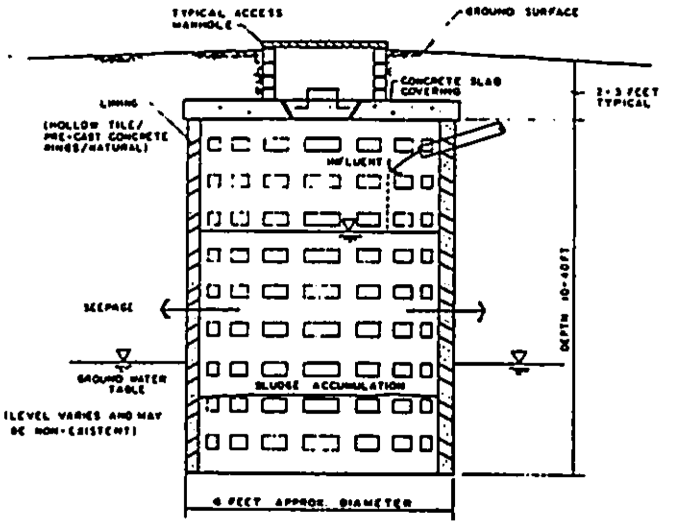
2.4 INDIVIDUAL WASTEWATER SYSTEMS

As previously stated, individual treatment systems (IWS) collect, treat, and dispose household or domestic wastewater where it is generated provided the flows does not exceed 800 gpd. Cesspools, as well as more sophisticated systems, fall into this category, but the level of pollutant removal which occurs in cesspools is relatively low. Except for the 307 units in the Pa'ala'a Kai Subdivision, all of the development in the Waialua-Hale'iwa planning area is now served by private sewage treatment plants (STP) and such IWS. Wastewater from Pa'ala'a Kai is now collected in a small gravity system, treated, and disposed of through injection wells situated adjacent to the plant.

Cesspools are the most common type of individual units found in the planning area. They are usually 6- to 8-foot diameter pits approximately 30 feet deep and typically have concrete covers (see Figure II-5, box A). Cesspools retain most solids from the wastewater and allow a small amount of decomposition to occur; however, the concentrations of dissolved pollutants remain high. Cesspools do not function well in soils with low permeability or where there is a high water table. Moreover, they tend to "fail", i.e., lose their ability to dispose of the liquid wastewater, after continued use, since the solids within the cesspool eventually clog the soil's pore spaces. Proper construction, usage, and care can extend the life of

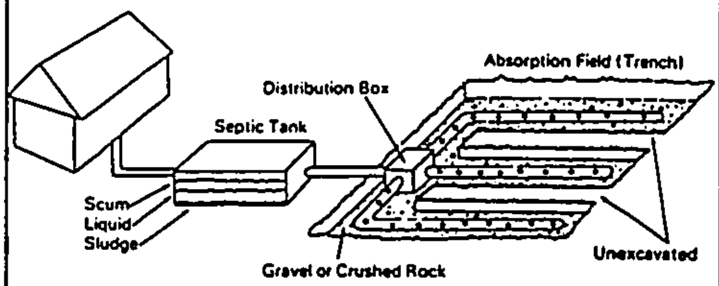
A. Cesspool

Liquid flows to a pit that is a metal tank with holes, or formed by open-jointed stone, brick, or hollow tile. In areas with a stable soil structure, there may be no walls at all. Degradation of solids occurs in an aerobic sludge layer and clarified liquid seeps through walls.



B. Septic Tank and Soil Absorption Field (Trench)

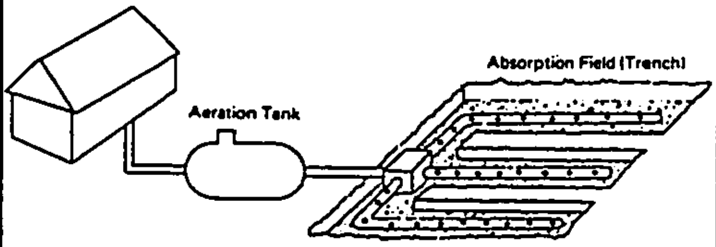
Sewage bacteria break up some solids in tank. Heavy solids sink to bottom as sludge. Grease & light particles float to top as scum. Liquid flows from tank through closed pipe and distribution box to perforated pipes in trenches; flows through surrounding crushed rocks or gravel and soil to ground water (underground water). Bacteria & oxygen in soil help purify liquid. Tank sludge & scum are pumped out periodically. Most common onsite system. Level ground or moderate slope.



SOURCE:
U.S. Environmental Protection Agency (January 1980) and M&E Pacific, Inc. (February 1982).

C. Aerobic System and Soil Absorption Field

Air and wastewater are mixed in tank. Oxygen-using (aerobic) bacteria grow, digest sewage, liquefy most solids. Liquid discharges to absorption field where treatment continues. Can use same treatment & disposal methods as septic tank. Maintenance essential. Uses energy.



D. Holding Tank

Sewage flows to large, underground, watertight storage tank. Tank is pumped periodically & sewage hauled away. Isolated or remote areas where absorption field not possible. Sewage hauling cost high.

Note: Dept. of Health no longer allows the use of Holding Tanks within "No - Pass" zones.

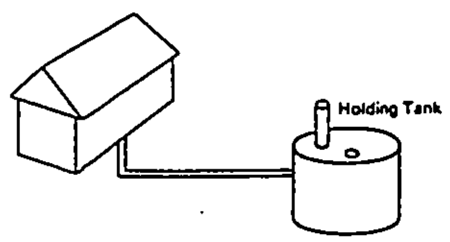


FIGURE II-5

SCHEMATIC DRAWINGS OF TYPICAL INDIVIDUAL WASTEWATER SYSTEMS cesspools, but only those in exceptionally porous soils and volcanic tubes can perform satisfactorily for an indefinite period. The others must be chemically treated periodically and/or pumped, and in some cases replaced.

Septic tank systems consist of a holding tank that retains and anaerobically digests sewage solids, plus an underground leaching field that disposes of the effluent (see Figure II-5, box B). The contents of the tank must be removed regularly (typically once or twice a year) by pumping to remove accumulated solids so that they do not enter and clog the leaching field. Septic tanks remove more of the settleable organic materials, grit, and grease than cesspools, providing the equivalent of primary treatment. Septic tank/drain field systems are more costly than cesspools to install; they require more maintenance as well. The drain fields also require a minimum lot size of 15,000 square feet. This makes it difficult to use them in most urban areas where lot sizes average about 5000 square feet, and there are relatively few in the planning area.

Household aerobic units are usually installed underground adjacent to its wastewater source. They provide a secondary level of treatment. As a result, the life of the disposal system is extended and frequency of pumping is less than septic tanks and cesspools. However, they require regular maintenance and consume relatively large amounts of electricity. Effluent from aerobic units must still be disposed of in seepage pits or drain fields.

Cesspools, septic tanks, and household aerobic units all involve the subsurface disposal of wastewater. In order to protect Oahu's drinking water sources, the Honolulu Board of Water Supply (BWS) opposes the use of all these units inland of the "No-Pass" line shown in Figure II-6. Existing units may be replaced as necessary, but no entirely new ones are permitted. Most of the Waialua-Hale'iwa Planning Area lies inland of the "No-Pass" line; however, the majority of the existing dwelling units are makai of the line. The only alternatives in these areas are integrated toilet/treatment systems which eliminate "black water" discharges (i.e., water from toilets, sinks, and garbage disposals), and these tend to be very costly and expensive for the homeowner to operate and maintain.

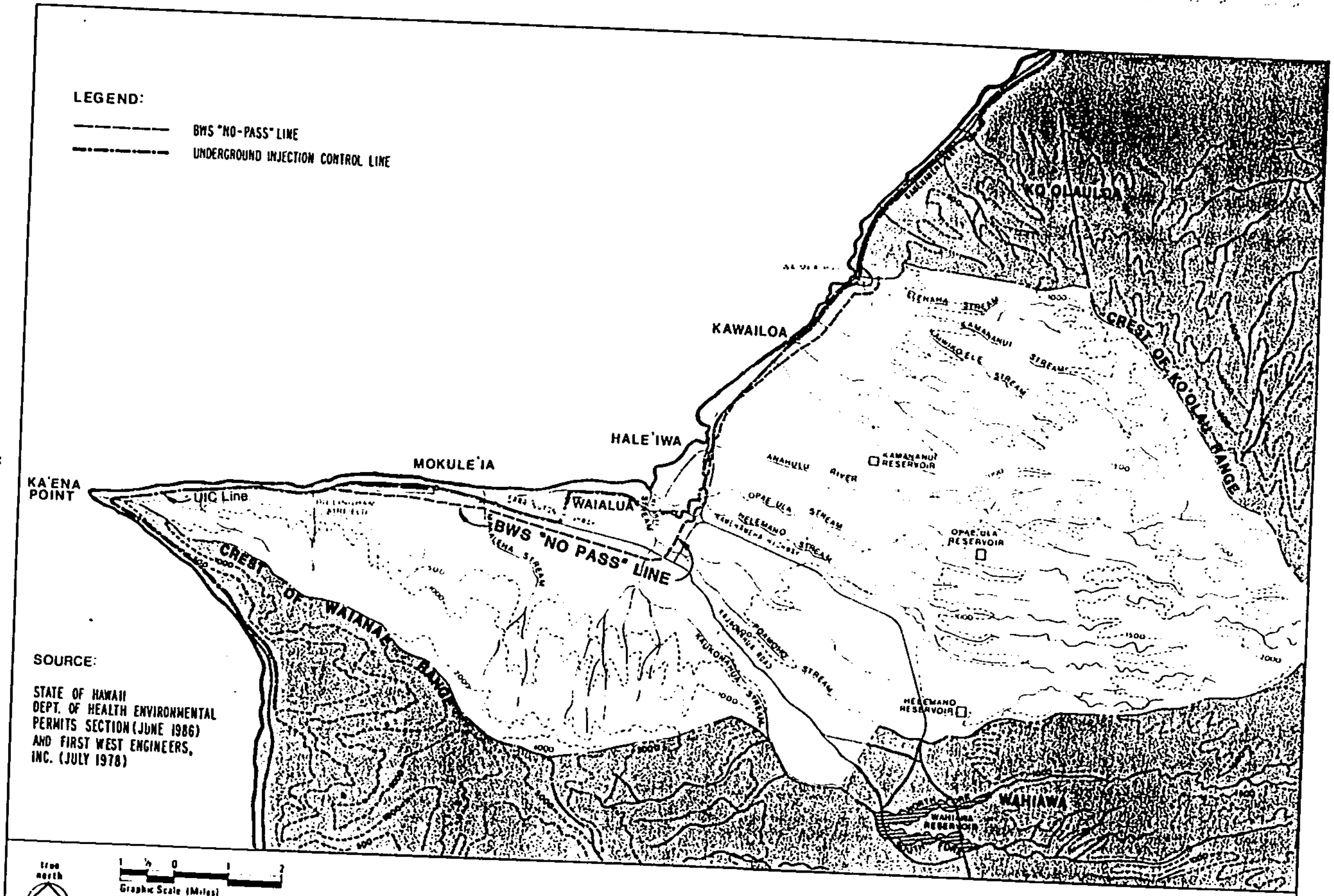


FIGURE II-6

BOARD OF WATER SUPPLY "NO-PASS" LINE & UNDERGROUND INJECTION CONTROL LINE LOCATIONS

2.5 COMMUNITY WASTEWATER TREATMENT PLANT SYSTEMS

Community WWTPs (CWWTP) attempts to provide service to selected areas of concern within the Waialua-Hale'iwa planning area with smaller wastewater collection and treatment systems.

Areas selected to be serviced under this alternative were based on those areas where cesspool failure rates of ten percent and greater were observed (the City's proposed definition of a failed cesspool is one that requires more than three pumpings per year). Service was also provided for residential areas located above the BWS "No-Pass" line. Based on this criteria, it was determined that six community wastewater treatment systems would be required. The location of these WWTPs are shown in Figures II-7 and II-8.

The CWWTP system would service approximately two-thirds of population in the urban portion of the study area - at approximately 90 percent of the cost of a centralized system. Servicing this portion of the urban area would require that the City construct and maintain six separate WWTPs and five separate injection well fields.

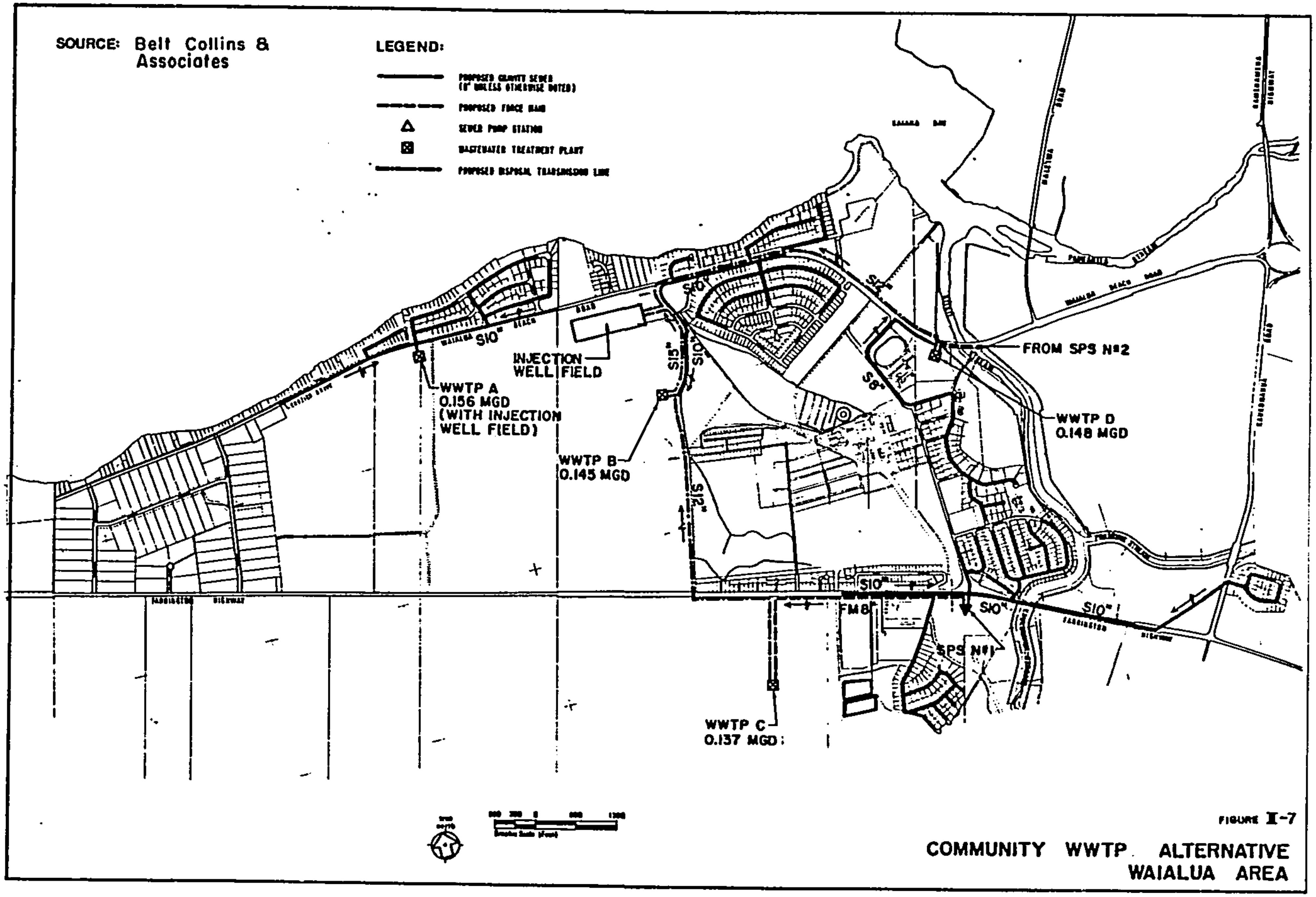


FIGURE II-7
COMMUNITY WWTP ALTERNATIVE
WAIALUA AREA

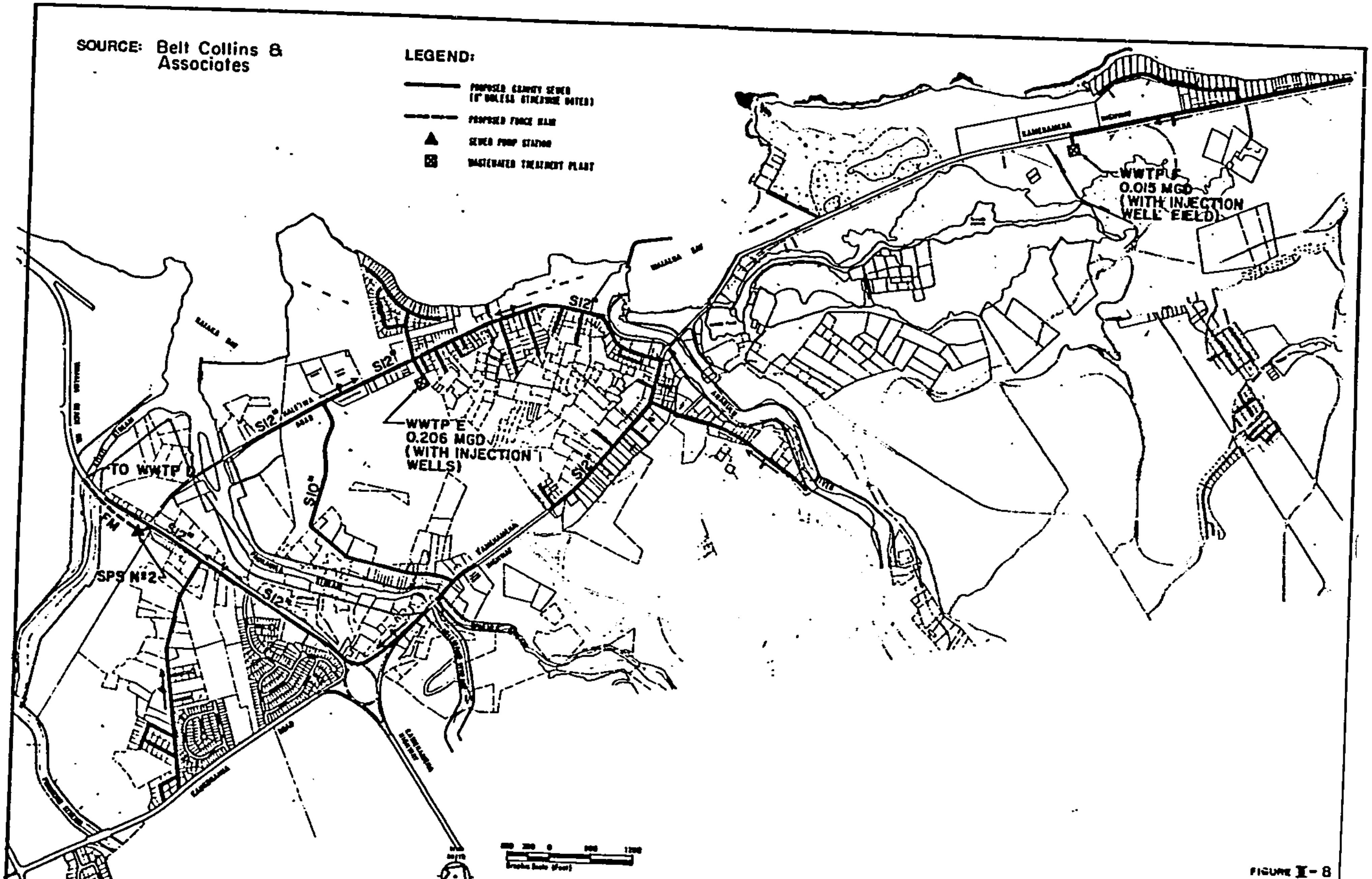


FIGURE II-8

COMMUNITY WWTP ALTERNATIVE
HALE'IWA AREA

2.6 SCREENING OF ALTERNATIVES

A three-tiered screening process was utilized to evaluate various wastewater management schemes for the study area. One of the primary factors to be taken into consideration in this evaluation process was the capability of the alternative to mitigate environmental problems (as identified in the 208 Plan). Alternatives under consideration include: (1) "No-Action", (2) centralized wastewater system (CWS), (3) individual wastewater system (IWS), and (4) community WWTPs (CWWTP).

For these evaluations, wastewater management alternatives for the urban and rural areas were evaluated separately. This was done primarily due to the drastic difference in population densities in the two subareas. It is noted that all alternatives were evaluated in terms of factors such as pollution abatement efficiency, cost effectiveness, operational characteristics, energy consumption, social-economic considerations, compatibility with public health and water quality goals, environmental impacts, and feasibility of implementation.

2.6.1 Tier 1

First tier evaluation involved the comparison of the various wastewater management alternatives for both the rural and urban areas.

2.6.1.1 Rural Area

Alternatives considered for the rural area included the IWS and the "No-Action" alternatives. The use of the CWS alternative was not considered under due to the relatively sparse distribution of population in the area (the cost of this alternative would be prohibitive).

The IWS alternative would involve the replacement of existing cesspools with other alternative individual wastewater systems (i.e., aerobic units, septage tanks with leaching fields, etc.). This alternative would be relatively costly to the (when compared to the "No-Action" alternative). In addition it is noted that occasional pumping of the units will be required for the removal accumulated sludge.

The "No-Action" alternative involves the continuation of present wastewater management practices. The existing low population density and the relatively low cesspool failure rate in the rural area does not contribute very significantly to the degradation of the water resources in the area. Based on this existing condition, and the very limited population growth projected for the rural area, it is anticipated that the future impact of the "No-Action" alternative would not be significant, and would therefore be the most appropriated wastewater management alternative for the area.

2.6.1.2 Urban Area

The "No-Action", IWS, CWS and CWWTP wastewater management alternatives were each evaluated for the urban portion of the study area.

The following two major conclusions were drawn from the evaluation of the "No-Action" alternative for the urban area: (1) the soils in the area were generally unsuitable for cesspools - this resulting in the alarmingly high number of cesspools requiring pumping; and (2) the lack of adequate pollutant removal achieved by cesspools (in an area with a relatively high population density) creates a greater potential for contamination of groundwater resources and coastal water quality within the area. These two conclusions indicate that the potential of serious public health problem is possible if the present wastewater handling practice is continued.

These two conclusions formed the basis for recommending the use of CWS for the urban core. This recommendation is further evaluated in the second tier screening process.

2.6.2 <u>Tier 2</u>

The second screening process further evaluates CWS alternatives based on specific wastewater treatment plant (WWTP) locations. Two centralized WWTP sites were located and compared to one another in determining the most appropriate alternative. Alternative IA consisted of a 1.4 mgd WWTP facility in Mokule'ia with a collection/conveyance system as shown in Figures II-9 and II-10. Alternative IB considered a 1.4 mgd WWTP facility in Kawailoa with a collection/conveyance system as depicted in Figures II-11 and II-12.

Another alternative evaluated in this second screening process was the consideration of employing two subregional WWTP facilities. Alternative II consisted of a 0.4 mgd WWTP in Kawailoa (at the same site as Alternative IB) and a 1.0 mgd WWTP in Mokule'ia (at the same site as Alternative IA). This alternative is shown in Figures II-13 and II-14.

In addition to the three scenarios (Alternatives IA, IB, and II), four effluent disposal options could be used with each alternative. The four effluent disposal options considered were: 1) exfiltration wells, 2) sugarcane irrigation, 3) California grass irrigation, and 4) ocean outfall. The matrix of second-tier alternatives, identified as options, are shown in Table II-4. For example, Option 1 consists of a 1.4 mgd WWTP in Mokule'ia with a collection and conveyance system (Alternative IA) as shown in Figures II-9 and II-10 employing exfiltration wells as its effluent disposal method.

A present worth cost comparison was conducted among the various CWS options and the results are shown on Table II-5.

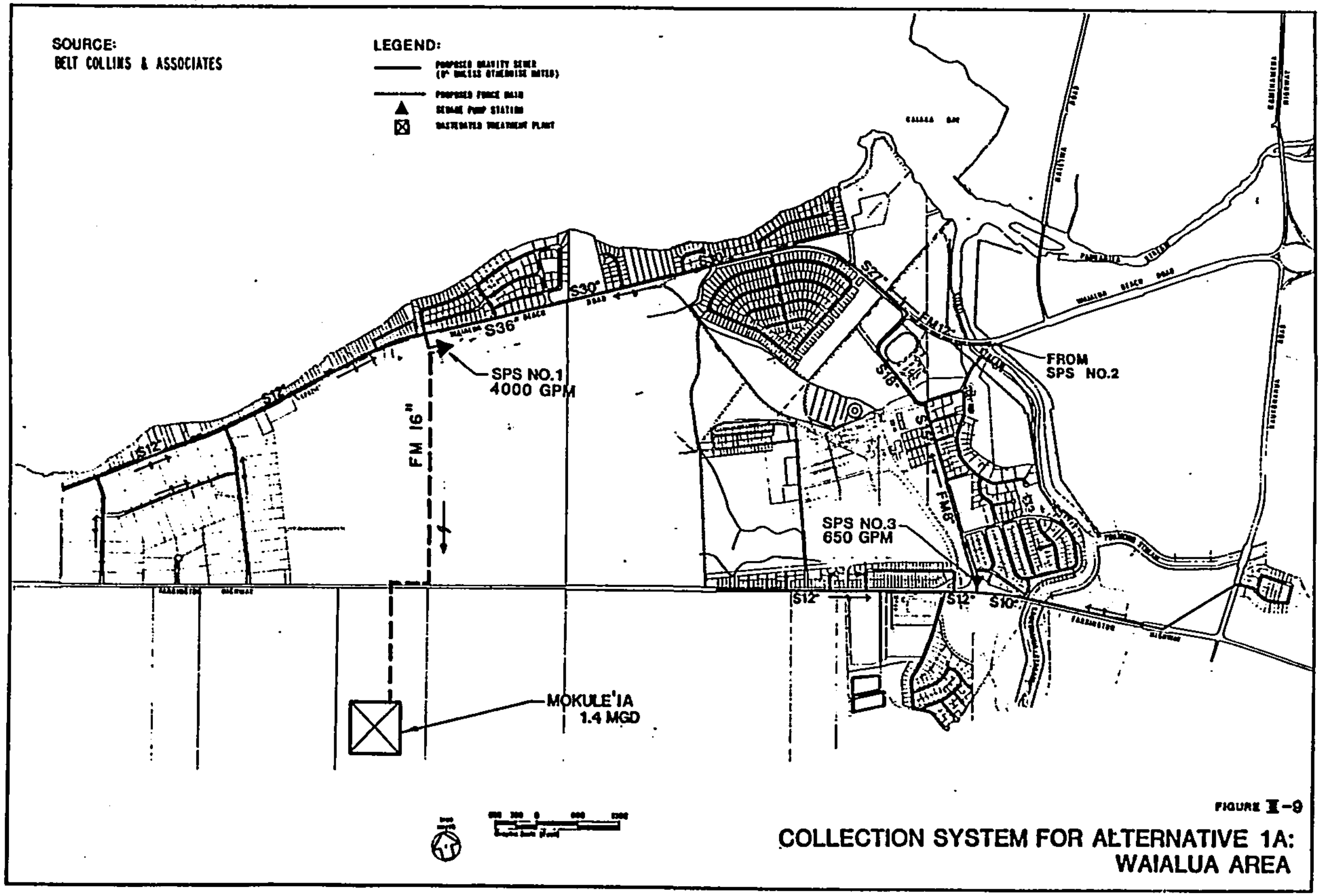


FIGURE II-9

COLLECTION SYSTEM FOR ALTERNATIVE 1A:
WAIALUA AREA

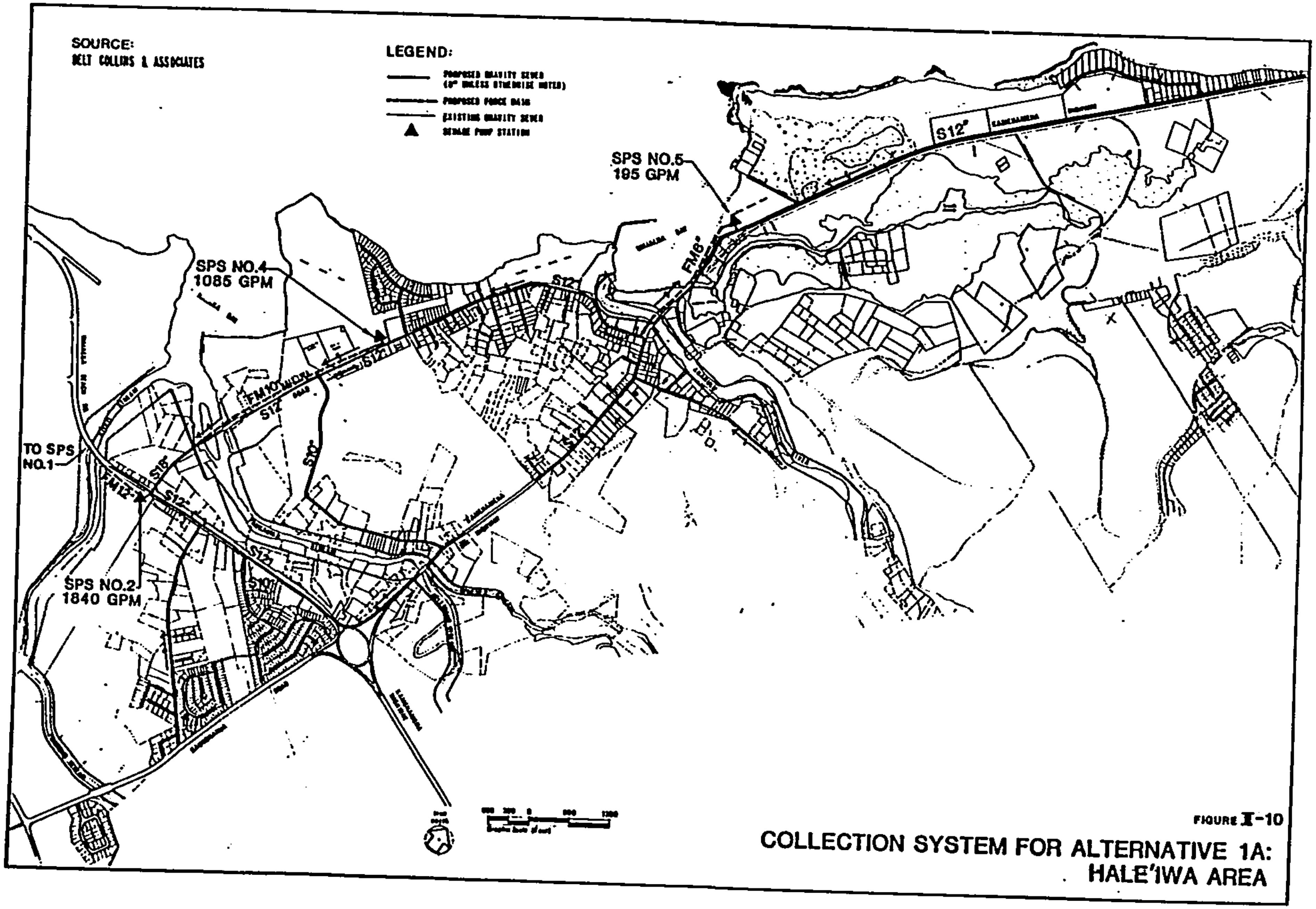


FIGURE II-10
COLLECTION SYSTEM FOR ALTERNATIVE 1A:
HALE'IWA AREA

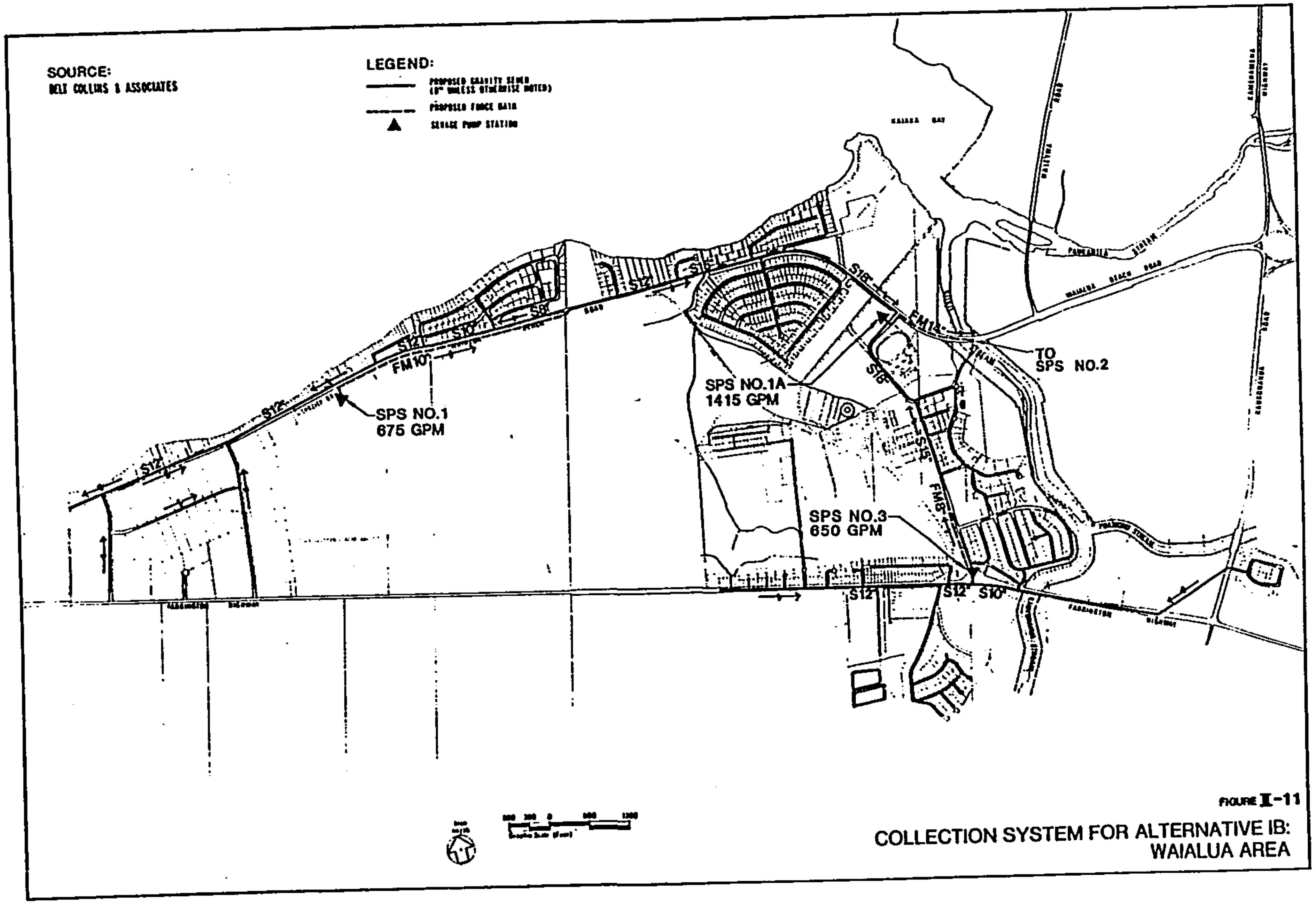


FIGURE II-11
COLLECTION SYSTEM FOR ALTERNATIVE IB:
WAIALUA AREA

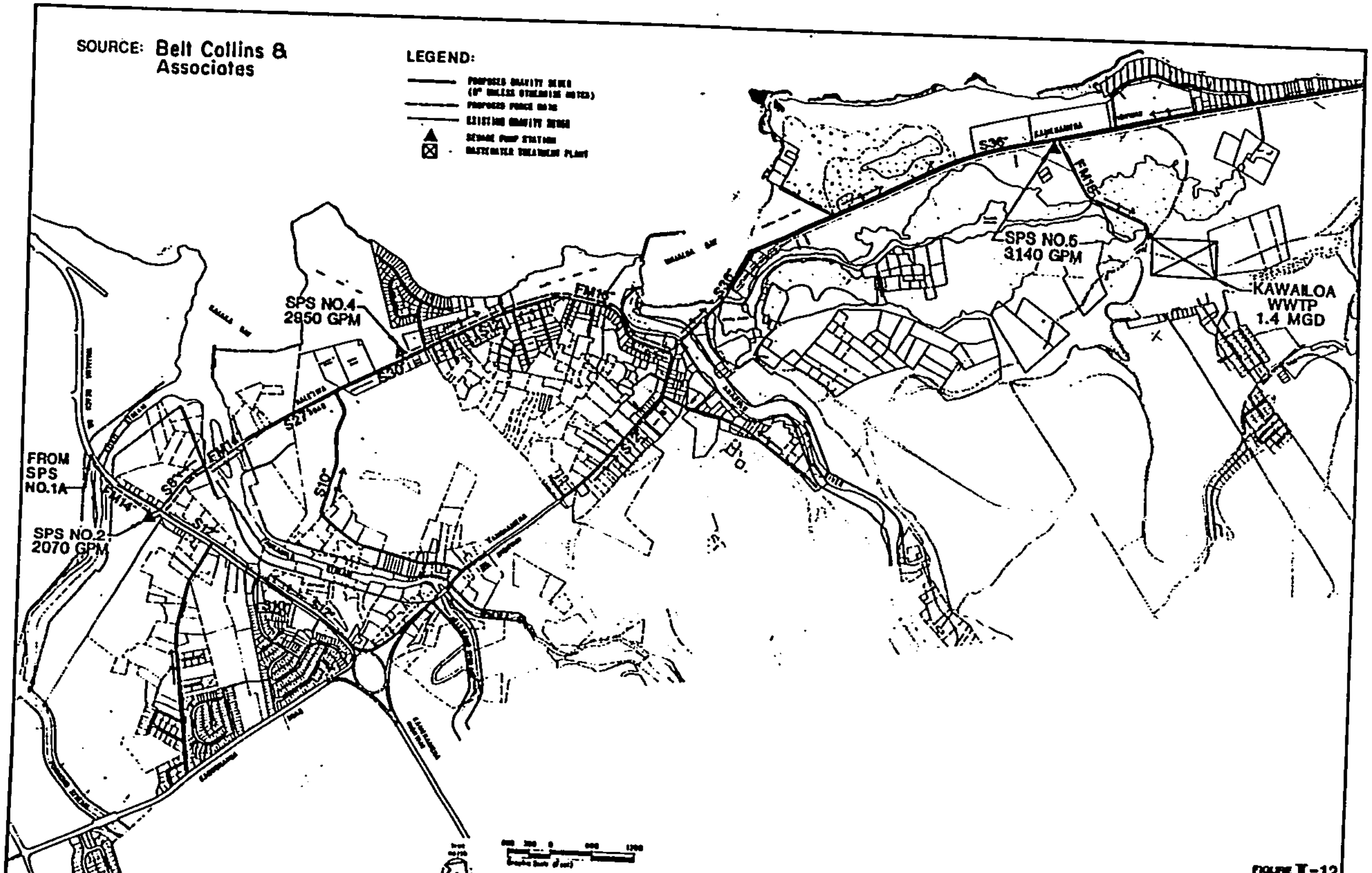


FIGURE II-12
COLLECTION SYSTEM FOR ALTERNATIVE IB:
HALE'IWA AREA

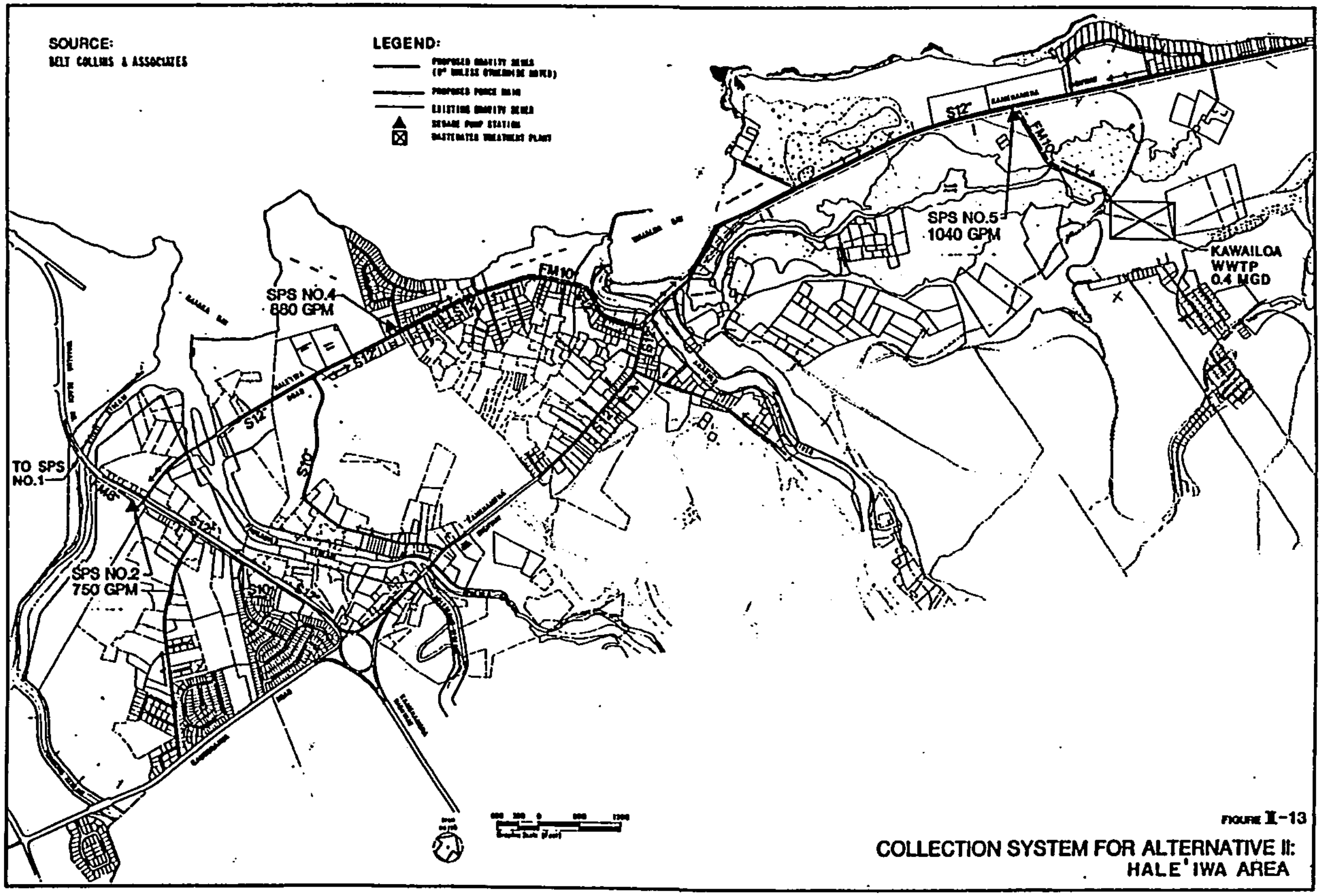


FIGURE II-13

COLLECTION SYSTEM FOR ALTERNATIVE II:
HALE'IWA AREA

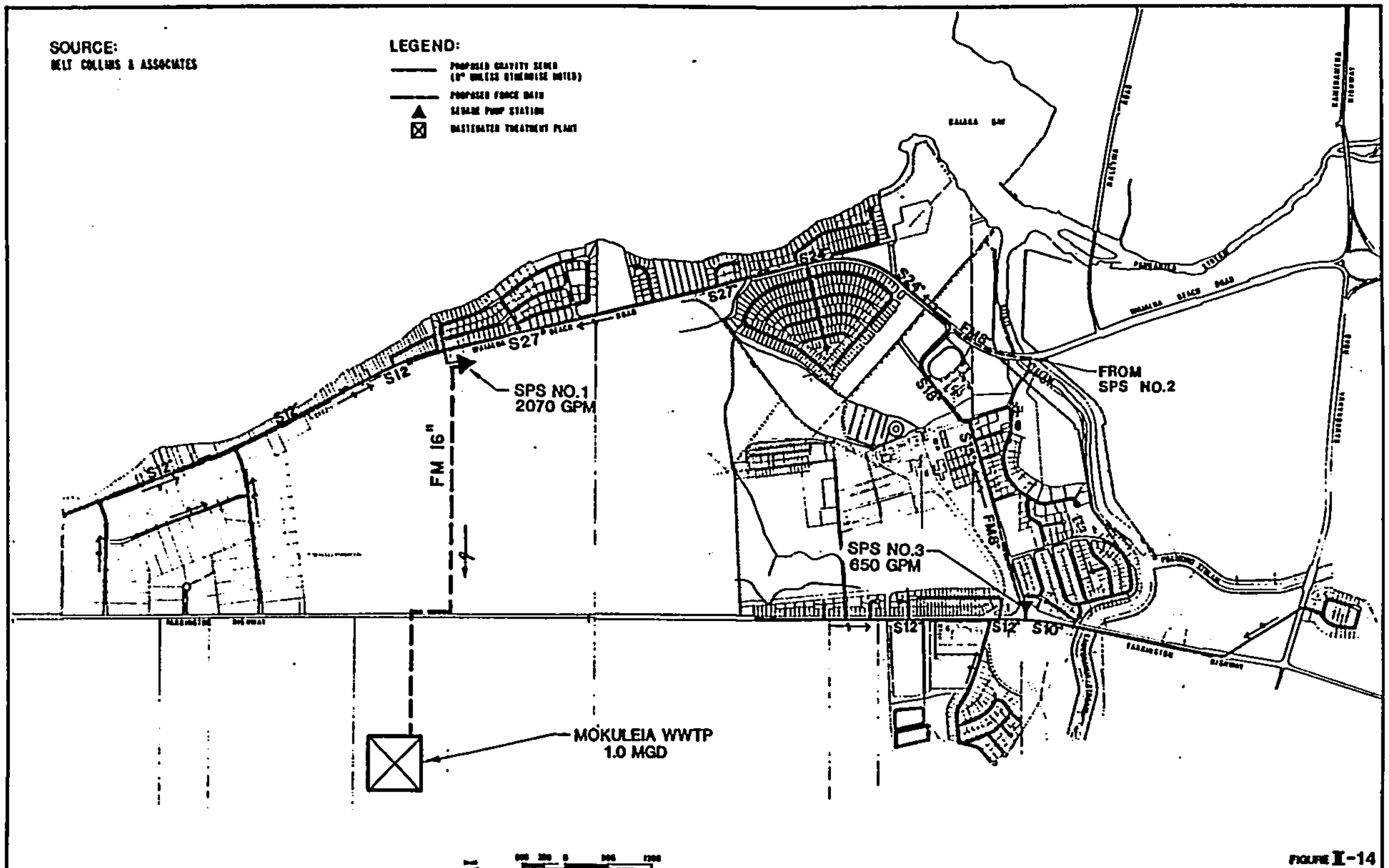


FIGURE II-14
COLLECTION SYSTEM FOR ALTERNATIVE II:
WAIALUA AREA

Table II-4. Alternatives IA, IB, and II Options Based on Effluent Disposal Method.

	OPTION NUMBER			
Alternative	Exfiltration Wells	Sugarcane Irrigation	California Grass Irrigation	Ocean Outfall
IA	1	2	3	4
IB	5	6	7	8
II:[a]				
1.0 mgd Mokuleia WWTP	9	10	11	*
0.4 mgd Kawailoa WWTP	12	13	14	*

[a] Alternative II comprised of two options for a complete system. Options 9 and 12, Options 10 and 13, and Options 11 and 14 thus comprise the three sub-alternatives of Alternative II based on effluent disposal method.

* Ocean outfall was determined to be very cost prohibitive for the two sub-regional WWTP alternatives.

Table II-5. Summary of Total Present Worth Costs for the Centralized Alternatives: Waialua-Hale'iwa Urban Area.

Collection System Alternative	Treatment Plant Option*	Collection System Present Worth	Treatment Plant Present Worth	Total Present Worth
IA	1	21,430,000	14,880,000	36,310,000
IA	2	21,430,000	15,290,000	36,720,000
IA	3	21,430,000	17,940,000	39,370,000
IA	4	21,430,000	19,060,000	40,490,000
IB	5	24,490,000	13,970,000	38,460,000
IB	6	24,490,000	14,390,000	38,880,000
IB	7	24,490,000	17,030,000	41,520,000
IB	8	24,490,000	19,370,000	43,860,000
II	9 & 12	20,210,000	17,420,000	37,630,000
II	10 & 13	20,210,000	18,110,000	38,320,000
II	11 & 14	20,210,000	20,790,000	41,000,000

* Treatment options described in Table II-4.

Source: Belt Collins & Associates.

The present worth costs ranged from a low of \$36.3 million for Option 1 (Alternative IA utilizing exfiltration wells) to a high of \$44.4 million for Option 8 (Alternative IB with ocean outfall). The results also showed that within each of the alternatives effluent disposal via exfiltration wells was the least costly while ocean outfall systems were the most costly.

Economic factors should not be used as the sole selection criteria and must incorporate a cost benefit type of evaluation. Such an evaluation was conducted to include a consideration with regards to the environment, reliability, energy requirements, and implementability of the project. The analysis resulted in the formulation of Table II-6 which ranked all the options for each alternative. The evaluation revealed that Option 4 (Alternative IA with ocean outfall) would provide the best possible solution from among the alternatives considered. This finding was then carried forth to the third level of screening.

Before proceeding to the third level of screening a brief discussion of the wastewater management system for the rural areas is warranted. Since the "No-Action" alternative was acceptable for the rural subareas (as determined from the first screening process) no further analysis (economic or otherwise) is or will be required to implement this recommendation. As such, it will be assumed that wastewater management in the rural subareas will remain as they presently are under the "No-Action" alternative.

Table II-6. Comparison of Centralized System Alternatives.

Alternative Option No.	Environment										Energy						
	(1) Land Requirements	(2) Inconvenience	Visual (3) TP	Visual (4) PS	Odor (5) TP	Odor (6) PS	(7) Average Total Col. (1) to (6)	(8) Reliability	(9) Implementability	(10) TP	(11) PS	(12) Average of (10) & (11)	(13) Cost	Average Score (Columns 7,8,9,12,& 13)	(15) Rank	(16) Recommended Alternative
Option 1	3.0	5	8	2	7.0	2	4.50	7.0	5	3	2	2.5	2	4.20	4	
Option 2	3.0	5	8	2	8.5	2	4.75	4.5	5	3	2	2.5	2	3.75	2	
Option 3	8.0	6	8	2	8.5	2	5.75	2.5	5	3	2	2.5	3	3.75	2	
Option 4	2.0	4	8	2	6.0	2	4.00	1.0	5	2	2	2.0	4	3.20	1	*
Option 5	3.0	5	5	8	4.0	8	5.50	9.0	5	6	8	7.0	3	5.90	11	
Option 6	6.5	5	5	8	5.5	8	6.33	5.5	5	6	8	7.0	3	5.37	8	
Option 7	8.0	5	5	8	5.5	8	6.58	4.0	5	6	8	7.0	4	5.32	8	
Option 8	2.0	4	5	8	3.5	8	5.08	1.0	5	5	8	6.5	5	4.52	5	
Options 9 & 12	5.0	5	2	5	3.0	5	4.17	10.0	5	8	5	6.5	2	5.53	10	
Options 10 & 13	8.0	5	2	5	3.5	5	4.75	6.5	5	8	5	6.5	3	5.15	6	
Options 11 & 14	9.0	5	2	5	3.5	5	4.92	5.0	5	8	5	6.5	5	5.28	7	

NOTE: TP = Treatment Plant
PS = Pump Station

2.6.3 Tier 3

The third level of screening consisted of re-evaluating the Mokule'ia WWTP site of Alternative IA against other potentially viable sites in Mokule'ia. This effort of screening identified two additional WWTP sites and were identified as Site M-2 (Alternative M-2) located east of Dillingham Airfield and Site M-3 (Alternative M-3) located west of Kaena quarry location. Alternative M-2 consists of a 1.5 mgd WWTP facility and a collection and conveyance system as depicted in Figures II-15, II-16 and II-17. Alternative M-3 also consisted of a 1.5 mgd WWTP facility with a collection and conveyance system as described in Figures II-16, II-17 and II-18.

The re-evaluation also included the four effluent disposal methods used in the second stage screening step to ensure that the rigid evaluation process is followed in selecting most feasible alternative.

A present worth cost analysis was conducted for each WWTP location along with the four respective effluent disposal options and is summarized in Table II-7. It should be noted that Site M-1 alternative is the same as Alternative IA (see Figures II-9 and II-10).

The analysis also revealed that Sites M-2 and M-3, under the exfiltration wells effluent disposal option, lack sites for

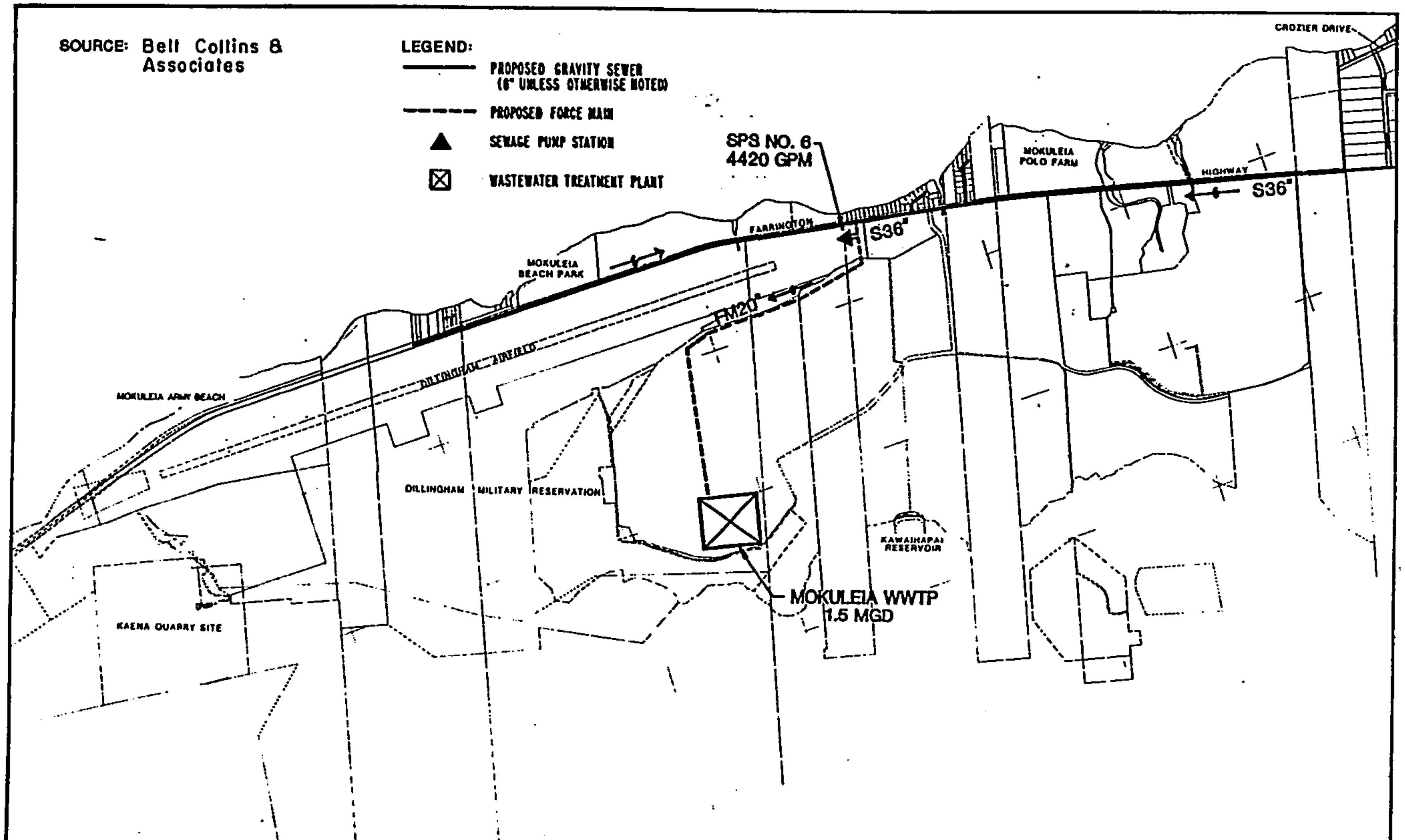


FIGURE II-15
COLLECTION SYSTEM FOR ALTERATIVE M-2
MOKULE'IA AREA

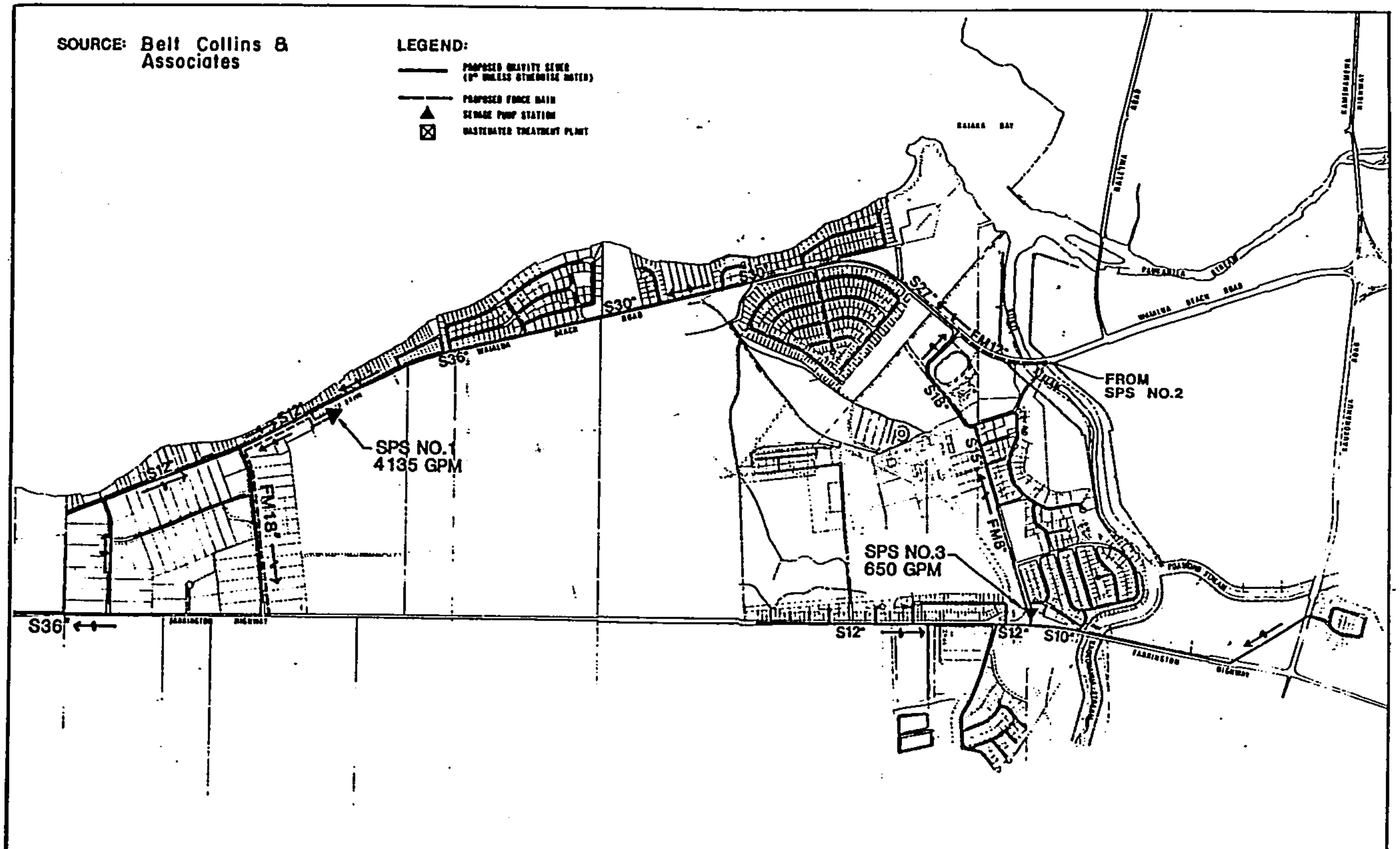


FIGURE II-16
COLLECTION SYSTEM FOR ALTERNATIVES M-2 & M-3
WAIALUA AREA

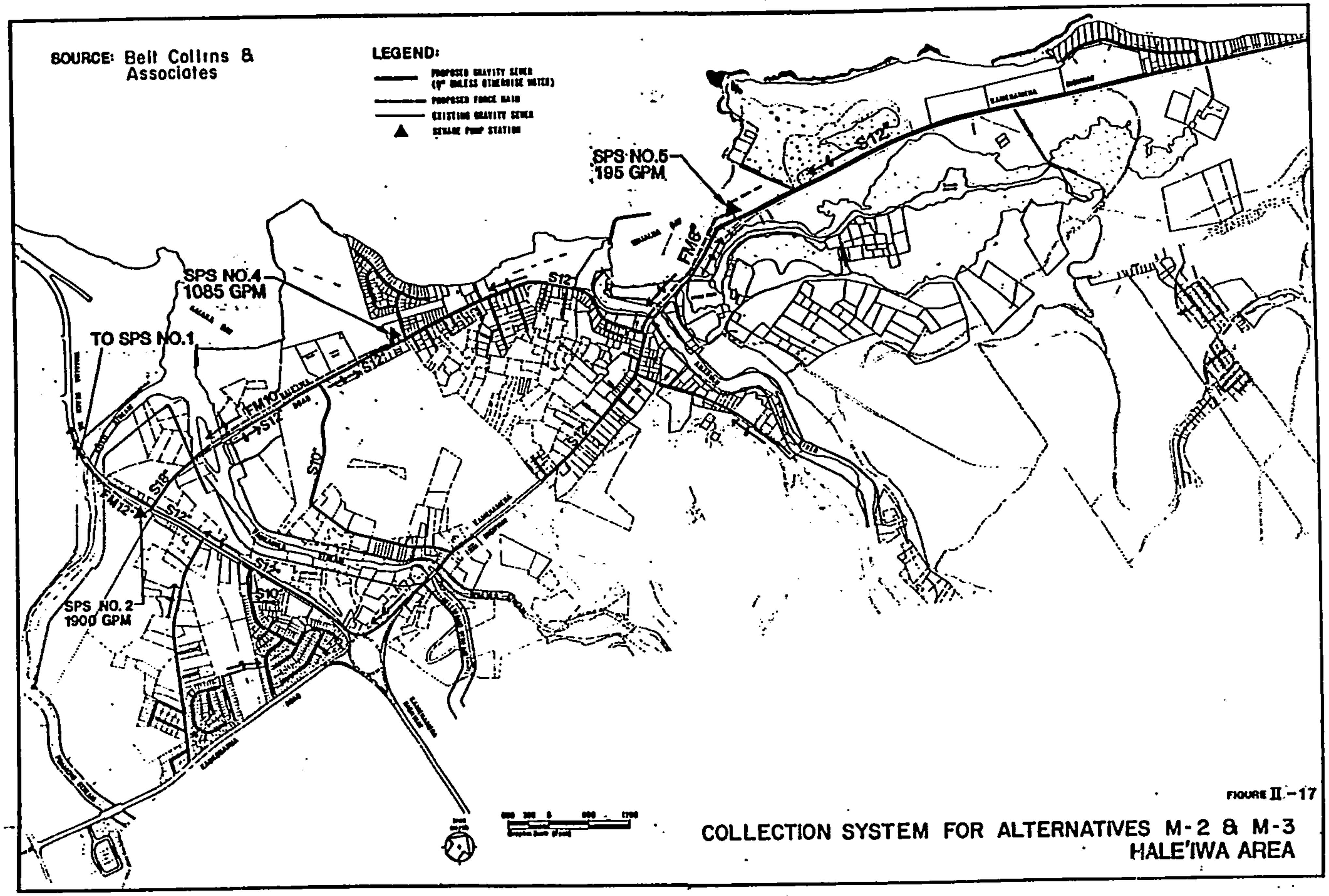


FIGURE II-17

COLLECTION SYSTEM FOR ALTERNATIVES M-2 & M-3
HALE'IWA AREA

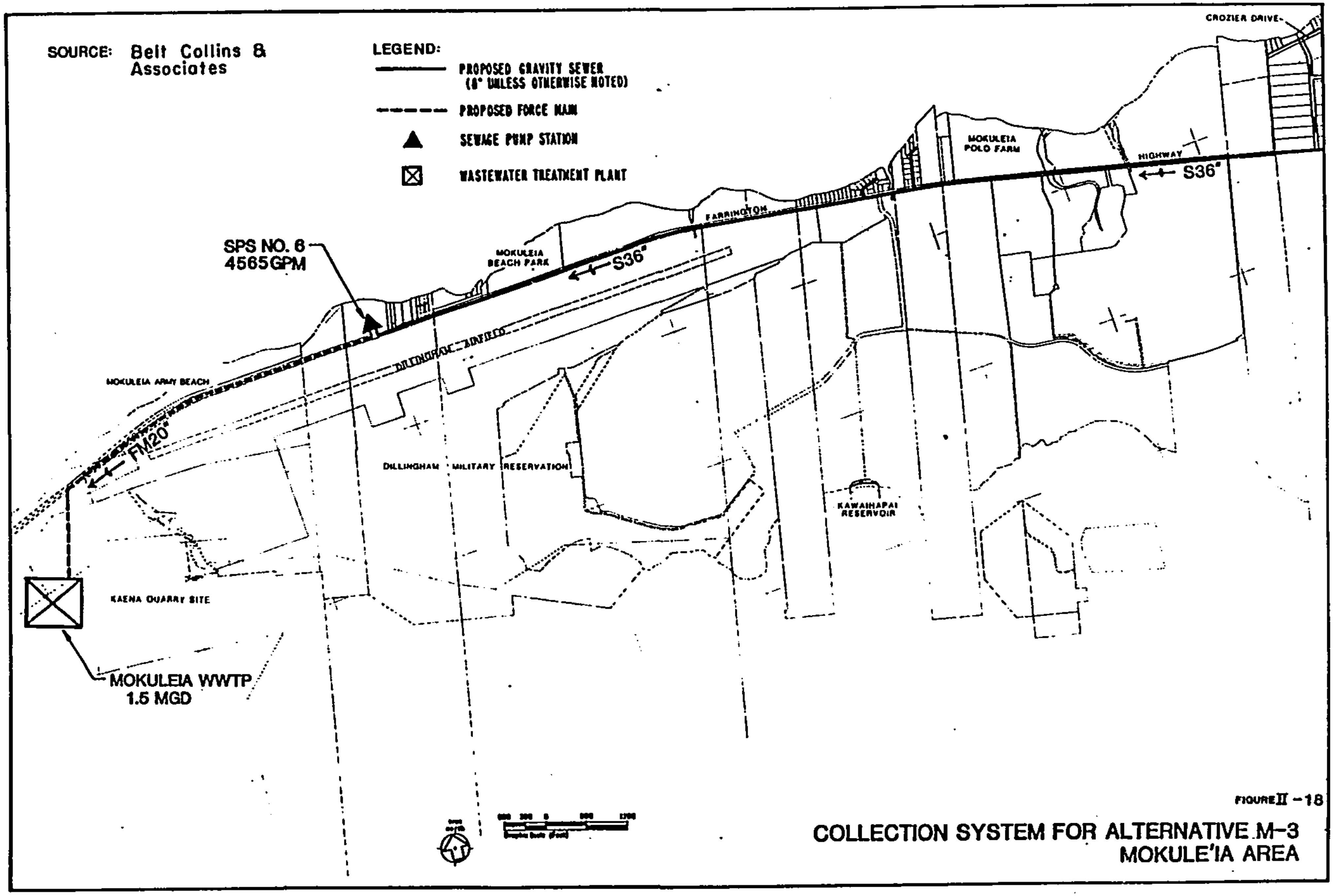


FIGURE II -18

COLLECTION SYSTEM FOR ALTERNATIVE M-3
MOKULE'IA AREA

Table II-7. Summary of Total Present Worth Cost for the Mokule'ia Centralized System Site Alternatives.

Site	Effluent Disposal	Collection System Present Worth	Treatment Plant Present Worth	Total Present Worth	Rank
M-1	Exfiltration Wells	22,400,000	14,900,000	37,300,000	1
M-2	Exfiltration Wells	26,700,000	18,700,000	45,400,000	5
M-3	Exfiltration Wells	27,600,000	18,700,000	46,300,000	8
M-1	Sugarcane Irrigation	22,400,000	15,300,000	37,700,000	2
M-2	Sugarcane Irrigation	26,700,000	19,100,000	45,800,000	7
M-3	Sugarcane Irrigation	27,600,000	19,200,000	46,800,000	9
M-1	California Grass	22,400,000	17,900,000	40,300,000	3
M-2	California Grass	26,700,000	22,400,000	49,100,000	11
M-3	California Grass	27,600,000	21,800,000	49,400,000	12
M-1	Ocean Outfall	22,400,000	19,100,000	41,500,000	4
M-2	Ocean Outfall	26,700,000	18,900,000	45,600,000	6
M-3	Ocean Outfall	27,600,000	19,800,000	47,400,000	10

exfiltration wells field. In fact, the lack of a suitable geologic stratum for effluent well disposal, the close proximity of the UIC line to the coastline, and the identification of potential potable water resources development by the Board of Water Supply determined that the only suitable exfiltration well field would be the one used under Alternative IA (see Figure I-6). The additional cost to transport the treated effluent to this well field site has been included into the present worth costs shown on Table II-7.

The comparison of environmental, reliability, implementability, energy consumption and cost factors of each of the three alternative Mokule'ia sites were evaluated and ranked as shown in Table II-8. The results showed that the ocean outfall effluent disposal alternatives provided the most feasible solutions. Of the three ocean outfall alternatives, Alternative IA (or Site M-1) was determined to be the most feasible solution.

Additional support studies for permit/approval applications are necessary prior to the construction of the ocean outfall. This requires the use of exfiltration wells (at Site M-1) for the interim period. Table II-8 implies that sugarcane irrigation at Site M-1 (ranked fourth) would be the applicable interim effluent disposal method, however, the uncertainty of Waialua Sugar Company's operations is seen as definite hindrance in its recommendation.

Table II-8. Comparison of Centralized System Alternatives.

Site	Effluent Disposal	Environment: (1) Land Requirements	Environment: (2) Inconvenience	Environment: Visual (3) TP	Environment: Visual (4) PS	Environment: Odor (5) TP	Environment: Odor (6) PS	Environment: (7) Average Total Col. (1) to (6)	(8) Reliability	(9) Implementability	Energy (10) TP	Energy (11) PS	Energy (12) Average of (10) & (11)	(13) Cost	Average Score (Columns 7,8,9,12,& 13)	Rank	Recommended Alternative
M-1	Exfiltration Wells	6	6	8	3	8	4	5.83	6	5	4	5	4.5	1	4.47	5	
M-2	Exfiltration Wells	5	6	5	4	6	5	5.17	6	4	5	6	5.5	4	4.93	9	
M-3	Exfiltration Wells	4	5	4	4	3	5	4.17	6	4	5	6	5.5	5	4.93	9	
M-1	Sugarcane Irrigation	7	6	8	3	8	4	6.00	4	5	5	5	5.0	1	4.20	4	
M-2	Sugarcane Irrigation	6	6	6	4	6	5	5.50	4	5	6	6	6.0	4	4.90	7	
M-3	Sugarcane Irrigation	5	5	4	4	3	5	4.33	4	5	6	6	6.0	5	4.87	6	
M-1	California Grass Irrig.	10	8	9	3	8	4	7.00	3	6	8	5	6.5	2	4.90	7	
M-2	California Grass Irrig.	9	8	7	4	6	5	6.50	3	5	9	6	7.5	5	5.40	12	
M-3	California Grass Irrig.	8	7	5	4	3	5	5.33	3	5	9	6	7.5	6	5.37	11	
M-1	Ocean Outfall	4	6	8	3	7	5	5.50	1	4	4	5	4.5	3	3.60	1	*
M-2	Ocean Outfall	2	4	5	4	5	5	5.00	1	4	5	6	5.5	4	3.90	3	
M-3	Ocean Outfall	1	2	2	4	2	5	2.67	1	4	5	6	5.5	5	3.63	2	

NOTE: TP = Treatment Plant
PS = Pump Station

2.7 SELECTED ALTERNATIVE

To summarize the results of this chapter the following conclusions were drawn:

1. The Waialua-Hale'iwa planning area should be divided into two subareas: urban core and rural.

2. Wastewater management proposed for the urban core is the centralized wastewater system.

3. Wastewater management proposed for the rural areas is the "No-Action" scenario.

4. The centralized wastewater system collects and conveys wastewater via gravity sewers: Alternative IA (force mains and pump stations are required).

5. The centralized wastewater system wastewater treatment plant produces an effluent quality equivalent to secondary treatment standards.

6. The centralized wastewater system wastewater treatment plant employs gravity thickeners, anaerobic digesters, conditioning, and belt filter press for sludge management.

7. The centralized wastewater system wastewater treatment plant employs chemical injection at the headworks and foul gas scrubbing at the preliminary treatment building and the gravity thickeners and anaerobic digesters for controlling odors.

8. Effluent disposal will be accomplished by exfiltration wells until the necessary permits/approvals can be obtained for the ocean outfall.

9. The centralized wastewater system wastewater treatment plant facility consists of a single 1.4 mgd plant.

10. The preferred wastewater treatment plant site location is Alternative IA situated in Mokule'ia in Waialua Sugar Company's Gay 2 cane field. Table II-9 attempts to summarize the reasons which led to the selection of Alternative IA's site.

Table II-9. Reasons for Rejecting Alternative Sites IB, M-2, and M-3.[a]

Alternative	Site	Reason(s) for Rejection
IB	Kawailoa	The primary reason this site was rejected was its close proximity to Uko'a Marsh. Any adverse impacts on the marsh from emergency conditions (i.e. main breaks in vicinity, or WWTP overflows, etc.) would have a potentially long term damaging effect. Due to the location of the Board of Water Supply's "No-Pass" line and the location of the Department of Health's UIC lines, there are no readily available exfiltration well sites near the WWTP site - this would impose additional higher effluent transmission costs for this site. Disposal via ocean outfall would be more difficult at this site since waters in the immediate vicinity of the outfall are classified as Class AA by the Department of Health. It is also noted that the initial phases of implementation would not provide service to the areas of greatest need - mainly in the Waialua area. (The collection system construction is implemented in a pattern spreading outward from the WWTP site.)
M-2	East of Dillingham Airfield	The primary reason this site was rejected was the cost associated with conveying the wastewater to the WWTP and the cost of transporting the effluent to the well field at Site M-l (Alternative IA). This would include an additional sewage pump station. Site also is situated where no flood information is available.
M-3	Old Kaena Quarry	The primary reason this site was rejected was again attributed to the cost associated with the additional conveyance system and transportation system as mentioned in Site M-2. Additional factors include the fact that this land is owned by the State whose intent is to develop a State Park. Other factors include a bird habitat at the abandoned quarry, the potential potable water source development in the area, the potential for significant archaeological sites in the area, and no flood information and risk is known.

[a] Reasoning is based on comparison to Alternative IA WWTP site (also known as M-1).

Source: Belt Collins & Associates

III. DESCRIPTION OF THE AFFECTED ENVIRONMENT

CHAPTER III

DESCRIPTION OF THE AFFECTED ENVIRONMENT

Physical, social, and economic conditions vary markedly from place to place within the 115 square miles of the Waialua District. This chapter contains a broad overview of these conditions and provides the background information on which the impact assessment in Chapter IV is based.

3.1 PHYSIOGRAPHY/GEOLOGY

The island of O'ahu consists of two parallel mountain ranges, the Waianae on the west and the Ko'olau on the east, joined by a central plateau (see Figure III-1). Each of the "ranges" is, in fact, the remnant of a large shield volcano. The central plateau was formed when lavas from the Ko'olau Volcano, the younger of the two, banked against the already-eroded flank of the Waianae Volcano. At 4,025 feet above sea level, the Waianae Range's Mount Ka'ala is the highest point in the District (and on the island); the highest elevation on the Ko'olau side of the Waialua District is 2,673 feet.

The district is composed of three different geologic units. They are, in order of decreasing age, (i) basaltic lavas and dikes of the Waianae Volcanic Series, (ii) similar lavas and dikes of the Ko'olau Volcanic Series, and (iii) alluvium and

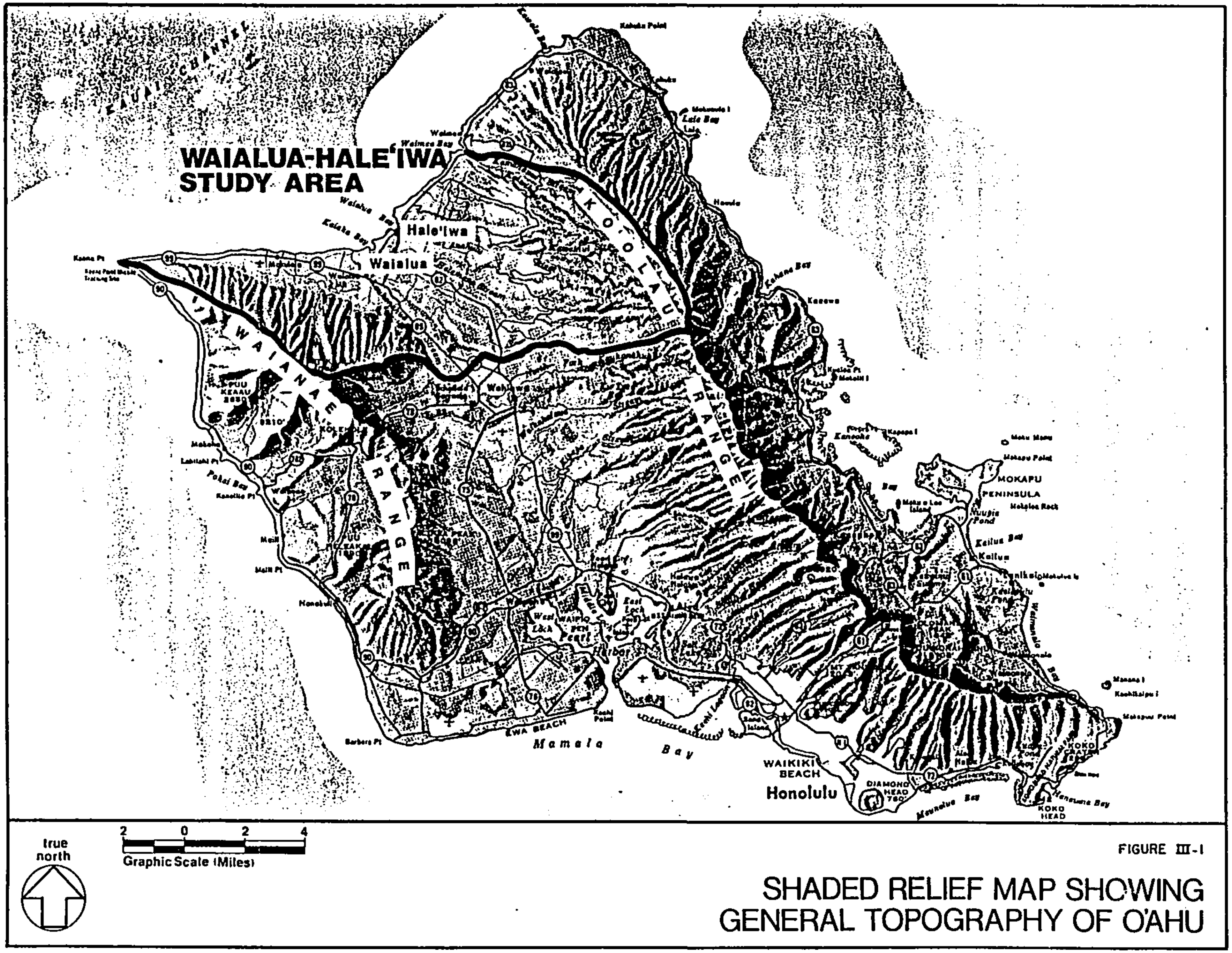


FIGURE III-1

SHADED RELIEF MAP SHOWING
GENERAL TOPOGRAPHY OF O'AHU

marine sediments of sand and coral (see Figure III-2). West of Kaukonahua Gulch the upland areas consist of rocks from the Waianae Volcano; east of the gulch they are from the Ko'olau Volcano. Nearly vertical, relatively impermeable dikes have intruded through both the Ko'olau and Waianae lavas in several rift zone extending for one to two miles on either side of their crests. A hydrologic discontinuity between the Wahiawa and Waialua Districts indicates some change in geologic structure across the Schofield Plateau. However, the nature of this discontinuity is not fully understood.

A distinct topographic break at the 200-foot elevation level inland of Waialua marks the boundary between the exposed Waianae lavas and a coastal plain composed of calcareous and terrigenous sediments laid down over the downsloping Waianae lavas. The width of the Waialua-Mokule'ia coastal plain varies from nothing at Ka'ena Point to two miles at Waialua. Its thickness at the coastline is equally variable, ranging from zero at its western end to over 400 feet at Waialua. A similar, but generally narrower and much thinner, layer of mostly alluvial material is present on the Kawailoa coastal plain northeast of Hale'iwa. Typical geologic cross-sections of the Waialua-Hale'iwa area are shown in Figure III-3.

The towns of Waialua and Hale'iwa have developed on the relatively flat coastal plain (see Figure III-4). All of Waialua seaward of Farrington Highway is less than 50 feet above

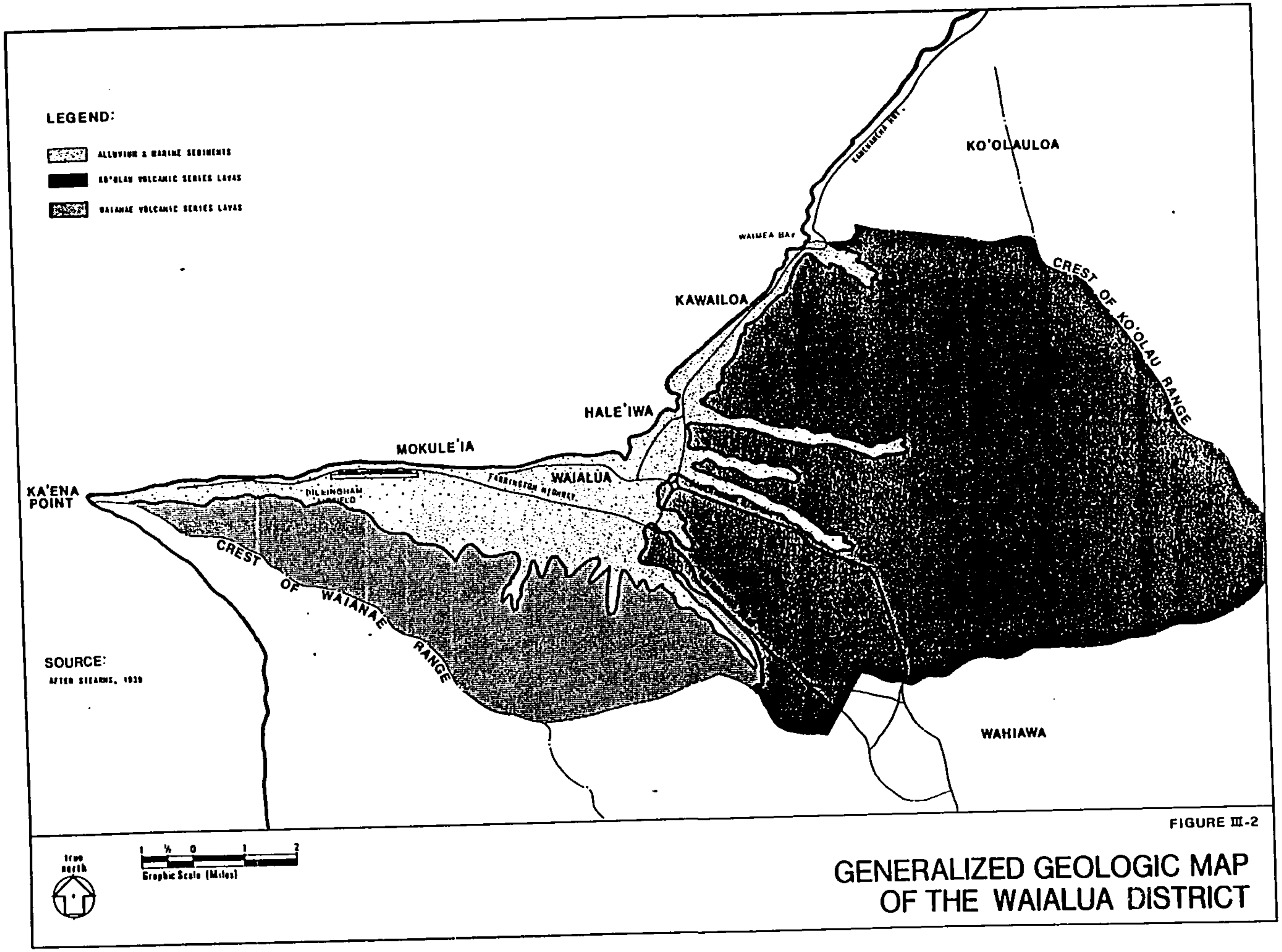


FIGURE III-2

GENERALIZED GEOLOGIC MAP OF THE WAIALUA DISTRICT

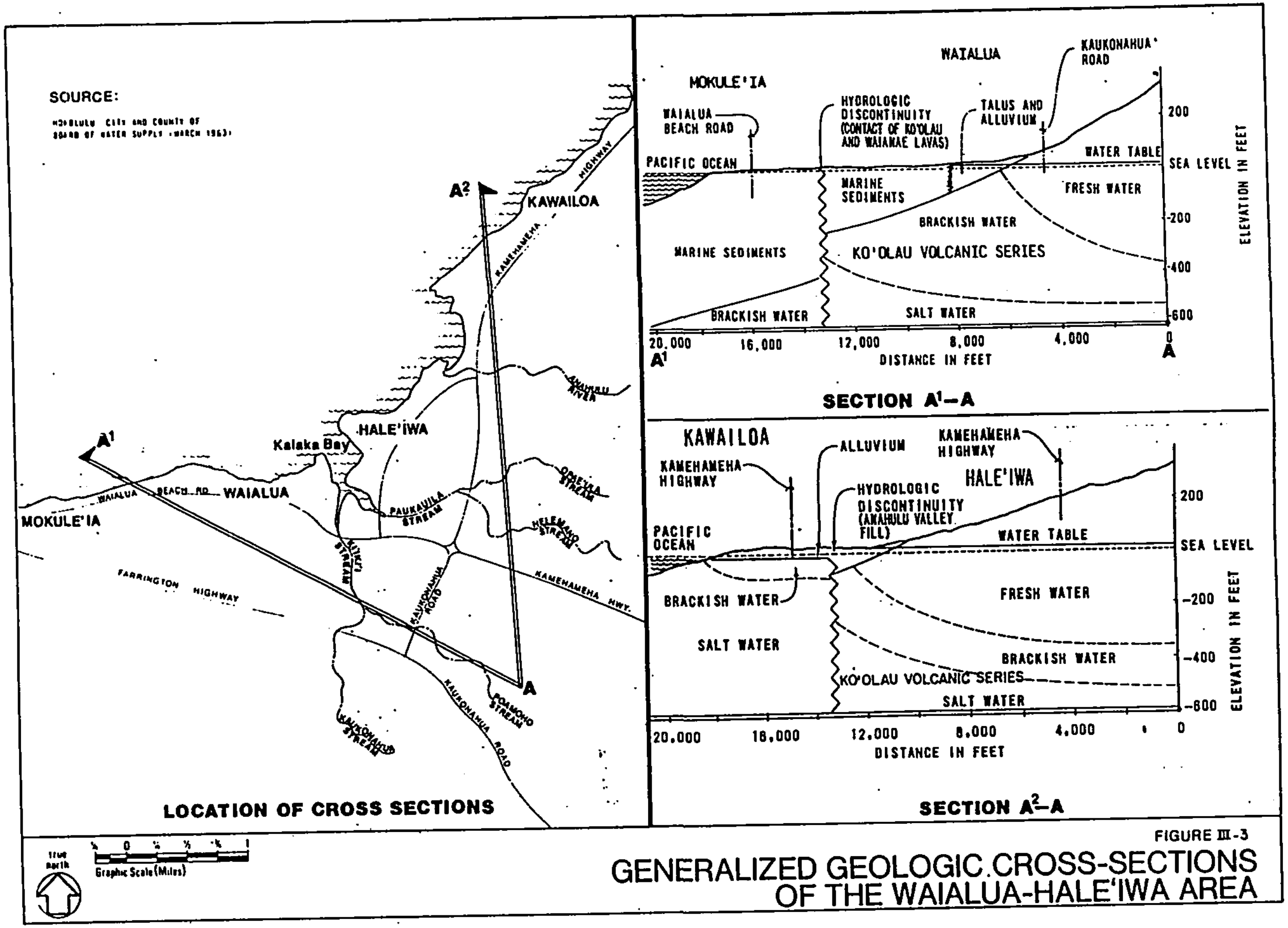


FIGURE III-3

GENERALIZED GEOLOGIC CROSS-SECTIONS OF THE WAIALUA-HALE'IWA AREA

SOURCE:
U.S. DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY

true north

2000 0 2000 4000
Scale in Feet

FIGURE III-4

TOPOGRAPHY OF
WAIALUA-HALE'IWA AND VICINITY

sea level; everything north of the Waialua Sugar Mill is less than 20 feet in elevation. The wide flood plain and marshes adjacent to Ki'iki'i Stream are less than 15 feet above sea level and thus physically separate the two towns. The town of Hale'iwa itself is further divided into two distinct parts by the flood plain and marshes of Paukauila Stream. The old town center and residences lie mostly north of Paukauila Stream below the 20-foot contour. Newer development, especially the 307-unit Pa'ala'a Kai subdivision, lies on gently sloping ground south of both the stream and Waialua Beach Road at elevations from 15 to 50 feet above sea level.

O'ahu is relatively free of serious earthquakes, although tremors originating in major fault systems near the island of Hawai'i are felt here periodically. The Moloka'i and Maui fracture zones are other potential sources of tectonic activity, but they are relatively inactive. The island of O'ahu is designated as Zone 1, the next to lowest rating on the scale used to rank earthquake hazards and establish structural design requirements for buildings.

3.2 HYDROLOGY

3.2.1 Streamflow

Three major streams discharge into the ocean in the vicinity of Waialua and Hale'iwa (see Figure III-5). They are Paukauila Stream (formed by the confluence of Helemano and Opae'ula Streams), the Anahulu River, and Ki'iki'i Stream (formed by the confluence of Poamoho and Kaukonahua Streams). Their combined drainage area is approximately 80 square miles. Average and peak stream discharge data for these streams are summarized in Table III-1. Of the watercourses for which full records are available, only Kaukonahua Stream is perennial; all others are intermittent. Even Helemano Stream at Hale'iwa, which had the highest peak discharge of all those listed, is dry on occasion. All three of the streams have a tidal estuary at their seaward end. Most of the perennial streamflow in the upper reaches of the streams is diverted for agricultural use or infiltrates through the highly permeable beds of the streams.

3.2.2 Flooding

Historically, most storm flooding in the Waialua-Hale'iwa area has resulted from the widespread rains that accompany the movement of large-scale frontal systems past the island during the winter (November through April). Floods are also produced by intense local thunderstorms; these may occur during any

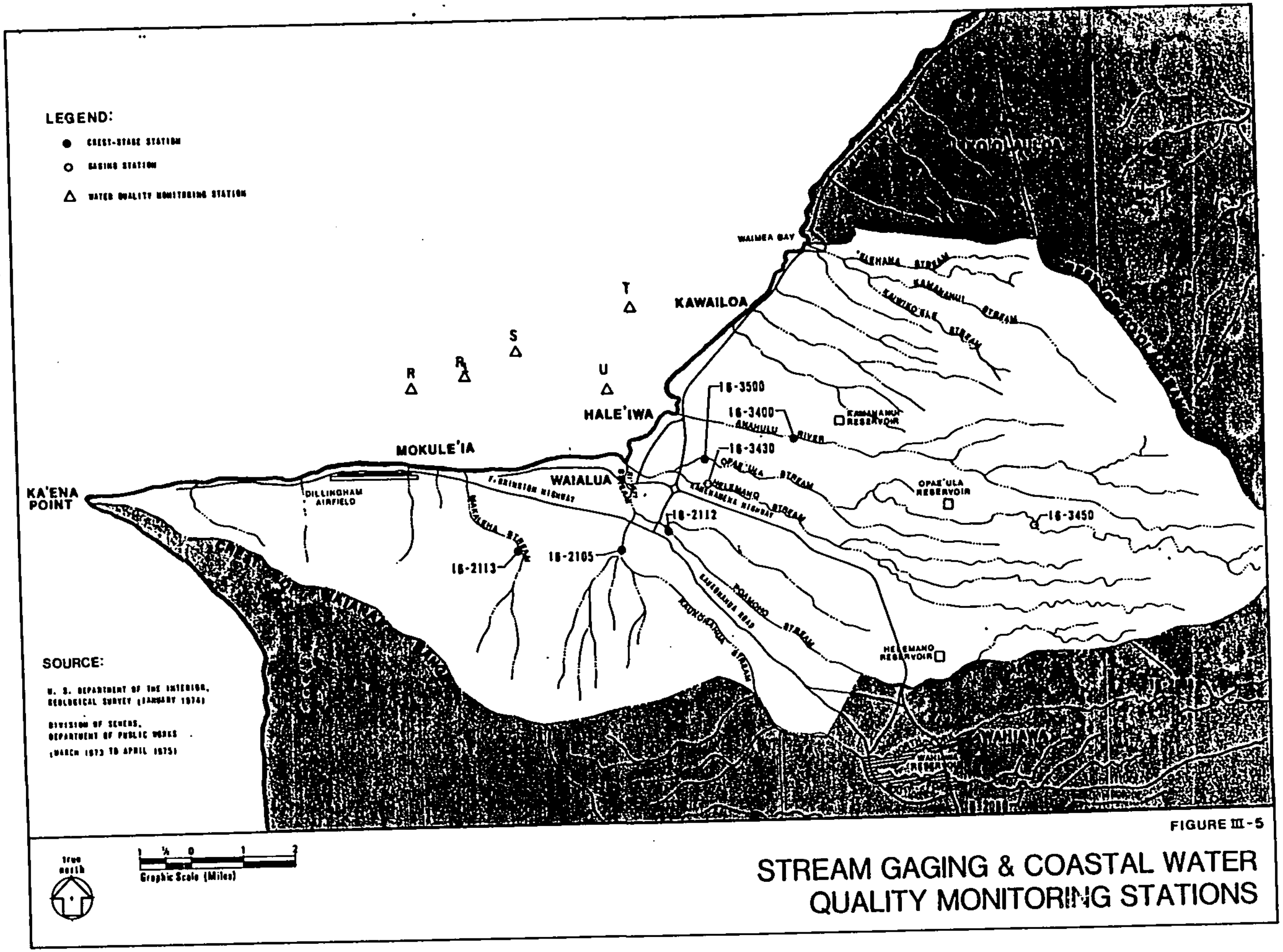


FIGURE III-5

STREAM GAGING & COASTAL WATER QUALITY MONITORING STATIONS

Table III-1. Historic Stream Discharge Records for Streams in the Waialua-Hale'iwa Area.

Station Number	Period of Record	Name of Station	Altitude (ft.)	Drainage Area (sq.mi.)	Average Discharge (cfs)	Peak Discharge (cfs)	Peak Discharge Date	Minimum Discharge (cfs)
16-2000	5/13 - 7/53; 4/60 - 9/84	N. Fork Kaukonahua Stream Above Right Branch	1,150	1.38	16.4	5,640	10/28/81	0.12
16-2080	7/57 - 9/84	S. Fork Kaukonahua Stream At East Pump Reservoir	860	4.04	21.6	5,460	4/15/63	0
16-2105	1963, 1968-84	Kaukonahua Stream at Waialua	22	38.70	n.a.	13,400	4/19/74	n.a.
16-2112	1969-84	Poamoho Stream at Waialua	24	10.90	n.a.	7,340	4/19/74	n.a.
16-2113	1958-1963, 1966-1984	Makaleha Stream Near Waialua	180	4.15	n.a.	2,580	12/23/64	n.a.
16-3400	1958-1984	Anahulu River Near Hale'iwa	70	13.50	n.a.	15,900	4/19/74	n.a.
16-3430	1968-1982*	Helemano Stream at Hale'iwa	2	14.20	10.8	18,200	4/19/74	0
16-3450	1957-1984	Opae'ula Stream Near Wahiawa	1,120	2.98	13.6	5,540	7/17/74	0
16-3500	1956-1984	Opae'ula Stream Near Hale'iwa	20	5.96	n.a.	7,600	4/19/74	n.a.

* Monitoring of Station 16-3430 discontinued after Water Year 1982.

Source: U.S. Department of the Interior, Geological Survey (Annual, 1970-1984) Water Resources Data for Hawaii and Other Pacific Areas and (January 1974) An Investigation of Floods in Hawaii Through September 30, 1973.

season, but they tend not to affect all of the streams at the same time. The primary cause of flooding is channel overbanking during periods of high streamflow. However, some localized areas, especially between Kamehameha Highway and Hale'iwa Road, flood during periods of intense local rainfall because the level terrain prevents adequate drainage. Major floods of record in the area are summarized in Table III-2. The worst floods occurred in 1932 and 1974. The latter caused damage of nearly $1,000,000 and claimed three lives.

In addition to storm flooding, coastal areas are also subject to inundation by tsunamis and large waves generated by North Pacific storms. Since record-keeping began in the early nineteenth century, approximately 40 tsunamis have struck the Hawaiian Islands. According to the U.S. Army Corps of Engineers (November 1970:5), the tsunami of March 9, 1957 had the severest effect on the coastline of the Waialua-Hale'iwa area. Waves generated by that tsunami ran up to the 13-foot elevation level in the coastal area from Waialua to Kaiaka Bays and carried water inland over one-half mile in places. Like most of those which have caused significant damage on this stretch of coastline, the 1957 tsunami originated from an earthquake in the North Pacific.

The North Shore of the island is famous among surfers for its large winter waves. Usually the waves cause no property damage. Occasionally, however, an unusual weather situation

Table III-2. Major Floods Recorded in the Waialua-Hale'iwa Area Since 1905.

Date	24-Hour Rainfall Amount (in inches)		Severity of Flooding	Comments
	Uplands	Lowlands		
02-28-32	26-30	6.5	Severe	Unusually heavy antecedent rainfall. Flooding exacerbated by failure of three irrigation dams and overflowing of one reservoir. Homes along Ki'iki'i and Paukauila Streams were inundated. Many acres of crops were destroyed.
02-02-35	16-20	8.55	Moderate	Some residents claim this was comparable to the 1932 flood. It was accompanied by lightning, thunder, and hail.
10-23-39	16-20	8.55	Moderate	Some damage to crops, roads, and plantation housing.
02-25-56	14	4.3	Moderate	Much of flooding resulted from a realtively short, localized downpour over Waialua.
02-01-69	21	4.0	Severe	Streamflow gages on Paomoho, Opae'ula, and Helemano Streams recorded high flows. Many residences were inundated.
04-19-74	20-22	9.05	Very Severe	Seventy-five homes were damaged or destroyed and three persons were killed. Streamflows were by far the greatest recorded since gages were installed in 1957-58.

Source: U.S. Army Corps of Engineers (October 1974) and (November 1970); Schroeder (February 1976).

north of the island produces sustained high winds over a large stretch of ocean and generates exceptionally powerful waves. Two such storms in early December 1969 produced breaking waves estimated at 30 to 35 feet off the Waialua shoreline. These waves damaged shoreline structures, boats, and recreational facilities; they also carried debris several hundred feet inland. While storm waves increase the frequency with which areas along and immediately adjacent to the shoreline are inundated, they are less of a threat than tsunamis.

The U.S. Army Corps of Engineers (November 1970; February 1978) has estimated peak flood flows for the Waialua-Hale'iwa area using a regional flood frequency approach that relates expected stream discharge to drainage area size (see Table III-3). The Federal Insurance Administration flood estimates were used in preparing the official flood boundary maps. The U.S. Department of the Interior, Geological Survey, Water Resource Division (March 31, 1982) has noted that the Hale'iwa flood boundary map is at odds with the known topography. They state that 'Uko'a Marsh would be the first area to be inundated since it is at a lower elevation than the surrounding land.

The flood boundaries for the Waialua and Mokule'ia areas have recently been revised as shown in Figures III-6, III-7 and III-8. The City and County of Honolulu is currently waiting for the Federal Emergency Management Administration (FEMA) to formally adopt these revisions prior to enactment as the new

Table III-3. Estimated Stream Discharges for Events Having a Recurrence Interval of 100 Years.

Stream/Location	Drainage[1] Area (sq. mi.)	100-Year[2] Flood Peak (in cfs)	Velocity (fps) Maximum[3]	
			Channel	Overbank
Opae'ula Stream at Confluence w/Helemano Stream	6.0	10,000	13	3
Helemano Stream at Confluence w/Opae'ula Stream	15.1	14,800	17	7
Anahulu River at Outlet	16.0	16,200	16	4
Poamoho Stream at Confluence w/Kaukonahua Stream	18.1	17,000	15	5
Paukauila Stream at Confluence w/Ki'iki'i Stream	21.4	18,700	11	3
Kaukonahua Stream at Confluence w/Poamoho Stream	39.6	25,500	14	5
Ki'iki'i Stream at Confluence w/Paukauila Stream	58.4	32,000	11	3
Ki'iki'i Stream at Outlet	79.8	39,000	n.a.	n.a.

[1] U.S. Army Corps of Engineers (November 1970:10).

[2] U.S. Department of Housing and Urban Development, Federal Insurance Administration (February 1978:Figure 18).

[3] U.S. Army Corps of Engineers (November 1970:13).

Source: Compiled by Belt Collins & Associates from sources identified above.

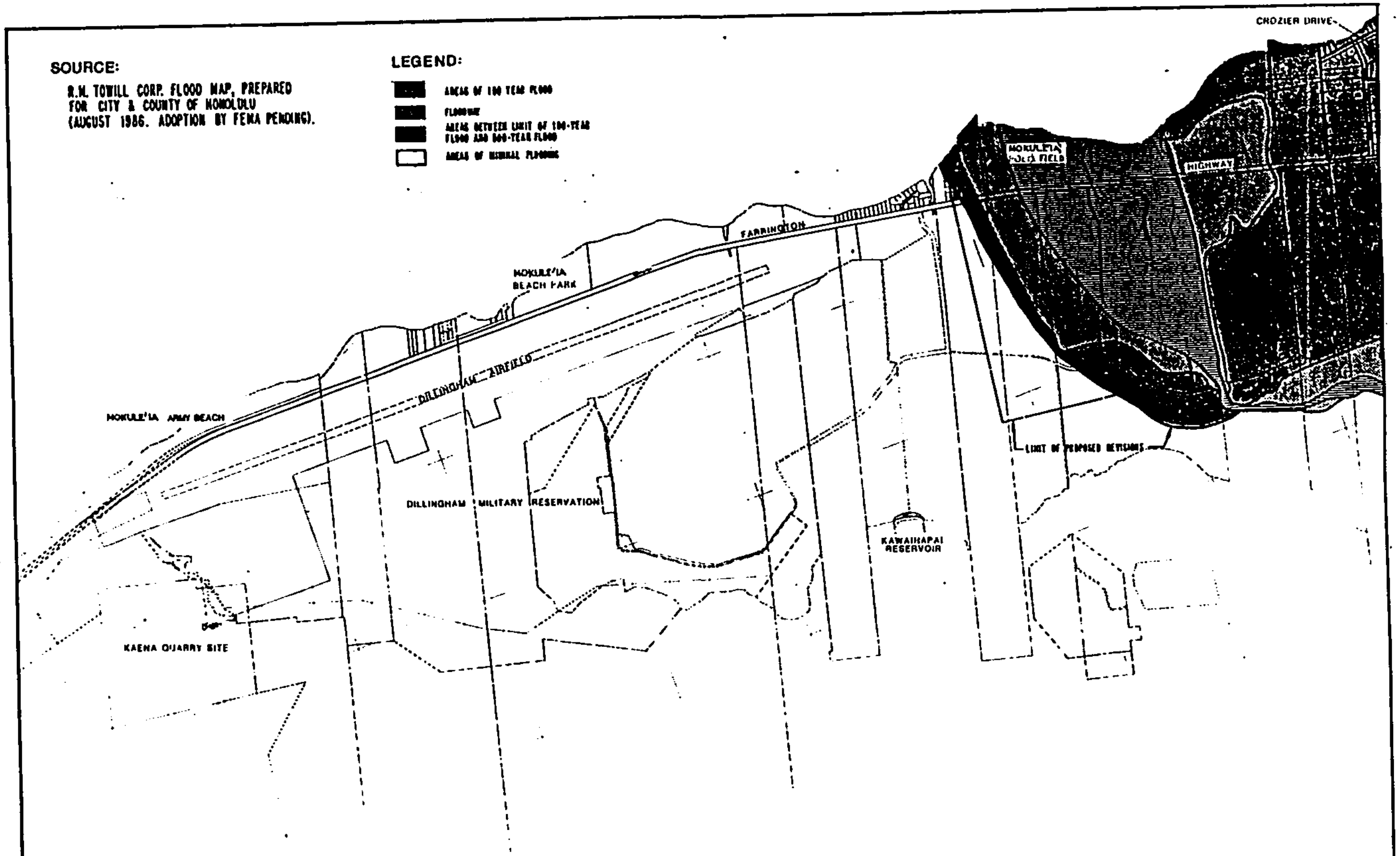


FIGURE III-6
FLOOD ZONE MAP (PROPOSED):
MOKULE'IA AREA

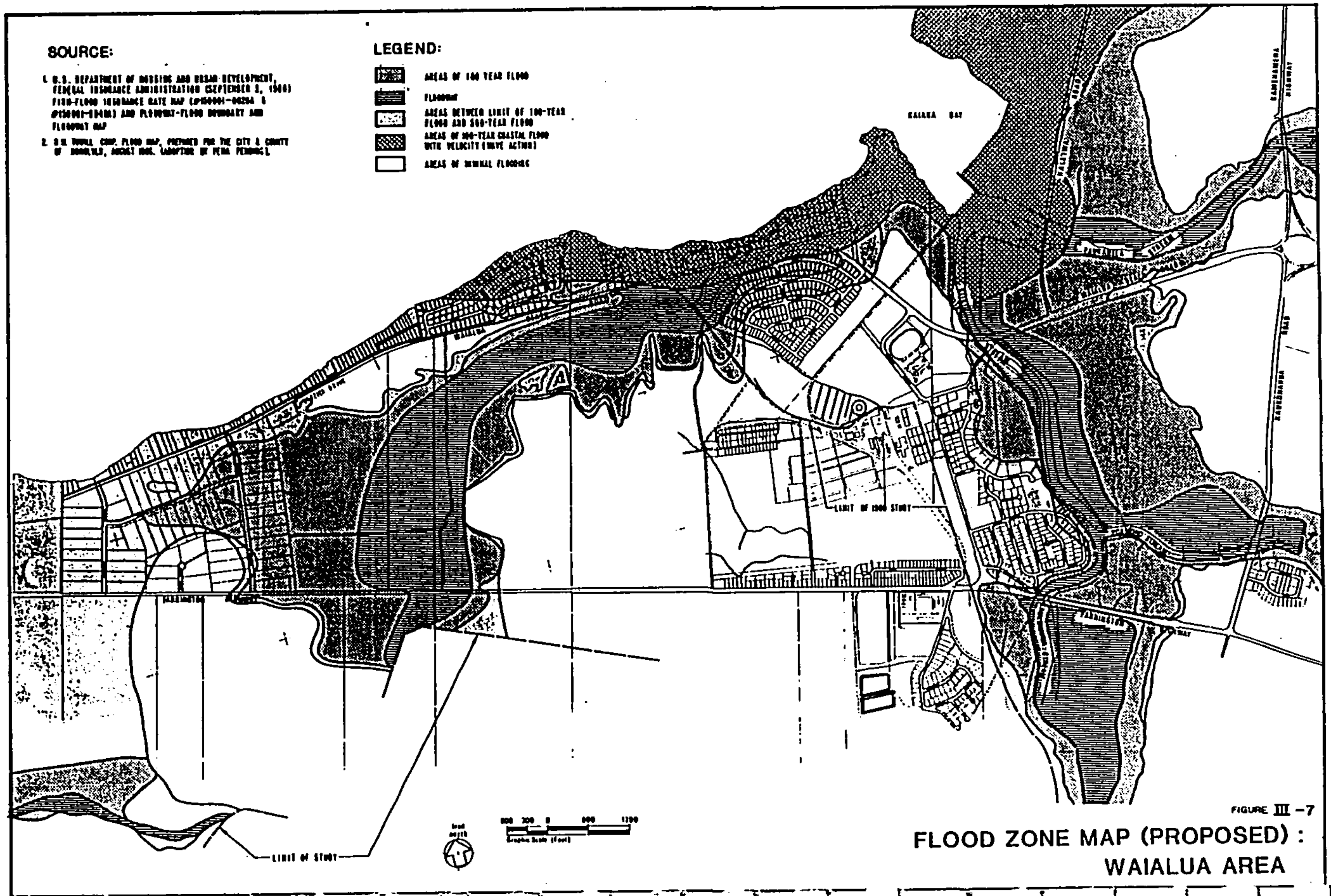


FIGURE III-7
FLOOD ZONE MAP (PROPOSED) :
WAIALUA AREA

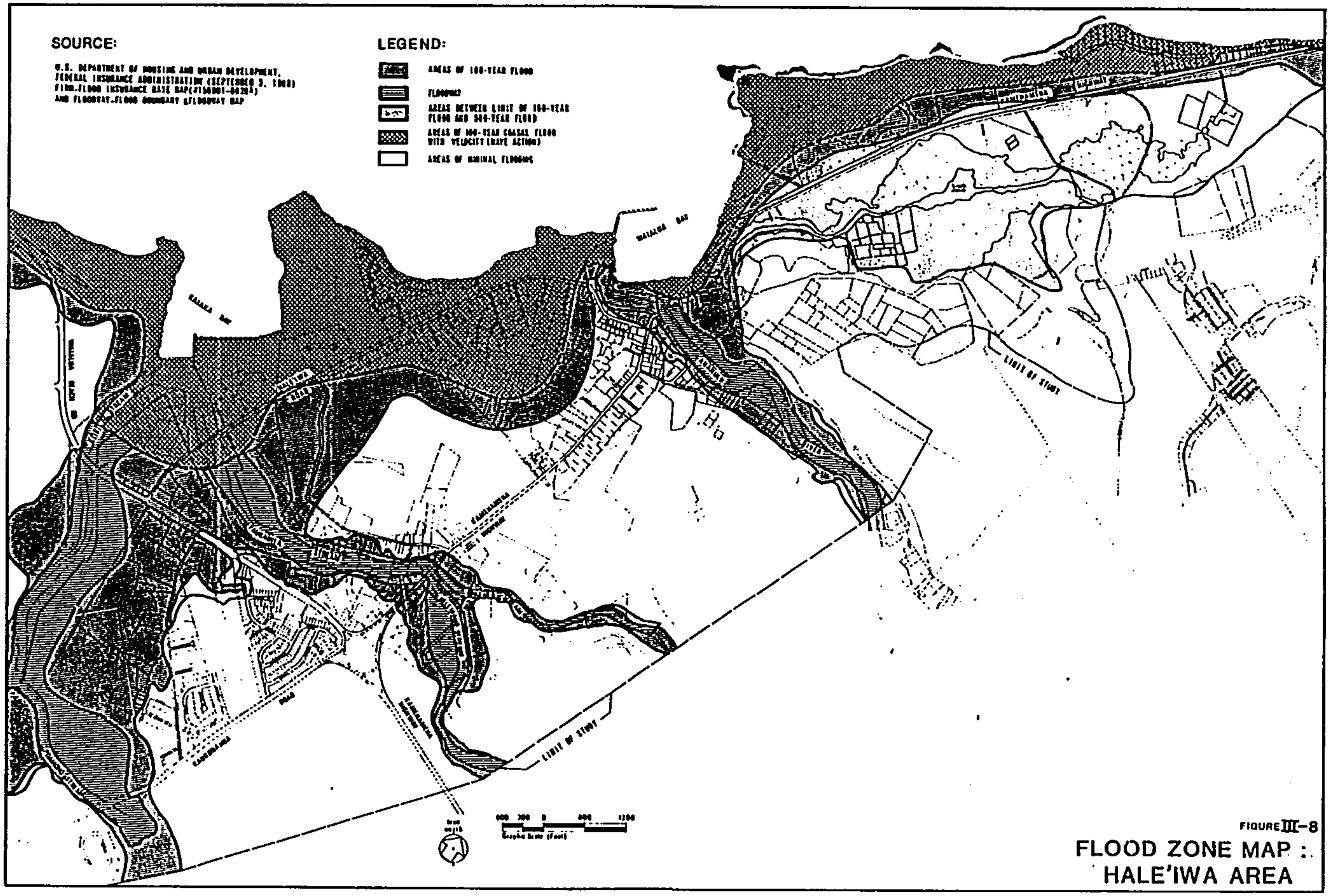


FIGURE III-8
FLOOD ZONE MAP :
HALE'IWA AREA

City and County flood maps of these two areas. The decision on the use of these maps are applicable for this study was based upon consultation with both the City and County Department of Land Utilization (DLU) and the State Department of Land and Natural Resources (DLNR). Both DLU and DLNR (DLNR consulted with FEMA) stated that the best flood information currently available would supercede the existing flood information. Consequently, the proposed flood zone maps are being used for this Facilities Plan.

The damage caused by a flood is a function of the velocity of flood waters as well as their areal extent. Velocities can vary greatly as a result of localized obstructions and relatively small changes in slope, making generalizations subject to considerable error. Nevertheless, the estimates given in Table III-3 provide a useful approximation. As an interesting comparison, the maximum velocity of tsunami flooding at the coastline is probably on the order of 30 feet per second.

3.2.3 Groundwater

Most of the groundwater in the Waialua District is contained in permeable volcanic rocks. A U.S. Geological Survey study by Rosenau, et al. (1971) identified six major groundwater compartments. They are: high level dike water impounded in the upper reaches of the Ko'olau and Waianae Mountain Ranges, mid-level water beneath the Schofield plateau, and basal water in the Mokule'ia, Waialua-Hale'iwa, and Kawailoa areas, respectively. The subdivision is very similar to that put forward by the Honolulu Board of Water Supply (March 1963:36-37) and by Dale (January 1978:11-19). The approximate boundaries of these different groundwater compartments are shown in Figure III-9.

Dale (January 1978) estimated that total pumping from the various compartments of the Waialua basal water body is about 36 million gallons per day. In 1980, about 2.2 mgd of this was used for domestic purposes; the remainder was used for irrigation. About 1.7 mgd of the water used for domestic purposes was drawn from the Honolulu Board of Water Supply's Waialua well field at elevation 200 feet along Kamehameha Highway; most of the rest was pumped from a private well in Mokule'ia that belongs to Mokule'ia Ranch. In addition, the Waialua Sugar Company provides domestic water to its plantation homes via their three wells.

The Board of Water Supply has completed and is presently utilizing the 1.0-mgd capacity Hale'iwa wells located about one mile northeast of its existing Waialua wells. Preliminary approval has also been given for another 1.0-mgd well that would serve a new 350-lot subdivision proposed for Mokule'ia Ranch lands. Over the long-term, the Board of Water Supply has targeted the Waialua basal lens for considerable additional development.

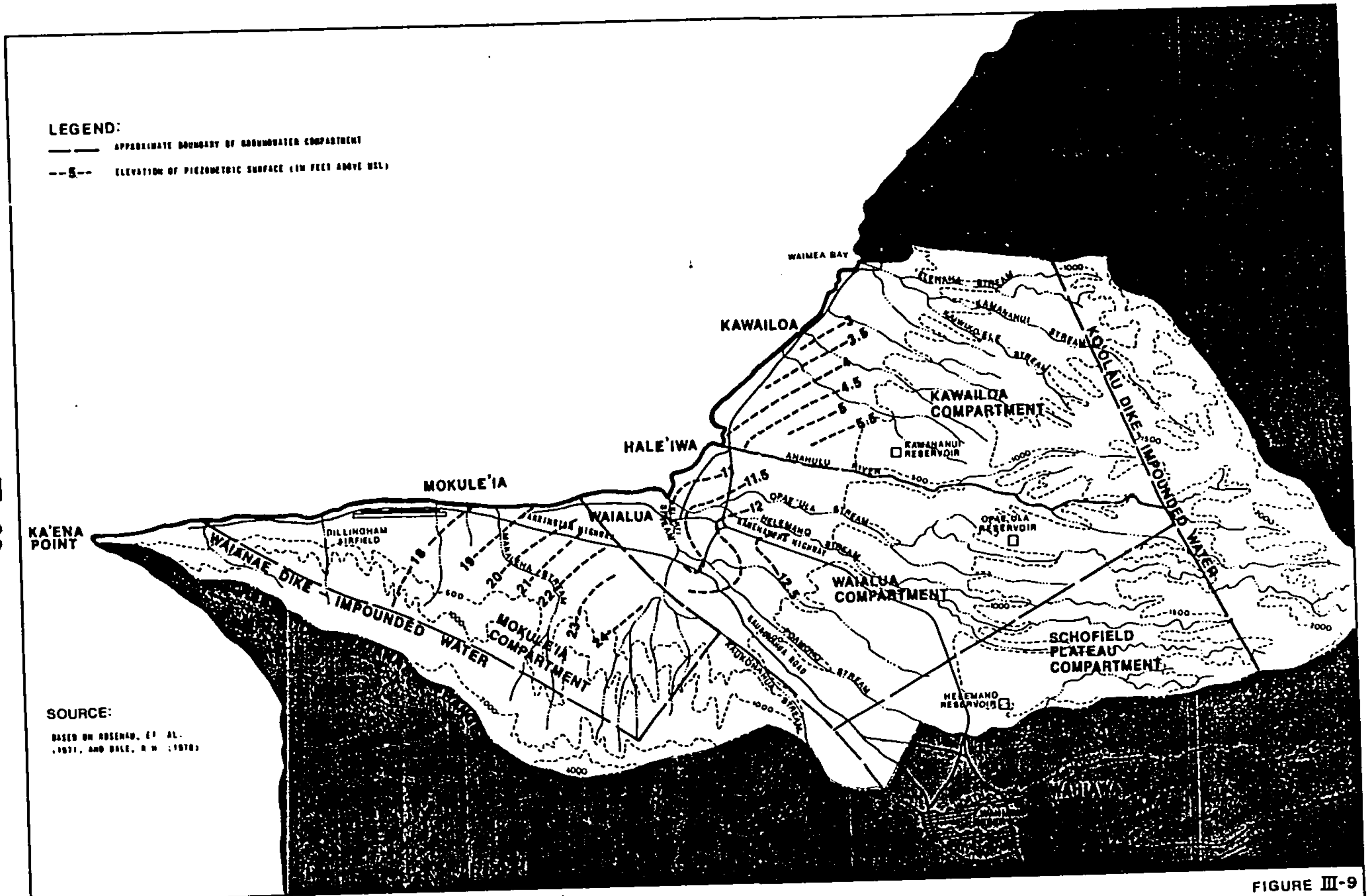


FIGURE III-9

GROUNDWATER COMPARTMENTS IN THE STUDY AREA

However, the Groundwater Control Area program, regulated by the State Department of Land & Natural Resources (DLNR), identifies three control areas in our region of study. The three areas, along with their sustainable yields and allocated yields are:

	Groundwater Yield (in mill. gallons/day)	
Control Area	Sustainable	Allocated
Waialua Control Area	60.0	53.6
Mokule'ia Control Area	20.0	7.8
Kawailoa Control Area	10.0	6.0

All future withdrawals must be approved by the Department of Land and Natural Resources in accordance with the Groundwater Control Area regulations.

3.3 WATER QUALITY

3.3.1 Stream Quality

Water quality data for the streams in the Waialua-Hale'iwa planning area are limited to the records maintained by the United States Geological Survey (USGS). Presently, the only streams in the planning area which the USGS monitors for water quality are Helemano Stream and Opae'ula Stream. Selected data for the streams are summarized in Table III-4. In general, the figures shown are based on only one or two samples per year. Hence comparisons of reported water quality with the State standards must be made with caution.

The monitoring station for Helemano Stream (station no. 16-3430) is located in the lower reach of the stream near Hale'iwa, while the main station for Opae'ula Stream (station no. 16-3450) is located far upstream. A second station on Opae'ula Stream near Hale'iwa (station no. 16-3500) was also monitored for water years 1971-1973. Monitoring station locations are shown on Figure III-5.

Water quality standards for streams in the state of Hawai'i are contained in Title 11, Chapter 54, of Administrative Rules, State of Hawaii /Section 11-51-05(c)(2)/. Data from the sampling stations near Hale'iwa indicate that Helemano and Opae'ula Streams exceed the State standards for specific

Table III-4. USGS Water Quality Data: Helemano Stream and Opae'ula Stream.

Water Year	Temperature (°C)	Specific Conductance (u-MHOS)	pH	Dissolved Oxygen (mg/L)	Nitrite + Nitrate (mg/L-N)		Orthophosphorus (mg/L-P)		Turbidity (JTU)		Suspended Solids (mg/L)	
					Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Water Quality Criteria (Class 2 Stream)	1°C from ambient	300	Between 5.5 and 8.0	Not less than 80% of saturation	0.070	0.030	0.050	0.030	5.0	2.0	20	10
Station No. 16-3430: Helemano Stream												
1970	22.3	105	6.6	-	0.2*	0.4*	-	-	25	1	3	-
1971	25.0	540	7.0	9.8	-	5.6*	-	0.06	-	1	-	-
1972	23.0	750	7.4	7.0	-	1.8*	-	-	-	110	-	-
1973	-	554	7.8	-	1.6	1.3	0.03	-	-	1	-	-
1974	23.4	93	6.6	-	0.02	0.97	0.02	0.04	10	90	-	-
1975	23.8	262	6.8	-	0.14	0.77	0.04	0.08	20	1	-	-
1976	24.0	423	6.5	-	0.57	0.90	0.02	0.02	1	30	-	-
1977	23.6	198	6.6	-	0.23	-	0.01	-	550	-	-	-
1978	23.4	912	7.1	-	-	-	-	-	-	-	-	-
1979	22.4	582	6.9	-	-	-	-	-	-	-	-	-
1980	23.1	310	6.8	-	-	-	-	-	-	-	-	-
1981	23.2	570	6.7	-	-	-	-	-	-	-	-	-
1982	24.0	154	6.7	-	-	-	-	-	-	-	-	-
Station No. 16-3450: Opae'ula Stream (near Wahiawa)												
1970	22.8	40	6.0	-	0.3*	0.5*	-	-	4	5	3	-
1971	24.0	65	5.9	7.4	-	0.0*	-	0.00	-	0	-	-
1972	22.5	50	6.2	8.2	-	0.0*	-	-	-	1	-	-
1973	-	54	6.6	-	0.0*	-	-	0.10	1	2	16	-
1974	21.5	35	6.4	-	0.0	0.0	0.00	0.02	9	4	20	8
1975	23.2	52	7.0	-	0.01	0.00	0.00	0.02	2	2	-	-
1976	20.4	49	6.3	-	0.00	0.00	0.00	0.00	3	3	-	-
1977	21.7	44	6.1	-	0.25	-	0.01	-	9	-	-	-
1978	21.9	52	6.9	-	-	-	-	-	-	-	-	-
1979	22.6	47	6.7	-	-	-	-	-	-	-	-	-
1980	22.1	47	6.7	-	-	-	-	-	-	-	-	-
1981	23.3	49	6.7	-	-	-	-	-	-	-	-	-
1982	23.4	43	6.5	-	-	-	-	-	-	-	-	-
1983	22.8	45	6.7	-	-	-	-	-	-	-	-	-
1984	24.0	50	6.5	-	-	-	-	-	-	-	-	-
Station No. 16-3500: Opae'ula Stream (near Hale'iwa)												
1971	23.0	310	6.6	6.9	-	3.6*	-	0.06	-	15	-	-
1972	22.0	460	6.3	3.6	-	0.8*	-	-	-	1	-	-
1973	-	495	7.4	-	0.1*	2.2*	0.00	-	1	0	-	-

* Nitrate only.
Note: All figures are yearly averages based on geometric mean.

Source: U.S. Department of the Interior, Geological Survey, Water Resources Division (Annual, 1970-1984).

conductance and nitrite + nitrate-nitrogen (for both wet and dry periods). For both streams, the dry-weather standard for total phosphorus is exceeded. It seems that the standard is met during wet weather; however, the USGS data incorporates only orthophosphorus and not total phosphorus. Consequently, total phosphorus levels may still exceed the present wet-weather standard.

The data for Opae'ula Stream near Wahiawa indicates that it generally satisfies the standards for specific conductance and nitrite + nitrate-nitrogen at that location. Phosphorus levels there appear to be lower than the levels in the downstream sections near Hale'iwa.

Turbidity levels at all three monitoring stations show a wide variation in relation to the existing standards. Suspended solids (non-filterable residue) values of the samples taken meet the State standards, but the available data is quite limited.

3.3.2 Groundwater Quality

O'ahu has a relatively permeable rock base which is saturated with water. This groundwater consists of a lens-shaped body of freshwater which, because of its lower density, "floats" on denser saline water contained in surrounding rock. The exact location of the three-dimensional boundary between fresh and salt water is a function of the amount of freshwater recharge at the surface and the relative permeability of the rock units that are involved. Because of this, perhaps the single most basic measurement of groundwater quality is the chloride level. The greater the amount of outward moving freshwater and the more impermeable the caprock along the ocean, the lower the chloride concentrations are along the coast; lower freshwater flow rates and/or higher permeability lead to more salt water intrusion.

Groundwater quality data have been collected and analyzed by First West Engineers, Inc. as part of that firm's work for the State Department of Health's Underground Injection Control (UIC) regulations. From this data a 2,500 milligram per liter (mg/L) isochlor (line of equal concentration of chloride) was drawn. As shown in Figure II-6, the 2,500 mg/L isochlor is at the coastline towards the western end of the study area, whereas at its eastern end it generally follows Kamehameha Highway; in the central portion of the region it swings farther inland.

The Underground Injection Control (UIC) regulations adopted by the State Department of Health establish a line inland of which domestic and industrial wastewater injection wells are not allowed. This line generally follows the 2,500 mg/L isochlor, but it has been drawn along recognizable boundaries for administrative clarity.

Of necessity, First West Engineer's estimate of the location of the 2,500 mg/L isochlor was based on water quality samples taken from many different wells. Each draws from different depths and, hence, from different locations within the basal lens. Because of this and differences in other parameters, such as quantity of water pumped, chloride levels in wells are not often directly comparable, and considerable professional judgment and interpretation were involved in the delineation of the 2,500 mg/L isochlor. Thus, not all experts agree with the location shown. For example, the U.S. Dept. of the Interior, Geological Survey, Water Resources Division (March 31, 1982) has noted that Laniakea Springs in Kawailoa has a chloride concentration of 500 mg/L even though it is at the shoreline.

3.3.3 Coastal Water Quality

Kaiaka Bay is an embayment designated Class A and Class II Bottom marine waters by the State Health Department /Section 11-54-06(a)(2)(B)/. Waialua Bay is classified Class AA and Class II Bottom marine waters. Hale'iwa Boat Harbor is an embayment located at the original mouth of the Anahulu River; it is designated Class A and Class II Bottom marine waters.

Available water quality data from Kaiaka and Waialua Bays are summarized in Tables III-5 and III-6. With the exception of dissolved oxygen, the maximum criteria are exceeded for all parameters covered by the standards. The most notable violations are for total and orthophosphate phosphorus, nitrate and nitrite nitrogen, turbidity, and suspended solids. The possible

Table III-5. Water Quality for Waialua and Kaiaka Bay Embayments.

Embayment	Year	Temp. °C	pH	Dissolved Oxygen (mg/L)	Nitrite + Nitrate Nitrogen (mg/L-N)	Ammonia Nitrogen (mg/L-N)	Total Kjeldahl Nitrogen (mg/L-N)	Orthophosphate Phosphorus (mg/L-P)	Total Phosphorus (mg/L-P)	Turbidity (NTU)	Suspended Solids (mg/L)	Salinity (S^o/oo)
Water Quality Criteria (Embayment)		1°C from ambient	Btwn 7.6 & 8.6	Not less than 75% of saturation	0.005	0.0035	0.15	0.007	0.020	0.4	15.0	—
Kaiaka Bay												
(1)	1961	24.5	8.0	4.2	0.072*	—	—	—	0.007	—	124	34.0
(3)	1980	23.0	8.1	6.9	0.01	0.1	0.16	0.011	0.019	3.1	53	34.3
(3)	1981	25.3	8.1	6.8	0.05	0.1	0.46	0.052	0.087	37.7	162	32.6
(3)	1982	25.3	8.1	6.5	0.04	0.11	0.32	0.061	0.089	38.9	73	32.5
(3)	1983	23.5	8.1	6.9	0.17	0.15	0.22	0.031	0.065	27.1	65	31.4
(3)	1984	25.5	8.1	6.6	0.03	0.46	0.14	0.020	0.036	10.2	34	33.0
(3)	1985	24.2	8.1	7.4	0.02	0.11	0.18	0.011	0.019	2.5	58	32.9
	1986	25.2	8.2	7.0	0.02	0.05	0.13	0.005	0.014	1.1	37	32.8
Waialua Bay												
(1)	1961	25.5	8.3	7.0	0.016*	0.079	—	—	0.002	—	2,120	38.2
(2) (Hale'iwa Boat Harbor)	1970/ 1971	26.2	—	5.7	—	0.010	—	0.008	0.085	—	—	14.5
(3)	1977	—	—	—	0.09	None Detected	0.17	—	0.026	1.1	—	—

* Nitrate-Nitrogen only.
Note: All figures are yearly averages based on geometric means. Samples taken under "DRY" conditions, see Figure III-4a for locations.

Sources: (1) Belt Collins & Associates (1962)
(2) Dillingham Environmental Company (June 1971)
(3) State of Hawai'i, Department of Health, STORET #170 (Unpublished).

Table III-6. Open Coastal Water Quality.

Station	Year	Temperature °C	pH	Dissolved Oxygen (mg/L)	Nitrite + Nitrate Nitrogen (mg/L-N)	Ammonia Nitrogen (mg/L-N)	Total Kjeldahl Nitrogen (mg/L-N)	Orthophosphate Phosphorus (mg/L-P)	Total Phosphorus (mg/L-P)	Turbidity (NTU)	Suspended Solids (mg/L)	Salinity (S^o/oo)	Secchi Depth (feet)	Coliform Total (no/ml)	Coliform Fecal (no/ml)
Water Quality Criteria (Open Coastal Waters)		1°C from ambient	Between 7.6 & 8.6	Not less than 75% of saturation	0.0035	0.002	0.110	0.005	0.016	0.20	10.0	—			
(R)	1973-1975	24.9	8.0	6.5	0.003	—	0.093	0.005	0.011	—	—	34.1	69.4	3.9	3.5
(Ri)	1973-1975	24.8	8.1	6.6	0.002	—	0.064	0.006	0.012	—	—	34.2	78.1	3.0	3.0
(S)	1973-1975	24.8	8.1	6.6	0.002	—	0.071	0.005	0.011	—	—	34.1	78.6	3.2	3.1
(T)	1973-1975	24.6	8.1	6.5	0.004	—	0.069	0.006	0.012	—	—	34.0	31.5	3.1	3.1
(U)	1973-1975	24.7	8.1	6.5	0.009	—	0.082	0.006	0.012	—	—	33.7	45.4	6.6	4.8

Note: All figures are yearly averages based on geometric means.
Samples taken under "DRY" conditions. See Figure III-5 for locations.

Source: City and County of Honolulu, Department of Public Works (1973-1975) pollutant sources are sediment from soil erosion within the drainage basin, household cesspools, and injection wells from thirteen private and one municipal treatment plants.

3.3.4 Bacteriological Survey

Bacteriological surveys were conducted at 14 monitoring stations within the Waialua-Hale'iwa planning area. Wet and dry weather data was collected from these sampling stations between February and June 1985. Results obtained from this survey are summarized in Tables III-7 and III-8.

Evaluation of the data indicates that only Stations No. 1, 2, 8, 12, 13 and 14 (located along the shoreline) meet current State Department of Health (DOH) fecal coliform (FC) limitations ($\leq$200 FC/100 mL) during both wet and dry weather conditions. Samples from Station 3 (located at the mouth of a small stream) and 11 (located offshore from a stream) meet DOH limitations only during dry weather conditions. All other stations are located on inland portions of streams in the area and greatly exceed DOH limitations.

Stations found to be in violation of DOH limitations were further evaluated in terms of the fecal coliform to fecal streptococus ratio (FC:FS). FC:FS ratios are utilized to determine the potential source of the high coliform count. Samples with FC:FS ratios greater than two are interpreted to be of human

Table III-7: Bacteriological Survey - Wet Weather Conditions.

Site No.	Location	Date (1985)	Organisms/100 ml. Total Coliform	Fecal Coliform	Fecal Strep	FC:FS Ratio
1	Mokule'ia Beach off empty lot	2/4	4	4	6	<1
		2/26	1	1	18	<1
		3/6	2	<1	4	<1
2	Mokule'ia Beach off condominium	2/4	6	2	10	<1
		2/26	80	29	87	<1
		3/6	23	15	14	1.1
3	Mokule'ia Beach off Hawthorne Stream	2/4	6	4	52	<1
		2/26+	9.6×10^4	3.2×10^4	2.0×10^4	1.6
		3/6	1.1×10^2	40	20	2.0
4	Ki'iki'i Stream at Waialua Beach Rd.	2/4	6.1×10^3	2.8×10^3	2.0×10^3	1.4
		2/26	1.0×10^4	6.0×10^3	6.3×10^3	<1
		3/6	1.1×10^4	1.1×10^3	4.6×10^3	<1
5	Ki'iki'i Stream at Farrington Hwy.	2/4	6.6×10^3	1.2×10^3	8.0×10^3	<1
		2/26	5.0×10^3	9.0×10^2	2.9×10^3	<1
		3/6	1.5×10^4	2.0×10^3	5.3×10^3	<1
6	Paukauila Stream at Haleiwa Road	2/4	3.5×10^3	1.7×10^3	1.5×10^3	1.1
		2/26	1.5×10^4	5.5×10^3	7.1×10^3	<1
		3/6	1.4×10^4	2.5×10^3	4.7×10^3	<1
7	Paukauila Stream at Kamehameha Hwy. (Wahiawa fork)	2/4	1.6×10^4	7.7×10^3	1.5×10^4	<1
		2/26	2.4×10^3	4.0×10^2	2.1×10^3	<1
		3/6	5.3×10^3	1.2×10^3	7.2×10^3	<1
8	Waialua Bay off Pikai Street	2/4	8	8	4	2.0
		2/26	9	6	<1	>6
		3/6	5	4	5	<1
9	Anahulu River at Kamehameha Hwy.	2/4	6.3×10^3	4.3×10^3	6.1×10^3	<1
		2/26	2.2×10^4	7.5×10^3	1.2×10^3	6.3
		3/6	5.6×10^3	1.2×10^3	2.8×10^3	<1
10	Anahulu River off Emerson Road	2/4	7.2×10^4	1.4×10^4	8.0×10^4	<1
		2/26	1.3×10^4	4.1×10^3	1.1×10^4	<1
		3/6	4.8×10^3	2.0×10^3	4.2×10^3	<1
11	Waialua Bay off Jetty	2/4	4.0×10^2	4.0×10^2	1.1×10^2	3.6
		2/26	9.8×10^2	4.2×10^2	4.4×10^2	<1
		3/6	2.5×10^2	86	2.3×10^2	<1
12	Hale'iwa Beach Park	2/4	2	2	16	<1
		2/26	27	22	42	<1
		3/6	4	2	16	<1
13	Kawailoa Beach off Papailoa Road	2/4	2	<2	4	<1
		2/26	<1	5	11	<1
		3/6	4	<1	1	<1
14	Kawailoa Beach at Laniakea	2/4	4	4	2	2
		2/26	18	18	30	<1
		3/6	4	3	5	<1

Weather Conditions:

2/4: Heavy rains 24 hours prior, moderate rains during and after sampling. Streams slightly turbid. High surf.
2/26: Heavy rains 24 hours prior, light rains during sampling. High flow in streams with moderate turbidity. Seas calm.
3/6: Heavy rains 24 hours prior, moderate to light rains during sampling. High to moderate flow in streams with slight turbidity. Seas calm.

+ Hawthorne Stream opened to ocean by Waialua Sugar Co. approx. 2.5 hrs. prior to sampling.

Source: City & County of Honolulu, Dept. of Public Works, Div. of Wastewater Management.

Table III-8: Bacteriological Survey - Dry Weather Conditions.

Site No.	Location	Date (1985)	Organisms/100 ml: Total Coliform	Fecal Coliform	Fecal Strep	FC:FS Ratio
1	Mokule'ia Beach off empty lot	5/14	8	< 1	< 1	< 1
		6/03	3	< 1	13	< 1
		6/17	1	< 1	< 1	< 1
2	Mokule'ia Beach off condominium	5/14	17	< 1	2	< 1
		6/03	< 1	< 1	7	< 1
		6/17	1	< 1	1	< 1
3	Mokule'ia Beach off Hawthorne Stream	5/14	150	< 10	10	< 1
		6/03	13	4	15	< 1
		6/17	1	< 1	2	< 1
4	Ki'iki'i Stream at Waialua Beach Rd.	5/14	300	140	110	1.3
		6/03	1,600	110	140	< 1
		6/17	1,800	70	100	< 1
5	Ki'iki'i Stream at Farrington Hwy.	5/14	7,700	1,600	1,300	1.2
		6/03	7,000	100	560	< 1
		6/17	9,500	2,800	710	3.9
6	Paukauila Stream at Haleiwa Road	5/14	4,100	150	230	< 1
		6/03	1,800	250	350	< 1
		6/17	230	90	70	1.3
7	Paukauila Stream at Kamehameha Hwy. (Wahiawa fork)	5/14	3,800	280	220	1.3
		6/03	270	40	80	< 1
		6/17	540	100	140	< 1
8	Waialua Bay off Pikai Street	5/14	< 1	< 1	1	< 1
		6/03	4	< 1	1	< 1
		6/17	< 1	< 1	< 1	< 1
9	Anahulu River at Kamehameha Hwy.	5/14	3,400	370	510	< 1
		6/03	1,500	170	150	1.1
		6/17	460	150	110	1.4
10	Anahulu River off Emerson Road	5/14	9,000	300	730	< 1
		6/03	2,500	50	400	< 1
		6/17	140	90	400	< 1
11	Waialua Bay off Jetty	5/14	370	55	40	1.4
		6/03	2	< 1	2	< 1
		6/17	5	5	2	2.5
12	Hale'iwa Beach Park	5/14	140	17	400	< 1
		6/03	< 2	< 2	770	< 1
		6/17	20	3	240	< 1
13	Kawailoa Beach off Papailoa Road	5/14	1	1	< 1	> 1
		6/03	1	< 1	5	< 1
		6/17	< 1	< 1	< 1	< 1
14	Kawailoa Beach at Laniakea	5/14	22	6	37	< 1
		6/03	< 1	< 1	11	< 1
		6/17	< 1	< 1	1	< 1

Weather Conditions:

6/03: Clear weather 24 hours prior to and during sampling. Low stream flow with relatively clean waters. Seas calm with the tide rising. Beach site #12 was turbid.

6/17: Clear weather 24 hours prior to and during sampling. Low stream flow with relatively clean waters. Seas calm at low tide. Beach site #12 was turbid.

Source: City & County of Honolulu, Dept. of Public Works, Div. of Wastewater Management.

origin, ratios less than one are from animal sources, and ratios between one and two are of undetermined origin.

Based on analysis of the available data, it appears that the high coliform counts are of non-human origin (see Tables III-7 and III-8). From the general location of these stations (on or near streams or stream outlets) it is highly possible that the pollution is generated from nearby agricultural areas. The exact location or type of source, however, cannot be pinpointed based on the data available. It is therefore anticipated that above standard coliform counts will continue to occur in this area.

3.4 SOILS

The U.S. Department of Agriculture, Soil Conservation Service (August 1972) has identified three soil associations in the planning area. The Tropohumults-Dystrandepts association is found on the east side of the Waianae Range. These soils are gently sloping to very steep and are well drained. Since this association is composed of mostly steep and inaccessible land, these soils are used primarily for watershed, although some of the soils that comprise a minor portion of this association are used for woodland, pasture, pineapple, or sugarcane.

The Helemano-Wahiawa association comprises the soils of the central plateau. These deep soils are nearly level to moderately sloping, and are well drained. They occur in broad flat areas dissected by steep gullies. Overall, the Helemano soils make up about 40 percent of the association, are found on the sides of gulches, and are used for pasture. The Wahiawa soils form 30 percent of the association, are located on the broad upland areas, and are used largely for sugarcane and pineapple. Three other soils series complete the remaining 30 percent of the association.

The coastal plain has soils of the Ka'ena-Waialua association. These are formed in alluvium and have widely varying texture and drainage characteristics. In general, the Ka'ena and Waialua soils are 50 percent of the association, while the remainder is split among eleven other soil series. This association is used for sugarcane, truck crops, pasture, orchard, recreation and urban development.

The specific soils on which urban development within the planning area occurs are Jaucus sand (JaC), 'Ewa silty clay loam (EaB), Fill land (Fd), Hale'iwa silty clay (HeA), Kawaihapai clay loam (KlA and KlB), Kea'au clay (KmA and KmbA), Mamala stony silty clay loam (MnC), Mokule'ia loam (Ms), Waialua silty clay (WkA), Waialua stony silty clay (WlB), and Waipahu silty clay (WzA). (See Figures III-10, III-11 and III-12.) Selected characteristics of these and other soils in the study area are shown in Table III-9.

Two soils series in the planning area that can be marshy are the Hale'iwa and Tropaquept soils. Generally, the Tropaquepts are "poorly drained soils that are periodically flooded by irrigation in order to grow crops that thrive in water". The Hale'iwa series are found on alluvial fans or along drainageways of the coastal plain. They are usually well drained but included in the Hale'iwa silty clay mapping unit (HeA) as "areas of poorly drained clayey soils in depressions". The area northeast of Lokoea Pond is classified as a marsh (MZ) (U.S. Department of Agriculture, Soil Conservation Service, August 1972).

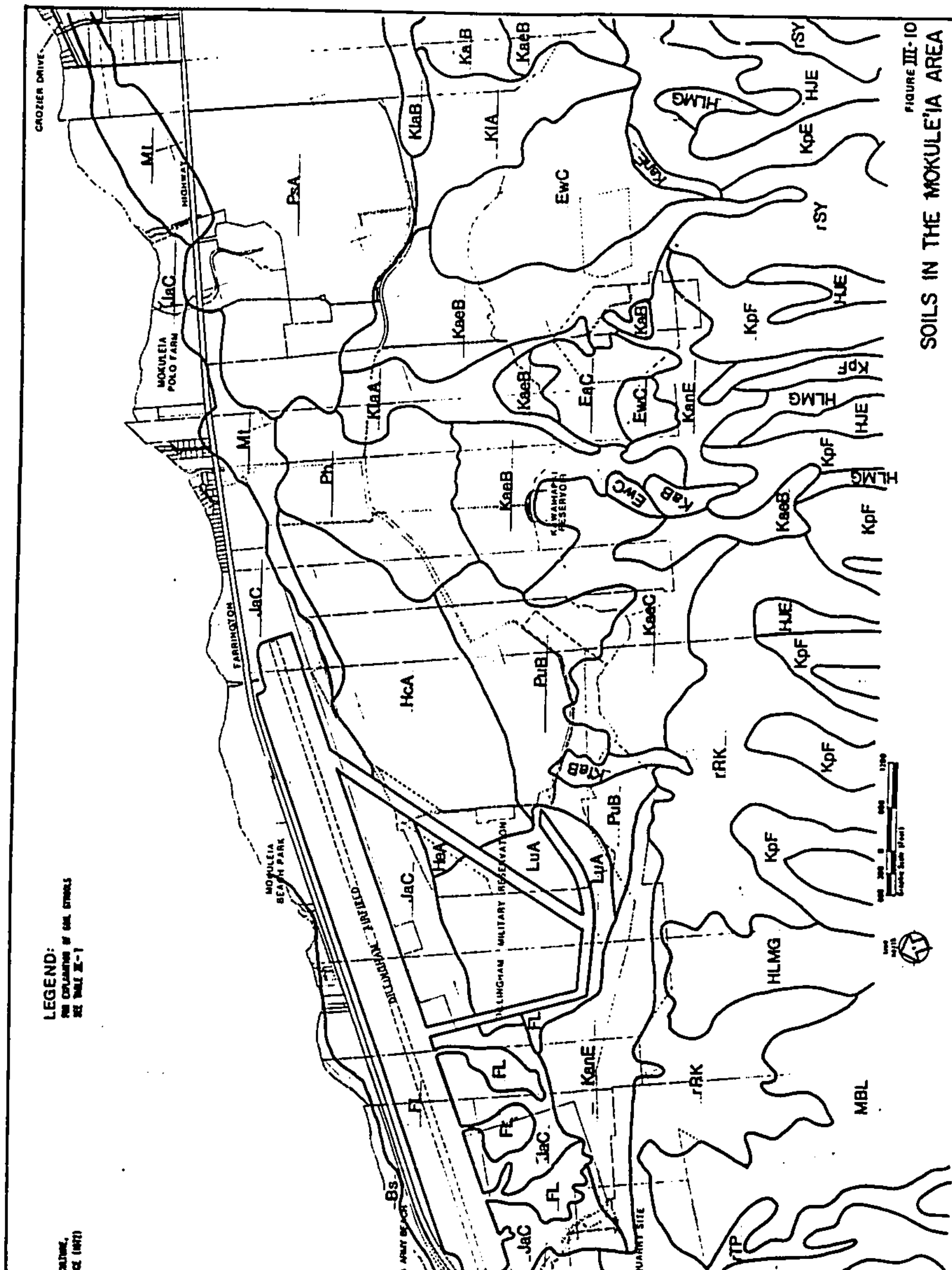


FIGURE III-10
SOILS IN THE MOKULE'IA AREA

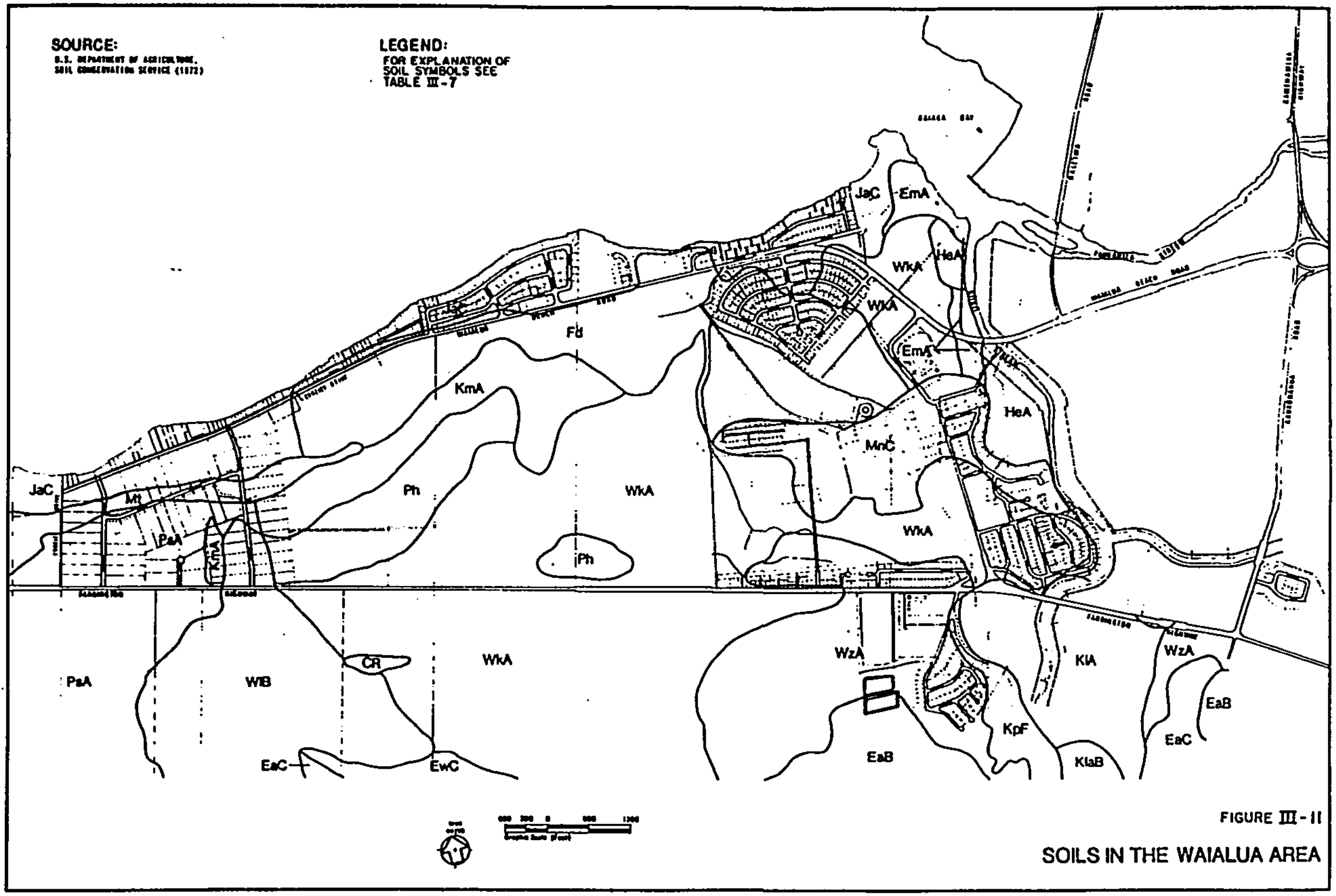


FIGURE III-11

SOILS IN THE WAIALUA AREA

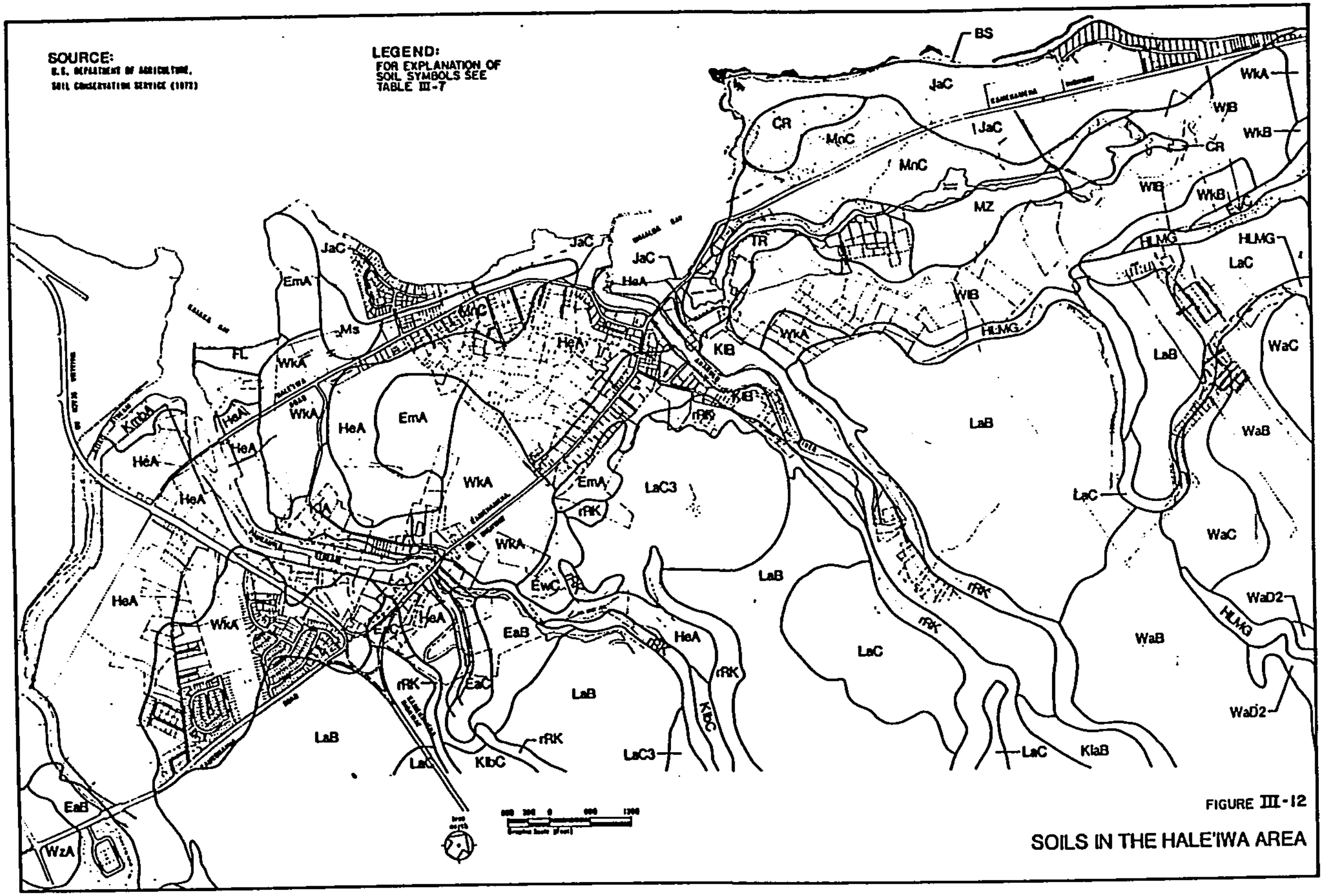


FIGURE III-12

SOILS IN THE HALE'IWA AREA

Table III-9. Characteristics of the Soils in the Study Area.

Map Symbol	Mapping Unit	Capability Classification Irri-gated	Non-Irri-gated	Soil Features Affecting Foundations for Low Buildings	Degree and Kind of Limitations for Septic Tanks Filter Fields
CR	Coral outcrop	--	VIIIs	n.a.	n.a.
EaB	Ewa silty clay loam, 3-6%	IIe	IVc	All features favorable	Slight: moderate permeability; severe where soil is moderately shallow
EaC	Ewa silty clay loam, 6-12%	IIIe	IVe	All features favorable	
EmA	Ewa silty clay loam, mod. shallow, 0-2% slopes	IIs	IVs	All features favorable	
EwC	Ewa stony silty clay, 6-12% slopes	IIIe	IVe	All features favorable	Slight: moderate permeability
Fd	Fill land	--	--	n.a.	n.a.
FL	Fill land, mixed	--	--	n.a.	n.a.
HeA	Hale'iwa silty clay, 0-2% slopes	IIe	IIIc	All features favorable	Slight: except where subject to local flooding
HLMG	Helemano silty clay, 30-90% slopes	--	VIIe	Slopes of 30-90%; susceptible to sliding	Severe on slopes of 30-90%
JaC	Jaucus sand, 0-15% slopes	IVs	VIe	All features favorable	Slight: rapid permeability
KaB	Ka'ena clay, 2-6% slopes	IIIw	IVw		
KaeB	Ka'ena stony clay, 2-6% slopes	IIIw	IVw	High shrink-swell potential; poorly drained; low shear strength; seepage	Severe: slow permeability; seepage
KaeC	Ka'ena stony clay, 6-12% slopes	IIIw	IVw		
KanE	Ka'ena very stony clay loam, 10-35% slopes	--	VIw		
KeA	Kawaihapai clay loam, 0-2% slopes	I	IIc	High shear strength	Slight
KlB	Kawaihapai clay loam, 2-6% slopes	IIe	IIe	High shear strength	Slight
KlaA	Kawaihapai stony clay loam, 0-2% slopes	IIs	IIs	Stoniness	Slight
KlaB	Kawaihapai stony clay loam, 2-6% slopes	IIe	IIe	Stoniness	Slight
KlbC	Kawaihapai very stony clay loam, 0-15% slopes	--	VIs	Slopes as much as 15% high shear strength	Slight to moderate, depending on slope
KmA	Kea'au clay, 0-2% slopes	IIIw	Vw	High shrink-swell potential; high water table; low shear strength	Severe: slow permeability; high water table
KmbA	Kea'au clay, saline, 0-2% slopes	--	VIw		
KpF	Kemo'o silty clay, 35-70% slopes	--	VIIe	Slopes as much as 70%; high bearing strength	Severe due to slope

Table III-9. Characteristics of the Soils in the Study Area. (Continued)

Map Symbol	Mapping Unit	Capability Classification: Irri-gated	Capability Classification: Non-irri-gated	Soil Features Affecting Foundations for Low Buildings	Degree and Kind of Limitations for septic tank Filter Fields
LaB	Lahaina silty clay, 3-7% slopes	IIe	IIIc	No unfavorable features	Slight
LaC	Lahaina silty clay, 7-15% slopes	IIIe	IIIe	Slopes as much as 15%	Moderate, due to slope
LaC3	Lahaina silty clay, 7-15% slopes, severely eroded	IVe	IVe	Slopes as much as 15%	Moderate, due to slope
Mnc	Mamala stony silty clay loam, 0-12% slopes	IIIs	VIs	Coral at depth of less than 20 inches; slopes as much as 12%; stoniness	Severe: coral at a depth of less than 20 inches
Ms	Mokule'ia loam	IIs	VIs	Sand at depth of less than 20 inches; low shrink-swell potential below a depth of 20 inches	Slight: rapid permeability below a depth of 20 inches
Mt	Mokule'ia clay loam	IIs	VIs		
MZ	Marsh	—	VIIIw	n.a.	n.a.
Ph	Pearl Harbor clay	IVw	IVw	High water table; high shrink-swell potential; low bearing capacity	Severe: very poorly drained, very slow permeability
PsA	Pulehu clay loam, 0-3% slopes	I	IVc	High shear strength; subject to flooding in low areas	Slight on slopes of 0-7%; moderate in low areas subject to occassional flooding
PuB	Pulehu stony loam, 2-6% slopes	IIe	IVs		
rSY	Stony steep land	—	VIIs	n.a.	n.a.
rRK	Rock land	—	VIIs	n.a.	n.a.
TR	Tropaquepts	IVw	IVw	Slow permeability; high water table; low shear strength	Severe: high water table
WaB	Wahiawa silty clay, 3-8% slopes	IIe	IIe	High shear strength	Slight
WaD2	Wahiawa silty, clay 15-25% slopes, eroded	—	IVe	Slopes as much as 25%; high shear strength	Severe, due to slope
WkA	Waialua silty clay, 3-8% slopes	I	IIIc	Moderate shrink-swell potential; low shear strength; stoniness in places	Slight on slopes of 0-8%; moderate permeability
WlB	Waialua stony silty clay, 3-8% slopes	IIIe	IIIs		
WzA	Waipahu silty clay, 0-2% slopes	I	IVc	Low shear strength; high shrink-swell potential	Severe: moderately slow permeability

Source: U.S. Department of Agriculture (1972: Guide to Mapping Units and Table 3).

The soils series present in the developed areas that the Soil Conservation Service has classified as having severe limitation for septic tank leaching fields are Ka'ena (KaB, KaeB, KaeC, and KaeE); Kea'au (KmA and KmbA); Kemo'o (KpF); Mamala (Mnc); Pearl Harbor (Ph); Tropaquepts (TR); and Waipahu (WzA). The State Department of Agriculture (1977) has designated most of the arable acreage in the Waialua District as either "prime agricultural land" or "other important agricultural land" (see Figures III-13, III-14 and III-15).

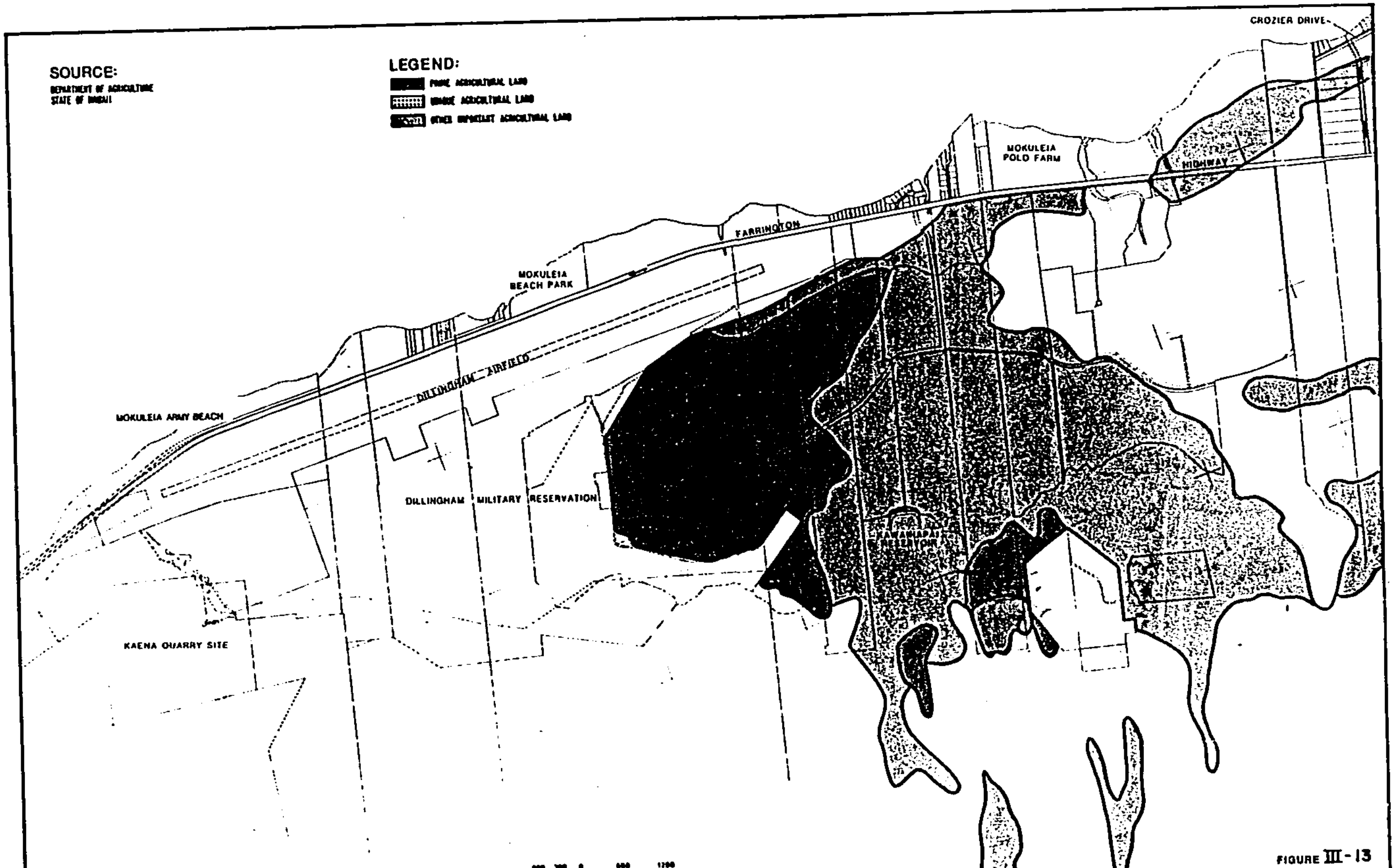


FIGURE III-13

AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAI'I : MOKULE'IA AREA

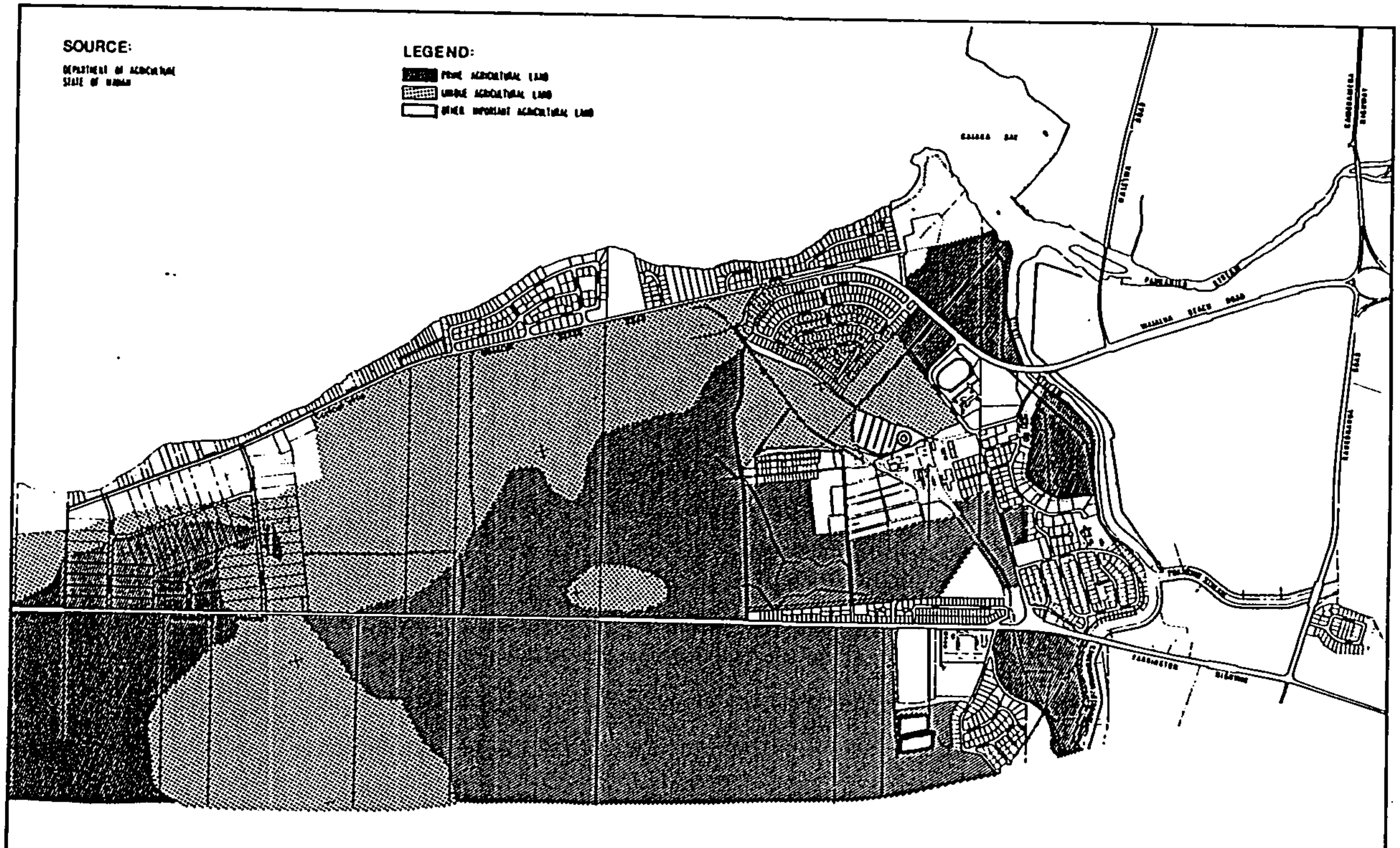


FIGURE III - 14
AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAI'I: WAIALUA AREA

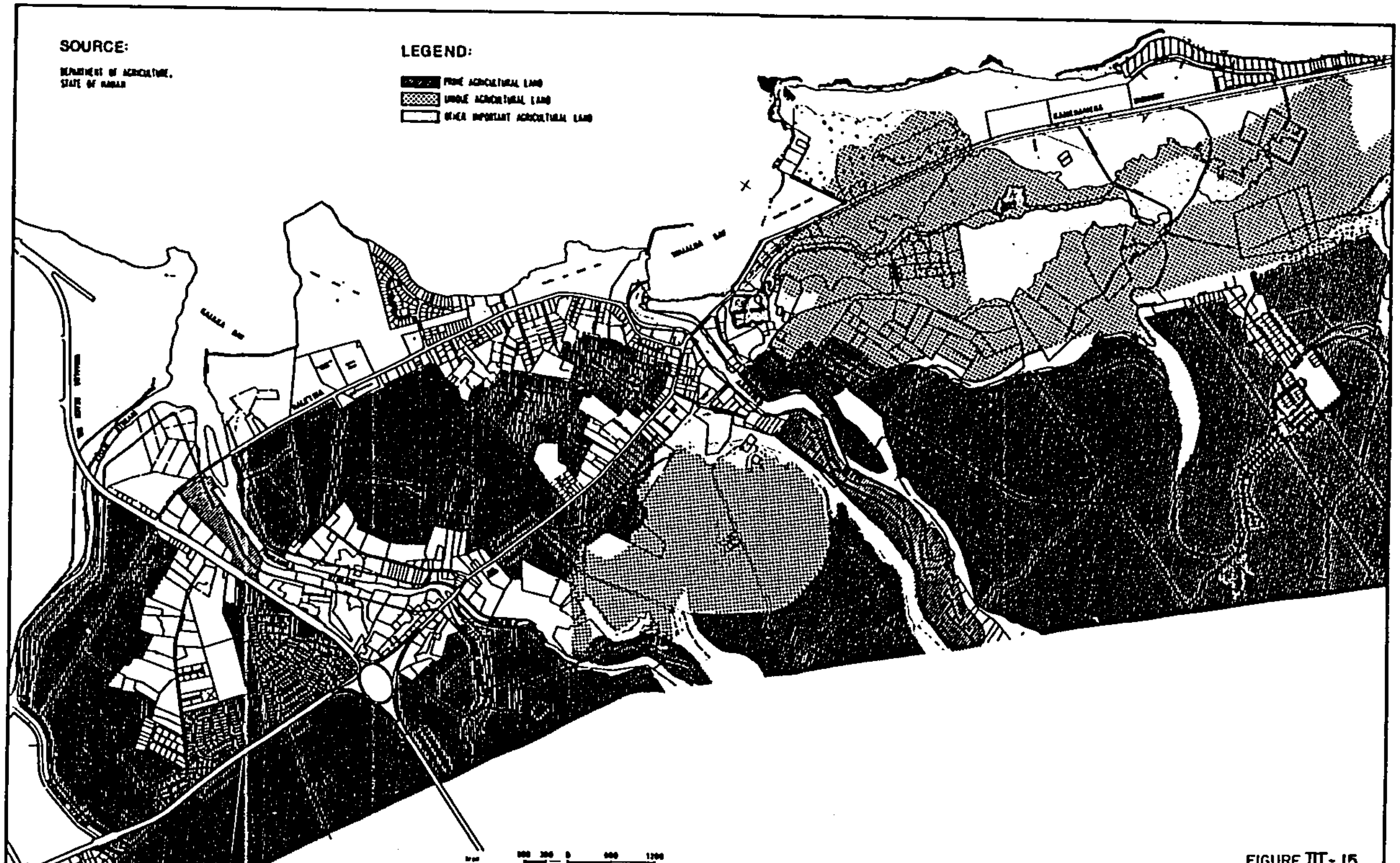


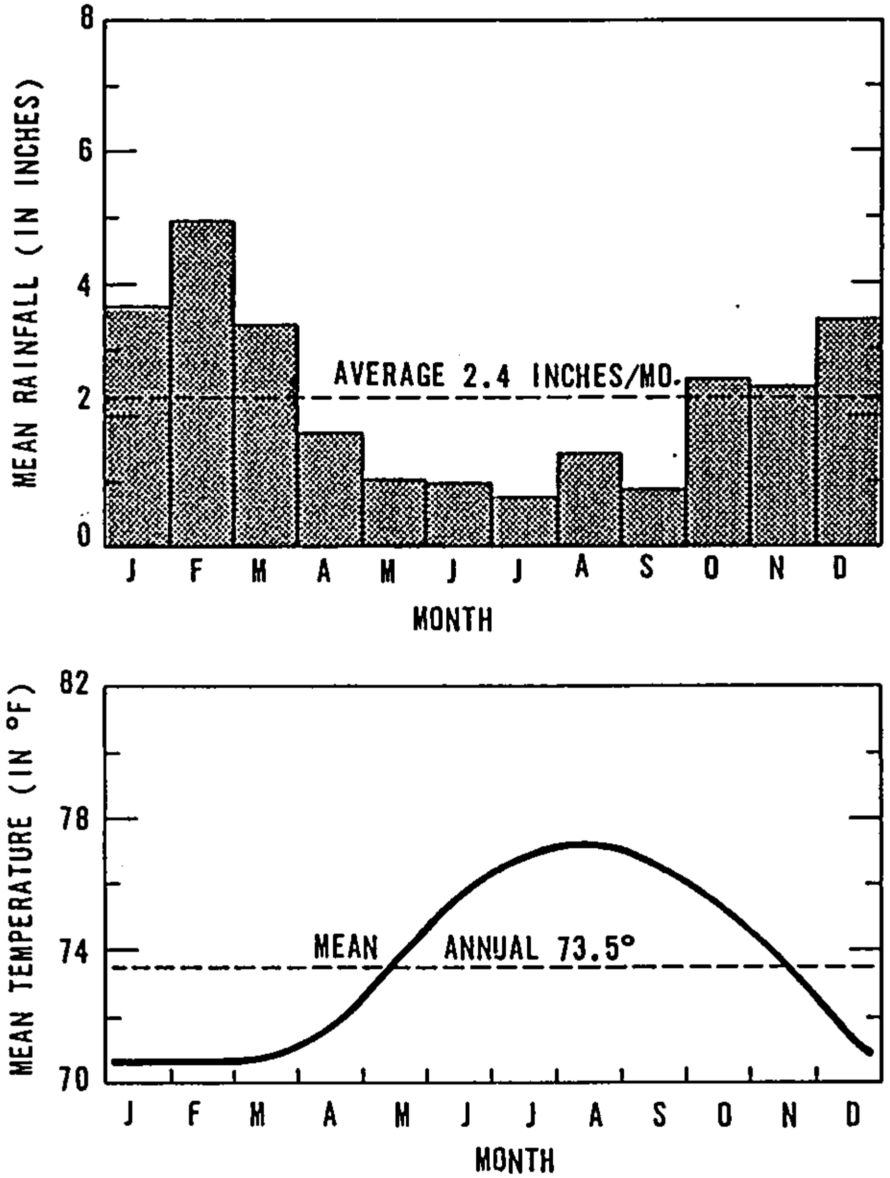
FIGURE III-15
AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAI'I: HALE'IWA AREA

3.5 CLIMATE

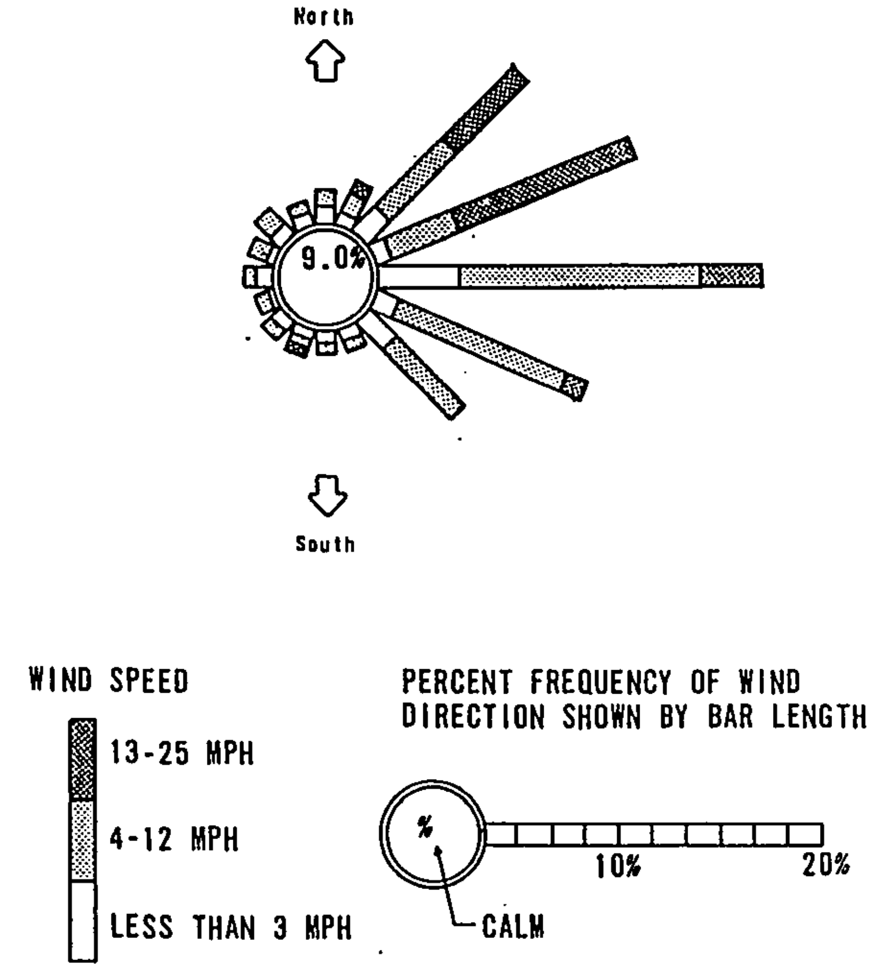
3.5.1 Winds

The prevailing winds in the Waialua District are the northeast tradewinds. A wind rose based on data collected at the Dillingham Airfield site in Mokule'ia is shown in Figure III-16. It indicates that winds there come from northeast through southeast about 80% of the time. Long-term data from other recording stations suggests that there is considerable seasonal variation in this number with the tradewinds prevailing over 90% of the time in the summer and about 60% of the time in mid-winter. Over the open ocean the tradewinds have a somewhat more northerly component than those recorded at Mokule'ia. Hence, it appears that the nearby Waianae Mountains exert some influence on wind direction there. Similar local influences undoubtedly affect winds elsewhere in the district, and winds at other locations will vary accordingly. There appears to be a prevailing daily wind pattern also. At sunset, the wind shifts and appears to come from a more easterly direction and is labeled as the Schofield wind. Nevertheless, the pattern shown in Figure III-16 provides a reasonably good indication of what may be expected elsewhere near the coast in the Waialua District.

Wind speed also varies somewhat on a seasonal basis. Winds greater than 12 miles per hour occur less frequently during the winter than during the summer (e.g., 30% in January versus 70%



MEAN MONTHLY TEMPERATURE AND RAINFALL
AT WAIALUA (STATION 847): 1931-1955



SOURCE:
NATIONAL WEATHER SERVICE,
PACIFIC REGION

SURFACE WIND ROSE: DILLINGHAM
AIRFIELD, MOKULE'IA, OAHU

FIGURE III - 16

SELECTED CLIMATOLOGICAL CHARACTERISTICS:
Waialua-Hale'iwa Area

in August). While there are more calms in the winter, winter storms generate the strongest gusts (about 70 mph).

3.5.2 Temperature

The mean annual temperature in Waialua is 73.5° Fahrenheit, and the seasonal variation is slight (see Figure III-16). During the coldest month the mean monthly temperature is just over 70°F; during the warmest it is about 77°F. Normal daily lows at the coast in the winter are in the low- to mid-60s (degrees Fahrenheit); in the summer they are closer to 70°F. The low of record at Waialua is in the upper 40s. High temperatures at Waialua are typically in the low- to mid-70s in the winter and the mid-80s in the summer. The highest temperature ever recorded at Waialua is 92°F.

3.5.3 Rainfall

Mean annual rainfall in Waialua town is about 30 inches (see Figure III-16). However, rainfall within the Waialua District exhibits great spatial variability, largely as a result of the orographic effects of terrain. Near the crest of the Ko'olau Mountains, the mean annual rainfall is close to 300 inches, or ten times the amount received at Waialua on the coast (see Figure III-17).

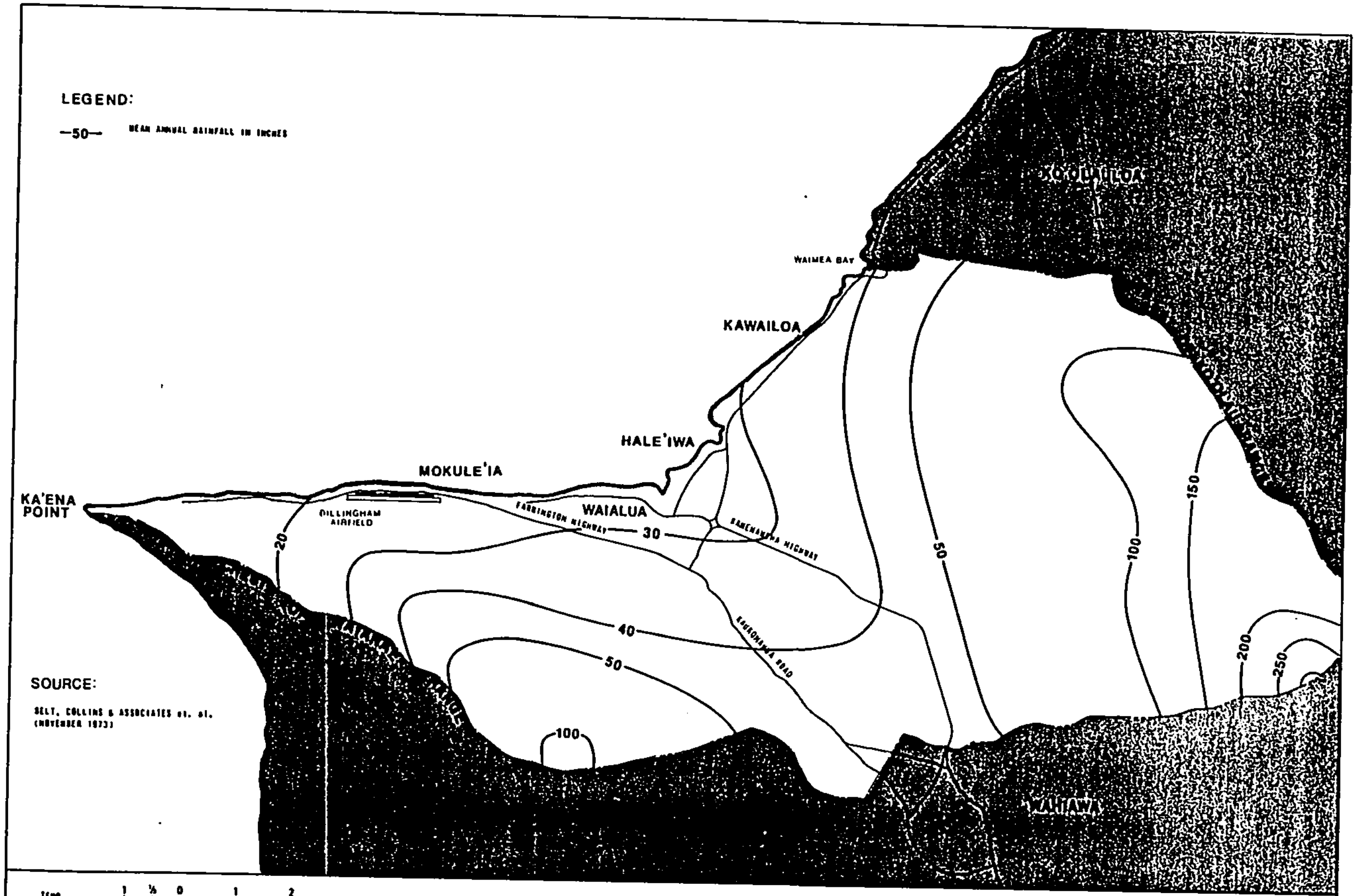


FIGURE III-17

MEAN ANNUAL RAINFALL
IN THE WAIALUA DISTRICT

Storms can produce much higher rainfall intensities at the coastline than the figures would suggest. A total monthly rainfall of at least 14 inches has been recorded at Waialua town one or more times in each of the winter months (October through March). One very wet February it was over 35 inches, or more than is received in an average year. The rainfall-frequency maps prepared by the Weather Bureau of the U.S. Department of Commerce (1962) show that at Waialua town the one-hour rainfall having a recurrence interval of 100 years is just under four inches; the comparable rainfall amount for a 24-hour period is nearly 14 inches. The "probable maximum rainfall" for a six-hour period at that point is estimated at 26 inches.

3.5.4. Humidity/Class A Pan Evaporation

Average daily maximum humidity at Waialua is 80 percent; the average minimum humidity is 65 percent. Most of the daily fluctuation comes as a result of changes in ambient air temperature rather than changes in the vapor pressure. Hence, the minimum relative humidity tends to occur in the day time and the maximum at night. The mean annual Class A pan evaporation rate in the vicinity of Hale'iwa and Waialua is about 70 inches. Maximum evaporation rates (7.5 to 8.5 inches per month) occur during the summer; in December and January the average loss is about 3.5 to 4 inches per month.

3.5.5 Air Quality

Since the Waialua-Hale'iwa District is largely a rural area of low population density, there are few air pollution sources. The principal stationary and indirect sources are listed in Table III-10. In addition to these sources, it is noted that high surf periods produce high amounts of salt mist that may be corrosive to many metals.

In the past, the Waialua Sugar Mill has been cited by federal officials for violation of visible emissions (opacity) standards (U.S. Environmental Protection Agency, 11 July 1979), but this seems to be a transient problem that has been largely brought under control through the installation of pre-driers which drive off moisture from wet bagasse and result in cleaner, more efficient combustion.

Although the State Department of Health does not maintain a permanent air monitoring station in the area, and there are no monitoring data available, it seems reasonable to assume that existing air quality is generally quite good due to the relatively low level of development and man's activities. In the air quality impact analysis done for the Hale'iwa Bypass highway project (U.S. Department of Transportation, April 1980), the

Table III-10. Existing Air Pollution Sources in the Waialua-Hale'iwa Area.

SOURCE	TYPE	POLLUTANTS AND ACTIVITY
Waialua Sugar Mill	Stationary (point)	Particulates and carbon monoxide when firing bagasse
		Sulfur oxides, nitrogen oxides, particulates, hydrocarbons, and carbon monoxide when firing oil
Mokule'ia Quarry	Stationary (area)	Particulates from rock processing
	Indirect (mobile/area/ line)	Carbon monoxide, nitrogen oxides, hydrocarbons, particulates from hauling
Kamehameha Highway Farrington Highway Kaukonahua Road	Indirect (mobile/line)	Carbon monoxide, hydrocarbons, nitrogen oxides, particulates from motor vehicle activity
Dillingham Airfield	Indirect (area/line)	Carbon monoxide, hydrocarbons, nitrogen oxides, particulates from motor vehicles and aircraft activity
Sugar Cane Fields	Stationary (area/line)	Particulates, carbon monoxide, hydrocarbons from field burning
		Particulates from vehicular and cultivation activities
		Pesticides drift during spraying
Kawailoa Dairy	Stationary (area)	Animal odors

Source: Morrow (June 1982:Table 5).

maximum carbon monoxide concentration predicted along Kamehameha Highway for existing traffic levels was 30.7 milligrams per cubic meter, thus exceeding the State's one-hour standard but meeting the Federal standard. Future levels were predicted to meet State standards due to Federal emission controls on new motor vehicles.

Officially, the Waialua District is "considered an attainment area with respect to both federal and state ambient air quality standards" (Morrow; June 1982:4).

3.6 SONIC ENVIRONMENT

Existing noise levels within the Waialua District vary widely with the time of day and distance from natural and human noise sources (Darby-Ebisu & Associates, Inc., April 29, 1982). Background ambient noise levels are controlled by natural sources such as surf, wind-blown leaves, crickets, and birds. When these are present, minimum noise levels will generally range from 38 to 45 dB. Areas which are adjacent to vacant brush or to cultivated fields of maturing sugarcane can experience higher background ambient levels of 50 to 60 dB, particularly during the first two hours following sunset. These natural noise sources provide a nearly continuous masking effect over other distant sounds during the night. They can also exceed state and local noise limits, particularly during the nighttime hours.

Noise sources associated with human activity, such as motor vehicles and aircraft, are generally louder than the natural sources and generate intermittent noise levels of 70 to 96 dB. However, because of their intermittent nature (particularly at night), they do not provide a reliable source for masking (or making inaudible) the natural noise sources, which are always present in one or more forms.

The existing L_{dn} noise levels probably range from 55 dB to 70 dB, depending upon distance of a particular location from major streets. Locations immediately fronting major streets such as Kamehameha and Farrington Highways, Waialua Beach Road, Goodale Avenue, and Haleiwa Road probably experience L_{dn} values of 65 to 70 dB. Locations which are shielded or remote (in excess of 200 feet) from these major streets probably experience L_{dn} levels of 55 to 60 dB.

3.7 BIOLOGICAL ENVIRONMENT

3.7.1 Vegetation

The predominant "natural" vegetation in the vicinity of Waialua and Hale'iwa consists of dry scrub and mixed lowland vegetation. However, these have been displaced by sugarcane in virtually all of the areas where its cultivation is possible. Only near Dillingham Airfield does the sugarcane give way to pastureland grazed by cattle belonging to Mokule'ia Ranch. On the southern side of the planning area, Kaukonahua Gulch and a sharp break in slope on the Waianae Mountains marks the change from irrigated sugarcane to natural vegetation.

Kiawe (Prosopis pallida) occurs on undisturbed coral outcrops north of the Anahulu River; it forms relatively dense stands that have an undergrowth of grasses. Other trees also present in this area include date palm (Phoenix dactylifera), Koa haole (Leucaena leucocephala), and Java plum (Eugenia cumini). The koa haole scrub vegetation is also found on the steep sides of stream valleys and on disturbed areas.

'Uko'a Marsh is one of the largest freshwater wetlands on O'ahu. Its limits were demarcated for the environmental impact statement prepared for the Kamehameha Highway/Hale'iwa Bypass Project (U.S. Department of Transportation, May 1981:III-11) using an aerial photograph taken in December 1969 (see Figure

III-18). Elliott and Hall (1977) reported that the marsh is dominated by a sedge (Cladium leptostachyum), two species of bullrush (Scirpus californicus and S. validus), and California grass (Brachiaria mutica). According to the Hale'iwa Bypass EIS:

> Roughly 10-15 acres in the southeastern portion of the marsh were formerly cultivated in taro and lotus (neither of which remain), and large areas of the southerly and westerly portion are accessible to cattle. As a result of these disturbances, plus irrigation water diversion, the southerly and westerly portions of the marsh are periodically dry....Two shrubby species, (Pluchea indica and P. odorata), give these areas a very non-marshy appearance, but the presence of water hyssop (Bacopa monnieria) confirms that the areas are frequently inundated. (U.S. Dept. of Transportation, 1981:III-12).

At the time of the study, the outlet to the marsh was completely filled with large bulrushes and with California grass floating in a tight mat of roots and old stems. A dike and weir at the Lokoea fishpond control the water level in the channel.

3.7.2 Mammals and Birds

Hawai'i has only two endemic land-based mammals, a species of monk seal and a subspecies of hoary bat (Tomich, 1969:1). Even these are not truly terrestrial, for the seal arrived by water and the bat by air. However, many others have been imported by people, and the mammalian fauna of the Waialua District consists primarily of these imports. The material on mammals presented below is based on the synopsis prepared by Tomich (1969).

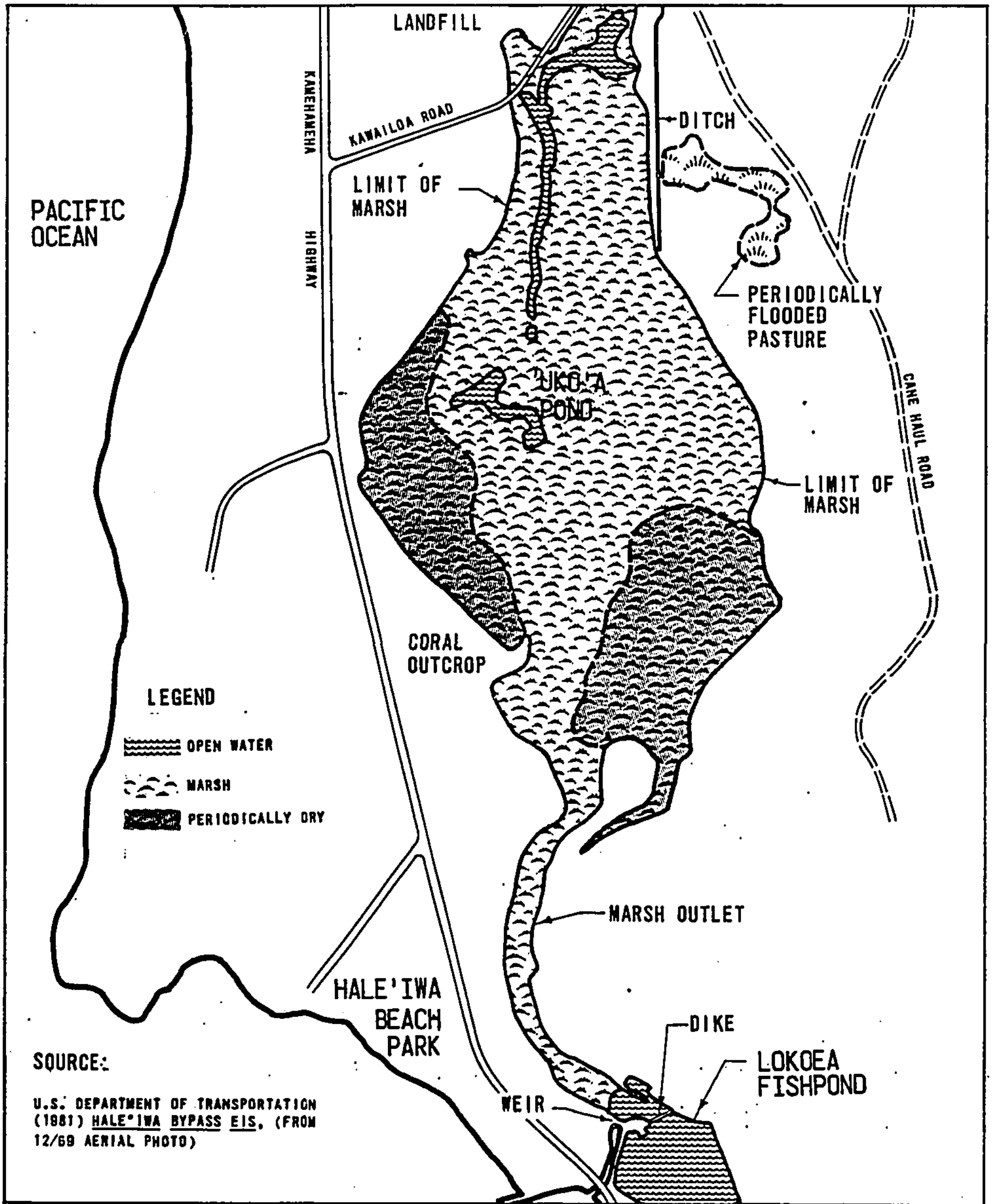


FIGURE III-18

APPROXIMATE BOUNDARY OF 'UKO'A MARSH

The hoary bat (<u>Lasiurus cinereus</u>) is the sole endemic mammal found in the Waialua area. It is scattered sparsely in areas with suitable sheltering tree growth. Since it is highly unselective in the kind of tree used for roosting, it is able to adapt relatively well to changes in the species composition of wooded areas.

Several species of rodents are found in the study area. These are the roof rat (<u>Rattus rattus</u>), the Norway rat (<u>Rattus norvegieus</u>), Polynesian rat (<u>Rattus exulans</u>), and the house mouse (<u>Mus musculus</u>). The roof rat and the house mouse appear to thrive equally well in forests, fields, and towns; the Norway rat prefers agricultural fields and human settlements. Mongooses (<u>Herpestes auropunctatus</u>), feral house cats (<u>Felis catus</u>), and feral dogs (<u>Canis familiaris</u>) complete the list of smaller mammals that are present. The first prospers well in cultivated fields where it feeds primarily on rats. The others range wherever food is available.

The two larger mammals known to be present are the wild pig (<u>Sus scrofa</u>) and the feral goat (<u>Capra hircus</u>). The pigs are abundant in mountainous areas, especially in the Ko'olau Range. Their rooting causes significant environmental degradation when their numbers become excessive. Hunting is used as the major means of population control. Goats, which constitute significant control problems on the island of Hawai'i, Maui, and Kaho'olawe, are few in number on O'ahu.

Mynahs (Acridotheres tristis), cardinals (Richmondena cardinalis and Paroaria coronata), doves (Streptopelia chinensis and Geopelia striata), house finches (Carpodacus mexicanus frontalis), and English sparrows (Passer domesticus) are probably the most common of the lowland bird species that are present. In the upper, naturally vegetated parts of the Waianae and Ko'olau Mountains one finds such introduced species as the ring-necked pheasant (Phasianus colchicus torquatus), Erckel's Francolin (Francolinus erckelii), shama thrush (Copsychus malabaricus), and the Chinese thrush (Garrulax canorus). The 'amakihi (Loxops virens chloris) and the 'apapane (Himatione sanguinea), as well as the endangered 'alauwahio (Loxops maculata) and i'iwi (Vestiaria coccinea) are native birds present in upland areas.

According to a survey conducted by Elliott and Hall (1977) for the U.S. Army Corps of Engineers, 'Uko'a Marsh is an important waterbird habitat. It is used by three species of endangered waterbirds, the Hawaiian gallinule (Gallinula chloropus sandvicensis), Hawaiian coot (Fulica americana alae), and Hawaiian stilt (Himantopus himantopus knudseni). A breeding population of at least 30 Hawaiian gallinule has been observed there. Their primary feeding area is centered around the open water in 'Uko'a Pond at the northern end of the marsh, but it is believed that the remainder of the marsh is used as well. The Hawaiian coots and Hawaiian stilts utilize the marsh primarily as a feeding area, but the coots may also nest there on occasion. During periods of high water, stilts have also used a flooded pasture east of the marsh as a temporary feeding area. Hawaiian ducks, or koloa (Anas wyvilliana), the fourth endangered waterbird species found in Hawai'i, may occasionally visit the marsh as well. Besides the endangered species, 'Uko'a Marsh is also frequented by night herons (Nycticorax nycticorax hoactli) and cattle egrets (Bubuleus ibis). The pueo, or Hawaiian owl (Asio flammeus sandwichensis), another endangered species, has been seen flying over the marsh.

The Hawaiian Waterbirds Recovery Plan (Hawaiian Waterbirds Recovery Team, 1978) names 'Uko'a Marsh as an important waterbird habitat. However, the marsh has not been recommended by the U.S. Fish and Wildlife Service for official designation as a federally protected critical waterbird habitat. At this time the U.S. Fish and Wildlife Service has no plans to nominate the marsh as a protected habitat. Although 'Uko'a Marsh is not designated as a critical habitat, this does not diminish its importance to the recovery of endangered waterbirds or negate any federal or State regulations pertaining to wetlands or endangered species. All actions involving the expenditure of Federal funds that might affect the marsh will therefore need to be coordinated with the U.S. Fish and Wildlife Service.

3.7.3 Aquatic Fauna

A macrofaunal survey of Paukauila Stream and Anahulu River and of 'Uko'a Marsh was conducted by Timbol (August 21, 1979) for another study. It provides an indication of the kinds of aquatic fauna likely to be present throughout the planning area. It concluded:

> A total of nineteen species were found, including four species of prawns and shrimps, three species of crabs, and twelve species of fish. Of these, nine species are native to Hawaii and only two of the fish are endemic (occurring naturally in Hawaii only). The streams are characterized by the presence of one native prawn (Opae oeha'a), one native swimming crab (papa'i maku'e), and three native fishes (ama'ama, o'opu okuhe, and aholehole). The dominant species in Ukoa Marsh are introduced guppys, mollys, and /sic/ swordtails (family poeciliidae), and crayfish. Only one goby fish (o'opu nanjha) was found in the areas sampled. However, it is expected that another goby (o'opu nakea), which lives in the mid and upper reaches of streams, is present at least during its juvenile stage....None of the fish found in the project area are listed as endangered, rare, or threatened (U.S. Department of Transportation, 1981: III-12).

3.8 HISTORIC AND ARCHAEOLOGICAL SITES

Most of the readily accessible land within the Waialua District has been modified in the course of the urban and agricultural development that has taken place there over the past 150 years. These changes have resulted in the destruction of many of the physical remains of previous aboriginal Hawaiian settlements. However, the number, variety, and wide distribution of the archaeological sites that once existed throughout the region, as well as related historical records, indicate that a substantial native population and extensive agricultural activities thrived there well before the first contact with the Europeans and Americans. Many of the sites which once existed have been destroyed. (The locations of these sites are shown in Appendix A, Figure 3.) However, eight properties are currently listed on the State Register of Historic Places; two of these are also on the National Register (see Table III-11).

According to Hommon (May 1982:7):

> The archaeological record, including the information that has been preserved on destroyed sites, indicates that in pre-Contact times and during the 19th century the economic system in the project region included both wet and dry agriculture as well as aquaculture in at least two ponds. Little is known of the residential pattern,....but the population was probably relatively dense, especially along the shore if we may judge from the number of religious sites (nine heiau and four known shrines and altars, now destroyed) that were recorded by McAllister.

Table III-11. Historic and Archaeological Sites in the Waialua District Listed on the Hawai'i State Register of Historic Places.

SITE	TMK
Kupopola Heiau*	6-1-5-16
Burial Complex	6-1-5-16
Keahu O Hapu'u Complex	6-1-1-1
Kalakiki Heiau	6-8-7-1
Waialua Habitation Area	6-7-2-6
Habitation and Agricultural Complex	6-7-4-1
Waialua Courthouse	6-6-9-23
Hale'iwa School*	6-6-13-12

* Also on the National Register.

Source: Hawai'i Historic Places Review Board (June 22, 1979).

In 1986 an additional archaeological study (Kennedy, 1986) was conducted to include the Dillingham Airfield area (see Appendix A). The survey noted the presence of numerous archaeological remains on the lower slopes of the mountains and on Federal property inland of Dillingham Airfield. However, none of these were located in areas affected by wastewater facilities.

3.9 ENERGY CONSUMPTION FOR WASTEWATER TREATMENT

At present, most of the sewage in the planning area is disposed of via cesspools. There is one treatment plant serving the Pa'ala'a Kai subdivision and various small private "package plants" used to treat sewage from apartment and commercial complexes which consume energy.

An order-of-magnitude estimate of current energy consumption for wastewater collection, treatment, and disposal is 4,400 million British thermal units (mBtu) per year (see Table III-12 for calculations). This is an average of about 358,00 Btu per person per year. Currently, a person in the Waialua-Hale'iwa area served by a cesspool uses about 2.8 times less energy for sewage collection, treatment, and disposal than does one who is served by the Pa'ala'a Kai WWTP. If it were not for the necessity of transporting the waste all the way to Wahiawa for disposal, the energy advantage of cesspools would be much greater still.

Table III-12. Order-of-Magnitude Estimate of Current Energy Use for Sewage Collection, Treatment, and Disposal: Waialua District.

	No. of Persons Served[a]	Per-Person Energy Use Rate (Btu/Person-Year)	Energy Use (mBtu/Year)
Cesspools	10,400	282,000[b]	2,934
Pa'ala'a Kai WWTP	1,160	803,000[c]	961
Individual Treatment Works	740	688,000[d]	509
Total	12,300		4,404
SAY			4,400

a Estimate based on census data and unit counts. All numbers have been rounded. Differences in definitions and assumptions are inherent in these numbers, but they are sufficiently accurate for these calculations.

b In calendar year 1980, there were approximately 4,459 cesspool pumpings in the area. Each pumping required a round-trip by the pumper-truck averaging twenty-five (25) miles (from the Wahiawa base yard to the cesspool to the disposal site at the Wahiawa WWTP to the base yard). At an average of five miles per gallon this amounted to five gallons of gasoline per pumping. At 127,650 Btu/gallon, each collection required 638,000 Btu per cesspool pumping. In addition, the energy expended in treating the pumpings is estimated at 20,000 Btu per cesspool pumping (this was based on an estimate of treatment energy use at 10 Btu per gallon of cesspool pumping treated and 2,000 gallons per cesspool pumping). The total energy required for collection and treatment was 658,000 Btu per cesspool pumping or 2,934 mBtu/year (based on 4,459 cesspool pumpings per year in the urban area).

c Engineers for the Pa'ala'a Kai Wastewater Treatment Plant estimate that average monthly energy use is about 23,500 kilowatt hours. This is equivalent to 282,000 kilowatt hours per year or about 235 kilowatt hours per year per person. At 3,415 Btu/kilowatt, this is equivalent to about 803,000 Btu/Person-Year.

d Per-person energy use by these facilities is estimated to be about 688,000 BTU/Person-Year, based on a 1,000-gallon cavitette for 10 persons.

Source: Belt Collins & Associates.

3.10 SOCIO-ECONOMIC CHARACTERISTICS

3.10.1 Historical Development

The portion of the Waialua District surrounding Waialua and Kaiaka Bays is as generously endowed with fresh water as any on the island. As a result, it was an area of active settlement and considerable agricultural activity for centuries before Captain James Cook's 1778 arrival in the Hawaiian Islands began a slow, but complete, transformation.

In the aboriginal period (i.e., in the years before the influence of Western civilization became significant), wetland taro was cultivated in many of the fields around Waialua where the combination of constant streamflow and spring discharges made this possible. Extensive areas on the lower slopes of the Waianae Mountains were planted with sweet potatoes, and the nearby upland areas provided a rich hinterland from which many of the people's needs could be met. The broad bay and fine beaches gave ready access to the ocean, and several fishponds were available to supplement the catch from the sea. According to McAllister (1933:133), the area contained the longest irrigation ditch (<u>'auwai</u>) on O'ahu (two miles). Due to limited rainfall, the absence of perennial streams, and relatively poor fishing conditions, the area from Mokule'ia to Ka'ena Point was sparsely settled, and inhabitants depended on sweet potato as their staple food (Handy and Handy, 1972:467).

The first western missionaries to land in the Waialua District arrived in 1832. They established a church and school at the mouth of the Anahulu River. The school was named Hale'iwa, or house (hale) of the frigate bird ('iwa), possibly because it, like the frigate bird, was believed to be possessed of great beauty (Pukui et al., 1974:37; Thrum, 1900:130-133). Until at least 1900 the name was used only to refer to the school and the nearby Hale'iwa Hotel (built in 1899); the broader area, from Mokule'ia to Pua'ena Point on the north side of Waialua Bay, was all considered to be part of Waialua. Over time, however, the name Hale'iwa began to be applied to more than just the hotel. By 1930 it was being used to refer to all of the development around the mouth of the Anahulu River, and by the 1960s, when official boundaries for towns and villages (i.e., census defined places) were adopted, Hale'iwa was considered a separate town that stretched from the Anahulu River to Waialua Beach Road (see Figure II-2).

The heritage of small-scale agriculture that was established during the early development of the area is still apparent in the pattern of small parcels in the lowland areas adjacent to Paukauila Stream and the Anahulu River. However, since the turn of the century the large-scale cultivation and processing of sugarcane has been the dominant influence on land use patterns in the region. The Waialua Agricultural Co. (now Waialua Sugar Co.) was founded in 1898 by Castle & Cooke and B.F. Dillingham as a successor to numerous previous, and generally unsuccessful agricultural operations around Waialua. Beginning with about 6,000 acres that were acquired from previous owners, the plantation expanded quickly during the early years. By 1915 approximately 20,000 acres were under cultivation.

In these early days, working the sugar fields required a large labor force, and the plantation imported laborers from China, Japan, the Philippines, and elsewhere. As a result, the population of the Waialua District jumped from 3,289 in 1900 to 6,083 in 1910 and 7,641 in 1920 (see Figure III-19). By 1930, the plantation had finished its period of great growth and the population of the district remained steady at about 8,000 people over the next 30 years before starting to grow again at about one percent per year between 1960 and 1980.

3.10.2 Existing Land Use Pattern

The vast majority of the land in the Waialua District is either in its natural state or is used for agriculture, primarily the cultivation of sugarcane (see Figure III-20). As a result, over 75 percent of the district's population is clustered in the small twin towns of Waialua and Hale'iwa. Most of the remainder live in low-density single-family homes strung along the coastline in Kawailoa to the northeast and Mokule'ia to the west. Road access to the area from central and windward O'ahu is provided by Kamehameha Highway and Kaukonahua Road; Farrington Highway serves the development west of Thomson's Corner.

SOURCE:

SCHMITT (1977)

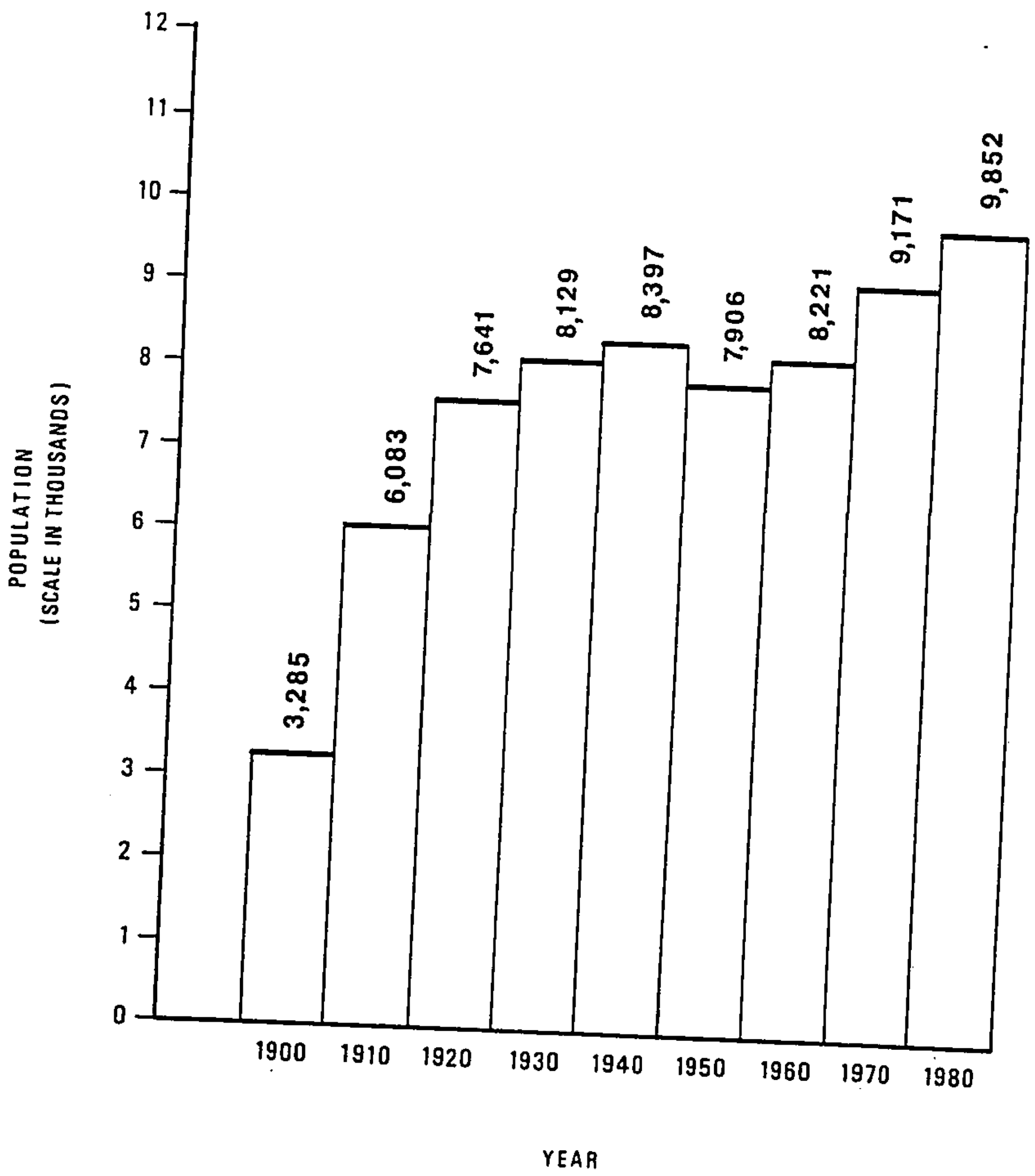


FIGURE III-19

POPULATION CHANGE IN THE WAIALUA DISTRICT: 1900-1980

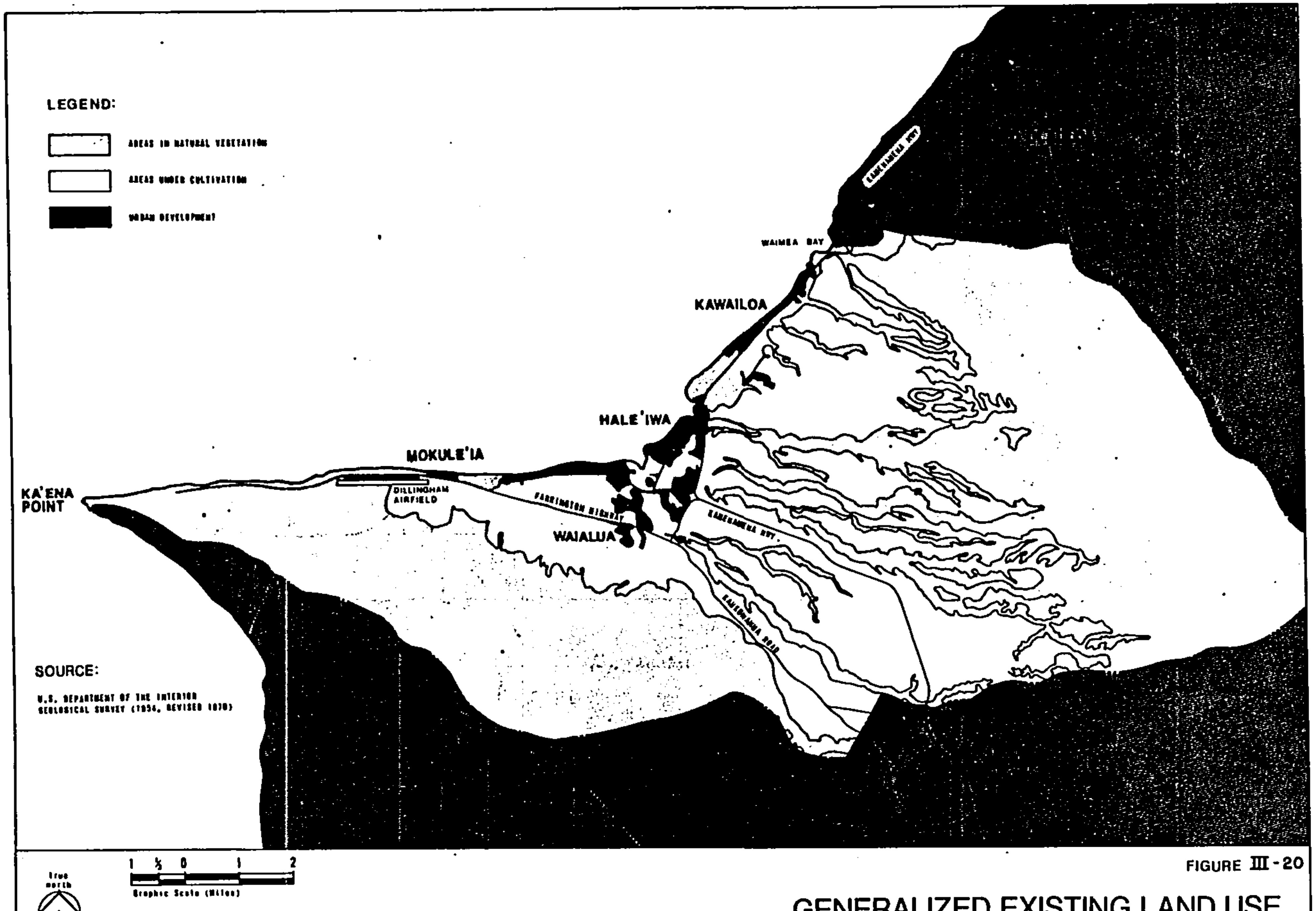


FIGURE III-20

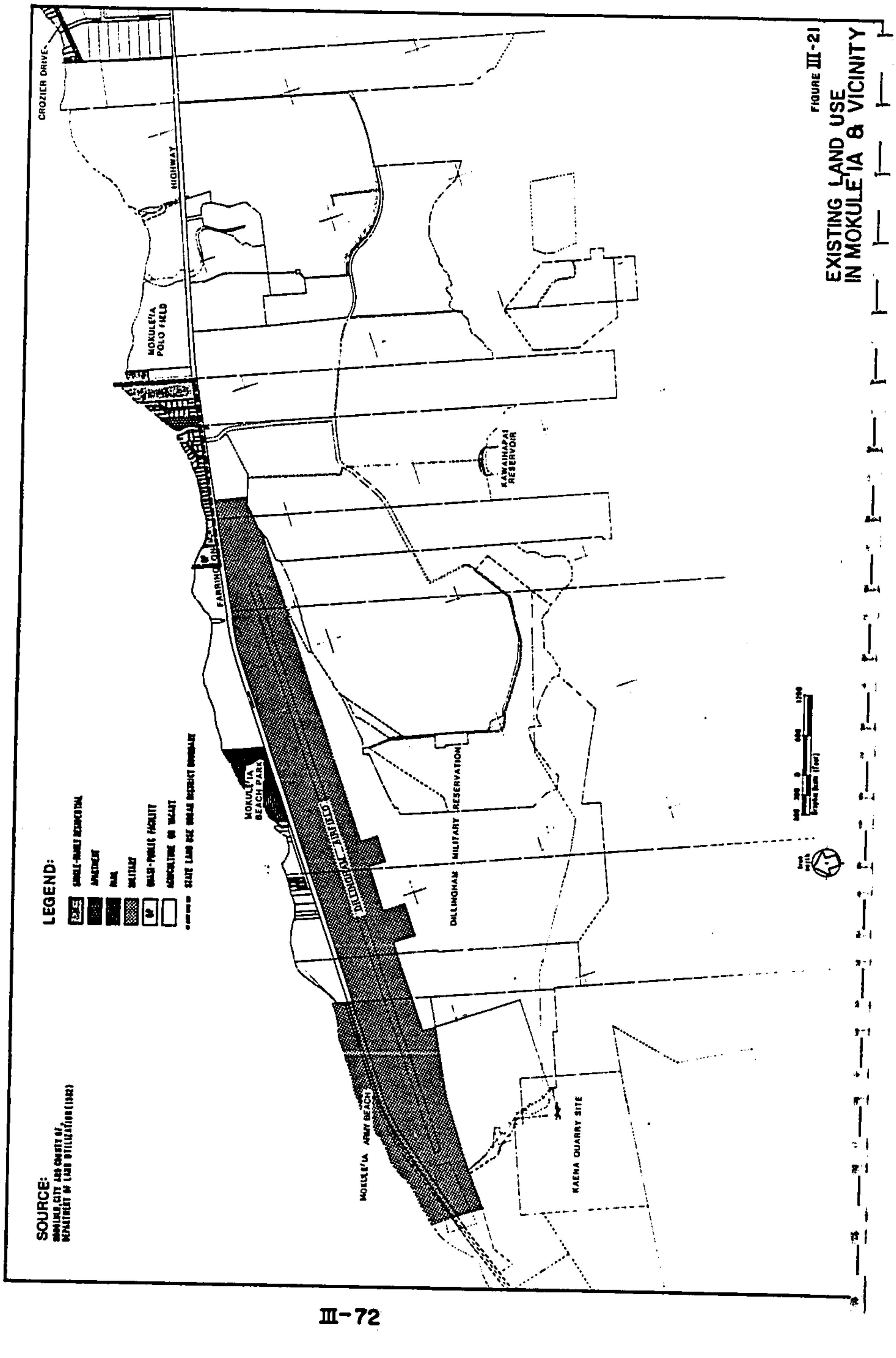
GENERALIZED EXISTING LAND USE MAP OF THE WAIALUA DISTRICT

3.10.2.1 Mokule'ia

The Mokule'ia area includes very few residential areas. Developed lands within this area are primarily utilized for agricultural purposes (cultivation of sugarcane) or recreational purposes (including the Mokule'ia Polo Field and proposed Ka'ena State Park). Other major land usages in the area are the general aviation airfield and the adjoining military training facility. Large sections in this area still remain undeveloped (see Figure III-21).

3.10.2.2 Waialua

The present land use pattern in the Waialua-Hale'iwa area is in large part a reflection of past influences. The sugar mill, with its associated housing areas, remains the focal point for the town of Waialua (see Figure III-22). The commercial "town center" lies just to the east of the mill and the great majority of the residential units lie within a half-mile of the mill site. Other stores are situated near the intersection of Goodale Avenue and Farrington Highway. The Fujioka Store, a prototypical general store serving the plantation houses just west of the mill, still does a good business with residents of the surrounding homes. However, Waialua's businesses suffer somewhat from the fact that the town's location makes access inconvenient for anyone not living there. As a result, recent commercial development has occurred primarily along Kamehameha Highway in Hale'iwa. Stores



EXISTING LAND USE IN MOKULE'IA & VICINITY
FIGURE III-21
LEGEND:
SINGLE-FAMILY RESIDENTIAL
APARTMENT
PARK
MILITARY
QUASI-PUBLIC FACILITY
AGRICULTURE OR VACANT
STATE LAND USE URBAN DISTRICT BOUNDARY
SOURCE:
CROZIER DRIVE
HIGHWAY
MOKULE'IA POLO FIELD
FARRINGTON
MOKULE'IA BEACH PARK
DILLINGHAM AIRFIELD
DILLINGHAM MILITARY RESERVATION
KAWAIHAPAI RESERVOIR
KAENA QUARRY SITE
MOKULE'IA ARMY BEACH

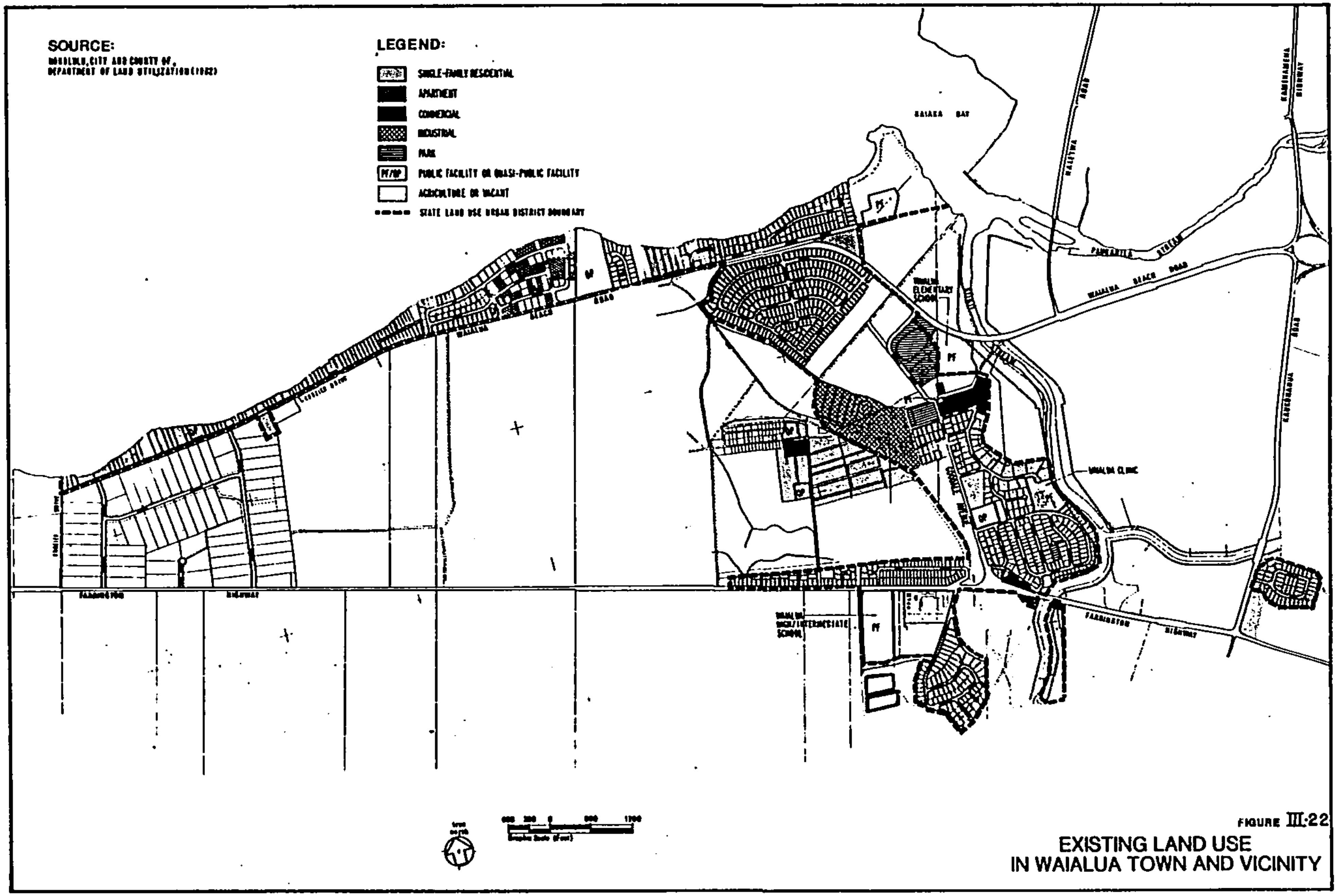


FIGURE III-22
EXISTING LAND USE
IN WAIALUA TOWN AND VICINITY

there can attract customers not only from Hale'iwa, but also from the residential development between Sunset Beach and the Anahulu River. Visitors and recreators passing through the town on Kamehameha Highway constitute another source of business.

The residential development makai of Waialua Beach Road is of fairly recent vintage, and some parcels remain vacant or under construction. Of particular note is the only apartment-zoned area in Waialua (bounded by 'Aweoweo Street and Pu'uiki Park) which is situated about one mile northwest of the mill. Only about half the lots in this apartment area have been developed thus far, and over 1,000 more people could live there if units are developed on the vacant lots at approximately the same density (about 48 units/acre) as that of the apartment buildings already constructed. However, in the most recent version of the North Shore Development Plan (June 1985), the vacant lots in the apartment area were designated low-density rather than medium-density. The maximum development density under this designation is 30 units/acre; and under this land use control fewer than 650 additional people would live there.

3.10.2.3 Hale'iwa

The town of Hale'iwa is physically separated from Waialua by the floodplain of Ki'iki'i Stream (see Figure III-23). The westernmost portions of the town, as well as the area adjacent to Paukauila Stream, consist mostly of relatively large parcels

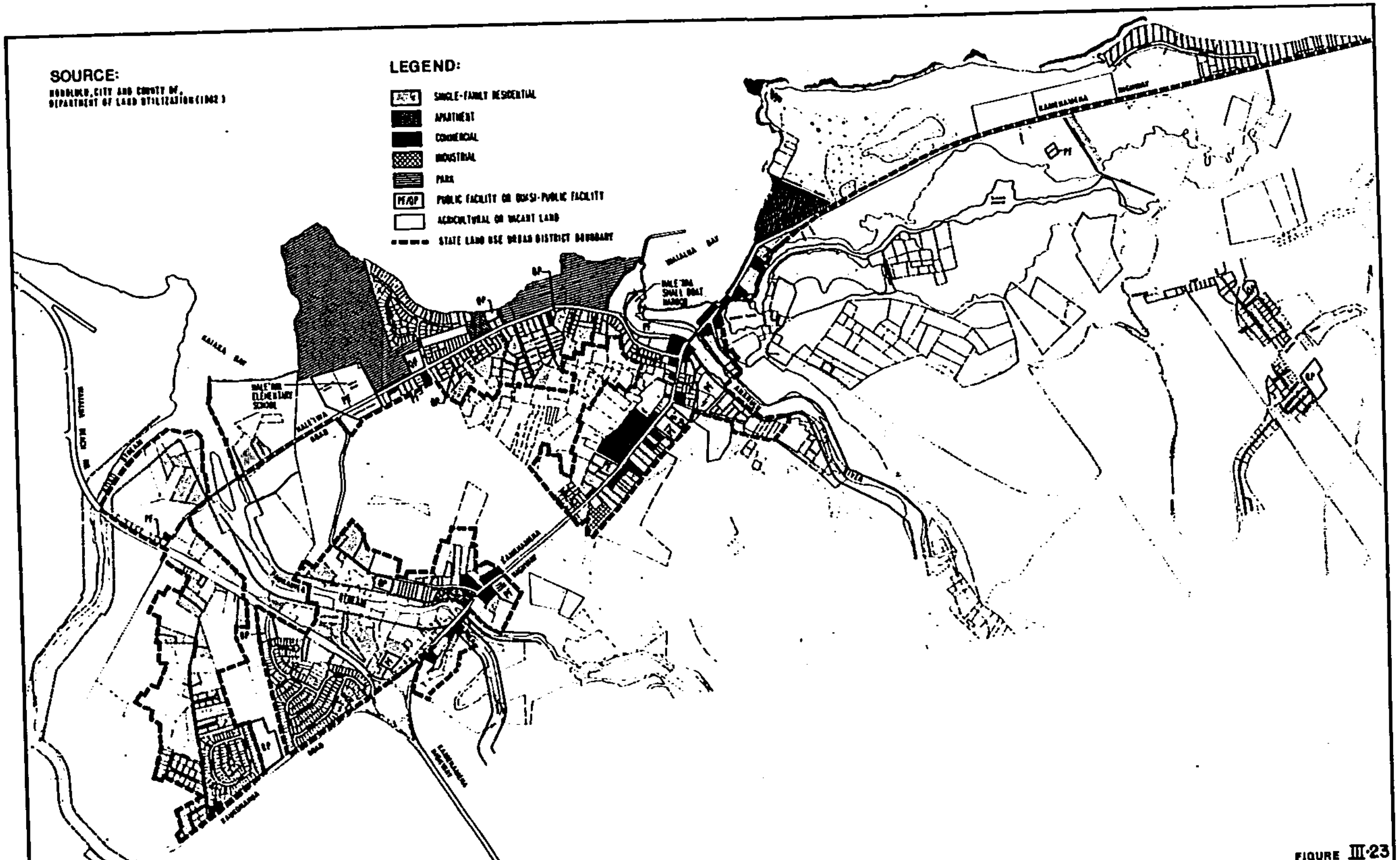


FIGURE III·23
EXISTING LAND USE
IN HALE'IWA TOWN AND VICINITY

containing from one to six houses. A number of active farms are present, and sugarcane is still cultivated on a large (about 150 acres) area north and west of Pa'ala'a Road. Commercial development is strung along Kamehameha Highway between Weed Circle and the Anahulu River. Some of these stores cater to passing tourists, but the recent development of the Hale'iwa Shopping Center and the renovation of several other nearby commercial establishments has reaffirmed Hale'iwa's claim as the commercial center for residents of the entire North Shore area as well.

Residential development in Hale'iwa is split into a number of clusters. The three oldest consist of the houses along Hale'iwa Road and Kamehameha Highway north of Achiu Lane, the homes north and west of Weed Circle near Paukauila Stream, and the houses along Ka'amo'oloa Road. The 307-unit Pa'ala'a Kai Subdivision developed between the latter two areas greatly increased the number of residential units in Hale'iwa (only a small percentage of these were occupied at the time of the 1980 census).

3.10.3 Economic Base

The Waialua Sugar Company is still by far the single most important economic force in the Waialua-Hale'iwa area. Figures developed by the State of Hawai'i Department of Labor and Industrial Relations (1977) and summarized in Table III-13 indicate that in 1975, there were about 1,450 jobs in the area, about 20 percent more than there were 10 years earlier. Of these, over 600

Table III-13. Employment by Industry Category in the Waialua District: 1964 and 1975.

Industry	1975 Employment Island-wide (as % of Tot.)	Employment in CT 99 and 100					
		1964		1975		Change: 1964–1975	
		No.	% of Tot.	No.	% of Tot.	No.	%
Agriculture	1.1	349	29.3	364	25.2	15	4.3
Manufacturing	6.7	307	25.8	332[1]	23.0	25	8.1
Trans., Comm. & Utilities	9.3	26	2.2	16	1.1	(10)	(38.5)
Wholesale Trades	5.4	5	0.4	D[2]	D[2]	D[2]	D[2]
Retail Trades	22.0	158	13.3	253	17.5	95	60.1
Fin., Insur. & Real Estate	8.5	7	0.6	24	1.7	17	242.9
Services	23.9	78	6.5	89	6.2	11	14.1
Local Government	2.8	46	3.9	40	2.8	(6)	(13.0)
State Government	8.7	117	9.8	136	9.4	19	16.2
Federal Government	11.6	98	8.2	D[2]	D[2]	D[2]	D[2]
Subtotal Identified		1,191	100.0	1,254	86.9	—	—
"D" Disguised for Confidentiality[2]		0	0	189	13.1	189	n.a.
Total Employment	100.0	1,191	100.0	1,443	100.0	252	21.2

[1] Corrected for 389 manufacturing employees that the published report erroneously cited as working in Census Tract 99.

[2] These numbers were disguised because the small number of employers would otherwise have made it possible to calculate confidential information concerning specific businesses.

Source: 1964 - State of Hawaii Department of Labor and Industrial Relations (1968);
1975 - State of Hawaii Department of Labor and Industrial Relations (1977).
Compiled by Belt Collins & Associates.

(i.e., about 40 percent) were with the plantation. Industries which showed the greatest employment growth (in absolute terms) during the period were retail trades (+95 jobs) and the Federal Government (estimated at +81 jobs). The data reflects the underlying stability of the area's economic base as well as the Waialua District's increasing importance as a commercial center for both North Shore residents and tourists passing through.

A comparison of the distribution of employment by type for the Waialua-Hale'iwa area in 1975 with the distribution for the entire island (see Table III-13) highlights several very important characteristics of the region:

- The dominant economic position held by the sugar plantation is evident in the fact that employment in agriculture (mostly the sugar fields) and employment in manufacturing (mostly the sugar mill) are 23 and 3.5 times the islandwide average, respectively.

- The transportation, communication, and utility sector; the wholesale trades sector; and the finance, insurance, and real estate sector -- all of which are typically concentrated in cities rather than rural towns -- employ relatively few persons.

- Employment in the service sector is also relatively small compared with the islandwide average; this is largely because of the low profile of the visitor industry in the region.

As can be seen from a comparison of the employment figures in Table III-13 with the labor force estimates in Table III-14, the number of jobs in the Waialua District in 1975 was far lower than the number of employed persons (1,443 versus 3,005). As a result, well over half of the workers must commute out of the area for work. Only in agriculture and manufacturing, the two industries most affected by the presence of the Waialua Sugar Company, is the employment to labor force ratio greater than 1.0, indicating that workers commute into the region for their jobs.

The last two columns in Table III-14 compare employment by industry of the Waialua District with that of the entire island. The data which they contain further emphasize the dominant position which sugar plays in the economic life of the region. It also shows the growing importance of government, service, and retail employment.

In recent years the price of raw sugar and, therefore, the profitability of the Waialua Sugar Co., has fluctuated widely. In early 1982 the average market value was below the production costs of even the most efficient of the Hawaiian sugar producers. This has led to the announced closing of the Puna Sugar Company on the island of Hawai'i, to plans for reductions in the labor force at many plantations, and to speculation that the era of large-scale

Table III-14. Waialua District Labor Force Aged 16 and Older by Industry: 1975.

Industry	Waialua District Labor Force Employed	Unemployed	Total	E:LF Ratio[1]	Industry as Percent of Total Employment: Waialua District	Oahu
Agriculture	325	30	355	1.12	10.7	1.9
Mining, Forestry, etc.	11	0	11	—	0.3	0.1
Construction	190	34	224	n.a.	6.8	9.1
Manufacturing	290	21	311	1.14	9.4	6.9
Transp., Comm., Util.	307	10	317	0.05	9.6	8.3
Wholesale Trades	41	10	51	0.10[2]	1.5	1.4
Retail Trades	464	67	531	0.55	16.0	18.9
Fin., Insur., Real Estate	94	33	127	0.26	3.8	6.5
Services	447	63	510	0.20	15.4	21.0
Government	813	44	857	0.42	25.8	21.6
Miscellaneous	23	0	23	—	0.7	4.3
TOTAL	3,005[3]	312	3,317[3]		100.0	100.0

[1] "E:LF Ratio" is the ratio of the employment estimates shown in Table III-9 to the labor force estimates (employed) shown above. It provides a crude estimate of the extent to which residents of the area also work there. In reality, some of the jobs within the district are held by persons who reside elsewhere.

[2] For purposes of calculation, 1975 employment was assumed equal to that reported in 1964.

[3] The State of Hawaii Department of Labor and Industrial Relations (March 3, 1981) estimates that the 1980 labor force for the Waialua District is about 4,100; 3,600 of whom are employed. Hence, the figures shown are probably lower than is actually the case.

Source: Survey and Marketing Services, Inc. (September 1976) and computer printouts of survey results by census tracts. Compiled by Belt Collins & Associates.

sugar production in Hawai'i might be drawing to a close. Some sugar industry representatives continue to believe that continued government support, the cooperation of workers, and improved economic efficiency on their part will insure the survival of the sugar industry as a major employer in the State, but there is an increasing tendency to see an end to sugar cultivation at all but the most efficient plantations. Castle & Cooke, Inc., the parent of the Waialua Sugar Company, recently announced tentative plans to cease operations there, but has allowed plantation management 60 days with another 30-day extension to try to arrange for a purchase of the company's assets.

While closure of the Waialua Sugar Company would be an economic blow to the region, so many of the company's employees are long-time residents of the region, own homes there, and have strong social ties to their neighbors that it seems likely that most of them would remain there even if they were forced to commute to other parts of the island for employment. Hence, the population projections that have been made here are believed to be reasonably valid regardless of the fate of the sugar company.

3.10.4 Selected Demographic Characteristics

Selected demographic characteristics of the residents of the Waialua District are shown in Table III-15. Comparable figures for the entire island are also included for the purposes of

Table III-15. Selected Demographic Characteristics: Waialua District, 1975.

	Distribution By Geographic Area[1]				
	Oahu-wide	Waialua District	CT 99.01	CT 99.02	CT 100
Sex (as % of total):					
Female	49.3	47.6	47.9	47.3	47.0
Male	50.7	52.4	52.1	52.7	53.0
Age Distribution (as % of total):					
Under 5 years old	9.0	10.3	12.4	9.8	4.9
5-19 years old	28.6	30.4	29.9	30.3	31.7
20-64 years old	56.9	52.2	50.0	53.8	56.1
65 years and older	5.5	7.1	7.7	6.1	7.3
Ethnicity (as % of total):					
Caucasian	30.5	27.8	29.6	22.0	32.9
Chinese	5.6	0.5	0.4	0.8	0.0
Filipino	10.2	23.3	35.0	9.1	15.2
Hawaiian/Part Hawaiian	15.3	18.7	11.2	34.5	12.2
Japanese	24.6	18.1	15.9	20.1	20.8
Mixed	8.2	10.9	7.4	12.9	17.0
Other	5.6	0.7	0.5	0.6	1.9
Residence 5 years ago (as % of Total):					
Same House	48.3	52.2	53.5	51.1	50.6
Other House on Oahu	24.2	25.3	21.4	33.3	22.3
Other House, Neighbor Islands	1.7	1.3	1.1	0.9	2.7
Other U.S. State	18.5	16.2	16.7	12.5	21.0
U.S. Possession or Territory	1.2	0.7	0.5	1.3	0.0
Other Country	5.9	4.3	6.8	0.9	3.4
Highest Grade Completed for Population 25 & Older (as % of Total):					
8 years or less	14.8	23.9	29.7	20.5	14.9
Some High School	9.6	16.3	13.0	23.6	12.7
Completed High School	36.2	30.5	25.6	30.8	42.6
Some College	15.5	16.3	20.2	11.8	13.9
4 years or more College	13.5	7.6	5.8	9.4	9.1
Rec'd Graduate Degree	5.4	1.1	0.4	0.8	3.4
Attended Bus./Trade School	3.3	1.2	0.4	3.1	0.0
Refused/Don't know	1.7	3.1	4.9	0.0	3.4
Household Income:					
Median Income ($/yr.)	14,139	12,687	13,385	10,889	13,875
Average Income ($/yr.)	16,273	14,880	15,233	13,377	16,486
Percent Households Below $10,000/yr.	28.1	34.0	34.7	41.3	19.3
Percent Households Above $25,000/yr.	18.8	13.6	16.9	8.1	14.0
Housing Characteristics:					
Mean Housing Costs-Owner Occupied ($/mo)	278	176	190	158	164
Mean Housing Cost-Rental Units ($/mo)	216	201	186	201	253

[1] See Figure II-2 for definition of geographic areas.

Source: 1975 Census Update Survey - Survey and Marketing Services, Inc., September 1976 and computer printouts.

comparison. The information is drawn from the 1975 Census Update Survey (Survey and Marketing Services, Inc.; September 1976).

The population of the Waialua District is slightly younger than that of the island as a whole, on the average, but the district includes a larger than average proportion of persons over 65 as well. Ethnically, the plantation heritage is evident in the high proportion of Filipinos, especially in Census Tract 99.01. The high proportion of Caucasians in Census Tract 100 is the result of the presence of a substantial number of persons from the mainland U.S. who have migrated to the North Shore over the past 15 to 20 years. The average educational level of the population is substantially below the islandwide average, an indication of the relative scarcity of high-skill jobs in the area. (See Figure II-2 for census tract boundaries.)

At $12,687, the median household income in the district in 1975 was 10% below the O'ahu average. About 34% of the households had an income of less than $10,000 as compared to 28% for the entire island. Hale'iwa (CT 99.02) was the sub-area with the highest proportion of households earning below $10,000 per year (41.3%) and the lowest percentage earning over $25,000 per year (8.1%). At $176 per month, the average housing cost for owner-occupied units was only 63% of the O'ahu average. Rental costs, averaging $201 per month, were only slightly below the islandwide average. Kawailoa, with many newer single-family residences on the ocean, was the most expensive sub-area for renters.

3.10.5 Existing and Future Population

Relevant statistics from the 1980 census for population and housing for the study area are shown in Table III-16. They indicate that as of April 1 of that year approximately 9,850 persons resided within the Waialua District. Of these, approximately 54% resided in census tract (CT) 99.01, 17% in CT 99.02, and 19% in CT 100.

The North Shore Development Plan Area (NSDPA) includes all of the Waialua District plus Block Group 2 of Census Tract 101. It is of interest primarily because it is the area for which population allocations have been made in the County Development Plans. Adding the 3,212 persons reported in this sub-area to the 9,849 within the Waialua District gives a total of 13,061.

The 1982 revised O'ahu General Plan, the City and County's principal policy planning document, projected very little growth to the North Shore Area (Honolulu, City & County of, January 5, 1978). The projected population estimate, for the year 2000, ranged from 14,700 persons to 16,500 persons. A more detailed account of the number of people residing in the planning area, in the year 2000, was conducted to incorporate land use controls in assessing the affects of development in the planning area and is contained in Appendix B. This effort determined that an estimated 14,720 people will reside in the planning area by the year 2000. Thus, the population of the Waialua-Hale'iwa planning area is projected to increase by 1600 persons to 3400 persons by the year 2000.

Table III-16. Resident Population and Dwelling Unit Data for Census Divisions Within the Waialua District and the North Shore Development Plan Area: 1980.

Area	Resident Population			No. of Housing Units[2]	No. of Occupied Dwelling Units[3]	Avg. Persons/ Occupied D.U.[4]
	1970	1980	No. in Group Quarters: 1980[1]			
Census Tract 99.01 (Waialua)	4,529	5,350	30	1,764	1,613	3.30
Census Tract 99.02 (Hale'iwa)	2,817	2,620	8	914	753	3.47
Census Tract 100 (Kawailoa)	1,825	1,879	288	558	478	3.33
Waialua District (CT 99.01, 99.02, & 100)	9,171	9,849	326	3,236	2,844	3.35
Census Tract 101, Block Group 2	n.a.	3,212	79	1,256	1,055	2.97
North Shore Development Plan Area	n.a.	13,061	405	4,492	3,899	3.25

1 From special tabulation by DPED of Census data.

2 The "total housing units" count from the 1980 census.

3 "Year-Round Housing Units" minus "Vacant Housing Units" from U.S. Bureau of the Census (1981). Census of Population and Housing, 1980: Summary Tape File 1A, Hawaii.

4 Calculated by taking the 1980 resident population, subtracting the number in group quarters, then dividing by the number of occupied dwelling units.

5 Represents the area that is within the North Shore Development Plan (NSDP) area but outside of the Waialua District.

Source: U.S. Bureau of the Census (1981). Census of Population and Housing, 1980: Summary Tape File 1A, Hawaii.

3.10.6 Non-Residential Land Use Estimates

As of December 1980, a total of 57.8 acres were devoted to commercial uses within the North Shore Development Plan area (see Table III-17). Of this, 43 acres were within the Waialua-Hale'iwa urban area, primarily along Kamehameha Highway.

Industrial uses in the Waialua District amounted to about 140 acres. The fact that over 95% of this was in just two places, the Waialua Sugar Mill and the Mokule'ia rock quarry, is an indication of how little diversified industrial activity there is in the area.

Institutional uses in the urban area include three schools, (Waialua Elementary, Waialua Intermediate and High School, and Hale'iwa Elementary School), several parks, the boat harbor, and several small government offices and facilities. Of these, only the schools and parks are significant sewage generators. The schools presently have approximately 2,090 students, teachers, and staff. Since sewage generation from neighborhood parks (which are primarily used by area residents) is already accounted for in calculations for residential wastewater flows, only the boat harbor and the beach parks (which are used by many people from outside the planning area) have to be considered as additional sources of wastewater. The acreage of the regional parks in the planning area totals 109 acres.

Table III-17. Land Area/User Population Attributable to Commercial, Industrial, and Institutional Uses: 1980.

Area	Land Area or User Population by Existing Use			
			Institutional	
	Commercial (Ac.)	Industrial (Ac.)	Schools (pers.)	Parks (ac.)
North Shore Development Plan Area	57.833	140.81	n.d.	n.d.
Waialua District Study Area:				
Census Tract 99.01	13.376	133.616[1]	1,598	11.8
Census Tract 99.02	20.063	0.296	492	79.2
Census Tract 100	9.568	5.454	—	18.0
Subtotal	43.007	139.366	2,090	
Waialua-Hale'iwa Urban Area	42.998	23.65	2,090	79.2

[1] Of this, 21.18 acres were at the Waialua Sugar Mill and the remaining 112.436 acres were at the Mokule'ia stone quarry.

Source: Compiled by Belt Collins & Associates from City and County of Honolulu Department of General Planning "Existing Land Use File" computer printout updated through December 1980.

3.11 EXISTING WASTEWATER SYSTEMS

3.11.1 Pa'ala'a Kai System

The only publicly owned wastewater treatment works in the Waialua District is situated in the Pa'ala'a Kai subdivision southwest of Weed Circle. The facility serves only the 307 single-family homes contained in the subdivision. It was constructed by the developer and dedicated to the City for operation and maintenance with the understanding that the treatment plant is temporary and will be abandoned if a regional system is developed by the City. The treatment plant began operation in late-1980. Data indicate that this facility currently produces approximately 12 mg/L BOD_5 and 7 mg/L suspended solids (City & County of Honolulu, 1986). Disposal of the effluent is accomplished by exfiltration wells. No problem has been observed with the wells.

3.11.2 Cesspools

Most of the structures in the Waialua District dispose of their wastewater via cesspools. The 208 Plan (Hawaii, State Dept. of Health and City & County of Honolulu, 1978:10-2) estimated that there were about 2,000 cesspools in the area and that 63% of these were "defective." More detailed analyses were conducted as part of the Facilities Plan study using the criteria contained in the City's draft design standards for individual wastewater treatment systems to determine which cesspools are "defective". The results indicate that the actual cesspool failure rate is between 15 and 30 percent.

Residents whose cesspools are failing must either replace the unit at a cost of from $400 to $5,400 each (Hawai'i, State of, Department of Health and City and County of Honolulu, December 1980:10-9) or have them pumped when they overflow. Cesspool pumpings must be disposed of at County-approved disposal locations, usually manholes near wastewater treatment plants. At present nearly all of the wastewater pumped in the Waialua District is disposed of at the Wahiawa Wastewater Treatment Plant. Besides the cost and inconvenience of pumping which failed cesspools require, they also constitute potential health hazards if the spillage reaches streams or coastal waters.

3.11.3 Other Existing Wastewater Systems

3.11.3.1 Residential Systems

Analyses undertaken for this Facilities Plan revealed that there are 18 private wastewater treatment systems in the Waialua District. Information on these systems was collected largely by contacting owners and resident managers. Most of these systems service units in the apartment area along Waialua Beach Road. All of these private systems utilize on-site, underground treatment and disposal facilities. Flow capacities range from 2,500 gallons per day (gpd) to 22,400 gpd. About half of the systems utilize an extended aeration process, and all of them dispose of the treated effluent by means of either seepage pits or gravity-feed injection wells. Collection systems are typically on-site; hence, wet-weather infiltration and inflow has little, if any, effect on flow volume. None of the facilities have overflow by-passes, and there are no known flow reduction programs in effect. Sludge removal is performed by private contractors who dispose of the waste sludge at one of the City's cesspool pumping disposal locations, generally in Wahiawa.

Problems experienced by these units include plant upsets, clogging of the wells and seepage pits, overflows, backups into the dwelling units, and nuisance odors. In most cases, the primary cause has been inadequate or improper operation and maintenance practices by the non-technical personnel who are typically assigned responsibility for the plant. Problems have rarely been blamed on hydraulic overloads of the treatment plants.

3.11.3.2 Commercial and Industrial Establishments

Most commercial and industrial establishments in the area are small-scale enterprises serviced by cesspools. The Hale'iwa Shopping Center -- Phase III and Waimea Falls Park are the only commercial exceptions to this rule. The two agro-industrial operations with special wastewater handling provisions are the Waialua Sugar Company mill and the Meadow Gold Dairy.

Wastewater discharges from the Waialua Sugar Mill are of three types. The largest is the 10 to 12 mgd of sugarcane wash water from the mill's hydroseparator that is produced during the eight-month long grinding season. This is used to irrigate the company's western fields. Second, heated water from the mill's cooling condensers is discharged into Ki'iki'i Stream near Waialua Beach Road under a Department of Health NPDES (National Pollutant Discharge Elimination System) permit. Finally, toilets and showers at the mill are serviced by cesspools.

The Meadow Gold Dairy operations cover about 80 acres in the Kawailoa section of the study area. Wash-down procedures for the dairy cows and the milking equipment account for approximately 200,000 gallons of wash water each day. Wash water for the cows is supplied from an on-site, brackish water well. Municipal water is used for washing the equipment. All of the wash water is collected and used to irrigate the pasture land. Toilet and shower facilities are all serviced by cesspools.

3.12 RELEVANT LAND USE PLANS AND CONTROLS

3.12.1 State of Hawaii

3.12.1.1 State Land Use Law

Land use in Hawai'i is subject to several levels of controls. The first, and most general, is the State Land Use District Regulations administered by the Land Use Commission of the State of Hawai'i, an independent body established by Act 187 of the 1961 State Legislature. In line with its legislative mandate (Chapter 205, Hawai'i Revised Statutes), the State Land Use Commission's regulations are intended to:

> preserve, protect, and encourage the development of lands in the State for those uses to which these lands are best suited in the interest of public health and welfare of the people of the State of Hawai'i. (Hawai'i, State of, Land Use Commission, December 1975:38)

In accordance with these regulations, all lands in the State have been placed in one of four Land Use Districts: Urban, Agriculture, Conservation, and Pural. (There is no Pural District on O'ahu.) General standards for establishing district boundaries are clearly defined in Section II.2.2 of the Land Use District Regulations; Section VI outlines procedures by which District boundaries may be amended.

State Land Use District boundaries for the Hale'iwa-Waialua area are shown in Figures III-22 and III-23. As can be seen from those maps, much of the land in the Urban District has not been intensively developed, particularly in Hale'iwa. Two factors are primarily accountable for this: (i) County regulations /General Plan/Development Plan Land Use Maps (DPs)/ are more restrictive than the State Land Use law and (ii) there has been insufficient market for additional residential and commercial properties to justify development of all the land that is available.

3.12.1.2 The Hawaii State Plan

The Hawaii State Plan (Chapter 226, Hawaii Revised Statutes) was enacted in 1978 and revised in 1986. It serves as a long-range guide for the future development of the State by establishing important goals, objectives, policies, and priorities. The objectives and policies most relevant to the wastewater treatment and disposal facilities proposed for the Waialua-Hale'iwa area are contained in Sections 226-11, 226-13, 226-14, 226-15, 226-16(b)3, and 226-104(a)(1), (a)(3) and (b)(3).

Section 226-14 makes it the policy of the State to accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with State and County plans. With specific reference to wastewater disposal, Section 226-15 makes it the policy of the State to encourage the adequate development of sewerage facilities that complement planned growth. The proposed project is intended to insure the maintenance of healthful and sanitary conditions within existing and planned development by providing improved disposal of sanitary wastes.

Sections 226-11 and 226-13 of the State Plan make it State policy to maintain and enhance environmental quality while accommodating the State's population and economic growth. The proposed facilities are designed to reduce the volume of pollutants reaching Oahu's ground and surface waters, thereby improving water quality. The ocean outfall that will be used will be designed to insure adequate dispersion of the treated effluent and minimal effect on the marine environment.

Section 226-16, Policy (b)(3) makes it State policy to reclaim and encourage the productive use of runoff water and wastewater discharges. During the course of evaluating the various effluent disposal alternatives for this project, efforts were made to reclaim and reuse the effluent generated by the proposed wastewater treatment plant. However, these alternatives were not found to be feasible for this proposed action primarily due to the large land area requirement, irregular demand for effluent, and high cost involved in such reclamation and reuse alternatives. In the case of sugarcane irrigation, the uncertainty of the long term viability of the sugar industry also makes the use of this alternative less desirable for use as a long term disposal alternative.

It is anticipated that the construction of the proposed facilities will add only very little to existing runoff volumes. Collection and reuse of this small runoff volume would not create any beneficial impacts and was therefore not included in the proposed action.

Section 226-104, Priority Guideline (a)(1) encourages planning and resource management to insure that population growth rates throughout the State are consistent with available and planned resource capacities and reflect the needs and desires of Hawaii's people. Priority Guideline (a)(3) ensures that adequate support services and facilities are provided to accommodate the desired distribution of future growth throughout the state. The population projections used to size the proposed facilities reflect the limited growth projected for the area, consistent with existing Development and General plans.

Section 226-104, Priority Guideline (b)(6) seeks participation from the private section for the cost of building infrastructure and utilities, and maintaining open spaces. The intent of the proposed plan is to provide a centralized wastewater management system for the existing population in the urban portion of the study area. A portion of the funds for the construction of the proposed system will come from the private sector via the improvement district assessments that would be paid by the individual property owners.

The twelve State Functional plans specifies in great detail the policies, quidelines, and priorities within specific fields of activities. The document most applicable to these proposed action is the State Health Functional Plan. Objectives and policies most relevant to this proposed action include the following:

<u>Objective A</u>: To prevent degradation and enhance the quality of Hawaii's air, land and water.

It is anticipated that if present wastewater management practices are left unchanged, conditions would deteriorate with time. The resulting increase in system failures would be an increasing threat to the quality of land and waters in the area. The proposed wastewater management system would significantly reduce the number of individual wastewater treatment and disposal facilities and reduce the high concentration of cesspools in the area. As a result, this action would limit potential degradation and improve the quality of Hawaii's water and land.

The design of the centralized wastewater management system will be designed to include adequate odor control systems. Therefore, no degradation of existing air quality would occur.

Objective B: To minimize the threat to Public Health from insanitary conditions by ensuring that facilities are built and maintained so that products and services are provided in a healthful manner.

The reduction of the number of cesspools and individual wastewater treatment and disposal systems in the area greatly reduces the risk of public exposure to untreated or partially treated wastewaters that may otherwise overflow from failing facilities. The proposed centralized system will be designed, built, operated, and maintained to meet appropriate regulatory agency requirements, thus protecting the health and welfare of the public.

Objective H: To reduce the amount and intensity of noise to acceptable levels.

Activities related to the construction, operation and maintenance of the proposed wastewater management system will be in compliance with Department of Health noise regulations. The design of the wastewater collection and treatment system will include provisions for the attenuation of equipment noise levels.

3.12.1.3 Coastal Zone Management Plan

The Hawaii Coastal Zone Management Program is an expression of State policy with respect to the use, protection, and development of land and ocean resources within the State's coastal areas. The cornerstone of the program is the Hawaii Coastal Zone Management law, Chapter 205A, Hawaii Revised Statutes. This section assesses the consistency of the Waialua-Hale'iwa Facilities Plan with each of the seven major objectives of that law.

<u>Objective 1</u>: *Provide coastal recreational activities accessible to the public.*

The proposed wastewater treatment and disposal facilities are intended to decrease the potential for pollution of the region's streams and coastal waters due to the discharge of untreated or inadequately treated wastewater. By maintaining and improving water quality, the project will insure the continued availability of the shoreline for recreational uses. No surfing sites or sandy beaches will be destroyed. Preliminary investigations indicate that there will be no significant adverse effects on marine biota as a result of the construction or operation of the proposed sewage outfall, but more detailed studies are still needed to confirm this.

Objective 2: Protect, preserve, and where desirable, restore those natural and man-made historic and pre-historic resources in the coastal zone management area that are significant in Hawaiian and American history and cultural.

Archaeological surveys of potential wastewater treatment plant sites were conducted as part of the facilities planning process. These indicate that the proposed site does not contain significant archaeological or historical remains. If remains are encountered during the course of trenching, foundation excavation, or other project-related work, construction activity in the vicinity of the threatened resources will be suspended until the remains are evaluated by a qualified archaeologist and an appropriate mitigation program developed.

Objective 3: Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.

Essentially all of the proposed collection and disposal system is below ground or underwater. Hence, only the sewage pump stations and the wastewater treatment plant itself will be visible. The WWTP is located well away from existing development; with landscaping that would be provided as part of the final design, it would be largely invisible to area residents and passers-by. Several of the sewage pump stations are located in developed areas, and, because of the need to provide adequate flood-proofing, it is impossible to completely bury these structures. However, they are relatively small and will be designed to blend in with surrounding development.

Objective 4: Provide public or private facilities and improvements important to the state's economy in suitable locations.

The proposed wastewater treatment and disposal facilities are designed to serve the existing population. The collection system is limited primarily to areas already designated for urban development on State and County land use plans. The proposed facilities are not expected to generate or support significant amounts of urban growth which would not otherwise occur.

Objective 5: Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.

As previously noted, the project is expected to reduce the volume of untreated wastewater reaching coastal waters. Construction of the sewage outfall will involve trenching and other in-water construction work with the potential to cause short-term reductions in water quality, and a zone of mixing will be needed around the diffuser portion of the sewage outfall. The area in which the discharge will occur does not appear to contain rare or endangered species or to be a coastal ecosystem of particularly significant biological or economic importance. Further biological and engineering studies will be conducted to confirm this before the final design of the outfall.

<u>Objective 6</u>: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence.

The proposed facilities are designed to comply with the requirements of the Federal Flood Insurance Program, and they will not increase the flood hazard in surrounding areas. They are located and designed so as to minimize the potential for damage from storm waves, tsunami, erosion, riverine flooding, and subsidence.

<u>Objective 7</u>: Improve the development and review process, communication, and public participation in the management of coastal resources and hazards.

The Waialua-Hale'iwa Wastewater Facilities Plan is the result of an extensive planning process that has sought (and been responsive to) input from the general public, surrounding landowners, government agencies, public interest organizations, and other interested parties.

3.12.2 County Plans

The present City & County of Honolulu Charter was adopted in 1973. It mandates a two-level planning process (zoning is considered an implementation tool rather than a separate planning level). The first level consists of the 1982 revised O'ahu General Plan. It contains a concise statement of the City's objectives and policies with respect to ten different subject areas, e.g., population, housing, transportation, etc. The second level is the regional Development Plan. The North Shore Development Plan (NSDP) allocates very little land for new development between now and the year 2000 (see Figures III-24, III-25 and III-26). In fact, within the Waialua-Hale'iwa urban area, the only substantial concentration of land where additional development would be permitted during this period is situated in the apartment district along Waialua Beach Road. The remaining growth is limited to construction on the few vacant parcels that remain within existing built-up areas.

The public facility location, just south of Crozier Drive in Figure III-25, was selected by the NSDP for a WWTP site. The selected WWTP site is further south and across Farrington Highway of this NSDP site (see Figures 1 and I-2). Therefore, an amendment (or compliance) to the County's Development Plan Public Facilities Land Use Map is required for deletion of the ols site and designation of the proposed WWTP site.

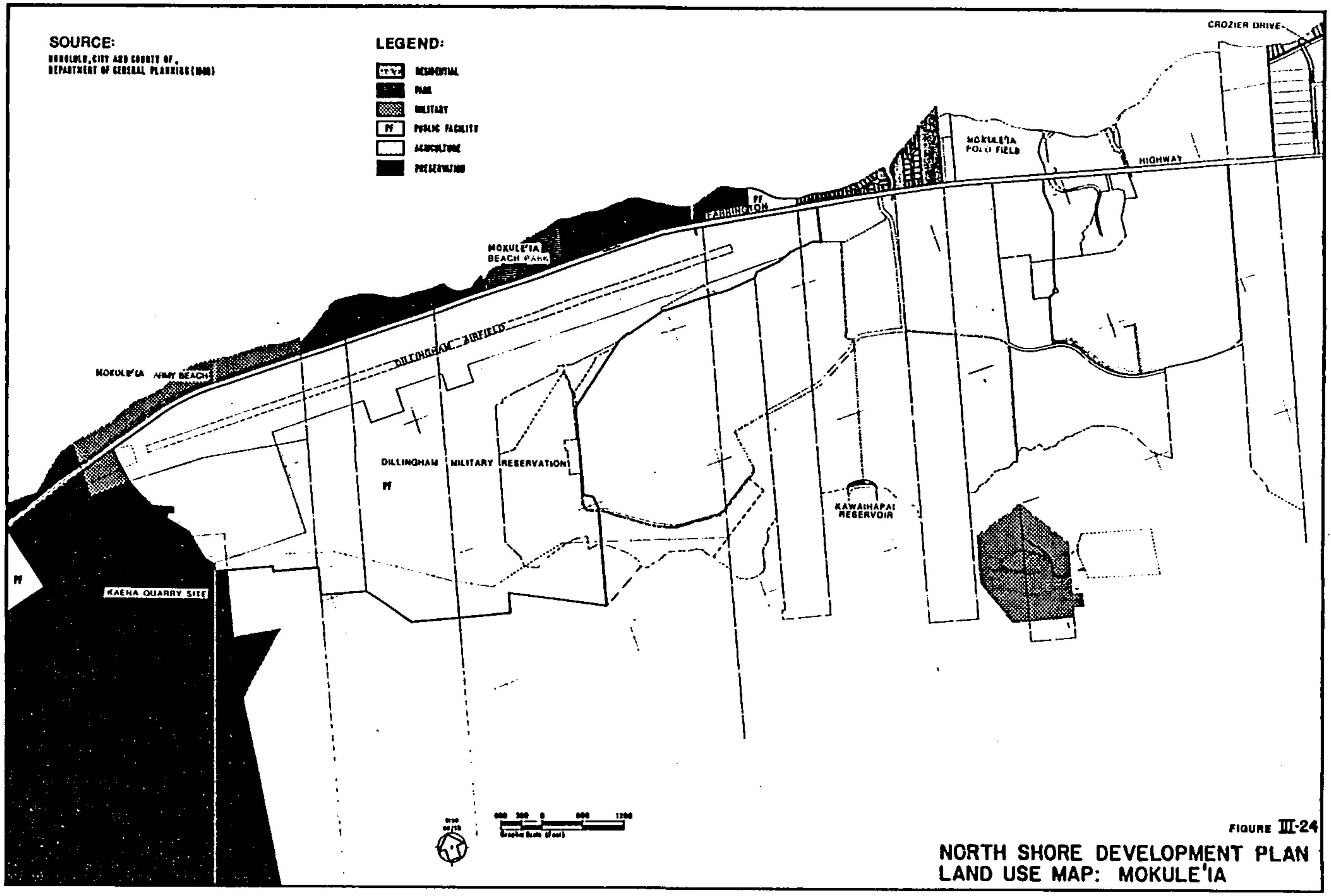


FIGURE III-24
NORTH SHORE DEVELOPMENT PLAN
LAND USE MAP: MOKULE'IA

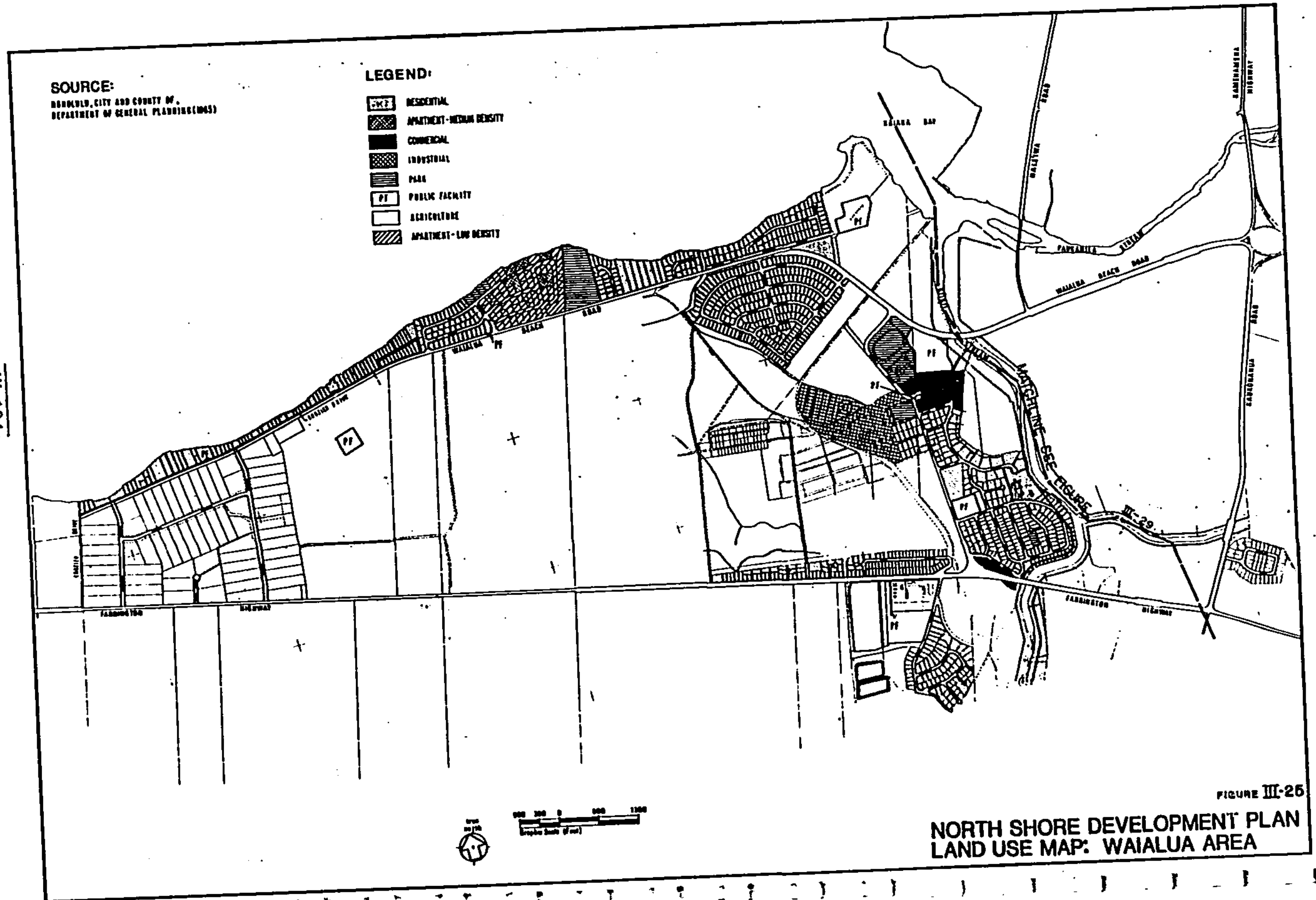


FIGURE III-25

NORTH SHORE DEVELOPMENT PLAN
LAND USE MAP: WAIALUA AREA

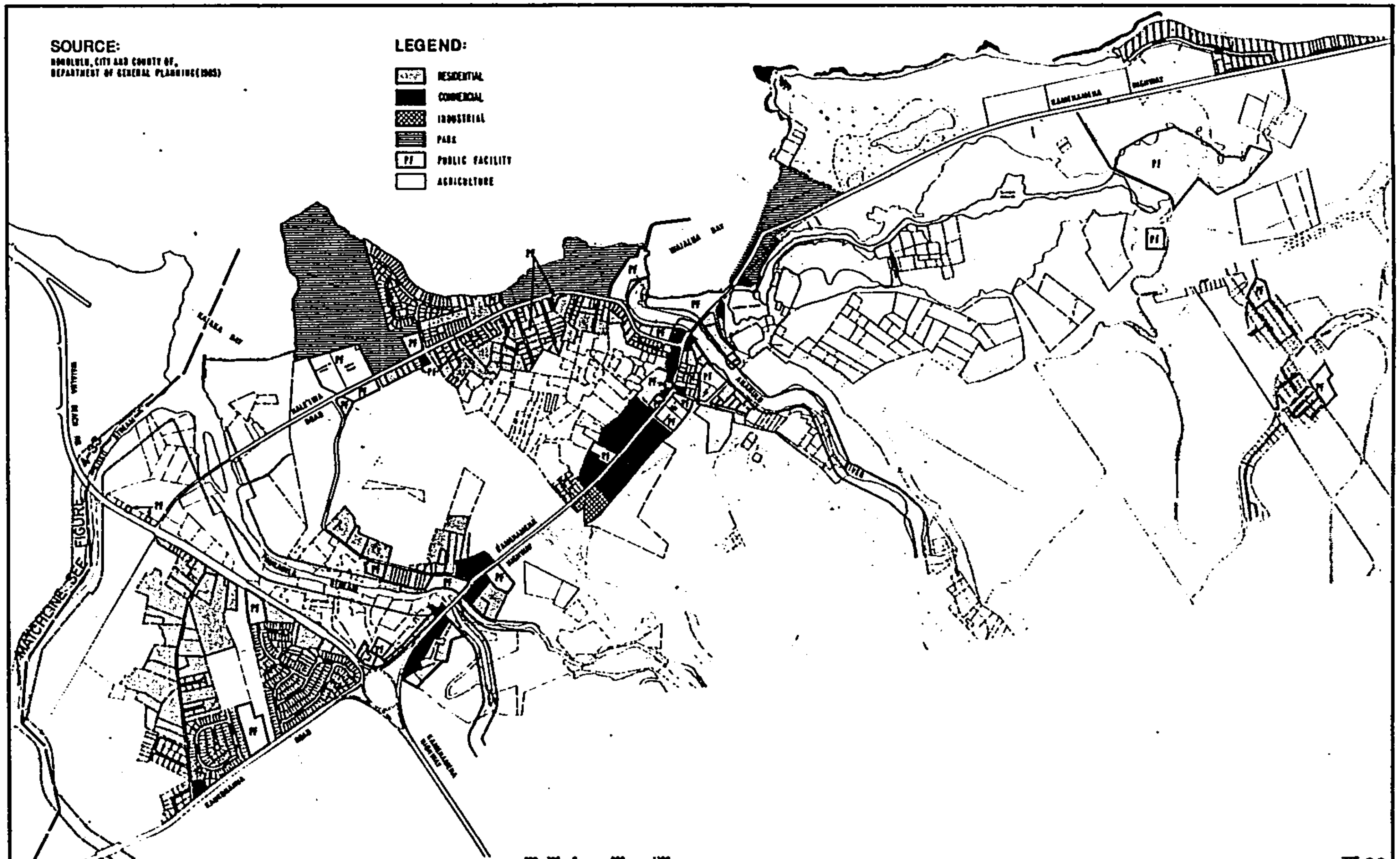


FIGURE III-26
NORTH SHORE DEVELOPMENT PLAN
LAND USE MAP: HALE'IWA AREA

IV. ENVIRONMENTAL CONSEQUENCES OF THE ACTIONS UNDER CONSIDERATION

CHAPTER IV

ENVIRONMENTAL CONSEQUENCES OF THE ACTIONS UNDER CONSIDERATION

The discussion contained in this chapter pertains to the environmental consequences of the "No-Action" alternative for both the rural and urban areas, as well as for the various collection system alternatives. Environmental impacts created by the construction and operation of the proposed ocean outfall will be addressed in a supplemental EIS - to be prepared upon completion of additional oceanographic studies.

4.1 PHYSIOGRAPHIC AND GEOLOGIC IMPACTS

None of the WWTP site alternatives under consideration would create substantial physiographic or geologic impacts. Construction of a centralized system would require excavation of between 200,000 and 300,000 cubic yards of earth. Nearly all of this would be for the collection network and outfall, and approximately three-quarters of it would be returned as cover for the pipes once they have been laid. Consequently, it is estimated that only about 50,000 to 75,000 cubic yards of excess material would be produced. Disposal sites for this volume of soil are readily available in the area.

4.2 HYDROLOGIC IMPACTS

4.2.1 Changes in Storm Runoff Volume

Construction of any of the centralized treatment plant alternatives would marginally increase the amount of impermeable surface in the area. Nearly all of the increase would come from the wastewater treatment plant site rather than from the pump stations or collection system. All the wastewater treatment plant site locations under consideration are situated in rural areas and are surrounded by substantial amounts of vacant land. They would be graded so that runoff flows onto these open areas. The additional runoff for a 10 year design storm is estimated at approximately 6 cfs, too little to cause flooding. The "No-Action" alternative would not affect runoff volumes.

4.2.2 Susceptibility to Damage or Disruption From Flooding

4.2.2.1 Centralized Alternatives

The wastewater treatment plants that are part of Alternatives IA, IB, and II are situated in areas that have been determined by the Federal Emergency Management Agency to be free of flooding. The WWTP sites for Alternatives M-2 and M-3 are located in areas of undetermined flood risk, and additional hydrologic studies are needed in these areas. However, information currently available indicates that it would be possible to eliminate flood threats to these WWTP sites through appropriate grading and other design features.

A substantial portion of the collection mains and most of the sewer pump stations would (of necessity) be in flood-prone areas. Because of this, the pump stations would be floodproofed to the projected flood level so that water would not enter (or leave) the system through them. The sewers would be sized to accommodate increased infiltration from groundwater that would occur when flooding saturates the surrounding soil and stormwater enters through manhole covers. The hydraulic and treatment capacity of the plant would be sufficient to accommodate the higher influent volumes and pollutants caused by flooding or the high groundwater table conditions that accompany flooding.

4.2.2.2 "No-Action" Alternative

Many of the cesspools that would be retained under the "No-Action" alternative would be inundated by the design flood and/or adversely affected by the high water table conditions that would accompany it. In many instances this would cause the contents of the cesspools to contaminate floodwaters and wastewater to back up into homes.

The Pa'ala'a Kai WWTP lies outside the 100-year flood zone and should not be affected by floods. Private treatment units in the area are within the flood zone and would be prone to flooding. Hence, there is a potential for a direct interchange as a result of flooding of these facilities. Furthermore, even if the treatment plants are not inundated, long periods of rainfall or high tide conditions can create elevated groundwater levels which increases the likelihood of overflows from the disposal wells.

4.2.3 Water Quality Effects

4.2.3.1 "No-Action" Alternative

The direction of groundwater flow in the Waialua-Hale'iwa area is towards the shoreline and percolating sewage (that may enter the groundwater) contains nutrients and pollutants which may, in sufficient concentrations, be detrimental to nearshore marine ecosystems and/or public health.

Urban Area. While it is not possible to quantify its effects, concern over the possible impact of seepage from a high density of cesspools and under-maintained private wastewater treatment plants on coastal water water quality was one of the principal concerns of the "208 Plans" and WQPO documents and provided the primary reason for preparing the Waialua-Hale'iwa Wastewater Facilities Plan.

The "No-Action" alternative would do nothing to alleviate this concern. In fact as time progresses, the aging of the existing cesspools compounded by their relatively high density, generally unsuitable soils, and close proximity to public beaches would seem to imply the inappropriateness of the "No-Action" alternative. The additional cesspools needed to serve the population growth (although limited) also would be an additional factor against the selection of the "No-Action" alternative.

Both Kaiaka and Waialua Bays are considered to be sensitive to pollutional loadings because of their water quality limited segment designations. The fact that Waialua Bay has been designated Class AA (the highest possible classification) by the State Department of Health indicates it should receive the highest possible protection from contamination.

Rural Area. Due to the generally good soil conditions and low population density in the rural area, the potential for adverse water quality impacts is expected to remain low.

4.2.3.2 Centralized Wastewater Treatment Alternatives

The centralized treatment system alternatives call for the abandonment of the majority of the cesspools in the Waialua-Hale'iwa District and virtually all of those in the urban core.

Without these cesspools, seepage of wastewater would eventually cease and the potential for adverse water quality effects from this source eliminated.

Over 90 percent of the planned collection system consists of gravity mains, which have low internal pressure. Hence, little exfiltration of untreated effluent is expected. In fact, groundwater infiltration into the system in areas where the pipes are below the water table is much more likely, and the system has been designed to accommodate the higher flow rates this will produce. Breaks in force mains (which comprise only 5 to 8 percent of the system) can result in leakage of untreated wastewater, but such occurrences are very rare. Force main breaks usually surface and show pressure drops at the pump station and can be quickly discovered and rectified.

Construction of the ocean outfall (see Figure IV-1) would involve the excavation of a suitable trench along the ocean shore, placement of a 36-inch effluent pipe, and backfilling. Direct impacts on benthic organisms would be limited to the areas immediately adjacent to the pipe trench, which would extend approximately 3,600 feet offshore. Evidence from sewer outfall construction projects at Sand Island and Honouliuli indicate that the coral destroyed during the construction of the outfall will regenerate over time.

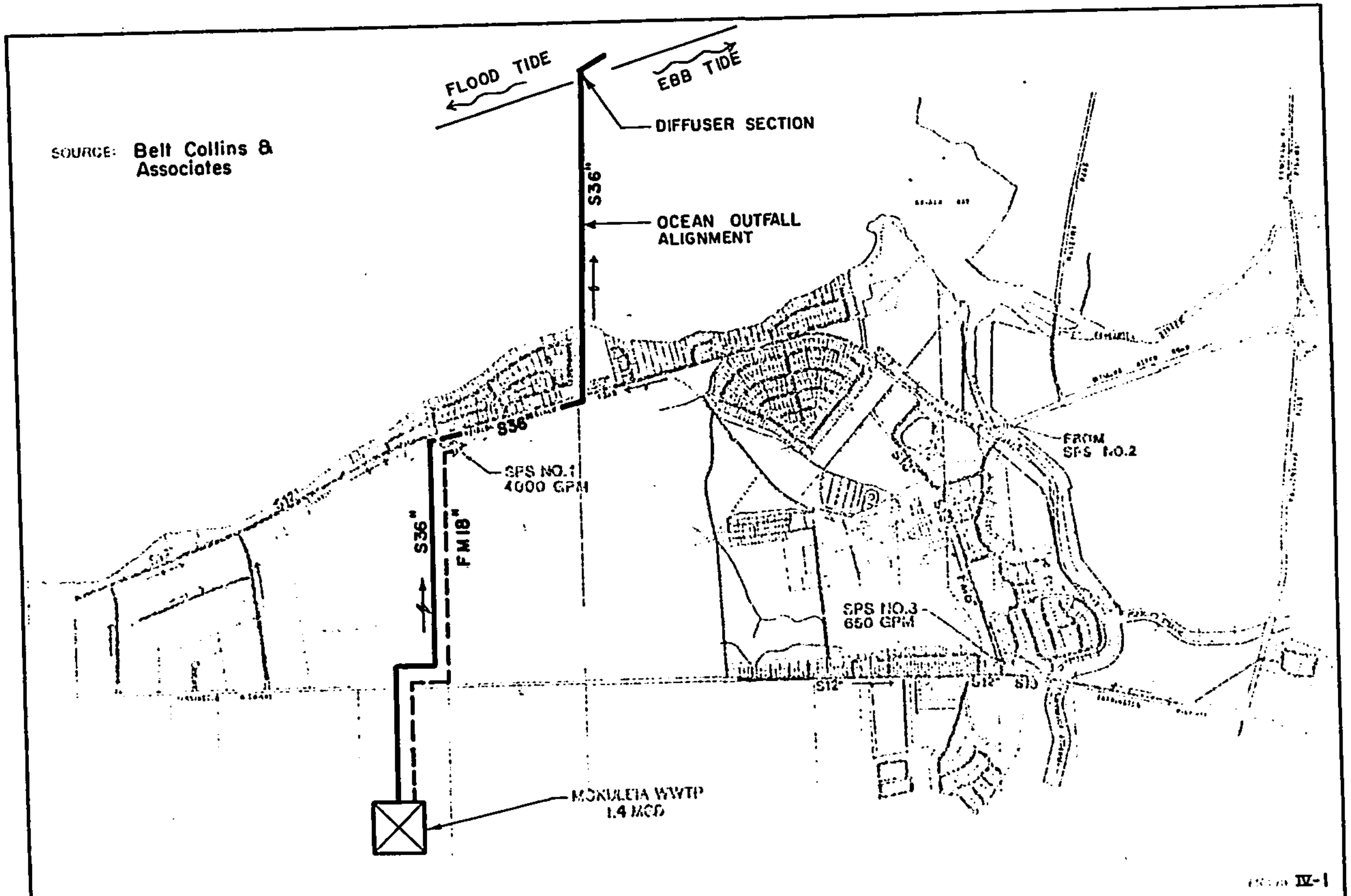


FIGURE IV-1

MOKULE'IA WWTP-OCEAN OUTFALL ALIGNMENT

The outfall would discharge the secondarily-treated effluent at a depth of approximately 80 feet (R.M. Towill, 1967). It would be designed to provide adequate initial dilution, dispersion, and die-off of organisms and residual pollutants. Consequently, no significant long-term effects on the water quality of surrounding coastal waters or beaches is expected. Additional current and marine studies must be undertaken to obtain the necessary permits/approvals for constructing and operating the outfall.

4.3 IMPACTS ON SOILS AND AGRICULTURAL PRODUCTIVITY

4.3.1 Loss of Prime Agricultural Land

The collection system, sewage pump stations, exfiltration wells, and/or outfall would be constructed in mostly urbanized areas and would not significantly affect agricultural lands. The existing agricultural uses and potential of the proposed wastewater treatment plant sites evaluated are summarized below:

Alternative	Existing Use	SCS Capability Rating	ALISH Designation	Land Area (acres)	Significance of Loss
IA (Mokule'ia)	Sugarcane	I	Prime	10	Removes productive acreage from Waialua Sugar Company operations.
IB (Kawailoa)	Scrub	IIIe	Other Important	10	None
II (Kawailoa/ Mokule'ia)	Scrub/ Sugar	IIIe/I	Other Imp./ Prime	10	Kawailoa-None/ Mokule'ia-Some adverse effect on W.S. Co. operations.
M-2 (East Dillingham)	Sugarcane	IIe	Prime	10	Removes productive acreage from Waialua Sugar Company operations.
M-3 (West Dillingham)	Scrub	VIIs	None	10	None
No Action	N/A	N/A	N/A	0	None

If the WWTP site were to be selected purely on the basis of minimizing adverse impacts on agricultural potential, Alternatives IB and M3 would be preferable, since they are not currently in agricultural use and have soils with low agricultural potential. The other centralized treatment plant alternatives (including IA, the preferred alternative) involve sites which are currently cultivated. The withdrawal of approximately 10 acres from sugar production could have a very slight adverse effect on the operations of the Waialua Sugar Company. It is noted that the Waialua Sugar Company has voiced their concerns on actions affecting their operations, such as land lost from production, interference with irrigation water flow, increased traffic on cane haul roads (and subsequent liability concerns), and stricter harvesting controls in close proximity to the site. These concerns were taken into consideration in selecting the proposed WWTP site.

4.3.2 Soil Erosion

The area that would be served by a centralized wastewater treatment and disposal system is relatively flat, and rainfall volumes are moderate. The use of standard erosion control measures during grading, grubbing, trenching, and other construction activities will prevent a significant increase in erosion.

4.4 AIR QUALITY IMPACTS

4.4.1 Applicable Ambient Air Quality Standards

Both Federal and State governments have promulgated ambient air quality standards for major air pollutants. These specify maximum allowable concentrations of these "criteria pollutants" and are intended to directly protect the public's health and welfare. The standards are summarized in Table IV-1. Wastewater treatment facilities which employ fossil-fuel combustion for sludge drying or incineration emit criteria pollutants, but no such combustion is envisioned in the facilities under consideration for the Waialua-Hale'iwa area.

Hydrogen sulfide, a by-product of anaerobic decomposition, can be produced during the course of wastewater treatment. It constitutes a health hazard only at concentrations far higher than those which could be produced by the processes that would be used. However, humans can detect its characteristic "rotten egg" odor at very low concentrations. **The State Department of Health has proposed a 1-hour ambient air quality standard of 0.1 ppm for hydrogen sulfide.** In order to achieve this, it may be necessary to include a hydrogen sulfide emissions control system in the design of the WWTP. The inclusion of this emission control system combined with the rural location of the treatment plant sites under consideration will help to minimize the release of malodorous gases.

Table IV-1. Summary of State of Hawai'i and Federal Ambient Air Quality Standards.

Pollutant	Sampling Period	Federal Standards Primary[1]	Federal Standards Secondary[2]	State Standards
Suspended Particulate Matter (TSP) (micrograms per cubic meter)	Annual Geometric Mean	75	60	60
	Annual Arithmetic Mean	--	--	--
	Maximum Average in Any 24 Hours	260	150	150
Sulfur Dioxide (SO_2) (micrograms per cubic meter)	Annual Arithmetic Mean	80	--	80
	Maximum Average in Any 24 Hours	365	--	365
	Maximum Average in Any 3 Hours	1300		1300
Carbon Monoxide (CO) (milligrams per cubic meter)	Maximum Average in Any 8 Hours	10		5
	Maximum Average in Any 1 Hour	40		10
Hydrocarbons (HC) Non-methane (micrograms per cubic meter)	Maximum Average in Any 3 Hours	160		100
Photochemical Oxidants (micrograms per cubic meter)	Maximum Average in Any 1 Hour	240		100
Nitrogen Dioxide (NO_2) (micrograms per cubic meter)	Annual Arithmetic Mean	100		70
	Maximum Average in Any 24 Hours	--		150
Lead (micrograms per cubic meter)	Calendar Quarter	1.5		1.5

[1] Intended to prevent adverse effects on public health.

[2] Intended to prevent adverse effects on public welfare including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials.

Source: Morrow (June 1982:Table 4; Chapter 54 of Title 11, Administrative Rules, State of Hawaii).

4.4.2 Emission Standards

In addition to ambient air quality standards, the Federal government has established standards which limit the rate and/or volume of air pollutants emissions from individual facilities. Two of these regulations are applicable to wastewater treatment plants. One is listed under the New Source Emission Standards (40 CFR 60, Subpart), and pertains to incinerators which burn sewage sludge. The other is contained in the National Emission Standards for Hazardous Air Pollutants (40 CFR 61, Subpart E) and pertains to mercury emissions from sludge incineration and sludge. Since sludge will be disposed of in an approved sanitary landfill rather than through incineration, the project will not violate these standards.

4.4.3 Other Emission Regulations

The State Department of Health's Administrative Rules (Title 11, Chapter 60) empower it to control "dust, fumes, mist, smoke, other particulate matter, vapor, gas, odorous substances, or any combination thereof" to the extent necessary to prevent air pollutant concentrations that might constitute a health risk or interfere with human welfare. The provisions of this chapter are broad enough to cover viable particles such as bacteria and viruses, as well as odors and will be addressed in the following sections concerning air quality impacts associated with the proposed project.

4.4.4 <u>Construction Impacts on Air Quality</u>

The potential for significant particulate emissions from the wastewater treatment plant and pump station sites during grubbing and grading is slight due to the limited areas involved and the dust control measures that will be taken by the contractor. The U.S. Environmental Protection Agency (EPA) has estimated uncontrolled dust emissions (i.e., emissions when no special mitigation measures are taken) from construction sites at about 1.2 tons per acre per month in an area having soils with 30 percent silt content and a Precipitation/Evaporation (P/E) Index of about 50 (E.P.A., October 1980). The lower P/E Index (40) and higher silt content of the soils on the sites under consideration (U.S. Department of Agriculture, August 1972); Buckman & Brady, 1969) indicate that the rate of dust emissions would be even higher from them if no control measures are taken. However, frequent watering and other dust control measures can reduce dust emissions by up to 50 percent, and are required in the City's construction contracts. These measures, together with the modest size and rural location of the wastewater treatment plant, will help to minimize dust emission problems.

Excavation needed to install the collection system is likely to be a more significant source of construction dust. This is true because the collection system involves excavation much closer to homes, businesses, and other sensitive receptor sites and because passing vehicles provide a mechanism for lifting more soil particles into the air. Frequent watering of the streets can reduce particulate emissions substantially, as can careful cleaning of the street surface after each day's activities. Nonetheless, it is virtually impossible to provide complete control at night and during other non-working hours, and residents may expect dust to be a nuisance while the sewer mains are being constructed near their homes. The most effective means of minimizing the impact of these emissions is to keep construction in any particular area as short as possible.

The "No-Action" alternative involves very limited construction of new facilities and does not require a collection system. Consequently, it would have virtually no effect on air quality.

4.4.5 Long-Term Effects of "No-Action" Alternative

As noted elsewhere, existing development in the Hale'iwa-Waialua area is served largely by cesspools. The exceptions are the 307 residential units served by Pa'ala'a Kai WWTP and small apartment and commercial projects served by private treatment units. The "No-Action" alternative involves the continued use of these facilities, with maintenance, replacement, and/or upgrading done at the discretion of the individual owners and on a low-priority basis.

A properly working cesspool is odor free, but cesspool failure, a common occurrence in the study area, produces odors. Construction of a replacement cesspool can solve the odor problem where the failure is the result of long use. It will not eliminate cesspool backups and consequent odors where the failures are the result of poor soil conditions. Cesspool odors tend to be localized, and this has limited the severity of the problem to date. However, given howeowners' tendency to undertake minimal cesspool maintenance, the number of cesspool failures may be expected to rise as the average age of the cesspools in the area increases. Over time, this will result in a greater odor problem, particularly in the most densely settled areas.

Furthermore, emissions from cesspool truck traffic will continue and increase should the existing system be kept.

4.4.6 Long-Term Air Quality Effects of Centralized Alternatives

4.4.6.1 Chemical Emissions

Wastewater facilities generally emit regulated pollutants only if they include sludge incineration or heating, neither of which is proposed for the Waialua-Hale'iwa area. Mercury, which can become airborne during sludge drying, is not a problem in the Waialua-Hale'iwa area because of the absence of any industrial source of this pollutant.

4.4.6.2 Viable Emissions

While the proposed WWTP for the Waialua-Hale'iwa area is not a potential source of airborne chemical pollutants, the nature of the waste that is handled makes it a potential emitter of bacteria, viruses, and other viable matter. In addition, any aeration of wastewater is a potential source of aerosols. The extent to which organisms become entrained in air is determined by such factors as the turbulence of the fluid flows, the amount of fluid exposed to air, and the turbulence and velocity of the air stream.

A number of studies have been funded by the U.S. Environmental Protection Agency in an attempt to evaluate the health risks associated with the treatment and disposal of municipal wastewater and sludge (see, for example, Clark, et al., May 1981; Majeti & Clark, April 1981; and Fiscus, et al., August 1978). These show that despite the possibility of relatively high levels of airborne microorganisms resulting from the operation of wastewater treatment facilities, there is no evidence of increased disease rates among WWTP workers. The downwind transport of these organisms to surrounding population also appears to have no measurable effect on the incidence of disease. Dispersion by the wind and die-off due to exposure to sunlight, desiccation, and other factors have been shown to significantly reduce the number of viable organisms as distance from the plant increases, and placement of a vegetative barrier around the plant can cut concentrations by up to 50%.

4.4.6.3 Odors

Odors, rather than the air pollutants discussed above, have historically been the most serious air pollution concern relative to wastewater treatment plants. Such facilities are known to be potential sources of undesirable odors, whose control in the past have often been neglected, but increasing complaints of nearby residents and advances in treatment technology and reliability have greatly reduced the frequency and intensity of odor emissions.

Some treatment processes have an inherently greater potential for odor production than do others. In addition, because of the extensive collection system, relatively flat slopes, and modest flows, sewage will take many hours to reach the treatment plant from its place of origin. Consequently, odor-producing septic conditions will develop, and the potential exists for the release of these odors at the sewer pump stations, the junction of force and gravity mains, and at the headworks to the wastewater treatment plant. The bad-smelling anaerobic decomposition gases include small amounts of a full range of low-molecular weight mercaptans, organic disulfides, organic acids, and methylamines, indoles, skatoles, as well as much larger amounts of hydrogen sulfide and ammonia (National Academy of Sciences, 1979). Hydrogen sulfide is particularly troublesome because it has a nauseating, rotten-egg smell and is detectable at concentrations as low as 0.47 parts per billion (by volume).

Various methods can be used to control odors (Adams, March 1974; Hemeon, March 1974). Some odor reduction can be achieved by injecting oxidizing agents such as hydrogen peroxide, chlorine, and ozone or by aeration into the wastewater at sewage pump stations and the headwater to the treatment plant, but scrubbing the malodorous gases with scrubbers, soil absorbers, or granular-activated carbon (GAC) absorbers provides a more cost-effective, reliable control of odors. Consequently, air pollution control equipment, such as either scrubbers, soil absorbers, or GAC absorbers, will be provided to minimize release of malodorous gases.

4.5 NOISE IMPACTS

4.5.1 Centralized System Alternative

Construction and operation of the various components of a centralized wastewater treatment system would generate noise impacts on the surrounding community. The character, magnitude, and significance of these impacts, as well as possible noise mitigation measures were evaluated by the acoustical consulting firm of Darby-Ebisu and Associates, Inc. (April 1982).

4.5.1.1 Construction Noise and Mitigative Measures

Collection System. Construction of the collection system required by the centralized wastewater treatment alternative would produce some adverse short-term noise impacts on existing residential and commercial structures. As indicated below, many of these impacts are unavoidable. However, they are not expected to be severe, and noise mitigation measures can be used to insure that they do not become overly disruptive.

The primary noise sources during construction are expected to be trenchers, backhoes, front end loaders, pumps, small cranes, and trucks. The noise levels produced by such diesel-powered equipment typically range from 75 to 90 dB at a distance of 50 feet. Table IV-2 depicts the range of construction noise levels that are expected as a function of distance from

Table IV-2. Anticipated Range of Construction Noise Levels as a Function of Distance.

Distance From Source (in feet)	Anticipated Construction Noise Level (in dBA)		
	Minimum	Maximum	Median
50	80	90	86
70	77	87	82
100	74	84	79
150	71	81	76
250	66	76	71
400	62	72	67
600	57	67	63
1,000	52	62	57

Source: Darby-Ebisu and Associates, Inc. (April 1982).

operating diesel equipment. Noise measurements were made of a trencher while it was digging a trench for a sewer lateral; they showed noise levels of 70 to 80 dB(A) occurring nearly continuously during working hours. Only brief respites occurred when the equipment was idling or being repositioned.

Based on the available noise source data, it is projected that exterior construction noise levels will, at times, exceed 80 dB(A) when work is performed within 50 feet of a structure. Interior noise levels will probably exceed 60 dB(A) under such conditions. Because of their very limited setback (10 to 30 feet) the residences along Crozier Drive are expected to be most severely affected. Disruption of normal residential activities in the rooms facing the sewer line will probably occur when work is underway. However, since construction activity will move as work on the collection system progresses, significant noise exposure at any one location will last only two to four weeks.

The construction of sewage pump stations will generate additional hammering, jackhammer, and concrete mixer noises. As the separation from residences increases, construction of the SPS's will have less adverse impact. The construction of the SPS's will generate audible construction noise, but its impact will be localized and less significant than noise generated during the installation of the collection lines.

Wastewater Treatment Plant. While construction of a wastewater treatment plant will involve sustained activity for about two years, all of the WWTP sites under consideration are relatively isolated from existing development. Because of this, significant construction noise impacts are not expected.

Mitigative Measures: Construction noise levels as well as noise levels created by vehicles going to and from the construction site must be kept within levels specified in Title II, Administrative Rules Chapter 43, Community Noise Control for Oahu, and Chapter 42, Vehicle Noise Control for Oahu (respectively). In addition, all construction equipment and onsite vehicles requiring the exhaust of gas or air must be equipped with mufflers. Should a baseyard or stockpile area be located near residences, mitigative measures, such as berms or barriers, will be constructed to minimize noise impacts from such areas.

4.5.1.2 Operating Noise and Mitigation Measures

Wastewater Treatment Plant. In order to predict wastewater treatment plant noise levels, the existing Wahiawa Wastewater Treatment Plant was used as an acoustical model. Sound level measurements were made at that facility and used to estimate the amount of noise that would be produced by a centralized WWTP serving the Waialua-Hale'iwa area. These estimates indicate that total plant noise at a distance of 1,000 feet would be below 40 dB. This is below the A-weighted nighttime background ambient noise level. Since existing residential development is located over 1,000 feet from the WWTP sites, no adverse impacts from overall operating noise levels is expected.

While overall noise conditions appear satisfactory, theoretical calculations suggest that the aerator blowers could produce a high-pitched whine that, if untreated, might be audible in areas exposed to the ventilator intake and exhaust openings. Since Section 3.100-2.B of the Land Use Ordinance calls for lower noise levels in the high-frequency range, noise abatement measures may be required. The aerator blower equipment would be enclosed and the building can be sited so that no walls with ventilation openings face residential areas. The openings can also be treated with intake silencers or acoustic louvers.

Finally, the diesel-powered standby electric generator also constitutes a potential noise source. However, it will be operated only as necessary for periodic maintenance and during power outages.

Sewage Pump Stations. Sewage pump stations (SPSs) must, by necessity, be located closer to residential areas than the WWTP. Moreover, interior noise levels in these stations can be as high as 80 dB. Hence, there is a greater potential for adverse noise impacts from these SPSs than from the WWTP.

The primary noise sources at the SPSs are expected to be electric motors, air compressors, and a standby electrical generator. These are sufficiently loud to make careful treatment of the walls and ventilating openings mandatory. So long as the SPS ventilation openings are treated with sound attenuating louvers, the State Department of Health nighttime noise limits can be met by providing a 20-foot setback from the property line. By locating the treated sewage pump station buildings at least 60 feet from the nearest residence, noise levels at the residences will not exceed 40 dB, and minimal noise impact will result.

Exfiltration Well Field. The exfiltration well field sites may be located in relative close proximity to residences. However, the discharge of effluent into the wells is accomplished by gravity and would not create adverse noise impacts. The entire structure is underground and no pumps are utilized to force the effluent into the ground. Fowever, short-term impacts may be created during routine maintenance periods, i.e. if wells are to be backflushed (this procedure would require the use of a pump). Backflushing of wells would normally be done during daytime hours and is not expected to create any significant noise impacts.

Mitigative Measures: To mitigate potential problems, noises from wastewater collection and treatment system must be to meet attenuated the allowable noise levels stated in Title

11, Administrative Rules Chapter 43, Community Noise Control for Oahu.

4.5.2 <u>"No-Action" Alternative</u>

There would be few noise impacts under this alternative. The only changes in the existing noise environment would result from construction of new or replacement cesspools and new package treatment plants in the apartment area off Waialua Beach Road. The expected increase in cesspool failures would also mean additional noise generated by cesspool pumping trucks. All of these noise sources would be temporary and are not expected to have significant impacts.

4.6 IMPACTS ON VEGETATION

The "No-Action" alternative involves little new construction, and would have no significant effect on vegetation. Consequently, this analysis focuses on the areas that would be affected by construction of a centralized wastewater treatment system.

In the urban area, construction of the proposed wastewater treatment plant, sewage pump stations, sewer mains, and the land portion of the ocean outfall involves land clearing. Thorough surveys of the affected areas were conducted to determine the extent to which this might adversely impact vegetation. The remainder of this section describes the survey methodology, and the nature and importance of existing vegetation.

4.6.1 Survey Methodology and Findings

Before fieldwork was initiated, maps, aerial photographs, and reports pertinent to the project were collected and studied. Wildlife management agencies were contacted for information regarding the possible presence of rare or endangered species. Field reconnaissance surveys were conducted in May 1982 and June 1986. Following an initial orientation trip, walk-through surveys were made at each of the WWTP and sewage pump station sites under consideration. Cursory inspections were made of the routes followed by collection lines.

During the walk-through surveys, characterizations were made for each site based on the vegetative structure and dominant plant species observed. The floristic composition of each study area was recorded. Each plant species observed was recorded and qualitative estimates of its relative abundance and cover were made. Those plant species which could not be positively identified in the field were photographed and collected for later verification. A plant species checklist was compiled for each area studied. A narrative discussion of the survey findings is contained in Appendix C.

The results of the survey are summarized in Table IV-3. The summary indicates that nearly all of the plant species observed are exotic. No rare or endangered species were encountered.

4.6.2 <u>Probable Impacts on Vegetation</u>

4.6.2.1 Collection Lines, Sewage Pump Stations, & Ocean Outfall

Except for two minor segments running through sugarcane fields and for house laterals, the sewer mains and land portion of the outfall would be laid beneath existing roadways. The few vegetated areas which would be affected would be immediately replanted, thereby insuring adequate groundcover and minimizing undesirable changes in floristic composition.

Table IV-3. Plant Species Found on Alternative Centralized Wastewater Treatment Facilities Sites.

FAMILY Scientific Name	Common Name(s)	Status	Mokule'ia Project Area WWTP	Mokule'ia Project Area Pump Stations 1	1a	3a	3b	Kawailoa Project Area WWTP	Kawailoa Project Area Pump Stations 5	4	2a	2b	Dillingham Airfield Vicinity
ACANTHACEAE - Acanthus Family													
Asystansia gangetica (L.) T. Anders	Asystasia Chinese Violet	Exotic						x					x
AMARANTHACEAE - Amaranth Family													
Achyranthes indica (L.) Mill.		Exotic											x
Amaranthus spinosus L.	Spiny amaranth Pakai-kuku	Exotic	x		x	x	x	x		x	x		x
Amaranthus viridis L.	Slender amaranth Pakai	Exotic										x	
AMARYLLIDACEAE - Amaryllis Family													
Crinum asiaticum L.	Spider lily	Exotic											x
ANACARDIACEAE - Mango Faimly													
Schinus terebithifolius Raddi	Christmas berry Nani-o-hilo	Exotic					x	x				x	x
ARACEAE - Arum Family													
Alocasia macrorrhiza (L.) Sweet	'Ape, apii	Exotic											x
BIGNOIACEAE - Bigonia Family													
Spanthaodea campanulata Beauv.	African tulip tree	Exotic						x		x	x		x
Tabebuia pentaphylla (L.) Hemsl.	Pink tecoma	Exotic											x
Tecomaria capensis (Thunb.) Spach	Cape honeysuckle 'I'iwi haole	Exotic											x
BORAGINACEAE - Heliotrope family													
Heliotropium procumbens P. Mill.	Weedy heliptrope	Exotic											x
CASUARINACEAE - Casuarina Family													
Casuarina equisetifolia Stickm.	Common ironwood Paina	Exotic		x					x				x
CHENOPODIACEAE - Goosefoot Family													
Chenopodium ambrosioides L.	Mexican tea	Exotic											x
Chenopodium murale L.	Nettle-leaved goosefoot	Exotic											x
COMMELINACEAE - Spiderfort Family													
Commelilina benghalensis L.	Hairy honohono	Exotic											x
Commelina diffusa Burm.f.	Day flower	Exotic						x					x

Table IV-3. Continued

FAMILY / Scientific Name	Common Name(s)	Status	Mokule'ia Project Area					Kawailoa Project Area					Dillingham Airfield Vicinity
				Pump Stations					Pump Stations				
			WWTP	1	1a	3a	3b	WWTP	5	4	2a	2b	
COMPOSITAE - Sunflower Family													
Ageratum conyzoides L.	Ageratum Maile-honohono	Exotic						x			x		x
Bidens pilosa var. pilosa L.	Spanish needle Beggar's tick Ko'oko'olau	Exotic						x	x		x		x
Bidens pilosa var. minor (Bl.) Sherff		Exotic											x
Calyprocarpus vialis Less.	Hierba del cabello	Exotic											x
Crassocephalum crepidioides (Benth.) S. Moore	Crassocephalum	Exotic											x
Eclipta alba (L.) Hassk.	False daisy	Exotic											x
Emilia fosbergii Nicolson	Flora's paintbrush	Exotic											x
Emilia javanica (Burm.f.) C.B. Robins	Red pua-lele	Exotic					x	x				x	
Erechtites hieracifolia (l.) Raf.	Fireweed	Exotic		x				x	x	x			
Erechtites valerianaefolia	Purple erechtites	Exotic											x
Erigeron bonariensis L.	Hairy horseweed Ilioha	Exotic											x
Erigergon candensis L.	Canada fleabane	Exotic											x
Franseria strigulosa Rydb.	False ragweed	Exotic											x
Pluchea x fosbergii Cooperrider & Galang	Hybrid pluchea	Exotic											x
Pluchea indica (L.) Less.	Indian pluchea	Exotic											x
Pluchea odorata (L.) Cass.	Pluchea	Exotic											x
Sonchus asper (L.) Hill	Spiny sow thistle	Exotic											x
Sonchus oleraceus L.	Sow thistle Pua-lele	Exotic											x
Synedrella nodiflora (L.) Gaertn.	Synedrella	Exotic											x
Tridax procumbens L.	Coat buttons	Exotic											x
Verbesina encelioides (Cav.) B. & H. ex Gray	Golden crown-beard	Exotic											x
Veronia cinerea (L.) Less.	Ironweed	Exotic						x					x
Wedilia trilobata (L.) Hitchc.	Wedelia	Exotic	x										
Xanthium saccharatum Wallr.	Cocklebur Kikania	Exotic											x
CONVOLVULACEAE - Morning Glory Family													
Ipomoea alba L.	Moon flower Koali-pehu	Exotic								x			
*Ipomoea cairica var. cairica (L.) Sweet	Koali	Indigenous						x				x	x
*Ipomoea congesta R. Br.	Morning glory Koali-'awania	Ingigenous						x					
Ipomoea indica (Burm.) Merr.	Koali-'awania	Indigenous											x
Ipomoea obscura (L.) Ker-Gawl		Exotic						x					x
Ipomoea triloba L.	Little bell	Exotic					x			x	x		x
Merremia aegyptia (L.) Urban	Hairy merremia	Exotic						x					x

Table IV-3. Continued

FAMILY / Scientific Name	Common Name(s)	Status	Mokule'ia Project Area WWTP	Mokule'ia Pump Stations 1	1a	3a	3b	Kawailoa Project Area WWTP	Kawailoa Pump Stations 5	4	2a	2b	Dillingham Airfield Vicinity
CRASSULACEAE - Orpine Family													
Kalanehoe pinnata (Lam.) Pers.	Air plant, 'Oliwa-ku-kahakai	Exotic						x					
CRUCIFERAE - Mustard Family													
Coronopus didymus (L.) Sm.	Swine cress, Wartcress	Exotic											x
Lepidium virginicum L.	Wild peppergrass	Exotic											x
CUCURBITACEAE - Squash Family													
Cucumis dipsaceus Ehrenb. ex Spach	Wild cucumber	Exotic											x
Momordica charantia var. pavel Crantz	Wild bitter mellon	Exotic											x
Sicyos mocrocarpus Mann	Sicyos	Endemic											x
CYPERACEAE - Sedge Family													
Cyperus alternifolius L.	Umbrella plant	Exotic											x
Cyperus esculentus L.	Yellow nutsedge	Exotic	x										
Cyperus rotundus L.	Nutgrass, Kili'o'opu	Exotic											x
Kyllinga brevifolia Rottb	Kyllinga, Kili'o'opu	Exotic											x
Scirpus validus Vahl	Great bulrush, Aka'akai	Exotic											x
EUPHOBIACEAE - Spurge Family													
Aleurites moluccana (L.) Willd	Kukui, Tutui	Exotic											x
Euphorbia geniculata Ortega	Wild spurge, Kaliko	Exotic											x
Euphorbia glomerifera (Millsp.) L.C. Wheeler	Graceful spurge, Glomerate spurge	Exotic					x					x	x
Euphorbia heterophylla L.	Mexican fire plant	Exotic				x							
Euphorbia hirta L.	Garden spurge, Koko-kahiki	Exotic	x	x	x			x			x	x	x
Euphorbia prostrata Ait.	Prostrate spurge	Exotic									x		
Phyllanthus debilis Klein ex Willd.	Phyllanthus weed	Exotic											x
Ricinus communis L.	Castor bean, Koli	Exotic					x	x		x			x
GENTIANACEA - Gentian Family													
Cnetartium erythaea Rafn.	Bitter herb	Exotic											x

Table IV-3. Continued

FAMILY Scientific Name	Common Name(s)	Status	Mokule'ia Project Area WWTP	Mokule'ia Pump Stations 1	Mokule'ia Pump Stations 1a	Mokule'ia Pump Stations 3a	Mokule'ia Pump Stations 3b	Kawailoa Project Area WWTP	Kawailoa Pump Stations 5	Kawailoa Pump Stations 4	Kawailoa Pump Stations 2a	Kawailoa Pump Stations 2b	Dillingham Airfield Vicinity
GRAMINEAE - Grass Family													
Andropogon pertusus (L.) Willd.	Pitted beardgrass	Exotic											x
Brachiaria mutica (Forsk.) staf.	California grass	Exotic									x		x
Cenchrus ciliaris L.	Buffelgrass	Exotic							x				x
Cenchrus echinatus L.	Sandbur	Exotic						x	x	x			
	'Ume'alu												
Chloris inflata Link	Swollen fingergrass	Exotic	x			x		x		x			x
	Mau'ulei												
Chloris radiata (L.) Sw.	Radiate fingergrass	Exotic	x					x					
Coix lachryma-jobi L.	Job's tears	Exotic											x
Cynodon dactylon (L.) Pers.	Bermuda grass	Exotic	x		x	x		x	x				x
	Manienie												
Digitaria radicosa (Presl) Miq.		Exotic											x
Echinochloa colona (L.) Link	Jungle rice	Exotic	x										x
Echinochloa crusgalli (L.) Beauv.	Barnyard grass	Exotic											x
Eleusine indica (L.) Gaertn.	Wiregrass	Exotic	x		x			x	x		x		x
	Manienie-ali'i												
Eragrostis tenela (L.) Beauv. ex R. & S.	Lovegrass	Exotic											x
Panicum maximum Jacq. var. maximum	Guinea grass	Exotic		x			x	x		x	x	x	x
Panicum maximum var. trichoglume Eyles ex Robyns	Green panicgrass	Exotic											x
Paspalum diclataum Poir.	Paspalum grass	Exotic	x		x	x	x			x			x
	Dallis grass												
Pennisetum purpureum Schumach.	Napiergrass	Exotic											x
Rhynchelytrum repens (Willd.) C.E. Hubb.	Natal redtop	Exotic											x
Saccharum officinarum L.	Sugarcane	Exotic	x		x	x	x						x
	Ko												
Sertatria verticillata (L.) Beauv.	Bristly foxtail	Exotic											x
Sporobolus africanus (Poir.) Robyns & Tournay	African dropseed	Exotic											x
Stenotaphrum secundatum (Walt.) Ktze.	St. Augustine grass	Exotic											x
	Buffalo grass												
Tricachne insularis (L.) Nees	Sourgrass	Exotic						x	x		x		x
LABIATAE - Mint Family													
Hyptis pectinata (L.) Poit.	Comb hyptis	Exotic											x
Leonotis leonurus (L.) R. Br.	Purple lions-ear	Exotic											x
Leonotis nepetaefolia (L.) Alt.	Orange lions-ear	Exotic						x			x		x
Ocimum gratissimum L.	Wild basil	Exotic											x

Table IV-3. Continued

FAMILY Scientific Name	Common Name(s)	Status	Mokule'ia Project Area WWTP	Mokule'ia Pump Stations 1	1a	3a	3b	Kawailoa Project Area WWTP	Kawailoa Pump Stations 5	4	2a	2b	Dillingham Airfield Vicinity
LEGUMINOSAE - Pea Family													
Acacia farnesiana (L.) Willd.	Klu Kolu	Exotic											x
Caloigonium mucunoides Desv.	Calopogonium	Exotic											x
Cassia bicapsularis L.		Exotic											x
Cassia lechenaultiana DC	Partridge pea Lauki	Exotic											x
Cassia occidentalis L.	Coffee senna 'Auko'i	Exotic											x
Cassia spp.	Shower tree	Exotic					x						
Cassia surattensis	Scrambled eggs Kalamona	Exotic						x					
Crotalaria incana L.	Fuzzy rattlepod Kukae-hoki	Exotic											x
Crotalaria pallida Aiton		Exotic											x
Desmanthys virgarus (L.) Willd.	Virgatte mimosa	Exotic											x
Desmodium canum (Gmel.) Schinz & Thell.	Spanish colver Ka'imi	Exotic											x
Indigofera suffruticosa Mill.	Indigo 'Iniko	Exotic											x
Leucaena leucocephala (Lam.) de Wit	False koa Koa-haole	Exotic		x			x	x	x	x	x	x	x
Medicago polymorpha L.	Bur clover	Exotic											x
Mimosa pudica L.	Sensitive plant Pua-hilahila	Exotic						x					
Mimosa pudica var. unijuga (Duchess. & Walp.) Griseb.	Sensitive plant Pua-hilahila	Exotic											x
Phaseolus atropurpureus DC.	Wild bushbean	Exotic											x
Phaseolus lathyroides L.	Cow pea	Exotic											x
Pithecellobium dulce (Roxb.) Benth.	Manila tamarind 'Opiuma	Exotic						x			x		x
Prosopis pallida (Humb. & Bonpl. ex Willd.) HBK.	Mesquite Kiawe	Exotic						x		x			x
Samanea saman (Jacq.) Merr.	Monkey pod	Exotic											x
LILIACEAE - Lily Family													
Sansevieria thyrsiflora Thunb.	Bowstring hemp	Exotic											x
LOGANIACEAE - Strychnine Family													
Buddleja asiatica Lour.	Asiatic butterfly bush, dogtail Huelo-'ilio	Exotic											x

Table IV-3. Continued

FAMILY Scientific Name	Common Name(s)	Status	Mokule'ia Project Area WWTP	Pump Stations 1	1a	3a	3b	Kawailoa Project Area WWTP	Pump Stations 5	4	2a	2b	Dillingham Airfield Vicinity
MALVACEAE - Mallow Family													
Abutilon grandifolium (Willd.) Sweet	Hairy abutilon Ma'o	Exotic						x					x
Hibicus rosa-sinensis L.	Red hibiscus Chinese hibiscus	Exotic								x			x
Hibiscus cv. "Pink Waterfall"		Exotic											x
Hibiscus tiliaceus L.	Hau	Indigenous											x
Malva parviflora	Little mallow Cheeseweed	Exotic											x
Malvastrum coromandelium (L.) Garcke	False mallow Hauuoi	Exotic		x				x		x			x
Sida acuta Burm.	'Ilima	Exotic											x
Sida fallax Walp.	'Ilima	Indigenous											x
Sida rhombifolia L.	Cuba jute	Exotic											x
Sida spinosa L.	Prickly sida	Exotic						x					x
Thespesia populnea (L.) Soland. ex Correa	Milo	Exotic											x
MELIACEAE - Mahogany Family													
Melia azedarach L.	Pride of India Chinaberry tree 'Inia	Exotic											x
MENISPERMACEAE - Moonseed Family													
*Cocculus ferrandianus Gaud.	Huehue	Endemic						x					
MORACEAE - Mulberry Family													
Ficus benjamina L.	Benjamin tree	Exotic						x					
Ficus microcarpa L.	Chinese banyan	Exotic						x					x
Morus nigra L.	Black mulberry Kilika	Exotic											x
MUSACEAE - Banana Family													
Musa x nana Lour.	Chinese banana	Exotic											x
MYRTACEAE - Myrtle Family													
Eugenia cumini (L.) Druce	Java plum Palama	Exotic						x			x		
Psidium guajava L.	Guava Kuawa	Exotic											x
Syzygium cumini (L.) Skeels	Java plum Palama	Exotic											x
NYCTAGINACEAE - Four o'clock Family													
*Boerhavia diffusa L.	Alena	Indigenous									x		
Bougainvillea spp.	Bougainvillea	Exotic						x					
Mirabilis jalapa L.	Common four o'clock [illegible]	Exotic											x

Table IV-3. Continued

FAMILY Scientific Name	Common Name(s)	Status	Mokule'ia Project Area WWTP	Mokule'ia Pump Stations 1	1a	3a	3b	Kawailoa Project Area WWTP	Kawailoa Pump Stations 5	4	2a	2b	Dillingham Airfield Vicinity
ONAGRACEAE - Evening Primrose Family													
Ludwigia octivalvis (Jacq.) Raven	Primrose willow Kamole	Indigenous											x
OXALIDACEAE - Wood Sorrel Family													
Oxalis corniculata L.	Yellow wood sorrel 'Ihi	Exotic	x				x	x					x
Oxalis martiana Zucc.	Pink wood sorrel 'Ihi pehu	Exotic	x				x	x					
PALMAE - Palm Family													
Cocos nucifera L.	Coconut Niu	Exotic											x
Pheonix spp.	Date palm	Exotic						x	x				
PASSIFLORACEAE - Passion Flower Family													
Passiflora edulis f.flavicarpa Deg.	Yellow liliko'i	Exotic							x	x			x
Passiflora foerida L.	Scarlet-fruited passionflower Pohapoha	Exotic											x
Passiflora suberosa L.	Huehue-haole	Exotic											x
PHYTOLACCACEAE - Pokeweed Family													
Phytolacca octandra L.	Southern pokeberry	Exotic		x					x				x
PIPERACEAE - Pepper Family													
Pepperomia spp.	'Ala'ala-wai-nui	Exotic						x					
PLANTAGINACEAE - Plantain Family													
Plantago lanceolata L.	Narrow-leaved plantain	Exotic						x	x				x
Plantago major L.	Broad-leaved plantain	Exotic					x			x			x
PLUMBAGINACEAE - Leadwort Family													
Plumbago zeylanica L.	'Ilie'e Hilie'e	Indigenous											x
POLYGONACEAE - Buckwheat Family													
Antigonon Letopus H. & A.	Mexican creeper	Exotic						x					
PORTULACACEAE - Purslane Family													
Portulaca oleracea L.	Common purslane Pigweed 'Ihi	Exotic						x					x

Table IV-3. Continued

FAMILY Scientific Name	Common Name(s)	Status	Mokule'ia Project Area WWTP	Mokule'ia Pump Stations 1	1a	3a	3b	Kawailoa Project Area WWTP	Kawailoa Pump Stations 5	4	2a	2b	Dillingham Airfield Vicinity
PRIMULACEAE - Primrose Family													
Anagallis arvensis L.	Scarlet pimpernel	Exotic		x									x
PROTEACEAE - Silk oak Family													
Grevillea robusta A. Cunn.	Silk oak 'Oka-kalika	Exotic											x
SOLANACEAE - Nightshade Family													
Lycopersicon esculentum var. cerasiforme (Dunal) Alef	Cherry tomato 'Ohi'a-lomi	Exotic						x					
Lycopersicon pimpinellifolium Mill.	Currant tomato	Exotic											x
Nicandra physalodes (L.) Gaertn.	Apple-of-Peru	Exotic						x					x
Solanum nigrum L.	Black nightshade Popolo	Exotic		x				x					x
Solanum seaforthianum Andr.	Blue potato vine	Exotic											x
Solanum sodomeum L.	Apple of Sodom Popolo-kikania	Exotic											x
STERCULIACEAE - Cocoa family													
Waltheria indica var. americana (L.) R. Brown ex Hosaka	Hi'aloa 'Uhaloa	Indigenous											x
TILIACEAE - Linden Family													
Triumfetta semitriloba (L.) Jacq.	Burbush	Exotic											x
TYPHACEAE - Cattail Family													
Typha latifolia L.	Common cattail	Exotic											x
UMBELLIFERAE - Carrot Family													
Apium tenuifolium (Moench) Thell. ex Hegi	Apium	Exotic											x
Foeniculum vulgare Mill.	Sweet fennel	Exotic	x				x		x				
VERBENACEAE - Verbena Family													
Lantana camara L.	Lantana Lakana	Exotic											x
Stachytarpheta jamaicensis (L.) Vahl	Jamaca vervain Owi, oi	Exotic											x
Verbena litoralis HBK.	Weed verbena Ha'uowi	Exotic											x

* Native Plants
WWTP = Wastewater Treatment Plant

Source: Earthwatch (May 1982); Char & Associates (July 1986)

Clearing the sewage pump station sites will result in the loss of approximately 8,000 square feet of vegetative cover at each location. No known rare or endangered species will be affected, and the change will not significantly reduce the regional abundance of the species.

4.6.2.2 Wastewater Treatment Plant Sites

Construction of the wastewater treatment plant(s) incorporated in each of the alternatives involves the clearing of approximately 10 acres of land. No known rare and endangered species are located at any of the sites. As previously indicated, Alternatives IA, M-2, M-3, and part of II place the treatment plant on existing sugarcane land; Alternatives IB and part of II require clearing of existing scrub vegetation. The effect on sugarcane production is discussed in Section 4.3 of this report. No cumulative effects on vegetation are expected.

4.7 IMPACTS ON FAUNA

The "No-Action" alternative involves very little new construction with the potential to adversely affect fauna. Similarly, by virtue of their location under areas not heavily used by fauna (such as existing paved areas), neither the collection system nor the land portion of the ocean outfall has the potential for significant faunal effects.

The following impact analysis focuses on the alternative wastewater treatment plant sites.

4.7.1 Survey Methodology and Findings

Walking surveys were made of each of the wastewater treatment plant sites (Bruner, 1982 and 1986). In addition, all birds and mammals seen or heard in accessible areas were enumerated using the eight-minute count method. Fecal droppings and tracks left by mammals were also recorded. Data from these counts form the basis for the relative abundance figures presented in Tables IV-4 and IV-5.

No resident indigenous birds were observed at any of the sites except M-3 (Dillingham Airfield), but the U'koa Marsh habitat is suitable for Pueo, the Hawaiian Owl (Asio flammeus sandwichensis) and Black-crowned Night heron (Nycticorax nycticorax hoactli). American coot (Filica americana alai), the

Table IV-4. Exotic Bird Species Found at Mokule'ia and Kawailoa Centralized Wastewater Facilities Sites.

COMMON NAME	SCIENTIFIC NAME	Relative Abundance[1]	Location Sighted	
			Kawailoa[2]	Mokule'ia
Cattle Egret	<u>Bubulcus ibis</u>	P	X	X
Barred Dove	<u>Geopelia striata</u>	A	X	X
Spotted Dove	<u>Streptopelia chinensis</u>	U	X	X
Ring-necked Pheasant	<u>Phasianus colchicus</u>	R		X
Common Myna	<u>Acridotheres tristis</u>	U	X	X
Japanese White-eye	<u>Zosterops japonica</u>	C	X	
Northern Cardinal	<u>Cardinalis cardinalis</u>	R	X	
Red-crested Cardinal	<u>Paroaria coronata</u>	U	X	
Red-vented Bulbul	<u>Pycnonotus cafer</u>	U	X	
House Sparrow	<u>Passer domesticus</u>	U	X	
House Finch	<u>Carpodacus mexicanus</u>	R	X	
Spotted Munia	<u>Lonchura punctulata</u>	U	X	X
Shama Thrush	<u>Copsychus malabaricus</u>	U	X	
Japanese Bush Warbler	<u>Cettia diphone</u>	R	X	

[1] Relative abundance = Number of times observed during survey or frequency on eight-minute counts.

A = Abundant (Greater than 50 on walking census, or average on eight-minute count greater than 10)
C = Common (Greater than 25 but less than 50 on walking census, or average on eight-minute count greater than 5 but less than 10)
U = Uncommon (Greater than 10 but less than 25 on walking census, or average on eight-minute count less than 5)
R = Rare (Less than 10 on walking census, may or may not have been on eight-minute count)

[2] Kawailoa - both at WWTP and disposal wells sites.

Source: Bruner (May 4, 1982).

Table IV-4. Exotic Bird Species Found at Mokule'ia and Kawailoa Centralized Wastewater Facilities Sites.

COMMON NAME	SCIENTIFIC NAME	Relative Abundance[1]	Location Sighted: Kawailoa[2]	Location Sighted: Mokule'ia
Cattle Egret	*Bubulcus ibis*	P	X	X
Barred Dove	*Geopelia striata*	A	X	X
Spotted Dove	*Streptopelia chinensis*	U	X	X
Ring-necked Pheasant	*Phasianus colchicus*	R		X
Common Myna	*Acridotheres tristis*	U	X	X
Japanese White-eye	*Zosterops japonica*	C	X	
Northern Cardinal	*Cardinalis cardinalis*	R	X	
Red-crested Cardinal	*Paroaria coronata*	U	X	
Red-vented Bulbul	*Pycnonotus cafer*	U	X	
House Sparrow	*Passer domesticus*	U	X	
House Finch	*Carpodacus mexicanus*	R	X	
Spotted Munia	*Lonchura punctulata*	U	X	X
Shama Thrush	*Copsychus malabaricus*	U	X	
Japanese Bush Warbler	*Cettia diphone*	R	X	

[1] Relative abundance = Number of times observed during survey or frequency on eight-minute counts.

A = Abundant (Greater than 50 on walking census, or average on eight-minute count greater than 10)

C = Common (Greater than 25 but less than 50 on walking census, or average on eight-minute count greater than 5 but less than 10)

U = Uncommon (Greater than 10 but less than 25 on walking census, or average on eight-minute count less than 5)

R = Rare (Less than 10 on walking census, may or may not have been on eight-minute count)

[2] Kawailoa - both at WWTP and disposal wells sites.

Source: Bruner (May 4, 1982).

Table IV-5. Exotic Bird Species Found in the Vicinity of Dillingham Airfield.

COMMON NAME	SCIENTIFIC NAME	RELATIVE[a] ABUNDANCE	HABITAT[b]
Erckel's Francolin	*Francolinus erckelii*	U	T
Spotted Dove	*Streptopelia chinensis*	C	E
Zebra Dove	*Geopelia striata*	A	E,G,T
Common Myna	*Acridotheres tristis*	C	E,G
Northern Mockingbird	*Mimus polyglottos*	U	T
Japanese White-eye	*Zosterops japonica*	A	T
Northern Cardinal	*Cardinalis cardinalis*	C	T
Red-crested Cardinal	*Paroaria coronata*	C	E,T,G
White-rumped Shama	*Copsychus malabaricus*	C	T
Japanese Bush-warbler	*Cettia diphone*	U	T
Red-vented Bulbul	*Pycnonotus cafer*	A	T,E
House Sparrow	*Passer domesticus*	U	G
House Finch	*Carpodacus mexicanus*	U	T,E
Nutmeg Mannikin	*Lonchura punctulata*	C	G,E
Common Waxbill	*Estrilda astrild*	C	G

[a]RELATIVE ABUNDANCE = Number of times observed during survey or frequency on eight-minute counts plus walking counts.

A = Abundant (ave. 10+) (number which follow is ave. of all survey days)
C = Common (ave. 5-10) "
U = Uncommon (ave. less than 5) "

[b]HABITAT = Area most frequented. Order of most preferred or utilized begins at left.

E = Edge of roads or other breaks in the vegetation
T = Thickets of dense vegetation
G = Open grassland

Source: Bruner (July 9, 1986).

Black-crowned Night Heron (Nycticorax nycticorax hoactli), and the Black-necked stilt (Himantopus mexicanus knudseni) were observed at the Dillingham Airfield site, and the Common Moorhen (Gallinola chloropus sandvicensis) and the Hawaiian Duck (Anas wyvilliana) may also be present.

No migratory birds were recorded at Mokule'ia or Kawailoa. Golden Plover (Pluvialis dominica), Ruddy Turnstone (Arenaria interpres), and Wandering Tattler (Heteroscelus incanus) do occasionally use the 'Uko'a Pond wetland which is adjacent to the Kawailoa site. Shorebird use of the Kawailoa and Mokule'ia sites is precluded by the dense vegetation. Migratory birds were also absent from site M-3 (Dillingham) at the time of the survey; however, migratory birds such as the Pacific Golden Plover (Pluvialis fulva), the Wandering Tattler (Heteroscelus incanus), the Ruddy Turnstone (Arenaria interpres), and the Sanderling (Calidris alba) may use the area.

Exotic birds were much more abundant than the resident indigenous and migratory birds discussed above. Species observed at each of the sites are listed in Tables IV-4 and IV-5. No unusual species were observed, and the relative abundance was typical for the time of year at which the counts were made.

Mongoose were abundant at all of the sites. Feral dog and cat tracks were also noted, and various species of rodents are undoubtedly present. The native Hoary Bat (Lasiurus cinereus) has reportedly been sighted on O'ahu, but no specimen records have been reported from the Waialua-Hale'iwa area, and the type of habitat present at the WWTP sites makes it extremely unlikely that any are present there.

4.7.2 Probable Impacts

Local bird populations are likely to be altered slightly by construction of a centralized wastewater treatment plant. Following the removal of the dense underbrush at the Kawailoa site and at the proposed disposal wells site, birds such as the Shama Thrush (*Copsychus malabaricus*) and Japanese Bush Warbler (*Cettia diphone*) will be less common; birds such as the Common Myna (*Acridotheres tristis*) and Cattle Egret (*Bubulcus ibis*) which prefer more open habitat will probably increase in number. At Mokule'ia and Dillingham Airfield, Ring-Necked Pheasant (*Phasianus colchicus*) will decrease when the area is cleared; Common Myna and Cattle Egret will also become more common at these sites. These changes will only occur on and immediately around the WWTP sites.

The mammal situation will also change slightly as development proceeds. As the groundcover is removed, the number of mongoose, cats, and dogs immediately around the facilities will decline somewhat.

4.7.3 'Uko'a Marsh

While none of the alternatives under consideration would have a significant direct effect on fauna, the alternative Kawailoa WWTP site is just northeast of 'Uko'a Marsh (see Figure III-10). The marsh is an important waterbird habitat used by three species of endangered waterbirds--the Hawaiian gallinule (*Gallinula chloropus sandvicensis*), the Hawaiian Coot (*Fulica americana alae*), and the Hawaiian Stilt (*Himantopus himantopus knudseni*).

The only potential link between the WWTP and the marsh is a hydrologic one and involves the possible movement of raw waste-water or treated effluent from the plant site into the marsh. So long as the pipelines and treatment plant remain in proper working order, such contamination would not occur. Only if leaks develop in the sewer mains or if there are accidental spills at the WWTP might there be an opportunity for nutrients or chemical and biological contaminants to move into the groundwater and, hence, into the marsh. Such a failure is extremely unlikely. Moreover, if one were to occur it would be quickly detected and repaired.

4.8 IMPACTS ON ARCHAEOLOGICAL AND HISTORICAL RESOURCES

The "No-Action" alternative requires no extensive construction or excavation that might adversely affect historical or archaeological sites. Consequently, the following analysis focuses on the centralized wastewater treatment system alternatives.

4.8.1 Survey Methodology and Findings

The Kawailoa and Mokule'ia wastewater treatment plant sites were studied by Hommon (May 1982); an archaeological reconnaissance survey of the Dillingham Airfield site was undertaken by Archaeological Consultants of Hawaii in 1986. The two reports are reproduced in Appendix A. Because they are located almost entirely in already developed areas, the collection and disposal system elements were not studied.

Previous archaeological studies and the records of the Historic Sites Section of the State Department of Land & Natural Resources were reviewed. Following this preliminary research, the sites were inspected on foot.

The survey indicated that sugar cultivation, excavation, and planting of grass and trees during the post-contact period (and especially during the twentieth century) has altered all of the remains in the Kawailoa and Mokule'ia areas. The only features encountered by Hommon were located at the Kawailoa WWTP site. The first grouping of features, which includes fences, concrete foundations, a shed, and a small wooden house, is the remains of an abandoned livestock farm. The age of this grouping was placed at no more than 20 to 30 years, and it was devoid of significant cultural material.

The other group of features at Kawailoa is located near the eastern corner of the site; it contains an unmortared stone wall and a rough stone pavement (see Figure IV-2). The feature, which was designated 50-80-04-3400, is constructed as a veneer along two sides of a bedrock outcrop. No surface artifacts were found, and little could be determined regarding its function or age. However, it was surmised that it may have been part of an enclosure and that the paved area may have been part of a structure. The presence of date palm and African tulip trees near the feature suggests it could date from the post-contact period.

The 1986 survey of the area around Dillingham Airfield found a dense concentration of sites beginning inland of the runway midpoint and running towards Ka'ena Point. Both Alternatives M-2 and M-3 are located makai of these sites.

4.8.2 Potential Impacts and Mitigation Measures

Alternatives IB and II involve development of a WWTP at the Kawailoa site. Archaeological remains are present at this site,

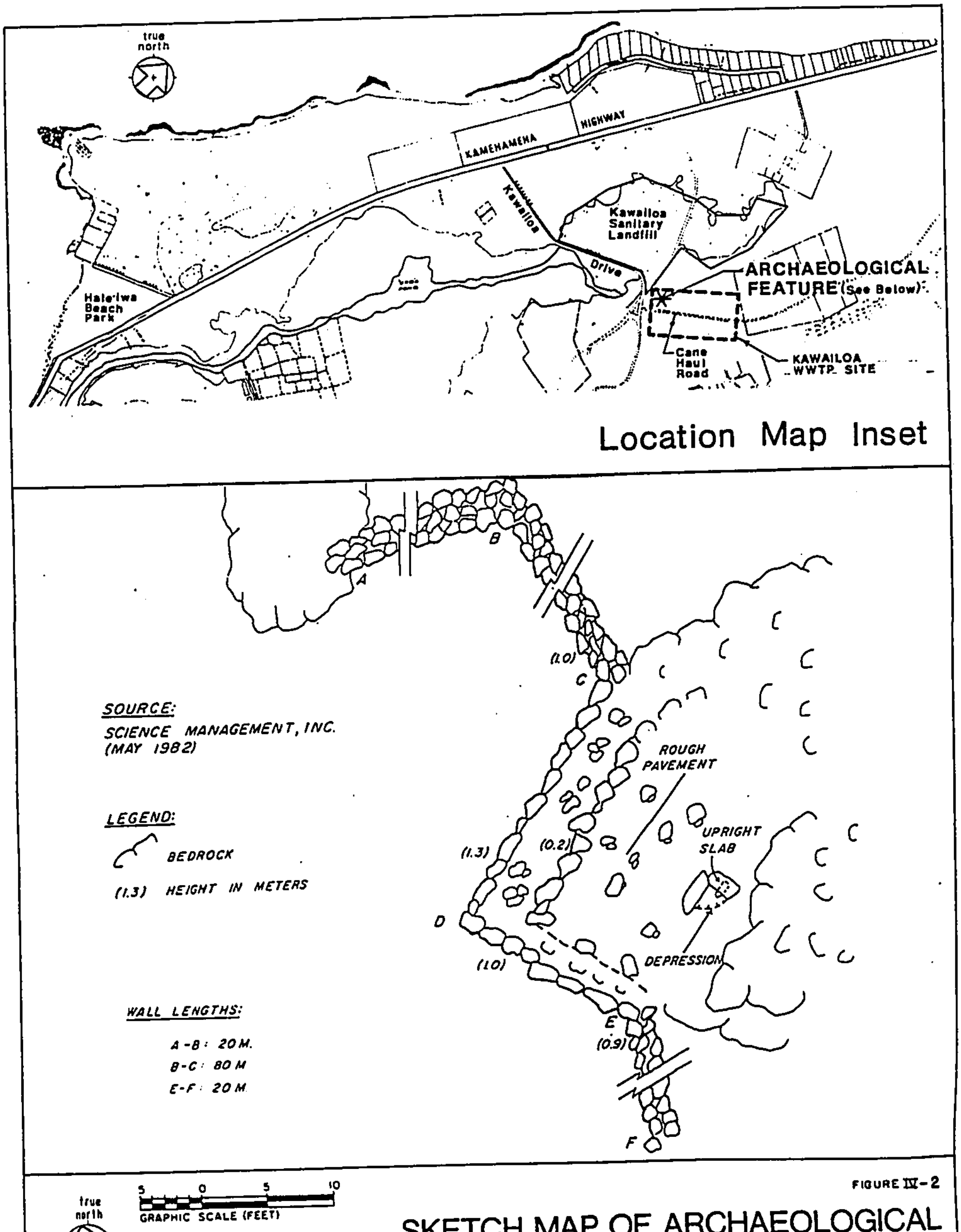


FIGURE IV-2

SKETCH MAP OF ARCHAEOLOGICAL FEATURE ON THE KAWAILOA WWTP SITE and the reconnaissance survey recommends that an intensive archaeological investigation of the feature, including detailed mapping and controlled test excavations be conducted to determine the feature's age, function, and significance. Once this data has been recovered, the feature could be removed without significant loss. It is also possible that excavation for the sewage pump station, the sewer mains, or the WWTP could uncover cultural remains, including human skeletal material, not now known. If this occurs, construction activities in the vicinity of the discovery will be halted until such time as the Historic Sites Section of the Department of Land and Natural Resources determines the appropriate course of action.

Construction of Alternatives IA or M-3 will not adversely affect <u>known</u> archaeological remains. However, as in the case of Alternatives IB and II, excavations for the WWTP, the sewage pump stations, or the collection system could uncover cultural materials, including human skeletal remains. If this occurs, the procedure outlined above will be followed. Should the WWTP site be relocated to site M-2, recommendations for additional archaeological testing, as outlined in the 1986 Kennedy report, should be implemented prior to commencing construction activities.

4.9 ENERGY USE

4.9.1 "No-Action" Alternative

Current energy use for sewage treatment and disposal in the Waialua-Hale'iwa area is estimated at 4,600 million British thermal units (MBtu) per year (see under "No-Action" heading, 1980 column, Table IV-6). Under the "No-Action" alternative this is expected to rise to about 7,200 MBtu/year by the year 2000. About 35 percent of this would be in the form of electrical energy needed to treat Waialua District's pumped septage at the Wahiawa WWTP, and to operate the Pa'ala'a Kai WWTP and various small private package treatment units serving apartment and commercial complexes in the area. The remainder consists of fossil fuel energy used by the trucks which pump cesspools and deliver the septage to the Wahiawa WWTP for treatment and disposal.

4.9.2 Centralized System

If a centralized wastewater treatment alternative is implemented, energy use in the year 2000 would amount to about 6,700 MBtu per year. In general, larger plants use less energy per gallon of wastewater treated than smaller ones; and energy use increases as the number of pump stations rises.

Table IV-6. Comparison of Energy Use by Major Types of Alternatives.

Alternative	Energy Use (MBtu/Year) Year 1980	Year 2000
"No Action":		
Urban Area[a]	4,400	6,800
Rural Area[b]	200	400
Total	4,600	7,200
Centralized System & Cesspools:		
Urban Area[c]	5,200	6,300
Rural Area[b]	200	400
Total	5,400	6,700
Centralized System & Individual Units:		
Urban Area[c]	5,200	6,300
Rural Area[d]	350	400
Total	5,850	6,700

[a]:Notes;

- In calendar year 1980, there were approximately 4,459 cesspool pumpings in the Urban Area. Each pumping required a round-trip by the pumper-truck averaging twenty-five (25) miles (from the Wahiawa base yard to the cesspool to the disposal site at the Wahiawa WWTP to the base yard). At an average of 5 miles per gallon this amounted to 5 gallons of gasoline per pumping. At 127,650 Btu/gallon, each collection required 638,000 Btu per cesspool pumping. In addition, the energy expended in treating the pumpings is estimated at 20,000 Btu per cesspool pumping for a total of 658,000 Btu per cesspool pumping. (This was based on an estimate of treatment energy use at 10 Btu per gallon of cesspool pumping treated and 2,000 gallons per cesspool pumping.) The total energy required for collection and treatment was 658,000 Btu per cesspool pumping or 2,934 MBtu/year, based on 4,459 cesspool pumpings per year in the urban area.

- Engineers for the Pa'ala'a Kai Wastewater Treatment Plant estimate that average monthly energy use is about 23,500 kilowatt hours. This is equivalent to 282,000 kilowatt hours per year. At 3,415 Btu/kilowatt, this is equivalent to about 963 MBtu/year.

- Per-person energy use by private facilities is estimated to be about 688,000 Btu/person, based on a 1,000-gallon cavitette for ten persons. At an estimated 700 persons that use this type of facility, the estimated energy use is 482 MBtu/year.

- In the year 2000, 7,244 cesspool pumpings are anticipated. Therefore, the total energy required for collection and treatment is expected to be 4,770 MBtu/year based on 658,000 Btu per cesspool pumping.

- Based on no significant change in Pa'ala'a Kai service area population and water use characteristics, as well as no increase in treatment plant energy usage related to wear and tear on equipment.

- It is estimated that 1,600 persons will use private facilities in the year 2000, at about 688,000 Btu per person. The total use would be 1,032 MBtu/year.

[b]:Notes;
- In calendar year 1980, there were approximately 288 cesspool pumpings in the rural areas. Each pumping required a round-trip by the pumper-truck averaging (25) miles (from the Wahiawa baseyard to the cesspool to the disposal site at the Wahiawa WWTP to the baseyard). At an average of 5 miles per gallon, the amounted to 5 gallons of gasoline per pumping. At 127,650 Btu/gallon, each collection required 638,000 Btu per cesspool pumping per year. In addition, the energy expended in treating the pumpings is estimated at 20,000 Btu per cesspool pumping per year, for a total of 658,000 Btu per cesspool pumping per year. (This was based on an estimate of treatment energy use at 10 Btu per gallon of cesspool pumping treated and 2,000 gallons per cesspool pumping.) The total energy required for collection and treatment was 190 MBtu/year based on 288 cesspools pumping in the rural area.

- In the year 2000, 562 cesspool pumpings are anticipated. Therefore, the total energy required for collection and treatment is expected to be 370 MBtu/year, based on 562 cesspool pumpings and 658,000 Btu per cesspool pumping.

[c]:Notes;
- This table is not intended to indicate the energy use of each centralized treatment option. Rather, it is supplied for comparison against the no-action alternative for the urban area.

- Alternative I, Option 1. The treatment and disposal system will require 4,078 MBtu/year (900,000 kwh/year). The collection system has four pump stations that draw 990,000 Btu per hour of operation (290 kwh/hour). Assuming that the pump stations run an average of three hours a day for 365 days a year (based on an average flow of 0.70 mgd), then the collection system will use 1,080 mBtu/year, for a total energy requirement of 5,160 MBtu/year.

- Alternative I, Option 1. The treatment system will require 4,078 MBtu/year (1,587,300 kwh/year). The collection system will draw 990,000 Btu per hour of operation. Assuming that the pump stations run an average of six hours a day for 365 days a year (based on an average flow of 1.4 mgd), the collection system will use 2,170 MBtu/year, for a total energy requirement of 6,250 MBtu/year.

[d]:Notes;

- Assumes that each two septic tank are pumped per trip which requires a round-trip by the pumper-truck averaging 25 miles (from the Wahiawa baseyard to the septic tank to the disposal site at the Wahiawa WWTP to the baseyard). At an average of five miles per gallon, this amounts to 2.5 gallons of gasoline per septic tank pumping. At 127,650 Btu/gallon, each collection requires 319,000 Btu per septic tank pumping. In addition, the energy expended it treating the pumpings is estimated at 10,000 Btu per septic tank, for a total of 329,000 Btu per septic tank pumping. (This was based on an estimate of treatment energy use at 10 Btu per gallon of septic tank pumping treated and 1,000 gallons per septic tank pumping.) The total energy required for collection and treatment would be 336 MBtu/year, based on 1,020 septic tank pumpings per year in the rural areas (twice a year per residence).

- Based on 1,226 septic tank pumpings per year in the rural areas (twice a year per residence) and 329,000 Btu per septic tank pumping, the total energy required would be 403 MBtu/year.

Source: Belt Collins & Associates.

The energy consumption results appear to favor the "No-Action" alternative. However, a closer scrutiny reveals that the "No-Action" alternative (particularly in the urban area) does not solve or relieve the environmental stresses placed on the ecology through the continued use of cesspools. Cesspools provide little, if any, pollution abatement or the removal of contaminants in wastewater. Therefore, the additional energy that must be expended for the operation of a centralized wastewater system is deemed to be justifiable and consistent with the water quality goals and objectives stated in the WQPO and "208 Plans" documents.

Hawaiian Electric Company was contacted in the course of this study to determine if their generating, transmission, and distribution facilities were capable of handling the demands of the various wastewater facilities alternatives. HECO replied (Muench, March 23 and 25, 1982) that their system had adequate capacity to provide the electric needs of any of the alternatives. However, HECO has no transmission facilities in the vicinity of the proposed WWTP. These facilities would have to be installed in conjunction with the commencement of construction activities.

4.10 TRAFFIC IMPACTS

4.10.1 "No-Action" Alternative

Under the "No-Action" Alternative, the area would continue to rely mainly on cesspools for sewage disposal. The number of pumping and chemical treatments would increase both due to a small increase in the number of cesspools and an increase in the cesspool failure rate as these units age. This would result in an increased number of trips by cesspool treatment or pumping trucks on the roads of the Waialua District. The number of pumpings and chemical treatments in the Waialua District in the year 2000 per work day would be about 30. Since each cesspool pumping or chemical treatment requires two trips (to the cesspool from Wahiawa, and back), this amounts to 60 one-way trips per work day on Waialua District's roads just to handle wastewater disposal.

4.10.2 Centralized System Alternatives

4.10.2.1 Traffic Impacts of Operation

If a centralized system is installed, virtually all cesspools in the urban area will be filled in. Only the rural fringe areas will continue to require cesspool pumping service, and this will involve only 10 to 15 one-way truck trips per week. A similar number of trips will be generated by trucks carrying sludge from the WWTP to a disposal site. Finally, vehicles carrying employees and other persons traveling to and from the facility (i.e. maintenance vehicles) will make about 150 trips per week. Average daily project-related traffic, then, will be about 25 one-way trips per day, or about half the volume projected for the "No-Action" alternative. This number is insignificant in comparison to existing traffic and will not substantially affect the service level on the area's roadways.

4.10.2.2 Traffic Impacts of Construction and Proposed Mitigation Measures

Construction of the WWTP and sewage pump stations (SPSs) will generate additional vehicular traffic over a two- to three-year period, but the changes will not be significant. A much more significant concern is the traffic disruption that could result from construction of the collection system beneath most roads in the urban area. In most cases it will be necessary to close one lane while the construction crews are laying the sewer mains. Flagmen will be used to control traffic, and short delays are inevitable.

The adverse effects of the activity will be minimized with small working segments, maintaining two lanes of flow during busy traffic hours, and insuring that trained flagmen are assigned to traffic control duties. It will also be possible to route the majority of the traffic onto alternate routes around construction areas. The fire department shall be notified in advance of all roadside construction activities that may impact their response routes.

4.11 VISUAL IMPACTS

4.11.1 "No-Action" Alternative

Almost all the existing wastewater treatment facilities in the Waialua-Hale'iwa area are underground, the only major exception being the Pa'ala'a Kai WWTP. Since the "No-Action" scenario involves virtually no new above-ground construction, it would have almost no visual impacts.

4.11.2 Centralized System Alternatives

4.11.2.1 Construction Period Impacts

Grubbing, grading, and building construction on the wastewater treatment plant site will result in a very disordered appearance for the two to three years that they are underway. Its proximity to Farrington Highway near Waialua may make Alternative IA the most sensitive in this regard. Alternatives M-2 and M-3 are set back further from the highway and are farther from residential development, making them much less visible. Alternative IB is visible only to the few people who travel between Hale'iwa and Kawailoa Camp. Means of reducing these impacts are discussed in Section 4.11.2.3, below.

Construction of sewage pump stations requires approximately 18 months. Their location close to roads gives them greater visibility than the WWTP, but this is more than offset by their smaller size (10,000 square feet versus 10 acres). In any event, construction work on them will not generate significant visual impacts.

4.11.2.2 Long-Term Impacts

Much of a sewage pump station's equipment is underground. Hence, all that is visible to the public is a rectangular concrete block building (about 20 feet by 30 feet) having a flat roof, a few ventilation openings with louvers, and a door. These pump station buildings will stand about ten feet above grade, except where they are located in a flood zone. In those instances the roof will be approximately ten feet above the 100-year flood elevation. As shown in Table IV-7, with a roof elevation approximately 18 feet above grade, sewage pump station number 4 will be the highest.

Unlike the pump stations, all the wastewater treatment plant sites under consideration are located away from main roads. Some of the facilities will be set into the ground, but the headworks building, gravity thickeners, anaerobic digesters, the laboratory/shop/administration building, odor control equipment, bioreactors, and the chlorine storage building may stand higher than 6 feet. Buildings will be constructed of

Table IV-7. Calculation of Height of Sewage Pump Stations.

SPS #[a]	Location	Ground Elev. (ft.)	Flood[b] Elev. (ft.)	Elev. of Adj. Road (ft.)	Height of Roof Line Above Road (ft.)
1A	Corner of Goodale Ave. and Wailua Beach Road	15	--	15	10
1B	Cozier Drive	11	--	11	10
2 (Site A)	Corner of Waialua Beach Road and Hale'iwa Road	7	11	10	11
2 (Site B)	Mauka side of Waialua Beach Road opposite Hale'iwa Road	3	13	10	13
3 (Site A)	Intersection of Goodale Ave. and Farrington Highway	20	--	20	10
3 (Site B)	Mauka side of Farrington Highway opposite Goodale Ave.	5-10	20	20	10
4	Makai of Hale'iwa Road near entrance to Kaiaka State Park	3	11	3	18
5	Corner of Kawailoa Drive & Kamehameha Highway	9	10	9	11
6A	West end of Dillingham Airfield along Farrington Highway	11	--	11	10
6B	Approximately 1800 feet west of Farrington Highway - Makai side	11	--	11	10

[a]SPS #6A & 6B would be required only for Alternatives M-2 and M-3.

[b]U.S. Department of Housing and Urban Development, Federal Insurance Administration (September 3, 1980). Flood Insurance Rate Maps, and City & County of Honolulu. Proposed Flood Map Revisions.

Source: Belt, Collins & Associates.

concrete or concrete block. All except the anaerobic digesters will have flat roofs; the latter may be covered with geodesic domes as required for maintaining anaerobic conditions.

4.11.2.3 Mitigation Measures

The City's design standards require that plans for sewage pump stations be prepared by a registered architect so that they are in harmony with surrounding development. They also state that the sites shall be suitably landscaped so that they blend with the surrounding environment and render a pleasing overall appearance. Automatic irrigation systems are required to facilitate landscape maintenance. Adhering to these design standards should insure that the pump stations are compatible with the area's existing development.

Mitigating measures (i.e., planting of trees and hedges) will be provided to minimize the visual impact of the WWTP(s). This matter will be assessed in more detail during the design phase of the project. Also, landscaping and/or structural provisions will be included (as necessary) to provide an aesthetically pleasing facility that is compatible with the surrounding area.

4.12 SOCIAL IMPACTS

None of the wastewater facilities alternatives under consideration would result in significant adverse social impacts. Each would accommodate only the very limited amount of additional growth that is called for in the North Shore Development Plan.

The centralized treatment plant alternatives will improve the quality of wastewater treatment in the area. This, in turn, will reduce the potential for water quality-related health problems. These will also drastically reduce the number of homes suffering the inconvenience of frequent cesspool failures (i.e., eliminating nuisance conditions such as odors and cesspool overflows, as well as the inconvenience of waiting for the cesspool truck).

4.13 ECONOMIC IMPACTS

The economic impacts of implementing the Waialua-Hale'iwa Wastewater Facilities Plan can be viewed from several perspectives: (1) the O'ahu economy in general, (2) the individual landowner in the collection area, and (3) the various levels of government -- Federal, State, and Local. These three viewpoints are discussed below; the centralized wastewater treatment system alternatives are discussed first, followed by the "No-Action" alternative.

4.13.1 Centralized System Alternatives

4.13.1.1 General Economic Impacts

This discussion of the impacts on the O'ahu economy of establishing a centralized wastewater treatment system for the Waialua-Hale'iwa area is presented in two parts: (1) the construction of the treatment plant and collection grid and (2) the operation and maintenance of the system. The analysis of impacts is based on an input-output (interindustry) model of the Hawai'i economy prepared by the State of Hawai'i Department of Planning and Economic Development (1982). Multipliers derived from the model are applied to the direct impacts to estimate the indirect and induced effects.

__Construction Period__. The direct economic activity generated by Alternative IA (i.e., by building the Mokule'ia WWTP and the five sewage pump stations, buying and laying the force mains and sewer lines, connecting the service laterals, backfilling the existing cesspools, etc.) is estimated at approximately $67 million (construction cost 1986 dollars). This figure is used to calculate the economic impacts described below.

Ratios of labor income to construction output and of construction employment to the dollar value of construction output were calculated from the 1985 __State of Hawaii Data Book__ (Hawai'i, State of, Department of Planning & Economic Development:pp. 334* & 528**). The labor income factor is 33% of construction output. Applying this factor to the $67 million construction cost figure suggests labor incomes directly generated by the project would be $22 million. The ratio of construction employment to million dollars of construction output was 12.7 to 1 in 1984. This implies approximately 850 person-years of construction labor would be generated by a $67 million project (spanning a three-year period). These estimates and those that follow refer to the entire project. They can be annualized once the length and scheduling of the job is known with more certainty.

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* Entry for Mining and Contract construction (1984 data): Average employment--15,788; total wages--$411 million.

** Construction put in place in 1980 - $1.24 billion.

Besides the direct employment and income efects noted above, output would be stimulated in several industries which supply inputs to the construction sector, such as ready-mix concerete, concrete products, lumber, trucking, wholesale trade, and professional services. This is called the indirect impact of the project. It can be estimated using the Type I income coefficient for "Other Construction". This multiplier is 0.46, meaning a direct and indirect income of 46 cents for every construction dollar or $30.8 million for a $67 million project. Subtrcting out the direct construction income, the indirect income effect is about $8.8 million. If an average annual wage of $18,000 is assumed for these associated industries, this would imply approximately 490 additional person-years of construction employment.

The spending and respending of the project-generated income on consumer goods also creates additional economic activity. This is called the induced effect and can be estimated using the Type II income coefficient (0.73 for "Other Construction"). The total direct, indirect and induced effects would be $48.9 million or an induced effect of about $18.1 million ($48.9 - $30.8 = $18.1). Assuming an annual average wage of $16,000, about 1,380 more jobs would be supported in the production, transportation, and marketing sectors.

The total direct, indirect, and induced effects total about $49 million in income and 2,720 person-years of employment. If construction takes place during a hypothetical three-year period, the total annual income generated should amount to about two-tenths of a percent of the State's labor income.

It should be pointed out as an aid to interpreting these estimates that if State and local government and individual funds are used in this project which would otherwise have been available for alternative investment, the results should not be viewed as expansionary. To the extent that it is paid for with otherwise unavailable Federal grants, it might be seen as an exogenous addition to the economy, but we might also assume that the effect is balanced off by Hawai'i taxes financing similar construction elsewhere.

<u>Operation and Maintenance</u>. The operation and maintenance (O&M) of a centralized wastewater treatment system would have a much smaller impact on the economy than its construction. The yearly O&M costs for the Mokule'ia WWTP is estimated at about $664,000; sewage pump station and sewer line annual O&M costs are expected to be about $106,000. Combining these gives a total of about $770,000 per year. Using the input-output model figures for the "Water and Sanitary Services" sector, a direct income effect of $277,000 is projected; this implies a direct labor effect of 14 to 16 jobs. Applying the Type II multiplier (0.72 for this sector) to the $770,000 industry output, a total income effect of $554,000 is estimated.

This estimate of annual O&M costs is roughly half the combined current annual cost of private treatment plant O&M plus cesspool pumping and treatment in the urban area. Considering the increased costs of maintaining the existing system as cesspool failures increase over the next twenty years. Costs and manpower needs under the "No-Action" alternative are expected to double by 2000 (see Section 13.2).

4.13.1.2 Economic Impacts on Individuals

From the point of view of the majority of individual property owners in the urban core, upgrading the system may make wastewater disposal more costly than it is at present although for some, the cost would be reduced. Present wastewater disposal costs are quite low for a large share of the households in the area. Studies made by the Department of Health showed that almost 40 percent of the cesspools in the Waialua-Hale'iwa District have never had to be pumped. Thirty percent had been pumped one or more times in the last 10 years and, of these, about half had to be pumped four or more times per year. Individuals have a choice of paying the City and County monthly Wastewater System User Fee of $10.25 or a subsidized charge of $24.60 per pumping if the service is provided by the City and County (1986). Private contractors usually charge more than twice this amount, but they often respond to a request for service faster than the C&C trucks.

Replacement of a cesspool is a major expense compared to other costs of maintaining a home, but it is an expense rarely incurred. A cesspool in good soil can function almost indefinitely, although it may need pumping and chemical treatment every 15 to 20 years. Cesspools located on poor soils exhibit a different situation. Owners of these cesspools are usually unwilling to pay for a new cesspool which may clog within a few years. Because it is much less costly, they are often willing to put up with the inconvenience of frequent pumpings, especially if they choose the option of paying the City and County's Wastewater System User Fee (at present \$10.25/month). Thus, current expenses for wastewater disposal are low for most residents.

If a centralized treatment facility is built, affected property owners will be faced with three types of charges: an improvement district assessment, the on-site costs for connecting the dwelling or business to the collection system and for backfilling any existing cesspools, and a monthly wastewater system user charge. For residential- and apartment-zoned land the assessment is made on the basis of the number of square feet of "specially benefitted" land in the parcel. Typically, this will be 5,000 square feet per house on R-5 zoned parcels like those found in most of the residential neighborhoods of the Waialua District. Since the assessment is \$0.16 per square foot (s.f.), R-5 residential lot owners could expect to pay \$800. If a lot's square footage is such that it can legally be subdivided, the assessment would be based on the possible number of subdivided parcels. Apartment parcels pay a higher assessment rate ($0.24 per s.f.), but the charge can be spread over a greater number of units; hence, the per-unit cost is normally less. Homeowners in the Pa'ala'a Kai subdivision would be exempt from this assessment, since their collection system is in place and its expense included in the overall home cost. Commercial and industrial users would be assessed based on a $0.20 per s.f. rate.

On-site costs will also be the responsibility of the landowner. The cost of making the house connection will be about $500 to $4,000 for a residential or apartment parcel (depending on the size of the lot) if the work is done by a contractor; backfilling each cesspool will cost about $500.00.

The wastewater system user fee that the single-family unit would be charged is currently $10.25 per month, while apartment units now pay $7.20 per month. Non-residential users pay $0.95 per 1,000 gallons of metered wastewater discharge. If there is no meter on the wastewater stream, the charge is based on metered water use ($0.76 per 1,000 gallons). A small commercial establishment which discharges 400 gallons per day would incur a charge of about $11.30 per month. The minimum monthly charge is the same as the single-family residential unit charge. Wastewater system user charges are based on the average per user cost of operating and maintaining all municipal wastewater facilities on O'ahu.

This combination of assessments, on-site costs, and monthly charges is expected to raise wastewater disposal costs for the majority of residents in the sewered area. Those residents whose cesspools now require frequent pumping and who use private pumping services may have their costs lowered. This is because they are already paying the monthly Wastewater System User charge for municipal cesspool pumping services (or more if they utilize private pumpers). The benefits to the residents of the district would consist of both improved reliability and the public health advantages of discontinuing use of failing cesspools. Owners of failing cesspools will be relieved of the inconvenience of pumping. In addition, they and their neighbors would no longer be subject to odors emanating from failed cesspools. Some properties may appreciate in value with the improved service a centralized system would provide. The impact of the project on the appreciation of properties with currently satisfactory cesspools is uncertain. A very limited number of currently undeveloped residential parcels have all the land use designations needed for residential use, but are situated in areas where Board of Water Supply policy prevents on-site disposal of effluent. These would be available for development if served by the system, and, thus, their owners would benefit financially from construction of a centralized system.

4.13.1.3 Economic Impacts on Government

All three levels of government will be involved in funding the public portion of the project: the Federal Environmental Protection Agency, the State Department of Health, and finally the City and County of Honolulu Department of Public Works. As an example of the possible magnitude of costs, the previous $67 million construction cost estimate will be used.

Current estimates suggest that about 9.5 percent of the construction cost of the project ($6.3 million) will be the obligation of private landowners (i.e., improvement district assessment, installation of house connections, and backfilling cesspools). It is anticipated that the State and Federal governments will participate with 18 percent and 55 percent, respectively, of "eligible" conventional system, and 10 percent and 75 percent, respectively, of "eligible" I/A construction costs (total of $56.8 million). The portion left to be paid by the City and County (excluding land acquisition costs) would be $18.3 million. This figure will increase to the extent that any other costs are judged ineligible. It is also expected that land acquisition will be funded by the City and County. Land costs would be approximately $462,000.

Improvement district assessments will cover a portion of the City and County non-land costs. Assessments for residential properties will amount to about $2.9 million (3600 lots at $800 per lot). Apartment land should return about $0.2 million and commercial zoned property should contribute another $.04 million. The City and County could also receive a very small increase in tax revenues as a result of the development of the few parcels which were previously restricted.

4.13.2 "No-Action" Alternative

The "No-Action" alternative involves very little construction activity. What work is involved is spread over the 20-year planning period rather than concentrated in the early years as is the case with the centralized WWTP alternatives. Because of this, a simple comparison of its required capital expenditures with those of the other alternatives is not meaningful.

Continued operation and maintenance of the existing system will become increasingly costly as the cesspools age and require more frequent pumping and, in some instances, replacement. Employment generated by ongoing maintenance activities could be expected to rise from the present level of 18 workers to about 30 workers by the year 2000. This can be compared to the 13 workers who could handle the District's wastewater if a centralized facility were constructed.

The direct economic impacts of the "No-Action" alternative on the majority of individual residents would be less than those of any of the centralized system alternatives. The only exceptions are those homeowners who would have to replace their cesspools under the "No-Action" alternative. The cost of this (about $3,500) is higher than the combination of assessment, on-site costs, and monthly charges for the typical residential lot.

4.14 IMPACTS ON WATER SYSTEM

4.14.1 "No-Action" Alternative

The present General Plan and North Shore development Plan indicate only a very small amount of growth for this area. The "No-Action" alternative will therefore result in only a small increase in water demand over the coming years. It is anticipated that no additional improvements to the existing water system will be required.

4.14.2 Centralized System Alternative

The proposed centralized wastewater management system is intended to basically provide service to existing homes in the urban portion of the study area (with the inclusion of only a limited amount of additional growth - as indicated on present official planning documents). No additional improvements to the existing water system within this aea is therefore anticipated as a direct result of the construction of this system.

It is noted however that at the present time, the Board of Water Supply has no water mains in the vicinity of the proposed Mokule'ia WWTP site. The construction of a new water main, installation of fire hydrants for fire protection, and the payment of appropriate water system facilities charges will be required for construction of the WWTP to proceed.

It is anticipated that the new water main will be connected into the existing eight-inch water main at the intersection of Olohio Street and Farrington Highway. The main would then be routed along the edge of Farrington Highway and up Mount Kaala Road to the WWTP site.

V. ADVERSE IMPACTS OF THE PROPOSED PROJECT WHICH CANNOT BE AVOIDED

CHAPTER V

ADVERSE IMPACTS OF THE PROPOSED PROJECT WHICH CANNOT BE AVOIDED

5.1 CONSTRUCTION IMPACTS

5.1.1 "No-Action" Alternative - Rural Area

The "No-Action" alternative involves very little construction. Individual property owners would construct or replace some individual treatment units, but the number of locations involved is small, the sites are dispersed over a wide area, the work required is extremely limited, and the construction would be spread over a long period of time.

5.1.2 Centralized System Alternatives - Urban Area

Centralized wastewater collection, treatment, and disposal facilities will require much more extensive construction activities and a correspondingly greater possibility of construction impacts. Noise, dust and other air pollutants, as well as temporary traffic disruptions, will cause inconvenience to nearby residents and to motorists. Because the collection system is the largest component of these alternatives, involves extensive excavation, and would traverse most of the area's main roads, it has the potential for creating the most serious effects. These would inconvenience residents, but the duration at any one location would be relatively short. The potentially degraded condition of the roads after trenching for the collection lines would affect residents and motorists for a longer period, since road resurfacing would only be done incrementally.

The proposed wastewater treatment plant site is relatively isolated from developed areas. Hence, construction activities are not expected to affect residents significantly. No known rare or endangered species is present at the site. Construction of the WWTP would displace approximately 10 acres of Waialua Sugar Company cane land. Excavation for the collection pipes could uncover cultural material and/or human remains. If this occurs, appropriate action will be taken to insure their protection and/or salvage.

5.2 OPERATIONAL IMPACTS

5.2.1 "No-Action" Alternative - Rural Area

Continued reliance on existing wastewater treatment facilities will result in a number of potentially adverse impacts. First, most human wastes will continue to be disposed of via cesspools; consequently, contamination of groundwater, streams, and coastal waters will remain a possibility. Homes in areas with soils poorly suited for cesspools will continue to be plagued by cesspool failures. This is not only inconvenient but also the cause of localized odors and a source of potential health problems. Due to the increasing age of the cesspools, it is anticipated that the number of cesspools requiring pumping each year will rise. The resulting increase in pumping costs will have to be paid not only by individual property owners, but also by the City. This is because residents whose cesspools are pumped by the City are charged only a fraction of the actual costs; the remainder is absorbed (i.e., subsidized) by the City's sewer charge revenues.

5.2.2 Centralized System Alternatives - Urban Area

5.2.2.1 Physiographic and Geologic Impacts

Construction of a centralized wastewater treatment system will cause no significant effects on physiographic or geologic features or resources.

5.2.2.2 Hydrologic Impacts

There will be little change in the volume of storm runoff. The WWTP will lie outside flood hazard areas. Pump stations in areas susceptible to flooding will be floodproofed. The collection system will be designed to minimize infiltration, and the WWTP will be designed to accommodate whatever water does infiltrate without disrupting operations. The effluent disposal system also will be designed to accommodate peak flow conditions.

5.2.2.3 Impacts on Soils and Agricultural Productivity

Because of the relatively level terrain and the nature of the facilities themselves, no long-term effect on soil erosion is expected. However, construction of the proposed WWTP would preclude agricultural operations from approximately 10 acres of "prime" agricultural land (on which sugarcane is now cultivated). The loss of this land will not reduce the viability of any existing agricultural operation.

5.2.2.4 Air Quality Impacts

The primary air quality concern with respect to the centralized wastewater treatment alternatives is the possibility of odors. So long as the system is operating at optimal efficiency, these should be well controlled. However, the long transit times that are involved in bringing raw wastewater from the extremes of the system to the treatment facilities can provide an opportunity for anaerobic conditions to develop. This, in turn, can result in the generation of malodors, particularly hydrogen sulfide. Odors will be controlled by using appropriate odor control technology as are found necessary. The concentration of airborne microorganisms and other viable particles downwind of the WWTP sites may increase over their present levels, but studies to date indicate that this will not increase the incidence of disease among WWTP workers or nearby residents.

5.2.2.5 Noise Impacts

Due to the relative isolation of the proposed WWTP from existing development, no adverse impacts from overall operating noise levels is anticipated. However, individual pieces of equipment could produce unacceptably high noise levels in certain octave bands if not controlled. Present plans call for special noise reduction measures to prevent this. These measures include directing building openings away from residential areas and using intake silencers and acoustic mufflers.

Sewage pump stations are situated closer to noise-sensitive land uses than are the WWTP sites. Moreover, interior noise levels in them can be moderately high. Proper design of the SPS buildings and acoustical treatment of ventilation openings can prevent significant adverse impacts.

5.2.2.6 Impacts on Vegetation

No known endangered plant species have been located at the proposed WWTP site. Development of this site would have no significant adverse effect on vegetation communities.

5.2.2.7 Impacts on Fauna

None of the areas that might be directly affected by the construction of a centralized wastewater treatment system are habitats for rare or endangered species. The proposed changes will not significantly affect the region's fauna. Species which thrive in dense cover may decrease slightly and those which prefer more open habitat might increase as a result of facility construction.

5.2.2.8 Impacts on Archaeological and Historic Resources

No known archaeological or historical sites are located on the proposed WWTP site. Also, since the proposed collection system sewer lines will be laid along the roads in the urban area, this proposed action would not adversely impact any known archaeological sites. However, should construction activities unearth any archaeological features, construction would be halted, and the proper State authorities would be contacted and appropriate mitigative measures taken.

5.2.2.9 Energy Use

Evaluation of projected energy useage indicates that servicing of the existing population with a centralized wastewater system would require approximately 800 MBtu more than the existing cesspool/indivisual wastewater treatment practices.

However, in the year 2000, it is estimated that use of the proposed centralized system alternative will result in an energy savings of approximately 500 mBTU more energy per year than the "No-Action" alternative (for the urban area).

5.2.2.10 Traffic Impacts

There will be a significant disruption to vehicular circulation patterns during construction of the collection system. Roads will be torn up and delays experienced. However, once the system is in operation the overall volume of truck traffic in the region will decrease slightly. A very small increase in vehicular traffic will occur on the highway segments immediately adjacent to the WWTP site, but this would not affect service levels significantly.

5.2.2.11 Visual Impacts

The sewage pump stations will be visible from adjoining roadways and/or parcels. However, none will block important views or alter the basic visual character of the area. The WWTP will be located away from existing development, and landscaping will be used as necessary to screen it.

5.2.2.12 Social Impacts

No significant adverse social impacts are expected.

5.2.2.13 Economic Impacts

Individual property owners within the area serviced by a centralized wastewater treatment system will be required to connect their units to the collection system; they will also have to pay a one-time improvement district assessment. All properties connected to the system will be charged a wastewater system user fee (currently about $10.25 per month for a single-family residence). This may increase costs to owners whose cesspools are already working satisfactorily and who do not currently pay this user fee. The monthly costs to owners who already pay the wastewater system user fee in return for City cesspool pumping service will remain unchanged, but the quality of the service provided will be improved. Owners who now pay for frequent private cesspool pumping services or for the operation and maintenance of a private wastewater treatment plant will pay less if a municipal wastewater system is constructed.

Total capital cost for the centralized system is about $85.6 million. It is estimated that individual landowners will pay about $6.3 million of the cost for their on-site work. Taking the remaining $79.3 million (of which $69.2 million is grant eligible), the Federal government is anticipated to pay $38.8 million, the State about $12.2 million, and the remainder will be the responsibility of the City, including the land acquisition costs. The Federal Construction Grants Program is expected to end grant allocations in 1990. Therefore, the breakdown on cost responsibility, mentioned above, reflects the current situation where Federal construction grants monies are available.

VI. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITIY

CHAPTER VI

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

6.1 CENTRALIZED ALTERNATIVE - URBAN AREA

The construction phase for the proposed centralized wastewater treatment system would involve activities which generate noise and air pollutants, disrupt vehicular traffic in limited areas, and require substantial amounts of public money. Some of these actions have the ability to cause significant short-term declines in environmental quality.

On the positive side, the establishment of a municipal wastewater treatment system is likely to result in improved water quality. This improvement would endure so long as the facilities remain in operation. It would eliminate a potential health threat without significantly narrowing the range of possible future actions.

6.2 "NO-ACTION" ALTERNATIVE - RURAL AREA

Few short-term losses would result from this alternative. Over the long term, additional residents would face the costs, odors, and inconveniences of failing cesspools. It is noted, however, that this alternative may pose a long-term risk to health as increasing numbers of cesspools fail and overflow.

CHAPTER VII

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

7.1 CENTRALIZED ALTERNATIVE - URBAN AREA

Implementation of the proposed centralized treatment system alternative will involve the commitment of human and natural resources. The most obvious are the land that will be required for the facilities, the raw materials (concrete, metals, aggregate, etc.) used in the construction, and the labor. But other resource commitments are also involved.

The land commitment consists of about ten acres that are needed for the wastewater treatment plant. Easements would be required for the collection system and land portion of the ocean outfall, however these lines are buried and situated in areas where their creation would not preclude other likely uses. It is also noted that the WWTP site is on prime agricultural land.

The collection system would contain about 25 miles of pipe of various sizes. The larger sewer mains would be made locally of reinforced concrete pipe; the smaller ones would be imported vitrified clay or plastic pipes. Substantial amounts of aggregate would be required, both for making concrete and for select fill in the collection system trenches.

The project would involve a substantial construction work force over a multi-year period. Once completed, operation and maintenance would occupy more than ten workers on a full-time basis.

The energy requirements of the centralized system plus the individual treatment units needed to serve the rural areas are estimated to be on the order of 6,300 million British thermal units (Btu) per year. Most of this would be in the form of electricity obtained from the Hawaiian Electric Company.

The decision to implement the centralized alternative implies a willingness on the part of the public to finance the initial construction cost and the cost of operating and maintaining the facility. This, in turn, means that taxes and user charges will be needed.

7.2 "NO-ACTION" ALTERNATIVE - RURAL AREA

In general, the "No-Action" alternative involves relatively little in the way of construction materials. Most of the energy required is in the form of gasoline and/or diesel fuel consumed by trucks transporting cesspool pumpings to the WWTP. No additional land would need to be acquired, but private landowners would need to keep areas overlying underground units free of structures.

If present policies are continued, pumping of these cesspools would involve a substantial subsidy in favor of the owners of cesspools requiring pumping. Private landowners would have to continue to maintain their own units.

VIII. WATER QUALITY GOALS AND OBJECTIVES

CHAPTER VIII

WATER QUALITY GOALS AND OBJECTIVES

All human settlements generate wastewater that contains potentially harmful pollutants. The disposal problem is greatest in areas where industry contributes toxic chemicals, heavy metals, or large amounts of organic waste. But all wastewater, even from largely residential areas such as Waialua-Hale'iwa, have the potential to contaminate groundwater, streams, or coastal waters. This can cause eutrophication, produce undesirable changes in aquatic communities, or even lead to outbreaks of waterborne diseases. Some of the diseases are quite minor and cause little more than skin irritations. Others, such as cholera, typhoid, hepatitis, and numerous parasite-borne diseases, can be life-threatening.

In recent years, modern sanitation methods and the controls placed on wastewater disposal by the U.S. Environmental Protection Agency, the State Department of Health, and other government agencies have resulted in improved water quality and have prevented any large-scale incidence of such diseases in Hawai'i. However, as noted in the <u>Water Quality Management Plan (WQMP) for the City and County of Honolulu</u> (December 1980), the growing population of unsewered coastal communities such as Waialua and Hale'iwa increases the possibility that wastewater-related deterioration in water quality and public health problems could arise. It is for this reason that the WQMP recommended (on page 10-4) that: "Dense cesspool communities with extensive cesspool failures, such as Ewa Beach, Kahalu'u, Waialua [emphasis added], Waimanalo, and Waianae, should be given high priority for sewer construction." This statement, together with the policies expressed in Chapters 342, and 344, Hawai'i Pevised Statutes, the State Plan, the O'ahu General Plan, and the State Public Health Regulations indicate a strong desire to maintain the highest level of water quality practical. Implementation of the actions under consideration (i.e., any of the alternatives discussed in this report except "No-Action") would help in the achievement of this objective. This benefit is believed to outweigh any adverse impacts that they might entail.

IX. LIST OF NECESSARY APPROVALS AND UNRESOLVED ISSUES

CORRECTION

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

CHAPTER VIII

WATER QUALITY GOALS AND OBJECTIVES

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IX. LIST OF NECESSARY APPROVALS AND UNRESOLVED ISSUES

CHAPTER IX

LIST OF NECESSARY APPROVALS AND UNRESOLVED ISSUES

9.1 LIST OF NECESSARY APPROVALS

The following is a general list of approvals needed to implement one or more of the wastewater treatment alternatives under consideration. None of the permits listed have been applied for yet. Permit applications will be prepared only at such time as an alternative has been selected and a decision made to proceed with the project. Further engineering and environmental studies will be undertaken in the process of finalizing a design and preparing construction drawings.

Approving Agency or Body	Permit/Approval Needed
I. CITY AND COUNTY	
Dept. of Land Utilization	Special Management Area Use Permit
Dept. of Land Utilization	National Flood Insurance Program Conformance
Dept. of Land Utilization	Shoreline Setback Variance
Dept. of Public Works	Grading Permit
Dept. of Public Works	Drainage Plan Approval
Board of Water Supply	Water Connection Approval
Board of Water Supply	Fire Hydrant Installation Plan Approval
Building Department	Building Permit
Dept. of General Planning	Development Plan Public Facilities Map Designation

Approving Agency or Body	Permit/Approval Needed
II. STATE	
Department of Health	Community Noise Permit
Department of Health	Conditional Use Permit for Construction Activities
Department of Health	National Pollutant Discharge Elimination System
Department of Health	Section 401 Water Quality Certification (pertains to filling activities)
Department of Health	Underground Injection Control Permit
Dept. of Land & Natural Resources	Historic Sites Review
Dept. of Land & Natural Resources	Conservation District Use Permit
Dept. of Land & Natural Resources	Leasing
Dept. of Land & Natural Resources	Drilling Wells Permit
Dept. of Transportation	Permit to Perform Work Within State Highways
Dept. of Transportation (Harbors Division)	Permit for Work in Shore Waters of the State of Hawaii
Dept. of Business and Economic Development	Hawaii Coastal Zone Management Program, Consistency Determination
State Surveyor, Land Court	Approval for Subdivision of Land
III. FEDERAL	
United States Environmental Protection Agency	Wastewater Treatment Facility Construction Grant
United States Corps of Engineers	Section 10 Permit (pertains to dredging activities)
United States Corps of Engineers	Section 404 Permit (pertains to filling activities)

Approving Agency or Body	Permit/Approval Needed
IV. Hawaiian Electric Company	Electrical Connection Approval
V. Hawaiian Telephone Company	Telephone Connection Approval

9.2 UNRESOLVED ISSUES

At this time, the following items remain unresolved: 1) Ocean outfall - specific outfall alignment, discharge depth, and diffuser characteristics; and 2) Secondary treatment units - final selection.

The outfall alignment and discharge depth presented in this report were based on a 1967 oceanographic report prepared by the R.M. Towill Corporation. Specific/final alignment and other outfall characteristics would be determined in the design phase of the project. Additional detailed studies must be made to ensure proper design.

The proposed wastewater treatment plant contains an innovative and alternative (I/A) technology as the secondary biological wastewater treatment process. The wastewater treatment flow scheme was developed around this I/A technology. Although performance data gathered thus far has shown favorable treatment results, information on this I/A process is still rather limited. this is due to the recent introduction and limited use of this process. Therefore, the wastewater treatment processes may change as additional information is obtained. If changes in the treatment process are made, the wastewater treatment facility will still be required to provide a secondary level of treatment - thus, not changing the environmental impacts of the proposed project.

Finally, the question still remains as to whether or not the project will receive adequate financial support for construction of the facilities. When financial support has been obtained a definitive construction schedule will be established. The schedule, presented in Section 1.3, depicts a tentative implementation time frame.

X. ORGANIZATIONS AND PERSONS CONSULTED AND THOSE WHO PARTICIPATED IN THE PREPARATION OF THIS EIS

CHAPTER X

ORGANIZATIONS AND PERSONS CONSULTED AND THOSE WHO PARTICIPATED IN THE PREPARATION OF THIS EIS

10.1 CONSULTED PARTIES

The notice of availability of the EIS Preparation Notice (EISPN) for the Waialua-Hale'iwa Wastewater Facilities Plan was published in the EQC Bulletin on February 23, 1982. Subsequently, the notice for the Draft EIS was published in the EQC Bulletin on June 23, 1987. The agencies and organizations below were sent copies of the EISPN and Draft EIS, and asked to comment on the project. Everyone who we believed might have an interest in the project or who requested consulted party status was included.

Federal Agencies

U.S. Department of Agriculture

U.S. Department of Commerce, National Marine Fisheries Service

U.S. Department of Defense

- Air Force
- Army
- Navy
- Coast Guard

U.S. Department of Energy

U.S. Department of Health and Human Services

U.S. Department of Housing and Urban Development

U.S. Department of the Interior

- Fish and Wildlife Service
- Geological Survey, Water Resources Division

U.S. Department of Transportation

- Federal Aviation Administration
- Federal Highway Administration

U.S. Environmental Protection Agency

State Agencies

Department of Accounting and General Services

Department of Agriculture

Department of Budget and Finance

Department of Defense

Department of Education

Department of Hawaiian Home Lands

Department of Health

Department of Land and Natural Resources

- Division of Fish and Game
- Division of Forestry
- Division of State Parks, Outdoor Recreation and Historic Sites

Department of Planning and Economic Development

Department of Social Services and Housing

Department of Transportation

Office of Environmental Quality Control

University of Hawaii

Environmental Center

Marine Programs*

Water Resources Research Center

City and County Agencies

Board of Water Supply

Building Department

Department of the Budget

Department of General Planning

Department of Housing and Community Development

Department of Land Utilization

Department of Parks and Recreation

Department of Transportation Services

Fire Department

Oahu Civil Defense Agency

Police Department

Community Associations

Hale'iwa Community Association

North Shore Neighborhood Board

Waialua Community Association

Public Interest Groups

American Lung Association

Common Cause/Hawaii

League of Women Voters

Life of the Land

Oahu Development Conference

Oahu Metropolitan Planning Organization

Outdoor Circle

Sierra Club

Public Utilities

Hawaiian Electric Company

Hawaiian Telephone Company

PRI - Gasco, Inc.

Others

Councilman Toraki Matsumoto

Hale'iwa Surf Owners' Association

Hanahoa Computers

Mokule'ia Land Company

North Shore Community Review

Office of Hawaiian Affairs

Waialua Sugar Company

10.2 ORGANIZATIONS AND INDIVIDUALS WHO ASSISTED IN THE PREPARATION OF THIS EIS

The Environmental Impact Statement was prepared for the Division of Wastewater Management, Department of Public Works, City & County of Honolulu by Belt Collins & Associates. The following individuals were involved:

Belt Collins & Associates

Perry J. White - Project Manager
Ann K. Yoklavich - Contributor, Editor, Production Coordinator
Cary K. Kondo, Leland Y.S. Lee, Gary Tasato, Eric Takamura, Audrey Tsuji - Sanitary Engineers
Gary Yoshimura, Rodney Shiroma - Draftsmen
Nancy E. Brown, Ed Beveridge - Copy Editors

Sub-consultants/Sub-contractors

Phillip Bruner - Wildlife Survey
Darby-Ebisu & Associates, Inc. - Acoustical Consultants
EARTHWATCH - Vegetation Survey
Al Lyman - Economic Consultant
James Morrow - Air Quality Consultant
Science Management, Inc. - Archaeological Survey

XI. COMMENTS AND RESPONSES DURING THE CONSULTATION PERIOD

CHAPTER XI

COMMENTS AND RESPONSES DURING THE CONSULTATION PEPIOD

Letters of notification were sent to the parties listed in the previous chapter. Comments were subsequently received from the following agencies and interested parties:

Party Commenting	Comments Received	
	EISPN	Draft EIS
State Agencies		
Office of Environmental Quality Control	X	X
Department of Accounting and General Services	X	O
Department of Agriculture	X	X
Department of Budget and Finance	X	O
Department of Business and Economic Development	O	X
Department of Defense	X	X
Department of Education	X	O
Department of Health	X	X
Department of Land and Natural Resources (DLNR)	X	X
Department of Planning and Economic Development	X	O
Department of Social Service & Housing	X	X
Department of Transportation	X	X
University of Hawaii		
Environmental Center	X	X
Water Resources Research Center	X	O

Party Commenting	Comments Received EISPN	Draft EIS
Federal Agencies		
U.S. Department of Agriculture, Soil Conservation Service	O	X
U.S. Army Corps of Engineers	X	X
U.S. Department of Commerce, National Marine Fisheries Service	X	O
U.S. Department of Defense		
Airforce, 15th Air Base Wing/DEE	X	X
Army	X	O
Navy	X	X
U.S. Department of Housing and Urban Development	X	X
U.S. Department of the Interior		
Fish and Wildlife Service	X	X
U.S. Geological Survey, Water Resources Division	X	O
U.S. Department of Transportation, Federal Highway Administration	X	X
Honolulu City and County Agencies		
Building Department	O	X
Board of Water Supply	X	X
General Planning	X	X
Housing and Community Development	X	X
Land Utilization	X	X
Parks and Recreation	X	X
Transportation Services	X	X
Honolulu Fire Department	X	X
Honolulu Police Department	X	X
Oahu Civil Defense Agency	X	X

Party Commenting	Comments Received: EISPN	Comments Received: Draft EIS
Others		
Hanahou Computers	X	O
Hawaiian Electric Company	X	X
Honolulu Gas Company	X	O
Kenneth A. Martyn, Attorney	O	X
Mokuleia Management, Inc.	O	X
North Shore Community Board No. 27	X	O
Waialua Community Association	X	X

Note: "O" designates that no comments were received from these parties.

"X" designates that comments were received from these parties.

The following sheets are copies of the comments received, with the corresponding response/acknowledgement letters sent out by the City and County of Honolulu.

EISPN COMMENTS & RESPONSES

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
Western Pacific Program Office
P. O. Box 3830
Honolulu, Hawaii 96812

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TO ______

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March 15, 1982 F/SWR1:JJN

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DIV. OF WASTEWATER MANAGEMENT

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:

Subject: EIS Preparation Notice, Waialua-Haleiwa Wastewater Facility Plan, Waialua-Haleiwa, Oahu, Hawaii.

The National Marine Fisheries Service (NMFS) has reviewed the subject EIS preparation notice for the Waialua-Haleiwa Wastewater Facility Plan and offers the following comments for your consideration.

The proposed disposal of treated effluent via injection wells, seepage pits or in sugarcane irrigation should have no significant impacts on those marine and estuarine resources under NMFS jurisdiction. In fact, implementation of the Plan should correct the existing problems in the Waialua-Haleiwa area concerning seepage from defective cesspools in proximity to streams and coastal waters of the area.

We agree with the subject report's recommendation to prepare an EIS to cover the various alternatives that are under consideration. This is particularly important in light of potential impacts on 'Uko'a Marsh, an area identified as important habitat for three species of endangered Hawaiian waterbirds (under jurisdiction of the U.S. Fish and Wildlife Service).

Thank you for the opportunity to comment on the subject EIS preparation notice. Please send us a copy of the draft EIS as soon as it is available.

Sincerely yours,

Doyle E. Gates
Doyle E. Gates
Administrator

cc: F/SWR, Terminal Is., CA
F/HP, Washington, D.C.
FWS, Honolulu, Hawaii
Hawaii State Div. of Aquatic Resources

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-50

DEPUTY DIRECTOR

February 18, 1983

Mr. Doyle E. Gates, Administrator
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Region, Western Pacific Program Office
P.O. Box 3830
Honolulu, Hawaii 96812

Dear Mr. Gates:

Subject: Your Letter of March 15, 1982 (reference F/SWR1:JJN) Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

All comments on the EISPN have been reviewed, and the EIS should be available shortly. We will inform the Environmental Quality Commission to include you on their distribution list for the EIS.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

He ke aloha pumehana,

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

cc: Belt, Collins & Associates
Environmental Quality Commission

8201789
ENVUR
WWM

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 15TH AIR BASE WING (PACAF)
HICKAM AIR FORCE BASE, HAWAII 96853

REPLY TO ATTN OF: DEEV (Mr Yamada, 449-1831)

15 MAR 1982

SUBJECT: Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

TO: Office of Environmental Quality Control
550 Halekauwila 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.

WILLIAM T. MORIOKA
Chief, Engrg & Envmtl Plng Div
Directorate of Civil Engineering

Cy to: City and County of Honolulu
Department of Public Works
680 South King Street
Honolulu, HI 96813

RECEIVED
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TO

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-51

DEPUTY DIRECTOR

February 18, 1983

Mr. William T. Morioka, Chief
Engineering and Environmental Planning Division
Directorate of Civil Engineering
Department of the Air Force
Headquarters 15th Air Base Wing
Hickam Air Force Base, Hawaii 96853

Dear Mr. Morioka:

Subject: Your Memorandum of March 15, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project. Your letter indicating no comments on the EISPN is acknowledged.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858

PODED-PV

22 March 1982

RECEIVED
DEPT. OF PUBLIC WORKS
MAR 25 2 23 PM '82
TO

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 the opportunity to review the Environmental Impact Statement Notice of Preparation for the Waialua-Haleiwa Wastewater Facilities Plan, sent to us on 23 February 1982. Based on our review, we provide the following comments:

a. From the information presented, it could not be determined whether Department of the Army permits would be required. Should there be any activity in the waters of the United States, including wetlands, a Department of the Army permit might be required.

b. Four of the proposed sewage pump stations are situated within the coastal flood plain designated Zones V22 and A4, and are subject to tsunami inundation. Another proposed pump station is located within the Kiikii Stream flood plain, or more specifically, the flood fringe area, of Zone A7 designation, and is subject to riverine flooding. The attached Inclosure 1 Flood Insurance Rate Map, prepared by the Federal Insurance Administration as part of the Flood Insurance Study for Oahu, identifies the flood hazard areas in the Waialua to Haleiwa area. Proposed new facilities for sewage systems should be located and constructed to minimize or eliminate the potential for flood damage, and the infiltration of flood waters into the system or discharges from the system into the flood waters.

Sincerely,

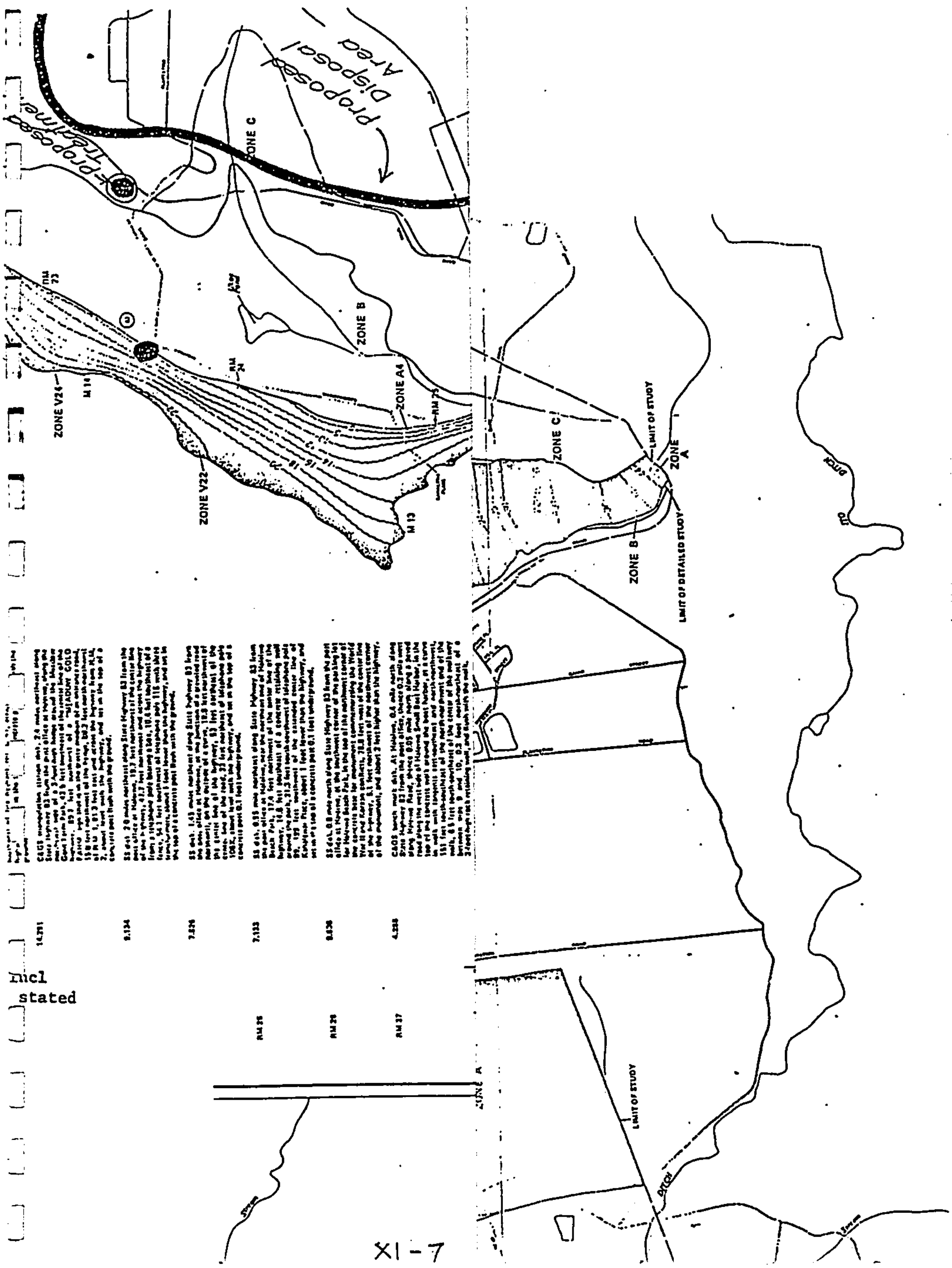
KISUK CHEUNG
Chief, Engineering Division

1 Incl
As stated

XI-6

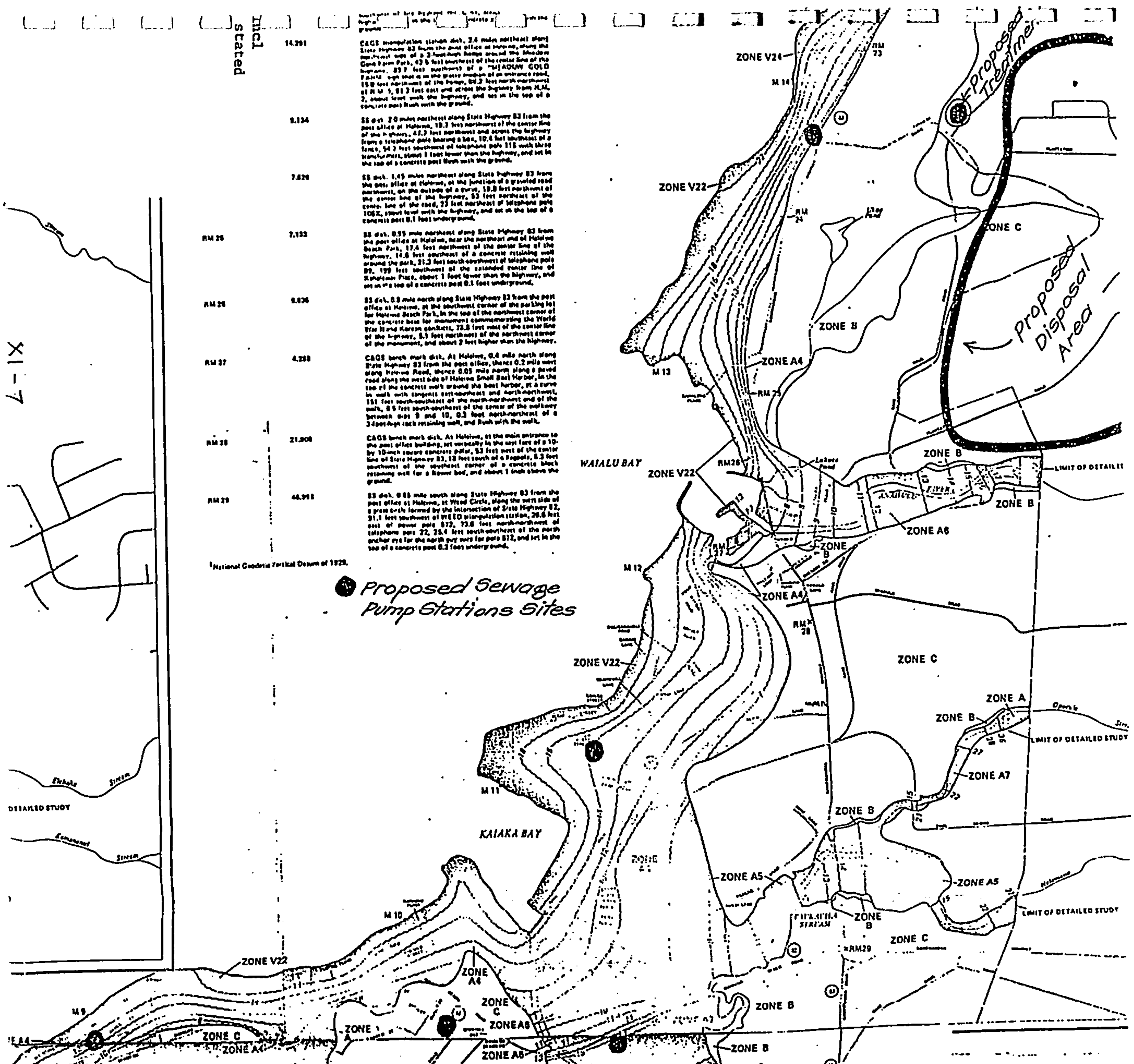
EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30*	Areas of 100-year flood, base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30*	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.
*	The numerals indicate the magnitude of difference between the 100-year and 10-year flood elevations. For numerals between 1-20, the difference is one half of the value; for values greater than 20, the difference is 10 less than the numerals shown. This information is used in establishing insurance rates.
—18—	100-year tsunami or riverine elevation line, with elevation in feet above mean sea level.
———	Zone boundary line



Proposed Disposal Area
Proposed Trailmet
ZONE C
ZONE B
ZONE A4
ZONE V24
ZONE V22
ZONE A
LIMIT OF STUDY
LIMIT OF DETAILED STUDY

incl
stated



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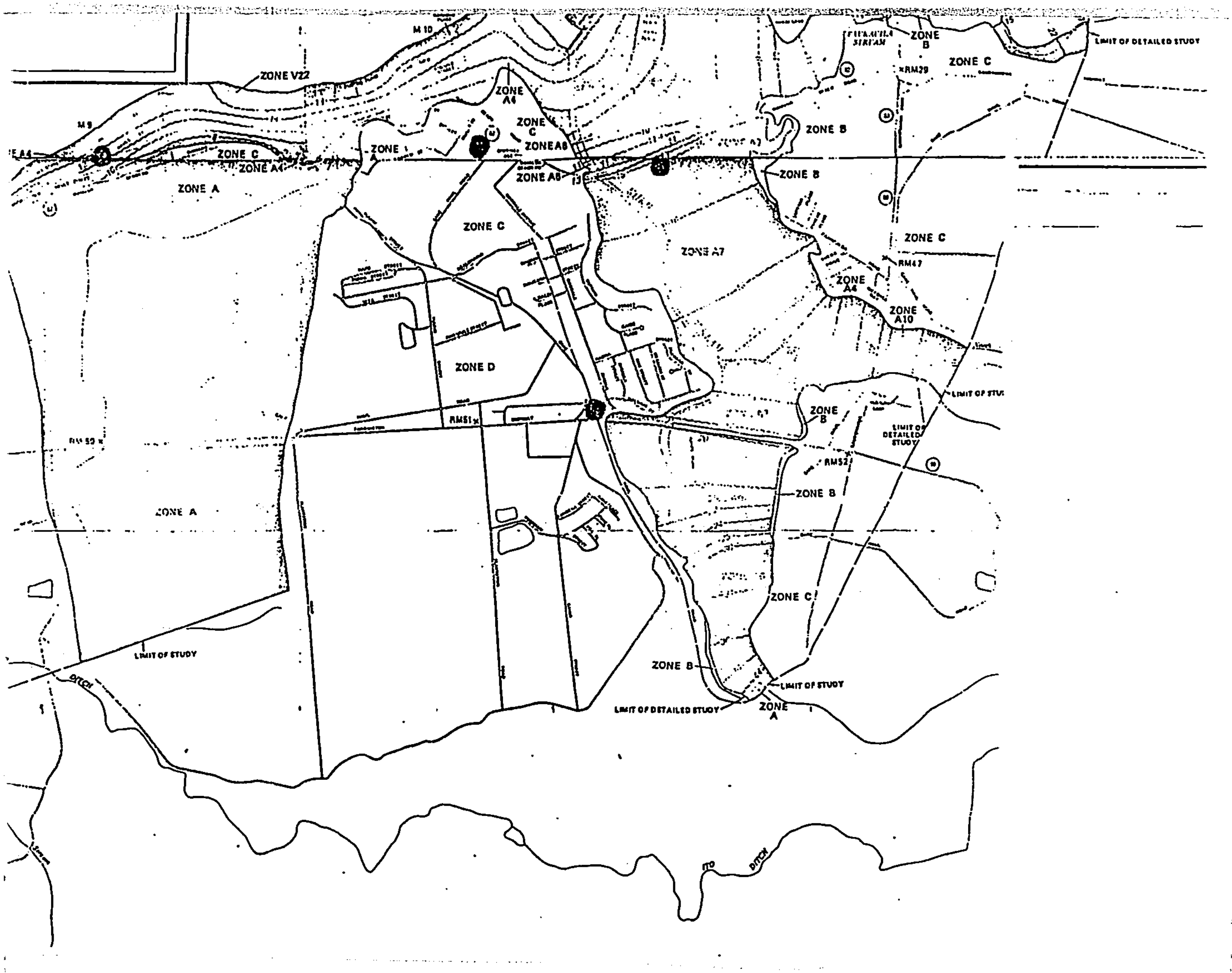
XI-7



ZONE V22
M 10
M 9
ZONE A4
ZONE C
ZONE A
ZONE A4
ZONE C
ZONE A8
ZONE A8
ZONE C
ZONE D
RM51
ZONE A
ZONE A7
ZONE B
ZONE B
ZONE B
ZONE C
ZONE C
RM29
RM47
ZONE A4
ZONE A10
LIMIT OF DETAILED STUDY
ZONE B
LIMIT OF DETAILED STUDY
RM52
ZONE B
ZONE C
ZONE B
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
ZONE A
LIMIT OF STUDY
DITCH

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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

WPP 83-52

DEPUTY DIRECTOR

February 18, 1983

Mr. Kisuk Cheung, Chief
Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
Fort Shafter, Hawaii 96858

Dear Mr. Cheung:

Subject: Your Letter of March 22, 1982 (reference PODED-PV) Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

Should any activity in the waters of the United States be involved in implementation of the Facilities Plan, a Department of the Army permit would be obtained.

Unfortunately, because of the topography of the service area, it is not practical to locate all the sewage pump stations outside of the flood hazard areas. However, pump stations within flood hazard areas would be designed and constructed to minimize flood damage, infiltration of flood waters into the system, and discharges from the system into the flood waters.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

RECEIVED
'82 MAR 10 AM 8 12

HEADQUARTERS
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860

DIV. OF WASTEWATER MANAGEMENT

ENV WL 820632
WWM

IN REPLY REFER TO:
002:09P2:SH:ci
Ser 478

8 MAR 1982

RECEIVED
DEPT. OF PUBLIC WORKS
MAR 9 2 32 PM '82
TO

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:

Environmental Impact Statement (EIS)
Preparation Notice for
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for your letter of 23 February 1982 providing a copy of the subject EIS preparation notice for review. At this time, there are no U. S. Navy or U. S. Marine Corps facilities within the defined outlines of the Waialua-Haleiwa planning area.

The closest is the Navy's Opana Communications Station in the Koolauloa area, east-northeast of Waimea Bay. Watershed drainage is towards the North Shore rather than to Pearl Harbor. Therefore, the Navy has no further comments on this EIS and it is returned for your files.

The Navy would appreciate the opportunity to review and comment on similar preparation notices for the Ewa and Koolaupoko planning areas as shown on the location map (figure 1).

Sincerely,

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

Enclosure

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-53

DEPUTY DIRECTOR

February 18, 1983

Captain M.H. Dallam
Facilities Engineer
Headquarters, Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860

Dear Captain Dallam:

Subject: Your Letter of March 8, 1982 (reference 002: 09PZ:sH:ci/Ser 478) Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project. We acknowledge that you have no further comments on this EIS, as the U.S. Navy and Marine Corps have no facilities in the planning area.

Your letter indicated that you wished to review and comment on EIS Preparation Notices for facilities plans in the Ewa and Koolaupoko planning areas. For the Ewa area, an environmental impact statement for the Honouliuli Wastewater Treatment Plant and Barber's Point Ocean Outfall System was completed in June 1975.

Two wastewater facilities plans are being prepared for the Koolaupoko area - one for Kaneohe-Kailua and one for Waimanalo. A copy of the EISPN for the Kaneohe-Kailua Wastewater Facilities Plan was sent to the U.S. Marine Corps Station at Kaneohe in October 1981. This was reviewed by Captain W.E. Woods and Lieutenant Colonel Alfred L. Mize. A letter requesting assistance and comments in the preparation of the EIS for the Waimanalo Facility Plan was transmitted to the Commander Naval Facility, Command Pacific Division in December 1982.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

He ke aloha pumehana,

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
HONOLULU AREA OFFICE
300 ALA MOANA BLVD., RM. 3318, P.O. BOX 50007
HONOLULU, HAWAII 96850

REGION IX

IN REPLY REFER TO:

8201985
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WWH

RECEIVED
DEPT. OF PUBLIC WORKS
MAR 24 2 17 PM '82
TO

March 22, 1982

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

Dear Mr. Chun:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Haleiwa Wastewater Facilities Plan
Waialua-Haleiwa, Oahu, Hawaii

The subject Notice that outlines the wastewater facilities under consideration in the Waialua-Haleiwa area was reviewed by this office.

We find that the installation of a wastewater treatment system in the area will minimize the degradation of surface and groundwater in the area. It will also enhance the properties in the area while relieving the City and County of servicing defective individual on-site sewage disposal systems.

We look forward to receiving the Draft Environmental Impact Statement.

Sincerely,

for Robert K. Fukuda
Area Manager, 9.1S

cc: 9CE James 8428

RECEIVED
'82 MAR 25 PM 1 36
WASTEWATER MANAGEMENT

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

EILEEN R. ANDERSON
MAYOR

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

WPR 83-54
DEPUTY DIRECTOR

February 18, 1983

Mr. Robert K. Fukuda
Area Manager
Department of Housing and Urban Development
Honolulu Area Office
P.O. Box 50007
Honolulu, Hawaii 96850

Dear Mr. Fukuda:

Subject: Your Letter of March 22, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project. Your comments regarding the beneficial effects of installing a wastewater treatment system will appear in the EIS.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. We will inform the Environmental Quality Commission to include you on their distribution list for the EIS.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

He ke aloha pumehana,

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

United States Department of the Interior
FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P O BOX 50167
HONOLULU, HAWAII 96850

IN REPLY REFER TO:
ES
Room 6307

8201456

RECEIVED MAR 2 1982 DEPT OF PUBLIC WORKS
MAR 3 2 19 PM '82

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

Re: EIS Preparation Notice,
Waialua-Haleiwa Wastewater
Facilities Plan, Oahu,
Hawaii

Dear Mr. Chun:

We have reviewed the subject Environmental Impact Statement (EIS) Preparation Notice and offer the following comments.

A description of the aquatic and terrestrial flora and fauna of the planning area, particularly the "sensitive" endemic plants (those which are proposed, candidates, or being considered for listing under the Endangered Species Act) and endemic water and forest birds would greatly enhance the EIS. The species should be identified, and the anticipated impact of the proposed project on those species should be explained.

Since 'Uko'a Marsh has been identified as habitat for three endangered Hawaiian waterbirds, and the higher elevations of the Koolau and Waianae Ranges contain a listed forest bird, the Federal agency providing project funds should initiate formal consultation with the U.S. Fish and Wildlife Service in accordance with the provisions of Section 7 of the Endangered Species Act of 1973, as amended.

We appreciate this opportunity to comment.

Sincerely yours,

Ernest Kosaka
Project Leader
Office of Environmental Services

cc: NMFS - WPPO
HDF&G
EPA, San Francisco

CONSERVE AMERICA'S ENERGY

United States Department of the Interior
FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P O BOX 50167
HONOLULU, HAWAII 96850

APR 3 0 1982

ES
Room 6307
APR 29 1982

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

Re: EIS Preparation Notice,
Waialua-Haleiwa Wastewater
Facilities Plan, Oahu,
Hawaii

Dear Mr. Chun:

In our March 2, 1982 letter to you containing comments on the referenced Environmental Impact Statement (EIS), we stated in paragraph 3 that formal consultation as specified in Section 7 of the Endangered Species Act should be initiated by the Federal agency providing funds for the project. This is not necessarily true.

Section 7 stipulates that any Federal agency which authorizes, funds, or carries out any action which <u>may affect</u> a listed species must initiate formal consultation; the emphasis being on <u>may affect</u>. In the case of the subject Facilities Plan, it would be up to the Environmental Protection Agency, after review of the EIS, to make that determination. For this reason, the EIS should address the forseeable effects, if any, of the project on these species. If it is clear that a species would not be affected in any way by the project construction or operation, it need not be addressed in the EIS other than, perhaps, mention that no effects are expected.

More specific to our March 2 letter, it may not be necessary to investigate deeply into the higher elevation forest birds in the final EIS unless an effect on them is expected.

We hope this information is useful.

Sincerely yours,

Lucian Kramer
Acting Project Leader
Office of Environmental Services

cc: NMFS - WPPO
HDF&G
EPA, San Francisco
Belt, Collins & Associates (Attention Ann Yokalavich)

CONSERVE AMERICA'S ENERGY

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

EILEEN R. ANDERSON
MAYOR

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

DEPUTY DIRECTOR

WPP 83-55

February 18, 1983

Mr. Ernest Kosaka
Project Leader
U.S. Department of the Interior
Fish and Wildlife Service
Office of Environmental Services
P.O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Subject: Your Letter of March 2, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project. Thank you also for the follow-up letter of April 29, 1982 from Lucian Kramer.

Flora and fauna on and around the selected sites for the centralized sewage treatment facilities will be described in the EIS. Anticipated impacts on affected species will also be outlined. Waterbirds using Ukoa Marsh will be discussed, but birds in the higher elevations of the Koolau and Waianae Ranges will not be investigated since implementation of the Facilities Plan would not affect them.

The April 29, 1982 letter from your office clarified the requirements regarding formal consultations with the U.S. Fish and Wildlife Service. In this case, the Environmental Protection Agency (EPA) is expected to make a determination, after reviewing the EIS. If any species on or being considered for inclusion on the Endangered Species List might be affected by the proposed Facilities Plan, formal consultations would be initiated.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

820 2370
EnvUt
WWM
8

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

March 31, 1982

RECEIVED
DEPT. OF PUBLIC WORKS
APR 2 2 33 PM '82
TO

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:

Subject: Environmental Impact Statement Preparation Notice - Waialua-Haleiwa Wastewater Facilities Plan

The subject EIS Preparation Notice has been reviewed by Marti Ikehara, Patricia Shade, Charles Hunt, and Kiyoshi Takasaki of this office. Their combined comments are attached.

The plan is being returned for your use.

Sincerely,

Benjamin L. Jones
District Chief

Attachment

RECEIVED
'82 APR -5 AM11 01
DIV. OF
WASTEWATER
MANAGEMENT

Comments to EIS Preparation Notice

Waialua - Haleiwa Wastewater Facilities Plan

Page	Paragraph	Lines	
12			Figure 2. Label the possible treatment site in Mokuleia
13	1	8	Insert "an" before "effluent well"
13	1	9	Insert "State's" before "UIC line"
18	1	9,10	Delete last sentence beginning with "Another series of dikes etc." Existence of dikes has not been confirmed.
20			Figure 5. Cross-sections should be in same general direction. In A-A[1] replace or add to hydrologic discontinuity "Contact of Koolau and Waianae lavas". In A-A[1], replace or add to hydrologic discontinuity "Anahulu Valley fill"
23	2	all	Delete entire sentence because leakage from dike-impounded water is small. Replace with "Most of the perennial streamflow in the upper reaches is diverted for etc."
23	3	1	Replace "it" with Waialua District.
24	1	4	Insert "floods" after "worst"
24	2	11	Replace last sentence with "Like most tsunami generated near-shore waves which caused significant damage on this stretch of coastline, etc."
27			Table 5. Put footnote number above in column description
30			Figure 7. The U.S. Geological Survey had some questions regarding the configurations of the 100-year and 500-year flood zones in the area north of Anahulu River. The flood zones appear to be at odds with the known topography in the vicinity. The Survey stated its reasons in a response to the final EIS for Haleiwa Bypass (FAP-83 from Weed Junction to Haleiwa Beach Park).
34			Table 7. Delete 1970 from column under Station No. 16-3500.
35	1	all	Is it possible to include the water-quality standards in table 7?
36	3	5	Laniakea Springs located approximately at the end of the word Kawailoa in figure 9 has a chloride concentration of 500 mg/l at the shoreline. This spring should be mentioned.
40	2	5	Make-up? Is this a misspelling?
50	1	7	What is "non-attainment area?"
52	1	1,2	Awkward.
65	2	11	Correct spelling is "Thomson's Corner." Correction will be made in new maps.
110	1	7	Replace "is a" by "are".

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

EILEEN R. ANDERSON
MAYOR

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

DEPUTY DIRECTOR

WPP 83-56

February 18, 1983

Mr. Benjamin Jones, District Chief
U.S. Department of the Interior
Geological Survey, Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

Dear Mr. Jones:

Subject: Your Letter of March 31, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project. Since the Environmental Impact Statement (EIS) will not incorporate the EISPN structure and wording exactly, some of the specific comments you made relating to the addition or deletion of a word may not be applicable for the EIS. However, we have listed your comments and our responses in the columns below.

Location (Page/Para./Line)	Comment	Response
12	Figure 2. Label the possible treatment site in Mokuleia	This exact figure will not be in the EIS as the sites are more precisely defined now. We will clearly label the treatment sites in all similar figures.
13 1 8	Insert "an" before "effluent well"	This should have read wells. However, this "Project Description" section is rewritten in the EIS to be more specific. We will endeavor to catch all typographical errors.

Location (Page/Para./Line)			Comment	Response
13	1	9	Insert "State's" before "UIC line"	Although this section will not appear exactly like this in the EIS, we will refer to the UIC line as the State's UIC line.
18	1	9,10	Delete last sentence beginning with "Another series of dikes etc." Existence of dikes has not been confirmed.	This sentence has been replaced with the following: "A hydrologic discontinuity between the Wahiawa and Waialua Districts indicates some change in geologic structure across the Schofield Plateau, but the nature of this is not fully understood."
20			Figure 5. Cross-sections should be in same general direction. In A-A' replace or add to hydrologic discontinuity "Contact of Koolau and Waianae lavas." In A-A', replace or add to hydrologic discontinuity "Anahulu Valley fill"	One cross-section will be flipped so that both read in the same direction. The wording you suggested will be added to the figure.
23	2	all	Delete entire sentence because leakage from dike-impounded water is small. Replace with "Most of the perennial streamflow in the upper reaches is diverted for etc."	The first two sentences will be deleted and the last modified as you suggested.
23	3	1	Replace "it" with Waialua District.	The sentence will be reworded as follows: "Because the towns of Waialua and Haleiwa lie at the mouth of several drainage basins where the terrain is relatively level..., they are...

Location (Page/Para./Line)			Comment	Response
24	1	4	Insert "floods" after "worst"	This will be inserted.
24	2	11	Replace last sentence with "Like most tsunami generated near-shore waves which caused significant damage on this stretch of coastline, etc."	Sentence will be replaced as requested.
27			Table 5. Put footnote number above in column description.	Footnote numbers will be moved.
30			Figure 7. The U.S. Geological Survey had some questions regarding the configurations of the 100-year and 500-year flood zones in the area north of Anahulu River. The flood zones appear to be at odds with the known topography in the vicinity. The Survey stated its reasons in a response to the final EIS for Haleiwa Bypass (FAP-83) from Weed Junction to Haleiwa Beach Park.	Your observations regarding the discrepancy between the flood-zone map and the topography in the vicinity of Ukoa Marsh are correct. However, this figure is based on the official Flood Insurance Rate Map. After our consultant discussed the matter with Charles Hunt of your staff, it was agreed that a sentence would be added to the text and the figure that such a discrepancy has been discovered.
34			Table 7. Delete 1970 from column under Station No. 16-3500.	This will be deleted.
35	1	all	Is it possible to include the water-quality standards in Table 7?	Water quality standards will be added to Tables 6 and 7.

Location (Page/Para./Line)			Comment	Response
36	3	5	Laniakea Springs located approximately at the end of the word Kawailoa in Figure 9 has a chloride concentration of 500 mg/l at the shoreline. This spring should be mentioned.	Laniakea Springs and its chloride concentration will be mentioned.
40	2	5	Make-up? Is this a misspelling?	Hyphen will be deleted.
50	1	7	What is "non-attainment area?"	A "non-attainment area" is an area that does not meet one or more of the Federal primary air quality standards. A more positive way of stating the situation is that the Waialua-Haleiwa area apparently meets all Federal primary air quality standards.
52	1	1,2	Awkward.	This sentence will be reworded as follows: "Ukoa Marsh is one of the largest freshwater wetlands on Oahu."
65	2	11	Correct spelling is "Thomson's Corner." Correction will be made in new maps.	Thank you for notifying us of the correct spelling.
110	1	7	Replace "is a" by "are."	Singular verb will be replaced with plural.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

He ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: ✓Belt, Collins & Associates
Environmental Quality Commission

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION NINE
Hawaii Division
Box 50206
Honolulu, Hawaii 96850

Arizona
California
Nevada
Hawaii
Guam
American Samoa

8202318
ENVLL
WWM

March 29, 1982

IN REPLY REFER TO
HDA-HI

RECEIVED
DEPT. OF PUBLIC WORKS
MAR 31 1 55 PM '82
TO

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

Dear Dr. Chun:

Subject: Environmental Impact Statement Preparation Notice Waialua-Haleiwa Wastewater Facilities Plan, Waialua-Haleiwa, Oahu, Hawaii

Thank you for the opportunity to review your preparation notice for the subject project. The State Department of Transportation and this office last year processed an EIS for Kamehameha Highway Realignment from Weed Junction to Haleiwa Beach Park. You may wish to expand your Sewer Service Area to the logical boundary formed by the proposed highway alignment.

Sincerely yours,

H. Kusumoto
Division Administrator

RECEIVED
APR -1 AM10 28
DIV. OF
WASTEWATER
MANAGEMENT

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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

WPP 83-57

DEPUTY DIRECTOR

February 18, 1983

Mr. H. Kusumoto
Division Administrator
U.S. Department of Transportation
Federal Highway Administration
Region Nine, Hawaii Division
Box 50206
Honolulu, Hawaii 96850

Dear Mr. Kusumoto:

Subject: Your Letter of March 29, 1982 (reference HDA-HI) Regarding the Environmental Impact Statement Preparation Notice for the <u>Waialua-Haleiwa Wastewater Facilities Plan</u>

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

The intent of the Facilities Plan for the Waialua-Haleiwa area is to service only existing development plus the limited new growth that the proposed North Shore Development Plan (NSDP) would allow. This is in accordance with the U.S. Environmental Protection Agency's policy that facilities plans be consistent with local plans.

The proposed new alignment of Kamehameha Highway between Weed Junction and the Haleiwa Beach Park is considerably inland of the existing urban development. The NSDP map calls for the land between the proposed roadway and the town to remain in agricultural use. Including this acreage within the Sewer Service Area, as you suggested, would tend to increase the pressures for its urbanization. Since this conflicts with the NSDP, it is our belief that the service area boundaries shown in the EISPN are most appropriate.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: ✓Belt, Collins & Associates
Environmental Quality Commission

RECEIVED
GEORGE R. AKITOSHI
'82 MAR 10 PM 2 27
DIV. OF WASTEWATER MANAGEMENT

ENVLL
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STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P. O. BOX 119, HONOLULU, HAWAII 96810

HIDEO MURAKAMI
COMPTROLLER
MIKE N. TOKUNAGA
DEPUTY COMPTROLLER

LETTER NO. (P)1237.2

MAR 5 1982

RECEIVED
DEPT OF PUBLIC WORKS
2 46 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: Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for this opportunity to review and comment on the subject project.

The project will not have any adverse environmental effect on any existing or planned facilities serviced by our department.

Very truly yours,

HIDEO MURAKAMI
State Comptroller

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

EILEEN R. ANDERSON
MAYOR

MICHAEL J. CHUN, Ph.D.
DIRECTOR AND CHIEF ENGINEER
DEPUTY DIRECTOR

WPP 83-58

February 18, 1983

Honorable Hideo Murakami
State Comptroller
Department of Accounting and General Services
P.O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Murakami:

Subject: Your Letter of March 5, 1982 (P 1237.2) Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project. Your letter indicating that the project will have no adverse effect on your department's facilities is acknowledged.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

GEORGE R. ARIYOSHI
GOVERNOR

JACK K. SUWA
CHAIRMAN, BOARD OF AGRICULTURE

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
P. O. Box 22159
Honolulu, Hawaii 96822

'82 MAR 29 PM12

DIV. OF WASTEWATER MANAGEMENT

820 2030

ENV WWM

RECEIVED
DEPT. OF PUBLIC WORKS
MAR 25 2 22 PM '82
TO

March 23, 1982

MEMORANDUM

To: Mr. Michael J. Chun, Director
Department of Public Works, C&C

Subject: Environmental Impact Statement Preparation Notice:
Waialua-Haleiwa Wastewater Facilities Plan,
TMK: 1st Division, Zone 6 - Waialua-Haleiwa, Oahu

The Department of Agriculture has reviewed the subject environmental impact statement preparation notice and offers the following comments.

We encourage the use of treated sewage effluent for agricultural irrigation under appropriate conditions. The subject notice states that the treated effluent could be used primarily for off-season sugarcane irrigation (four months per year) and/or irrigation of other crops. The limitations and potentials of using effluent should be thoroughly discussed in the EIS.

With regards to the selection of alternative sites for the sewage treatment plant, we suggest that any proposed locations avoid, to the greatest extent possible, lands classified as "Prime" under the Agricultural Lands of Importance to the State of Hawaii (ALISH) classification system and lands currently engaged in productive agricultural pursuits.

On page 113-114 of the subject notice, it is stated that the wastewater facilities are to provide improved service primarily to existing development, and that the lack of a municipal sewage treatment system has not significantly limited development in the Waialua District in the past. It is further stated that the proposed City and County North Shore Development Plan, ". . . which will be the major land use control in the area, would permit relatively little growth in the more densely developed portions regardless of whether or not a municipal wastewater system is installed. In short, no secondary growth impact is likely." We believe that it is premature to assume that the City and County North Shore Development Plan ordinance as proposed in October 1980 will be passed in the form described in the subject notice.

The subject notice does not specify the capacity of the proposed sewage treatment plant. The EIS should estimate the capacity required to service

the Waialua-Haleiwa area while avoiding the development of a large over-capacity plant which could provide additional impetus to whatever urbanization pressures already exist or may be experienced in the future. To simply state that no secondary growth is likely is to preclude serious consideration of potential urbanization of the extensive and productive agricultural lands in the sewage treatment service area. We request that the matter of increased urbanization directly or indirectly attributable to the operation of a sewage treatment plant receive appropriate analysis as the project environmental impact statement is developed.

Thank you for the opportunity to comment.

Jack K. Suwa
JACK K. SUWA
Chairman, Board of Agriculture

cc: Department of General Planning
City and County of Honolulu

Support Hawaiian Horticultural Products

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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

WPP 83-59

DEPUTY DIRECTOR

February 18, 1983

Honorable Jack Suwa
Chairman, Board of Agriculture
P.O. Box 22159
Honolulu, Hawaii 96822

Dear Mr. Suwa:

Subject: Your Memorandum of March 23, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the the Environmental Impact Statement Preparation Notice (EISPN) for this project. Responses to your specific comments follow.

Use of Effluent for Irrigation

The EIS will thoroughly discuss the limitations and potential of using treated sewage effluent for agricultural irrigation. Although the exact placement and wording of the discussion on this matter in the EIS is not yet fixed, the main points, presented below, will be covered.

Potential:

- The costs are low compared to the ocean outfall method of effluent disposal.
- It provides a means for re-using water resources.
- There are several crop options--sugarcane and California grass (a fodder crop) will be discussed in the EIS.
- Drip or furrow irrigation may be used, although use of drip irrigation requires a higher degree of effluent treatment.

Limitations:

- Irrigation of sugarcane with effluent is limited to the non-grinding season (four months/year).

- Quantity of effluent use depends on the ability of sugar company personnel to stagger field cycles. (This is because use of effluent in the second year of the sugarcane growth cycle increases the plants' bulk more than it increases sugar content; and so the amount of effluent applied to 2nd-year fields would probably be reduced.)
- Irrigation of sugarcane is usually done only during daylight hours.
- Sugarcane is not irrigated during periods of heavy rainfall.
- As with all effluent disposal options, disposal via irrigation must have a back-up system.
- Use of effluent for irrigation on land above the "no-pass" line would require Board of Water Supply approval.
- Using Waialua Sugar Company's irrigation system as part of the effluent disposal system for the WWTP requires coordination between the City and County of Honolulu Department of Public Works and Waialua Sugar. This involves more effort than if the system were entirely owned by the City.
- If, in the future, Waialua Sugar found itself unable to use any treated sewage effluent on its cane fields, the City may have to acquire land for growing California grass (or some similar crop), in order to continue irrigation as an effluent disposal option.

"Prime" Agricultural Land

One of the two proposed sewage treatment plan (STP) sites, the one in Mokuleia, is located entirely on land currently cultivated for sugarcane with about half of the ten-acre site classified as "Prime" agricultural land. Factors which had to be considered in selecting alternative sites for the STP(s), included flood zones, the Board of Water Supply's "no-pass" line, neighboring land uses, and proximity to the urban area. Since most of the region surrounding the urban area of Waialua-Haleiwa is designated "Prime" agricultural land, it was not possible to totally avoid using this "Prime" land for the Mokuleia site while also taking into account the other criteria.

Growth Impacts

The last two paragraphs of your comment letter express concern over growth in the area resulting from the installation of a centralized sewage treatment system in the Waialua-Haleiwa area. As you noted, the North Shore Development Plan (NSDP) of October 1980 is not in its final form. However, the revised NSDP of April 1982 shows only slight differences from the earlier version. Moreover, any future changes would also probably be minor because the development plans (DPs) are based as much as possible on the General Plan (GP) population distribution policy. The intent of this County policy is clear--that the population of the North Shore area, encompassing the towns of Waialua and Haleiwa, will grow by only a small amount in the next twenty years. The service area population that has been calculated in the Facilities Plan (and which will be presented in the EIS) is consistent with the NSDP map's land use allocations. The plant's design capacity would accommodate only that growth which would be allowed under the designations on the NSDP map. Since almost all of the growth the NSDP allows is infill of existing vacant parcels in the urban area, urbanization of productive agricultural lands is not likely to result.

These points will be presented in the EIS to expand on our statement that "no secondary growth impact is likely."

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

820 1528

ENV WWM

GEORGE R. ARIYOSHI
GOVERNOR

HAWAII PUBLIC EMPLOYEES HEALTH FUND
EMPLOYEES' RETIREMENT SYSTEM
PUBLIC UTILITIES COMMISSION
OFFICE OF THE PUBLIC DEFENDER

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
STATE CAPITOL
P. O. BOX 150
HONOLULU, HAWAII 96810

JENSEN S. L. HEE
DIRECTOR

DENNIS K. GODA
DEPUTY DIRECTOR

DIVISIONS:
BUDGET PLANNING AND MANAGEMENT
HAWAII INSTITUTE FOR MANAGEMENT AND ANALYSIS IN GOVERNMENT
ELECTRONIC DATA PROCESSING
FINANCE

March 5, 1982

RECEIVED
'82 MAR -8 PM 3 55
DIV. OF WASTEWATER MANAGEMENT

Mr. Michael J. Chun
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Chun:

Thank you for your letter of February 23, 1982, requesting comments to be considered in the preparation of an Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan.

I appreciate the opportunity to review the Environmental Impact Statement preparation notice relating to the proposed project. At this time, I have no specific comments regarding the proposed project.

Very truly yours,

Jensen S. L. Hee

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-60

DEPUTY DIRECTOR

February 18, 1983

Honorable Jensen S.L. Hee, Director
Department of Budget and Finance
State Capitol
P.O. Box 150
Honolulu, Hawaii 96810

Dear Mr. Hee:

Subject: Your Letter of March 5, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project. Your letter indicating no comments on the EISPN is acknowledged.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

820185

ENVLLE
WWM

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816

ARTHUR U. ISHIMOTO
BRIGADIER GENERAL
ADJUTANT GENERAL

DANIEL K. C. AU
COLONEL
DEPUTY ADJUTANT GENERAL

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17 MAR 1982

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DIV. OF WASTEWATER MANAGEMENT

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

Dear Mr. Chung:

Waialua-Haleiwa Wastewater Facilities Plan
Waialua-Haleiwa, Oahu, Hawaii

Thank you for providing us the opportunity to review your proposed project, Waialua-Haleiwa Wastewater Facilities Plan.

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

Yours truly,

Jerry M. Matsuda

JERRY M. MATSUDA
Captain, HANG
Contr & Engr Officer

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TO

XI-25

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

EILEEN R. ANDERSON
MAYOR

MICHAEL J. CHUN, Ph.D.
DIRECTOR AND CHIEF ENGINEER
DEPUTY DIRECTOR

WPP 83-61

February 18, 1983

Captain Jerry M. Matsuda
Office of the Adjutant General
Hawaii Air National Guard
State Department of Defense
3949 Diamond Head Road
Honolulu, Hawaii 96816

Dear Captain Matsuda:

Subject: Your Letter of March 17, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project. Your letter indicating no comments on the EISPN is acknowledged.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

He ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

GEORGE R. ARIYOSHI
GOVERNOR

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'82 MAR 16 AM 9 49
DIV. OF WASTEWATER MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

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MAR 16 AM 9 50
DIV. OF WASTEWATER MANAGEMENT

Dr. Donnis H. Thompson
SUPERINTENDENT

P20 1683
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March 3, 1982

RECEIVED
DEPT. OF PUBLIC WORKS
MAR 11 2 19 PM '82
TO

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

Dear Mr. Chun:

SUBJECT: Environmental Impact Statement Preparation Notice
Waialua-Haleiwa Wastewater Facilities Plan

For your information, the Public Works Division of the Department of Accounting and General Services will be reviewing the subject EIS on our behalf in terms of its impact on Haleiwa Elementary, Waialua Elementary, and Waialua High-Intermediate schools.

Their review and response will provide us with the necessary guidelines should any future action be required on our part to fulfill the requirements of the plan.

Thank you for the opportunity to review the plan.

Sincerely,

Lloyd K Migita
for Donnis H. Thompson
Superintendent of Education

DHT:HL:jl

cc: Mr. James Edington
Central District

AN EQUAL OPPORTUNITY EMPLOYER

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-62

DEPUTY DIRECTOR

February 18, 1983

Honorable Donnis H. Thompson
Superintendent
Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

Dear Dr. Thompson:

Subject: Your Letter of March 3, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

We acknowledge that the Department of Accounting and General Services will be reviewing the subject EIS on your behalf.

He ke aloha pumehana,

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

cc: Belt, Collins & Associates
Environmental Quality Commission
Department of Accounting and General Services

RECEIVED
MAR -4 PM 2 27
DIV. OF WASTEWATER MANAGEMENT

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

GEORGE A. L. YUEN, DIRECTOR OF HEALTH
VERNE C. WAITE, M.D., DEPUTY DIRECTOR OF HEALTH
HENRY N. THOMPSON, M.A., DEPUTY DIRECTOR OF HEALTH
~~JAMES S. KUMAGAI, PH.D., P.E.~~, DEPUTY DIRECTOR OF HEALTH
~~TADAO BEPPU~~, DEPUTY DIRECTOR OF HEALTH

Envll
WWM
8201449

In reply, please refer to:
File: EPHSD-SS

March 1, 1982

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

Dear Mr. Chun:

Subject: Request for Comments on Proposed Environmental Impact Statement (EIS) for Waialua-Haleiwa Wastewater Facilities Plan, Waialua-Haleiwa, Oahu, Hawaii

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.

Sincerely,

Brian J. J. Choy
for MELVIN K. KOIZUMI
Deputy Director for
Environmental Health

DC:ca

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MAR 3 2 19 PM '82

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

EILEEN R. ANDERSON, MAYOR

MICHAEL J. CHUN, Ph.D., DIRECTOR AND CHIEF ENGINEER
DEPUTY DIRECTOR

WPP 83-63

February 18, 1983

Mr. Melvin K. Koizumi
Deputy Director for Environmental Health
State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Koizumi:

Subject: Your Letter of March 1, 1982 Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project.

Your letter indicating no comments or objections to the project at this time is acknowledged. We also note that you reserve the right to impose environmental restrictions on the proposed project when final plans are submitted to the Department of Health for review.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

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

cc: Belt, Collins & Associates
Environmental Quality Commission

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

ENV:ll
WWM
820/988

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

DIVISIONS:
AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

RECEIVED
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MAR 19 2 17 PM '82
TO

March 17, 1982

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

Dear Dr. Chun:

Thank you for notifying us of the EIS being prepared for wastewater facilities proposed for the Waialua-Haleiwa area.

From the standpoint of aquatic resources the statement (EIS) should address the following points:

1. The effect of irrigation use of effluent on the quality of streams and on aquatic life.

2. Baseline survey of marine biota at any outfall that may be proposed.

3. Assessment of impacts and mitigation measures.

The notice correctly observes that in order to address wildlife concerns adequately further studies of any Kawailoa site would be necessary to determine possible impacts on waterbird use of the 'Uko'a pond/marsh.

We concur with the need for archaeologic surveys as site specific plans are developed in order to assess project impacts and to determine mitigation measures needed. We are pleased to see that such measures are intended. Buried archaeological sites are known to exist in the project area. Such sites are usually not discovered until disturbed by construction activities. The proposed undertaking should include archaeological salvage, planned and coordinated with site clearing and construction work. A final archaeologic report should be submitted to our historic sites office (Phone: 548-6408).

Very truly yours,

SUSUMU ONO
Chairman and State
Historic Preservation Office

RECEIVED
'82 MAR 25 PM 1 36
WASTEWATER MANAGEMENT

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-64
DEPUTY DIRECTOR

February 18, 1983

Honorable Susumu Ono, Chairman
Board of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Subject: Your Letter of March 17, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project. Responses to your comments in the three areas for which you expressed concerns are given below.

Aquatic Resources

It is our intention to completely explore the relationship between irrigation use of treated effluent and physio-chemical water quality in the EIS. Should the projected changes in water quality appear substantial, their potential effects on aquatic life will be analyzed. Measures needed to reduce or eliminate potentially adverse effects will be described as appropriate.

At present the use of an ocean outfall is not under consideration. Because of this, no baseline studies of marine biota are planned.

Wildlife Concerns

A reconnaissance survey of waterbird use of Ukoa Marsh has been conducted as part of our analysis of wastewater treatment system alternatives. It will be used as the basis for a discussion of potential impacts on waterbird use of the marsh.

Impacts on Archaeologic Resources

An archaeological reconnaissance survey of the areas that might be affected by implementation of each of the alternatives under consideration has been conducted as part of our study. A copy of the resulting report is attached for your use. It indicates that none of the alternatives is likely to have significant effects on the remains that are present.

Your observation that buried sites may exist which have not been identified by the surface survey is correct. The EIS will describe the measures that will be taken to insure that any archaeological remains encountered during construction will be dealt with adequately.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

Attachment
cc: Belt, Collins & Associates
Environmental Quality Commission

820 2454

ENV WWM

GEORGE R. ARIYOSHI
Governor

HIDETO KONO
Director

FRANK SKRIVANEK
Deputy Director

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

Kamamalu Building 250 South King St Honolulu Hawaii • Mailing Address P.O. Box 2359 Honolulu Hawaii 96804

March 31, 1982

Ref. No. 4475

RECEIVED
APR 6 PM 1 '82
DIV OF WASTEWATER MANAGEMENT

RECEIVED
DEPT. OF PUBLIC WORKS
APR 7 2 27 PM '82
TO

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:

Subject: Environmental Impact Statement Preparation Notice (EISPN) for the Waialua-Haleiwa Wastewater Facilities Plan

We have reviewed the subject report and offer the following comments for your consideration.

Since the Hawaii Coastal Zone Management (CZM) Program's statutory concerns incorporate scenic and open space resources, historic resources, coastal hazards and economic uses in the coastal zone, we believe the EISPN should include a discussion of the relevant CZM objectives and policies of Chapter 205A, Hawaii Revised Statutes. This will assist the agencies having functional CZM responsibilities in their evaluation of the project's consistency and compliance with the Hawaii CZM law.

Moreover, we believe that the first two sentences on page 10 of the EISPN do not provide an accurate reflection of the requirements contained in Chapter 226, HRS, relating to the Hawaii State Plan. To prevent any misconception on the part of the public readership on the actual requirements, may we suggest that these sentences be replaced with the actual language of the pertinent provisions, as follows:

Section 52(a)(3) of Chapter 226, HRS, (The Hawaii State Planning Act) in part, provides that:

"County general plans and development plans shall be used as a basis in the formulation of state functional plans."

Further, Section 61(a) of Chapter 226 requires that:

"The formulation, amendment, and implementation of county general plans or development plans shall utilize as guidelines, statewide objectives, policies and programs stipulated in state functional plans adopted in consonance with this chapter."

We have no further comments to offer at this time, but would appreciate the opportunity to review the completed EIS for this project.

Sincerely,

Frank Skrivanek
for Hideto Kono

cc: Office of Environmental Quality Control

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

EILEEN R. ANDERSON
MAYOR

MICHAEL J. CHUN, Ph.D.
DIRECTOR AND CHIEF ENGINEER
DEPUTY DIRECTOR

WPP 83-65

February 18, 1983

Honorable Hideto Kono, Director
Department of Planning and Economic Development
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Kono:

Subject: Your Letter of March 31, 1982 (reference no. 4475) Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

The Environmental Impact Statement (EIS) will include a discussion of the relevant CZM objectives and policies from Chapter 205A, Hawaii Revised Statutes.

The first paragraph which appeared on page 100 of the EISPN has been rewritten to incorporate the quotes from the Hawaii State Plan which you suggested. It now reads as follows:

> A symbiotic relationship between the Hawaii State Plan, state functional plans, and county general and development plans was forseen by the legislators who drafted the State Planning Act. Section 61c of the Hawaii State Plan requires that the county general plans and development plans "shall be in conformance with the overall theme, goals, objectives, policies and priority directions contained in this chapter" (the Hawaii State Planning Act, Chapter 226, Hawaii Revised Statutes). At the same time, the state plan stipulates in section 52a.3 that "county general plans and development plans shall be used as a basis in the formulation of state functional plans." It is further specified that when the functional plans are adopted by concurrent resolution of the legislature:
>
>> The formulation, amendment, and implementation of county general plans or development plans shall utilize as guidelines, statewide objectives, policies and programs stipulated in state functional plans (Section 61a, Hawaii State Plan).

Because the functional plans are being developed with the county development plans as their basis, it is reasonable to assume that they will not conflict with the proposed North Shore Development Plan.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

RECEIVED
'82 MAR -8 PM 3 53
DIV. OF WASTEWATER MANAGEMENT

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF SOCIAL SERVICES AND HOUSING

FRANKLIN Y. K. SUNN
DIRECTOR
RICHARD PAGLINAWAN
DEPUTY DIRECTOR
ALFRED K. SUGA
DEPUTY DIRECTOR

82-01559
ENV
WWP

March 4, 1982

RECEIVED
DEPT. OF PUBLIC WORKS
MAR 8 10 24 AM '82
TO

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

Gentlemen:

Subject: Environmental Impact Statement Preparation Notice, Waialua - Haleiwa Wastewater Facilities Plan

The Hawaii Housing Authority has reviewed the EIS Preparation Notice of the Waialua - Haleiwa Wastewater Facilities Plan and has no comments to offer relative to the proposal.

Thank you for the opportunity to comment on this matter.

Sincerely,

Franklin Y K Sunn

FRANKLIN Y. K. SUNN
Director

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

EILEEN R. ANDERSON
MAYOR

MICHAEL J. CHUN, Ph.D.
DIRECTOR AND CHIEF ENGINEER
DEPUTY DIRECTOR

WPP 83-66

February 18, 1983

Honorable Franklin Y.K. Sunn, Director
Department of Social Services and Housing
State of Hawaii
1390 Miller Street
Honolulu, Hawaii 96813

Dear Mr. Sunn:

Subject: Your Letter of March 4, 1982 Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project. Your letter indicating no comments on the EISPN is acknowledged.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

RECEIVED
'82 MAR 19 AM 8 45
DIV. OF WASTEWATER MANAGEMENT

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

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ENV WWM

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO:

STP 8.8144

March 16, 1982

RECEIVED
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MAR 18 2 33 PM '82
TO

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

Dear Mr. Chun:

EIS Preparation Notice
Waialua-Haleiwa Wastewater
Facilities Plan, Waialua-Haleiwa, Oahu

Thank you for the opportunity to comment on the subject EIS Preparation Notice.

We offer the following comments for your consideration in developing your EIS document.

1. The project will have a favorable impact on the existing and future operations of the Haleiwa Small Boat Harbor.

2. As a point of information, the proposed Poamoho Aviation Airport is located within the boundaries of the plan.

Very truly yours,

Ryokichi Higashionna

Ryokichi Higashionna
Director of Transportation

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-67

DEPUTY DIRECTOR

February 18, 1983

Honorable Ryokichi Higashionna
Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Dr. Higashionna:

Subject: Your Letter of March 16, 1982 (reference STP 8.8144) Regarding the Environmental Impact Statement Preparation Notice for the <u>Waialua-Haleiwa Wastewater Facilities Plan</u>

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project. We acknowledge your comments about the Haleiwa Small Boat Harbor and the proposed Poamoho Aviation Airport.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

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DIV. OF WASTEWATER MANAGEMENT

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
550 HALEKAUWILA ST.
ROOM 301
HONOLULU, HAWAII 96813

820 2292
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WWM

George Yuen
Director
TELEPHONE NO.
548-6915

March 19, 1982

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TO ______

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

Dear Dr. Chun:

Subject: Waialua-Haleiwa Wastewater Facilities Plan

We have reviewed your preparation notice and have no comment to make at the present time.

We look forward to providing comments on your draft EIS after you have decided where the wastewater treatment facility will finally be located.

Yours truly,

George Yuen, Director
Office of Environmental Quality Control

cc: Belt, Collins and Associates

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-68

February 18, 1983

Honorable Charles Clark, Director
Office of Environmental Quality Control
State of Hawaii
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Mr. Clark:

Subject: Your Letter of March 19, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project. Your letter indicating no comments on the EISPN is acknowledged.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

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Office of the Director

March 18, 1982
PN:0017

RECEIVED
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TO

Dr. Michael J. Chun
Department of Public Works
Division of Waste Water Management
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Chun:

EIS Preparation Notice
Waialua-Haleiwa Wastewater Facilities Plan
Waialua-Haleiwa, Oahu

We appreciate the opportunity to respond to your request for our input to the preparation of the EIS for the Waialua-Haleiwa Wastewater Facilities Plan.

We have reviewed the document submitted and find that most of the areas which we would assume to be of particular concern have been noted and are to be addressed in the EIS. Particularly, the concerns related to hydrology, coastal water quality, flood hazards, archaeological resources, and re-use of effluent are to be discussed. Perhaps some further considerations could be given to the use of alternate energy sources to reduce energy costs.

We look forward to reviewing the draft EIS when it becomes available.

Yours truly,

Doak C. Cox
Director

cc: Jacquelin Miller
Robert Rowland

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DIV. OF WASTEWATER MANAGEMENT

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-69

DEPUTY DIRECTOR

February 18, 1983

Dr. Doak Cox, Director
Environmental Center
University of Hawaii
2550 Campus Road
Honolulu, Hawaii 96822

Dear Dr. Cox:

Subject: Your Letter of March 18, 1982 (reference PN:0017) Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

The concerns you noted, related to hydrology, coastal water quality, flood hazards, archaeological resources, and re-use of effluent, will be addressed in the EIS. The feasibility of using methane gas from the anaerobic digester to produce inexpensive electricity will also be assessed in the EIS.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

He ke aloha pumehana,

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

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UNIV. OF WASTEWATER MANAGEMENT

University of Hawaii at Manoa

Water Resources Research Center
Holmes Hall 283 • 2540 Dole Street
Honolulu, Hawaii 96822

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17 March 1982

RECEIVED
DEPT. OF PUBLIC WORKS
MAR 22 2 13 PM '82
TO

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:

Subject: Environmental Impact Statement Preparation Notice, Waialua-Haleiwa Wastewater Facilities Plan, Waialua-Haleiwa, Oahu, Hawaii

We have reviewed the subject EISPN and offer the following comments:

1. Has Waialua Sugar Company agreed to use the effluent for irrigation? This is a crucial issue which needs to be ascertained. Also, can a water exchange be made whereby Waialua Sugar will exchange potable water to the Board of Water Supply in exchange for use of the effluent? A similar plan is being made in the Pearl Harbor groundwater basin with Oahu Sugar Company.

2. If the effluent is used for irrigation, it is highly desirable to keep the salt content as low as possible. Salt water infiltration into the influent appears to be a definite possibility because the influent pipes will probably be below sea level in many areas. Tight pipes and connections are needed, otherwise the effluent may not be suitable for irrigation.

3. A minimum amount of land should be used for the wastewater treatment facility because the land cost is more than just the initial purchase price. It includes the loss of agricultural production over time and the loss of jobs and taxes which accrue from that.

4. Ground injection of wastewater is always a sensitive issue. This subject should be discussed thoroughly in detail.

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

Sincerely,

Edwin T. Murabayashi

Edwin T. Murabayashi
EIS Coordinator

ETM:jm
cc: H. Gee
Y.S. Fok
Env. Center, UH

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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

WPP 83-70

DEPUTY DIRECTOR

February 18, 1983

Mr. Edwin T. Murabayashi
EIS Coordinator
Water Resources Research Center
2540 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Murabayashi:

Subject: Your Letter of March 17, 1982 Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project. Our responses below are numbered to correspond with your comments.

1. The Waialua Sugar Company has tentatively agreed to accept effluent from a centralized wastewater treatment facility situated in the Waialua-Haleiwa area so long as it is of a quality and quantity compatible with its irrigation needs. Since the company currently has more than adequate supplies of water for the fields it cultivates in the area, its willingness to utilize the wastewater stems primarily from its desire to cooperate with public agencies in pursuit of the public good.

   The Waialua Sugar Company will receive no significant economic benefit from the effluent it receives. Hence, it is doubtful that it would be willing to exchange any rights to potable water which it may now possess in return for the treated effluent. Nevertheless, this possibility will be explored with company representatives before plans are finalized.

2. Your comment regarding the desirability of minimizing the infiltration of groundwater into the system is well taken. Many of the collection pipes used in a centralized system would be laid beneath the water table, and excess leakage would needlessly increase the volume of wastewater entering the treatment plant. Because of this, care will be taken to insure that the collection system is designed and constructed in such a way as to minimize infiltration.

With respect to your concern that groundwater infiltrating into the system might raise chloride levels in the treated effluent to the point where it would be unsuitable for irrigation reuse, our analysis indicates that this is not a possibility. Even the deepest of the collection pipes would lie no more than ten feet beneath sea level. Based on geologic data assembled by Stearns, they would pass through calcareous and non-calcareous sediments that display only a weak hydrologic continuity with the basal aquifer in the underlying basaltic lavas. Hence, the potential for chloride infiltration into the wastewater collection system depends upon the concentration of that ion in the water in the surficial material rather than on its concentration in the water of the underlying basal aquifer.

In order to estimate the existing chloride levels in groundwater that might infiltrate into the collection system, well records maintained by the U.S. Geologic Survey were used to identify existing wells that tapped only this upper zone; these same records also provided data on chloride levels that are summarized in Table 1 attached to this letter. This information shows that chloride levels vary significantly from place to place within the area that would be traversed by the collection system. However, chloride levels are generally in the 200 to 600 mg/l range, and the median concentration is on the order of 400 to 450 mg/l.

The potable water supplied by the Honolulu Board of Water Supply to residential and commercial users in the Waialua-Haleiwa area has a chloride content of about 90 mg/l. Water quality samples from the Mililani Sewage Treatment Plant indicate that sewage adds about 30 mg/l of chloride to the amount present in the potable supply (the potable water from wells #2800-01 to 04 at Mililani has a chloride concentration of about 20 mg/l and the treated effluent about 50 mg/l). Assuming sewage from Waialua-Haleiwa has about the same chloride content as that at Mililani, in the absence of infiltration, treated effluent from a centralized facility would have a chloride concentration of approximately 120 mg/l. As a rough approximation, it is estimated that average wastewater volume would be about 1.3 MGD and average dry weather infiltration would be approximately 0.2 MGD. Taking a weighted average of chlorides in the wastewater and the groundwater:

$$\frac{(1.3 \text{ MGD})\ (120 \text{ mg/l}) + (0.2 \text{ MGD})\ (450 \text{ mg/l})}{1.5 \text{ MGD}} = 164 \text{ mg/l}$$

The preceding calculation shows that the average chloride concentration of effluent from the plant would be on the order of 150 to 175 mg/l. Even accounting for the possibility of some evaporation from the storage pond before the water is applied to the fields, it is clear that chloride levels in the effluent would be less than half the 500 mg/l level established as the upper limit for long-term irrigation or sugarcane. More

importantly, perhaps, the fact that the chloride concentration in the groundwater is below the 500 mg/l limit indicates that it would be safe to utilize the wastewater for sugarcane irrigation regardless of how much infiltration actually occurs.

3. The sewage treatment plant layout(s) would be designed to be as compact as possible. It is expected that by the year 2000 roughly ten acres would be required if a one-plant system was built and about 13 acres for a two-plant system. This accounts for the space requirements of plant equipment, access areas, and buffer zone.

4. Ground injection of wastewater will be discussed thoroughly in the EIS.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

Attachment
cc: Belt, Collins & Associates
Environmental Quality Commission

TABLE 1. CHLORIDE LEVELS REPORTED IN SHALLOW WELLS IN THE WAIALUA-HALE'IWA AREA.

Present Well Number	Old Well Number	Altitude (Ft. Above Mean Sea Level)	Depth (Ft. Below Ground Level)	Year Drilled	Chloride (mg/l) Range	Chloride (mg/l) Approximate Median	Comment
3-3406-07	T-102	16	50	1962	175	n.a.	Clay and cemented calcareous sand grading down to fine to medium sand.
3-3407-26	T-99	8	20	1962	345-625	450	Alluvium and calcareous sediments 7-20'.
-28	T-101	15	40	1962	235	n.a.	Alluvium; 0-25' clay, becoming sandy @ 20' with water entering hole".
-29	W-318-1	17	40	1964	347-370	360	Calcareous sediments: 6-foot diameter well.
-30	W-318-2	15	40	1965	360-2,100	1,300	Calcareous sediments: 6-foot diameter well.
3-3408-07	T-98	36	80	1962	541-554	550	Alluvium (mostly) interlayered with calcareous deposits @ bottom. Casing on top 32' of well.
3-3409-18	T-95	21	40	1962	307-520	400	Alluvium, 4" hole.
-19	T-96	9	60	1962	205-595	450	Reef limestone.
-20	T-107	30	60	1962	470-560	n.a.	Sedimentary material from 30-60 feet.
-22	T-109	40	20	1962	n.a.	n.a.	Dry hole. Abandoned @ 20'.
-23	T-110	45	30	1962	n.a.	n.a.	Dry hole. Abandoned @ 30'.
3-3505-23	T-105	20	35	1962	44-230	215	Dry hole.
3-3605-02	W-334-C	8	18	1900	n.a.	510	Artesian well fed by basal lens.
-03	W-334-D	8	47	1900	425-680	550	Artesian well fed by basal lens.
-04	W-334-E	5	51	1900	368	n.a.	Artesian well fed by basal lens.
-15	W-334-O	7	45	1955	370	n.a.	Black cinder.
-16	W-334-P	7	45	1955	420	n.a.	Black cinder.
-27	T-113	10	20	1962	n.a.	n.a.	0-15' had beach sand; 15-20' was coral.

Source: U.S. Department of the Interior, Geological Survey, Water Resources Division (Individual Well files as of 7/8/82).

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

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DIV. OF
WASTEWATER
MANAGEMENT

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RECEIVED
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April 26, 1982

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

FROM: KAZU HAYASHIDA, BOARD OF WATER SUPPLY

SUBJECT: YOUR LETTER OF FEBRUARY 23, 1982, ON THE EIS PREPARATION NOTICE FOR THE WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

Thank you for allowing us to review the environmental document on your proposed Wastewater Facilities Plan for the Waialua-Haleiwa area. We offer the following comments:

1. Description of Existing Environment (pp. 28-32): The new wells have been completed and the official name is Haleiwa Wells. The wells are located northeast of our Waialua Wells.

   The well to serve the Mokuleia Ranch lands should not be confused with our Haleiwa Wells. The wells at Mokuleia will be privately owned and operated.

   Currently, we have no plans to convey water from the Waialua basin to other areas of Oahu.

2. Existing Environment (p. 36): The derivation of the 2,500 mg/l isochlor should be discussed. Isochlor data are generally unreliable unless it is based on an extensive network of wells with reliable data on water quality, well depths, quantity of water pumped, and other parameters that could affect water quality.

April 26, 1982

3. We support your proposed Wastewater Facility Plan for Waialua-Haleiwa as it will eliminate existing private disposal systems that are located in areas where there is potential for contaminating potable groundwater resources.

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

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

XI-40

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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

WPP 83-71
DEPUTY DIRECTOR

February 18, 1983

MEMORANDUM

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

From: Michael J. Chun
Director and Chief Engineer

Subject: Your Memorandum of April 26, 1982 Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project. Responses below are numbered to correspond with your comments.

1. The EIS will note that the Board of Water Supply system now draws from both the Waialua and Haleiwa Wells. It will also describe the location and preserved uses of the wells.

   We were aware that the Board of Water Supply's new Haleiwa Wells were not the same as the wells for the proposed 350-lot Mokuleia Ranch Subdivision. The wording of our discussion will be revised to clarify this point.

   The reference to plans to export water from the basin was based on an earlier BWS document. It will be deleted.

2. We agree with your comments regarding isochlor data. The EIS will note the difficulties that are involved in defining the location of this boundary within a three-dimensional system. The limitations of the 2,500 mg/l isochlor line developed by First West Engineering as part of the State Department of Health's UIC program will be described, and their depiction of the boundary will be presented in that light. Their line will be referred to primarily as the basis for the State's UIC line. A copy of Section 3.2 of Chapter III of the EIS on groundwater quality is attached for your review and comment.

Mr. Kazu Hayashida -2- February 18, 1983

3. We appreciate your expression of support for our efforts to maintain and improve water quality in the Waialua District. We are confident that the Wastewater Facilities Plan will help eliminate potential sources of pollution that could adversely affect potable groundwater resources.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

Attachment
cc: ✓Belt, Collins & Associates
Environmental Quality Commission

RECEIVED
'82 APR 12 AM11 28
DIV. OF WASTEWATER MANAGEMENT

820 2434

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

EILEEN R. ANDERSON
MAYOR

WILLARD T. CHOW
CHIEF PLANNING OFFICER

RALPH KAWAMOTO
DEPUTY CHIEF PLANNING OFFICER

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DGP2/82-622

April 2, 1982

MEMORANDUM

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

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

SUBJECT: Waialua-Haleiwa Wastewater Facilities Plan

The plan provides an overview of alternative courses of action presently under consideration. Whether the final action will eventually include individual systems (such as cesspools and septic tanks) or a system of centralized sewage treatment plants or a combination has not been determined. Because the plan lacks specificity, assessment of environmental concerns is somewhat premature. We offer the following questions and suggestions:

--Shouldn't the plan identify alternative treatment facility sites and the surrounding land uses and assess the impact of subsequent land and housing, odor, noise and other problems likely to adversely affect nearby uses?

--Shouldn't the plan describe the major elements of a network of sewer lines required to transport wastewater from its sources to a treatment facility and the required transmission lines to carry treated effluent to disposal sites? Shouldn't the areas and population, existing and projected, to be served by the various treatment facilities be specified? These would affect costs which might have to be recovered from monthly sewer charges.

--Shouldn't the plan adequately describe the individual treatment plants under consideration in terms of design

flow, overall scale of on-site structures, off-site improvements required and other factors, such as their impact on scenic views?

--Shouldn't the plan discuss how the facility plan conforms or conflicts with the development plan being proposed for the area? Where conflict or inconsistencies exist, it may be necessary for the EIS to describe the extent to which the Waialua-Haleiwa wastewater facility plan and the proposed development plan can be reconciled.

Thank you for the opportunity to comment on the plan.

for RALPH KAWAMOTO
Planner

APPROVED:

WILLARD T. CHOW

cc: DLU
OEQC

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

EILEEN R. ANDERSON
MAYOR

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

DEPUTY DIRECTOR

WPP 83-72

February 18, 1983

MEMORANDUM

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

Via: Andrew I.T. Chang, Managing Director

From: Michael J. Chun, Director and Chief Engineer

Subject: Your Memorandum of April 2, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

At the time the EISPN for the Waialua-Haleiwa Facilities Plan was written, only preliminary analyses had been conducted. As a result, the description of the project was general. The intent in issuing the EISPN at a relatively early stage in the planning process was to insure that input regarding environmental concerns was obtained in time for it to influence the fundamental character of the alternatives developed for detailed analysis.

The Environmental Impact Statement itself will be based on discrete, well-defined alternatives. Hence, it will be possible to address all of the questions you raised. Specific responses to the more specific questions and suggestions contained in your letter are given below.

- Alternative treatment plant sites will be identified and the impacts on surrounding land uses, including odor and noise impacts, will be assessed.

- The alternative collection system layouts will be mapped. The existing and projected population to be serviced by each wastewater treatment alternative will be specified.

- The design flows of the treatment alternatives will be discussed as well as the extent of on- and off-site improvements. Visual impacts will be assessed.

- Population projections for the Waialua-Haleiwa Wastewater Facilities Plan were based on land use allocations in the proposed April 1982 North Shore Development Plan (NSDP) map, and therefore are consistent with the NSDP. This issue is covered in detail in the EIS and Facilities Plan.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at extension 4067.

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

RECEIVED
'82 MAR -9 PM 2 27
DIV. OF WASTEWATER MANAGEMENT

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813
PHONE 523-4101

EILEEN R. ANDERSON
MAYOR

JOSEPH K. CONANT
DIRECTOR

CHARLES K. TORIGOE
DEPUTY DIRECTOR

820606
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March 2, 1982

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TO

MEMORANDUM

TO: Michael J. Chun, Director & Chief Engineer
Department of Public Works

FROM: Joseph K. Conant

SUBJECT: Environmental Impact Statement, Preparation Notice
Waialua-Haleiwa Wastewater Facilities Plan
Waialua-Haleiwa, Oahu

Thank you for the opportunity to review your proposal on the development of an area-wide treatment and disposal system for the subject area that provides the highest level of environmental protection possible within fiscal, technical and institutional constraints.

We have no objections to your proposal.

The proposed Development Plan for the North Shore Planning Area allocates very little land for new development. The growth is limited to apartment districts along Waialua Beach Road and on the few vacant parcels within existing built-up areas. In essence, a growth impact is unlikely in the planning area.

JOSEPH K. CONANT

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

EILEEN R. ANDERSON
MAYOR

MICHAEL J. CHUN, Ph.D.
DIRECTOR AND CHIEF ENGINEER
DEPUTY DIRECTOR

WPP 83-73

February 18, 1983

MEMORANDUM

To: Mr. Joseph K. Conant, Director
Department of Housing and Community Development

From: Michael J. Chun, Director and Chief Engineer

Subject: Your Memorandum of March 2, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project.

Your letter indicating no objections to the facilities plan is acknowledged.

Should there be any questions, please contact Ms. Geraldine Lum at extension 4067.

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

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DIV. OF WASTEWATER MANAGEMENT

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 ● (808) 523-4432

EILEEN R. ANDERSON
MAYOR

MICHAEL M. McELROY
DIRECTOR

ROBERT B. JONES
DEPUTY DIRECTOR

820 1510
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March 4, 1982

LU2/82-931(JM)

MEMORANDUM

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

FROM : MICHAEL M. McELROY, DIRECTOR

SUBJECT : ENVIRONMENTAL IMPACT STATEMENT (EIS) PREPARATION NOTICE
WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN,
WAIALUA-HALEIWA, OAHU, HAWAII

We have reviewed the subject Preparation Notice. Since the exact location of the proposed Sewage Treatment Plants (STP) have not been precisely decided at this time, it is difficult to determine if the sites are within the Special Management Area (SMA). The proposed location for the Mokuleia STP appears to be outside of the SMA. The proposed location for the Kawailoa STP appears to be within the SMA and therefore, is subject to Ordinance No. 4529.

When more geographically-specific plans are developed, this department will review the sites for SMA compliance.

If you have any questions or comments, please contact John Machol of our staff at 523-4077.

for MICHAEL M. McELROY
Director of Land Utilization

MM:sl

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

EILEEN R. ANDERSON
MAYOR

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

HPP 83-74

DEPUTY DIRECTOR

February 18, 1983

MEMORANDUM

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

From: Michael J. Chun, Director and Chief Engineer

Subject: Your Memorandum of March 4, 1982 (reference LU2/82-931 JM) Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

While the two possible sewage treatment plant sites are outside of the Special Management Area (SMA), the collection lines and a potential site for disposal wells fall within the SMA. Therefore, the EIS will address the relationship of the proposed facilities to the SMA ordinance.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at extension 4067.

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

ROBERT K. MASUDA
DIRECTOR

SAM L. CARL
DEPUTY DIRECTOR

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DIV. OF WASTEWATER MANAGEMENT

March 4, 1982

MEMORANDUM

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

FROM : ROBERT K. MASUDA, DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

We have reviewed the wastewater facilities plan for Waialua-Haleiwa and have no comments.

Thank you for the opportunity to review the EIS Preparation Notice.

RKM:vc

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-75

DEPUTY DIRECTOR

February 18, 1983

MEMORANDUM

To: Mrs. Emiko Kudo, Director
Department of Parks and Recreation

From: Michael J. Chun, Director and Chief Engineer

Subject: Your Memorandum of March 4, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project. Your letter indicating no comments on the EISPN is acknowledged.

Should there be any questions, please contact Ms. Geraldine Lum at extension 4067.

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

82 01953

DEPARTMENT OF TRANSPORTATION SERVICES

CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

ROY A. PARKER
DIRECTOR

ENV

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WASTEWATER MANAGEMENT

March 18, 1982

MEMORANDUM

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

FROM: ROY A. PARKER, DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN
WAIALUA-HALEIWA, OAHU, HAWAII

We recommend that the environmental impact statement for this project address the following transportation concerns:

1. The traffic impact of the project during the construction phase and possible mitigating measures to minimize this impact.

2. The impact of the project on the City's bus service to the area during the construction phase.

If there are any questions, please contact Kenneth Hirata of my staff at Local 4199.

ROY A. PARKER

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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

WPP 83-76

DEPUTY DIRECTOR

February 18, 1983

MEMORANDUM

To: Mr. William A. Bonnet, Director
Department of Transportation Services

From: Michael J. Chun, Director and Chief Engineer

Subject: Your Memorandum of March 18, 1982 (reference TE 2/82-680 and PL-300682) Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

The environmental impact statement for this plan will address the impacts of a centralized sewage treatment system on traffic and bus service in the area during the construction period.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at extension 4067.

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
1455 S. BERETANIA STREET, ROOM 305
HONOLULU, HAWAII 96814

EILEEN R. ANDERSON
MAYOR

M. M. NONAKA
CHIEF

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DIV. OF WASTEWATER MANAGEMENT

March 11, 1982

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

FROM: MELVIN M. NONAKA, FIRE CHIEF

RE: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN,
WAIALUA-HALEIWA, OAHU, HAWAII

We have no objections or comments on the proposed project at this time.

Melvin M. Nonaka,
Fire Chief

MMN:ct/PM

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

EILEEN R. ANDERSON
MAYOR

MICHAEL J. CHUN, Ph.D.
DIRECTOR AND CHIEF ENGINEER
DEPUTY DIRECTOR

WPP 83-77

February 18, 1983

MEMORANDUM

To: Mr. Melvin M. Nonaka, Fire Chief
Fire Department

From: Michael J. Chun, Director and Chief Engineer

Subject: Your Memorandum of March 11, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Environmental Impact Statement Preparation Notice (EISPN) for this project. Your letter indicating no comments on the EISPN is acknowledged.

Should there be any questions, please contact Ms. Geraldine Lum at extension 4067.

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

OAHU CIVIL DEFENSE AGENCY

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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DIV. OF WASTEWATER MANAGEMENT

February 26, 1982

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

FROM : MALCOLM A. SUSSEL, ACTING ADMINISTRATOR

SUBJECT : ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN
WAIALUA-HALEIWA, OAHU, HAWAII

In reference to your memo dated February 23, 1982 requesting comments on the proposed Waialua-Haleiwa Wastewater Facilities, the following is submitted:

- There are no apparent adverse effects from the standpoint of Civil Defense planning caused by the development of the proposed facilities.
- It is noted that the proposed facilities fall within the 100-year flood plain, excepting the treatment plant.
- It is further noted that the major portion of the system, including the four pumping stations, are within the projected potential tsunami inundation zone.

MALCOLM A. SUSSEL
Acting Administrator

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DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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

WPP 83-78

DEPUTY DIRECTOR

February 18, 1983

MEMORANDUM

To: Mr. Malcolm Sussel, Administrator
Oahu Civil Defense Agency

From: Michael J. Chun, Director and Chief Engineer

Subject: Your Memorandum of February 26, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

We acknowledge that there appears to be no adverse effects caused by the development of the sewage treatment facilities from the standpoint of Civil Defense planning.

It is true, as you noted, that most of the collection lines and sewage pump stations do fall within the 100-year flood plain or 100-year tsunami inundation zone. The effects of floods and tsunamis in relation to the various wastewater treatment alternatives will be examined in the EIS.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at extension 4067.

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

1455 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96814 - AREA CODE (808) 955-8111

EILEEN R. ANDERSON
MAYOR

FRANCIS KEALA
CHIEF

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OUR REFERENCE MS-JS

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TO

March 5, 1982

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

FROM: FRANCIS KEALA, CHIEF OF POLICE

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN,
WAIALUA-HALEIWA, OAHU, HAWAII

We have no objections to the proposed Environmental Impact Statement to be prepared covering various alternative wastewater treatment and disposal systems for the Waialua-Haleiwa area.

The implementation of any such system would only be of concern to our department in reference to traffic flow and vehicular noise control during construction activities.

FRANCIS KEALA
Chief of Police

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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

WPP 83-79

DEPUTY DIRECTOR

February 18, 1983

MEMORANDUM

To: Mr. Francis Keala
Chief of Police

From: Michael J. Chun, Director and Chief Engineer

Subject: Your Memorandum of March 5, 1982 (reference MS-JS) Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

In the EIS we will address the construction period impacts of the wastewater treatment system alternatives, including impacts on traffic flow and vehicular noise.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at extension 4067.

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

NORTH SHORE NEIGHBORHOOD BOARD NO. 27
P. O. Box 607
HALEIWA, HAWAII 96712

82-0357
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3/29/82

RECEIVED
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DIV. OF WASTEWATER MANAGEMENT

March 23, 1982

Geraldine Lum, Planning Section
Division of Wastewater Management
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

SUBJECT: WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN EIS PREPARATION NOTICE.

Dear Miss Lum:

The North Shore Neighborhood Board has evaluated the EIS Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan. We feel there is a need for district wide service but we will continue to poll the community to determine their feelings. One of our concerns is the cost to the individual landowner and feel this area should be addressed in the EIS.

Areas that need further analysis are disposal of the effluent if the sugar industry folds and the location of the site. The preparation notice did not clearly outline the location of the two possible sites. With the Mokuleia site, noise and odor problems need to be addressed. With the Kawailoa site, the Ukoa Marsh is a delicate area and needs to be carefully evaluated.

The Board would like to thank you for the opportunity to comment on the Preparation Notice. We would appreciate being consulted when the EIS is prepared.

Sincerely,

Laura Bolles

Laura Bolles
Chairman NSNB

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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

WPP 83-80

DEPUTY DIRECTOR

February 18, 1983

Ms. Laura Bolles, Chairman
North Shore Neighborhood Board No. 27
P.O. Box 607
Haleiwa, Hawaii 96712

Dear Ms. Bolles:

Subject: Your Letter of March 23, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project. Responses to the comments in your letter are given below.

If a centralized sewage treatment system alternative is designed and constructed for the Waialua-Haleiwa sewerage district, it would not serve every house in the district, but only those in the urban area, i.e. the towns of Waialua and Haleiwa. Houses in the outlying rural areas would continue to be served by their individual systems (mostly cesspools). Lots that are within the service area of the centralized collection system are required to hook up to it. Costs for this are outlined on page 15 of the EISPN and will be further discussed in the Environmental Impact Statement (EIS).

If Waialua Sugar Company should cease its operations, its fields might be used for other crops which could be irrigated with effluent from a treatment plant. If no new agricultural operation were initiated, or if the available effluent were to prove unsuitable for the new use, then it might be necessary for the City to acquire land for growing a crop, such as California grass, which could be irrigated with treated sewage effluent. Exfiltration wells are expected to be installed as a back-up system for the disposal of effluent in any case. These disposal options will be further analyzed in the EIS.

The EIS will clearly outline the location of the two possible sewage treatment plant (STP) sites. The Mokuleia site has been located closer to Farrington Highway; this will help avoid noise and odor impacts on the residences in that area. These impacts will be addressed in the EIS. The impacts on Ukoa Marsh of building an STP on the Kawailoa site will also be carefully evaluated.

All comments on the EISPN have been reviewed, and the EIS is expected to be completed shortly. The State Environmental Quality Commission has included the North Shore Neighborhood Board on their distribution list for the EIS.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: ✓ Belt, Collins & Associates
Environmental Quality Commission

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WAIALUA COMMUNITY ASSOCIATION, INC.

TELEPHONE
WAIALUA 637-4606

66-434 KAMEHAMEHA HIGHWAY
HALEIWA, HAWAII 96712

March 22, 1982

Dept. of Public Works
City and County of Honolulu
650 South King St.
Honolulu, Hawaii 96813

Re: Dept. of Public Works letter dated February 23, 1982. Subject: Environmental Impact Statement Preparation Notice Waialua-Haleiwa Wastewater Facilities Plan, Waialua-Haleiwa, Oahu, Hawaii.

Above reference has been reviewed. Many residents are concerned by the deterioration or reported deterioration of reefs and marine life in the area due to failures and/or seepage from private sewerage disposal systems and other waste water disposal. It is recommended that this be further addressed.

The viability of the sugar industry is such that alternatives for disposal of treated effluent should be considered including possibility of irrigation of other crops and disposal for non-agricultural use.

Request for review purposes a copy of the completed Environmental Impact Statement.

Sincerely,

Nerl Hawthorne
Nerl Hawthorne
President
Waialua Comm. Assoc.

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

EILEEN R. ANDERSON
MAYOR

MICHAEL J. CHUN, Ph.D.
DIRECTOR AND CHIEF ENGINEER
DEPUTY DIRECTOR

WPP 83-81

February 18, 1983

Mr. Merl Hawthorne, President
Waialua Community Association
66-434 Kamehameha Highway
Haleiwa, Hawaii 96712

Dear Mr. Hawthorne:

Subject: Your Letter of March 23, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project. Responses to the comments in your letter are given below.

Community concern for the health of reefs and marine life in the Waialua-Haleiwa area is understandable. However, there is no factual evidence that seepage from cesspools or private sewage disposal systems has had a measurable adverse effect on marine biota. The concern about the seepage is that it may constitute a public health hazard if overflows occur, due to conditions such as heavy rains and/or flooding. The reefs are probably affected more by soil particles contained in the surface runoff that occurs during heavy rainfall events. In particular, Kiikii Stream, Paukauila Stream, and the Anahulu River carry large amounts of sediment onto the reef, and this may be a more significant impact on the vitality of the reef.

Several alternatives for disposal of treated effluent were considered in developing the Facilities Plan for the area. Irrigating sugarcane is the primary means proposed for effluent disposal. However, exfiltration/injection wells would be required as a back-up system for the disposal of the effluent. It is also feasible to use effluent to irrigate other crops or non-agricultural areas, such as golf courses. If the Waialua Sugar Company should cease its operations, its fields might be used for other crops which could be irrigated with effluent from a treatment plant. If no new agricultural operation were initiated, or if the available effluent were to prove unsuitable for the new use, then it might be necessary for the City to acquire land for growing a crop, such as California grass, which could be irrigated with treated sewage effluent. This scenario will be examined as part of the on-going work of the Facilities Plan and will be discussed in the EIS.

All comments on the EISPN have been reviewed, and the EIS is expected to be completed shortly. We will inform the Environmental Quality Commission to include you on their distribution list for the EIS.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

820 1790
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HAWAIIAN ELECTRIC COMPANY, INC.
Box 2750 . Honolulu, Hawaii / 96840

RICHARD L. O'CONNELL P.E.
MANAGER ENVIRONMENTAL DEPARTMENT

March 15, 1982

ENV 2-1
NV/G

RECEIVED
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TO

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

Dear Mr. Chun:

Subject: EIS Preparation Notice
Waialua-Haleiwa Wastewater Facilities Plan
Waialua-Haleiwa, Oahu, Hawaii

The Waialua-Haleiwa Wastewater Facilities Plan, as proposed, will negatively impact Hawaiian Electric facilities. HECO's "Mokuleia Mobile Radio Station" is now located in an area which is designated by the plan for disposal of treated effluent.

A review of the specific alternatives presented in the EIS for this project is anticipated.

Sincerely,

R. L. O'Connell

Richard L. O'Connell
Manager, Environmental Department

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DIV. OF WASTEWATER MANAGEMENT

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

EILEEN R. ANDERSON
MAYOR

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

WPP 83-82

DEPUTY DIRECTOR

February 18, 1983

Mr. Richard L. O'Connell
Manager, Environmental Department
Hawaiian Electric Company, Inc.
Box 2750
Honolulu, Hawaii 96840

Dear Mr. O'Connell:

Subject: Your Letter of March 15, 1982 (reference ENV 2-1 NV/G) Regarding the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

Leland Lee of Belt, Collins & Associates contacted Peter Perkins of your staff on March 22, 1982 to discuss Hawaiian Electric Company's concerns. In the course of the conversation it was determined that there would be no negative impact on HECO's "Mokuleia Mobile Radio Station." This site is not within the effluent disposal area, rather it is adjacent to the sugarcane fields which would be irrigated with treated effluent. Use of the effluent would not alter the irrigation rate, hence there would be no adverse impact on HECO's facilities.

Thank you for discussing this issue with us. Clarification of issues such as this is one of the purposes of the EIS process.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

He ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

PRI Gasco, Inc.
A Pacific Resources, Inc. Company

PRI Tower 733 Bishop Street
P O Box 3379 Honolulu, Hawaii 96842
Telephone 808 547 3333 Telex 0634238

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March 9, 1982

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DIV. OF WASTEWATER MANAGEMENT

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

Dear Mr. Chun:

Re: EIS Preparation Notice
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for providing notice and opportunity for input on EIS preparation for the above project. We have reviewed the information provided and have no comment at this time. We appreciate your continuing to consider the Gas Company in your planning.

Very truly yours,

Martin A. Smith
Supervisor of Environmental Affairs

MAS:nt

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

EILEEN R. ANDERSON
MAYOR

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

WBP 83-83
DEPUTY DIRECTOR

February 18, 1983

Mr. Martin A. Smith
Supervisor of Environmental Affairs
Gasco, Inc.
P.O. Box 3379
Honolulu, Hawaii 96842

Dear Mr. Smith:

Subject: Your Letter of March 9, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project. Your letter indicating no comments on the EISPN is acknowledged.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

Me ke aloha pumehana,

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

RECEIVED
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DIVISION OF
WASTEWATER
MANAGEMENT

Hanahoa Computers

Your "Working Partner"

1118A Bishop Street   Honolulu, Hawaii 96813   (808) 523-5577

Joseph B. Rothstein
General Manager

820 3350
DIR
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May 25, 1982

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

RECEIVED
DEPT. OF PUBLIC WORKS
MAY 28 10 35 AM '82
TO

re: Waialua-Haleiwa Wastewater Facilities Plan
Environmental Impact Statement

Dear Mr. Chun:

In reviewing the Environmental Impact Statement Preparation Notice for the Waialua-Haleiwa Wastewater Facilities Plan, it became apparent that the 208 Plan's conclusion -- that existing water quality problems warranted development of centralized wastewater treatment facilities serving the urban portions of the Waialua District -- was being used to establish the need for the project. However, a close reading of the 208 Plan for Oahu shows that the authors of that document did not present the scientific data on which this conclusion was supposedly based. Instead, they seem to have assumed that the presence of a significant number of cesspools within a limited geographic area would automatically lead to significant adverse effects on water quality. Certainly, no objective demonstration of this is presented in the 208 Plan report.

In view of the above, I believe the EIS for the proposed Facilities Plan should include a discussion, perhaps in the form of a letter from the Department of Health, of the water quality data which led to their conclusion regarding the desirability of a centralized wastewater treatment system.

I look forward to reviewing the EIS; thank you for this opportunity to comment on the EISPN.

Sincerely yours,

Joseph B. Rothstein

Joseph B. Rothstein

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

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

WPP 83-84

DEPUTY DIRECTOR

February 18, 1983

Mr. Joseph B. Rothstein
Hanahoa Computers
1164 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Rothstein:

Subject: Your Letter of May 20, 1982
Regarding the Environmental Impact
Statement Preparation Notice for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing and commenting on the Environmental Impact Statement Preparation Notice (EISPN) for this project.

Your observation that the initiation of the Waialua-Haleiwa Facilities Plan study came about because of recommendations made in the Water Quality Management Plan for Oahu (the 208 Plan) is correct. So is your statement that the 208 Plan does not present detailed water quality data which conclusively demonstrate the presence of cesspool-related water quality problems in the Waialua-Haleiwa area. Given the extremely dynamic nature of the many factors which influence water quality (e.g., groundwater flux, location of wastewater sources, fertilization practices, soil type, geology, ocean currents, and biologic activity, to name just a few), characterization of the water quality of a particular area is more a qualitative art than an objective science. Because of this, the 208 Plan did not attempt a rigorous quantitative demonstration of the presence of a water quality problem. Rather it noted (p. 10-7) that previous efforts to rely on such analyses had not produced useful information.

Instead of the "affirmative demonstration" approach, the 208 Plan attacked the problem inferentially. It noted that raw wastewater contains pollutants (chemicals, bacteria, viruses, and nutrients) which can adversely affect potable water supplies and the quality of the aquatic environment, and it concluded that cesspools are relatively inefficient at removing some of these. It further observed that the probability of these adverse effects occurring increases in direct proportion to the concentration of cesspools and their failure rates. Because Waialua-Haleiwa is a relatively densely settled cesspool community, has a high rate of cesspool failures, and is in proximity to nearshore waters, it was judged a high-priority candidate for sewer construction. In short, the 208 Plan's recommendation that centralized

wastewater treatment facilities be developed for Waialua-Haleiwa was based on the fact that a significant proportion of the cesspools are no longer capable of disposing of the waste which they receive and also on the potential which inadequately treated wastewater has for adversely affecting public health.

The situation has admittedly not reached the point where there are clearly documented outbreaks of wastewater-borne diseases. However, it would seem imprudent to wait for such a situation to develop before taking preventative measures. Because of this, the Department has undertaken the current study of wastewater treatment alternatives.

All comments on the EISPN have been reviewed, and have guided preparation of the EIS. The EIS is expected to be completed shortly. It will then be filed with the Environmental Quality Commission for the 30-day public review period. At that time, we will again appreciate your review and comment.

Should there be any questions, please contact Ms. Geraldine Lum at 523-4067.

He ke aloha pumehana,

Michael J. Chun

MICHAEL J. CHUN
Director and Chief Engineer

cc: Belt, Collins & Associates
Environmental Quality Commission

DRAFT EIS COMMENTS & RESPONSES

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DIV. OF WASTEWATER MANAGEMENT

RECEIVED DEPT OF PUBLIC WORKS

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STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

Harvin T. Miura, Ph.D.
DIRECTOR

TELEPHONE NO.
548-6915

ENV ul
7/23 WWM

July 21, 1987

Mr. Alfred Thiede
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

SUBJECT: Comments on the Waialua-Haleiwa Wastewater Facilities Plan

We have reviewed your Draft Environmental Impact Statement and offer our following comments:

1. The most frequent public complaint of sewage treatment plants is its bad smelling odor. Usually a residential development is designed around a sewage treatment plant, but in this instance the opposite will occur. Therefore residents who have never experienced the odor of a sewage treatment plant will suddenly have to deal with it on an ongoing basis. We anticipate a large number of complaints if odor is not handled properly. We, therefore, suggest the use of the best available odor control technology and the selection of a site with a sufficient buffer zone to dissipate the smell.

2. Since an ocean outfall is anticipated to be constructed eventually, we suggest that you pursue this means of effluent disposal rather then relying on an interim use of exfiltration wells. Exfiltration wells have a propensity to clog and may also result in coastal pollution through soil sepage.

3. In the construction of an ocean outfall, any blasting that may be required should not be conducted during the humpback whale migration season. Also care should be taken not to affect any existing surf or recreation sites.

4. We suggest the installation of backup generators and other safeguards to prevent the discharge of raw sewage during electrical blackouts. The discharge of raw sewage may necessitate the temporary closing of beaches in Waialua and Haleiwa which are heavily used for recreation.

Thank you for providing us the opportunity to review your project.

Sincerely,

Marvin T. Miura, Ph.D.
Director

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI, MAYOR

ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER

WPP 87-489

September 10, 1987

Dr. Marvin T. Miura, Director
State Office of Environmental
Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Your Letter of July 21, 1987 Regarding the Draft Environmental Impact Statement for the <u>Waialua-Haleiwa Wastewater Facilities Plan</u>

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. At this time we would like to acknowledge your comments point by point.

1. The wastewater management plan being proposed for this project includes provisions for best available odor control technology with supplemental odor polishing units. The proposed wastewater treatment plant (WWTP) site is set back approximately 1,800 feet mauka from the main highway. This setback will provide additional buffer between the WWTP and the nearest resident. These steps have been taken to mitigate potential odor problems that may be created by this project.

2. Interim use of exfiltration wells are being proposed for the following reasons:

   (a) Timing - installation of the exfiltration wells as an interim measure allows the City to start implementing the proposed centralized system at the earliest possible date. The use of the ocean outfall would require that the construction of the system be delayed until the required additional oceanographic studies and a supplemental EIS are completed;

   (b) Implementability - the number of wells can be phased into operation as the need increases; and

   (c) Flexibility - the outfall being recommended in this report is sized to handle flows generated from existing population. Should the Mokuleia Resort development be approved in the near future, i.e., before the design of the outfall is completed, the delay in construction may allow for developer participation in the cost of the design and construction of the outfall. This will eliminate the need for costly expansion of the outfall at a later date.

   The design of the exfiltration well field includes provisions for excess disposal capacity (design based on twice the anticipated peak flow rate) and routine maintenance of wells. In addition, the effluent generated from this facility will be filtered to further reduce the suspended solids concentration. These factors should greatly reduce the potential for clogging of the well.

   Effluent being discharged into the wells will be secondarily treated, disinfected and filtered prior to discharge. Coastal water pollution is not expected to occur.

3. Construction of the outfall will include measures to mitigate possible adverse impacts on the migrating humpback whales as well as nearby recreational waters.

4. Emergency generators have already been included in the recommended system.

Should there be any questions, please contact Geraldine Lum at 527-5392.

Very truly yours,

Sam Callejo
for ALFRED J. THIEDE
Director and Chief Engineer

cc: DLU
BCA

875315

JOHN WAIHEE RECEIVED
GOVERNOR

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DIV. OF
WASTEWATER
MANAGEMENT

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

SUZANNE D. PETERSON
CHAIRPERSON, BOARD OF AGRICULTURE

TADASHI TOJO
DEPUTY TO THE CHAIRPERSON

ENVW
s/o WWM

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822-0159

August 7, 1987

RECEIVED
DEPT OF PUBLIC WORKS
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TO

MEMORANDUM

To: Dr. Marvin T. Miura, Interim Director
Office of Environmental Quality Control

Subject: Draft Environmental Impact Statement (EIS)
Waialua-Haleiwa Wastewater Facilities Plan
City & County of Honolulu Department of Public Works
TMK: 6-6 Waialua, Oahu
Acres: 16

The Department of Agriculture has reviewed the Draft EIS and has the following comments to offer.

The Department of Public Works proposes to construct a wastewater treatment plant (wwtp) and related facilities to serve the Waialua and Haleiwa area. The wwtp would occupy approximately 10 acres of prime agricultural land if the preferred site is selected and 6 additional acres for the disposal wells. We commented some years back on the EIS Preparation Notice and raised several issues which are not addressed in the subject Draft EIS (Draft EIS, page XI-21). These issues include: (1) encouraging the use of treated sewage effluent for agricultural irrigation, (2) selection of alternative sites that would avoid lands classified as "Prime" according to the Agricultural Lands of Importance to the State of Hawaii classification system, and lands currently engaged in productive agricultural pursuits, (3) the effect this proposed wwtp would have on urban growth in the North Shore region, and (4) to specify the capacity of the proposed sewage treatment plant. We would like to see these issues more fully addressed in the EIS.

PREFERRED SITE "IA"

The alternative site "IA" is classified "Prime" according to the Agricultural Lands of Importance to the State of Hawaii (ALISH) system.

Dr. Marvin T. Miura
August 7, 1987
Page -2-

The Soil Conservation Service Soil Survey identifies the soil as Waialua stony silty clay (W1B) with 3 to 8 percent slopes. The soil is used for sugar cane, truck crops, orchard and pasture. The soil capability classification is IIIe (soils subject to severe erosion hazard if cultivated and not protected).

The Land Study Bureau Overall Productivity Ratings are B125i and B132i. By this method of classification, the parcel has very good productivity potential for many agricultural uses.

Thank you for the opportunity to comment.

Suzanne D. Peterson
SUZANNE D. PETERSON
Chairperson, Board of Agriculture

cc: √DPW

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-487

September 10, 1987

Ms. Suzanne D. Peterson
Chairperson, Board of Agriculture
State Department of Agriculture
1428 South King Street
Honolulu, Hawaii 96814-2512

Dear Ms. Peterson:

Subject: Your Memorandum of August 7, 1987
Regarding the Draft Environmental
Impact Statement for the Waialua-Haleiwa
Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. We would like to take this opportunity to respond to your comments.

1. Reuse of Wastewater Effluent: Reuse of effluent for irrigation purposes, specifically irrigation of sugarcane and California grass, has been included in the evaluation of effluent disposal alternatives for this project. Our evaluation indicated that these options would not be the most viable alternatives primarily based on reliability and energy requirement factors. In addition, a one-hundred percent back-up effluent disposal system will have to be constructed and maintained to dispose of unutilized flows. It is noted that the use of effluent for irrigation of crops for direct human consumption would also bring up the possibility of disease transmission via consumption of these items.

2. Selection of Sites Out of "Prime" Agricultural Lands: Selection of the wastewater treatment plant (WWTP) site was based on evaluation of many factors, one of the most important being the health and welfare of the community. Location of the WWTP at the IA site, while removing a relatively small portion of "Prime" agricultural land from use, would greatly facilitate servicing of problem areas during the initial phases of construction.

It is noted that attempts were made in our evaluation to keep the facility out of "Prime" lands; however, due to the proximity of these other lands to nearby residences and the public's strong objections to sites makai of Farrington Highway, the WWTP site was ultimately moved into "Prime" lands.

3. Impact on North Shore Development: The proposed WWTP has essentially been sized to accommodate flows that would be generated by the existing population in the urban portion of the study area. This project should therefore have little direct impact on urban growth in the North Shore region.

4. WWTP Capacity: The capacity of the WWTP has been specified as 1.4 million gallons per day (average flow).

Should there be any questions, please contact Geraldine Lum at 527-5392.

Very truly yours,

Sam Callejo
for ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

879093

DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

JOHN WAIHEE, GOVERNOR
ROGER A. ULVELING, DIRECTOR
MURRAY E. TOWILL, DEPUTY DIRECTOR
BARBARA KIM STANTON, DEPUTY DIRECTOR

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DIV. OF WASTEWATER MANAGEMENT

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TO

Ref. No. P-6883

July 30, 1987

Marvin T. Miura, PhD.
Director
Office of Environmental
Quality Control
465 South King Street
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Draft Environmental Impact Statement (DEIS), Waialua-Haleiwa Wastewater Facilities Plan

We have reviewed the subject draft EIS and have the following comments to offer.

Hawaii State Plan and State Functional Plans

The subject draft EIS identifies several Hawaii State Plan objectives and policies relevant to the wastewater treatment and disposal facilities proposed for the Waialua-Haleiwa area. The EIS should also consider the relationship of the proposed project to Section 226-16, policy (b)(3), which states, "Reclaim and encourage the productive use of runoff water and waste water discharges." Further, the EIS should review Section 226-104, particularly priority guidelines (a)(1), (a)(3), and (b)(6), to identify potential relationships and impacts.

While the Table of Contents of the subject draft EIS identifies State Functional Plans as an item to be covered in the review of relevant land use plans and controls, we find no narrative in Section III concerning potential functional plan relationships. The State Health Functional Plan and Technical Reference Document identify pollution control and abatement as a program activity. We encourage you to review and assess appropriate sections.

Coastal Ecosystems

An objective of the Hawaii Coastal Zone Management Program is to protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems. It is not clear from the text of the draft EIS why Site 1A with the ocean outfall is the preferred alternative. Environmental considerations in the matrices of Tables II-6 and II-8 appear to include only visual and odor criteria. Site selection and treatment-method

selection should take into account other environmental factors as well, such as the project's effects on water quality, flora and fauna, historic resources, and susceptibility to coastal flooding and tsunami.

The draft EIS states that the area in which the discharge from the proposed outfall will occur does not appear to contain rare or endangered species. According to the National Marine Fisheries Service, the endangered green sea turtle, the endangered humpback whale, the melon-headed whale, and the protected Laysan albatross have been sighted near the location of the proposed outfall. The final EIS should discuss potential impacts of the proposed dredging for and operation of the ocean outfall on these fauna. It should also discuss impacts on the numerous other marine species in the area that are valuable for commercial and recreational fishing.

Proposed Secondary Resort Area at Mokuleia

The EIS should discuss the relationship, both functionally and geographically, of the wastewater treatment plant and the proposed secondary resort area at Mokuleia.

Thank you for allowing us the opportunity to comment.

Sincerely,

Roger A. Ulveling

cc: Department of Land Utilization
City and County of Honolulu
Department of Public Works
City and County of Honolulu

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

WPP 87-512

September 10, 1987

Mr. Roger A. Ulveling, Director
State Department of Business and
Economic Development
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Ulveling:

Subject: Your Letter of July 30, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement for this project. We would like to take this opportunity to respond to your comments.

1. Hawaii State Plan and State Functional Plans:

   a. HRS Section 226-16, Policy (b)(3): During the course of evaluating the various effluent disposal alternatives for this project, efforts were made to reclaim and reuse the effluent generated by the proposed wastewater treatment plant. However, these alternatives were not found to be feasible for this proposed action primarily due to the large land area requirement, irregular demand for effluent, and high cost involved in such reclamation and reuse alternatives. In the case of sugarcane irrigation, the uncertainty of the long term viability of the sugar industry also makes the use of this alternative less desirable for use as a long term disposal alternative.

      In regard to the reuse of runoff water, it is anticipated that construction of the proposed facilities will add only very little to the existing runoff volume generated. Collection and reuse of this small runoff volume would not create any beneficial impacts and is therefore not included in this proposed action.

   b. HRS Section 226-104, Priority Guideline (a)(1) and (a)(3): The population projections used in this EIS reflect the limited growth projected for the area and are consistent with existing Development and General Plans.

   c. HRS Section 226-104, Priority Guideline (b)(6): The intent of the proposed plan is to provide a centralized wastewater management system for the existing population in the urban portion of the study area. A portion of the funds for the construction of the proposed system will come from the private sector via the improvement district assessments that would be paid by the individual property owners.

   d. The text has been revised to include discussion of the State Health Functional Plan.

2. Coastal Ecosystems: Selection of treatment and disposal methods took into consideration several factors (main factors summarized on the tables you have pointed out). Outfall disposal was selected over other disposal alternative primarily based on the long term reliability of the system. The text has been revised to further clarify this item. It is acknowledged that the EIS does not address all potential impacts of the outfall system.

   As noted in the EIS, additional studies must still be conducted. Detailed evaluation, such as what you are requesting will be conducted upon completion of these studies and summarized in a supplemental EIS which will be prepared for the outfall.

3. Proposed Secondary Resort Area in Mokuleia: The proposed Mokuleia Resort could potentially have a significant impact on the projected wastewater flow rates from the study area. However, plans for this development have not yet been finalized or approved, and therefore have not been included in the evaluations conducted for this report. Should this proposed resort development receive approval, the two basic options available to the developer are the construction of a separate private wastewater treatment plant or the expansion of the proposed Mokuleia WWTP and outfall system.

Should there be any questions, please call Geraldine Lum at 527-5392.

Very truly yours,

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

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STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
... ROAD, HONOLULU, HAWAII ...

RECEIVED
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TO

June 30, 1987

HIEC

Director
Office of Environmental
Quality Control
465 South King St., Rm. 104
Honolulu, Hawaii 96813

AND

Mr. John P. Whalen, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Director:

Waialua-Haleiwa Wastewater Facilities Plan
Waialua-Haleiwa, Oahu

Thank you for providing us the opportunity to review the above subject project.

We have no comments to offer at this time regarding this project.

Yours truly,

signed
Jerry M. Matsuda
Major, Hawaii Air
National Guard
Contr & Engr Officer

Enclosure

cc: C&C of Honolulu, Dept of Public Works

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DIV. OF WASTEWATER MANAGEMENT

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

July 27, 1987

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JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

COPY

In reply, please refer to:
EPHSD

MEMORANDUM

To: Director, Office of Environmental Quality Control
Director, Department of Land Utilization, City & County of Honolulu

From: Director of Health

Subject: Draft Environmental Impact Statement for Waialua-Hale'iwa Wastewater Facilities Plan, Oahu

Thank you for allowing us to review and comment on the subject DEIS. We provide the following comments:

Noise

1. Noise from the wastewater treatment plant and the sewage pump stations' equipment, such as electric motors, air compressor pumps and emergency generators, must be attenuated to meet the allowable noise levels as stated in Title 11, Administrative Rules Chapter 43, Community Noise Control for Oahu.

2. Activities associated with the construction phase must also comply with the provisions of Chapter 43.

   a. The contractor must obtain a noise permit since the noise levels from the construction activities are expected to exceed the allowable levels of the rules. The Community Noise Permit should be included with the permits and approvals listed in Part H, page 10, Necessary Permits and Approvals.

   b. Construction equipment and onsite vehicles requiring an exhaust of gas or air must be equipped with mufflers.

   c. The contractor must comply with the conditional use of the permit as specified in the rules and conditions issued with the permit.

3. Traffic noise from heavy vehicles travelling to and from the construction sites must be minimized near existing areas and must comply with the provisions of Title 11, Administrative Rules Chapter 42, Vehicular Noise Control for Oahu.

4. Should there be a baseyard or stockpile area located near residences, mitigative measures, such as barriers or berms, must be constructed to minimize noise impacts from such areas.

Director, OEQC
Director, DLU
July 27, 1987
Page 2

COPY

Vector Control

Abandoned cesspools must be filled to prevent rat nesting and in some cases, mosquito breeding.

JOHN C. LEWIN, M.D.

cc: Mr. Alfred J. Thiede

JOHN WAIHEE
GOVERNOR

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ENV
WWM

WINONA E. RUBIN
DIRECTOR
HAROLD FALK
DEPUTY DIRECTOR
ALFRED K. SUGA
DEPUTY DIRECTOR

TO ——— STATE OF HAWAII
DEPARTMENT OF SOCIAL SERVICES AND HOUSING
P. O. Box 339
Honolulu, Hawaii 96809

July 16, 1987

RECEIVED
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DIV. OF
WASTEWATER
MANAGEMENT

Director
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Sir:

Subject: Draft Environmental Impact Statement
Waialua - Haleiwa Wastewater Facilities
Plan

The Hawaii Housing Authority has reviewed the EIS for the Waialua - Haleiwa Wastewater Facilities Plan and has no comments to offer relative to the proposal.

Thank you for the opportunity to comment on this matter.

Sincerely,

WINONA E. RUBIN
Director

cc: Mr. Alfred J. Thiede, Director
Department of Public Works

JOHN WAIHEE
GOVERNOR OF HAWAII

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DIV. OF
WASTEWATER
MANAGEMENT

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

873863

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

LIBERT K. LANDGRAF
DEPUTY

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

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July 10, 1987

Mr. John P. Whalen, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Whalen:

SUBJECT: Review of Draft EIS, Waialua-Hale'iwa Wastewater Facilities Plan
Waialua-Hale'iwa, Oahu
TMK 6-6-various and 6-1-various

Thank you for the opportunity to review this EIS.

We find that archaeological surveys have taken place, and that site 80-04-3400 is proposed for archaeological testing. We concur with the statement that intensive archaeological investigation of this site, including detailed mapping and controlled test excavations to determine the feature's age, function and significance will result in a "no adverse effect" determination.

We would appreciate submission of two copies of the report resulting from this investigation, and would be glad to review the report and forward our comments to your office.

We also note that the EIS states (page IV-46) that unknown subsurface archaeological remains may be encountered in excavation for the pump station, sewer mains, or the Waste Water Treatment Plant location, and that our office will be notified if such discoveries are made. We would add only that in this particular area, such discoveries are extremely probable and that construction personnel should be apprised of this possibility.

Sincerely,

WILLIAM W. PATY
Chairperson and State
Historic Preservation Officer

cc: Director, Office of Environmental Quality Control
Alfred J. Thiede, Director, Department of Public Works

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

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-508

September 10, 1987

Mr. William W. Paty
Chairperson and State Historic
Preservation Officer
State Department of Land and
Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Subject: Your Letter of July 10, 1987 Regarding the
Draft Environmental Impact Statement for the
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. We would like to take this opportunity to clarify one point made in your letter. The wastewater treatment plant for the system being proposed would be located at the IA site. Construction of the treatment plant at this site should have no impact on site 80-40-3400. Additional testing of Site 80-04-3400 (near the alternate Kawailoa treatment plant site) would be conducted only if, for some reason, the treatment plant site is relocated to the Kawailoa site.

Your office will be kept informed of any additional archaeological studies conducted for the design phase of this project. In addition, your office will be notified if construction activities uncover any buried archaeological sites.

Should there be any questions, please contact Geraldine Lum at 527-5392.

Very truly yours,

for ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-503

September 10, 1987

Dr. John C. Lewin
Director of Health
State Department of Health
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Lewin:

Subject: Your Memorandum of July 27, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. Your comments have been incorporated into the report.

Should there be any questions, please call Geraldine Lum at 527-5392.

Very truly yours,

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

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STP 8.2180

July 8, 1987

Director
Office of Environmental Quality Control
465 South King Street, Room 115
Honolulu, Hawaii 96813

Gentlemen:

Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

While we prefer that the sewer line not be located within the State highway right-of-way, in those areas where this is not possible, the alignment should be as close to the right-of-way boundary as practicable. Therefore, all plans for work within the State highway right-of-way must be submitted to and approved by our Highways Division.

Thank you for this opportunity to review and comment on this draft EIS.

Very truly yours,

Edward Y. Hirata
Director of Transportation

AS/DT:ko

cc: STP(dt)
Alfred Thiede, C&C DPW

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

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-501

September 10, 1987

Mr. Edward Y. Hirata
Director of Transportation
State Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hirata:

Subject: Your Letter of July 8, 1987 Regarding the Draft Environmental Impact Statement for the <u>Waialua-Haleiwa Wastewater Facilities Plan</u>

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. Your recommendations regarding the location of sewer lines within State highway right-of-ways will be taken into consideration during the design phase of this project. All plans for work within the State highway right-of-way will be submitted to the Highways Division for approval.

Should there be any questions, please call Geraldine Lum at 527-5392.

Very truly yours,

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
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JUN 29 1987

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TO

Director
Office of Environmental
  Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Mr. John P. Whalen, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Gentlemen:

Subject: Waialua-Haleiwa Wastewater Facilities Plan

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

Very truly yours,

T. Tominaga

TEUANE TOMINAGA
State Public Works Engineer

SM:jk
cc: Mr. Alfred J. Thiede

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DIV. OF WASTEWATER MANAGEMENT

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

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s/o WWM

August 7, 1987
RE:0468

RECEIVED
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AUG 10 8 45 AM '87
TO

Dr. Marvin Miura, Director
Office of Environmental Quality Control
465 South King Street
Honolulu, Hawaii 96813

Mr. John P. Whalen, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Dr. Miura and Mr. Whalen:

Draft Environmental Impact Statement
Waialua-Haleiwa Wastewater Facilities Plan
Waialua-Haleiwa, Oahu

The Environmental Center has reviewed the above referenced Draft Environmental Impact Statement (EIS). We have been assisted in this review by Bertell Davis, Anthropology; Paul Ekern, Agronomy and Soils; Hans-Jurgen Krock, Ocean Engineering; Frank Peterson, Geology & Geophysics; and Jennifer Crummer, Environmental Center.

The proposed plan involves construction of a wastewater treatment facility by the City and County of Honolulu for the Waialua-Hale'iwa area. The project is to be located on 10 acres of "prime" agricultural land and is designed to process 1.4 million gallons of wastewater daily. The disposal of the treated wastewater initially will be by exfiltration (injection) wells with eventual conversion to an ocean outfall system.

General Comments

The increasing urbanization of the Waialua-Haleiwa area calls attention to the need for a change from individual cesspool wastewater systems to a more centralized wastewater treatment facility such as is proposed by this project. The concern expressed by our reviewers, however, is that the present Draft EIS falls far short of adequacy with regard to its evaluation of environmental effects of the disposal options presented. The issues of particular concern in this regard are:

1. The environmental impacts associated with the location, construction, and implementation of an ocean outfall system.

2. The environmental impacts associated with the siting, operations, life expectancy and probability for success of the proposed injection wells.

Ocean Outfall

Though an ocean outfall is anticipated, impacts of its construction and use are inadequately addressed. A discussion of the coastal biology, trenching, ocean currents, and predicted plume excursions should be included in the EIS in accordance with EIS rules Section 11-200-17.

Construction of the STP facility will predicate the location of the future outfall and thus eliminate full consideration of alternate outfall siting choices. Adequate assessment of the outfall at this early stage of planning is essential to provide for an environmentally and economically rational site selection and development plan.

On pages I-13 and IV-8, reference is made to a study conducted by R.H. Towill (1967) that concluded that the optimum location of the outfall was the Kaiaka Channel. The study is not referenced in Chapter XII, and details of the study are not included in the Draft EIS. We are, therefore, unable to evaluate the merits of the outfall site selection against present day knowledge. It would seem that more recent data should be considered prior to a firm committment to Kaiaka Channel and the siting of the STP. Not only are additional coastal resource data likely to be available, but also, new techniques in pipeline installation and engineering designs may dictate significant changes in the construction and/or location.

The implication in the Draft EIS that experience gained in the effects and attributes of Ocean outfalls elsewhere on Oahu can be applied to the Waialua-Halieva outfall is only partially correct. Certainly some of the operational aspects of the pipeline construction are transferrable. However, to assume that environmental conditions and impacts can be determined on the basis of work done elsewhere is patently inappropriate. Oceanographic conditions at Waialua-Halieva are quite different from those at the other outfall sites on Oahu and certainly will require careful site-specific studies to assure that the discharge does not significantly impact coastal or nearshore resources.

The recent success of the emplacement of the 16" plastic pipe to deep water at Keahole highlights one of the newer innovative approaches being developed to reach deep water resources. We understand that this pipe was laid at approximately 1/10th the cost of the previously engineered offshore pipelines. We are not suggesting that these newer techniques and materials are directly applicable to sewer outfall pipes, but we do suggest that alternatives to traditional designs with high installation costs should be considered.

Injection Wells

The information provided on the use of injection wells is insufficient to allow adequate environmental assessment of the efficacy and consequences of their use. Page I-13 states that 80 wells with capacities of 100 gpm/well will be required to dispose of the wastewater but no data are offered to support this need. The reference to Geolabs (1987) is not listed in Chapter XII, thereby making details of that study unavailable for review. Furthermore, the injection well capacity cited in the Draft EIS is 11.5 mgd (80 wells at 100 gpm/well). The projected STP capacity is given as 1.4 mgd. This equates to a backup capacity of over 800 percent. This seems excessive for a "temporary" disposal option. While injection wells can be a reasonable solution to the wastewater disposal issue when sited in the proper location, their use is frequently cut short by clogging. What is the expected duration of their useage for this STP?

Specific Comments

Sludge Treatment and Disposal: It is our understanding that sodium hydroxide is not used "to destroy the micro-organisms responsible for generating H_2S" as stated on page II-12 but rather to raise the pH so that H_2S stays in an ionized form, thereby controlling odor. We understand that H_2O_2 is being used successfully for odor control at the Waianae Treatment Plant and that NAOH is used at Midway Island. Which of these chemicals would be best suited for odor control alternatives at the Waialua-Haleiwa plant?

Effluent Disposal System: The Draft EIS briefly discusses (p. II-6-10) the reuse of the wastewaters for irrigation and concludes that such reuse would not be economic due to the large acreage required. Was the proposed new development at Mokuleia taken into consideration both in sizing the WWTP as well as providing a possible land area (golf course?) for reuse of the effluent?

Air Quality: Salt spray on the North shore of Oahu can reach significant levels during high surf periods. As this would constitute a highly corrosive agent to most metal surfaces, the effects of its presence should be included in the discussion of air quality/impacts.

Humidity/Pan Evaporation: The discussion on page III-48 addresses values which appear to reflect Class A Pan Evaporation amounts. Perhaps the heading of the paragraph should be modified to reflect the Class A category.

Treatment Process: Anaerobic digestion of sludge is very difficult and methane cannot be produced when sludge has excessive sulfates present. If H_2S is present in the sewers, complete digestion of sludge will be

difficult, and this will lead to odor problems. With this in mind, aerobic digestion processing of sludge should be considered as well as alternative sludge thickening and dewatering processes.

Historical Sites: In general, the archaeological report by Kennedy (Appendix A of the Draft EIS) seems adequate for a reconnaissance level survey. Kennedy's recommendations are also well made, particularly that more intensive site survey and testing for subsurface deposits be done prior to any construction once the proposed plant location is finalized. We note that pages IV-45 and 46 of the Draft EIS state that construction of the proposed M-2 alternative will not adversely affect known archaeological remains, since this plant site is located seaward of the sites found by Kennedy's reconnaissance. However, we note that on page II-41 of the Draft EIS, (Figure II-15), the M-2 alternative will be in or very close to the east end of a large complex of site remains. (Using the Kawaihapai Reservoir for a reference point, compare Figure II-15 with Kennedy's Figure 3 keeping in mind that Kennedy notes that his map shows only the approximate boundaries of this complex). Therefore, if the M-2 option is chosen, the mitigating measures given in the Draft EIS concerning archaeological monitoring are insufficient. Kennedy's original recommendations should be implemented prior to any construction or site grading.

The copy of the archaeological reconnaissance survey report by Hommon included in the Draft EIS (Appendix A) is not complete; Figures 1, 2, and 3 are missing. Excepting a new site found by Hommon, there is no way for the reviewer to determine where any of the previously reported sites are located.

Hommon's report (Appendix A, pp. 4-7) lists a total of 29 numbered archaeological sites, plus another 5 localities containing multiple site remains. These are: Halemano and Opaeula Gulches, the sand dunes along Waialua Bay, Waialua (town?), and Anahulu Valley. Five of these sites were first recorded in 1979 by Chiniago, Inc.; the others had been recorded, or reported, in the case of previously destroyed sites, by J.G. McAllister in 1930-1933. According to Hommon's list, ten of the numbered sites still exist:

#202	Burials in sand dunes to the west of Kaiaka Bay
#204	"Oahunui Stone"
#205	"Akua Stone"
#233	Small fresh water pond of ca. 2.5 acres
#236	Ukoa, or Ukua, fishpond
#1439	Historic refuse area dating to ca. AD 1880-1920
#1440	Wall remnant
#1441	Irrigated agricultural terraces of ca. 2.47 acres
#1442	The Emerson missionary homestead occupied ca. AD 1832-1842
#1443	An "old church" whose masonry walls probably date to the Emerson missionary period.

Apparently archaeological remains also survive in at least four of the areas identified as "localities": Halemano and Opaeulu Gulches, the sand dunes along Waialua Bay, and Anahulu Valley. It is difficult to ascertain from either the Hommon report or the Draft EIS, but apparently none of these sites are on the Hawaii State or the National Registers of Historic Places, and are therefore not addressed in the Draft EIS. Only the newly found site and eight properties that are listed on the Hawaii State Register are noted in the text of the Draft EIS (p. III-62), and again, excepting the new site, no map is given showing where these sites are located respective to the proposed undertaking. These deficiencies should be addressed in the Final EIS.

There appears to be an inconsistency between the text and the data in Table III-11 and Figure 3 of Appendix A. The text (p. III-61) indicates that ten properties are currently on the State Register of Historic Places and that two of these are also on the National Register. Table III-11 however lists only eight properties. The inconsistencies and omissions identified in our review should be corrected in the Final EIS so that appropriate mitigation measures can be adequately evaluated prior to acceptance of the document.

Irrigation: Is the impending closure of Waialua Sugar Mill a factor in not using the effluent for irrigation alternatives? What effects would the closure of Waialua Sugar Mill have upon the Wastewater Treatment Plant?

Mokuleia: The section on the Mokuleia area should include consideration of the pending Mokuleia Development Plan. This development will undoubtedly generate a considerable amount of wastewater for which there will need to be some method of disposal. A cooperative effort to examine the longer term needs of the two actions, the WWSTP and the Mokuleia development should be considered.

We thank you for the opportunity to comment on this document and look forward to your consideration and response to our comments.

Yours truly,

Jacquelin N. Miller

Jacquelin Miller
Associate Environmental Coordinator

cc: Alfred J. Thiede, Public Works ✓
L. Stephen Lau
Bertell Davis
Paul Ekern
Hans-Jurgen Krock
Frank Peterson
Jennifer Crummer

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-488

September 10, 1987

Ms. Jacquelin Miller
Associate Environmental Coordinator
Environmental Center
University of Hawaii
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Ms. Miller:

Subject: Your Letter of August 7, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. We would like to take this opportunity to respond to your comments.

1. Ocean Outfall: Detailed evaluation for the outfall must still be completed. Prior to design of the outfall, additional detailed oceanographic studies must be conducted and the results evaluated. A supplemental EIS will be prepared upon completing these studies and finalizing the outfall alignment. Your concerns expressed in this portion of your letter would be addressed at that time.

2. Injection Wells: The well field capacity was determined based on criteria from the City Design Standards - Volume 2, July 1984. To briefly summarize, these standards require that the design capacity of individual exfiltration wells be one-third of its tested capacity and the well field be designed to have the capacity to handle twice the peak flow. Based on the field tests for this project, the wells have a tested capacity of 300 gpm each. The anticipated peak flow rate for the proposed project is 5.6 mgd.

   Chapter XII of the report has been revised to include the Geolabs reference.

The expected duration of usage of these disposal wells is not known at this time. However, the wells are being proposed for the following reasons:

(a) Timing - installation of the disposal wells as an interim measure allows the City to start implementing the proposed centralized system at the earliest possible date. Use of the ocean outfall would require that the construction of the system be delayed until the required additional oceanographic studies and a supplemental EIS are completed;

(b) Implementability - the number of wells can be phased into operation as the need increases. In addition, the effluent generated from this facility will be filtered to further reduce the potential for clogging of the well.

3. Sludge Treatment and Disposal: The NaOH (caustic soda) application referred to in your letter involves the practice of raising the pH of the wastewater to a pH level of 8. Under this condition, the attempt is to solubilize the hydrogen sulfide. A second application is the upstream injection of an approximate 20-minute dosage of NaOH. This practice raises the pH of the wastewater to a level equal or greater than 11. In this environment, both microbial destruction and hydrogen sulfide solubilization would occur.

   Strong oxidants as hydrogen peroxide are alternatives to be considered to achieve oxidation of aqueous hydrogen sulfides. Unfortunately, the complete oxidation of all malodorous compounds is difficult under extreme loadings or transient conditions. Subsequently, some of the offending gases are released to the surrounding environment. The City and County has not had much success with the utilization of strong oxidants as the sole odor control system. Off-gas scrubbers have also been installed in order to treat the offending odors.

   At this point in time, all alternatives available for odor control must be considered as being applicable for the control of malodorous emissions. An accurate selection of chemicals to aide in the control of odors can be made only after the WWTP is in operation. It is noted, however, that the design of the collection system will carefully consider factors to decrease the amount of sea water infiltration and the formation of active anaerobic conditions, thus decreasing production of hydrogen sulfides and other malodorous gases.

4. Effluent Disposal System: The EIS does not include the proposed Mokuleia Resort development. This document was prepared in conjunction with the preparation of the facilities plan report and as such does not include projects such as this, which have not yet been finalized or approved by the City. Initial discussions with the developer, however, indicate that there is little interest at this time to accept municipal wastewater effluent for the irrigation of the proposed golf courses.

5. Air Quality: Text revised.

6. Humidity/Pan Evaporation: Text revised.

7. Treatment Process: The conversion of sulfates to sulfides under anaerobic biodegradation would definitely hinder the microbial population in the anaerobic digester. However, the Kailua WWTP, which employs anaerobic digestion, has not experienced problems with influent wastewater sulfate concentrations ranging from 180 to 250 mg/L. The wastewater entering the proposed Mokuleia WWTP is not expected to contain a sulfate concentration greater than that found at the Kailua plant. Toxicity problems arising from the higher than normal sulfate concentrations are therefore not expected to occur.

8. Historical Sites: Appropriate revisions to the text have been made.

9. Irrigation: The impending closure of the Waialua Sugar Mill was one of the factors for not using the effluent for irrigation alternative. The impact of the closure of the mill with respect to flow generation is anticipated to be minimal.

10. Mokuleia: This EIS has been prepared in conjunction with the preparation of the Waialua-Haleiwa Facilities Plan report. Environmental Protection Agency guidelines exclude anticipated populations from projects such as the proposed Mokuleia Resort development (plans for which have not been finalized or approved for inclusion in the Development Plan) from the design population.

    The expansion of the proposed WWTP at a future date or the inclusion of the proposed resort development in the initial design of the WWTP may be possible, depending on the timing of completion and approval of the proposed development.

Supplemental studies of the wastewater impacts of the proposed development would be most appropriately conducted at such time that the plans for the development are finalized.

Should there be any questions, please contact Geraldine Lum at 527-5392.

Very truly yours,

for Sam Callejo

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

P. O. BOX 50004
HONOLULU, HAWAII 96850

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July 23, 1987

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DIV. OF WASTEWATER MANAGEMENT

Dr. Harvin T. Maura, Director
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, HI 96813

Dear Dr. Maura:

We have no comments to offer at this time, but appreciate the opportunity to review the draft EIS on this project.

Sincerely,

RICHARD N. DUNCAN
State Conservationist

cc:
Mr. John P. Whalen, Director, City and County of Honolulu, Department of Land Utilization, 650 S. King St., Honolulu, HI 96813
Mr. Alfred J. Thiede, Director and Chief Engineer, City and County of Honolulu, Department of Public Works, 650 S. King St., Honolulu, HI 96813

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DIV. OF WASTEWATER MANAGEMENT

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Directorate of Facilities Engineering 10 AUG 1987

Director
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Sir:

The Draft Environmental Impact Statement (EIS) for the Waialua-Hale'iwa Wastewater Facilities Plan has been reviewed. The following comments are provided:

a. The Draft EIS indicates the probable disposal of the effluent by means of an ocean outfall. We would appreciate during your subsequent studies a greater discussion on other potential areas, such as Schofield Barracks, Helemano, and Wahiawa, that may be serviced by the ocean outfall.

b. The U.S. Army Support Command, Hawaii (USASCH) Dillingham Airfield and Mokuleia Beach Park are located within the Waialua rural subarea. Both of these areas are presently serviced by cesspools. When an upgraded system is considered for this subarea, we would appreciate inclusion in your plans of the two USASCH facilities.

Thank you for the opportunity to comment on the Draft EIS. If we may be of further assistance, please contact the Environmental Management Office, Directorate of Facilities Engineering, USASCH at 655-0691.

Sincerely,

Original signed by
MAURICE S. FURUKIYO

Joseph S. Wasielewski
Colonel, Corps of Engineers
Director of Facilities
Engineering

-2-

Copies Furnished:

Mr. John P. Whalen, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Mr. Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
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

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-500

September 10, 1987

Colonel Joseph S. Wasielewski
Directorate of Facilities Engineering
Headquarters USASCH
U.S. Department of the Army
Fort Shafter, Hawaii 96858-5000

Attention: Environmental Management Office

Dear Colonel Wasielewski:

Subject: Your Letter of August 10, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. We would like to take this opportunity to respond to your comments.

1. Inclusion of Flows from Schofield Barracks, Helemano, and Wahiawa in Future Ocean Outfall Studies: Evaluation of available disposal alternatives for these areas must still be completed. Supplemental ocean outfall studies will include these areas if the evaluation indicates that effluent disposal via the proposed Mokuleia WWTP would be the most feasible alternative.

2. Extension of the Collection System to include USACH Dillingham Airfield and Mokuleia Beach Park: Inclusion of these areas in the proposed collection system would be very cost prohibitive. It is anticipated that servicing of these areas would require approximately 15,500 linear feet of additional 12-inch line at an additional cost of approximately $4.1 million dollars.

Should there be any questions, please contact Geraldine Lum at 527-5392.

Very truly yours,

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
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DIV. OF WASTEWATER MANAGEMENT

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

REPLY TO ATTENTION OF

July 22, 1987

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RECEIVED DEPT. OF PUBLIC WORKS
JUL 27 8 48 AM '87
TO

Mr. John Whalen, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Mr. Whalen:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement for the Waialua-Hale'iwa Wastewater Facilities Plan. The following comments are offered.

a. A Department of the Army (DA) permit will be required for the ocean outfall. A DA permit may be required for work at stream crossings or for installation of the collection system (utility lines) in or above navigable waters of the United States. When final selection is made from the alternatives, DA permit requirements should be reviewed with our Operations Branch.

b. The following comments are based on the Flood Insurance Study for the City and County of Honolulu.

1) The WWTP (wastewater treatment plant) site, SPS (sewage pump station) #2 and SPS #3 are all located in a designated Zone C area, or area of minimal flooding.

2) SPS #1 is located in Zone A. This area is inundated by the 100-year flood.

3) SPS #4 and SPS #5 are located in Zone V22 with a base flood elevation of 12 feet above mean sea level.

Both A and V-numbered zones are subject to tsunami inundation and floodproofing is required along with flood insurance. Copies of the tax map key and the Flood Insurance Rate Map (FIRM) are enclosed for your use.

Sincerely,

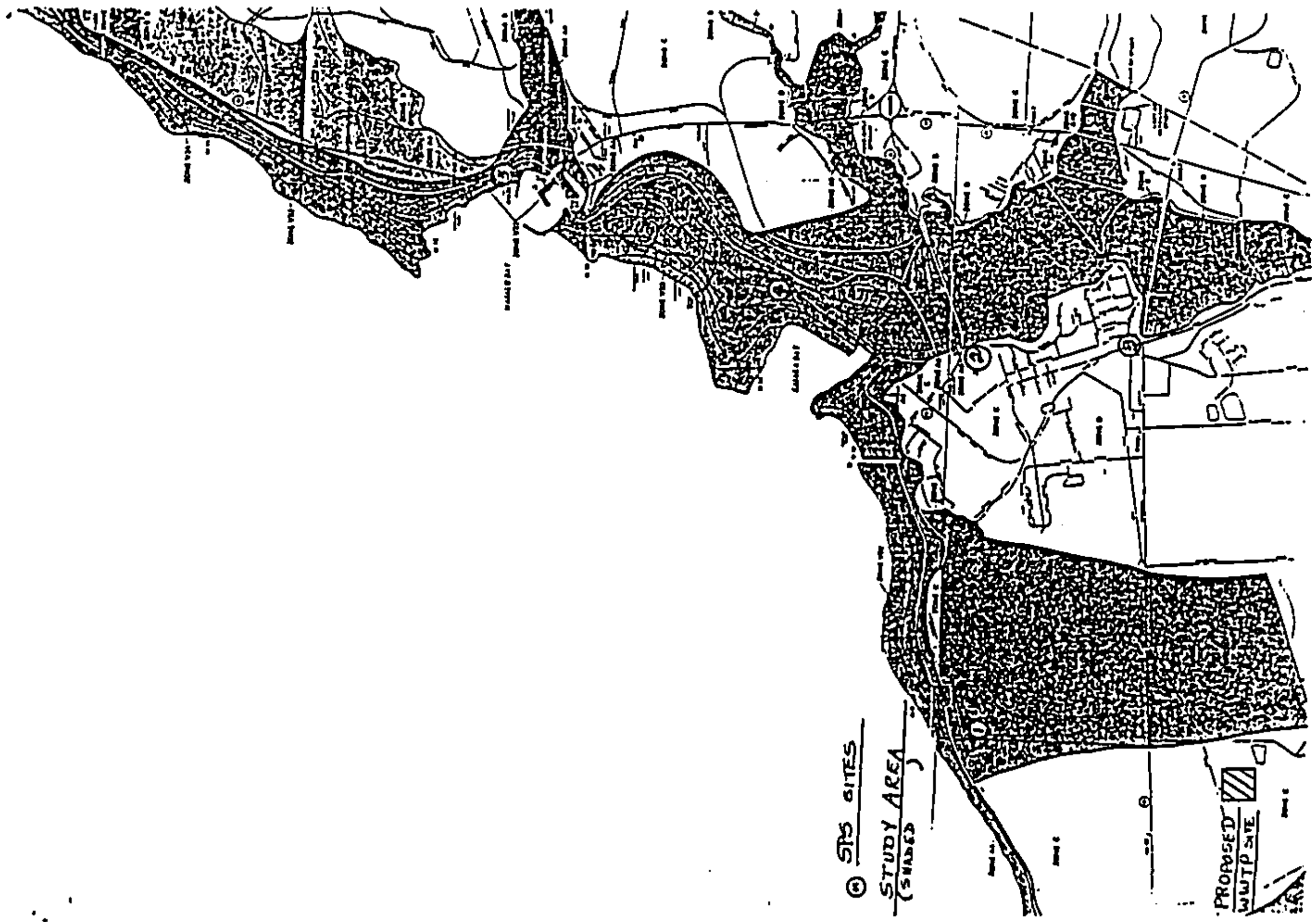
CLARENCE S. FUJII
Deputy Chief, Engineering Division

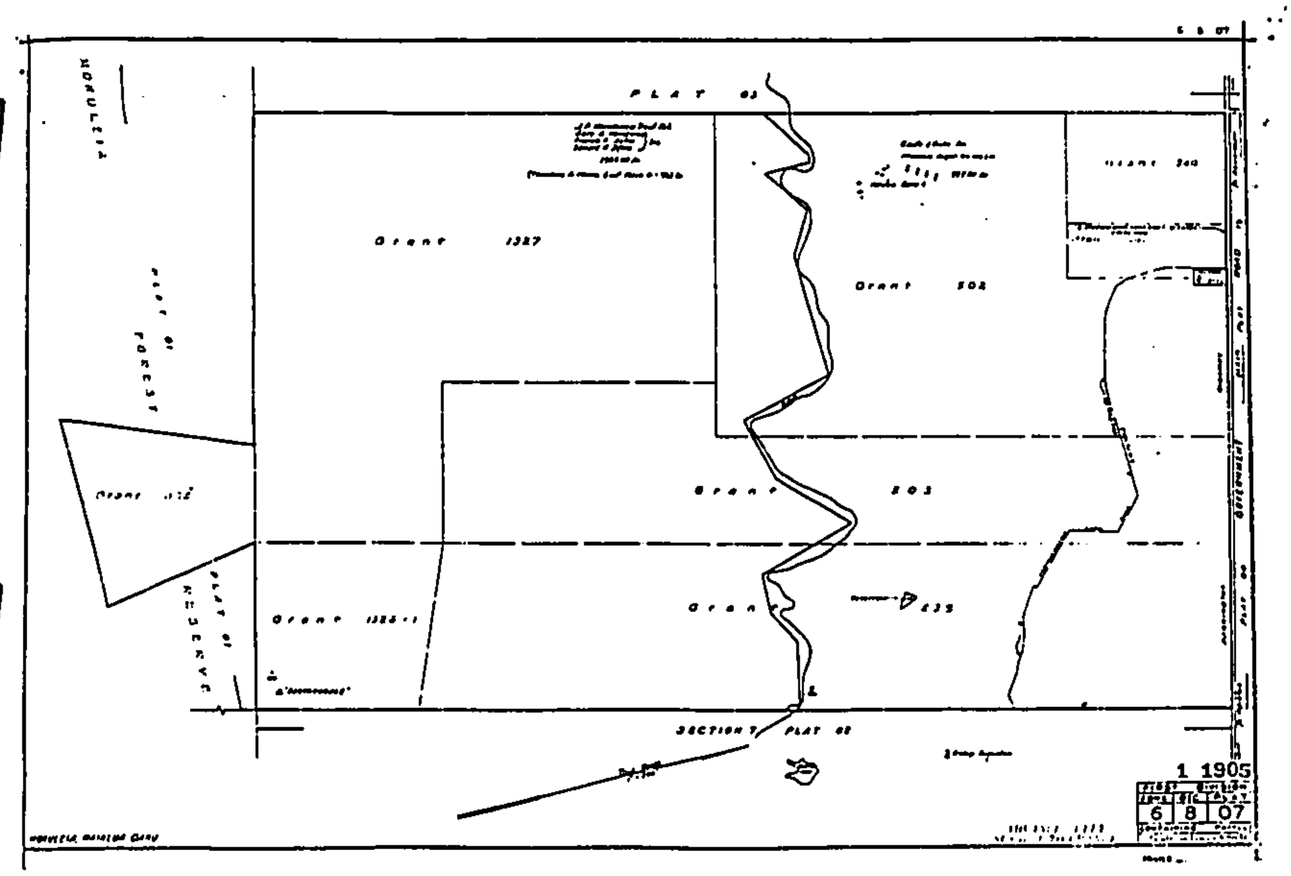
Kisuk Cheung
Chief, Engineering Division

Enclosures

Copy Furnished:

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


SPS SITES
STUDY AREA (SHADED)
PROPOSED WWTP SITE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Grant 1326-1
SECTION 7, PLAT 02
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DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-509

September 10, 1987

Mr. Kisuk Cheung, Chief
Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
Fort Shafter, Hawaii 96858-5440

Dear Mr. Cheung:

Subject: Your Letter of July 22, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. We would like to take this opportunity to address your comments.

1. Permit Requirements: The permit requirements contained in your comments have been reviewed and incorporated into the EIS.

2. Flood Insurance Study: Revised flood maps of the area, effective September 4, 1987, indicate that only sewage pump stations number 2, 4 and 5 would be located in areas prone to flooding (see attachment). The design of these pump stations will be flood proofed, thus mitigating potential adverse impacts resulting from flood conditions.

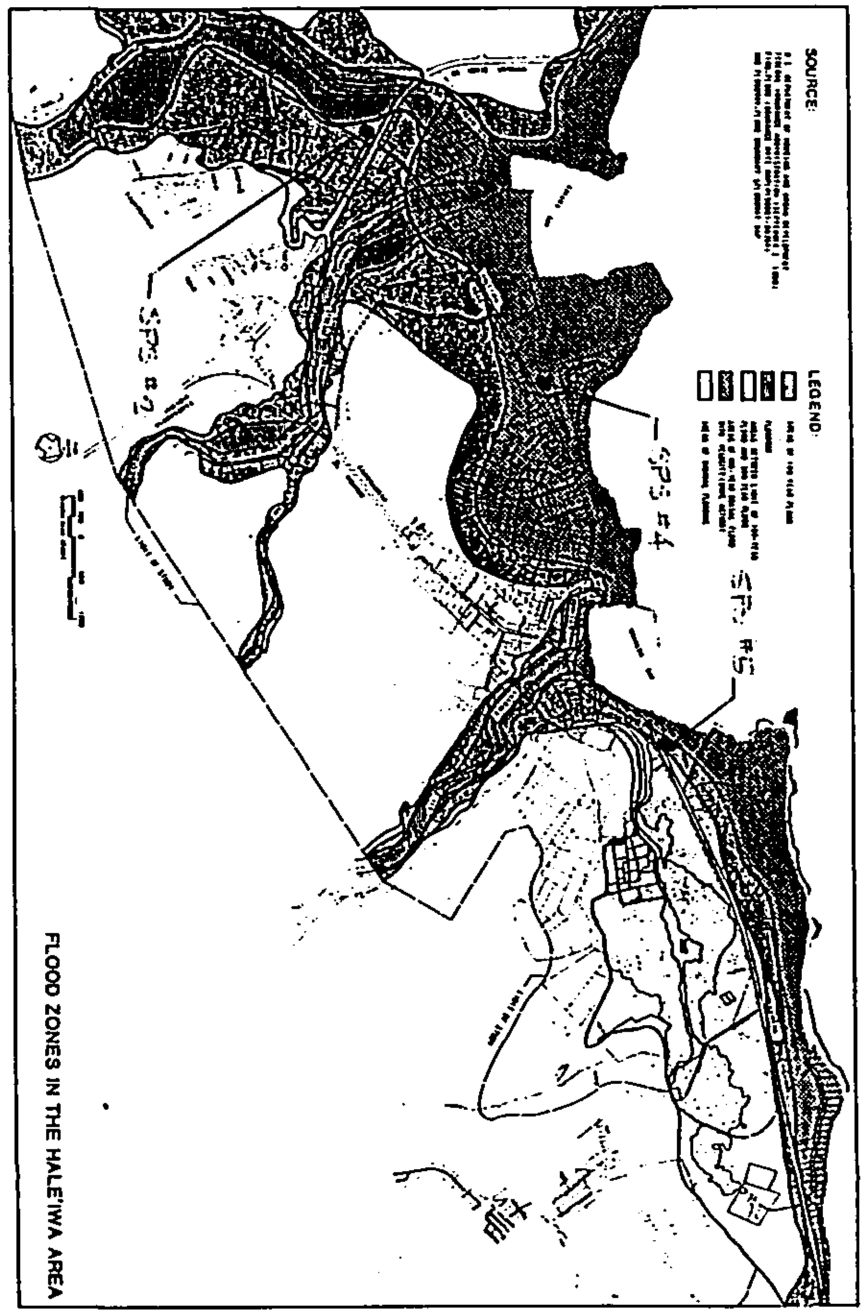
Should there be any questions, please contact Geraldine Lum at 527-5392.

Very truly yours,

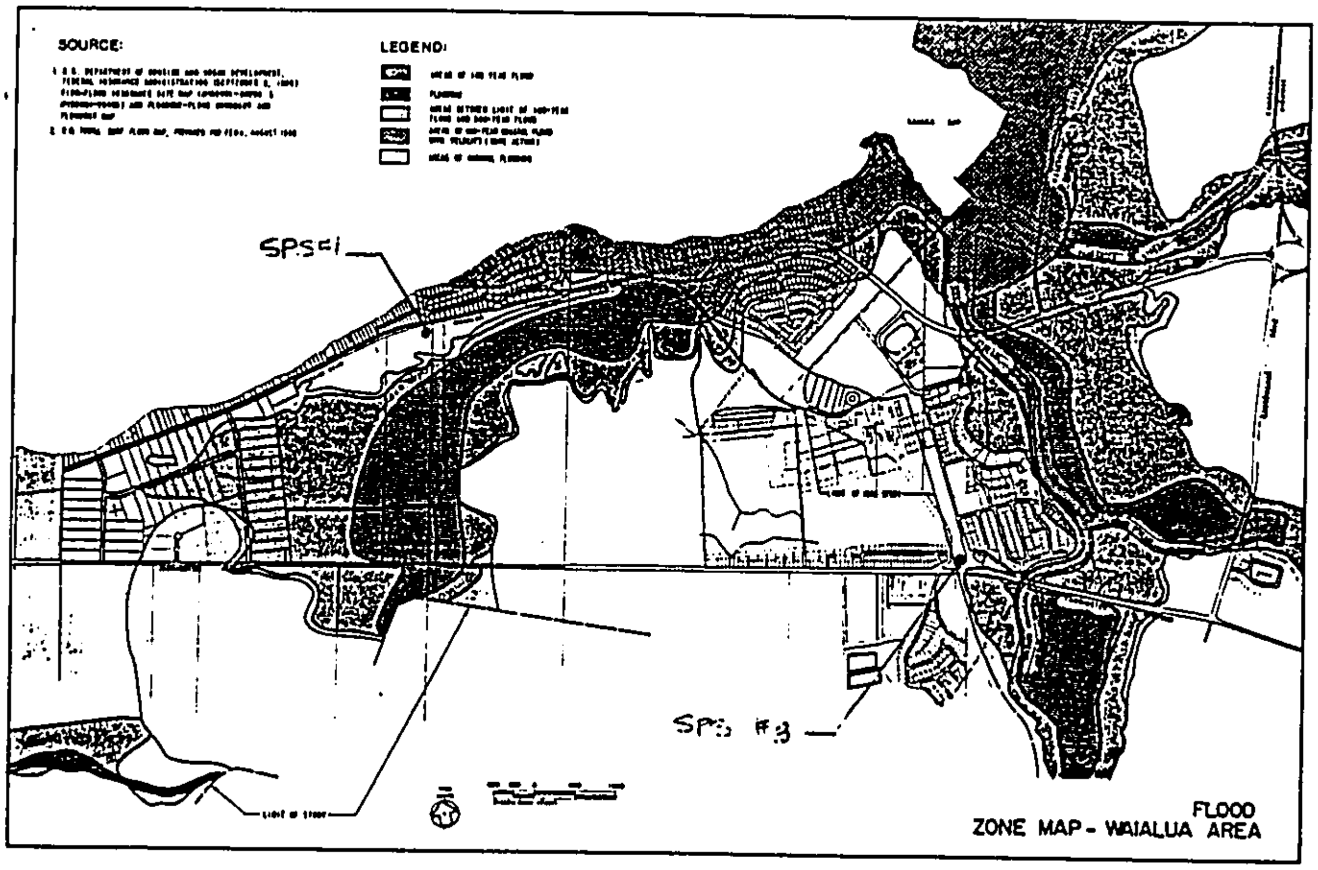
ALFRED J. THIEDE
Director and Chief Engineer

Attach.

cc: OEQC
DLU
BCA



FLOOD ZONES IN THE HALE'IWA AREA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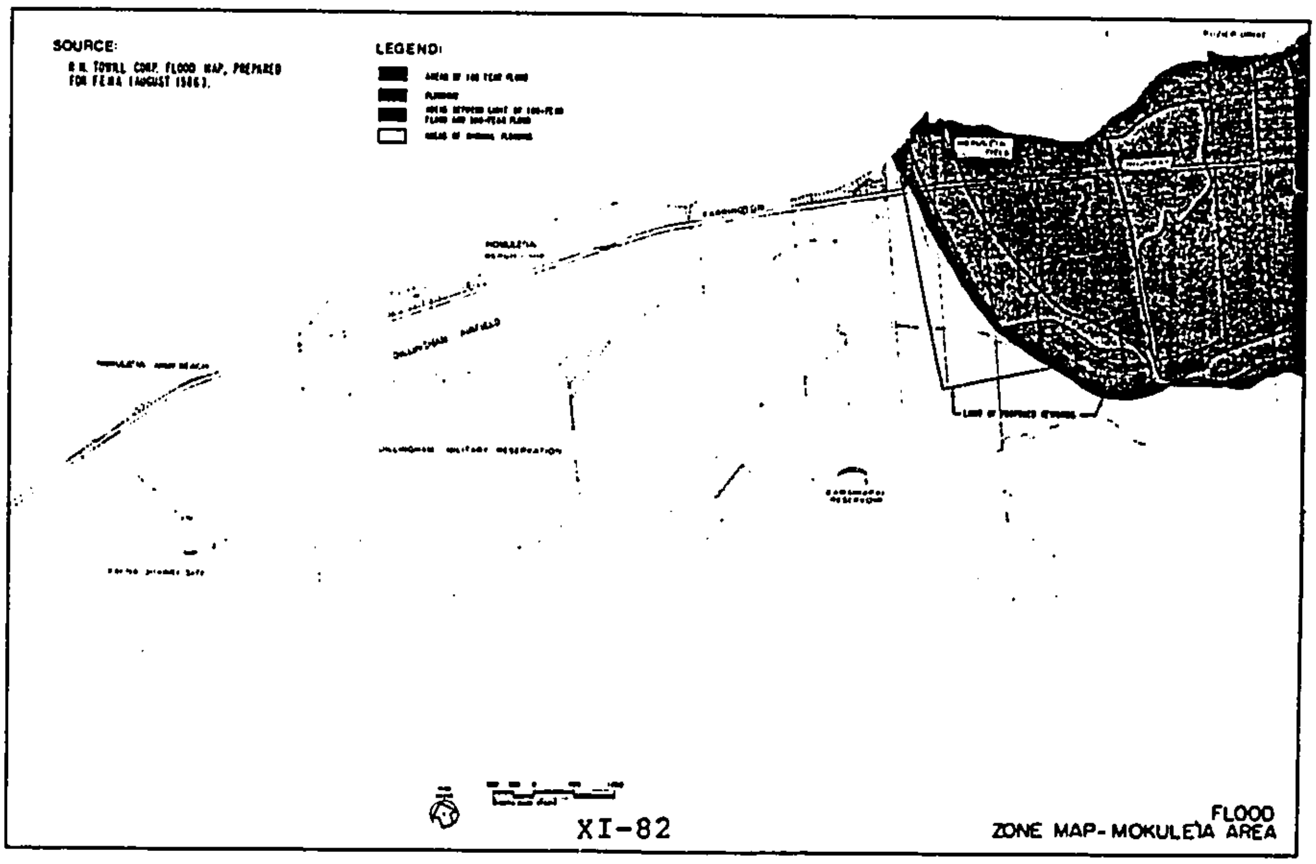
SPS #3
FLOOD
ZONE MAP - WAIALUA AREA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ZONE MAP - MOKULEIA AREA

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DIV. OF WASTEWATER MANAGEMENT

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
PEARL HARBOR, HAWAII 96860-5020

RECEIVED
DEPT OF PUBLIC WORKS
JUL 14 1 58 PM '87
TO

873903

IN REPLY REFER TO:
5090
Ser N58/1460
09 JUL 1987

ENV 4

Director
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Mr. John P. Whalen, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Gentlemen:

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

The Draft EIS for the Waialua-Haleiwa Wastewater Facilities Plan has been reviewed and we have no comments to offer. Since we have no further use for the EIS, it is being returned to the Office of Environmental Quality Control.

Thank you for the opportunity to review the Draft.

Sincerely,

R. G. HUBBARD
Captain, U.S. Navy
Chief of Staff
Acting

Enclosure

Copy to:
Mr. Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

RECEIVED

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DIV. OF WASTEWATER MANAGEMENT

U.S. Department of Housing and Urban Development
Honolulu Office, Region IX
300 Ala Moana Blvd., Room 3318, Box 50007
Honolulu, Hawaii 96850-4991

ENV 87-190

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RECEIVED
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AUG 12 10 52 AM '87
TO

August 5, 1987

Dr. Marvin Miura, Director
Office of Environment Quality
465 South King Street, Room 104
Honolulu, HI 96813

Dear Dr. Miura:

SUBJECT: Waialua-Haleiwa Wastewater Facilities Plan
Draft Environmental Impact Statement

We have reviewed the Draft EIS for the subject project that will provide a centralized wastewater treatment system, treatment plant and effluent disposal by means of exfiltration wells and/or an ocean outfall for the urbanized area of Waialua.

We have no objection to the proposed action and appreciate the opportunity to review and comment on the EIS.

We find no need to retain this Draft EIS and are returning it for your files.

Very sincerely yours,

Calvin Lew
Director
Community Planning and
Development Division

cc:
9C James

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-502

September 10, 1987

Mr. Calvin Lew, Director
Community Planning and
Development Division
U.S. Department of Housing
and Urban Development
Honolulu Office, Region IX
P.O. Box 50007
Honolulu, Hawaii 96850-4991

Dear Mr. Lew:

Subject: Your Letter of August 5, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. Your letter indicating no objection to the proposed action is acknowledged.

Should there be any questions, please call Geraldine Lum at 527-5392.

Very truly yours,

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

87571b

United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 ALA MOANA BOULEVARD
P.O. BOX 50167
HONOLULU, HAWAII 96850

ENV
WWM
ES
Room 6307
AUG 7 1987

Dr. Marvin Miura, Director
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Re: Draft Environmental Impact Statement, Waialua-Haleiwa Wastewater Facilities Plan, Oahu

Dear Dr. Miura:

We have reviewed the referenced Draft Environmental Impact Statement (EIS) for the Waialua-Haleiwa Wastewater Facilities Plan and offer the following comments for your consideration.

The proposed facility would consist of a 1.4 million gallon per day wastewater treatment plant west of Waialua town with an underground pipe collection system servicing the urban areas of Waialua and Haleiwa. Effluent from the plant would discharge into gravity-fed exfiltration wells south of Crozier Drive until an ocean outfall is constructed at Kaiaka Channel.

The Service's primary concerns with the proposed project are the following:

a. Several wetlands are found throughout the Waialua-Haleiwa area (enclosures 1 and 2, and legend, enclosure 3). From the Draft EIS, it appears that the collection system generally follows existing roadways and avoids wetland habitat. The proposed wastewater treatment plant appears to be located adjacent to an irrigation pond. It is not known if this pond is used by endangered waterbirds. If any construction work is proposed that would require filling or dredging these wetlands, we recommend that the U.S. Army Corps of Engineers be contacted for permit requirements.

b. We recommend the use of the exfiltration wells as the long-term disposal method for the sewage effluent. Selection of this alternative avoids impacting nearshore marine habitats during the construction of the 3,600-foot long outfall pipeline and avoids degradation of coastal water quality from the outfall discharge. Alternatively, we recommend using the sewage effluent for crop irrigation and the exfiltration wells as the back-up system and for disposal when the effluent cannot be used for irrigation.

c. For your information, the Hawaiian Waterbirds Recovery Plan was revised in 1985 and identifies Ukoa Marsh, Crowbar Ranch ponds, and the Haleiwa lotus fields as primary habitats for the recovery of the endangered Hawaiian waterbirds.

We would also like to clarify the following statements on page III-59 of the Draft EIS regarding Ukoa Marsh:

> "However, the marsh has not been recommended by the U.S. Fish and Wildlife Service for official designation as a federally protected critical waterbird habitat. At this time the U.S. Fish and Wildlife Service has no plans to nominate the marsh as a protected habitat."

No wetlands in Hawaii, including the Service's National Wildlife Refuges on Oahu, Kauai, and Molokai have been designated critical habitat for endangered Hawaiian waterbirds. The fact that Ukoa Marsh is not designated critical habitat does not diminish its importance to the recovery of endangered waterbird or negate any federal or state regulations pertaining to wetlands or endangered species.

We appreciate the opportunity to comment.

Sincerely,

Ernest Kosaka

Ernest Kosaka
Project Leader, Environmental Services
Pacific Islands Office

Enclosures

cc: NMFS - WPPO
EPA, San Francisco
DLU
DPW
CE, Operations Branch

United States Department of the Interior
FISH AND WILDLIFE SERVICE

NATIONAL WETLAND INVENTORY
Dade Building: Suite 217
9620 Executive Center Drive
St. Petersburg, Florida 33702-2498

NATIONAL WETLAND INVENTORY
Information and Legend
For Map Products

Classification System: The U.S. Fish and Wildlife Service uses the "Classification of Wetlands and Deepwater Habitats of the United States", December, 1979, by L. M. Cowardin, et al., to delineate and identify wetlands. This system is hierarchical and structured around a combination of ecological, biological, hydrological and substrate characteristics which permits universal use across the United States, its territories and possessions. It consists of five systems: Marine, Estuarine, Riverine, Lacustrine (lake) and Palustrine (swamps, bogs, marshes) and proceeds in a hierarchical manner through subsystem, class, and subclass. It also contains provisions to use water regime, water chemistry, soil, and special modifiers to provide additional levels of detail.

Figure 1 is an illustration of the classification system to the class level.

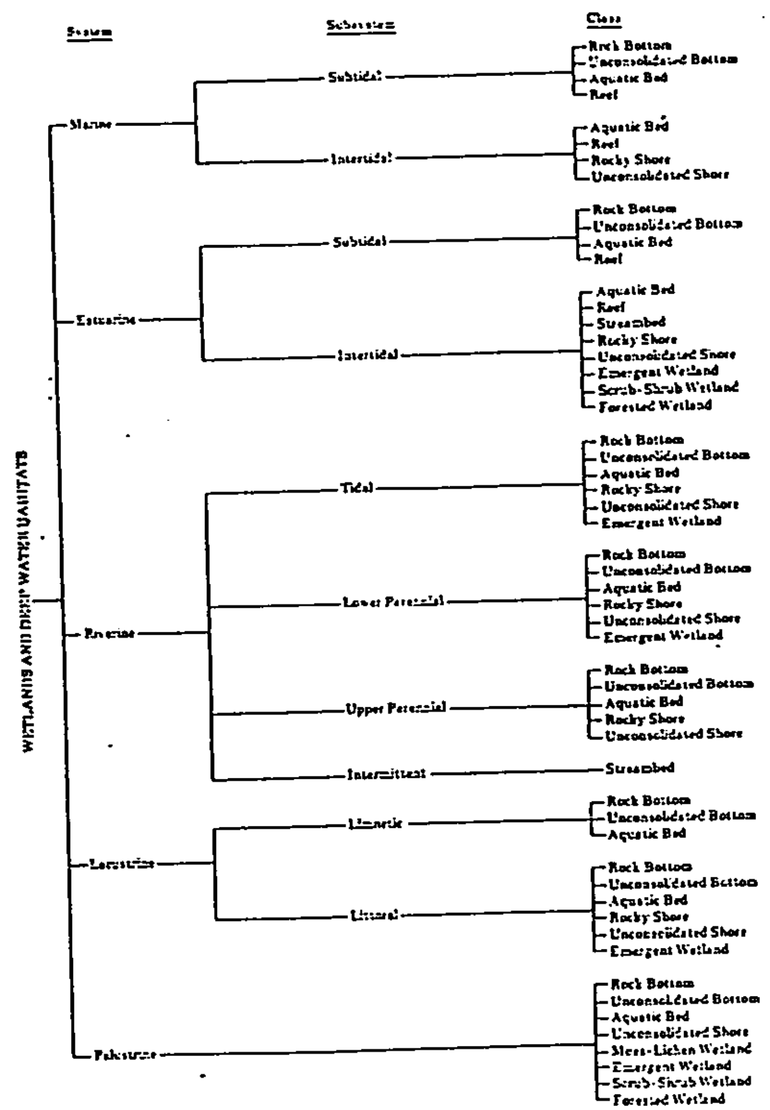


Fig. 1. Classification hierarchy of wetlands and deepwater habitats, showing systems, subsystems, and classes. The Palustrine System does not include deepwater habitats.

Use of Wetland Legend: Wetland data are displayed on overlays or maps by a series of letters and numbers (alpha numerics) with the first letter representing the system and subsequent alpha numerics representing, in a sequential manner, the subordinate levels of detail down to the modifiers. Where classes and subclasses have been mixed, they are separated by a diagonal line.

Examples

a. Classification of wetlands to water regime and special modifier:

System:	Lacustrine
Subsystem:	Limnetic
Class:	Unconsolidated Bottom
Subclass:	Mud
Water Regime:	Intermittently Exposed
Special Modifier:	Diked/Impounded

L 1 UB 3 G h

b. Mixing of wetland classes and subclasses:
PFO2/EM1F = Palustrine, Forested, Needle-leaved deciduous (PFO2) mixed with Palustrine, Emergent, Persistent (EM1) with semipermanent water regime (F).

WETLAND LEGEND*

- [ ] System
  - [ ] Subsystem

- [M] Marine
  - [1] Subtidal
  - [2] Intertidal
- [E] Estuarine
  - [1] Subtidal
  - [2] Intertidal
- [P] Palustrine
  - [ ] No Subsystem
- [R] Riverine
  - [1] Tidal
  - [2] Lower Perennial
  - [3] Upper Perennial
  - [4] Intermittent
  - [5] Unknown Perennial**
- [L] Lacustrine
  - [1] Limnetic
  - [2] Littoral
- [U] Upland

*Should be used in conjunction with "Classification of Wetlands and Deepwater Habitats of the United States," by L. M. Cowardin et al.
**Not included in "Classification of Wetlands and Deepwater Habitats of the United States." Created specifically for National Wetland Inventory mapping effort.

3

Wetland Legend (continued)

- [ ] Class
  - [ ] Subclass

CLASSES AND SUBCLASSES

- [AB] Aquatic Bed
  - [1] Algal
  - [2] Aquatic Moss
  - [3] Rooted Vascular
  - [4] Floating Vascular
  - [5] Unknown Submergent**
  - [6] Unknown Surface**
- [EM] Emergent
  - [1] Persistent
  - [2] Nonpersistent
- [FO] Forested
  - [1] Broad-Leaved Deciduous
  - [2] Needle-Leaved Deciduous
  - [3] Broad-Leaved Evergreen
  - [4] Needle-Leaved Evergreen
  - [5] Dead
  - [6] Deciduous**
  - [7] Evergreen**
- [ML] Moss/Lichen
  - [1] Moss
  - [2] Lichen
- [OW] Open Water/ Unknown Bottom**
- [RB] Rock Bottom
  - [1] Bedrock
  - [2] Rubble
- [RF] Reef
  - [1] Coral
  - [2] Mollusk
  - [3] Worm
- [RS] Rocky Shore
  - [1] Bedrock
  - [2] Rubble
- [SB] Streambed
  - [1] Bedrock
  - [2] Rubble
  - [3] Cobble/Gravel
  - [4] Sand
  - [5] Mud
  - [6] Organic
  - [7] Vegetated
- [SS] Scrub/Shrub
  - [1] Broad-Leaved Deciduous
  - [2] Needle-Leaved Deciduous
  - [3] Broad-Leaved Evergreen
  - [4] Needle-Leaved Evergreen
  - [5] Dead
  - [6] Deciduous**
  - [7] Evergreen**
- [UB] Unconsolidated Bottom
  - [1] Cobble/Gravel
  - [2] Sand
  - [3] Mud
  - [4] Organic
- [US] Unconsolidated Shore
  - [1] Cobble/Gravel
  - [2] Sand
  - [3] Mud
  - [4] Organic
  - [5] Vegetated

**Not included in "Classification of Wetlands and Deepwater Habitats of the United States." Created specifically for National Wetland Inventory mapping efforts.

4

MODIFIERS TO WETLAND CLASSIFICATION

WATER REGIME MODIFIERS

Nontidal

- A Temporary
- B Saturated
- C Seasonal
- D Seasonally Flooded-Well Drained
- E Seasonally Flooded-Saturated
- F Semipermanent
- G Intermittently Exposed
- H Permanent
- J Intermittently Flooded

Nontidal Combined

- Z Intermittently Exposed/ Permanent (G,H above)**
- W Intermittently Flooded/ Temporary (A,J above)**
- Y Saturated Semipermanent/ All Seasonals (B,C,D,E F above)**

Nontidal and Tidal

- U Unknown**
- K Artificial

Tidal

- L Subtidal
- M Irregularly Exposed
- N Regularly Flooded
- P Irregularly Flooded
- R Seasonal - Tidal
- S Temporary - Tidal
- T Semipermanent - Tidal
- V Permanent - Tidal

WATER CHEMISTRY MODIFIERS

Coastal Halinity

- 1 Hyperhaline
- 2 Euhaline
- 3 Mixohaline (Brackish)
- 4 Polyhaline
- 5 Mesohaline
- 6 Oligohaline
- 0 Fresh

Inland Salinity

- 7 Hypersaline
- 8 Eusaline
- 9 Mixosaline
- 0 Fresh

pH Freshwater

- a Acid
- t Circumneutral
- i Alkaline

**Not included in "Classification of Wetlands and Deepwater Habitats of the United States." Created specifically for National Wetland Inventory mapping Effort.

OTHER MODIFIERS

Special

- b Beaver
- d Partially Drained/ Ditched
- f Farmed
- h Diked/Impounded
- r Artificial
- s Spoil
- x Excavated

Soils

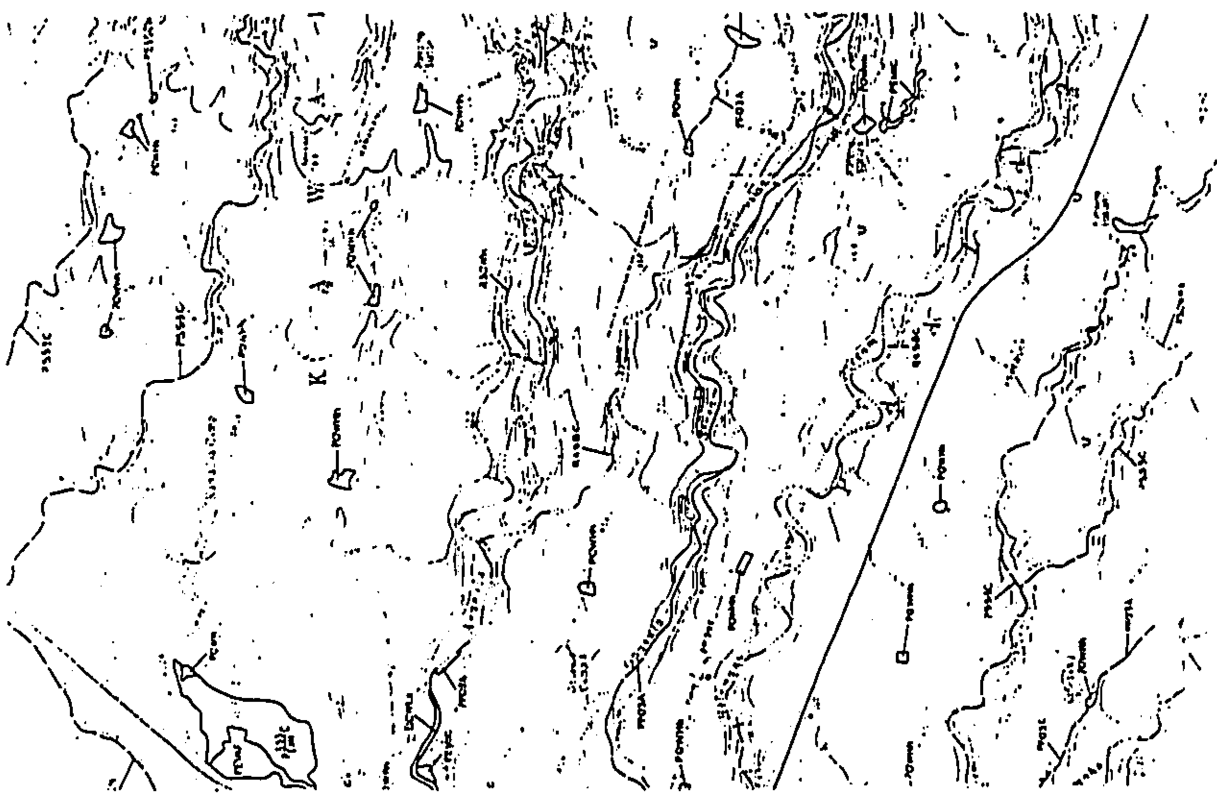
- g Organic
- n Mineral

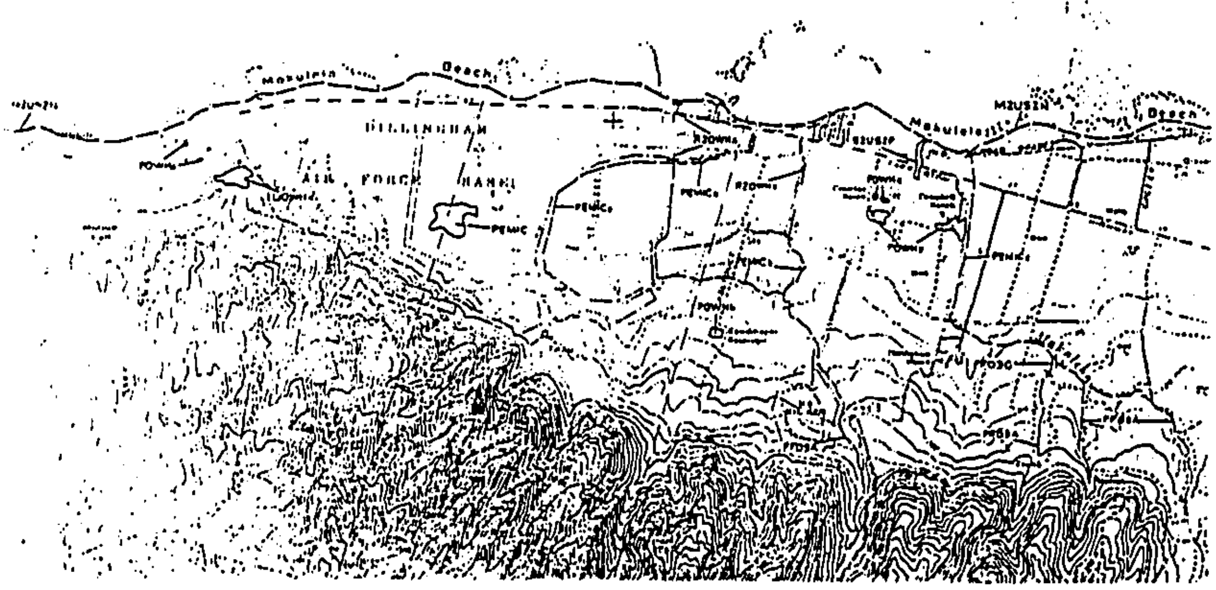
Statement to Users: The overlays/maps were prepared primarily by stereoscopic analysis of high altitude aerial photographs. Wetlands were identified on the photographs based on vegetation, visible hydrology, and geography in accordance with "Classification of Wetlands and Deepwater Habitats of the United States." The aerial photographs typically reflect conditions during the specific year and season when they were taken. In additon, there is a margin of error inherent in the use of aerial photographs. Thus, a detailed on-the-ground and historical analysis of a single site may result in a revision of the wetland boundaries established through photographic interpretation. In additon, some small wetlands and those obscured by dense forest cover may not be included on this map. Federal, State, and local regulatory agencies with jurisdictions over wetlands may define and describe wetlands in a different manner than that used in this Inventory. There is no attempt, in either the design or products of this Inventory, to define the limits of proprietary jurisdiction of any Federal, State, or local government or to establish the geographical scope of the regulatory programs and proprietary jurisdictions that may affect such activities.

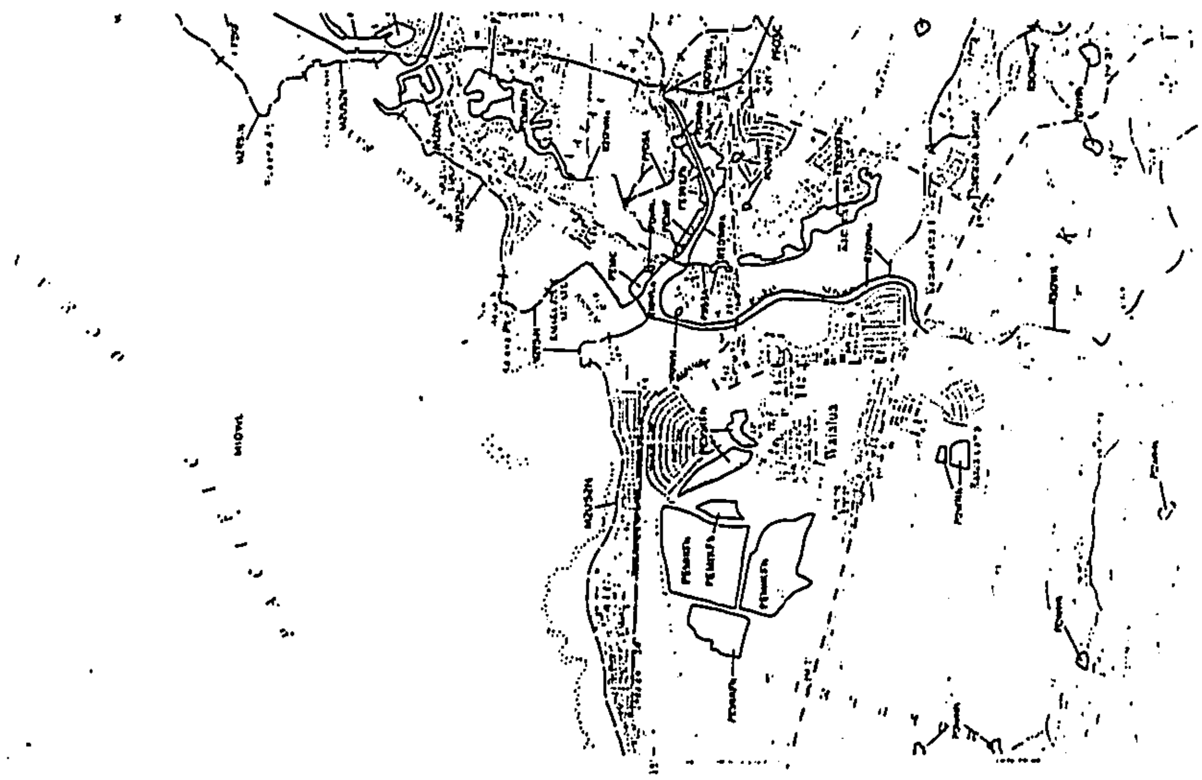
To Order NWI Topical Wetland Overlays/Maps: A National Wetland Inventory Order Form is required and can be obtained by writing to the address on the letterhead.

Additional Information: Contact the appropriate National Wetlands Inventory Regional Wetland Coordinator at the following US Fish and Wildlife Service Regional Office:

Region	Geographical Area	Regional Wetland Coordinator
1	Alaska, California, Nevada, Hawaii, Oregon, Washington	Dennis Peters, US Fish and Wildlife Service Lloyd 500 Building; suite 1692, 500 NW Multnomah Street, Portland, OR 97232 COM: 503/231-6116 FTS: 429-6154
2	Arizona, New Mexico, Texas, Oklahoma	Warren Hagenbuck, US Fish and Wildlife Service PO Box 1306, Albuquerque, NM 87103 COM: 505/766-2914 FTS: 474-2914
3	Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio	Ron Erickson, US Fish and Wildlife Service Federal Building, Ft. Snelling (AS/BSP), Twin Cities, MN 55111 COM: 612/725-3593 FTS: 725-3593
4	Arkansas, Louisiana, Florida, Mississippi, Alabama, Georgia, South Carolina, North Carolina, Tennessee, Kentucky, Puerto Rico	John Hefner, US Fish and Wildlife Service R.B. Russell Building; 75 Spring Street SW, Atlanta, GA 30303 COM: 404/221-6343 FTS: 242-6343
5	Maine, Vermont, New Hampshire, New York, Massachusetts, Connecticut, Rhode Island, Pennsylvania, New Jersey, Delaware, Maryland, West Virginia, Virginia	Ralph Tiner, US Fish and Wildlife Service One Gateway Center; suite 700, Newton Corner, MA 02158 COM: 617/965-5100 FTS: 829-9385
6	Montana, Wyoming, North Dakota, South Dakota, Nebraska, Utah, Colorado, Kansas, Iowa, Missouri	Charles Elliott, US Fish and Wildlife Service PO Box 25486, Denver Federal Center, Denver, CO 80225 COM: 303/234-5586 FTS: 234-5586
7	Alaska	Jonathan Hall, US Fish and Wildlife Service 1011 East Tudor Road, Anchorage, AK 99503 COM: 907/263-3403 FTS: 399-0150







DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-490

September 10, 1987

Mr. Ernest Kosaka, Project Leader
Environmental Services
Pacific Islands Office
U.S. Department of the Interior
Fish and Wildlife Service
P. O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Subject: Your Letter of August 7, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. We would like to take this opportunity to respond to your comments.

1. Wetlands: Recommendations regarding the dredging or filling of wetlands have been taken into consideration.

2. Exfiltration Wells: Long term use of exfiltration wells may be possible, providing that the wastewater flows do not significantly exceed the anticipated flow rate of 1.4 mgd and that the wells are continually monitored and properly maintained. However, should the flows increase significantly (as may be the case if the proposed Mokuleia resort development is approved and constructed), or unexpected or unusual conditions are encountered with the wells, the construction of an ocean outfall would be a more reliable long term disposal alternative.

   The use of effluent for crop (i.e., sugarcane and California grass) irrigation with exfiltration wells for a back-up system has already been included in the evaluation presented in this report. These alternatives were not recommended primarily for the following reasons:

   (a) The future viability of the sugar industry is still uncertain at this time. Therefore, disposal via sugarcane irrigation cannot be relied on as a long term disposal alternative.

   (b) Irrigation of California grass or any other crop would be very labor and land intensive for the disposal of the quantity of effluent anticipated. In addition, should the study area be further developed, these factors would become even more prohibitive.

   (c) Potential health impacts of the use of effluent on other types of crops for direct human consumption are still questionable.

3. Hawaiian Water Birds: Your comments regarding the impacts on Hawaiian waterbirds have been incorporated into the report.

Should there be any questions, please contact Geraldine Lum at 527-5392.

Very truly yours,

fo ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION NINE
Hawaii Division
Box 50206
Honolulu, Hawaii 96850

July 13, 1987

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DIV. OF WASTEWATER MANAGEMENT

Director
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Sir:

Subject: Waialua-Hale'iwa Wastewater Facilities Plan

We have reviewed the Draft Environmental Impact Statement transmitted by your letter dated June 23, 1987 and have no comments to offer at this time.

Sincerely yours,

William R. Lake
Division Administrator

By: N.L. Arthur
N. L. Arthur
Assistant Division Administrator

M 961-4281

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU HAWAII 96843

August 7, 1987

'87 AUG 11 PM 3 32
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

TO: JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

Thank you for allowing us to review the Draft Environmental Impact Statement.

We have the following comments regarding the proposed project:

1. There are no water mains in the area of the proposed wastewater treatment plant. The Department of Public Works will be required to extend a main from our existing main and also install fire hydrants for fire protection.

2. The availability of water will be determined when the building permit application is submitted for our review and approval. If water is made available, the developer will be required to pay our Water System Facilities Charges for source-transmission and daily storage.

3. The construction drawings for the new water main and water lateral should be submitted for our review and approval.

4. In the summary, description of the proposed action (page 3 and 4), the term "exfiltration wells" should be further clarified and or defined. If reference is made to injection wells, then that term should be used.

5. In the proposed action, implementation schedule, Table I-2 (page I-20), the number of injection wells should be mentioned.

6. In the description of the affected environment, physiography/geology (page III-3), the phrase "a dike zone" should be changed to "several rift zones".

7. In Section 3.2.3, groundwater (page III-19), in the discussion on providing domestic water, it should also be mentioned that the Waialua Sugar Company serves domestic water to their plantation homes from three of their wells.

If you have any questions, please contact Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Alfred J. Thiede, Director
Department of Public Works

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

WPP 87-511

September 10, 1987

MEMORANDUM

TO: MR. KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR LETTER OF AUGUST 7, 1987 REGARDING THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. Your comments and recommendations have been incorporated into the report.

Should there be any questions, please contact Geraldine Lum at extension 5392.

fo ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

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DIV. OF WASTEWATER MANAGEMENT

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July 6, 1987

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TO: MR. JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: HERBERT K. MURAOKA
DIRECTOR AND BUILDING SUPERINTENDENT

SUBJECT: WAIALUA-HALE'IWA WASTEWATER FACILITIES PLAN
DRAFT EIS

We have reviewed the draft EIS for the Waialua-Hale'iwa Wastewater Facilities Plan and have no comments.

Thank you for the opportunity to review the draft EIS.

Herbert K. Muraoka

HERBERT K. MURAOKA
Director and Building Superintendent

cc: J. Harada
Public Works Dept.

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813
PHONE 523-4181

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August 6, 1987

Mr. Marvin Miura, Director
Office of Environmental
Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Mr. Miura:

Subject: Draft Environmental Impact Statement (EIS)
Waialua-Haleiwa Wastewater Facilities Plan

Thank you for the opportunity to comment on the subject EIS. We understand that the recommended wastewater treatment plant site is located in agricultural fields well away from existing structures and urban zoned lands. Thus, the impact of potential noise and odor generated in case of a system breakdown will be greatly reduced. We also believe that the project is a necessary one whose long-term benefits far outweigh the inconveniences.

We support the proposal.

Sincerely,

for MIKE MOON
Director

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

WPP 87-495

September 10, 1987

MEMORANDUM

TO: MR. MIKE MOON, DIRECTOR
DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR LETTER OF AUGUST 6, 1987 REGARDING THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. Your understanding and support of the proposed project are acknowledged.

Should there be any questions, please contact Geraldine Lum at extension 5392.

for ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

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

87-3971

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WWM

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RH/DGP 6/87-2094

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July 15, 1987

MEMORANDUM

TO: JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

SUBJECT: WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN
DRAFT ENVIRONMENTAL IMPACT STATEMENT

The following are comments on the Draft Environmental Impact Statement of the Waialua-Haleiwa Wastewater Facilities Plan.

The North Shore Development Plan Public Facilities Map depicts a symbol for a Waialua Wastewater Treatment Plant, within 6 years, site undetermined. Only projects shown in the "within 6 years" funding category and as site determined can have funds budgeted for construction and land acquisition. When you notify us that a site or alternative system has been selected, we will process an amendment to the DP Public Facilities Map to reflect the new status.

General Plan Population Distribution policies indicate that growth along the North Shore is to be limited so that its relative share of the islandwide population remains essentially the same as it was in 1980. The estimated 1985 population of the North Shore was 13,200, which was 1.6 percent of the islandwide population. The GP population distribution guidelines indicate a range of 1.6 to 1.8 percent of Oahu's Year 2005 total population. Based on the current State Department of Planning and Economic Development projection of 954,500 people on Oahu, the North Shore's population should be in the range of 15,300 to 17,200 by the Year 2005.

A question arises as to how the Mokuleia Resort project would affect the Waialua-Haleiwa Wastewater Facilities Plan. The DP amendment request for Resort and other urban uses and infrastructure development in Mokuleia has been deferred to the 1988 DP Annual Amendment Review because a General Plan amendment is still needed to designate Mokuleia as a secondary resort area. Two alternatives to handle resort wastewater were suggested during the processing of the DP amendment. The first alternative was a separate privately funded wastewater system serving the resort development. The second alternative was a wastewater system which would be jointly funded by the resort developer and the City and serving the resort and Waialua-Haleiwa. Discussion of the impact of the Mokuleia Resort on the subject Wastewater Facilities Plan would be informative.

Thank you for the opportunity to review the Draft EIS. If you have any questions, please call Randy Hara at 523-4483.

Donald Clegg
DONALD A. CLEGG
Chief Planning Officer

cc: Alfred J. Thiede, Director
Department of Public Works

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

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-510

September 10, 1987

MEMORANDUM

TO: MR. DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR LETTER OF JULY 15, 1987 REGARDING THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. We acknowledge the need for an amendment to the North Shore Development Plan Public Facilities Map. DGP Form 101 has been submitted to reflect these changes.

Population estimates used in the EIS are in line with the population projection in your letter and are consistent with the 208 Plan now under revision.

The proposed Mokuleia Resort could potentially have a significant impact on the projected wastewater flow rates from the study area. However, plans for this development have not yet been finalized or approved, and therefore have not been included in the evaluations conducted for this report. Should this proposed resort development receive approval, the two basic options available to the developer are the construction of a separate private wastewater treatment plant or the expansion of the proposed Mokuleia WWTP and outfall system.

Should there be any questions, please contact Geraldine Lum at extension 5392.

Alfred J. Thiede

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

RECEIVED DEPARTMENT OF LAND UTILIZATION

CITY AND COUNTY OF HONOLULU 87-5062

'87 JUL 31 PM 6 01 650 SOUTH KING STREET HONOLULU, HAWAII 96813

DIV. OF WASTEWATER MANAGEMENT

FRANK F. FASI MAYOR

EWU WWM - cc PUS

JOHN P. WHALEN DIRECTOR

87/EIS-2(AC)

RECEIVED DEPT OF PUBLIC WORKS JUL 31 9 14 AM '87

July 30, 1987

MEMORANDUM

TO: ALFRED J. THIEDE, DIRECTOR
DEPARTMENT OF PUBLIC WORKS

FROM: JOHN P. WHALEN, DIRECTOR

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)
WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

The Department of Land Utilization (DLU) has reviewed the draft EIS and offers the following comments:

1. Construction of an ocean outfall, as the preferred method of effluent disposal, will require a Special Management Area (SMA) Permit and a shoreline setback variance from this Department. A SMA permit will also be required for the exfiltration well field if it is to be located within the SMA.

2. The draft EIS states that various types of odor control equipment will be provided to minimize release of malodorous gases; however, there is little discussion as to the systems' effectiveness in preventing odor emissions from impacting surrounding residential areas. The final EIS should examine the potential impact of undesirable odors on neighborhoods in the Mokuleia area.
In particular, the EIS should provide a discussion of impact potential from various wind directions which occur throughout the year.

3. Will the Waialua-Haleiwa wastewater system accommodate the proposed Mokuleia resort project?

We hope that these comments will be helpful in your preparation of the final EIS. If you have any questions, please call Art Challacombe of our staff at 523-4648.

John P. Whalen

JOHN P. WHALEN
Director of Land Utilization

JPW:sl
1146B

cc: OEQC

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET HONOLULU, HAWAII 96813

FRANK F. FASI MAYOR

ALFRED J. THIEDE DIRECTOR AND CHIEF ENGINEER

WPP 87-494

September 10, 1987

MEMORANDUM

TO: MR. JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM OF JULY 30, 1987 REGARDING THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. The following is a point by point response to your comments.

1. The requirement for SMA permits has been included in the listing of required approvals for the project.

2. The wastewater management plan being proposed for this project includes provisions for best available odor control technology with supplemental odor polishing units. The proposed wastewater treatment plant (WWTP) site is set back approximately 1,800 feet mauka from the main highway. This setback will provide additional buffer between the WWTP and the nearest resident. These steps have been taken to mitigate potential odor problems that may be created by this project.

3. The proposed Mokuleia Resort could potentially have a significant impact on the projected wastewater flow rates from the study area. However, plans for this development have not yet been finalized or approved, and therefore have not been included in the evaluations conducted for this report. Should this proposed resort development receive approval, the two basic options available to the developer are the construction of a separate private wastewater treatment plant or the expansion of the proposed Mokuleia WWTP and outfall system.

Should there be any questions, please contact Geraldine Lum at extension 5392.

for ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
BCA

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DIV. OF WASTEWATER MANAGEMENT

DEPARTMENT OF PARKS AND RECREATION

CITY AND COUNTY OF HONOLULU

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HONOLULU, HAWAII

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HIRAM K. KAMAKA
DIRECTOR

WALTER M. OZAWA
DEPUTY DIRECTOR

July 1, 1987

Dr. John C. Lewin
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Lewin:

Subject: Environmental Impact Statement Review for the Waialua-Haleiwa Wastewater Facilities Plan Dated June 10, 1987

The above Environmental Impact Statement has been reviewed by the Department of Parks and Recreation and we have no comments.

Sincerely,

Hiram K. Kamaka

HIRAM K. KAMAKA, Director

HKK:ei

cc: Department of Land Utilization
Department of Public Works

DEPARTMENT OF TRANSPORTATION SERVICES

CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

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JOHN E. HIRTEN
DIRECTOR

JOSEPH M. MAGALDI, JR.
DEPUTY DIRECTOR

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July 9, 1987

RECEIVED
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TO

Director
Office of Environmental
Quality Control
State of Hawaii
465 South King Street
Room 104
Honolulu, Hawaii 96813

Dear Sir:

Subject: Review of Environmental Impact Statement (EIS) for Waialua-Hale'iwa Wastewater Facilities Plan

This is in response to your letter of June 23, 1987 requesting our review of the draft EIS for the Waialua-Hale'iwa Wastewater Facilities Plan.

We have no objections to this project from a traffic standpoint, as presented in the EIS.

Sincerely,

JOHN E. HIRTEN

cc: Department of Land Utilization
/Department of Public Works

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-492

September 10, 1987

MEMORANDUM

TO: MR. JOHN E. HIRTEN, DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM OF JULY 9, 1987 REGARDING THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. Your letter indicating no objections to this project from a traffic standpoint is acknowledged.

Should there be any questions, please contact Geraldine Lum at extension 5392.

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

RECEIVED
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DIV OF WASTEWATER MANAGEMENT

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
1455 S. BERETANIA STREET ROOM 305
HONOLULU, HAWAII 96814

FRANK F. FASI
MAYOR

FRANK K. KAHOOHANOHANO
FIRE CHIEF

LIONEL E. CAMARA
DEPUTY FIRE CHIEF

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July 6, 1987

RECEIVED
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TO

Director
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Sir:

SUBJECT: WAIALUA-HALE'IWA WASTEWATER FACILITIES PLAN

We have reviewed the subject EIS and have no objections to the proposed project. Fire apparatus accessibility to the facilities should be provided and maintained. Should roadside construction require our fire apparatuses to use alternate response routes, the Fire Department should be so notified in advance.

Should you have any questions, please contact Battalion Chief Kenneth Word at local 3848.

Very truly yours,

FRANK K. KAHOOHANOHANO
Fire Chief

FKK:JKS:ln
cc: Alfred J. Thiede, Department of Public Works

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

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-505

September 10, 1987

MEMORANDUM

TO: MR. FRANK K. KAHOOHANOHANO, FIRE CHIEF
HONOLULU FIRE DEPARTMENT

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM OF JULY 6, 1987 REGARDING THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. Your comments regarding maintaining accessibility to fire apparatus and notification of your department in the event that construction activities interfere with response routes have been incorporated into the report.

Should there be any questions, please contact Geraldine Lum at extension 5392.

fr ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

FRANK F. FASI
MAYOR

DOUGLAS G. GIBB
CHIEF

WARREN FERREIRA
DEPUTY CHIEF

JCG
87-3961 Parts

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OUR REFERENCE SS-LK

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DIV. OF WASTEWATER MANAGEMENT

July 14, 1987

RECEIVED
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JUL 16 11 41 AM '87
TO

Office of Environmental Quality
465 South King Street, Room 104
Honolulu, Hawaii 96813

Gentlemen:

Subject: Environmental Impact Statement (EIS)
Waialua-Haleiwa Wastewater Facilities Plan

We have reviewed the Environmental Impact Statement and support the measures addressed in the report to minimize traffic disruption and to insure public health and safety during the construction phases of the project.

Thank you for the opportunity to comment on this EIS.

DOUGLAS G. GIBB
Chief of Police

cc: Mr. Alfred J. Thiede
Department of Public Works

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

WPP 87-491

September 10, 1987

MEMORANDUM

TO: MR. DOUGLAS G. GIBB, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR LETTER OF JULY 14, 1987 REGARDING THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. Your letter indicating support of the measures addressed in the report to minimize traffic disruption and to insure public health and safety during construction is acknowledged.

Should there be any questions, please contact Geraldine Lum at extension 5392.

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
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June 29, 1987

TO: DIRECTOR, OFFICE OF ENVIRONMENTAL QUALITY CONTROL

FROM: GEORGE L. KEKUNA, DEPUTY DIRECTOR DESIGNATE OF CIVIL DEFENSE, CITY AND COUNTY OF HONOLULU

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT, WAIALUA-HALE'IWA WASTEWATER FACILITIES PLAN

The Oahu Civil Defense Agency has reviewed subject plan and concurs with its contents.

GEORGE L. KEKUNA

cc: Al Thiede
Department of Public Works

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

WPP 87-493

September 10, 1987

MEMORANDUM

TO: MR. GEORGE L. KEKUNA, DEPUTY DIRECTOR DESIGNATE
OAHU CIVIL DEFENSE AGENCY

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM OF JUNE 29, 1987 REGARDING THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. Your memorandum indicating concurrence with its contents is acknowledged.

Should there be any questions, please contact Geraldine Lum at extension 5392.

for ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 0001

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DIV. OF WASTEWATER MANAGEMENT

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8-13

Brenner Munger Ph.D., P.E.
Manager
Environmental Department
(808) 548-6880

August 6, 1987

Mr. John P. Whalen, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Whalen:

Subject: Draft Environmental Impact Statement (EIS)
Waialua-Haleiwa Wastewater Facilities Plan

We have reviewed the subject EIS and have the following comments:

1. The subject project will be in close proximity to existing HECO overhead distribution lines that will remain energized during construction activities. As a result, the following HECO notes should be included as part of the final construction plans:

   * The Contractor is to exercise extreme caution when the excavation and construction crosses or is in close proximity of our lines and is to maintain 13'-0" clearance for his equipment while working close to and/or under the overhead facilities.

   * The Contractor is to comply with the regulations of the State of Hawaii Occupational Safety and Health Law (DOSH).

   * When excavation is adjacent to or under existing structures or facilities , the Contractor is responsible for properly sheeting and bracing the excavation and stabilizing the existing ground to render it safe and secure from possible slides, cave-ins and settlement, and for properly supporting existing structures and facilities with beams, struts or underpinning to fully protect it from damage.

An HEI Company

   * Should it become necessary, any work required to relocate HECO facilities shall be done by HECO. The Contractor shall be responsible for all costs and coordination.

   * The Contractor shall be liable for any damages to HECO's facilities.

   * The Contractor shall report any damages to HECO's facilities to the HECO Trouble Dispatcher at phone 548-6961.

2. The Contractor should clarify any possible disruption and relocation of HECO underground and overhead electric distribution facilities during the construction of the sewer line system.

3. HECO does not have existing nor planned transmission facilities in the vicinity of the proposed wastewater treatment facility.

Sincerely,

Brenner Munger

cc: Mr. Alfred J. Thiede,
Director and Chief Engineer
City and County of Honolulu

Director, Office of Environmental Quality Control

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

WPP 87-504

September 10, 1987

Dr. Brenner Munger, Manager
Environmental Department
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Dr. Munger:

Subject: Your Letter of August 6, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. Your comments will be taken into consideration in the design phase for this project.

Should there be any questions, please call Geraldine Lum at 527-5392.

Very truly yours,

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

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Kenneth A. Martyn
ATTORNEY AT LAW

DOWNTOWN OFFICE

NORTH SHORE OFFICE
P O BOX 1132
HALEIWA HAWAII 96712
(808) 637 6427

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TO

August 7, 1987

Director
Office of Environmental
Quality Control
465 S. King Street, Room 104
Honolulu, Hawaii 96813

Mr. John P. Whalen, Director
Dept. of Land Utilization
City & County of Honolulu
650 S. King Street
Honolulu, Hawaii 96813

Mr. Alfred J. Thiede
Director & Chief Engineer
City & County of Honolulu
Dept. of Public Works
650 S. King Street
Honolulu, Hawaii 96813

Re: Comments to the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Dear Sirs and/or Madam:

I am an attorney in the State of Hawaii and I reside at 68-505 Crozier Drive, Waialua, Hawaii 96891. I have the following comments to the above-referenced EIS:

Economic

The proposed project is not cost effective. The cost of $66 million dollars means a minimum outlay by the City and County of Honolulu of $16.5 million dollars and it is likely that by the time the project is constructed little or no federal funds will be available so that most of the $66 million dollar cost will be borne local taxpayers. The $66 million dollars will produce only 1.4 MGD of capacity. In contrast, proposed expansions of the facilities in the more populated areas of Oahu are estimated to produce 26 MGD of capacity for only $52 million dollars. Thus, this proposed facility is approximately 20 times as expensive per unit of treated wastewater. With limited funds, this is a very silly project.

The EIS makes a comparison of estimated costs to the City of current cesspool pumping and its associated treatment with the operation and maintenance cost of the proposed plan. However, the EIS does not adequately discuss and compare the projected annual costs of the no action alternative with the proposed project when the capital costs of the proposed project are considered.

The EIS also makes no adequate comparison of the cost of the proposed centralized treatment plant with the cost of localized community wastewater treatment plants, which could be placed in only those areas that it is projected there is a need for such localized treatment plants.

Failure to adequately consider alternatives.

Although pages II-23 through 25 show the proposed location of six potential localized community wastewater treatment plants, the costs and benefits of that approach, which is probably the most logical and cost effective approach, is not adequately discussed anywhere else in the entire report!

Lack of demonstrated need for the proposed project.

The charts contained in the EIS and slides presented at the last public hearing on this project indicate very strongly that there is no contamination problem in many areas that are proposed to be connected to the proposed project. For example, there is no reason to suppose that two-acre lots in the Mokuleia agricultural subdivision need to be connected to sewers. The water quality data indicates that those problems that do exist are extremely localized, and that many of the areas proposed to be connected to the centralized treatment plant are not causing any pollution problems. Nor is there any data to suggest that in those areas which do not need to be sewered at the present time, the deterioration of cesspools over time cannot be adequately and more cost effectively dealt with by individual cesspool replacement or local community wastewater treatment plants.

Proposed injection wells.

The ability of the proposed injection wells to handle effluent volumes during periods of heavy rainfall is not adequately discussed. The combination of high effluent volumes and saturated ground may produce terrible odors and health problems if the injection wells cannot handle the effluent.

Proposed ocean outfall.

The effects of 30 to 50 foot winter waves upon ocean current patterns and their effect upon the ocean outfall are not adequately discussed. Further study on this matter should be done before any EIS is approved.

Odor control.

Odor control at the plant and also the effects of various wind conditions (particularly Kona winds and the so-call "Schofield Winds") are not adequately discussed. In addition, odor control at the sewage pump stations is not adequately discussed.

Miscellaneous

The potential effect of tsunamis on the collection system is not adequately discussed. The potential negative environmental effects of a treatment plant malfunction are not adequately discussed, particularly in light of the fact that areas for which there is no demonstrated environmental need for sewers are proposed to be connected to the plant, thus creating an environmental risk in the event of a plant malfunction where none existed before.

I request that written responses to these comments be given to me. Thank you very much for your attention.

Very truly yours,

Kenneth A. Martyn

KAM:nkf

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

WPP 87-506

September 10, 1987

Mr. Kenneth A. Martyn
68-505 Crozier Drive
Waialua, Hawaii 96891

Dear Mr. Martyn:

Subject: Your Letter of August 7, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. We would like to take this opportunity to respond to your comments.

1. Economic: The comparison of the economics of this project cannot be presented as simply as stated in your letter for the following reasons:

   (a) Inequities in Treatment Processes: The treatment plant your letter appears to be referencing is a primary treatment plant. This type of system involves fewer treatment units (a simpler treatment process) than the secondary treatment plant being proposed by this project.

   (b) Exclusion of Collection System Costs: The referenced $52 million do not include any costs for the construction of the collection system. The $66 million referenced for this project provides for the cost of the entire system (collection, treatment and disposal).

   It appears that your concerns regarding inadequate comparisons of the costs of "No-Action" and the proposed centralized system was based on information contained in Section 4.13 of the EIS. The discussion of O&M costs is not intended to be a justification of the proposed action, but rather a straight comparison of O&M costs. Present worth analyses (although not included in the EIS) does indicate that the present

   worth cost of the proposed system is significantly higher than that of the "No-Action" alternative. We believe, however, that the potential benefits to the members of the community as well as the general public as a whole justifies this higher cost; benefits such as those discussed in point 3 of this letter and at the end of Section 4.13.1.2 in the EIS.

   Evaluation of the cost of the Community Wastewater Treatment alternative indicates that this community wastewater management scheme would cost approximately 90 percent of the cost of the centralized alternative. This community system alternative, however, would service only two-thirds of the urban population. The actual cost per person serviced by a community system would therefore be approximately 35 percent higher than the per person cost for a centralized system.

2. Failure to Adequately Consider Alternatives: Text has been revised to include a more detailed discussion of the community wastewater management system alternative.

3. Lack of Demonstrated Need for the Proposed Project: The data included on the referenced charts and slides were only part of the information used to evaluate the need for the proposed project. Analysis also included evaluation of cesspool pumping records for the area. These records indicate a high cesspool failure rate within the urban portion of the study area.

   Failure of cesspools and other individual wastewater systems currently utilized in the study area has the potential to adversely impact the public health and welfare of not only the immediate home owners, but also the general public who may become exposed to inadequately treated wastewater. In the long-run the completion of the proposed wastewater management project would have the potential to benefit not only residents of the area, but all persons utilizing the area by reducing the risk of exposure to potential unsanitary conditions.

4. Proposed Injection Wells: Exfiltration wells are designed to dispose of effluent into the subsurface strata and not into the surface soil levels which may become saturated during periods of heavy rains. In addition, the system would be designed in accordance with City and County of Honolulu design standards which include adequate surplus well capacity. These factors would make overflow of the system and subsequent related problems highly unlikely.

5. Proposed Ocean Outfall: A supplemental EIS will be prepared for the ocean outfall upon completion of supplemental oceanographic studies. This supplemental EIS will address, in more detail, the potential impacts that may be created by the proposed outfall.

6. The wastewater management plan being proposed for this project includes provisions for best available odor control technology with supplemental odor polishing units. The proposed wastewater treatment plant (WWTP) site is set back approximately 1,800 feet mauka from the main highway. This setback will provide additional buffer between the WWTP and the nearest resident. These steps have been taken to mitigate potential odor problems that may be created by this project.

   Odor control systems will be considered as part of the design of the wastewater pump stations.

7. Miscellaneous:

   The text contains a discussion of impacts that would be created by flooding of the system (Section 4.2.2). This section is applicable for flooding not only by riverlets but also flooding that may occur as a result of tsunami inundation.

   The treatment plant will be designed to include back-up capacity for the various treatment units as well as an emergency generator. These items will reduce the likelihood of a treatment plant malfunction and mitigate any adverse impact.

Should there be any questions, please contact Geraldine Lum at 527-5392.

Very truly yours,

ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

mokuleia management, inc.

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DIV. OF WASTEWATER MANAGEMENT

August 10, 1987

Mr. Alfred J. Thiede
Director and Chief Engineer
City and County of Honolulu
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

RE: WAIALUA-HALEIWA WASTEWATER FACILITIES PLAN

I am in receipt of the Environmental Impact Statement with reference to the above matter. My company manages four of the condominiums which will be affected by this plan and the Board of Directors of the individual condominiums have requested that I inquire as to the anticipated sewer assessments for the following:

70 unit condo with package plant

64 unit condo with package plant

20 unit condo with package plant

18 unit condo with nine cesspools

Any information you can provide as to the assessments will be greatly appreciated.

Please do not hesitate to contact me should you have any questions.

Sincerely,

India Andrews-Noe

India Andrews-Noe
Mokuleia Management, Inc.

IAN:ihf

(808) 637-3507 management and sales

66-134 kam hwy haleiwa hawaii 96712

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

WPP 87-497

September 10, 1987

Ms. India Andrews-Noe
Mokuleia Management, Inc.
66-134 Kamehameha Highway
Haleiwa, Hawaii 96712

Dear Ms. Andrews-Noe:

Subject: Your Letter of August 10, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project.

Based on the current ordinance, the anticipated sewer assessment for the various condominiums is 24 cents per square foot of land area.

Should there be any questions, please call Geraldine Lum at 527-5392.

Very truly yours,

Sam Callejo

ALFRED J. THIEDE
Director and Chief Engineer

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WAIALUA COMMUNITY ASSOCIATION, INC.

ENV WWM

TELEPHONE
WAIALUA 637-4606

66-434 KAMEHAMEHA HIGHWAY
HALEIWA, HAWAII 96712

August 4, 1987

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Mr. Alfred J. Thiede
Director and Chief Engineer
City & County of Honolulu Dept. of Public Works
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

The Waialua Community Association has reviewed the Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities plan for Waialua-Haleiwa, Oahu. While the Waialua Community Association realizes that the existing cesspools in the area function poorly at best and that a wastewater facility is required to ultimately replace them, the Association wishes to express the following concerns regarding the unresolved items found in Chapter IX, pp. IX-3 - IX-4.

1. Ocean outfall - specific outfall alignment, discharge depth and diffuser characteristics,
2. Secondary treatment units - final selection, and
3. Funding for the project.

The proposed facilities innovative and alternative technology to be utilized has limited information due to it's recent introduction and limited use and while a secondary treatment will be utilized, there is concern about the operational viability/odor generation of this system. The Association feels that the unresolved ocean outfall issue will have major environmental impact and feels that both issues of the outfall and the secondary treatment units should have been resolved prior to the EIS to allow the public to have the adequate information to review the EIS appropriately.

Furthermore, there is still the question as to whether the project will receive adequate financial support for the construction of the facility. This causes concern that in the event the funding is insufficient and the project is unable to be completed, what the impact will have on the community.

Thank you for allowing us to express our concerns herein.

Sincerely,

Gabrielle M. Casart

Gabrielle M. Casart
President

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

WPP 87-507

September 10, 1987

Ms. Gabrielle M. Casart
Waialua Community Association, Inc.
66-434 Kamehameha Highway
Haleiwa, Hawaii 96712

Dear Ms. Casart:

Subject: Your Letter of August 4, 1987 Regarding the Draft Environmental Impact Statement for the Waialua-Haleiwa Wastewater Facilities Plan

Thank you for reviewing the Draft Environmental Impact Statement (EIS) for this project. We would like to take this opportunity to respond to your comments.

1. Ocean Outfall: A supplemental EIS will be prepared for the ocean outfall prior to its construction. This supplemental EIS will consider information from additional oceanographic studies as well as a more detailed evaluation of the impacts that may be created by the construction and use of an ocean outfall disposal system.

2. Finalizing Selection of Secondary Treatment Processes: The treatment processes proposed in Chapter II of this report would be capable of meeting secondary treatment requirements. Performance data gathered thus far indicated that the innovative/alternative treatment process is capable of consistently meeting secondary treatment requirements. It should be pointed out that a preliminary engineering report will be prepared for this proposed project. Treatment process selection will be finalized in this document.

   In regard to your concern about odor generation from the system, the design of the proposed system will include provisions to mitigate potential odor problems. The treatment plant design may include provisions for covering selected treatment units. The air stream from these units will be treated through an odor control system prior to its release into the atmosphere. The odor control system will

include back-up treatment and odor polishing units as an additional precaution. Under normal operating conditions, the treatment system should significantly reduce the levels of odors released from the treatment plant. In addition to these provisions for treatment of the air stream, the treatment plant site has been located south of and set back approximately 1,800 feet from Farrington Highway. The increased separation distance should also aid in mitigating potential odor impacts on nearby residential areas.

   Odor control systems will be considered as part of the design of the wastewater pump stations.

3. Funding of the Project:

   The treatment, disposal and collection system will be implemented in phases over the years based on priority or need, subject to the availability of funds. Areas of greatest need will be implemented first.

Should there be any questions, please contact Geraldine Lum at 527-5392.

Very truly yours,

for ALFRED J. THIEDE
Director and Chief Engineer

cc: OEQC
DLU
BCA

XII. REFERENCES

CHAPTER XII

REFERENCES

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APPENDICES

APPENDIX A

RECEIVED
JUL 7 1986
BELT, COLLINS & ASSOCIATES

ARCHAEOLOGICAL INVESTIGATIONS AND RECOMMENDATIONS FOR MOKULEIA, O'AHU (TMK 6-8-30 and 6-8-02)

JULY, 1986

Prepared for: Belt, Collins & Associates
606 Coral St.
Honolulu, Hawaii 96813

Prepared By: Joseph Kennedy
Archaeological Consultants
of Hawaii. Inc.
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Honolulu, Hawaii 96822

CONTENTS

LIST OF FIGURES

INTRODUCTION

At the request of Belt, Collins and Associates, Archaeological Consultants of Hawaii, Inc. has conducted a preliminary archaeological investigation of the proposed Waialua-Haleiwa Wastewater Treatment Plant and & Effluent Areas at Mokuleia, O'ahu, TMK 6-8-02 and 6-8-03.

The purpose of this report is to provide preliminary information regarding the existence of any archaeological resources within the project area, assess their significance, and, based on these data, to offer recommendations regarding their future treatment.

To this end, a brief field examination was conducted on the property. In addition, archival sources were researched as were documents relating to previous archaeological work in the Mokuleia area.

Our field investigation confirms the presence of a large, multifunctional site complex (most likely of precontact origin), located within the property limits. There are also two platforms (also likely precontact) which are set apart from this complex. In addition, structures associated with military and ranching activities are common.

Archival and previous archaeological records suggest that buried agricultural, habitation or religious structures may exist on the property, as well as unrecorded human remains.

Site specific recommendations are presented at the end of this report.

METHODOLOGY

Prior to the field examination portion of this investigation, I had the opportunity to speak with Mr. Tommy Ah Choo, a long-time resident of the area and cowboy at Mokuleia Ranch, where he has been employed for the past 35 years. From the beginning, it was quite clear that Mr. Ah Choo is very familiar with the property in question and his historical information has been augmented by discussions with his father who is still alive and is well-known for his familiarity with Mokuleia.

From this discussion, it was clear that the field search for remaining above-ground structures should be directed along the mauka or southern portions of the property and especially on the military lands south of the Dillingham Airfield which have been relatively undisturbed by modern agricultural activities.

To this end, the author and two assistants conducted a series of east/west sweeps, on foot, through the southern portions of the property. Field location was determined with the assistance of aerial photographs, existing landmarks and modern structures.

No archaeological report can be complete without a complete review of like-work on the property in question and in the immediate area. Accordingly, the archaeological library at the Department of Land and Natural Resources, Historic Sites Section was consulted for archival information as was the State of Hawaii Survey Office; with the help of Mr. Charlie Okino, I was able to inspect the J.S. Emerson map of the area, drawn in 1887. It should be noted that this was of little value in terms of the placement or nature of archaeological sites.

At the archaeological library, with the help of Mr. Earl Neller and Agnes Griffin, I was able to review McAllister's 1933 survey report and in particular, the section dealing with Mokuleia. In addition, I was able to consult earlier reports for the area by Hommon (1982) and Barrera (1986). A survey report for the Mokuleia Ranch property, by the author (1986) must also be listed. Other material examined includes Summers and Sterling's Sites of Oahu (1978), and Foote et.al. (1972).

In this archival search, I was also able to locate a site map prepared by the State of Hawaii entitled Kaena Point Conceptual Plan which gives approximate locations of archaeological sites which were known to have existed on the subject property.

At a legislative hearing before the State of Hawaii House of Represenatives earlier this year, I witnessed the testimony of a Hawaiian man who told of family grave sites located under what is now the runway of the Dillingham Airfield. I include this information because it does raise the possibility that unmarked and previously unrecorded human remains still exist in this general area; however, it is not impossible that these remains may have already been attended to in the course of airfield construction.

PHYSICAL SETTING

The subject property spreads from sea level to almost 400ft. or up to the beginning talus slopes of the Kaaia Mountians. Within this area, a wide variety of soil types are in evidence along with a number of differing land forms. These range from near ocean front sandy beach land, across alluvial plains and, as mentioned, to the lower talus portions of steeper mountian declivities.

Named streams occur on the property and run according to rainfall. Floral patterning on the property is also varied and includes cultivated sugarcane (*Saccharum officinarum*), *haole koa* (*Leucaena glauca*), *kiawe* (*Prosopis pallida*), Christmasberry (*Schinus terebinthifolius*), and a number of vines, shrubs, and grasses.

Much of the property has been subjected to post contact alterations that include the tarmac and structures associated with the Dillingham Airfield, military constructions and the varied results of farming and ranching activities. There can be little doubt that these developments have had a substantial impact on many of the above-ground archaeological sites that once existed here.

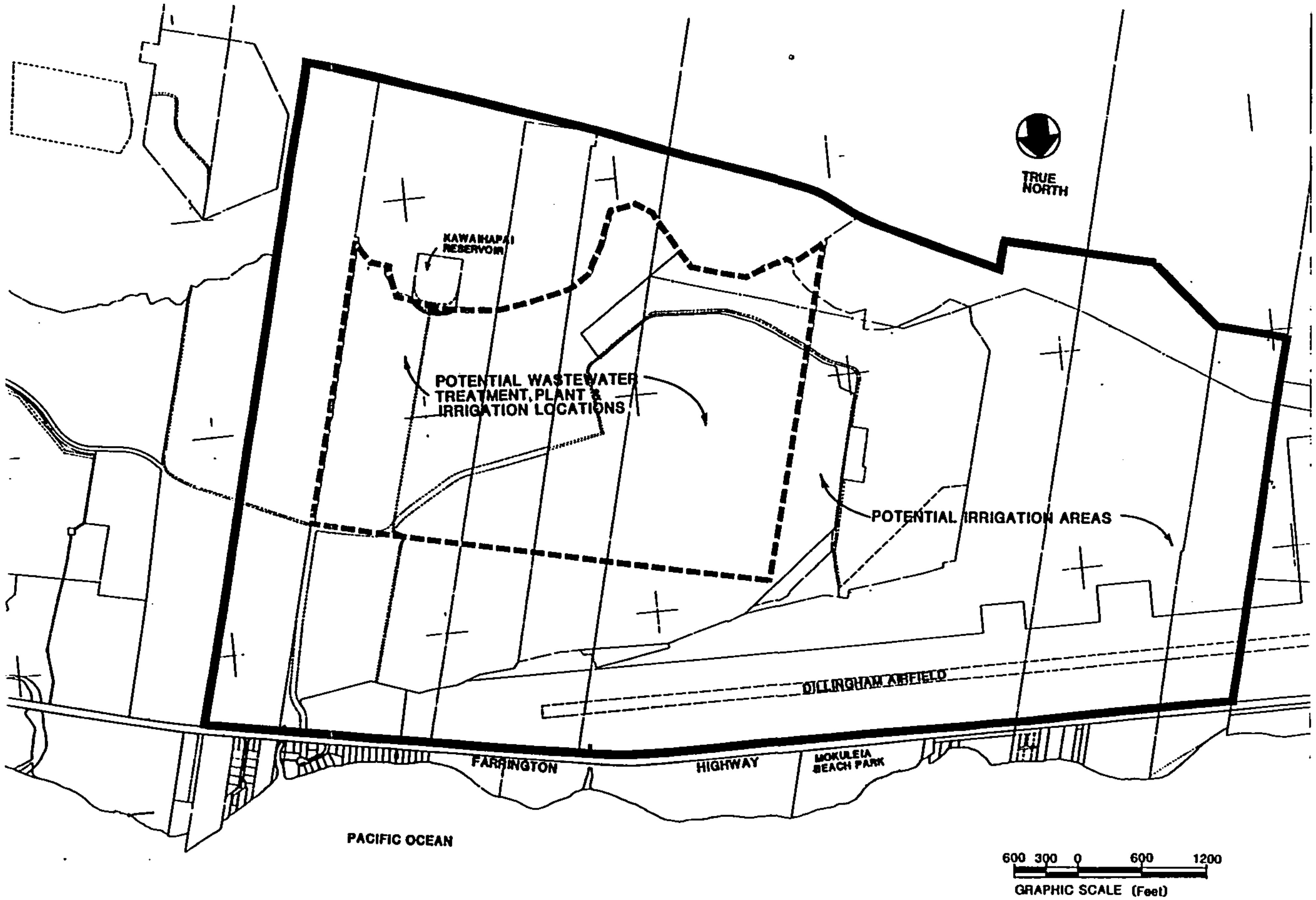

FIGURE # 1. PROJECT AREA AND BOUNDARY

PREVIOUS ARCHAEOLOGICAL WORK

The first archaeological examination of the Mokuleia area was conducted in 1933 by Gilbert McAllister. While McAllister's site total for the immediate area exceeds this number, for the purposes of this report we may concern ourselves with just seven (# 189, 190, 191, 192, 193, 194 and 195). These are the recorded sites from the 1933 survey that are, or were once contained within the limits of the property, or very close to it.

#189. Ulehulu Heiau. Once located just west of the property and reported destroyed by McAllister and Summers and Sterling. While the location of this religious structure is off the property limits its former presence must be taken into account if only to help establish the likelihood of contiguous cultural activity in the area which was preempted by modern developments. I would like to stress that this site was once located outside the property limits and is now destroyed and is included in this list only as a reference and not as an area of recommended further work.

#190. Puu o Hekili. An ahua, or type of fishing shrine. Again, this site was once very close to, but not actually within the limits of the property - at any rate, it too has been destroyed and it's function suggests little opportunity for sub-surface data recovery,

#191. Kawailoa Heiau. This site was once located well within the limits of the property. Although it has been reported destroyed, I have my doubts as its general location places it within the large site complex discovered in our field examination. As will be seen later, this site complex was not recorded by McAllister (or anyone else for that matter) and there is a good possibility that some portion of Kawailoa Heiau, or the kahu hale, or priest houses that were associated with it, may still remain and comprise a portion of this complex.

#192. Hidden Waters. Located on the property. These consist of four springs which have important legendary associations with the Hawaiian diety Hiiaka. It is unlikely that these springs will lend themselves to archaeological data recovery, although they surely are not outside the realm of anthropological concern.

#193. __Kuakea Fishing Shrine__. Once located just __makai__ of the property and reported destroyed. Once again, Kuakea is listed here for reference purposes only; even if it did still exist (it does not), site function indicates that sub-surface investigation would not be likely to yield significant results.

#194. __Heiau Site__. Within the property limits. Summers and Sterling have reported that this site has been destroyed: I am not so sure that this is the case. Our field examination in the resevoir area, upon which this possibility is based, will be discussed in a later section of this report.

#195. __Kolea Fishing Shrine__. Just __makai__ of project area. Like many of the others, this site has been destroyed and is a poor candidate for sub-surface data recovery at its former location. Once again, its inclusion on this list is for reference purposes which are designed to bolster the probability that this portion of Mokuleia was an area of intense pre-contact activity.

In sum then, McAllister's 1933 report lists seven sites which were on, or located very close to the subject property. Four of these sites have been destroyed (189, 190, 193 and 195) and site function for two of these - located off the property - indicate that sub-surface excavation at their former locations would be unnecessary. Excavation at the former location of site 189 could prove useful; however, as mentioned earlier, this location is outside the project area. Site 192, which is on the property, is an area of anthropological concern but is unlikely to lend itself to archaeological examination.

Some or all of sites 191 and 194, on the other hand, may still exist and are well within the property limits. If the proposed development should impact these structures, further work will be necessary. Detailed recommendations will appear in a later section of this report.

The next archaeological work in the area was conducted by Robert J. Hommon in May of 1982. This reconnaissance covered five select areas some distance east of the subject parcel towards Waialua. Hommon lists nearly 30 sites of archaeological interest in the general area and added another as a result of his field investigations (site 50-80-04-3400).

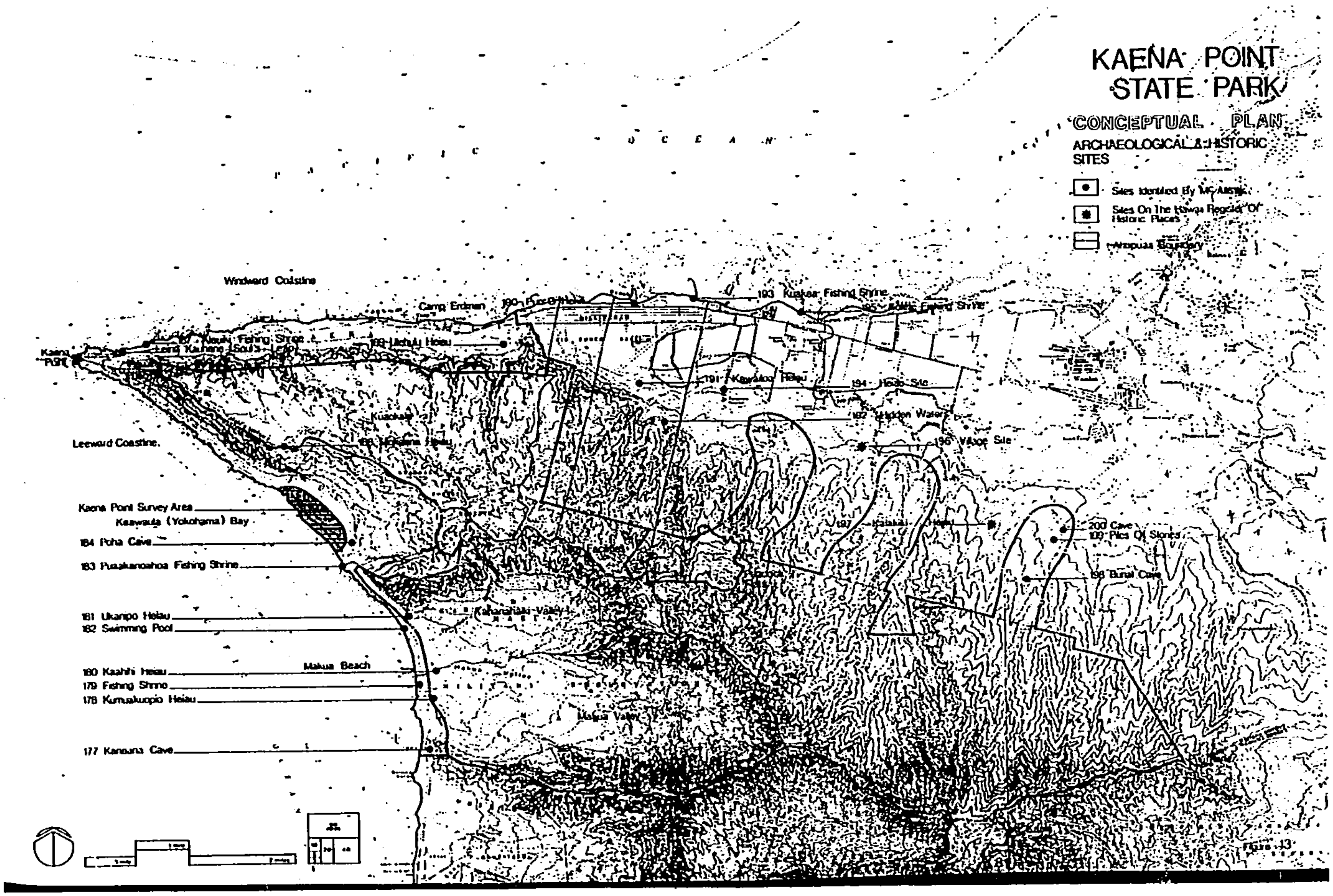

FIGURE # 2. KEANA POINT CONCEPTUAL PLAN, SHOWING LOCATION OF ARCHAEOLOGICAL SITES

It is worthwhile to quote directly from Hommon's report as his observations concerning the archaeology of the Mokuleia region are not without value to conclusions set forth later in this report.

> The archaeological record including the information on destroyed sites indicates that in precontact times and during the 19th century the economic system in the project region included both wet and dry agriculture as well as aquaculture in at least two ponds. Little is known of the residential pattern...but the population was probably relatively dense, especially along the shore if we may judge from the number of religious sites...that were recorded by McAllister.
>
> (Hommon 1982:7)

E.C.S. Handy also speaks of argicultural activities in the Mokuleia area. Again, it is best to quote directly.

> Kealia. The large area of lowland terraces between the cliff and the elevated coral, though mostly in Kawaihapai, extends a short way into Kealia.
>
> Kawaihapai. There is a sizeable area of terraces in the low lands now surrounded by sugarcane, watered by Kawaihapai Stream. These terraces have evidently been lying fallow for some time, although several were being plowed for rice or taro in the summer of 1935. At the foot of the cliffs, watered by a stream...are several small terraces in which taro is grown.
>
> (Handy 1940:85)

Handy also quotes "...an old Hawaiian of Kawaihapai" who remembered the general area being extensively planted in sweet potato. (ibid:155).

In January of 1986, William Barrera Jr. conducted an archaeological reconnaissance survey of the Mokuleia Ranch property (whose far western end extends to and includes a portion of this subject property). He found only two `areas of archaeological interest' - one stone wall on the end of the ridge south of the Dillingham Ranch and another which he called `...part of a historic paddock southeast of the Kawaihapai Reservoir.' (Barrera 1986:5) This formation is located within the limits of the present survey. Had he followed this so-called `historic paddock' to its end (it is a stone wall), he would have discovered the two stone platforms mentioned earlier in this report. As mentioned, these may be a possible remnant of the once-thought destroyed 194 heiau site recorded by McAllister. There is little chance that these two platforms were ever part of a historic paddock.

All this notwithstanding, Barrera did conclude that there is a likehood that "...subsurface evidence of agricultural practices is present on the property." and that references indicate that "...habitation sites were present in the vicinity...[and that]...significant archaeological sites...are buried here also." (Barrera 1986:7).

The author reexamined this same property five month later. In this report, the two aforementioned platforms were recorded and added to the literature, along with the results and a brief review of Hommon's reconnaissance. Also presented in this report was the possibility that some portions of, or indeed all of the Kawailoa Heiau may still exist as part of a previously unrecorded site complex. In addition, all the rest of McAllister's sites were rechecked, with added recommendations. Beyond this, the likelihood that unmarked and previously unrecorded human burials may be present within the project area was stated for the first time.

FIELD EXAMINATION RESULTS

As stated in the Methodology section of this report, surface survey on the subject property was directed towards the examination of the southern, or mauka portions. Briefly, the reasons for this choice were based on reliable informant testimony, the relatively undisturbed nature of the terrain and the presence of previously unchecked, but not unrecorded, archaeological sites.

It was reasoned that the term, or classification, 'destroyed', issued in the 1920's, may not mean today what it did back then. Due to the advance of excavation techniques and other factors,a site thought 'lost' to an archaeologist 60 years ago may now appear quite attractive to their modern counterparts. Accordingly, we began the field portion of this investigation with a search for some remnent of the Kawailoa Heiau, which was reported to be located just <u>mauka</u> of of the Dillingham Airfield.

It is, roughly, at this location that the floral topography makes a radical change. At this particular point on the property, tarmac, runways, historic structures and California grass give way to a forest of <u>haole koa</u> trees. When one crosses this landscape division, at least on the military-owned portion of the property, it would be difficult for the trained eye to miss the extensive stone constructions that comprise a contiguous and multifunctional archaeological site complex. This complex extends, uninterrupted, across the western <u>mauka</u> quarter of the property, and beyond, to Kaena Point.

Towards Waialua, from approximatly midway, and <u>mauka</u> of the existing runway, site frequency is reduced considerably until just southeast of the Kawaihapai Reservoir where the two stone platforms mentioned earlier are located.

While there is no surface indication of either agricultural, habitation or burial sites, there is sufficient evidence to reasonably expect that examples of all three types are buried somewhere within the property.

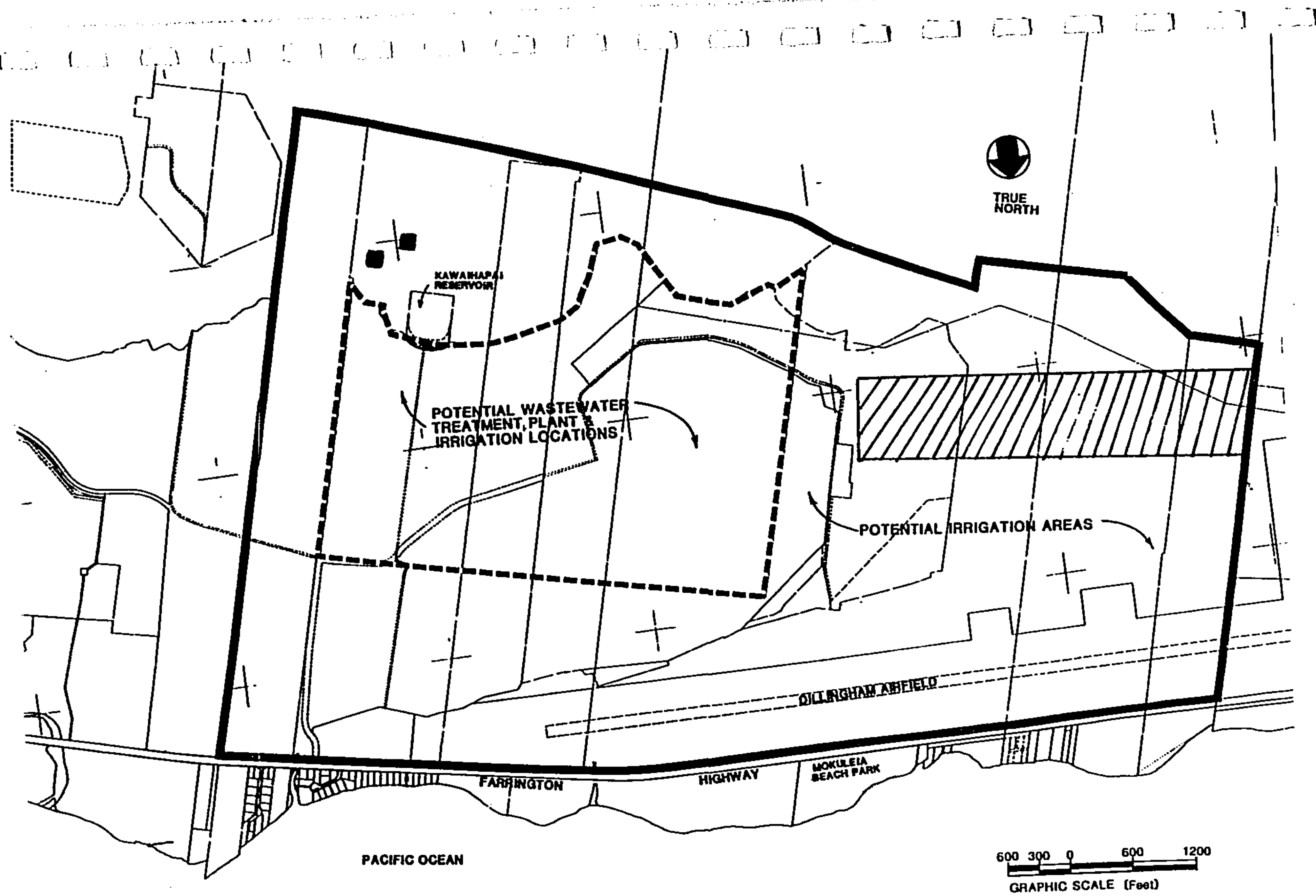

FIGURE # 3. PROJECT AREA SHOWING APPROXIMATE LOCATION OF SITE COMPLEX AND PLATFORMS

SITE COMPLEX (not to scale)

PLATFORMS (not to scale)

RECOMMENDATIONS

An equable archaeological evaluation of this property must include the following discussion.

On one hand, the project boundary for this proposed Wastewater Treatment Plant and Effluent Areas is quite extensive and covers a large portion of land that is known to have an extensive history; and also land which we know very little about. For example, I believe it is correct to say that, at this writing, there is not a single radioisotope or obsidian hydration date available for the entire Mokuleia area!

It goes without saying that some portions of this property most probably contain research data of the highest order. The confirmation of a previously unrecorded site complex on the property, and the possibility that portions of two once-thought destroyed heiau may still exist here, can only add to the archaeological attraction.

Now, on the other hand, after consulation with Ms. Audrey Tsuji and Mr. Perry White of Belt, Collins & Associates, it is clear that the property boundary does not reflect the actual area that will be effected by the proposed development. The proposed impacted area will only occupy a portion of the whole. Furthermore, there is a possibility that only a fraction of the actual project area will involve substantial land alterations. To a large part, this is dependent on exactly how the effluent area is to be constructed -an issue I take to be unresolved at this writing.

With this information in mind, the following recommendations may be offered:

1. When the actual site and boundaries of the proposed Wastewater Treatment Plant, its service roads, effluent areas and attendant facilities are finally determined, an archaeologist should be consulted to recommend a follow-up exercise based on these general criteria.

2. The entire impacted area must be subjected to a more thorough surface survey.

3. Any archaeological surface remains located within the impacted area should be mapped individually, photographed and have their location fixed on an overall map of the area. In addition, these sites should be subjected to subsurface investigation, if possible.

4. Should the project area be selected on a portion of the property that has no surface manifestations of cultural activity, an archaeologist should, at least, initiate a preliminary subsurface sampling exercise in order to test for buried deposits.

5. A realization that archaeological monitoring may be considered as both an alternative to subsurface testing as well as an adjunct procedure. I have in mind, monitoring land with proven previous subsurface disturbances and monitoring as an adjunct activity in areas with established research potential.

6. I would like to suggest that all further work conform to the standards set forth by the Society for Hawaiian Archaeology.

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ARCHAEOLOGICAL RECONNAISSANCE SURVEY OF PORTIONS OF THE WAIALUA-HALE'IWA WASTEWATER FACILITIES SYSTEM

by

Robert J. Hommon

Prepared for

Belt, Collins & Associates

May 1982

CONTENTS

LIST OF FIGURES

INTRODUCTION

This report presents the results of an archaeological reconnaissance survey of portions of the Waialua-Hale'iwa Wastewater Facilities System. The work was conducted by Science Management, Inc. (SMI), a private consulting firm, for Belt, Collins & Associates of Honolulu.

The scope of work, as outlined in correspondence between SMI and Belt, Collins & Associates is to conduct a reconnaissance-level survey of eleven areas where elements of the Waialua-Hale'iwa Wastewater Facilities System may be constructed. It was agreed that the resulting report would conform to the Society for Hawaiian Archaeology Minimum Requirements for Reconnaissance Survey Reports. The introductory statement in this document is as follows:

I. Purpose: An archaeological reconnaissance survey is a general inspection of a defined area.

   A. To determine the presence or absence and general nature of archaeological resources;

   B. To arrive at a preliminary evaluation of these resources by surface survey and subsurface testing, as necessary;

   C. To determine whether further archaeological work is necessary; and

   D. To record data from those sites that do not warrant further investigation.

BACKGROUND

Environment

The surveyed areas are situated throughout much of the wastewater facilities system, most of which is within a mile of the shoreline from the vicinity of Kawailoa Beach to Mokuleia Beach. The system is designed to serve the towns of Haleiwa and Waialua and the surveyed areas are in residential areas and the fringing agricultural areas along the alluviated coastal plain. All of the areas are below 80 feet in elevation (Figures 1, 2 and 3). Annual rainfall in the surveyed areas is 30 to 35 inches (Belt, Collins & Associates 1982:48).

The survey areas include eight pumping station sites (SPS), two wastewater treatment plants (WWTP), and a cluster of disposal well sites. The pumping station sites are about 10,000 square feet (929 square meters) in area; the wastewater treatment plants are each ten acres (4.05 hectares) in area; and the disposal well sites are in an irregular area of several acres. Each area is described briefly below. Their locations are shown on Figures 1, 2, and 3.

SPS No. 1 is on fill land (Foote, et al. 1972:31) covered with various grasses and a thick growth of koa haole (Leucaena glauca) trees. A large excavated pit on the inland side of the area has apparently exposed the underlying Jaucas sand (cf. Foot, et. al. 1972:48).

SPS No. 1A is situated in the corner of a sugar cane field. The soil is Waialua silty clay (Foote, et al. 1972:128).

SPS No. 2A is in a sugar cane field. The soil is Haleiwa silty clay (Foote, et al. 1972:33).

SPS No. 2B is covered with a growth of thick grasses up to seven feet high. The presence of this heavy grass cover, and the surrounding developed land strongly suggests that this area has been cleared and/or cultivated in the recent past. The underlying soil is Haleiwa silty clay (Foote, et al. 1972:33).

SPS No.3 appears to be in or adjacent to the intersection of Farrington Highway and Goodale Avenue. Vegetation cover on unpaved portions of this area is mowed grass. The underlying soil is Waialua silty clay (Foote, et al. 1972:128).

SPS No. 4 is covered in part with a thick growth of grasses, weeds and koa haole trees and in part with mowed grass. The soils are Malama stony silty clay loam (Foote, et al. 1972:93) and Mokuleia loam (p. 96).

The soil identifications for the above areas were drawn from Belt, Collins & Associates (1982:43, 44, Figures 10 and 11).

SPS No. 5 is covered with low grass and scattered ironwood (Casuarina equisetiafolia) trees. A portion of the area appears to be in pasture. The soil is Jaucas sand (Foote, et al. 1972:48).

Mokuleia Wastewater Treatment Plant site is situated at the edge of a sugar cane field and is entirely covered with cane. The soils are Pearl Harbor clay (Foote, et al. 1972:112) and Waialua silty clay (p. 128).

Kawailoa Wastewater Treatment Plant site is covered with thick stands of grasses and koa haole trees. Near the southwest side of the area are date palm (Phoenix dactylitera) and Chinese Banyan (Ficus retusa) trees. The secondary growth and the abundant evidence of bulldozing (piles of boulders and even ground surface), as well as abandoned recent farm structures and the cane haul road that runs through the area, all indicate large-scale 20th century land modification. A portion of a landfill dump is situated at the west corner of the area. The underlying soil is Waialua stony silty clay and silty clay (Foote, et al. 1972:128).

The Disposal Well Sites Area is covered with stands of koa haole trees and various grasses. The underlying soil is Jaucas sand (Foote, et al. 1972:48).

Historic Sites

Most of the Waialua-Hale'iwa Wastewater Facilities area has been modified by urban or agricultural development since about 1898, when the Waialua Agricultural Company (now Waialua Sugar Company) began to acquire land for sugar cane (Belt, Collins & Associates 1982:63 and 69, Figure 17).

The number, variety and wide distribution of archaeological sites that once existed throughout the region, as well as related historical data indicate a large population and extensive land use before Western contact (1778) as well. The record of the pre-Contact and, to a lesser extent, 19th century history of the Waialua-Haleiwa area is summarized in the following list. Data concerning the surveys and related work done by the staff of the Historic Sites Section of the State Parks Division during the early 1970s were provided by Mr. Earl Neller, now of the State Parks staff. The impact of urban and agricultural development on the archaeological record is demonstrated by the number of sites reported as destroyed in the list below (see also Figure 3).

201. Keauau Fishing Shrine. A site situated on the beach at Puuiki; reported destroyed by McAllister (1933:132).

202. Human Burials. Reported in sand dunes west of Kaiaka Bay by McAllister (1933:202). Others found along Waialua Bay (Sterling and Summers 1978:105).

203. Heiau. A small heiau of unknown name was said to have been located near Kaukonahua stream where the Waialua Agricultural Company installed their Pump No. 1. Reported destroyed by McAllister (1933:132).

204. Oahunui Stone. Stone said to resemble the shape of Oahu in a gulch near the boundary between Ewa and Waialua districts. Reported in early 1970s by State staff to be in complex 771, which has not been entered on State maps.

205. Akua Stone. A sacred stone reported by McAllister (1933:132) as being in the Poloa tree grove sacred to the goddess Pele. The grove had been preserved in the midst of a cane field but had been destroyed by 1954, though the stone may still be present (Sterling and Summers 1978:105). In the early 1970s the site was reported by the State staff as being in complex 752, which has not been entered on State maps.

206. Kahakahuna Heiau. Reported destroyed by McAllister (1933:132).

207. Kawai Heiau. Reported destroyed by McAllister (1933:132).

Halemano and Opaeula Gulches. Numerous small agricultural terraces were reported by Handy (1940:86) on the floors of these gulches, extending inland four or five miles.

Waialua. "Much of the gently sloping and level land now covered by sugar cane, the sugar mill, and the town was formerly covered with wet-taro terraces. And beyond there was a great spread of kula land with red soil (where sugar cane now flourishes) which was ideal terrain for sweet potato planting." (Handy and Handy 1972:465-6.)

221. Laukiaha Spring. Once flowed into Opaeula stream inland of the twin bridges at Waialua (McAllister 1933:140).

222. Kumailia-unu. McAllister (1933:140) reported that truck gardens had replaced this site, which may have been an altar (unu).

223. Hekili Heiau and the Kaohe Fishing Shrine. The heiau, reportedly of the luakini (human sacrifice) class and a place of refuge had been replaced by a Bhuddist temple. Evidently the fishing shrine had been destroyed too (McAllister 1933:140).

224. Punakai. Residence of a kahuna and site of a former unu (altar), according to McAllister (1933:140).

225. Kapukapuakea Heiau. This medium-sized heiau, located at Palaa-kai at the east end of Kaiaka Bay was said to have been of menehune construction. The heiau was "long since destroyed," according to McAllister (1933:140). Salt pans that had been nearby had also been destroyed. (See also Beckwith 1940:347 and Sterling and Summers 1978:113.)

226. Pohaku Lanai Stone. Large balanced stone used by fishermen as a lookout (McAllister 1933:140-1).

227. Puupiio Heiau. Reported as destroyed by McAllister (1933:141), it stood formerly seaward of the Haleiwa Courthouse, Paaloa.

228. Kepuwai Heiau. McAllister reported this site destroyed and replaced by a cemetery.

229. Kawaipuolo Spring. A spring "south of the Anahulu stream, mountainward of Haleiwa" (McAllister 1933:141).

Anahulu Valley. A number of late pre-historic and 19th century archaeological sites are situated on the floor of Anahulu valley above about 80-foot elevation and outside the project area. Most of the sites are remains of agricultural and habitation activities pertaining to the last half of the 19th century (Kirch 1979). Handy (1940:86) noted taro growing areas to north and south of the mouth of the Anahulu.

230. Po'o o Mo'o and Wawae o Mo'o. Described by McAllister (1933:141) as: "Two stones known as moo [mo'o: reptile or water spirit], on either side of the Anahulu Stream above the old Haleiwa Seminary."

CORRECTION

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

extent, 19th century history of the Waialua-Haleiwa area is summarized in the following list. Data concerning the surveys and related work done by the staff of the Historic Sites Section of the State Parks Division during the early 1970s were provided by Mr. Earl Neller, now of the State Parks staff. The impact of urban and agricultural development on the archaeological record is demonstrated by the number of sites reported as destroyed in the list below (see also Figure 3).

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231. Anahulu Heiau. At Kamani; reported as having been destroyed during the construction of the Hale'iwa Hotel according to McAllister (1933:141).

232. Akua Stone. A sacred stone removed "some years" before 1933 from the mouth of the Anahulu river (McAllister 1933:141).

233. Small Fresh Water Pond. A 2.5-acre pond reported as "still in use" by McAllister (1933:141). Noted as of marginal significance in 1971 by State staff.

234. Kahakakau Kanaka. A rock ledge at Puaena Point where human bodies were placed and allowed to decompose (McAllister 1933:141-2; see also Sterling and Summers 1973:117).

235. Stone with Curative Powers. According to McAllister (1933:142) cures were said to be accomplished by means of a ceremony and touching the stone.

236. Uko'a Fishpond. "One of the two Waialua ponds; still in use [in 1933]. It is a long narrow fresh-water pond, approximately a mile in length. Most of it now overgrown with weeds" (McAllister 1933:142). A number of stories about the pond and its mo'o, Laniwahine, can be found in Sterling and Summers (1978:119-120).

237. Iliilikea Heiau. According to McAllister (1933:142) this heiau was destroyed in 1916 by the Waialua Agricultural Company.

Sites in the Kamehameha Highway Realignment. Five sites near the mouth of the Anahulu river were recorded in 1979 by Chiniago, Inc. (1979:25-33). They included:

Site 1439. A deposit of bottles, ceramic sherds and other historical materials probably dating from about AD 1880 to 1920.

Site 1440. A wall remnant.

Site 1441. Irrigated agricultural terraces covering about one hectare (c. 2.47 acres) of land.

Site 1442. The Emerson Homestead. Remnants of the residence of Reverend John S. and Ursula Sophia Emerson, members of the Fifth Company of missionaries to Oahu. They were stationed here from 1832 to 1842, and construction of the household began in 1833.

Site 1443. An "old church" whose masonry walls probably date from the Emerson missionary period.

The archaeological record including the information that has been preserved on destroyed sites indicates that in pre-Contact times and during the 19th century the economic system in the project region included both wet and dry agriculture as well as aquiculture in at least two ponds. Little is known of the residential pattern, except what is summarized above, but the population was probably relatively dense, especially along the shore if we may judge from the number of religious sites (nine heiau and four known shrines and altars, now destroyed) that were recorded by McAllister.

The northeast edge of the Kawailoa Wastewater Treatment Plant site extends into a parcel of land (see Figure 2) that was originally defined in the mid-19th century during the Great Mahele as Land Court Award 10,364, parcel 2. According to the Native Register (Archives 1974-5) recorded at Waialua on February 1st, 1848, this land was claimed by a person named Nanokaeho as a pali wauke, evidently an area used for wauke, the paper mulberry (Broussonetia papyrifera), whose inner bark was the raw material for tapa cloth. (No trace of the Land Court Award boundary or 19th century use of the land was found during the present survey.)

THE SURVEY

Procedures

Pre-field research included consulting the pertinent standard published works, as indicated in the section summarizing the archaeological and historic data of the project region. We also consulted the files of the Historic Sites Section and the State Historic Preservation Office, Department of Land and Natural Resources, as well as the map archives of the Land Survey Division of the State Department of Accounting and General Services. The State Archives was also used for land-use data.

The reconnaissance survey was conducted on the 26th of April, 1982 by the author of this report, assisted by Mr. Tommy Holmes. Each area was first located with the aid of project maps, road maps and the USGS Haleiwa, Hawaii 7.5-minute quadrangle maps.

Most areas were then searched on foot by means of sweeps, i.e. walking parallel strips of each area. It should be noted that the precise locations and boundaries of the SPS areas were not indicated on the maps provided by Belt, Collins & Associates, nor were any of the survey areas marked on the ground. In most cases, we made an effort to inspect an area somewhat larger than that indicated by the specifications. In those cases where the survey area could be seen to be entirely covered with sugar cane, field inspections were cursory, since the likelihood of finding significant intact cultural remains was extremely low.

Results

As indicated in the description of the survey areas, the vegetation and land surface as well as maps and historical information evidenced 20th century land modification throughout nearly all of the survey areas. The single exception was the Kawailoa wastewater treatment plant site.

In addition to widespread evidence of bulldozing, there was evidence of human activities in two portions of this survey area (Figure 4; inset). Throughout much of the survey area to the southeast of the cane haul road are the remains of agricultural activities, including

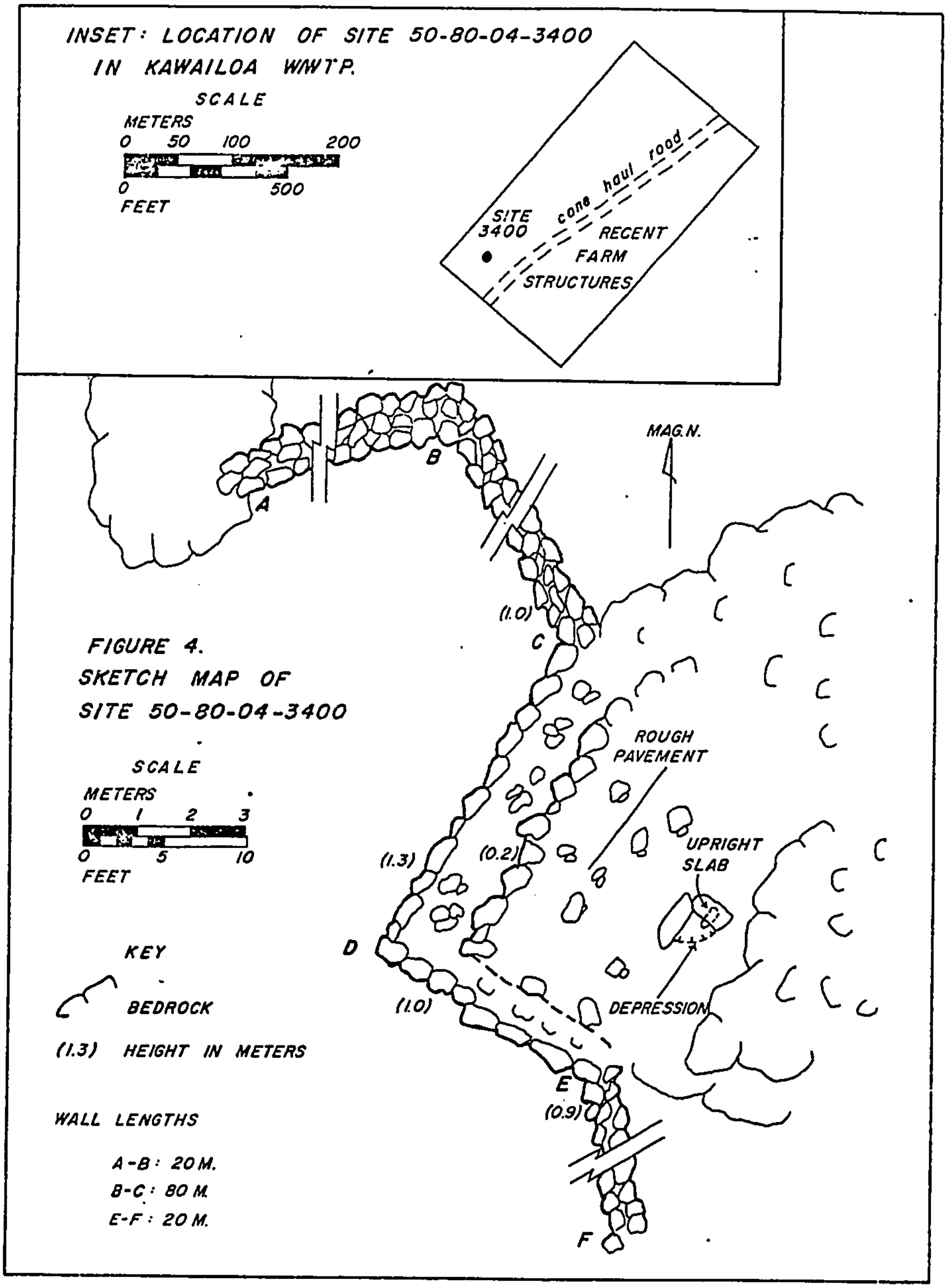

FIGURE 4.
SKETCH MAP OF
SITE 50-80-04-3400

overgrown dirt roads, barbed wire and "pig-wire" fences, concrete foundations, a shed and a small wooden house. This complex, which seems to have been used for cattle and pigs, was evidently used and abandoned within the last 20 to 30 years if we may judge from such artifacts as plastic, PVC plumbing in the house, an aluminum foil pie tin and scattered recent bottles that were found. The sparseness of the remains, their recency and the absence of any cultural deposits of any depth indicate that further study of this complex would yield no significant information.

Near the east corner of the Kawailoa Wastewater Treatment Plant area we found an archaeological site to which we have assigned the number 50-80-04-3400. This number in the State of Hawaii system includes a designation for the State of Hawaii (50), the island of Oahu (80), the Haleiwa, Hawaii USGS 7.5-minute quadrangle map (04), and the unique site number itself (3400). The site is referred to here by the last four digits.

Site 3400 consists of two adjacent structures of unmortared stone masonry. All of the stones used in construction appear to have been gathered from the immediate vicinity. The more extensive of the two structures is a stone wall that is about one meter (3.3 feet) high and 0.75 meter (c. 29.5 inches) high (Figure 4). One section of this wall which stands up to 1.3 meters (c. 4.3 feet) wide was built along two sides of a bedrock outcrop in such a way that it has the appearance of being a retaining wall for the outcrop. The top of the outcrop behind this veneer of stones is a rough stone pavement measuring about five by six meters (c. 16.4 by 19.7 feet). Near the rear of this pavement are two long narrow boulders (80 and 70 centimeters or c. 2.6 and 2.3 feet in length, respectively) set at right angles to each other. The 70-centimeter boulder is supported at its center by a vertical slab, which is visible because there is a rough-sided depression about 50 centimeters (c. 1.6 feet) deep in the angle formed by the two horizontal slabs.

The stone wall appears to be part of an enclosure. The paved area may have been constructed as a foundation for a structure that has since disintegrated or been removed. Beyond these observations, little can be said regarding the function or age of site 3400 on the basis of surface data collected during the reconnaissance survey. It should be noted, however that the presence of date palm and African tulip (Phoenix dactylifer and Spathodea campanulata) trees in the vicinity may indicate post-Contact use of the site.

No surface artifacts were observed at site 3400. In an effort to determine whether the site was known to individuals who work and live in the region, the author spoke by phone with Mr. Russell S. Sowers of the Waialua Sugar Company. Mr. Sowers suggested contacting Mr. Andrew Andersen of Haleiwa. During a telephone conversation Mr. Andersen indicated that he was quite familiar with the Haleiwa region and its historic sites, but that he had no knowledge of site 3400.

CONCLUSIONS AND RECOMMENDATIONS

A single archaeological site, assigned the number 50-80-04-3400, was found during the reconnaissance survey of portions of the Waialua-Hale'iwa Wastewater Facilities System. The preliminary nature of the reconnaissance survey reported here was insufficient to determine the age or function of site 3400 and the nature of its significance.

If site 3400 is to be adversely impacted by development of the Kawailoa Wastewater Treatment Plant, we recommend that the site be the subject of intensive archaeological investigation. Specifically, we suggest that a detailed map of the site be prepared, and that at least one controlled test be excavated to determine its age, function and significance.

As noted previously, human burials have been found in the sand deposits along the shoreline of Waialua Bay and the Waialua Beach area. If human skeletal remains or cultural evidence is found during excavations for the Waialua-Hale'iwa Wastewater Facilities System, we recommend that those construction activities cease and that the Historic Sites Section, State Parks Division, Department of Land and Natural Resources be contacted to determine the appropriate course of action.

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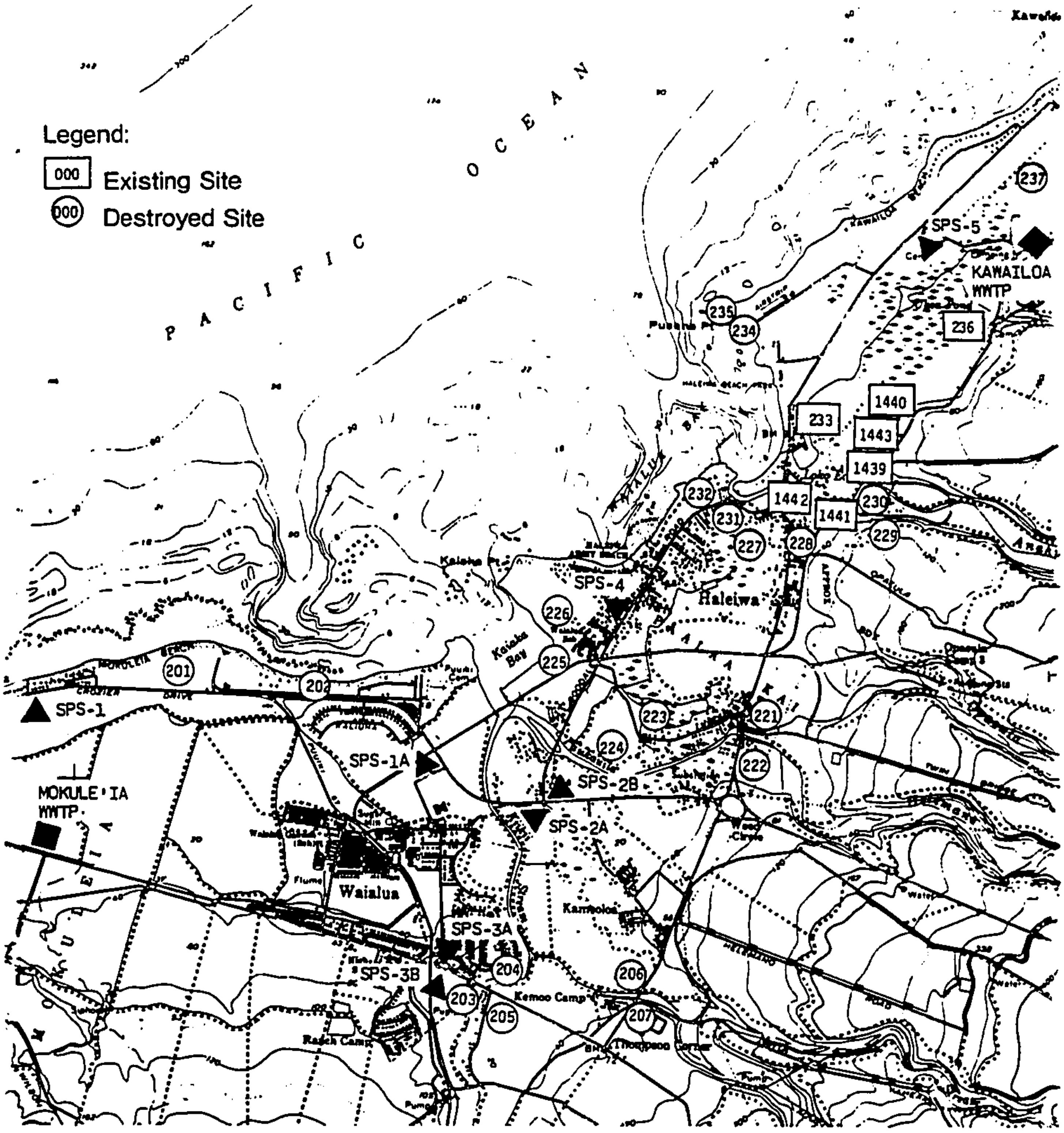


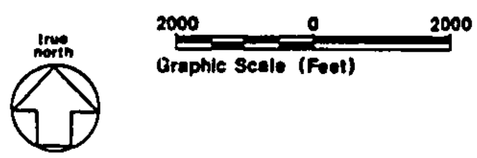
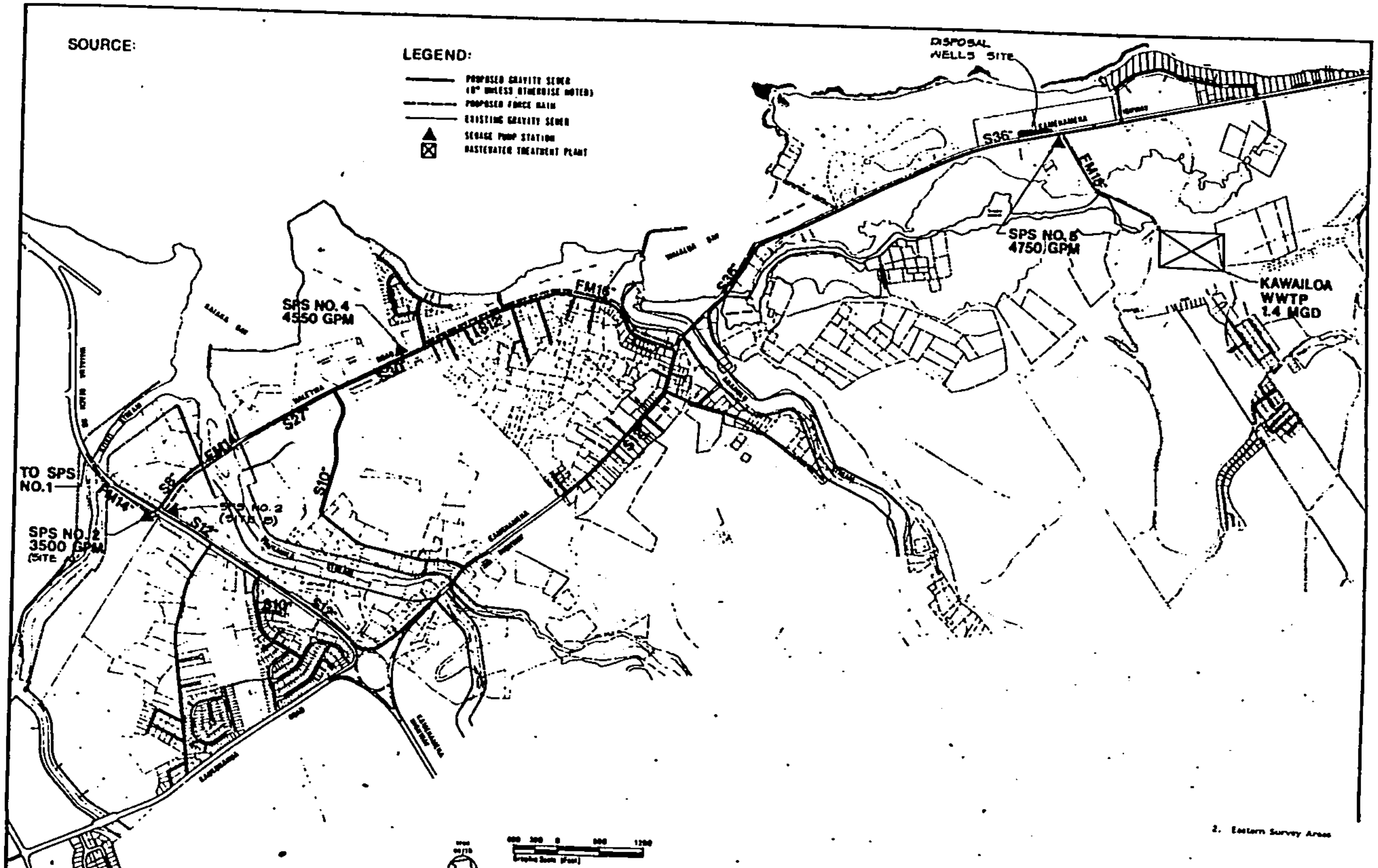
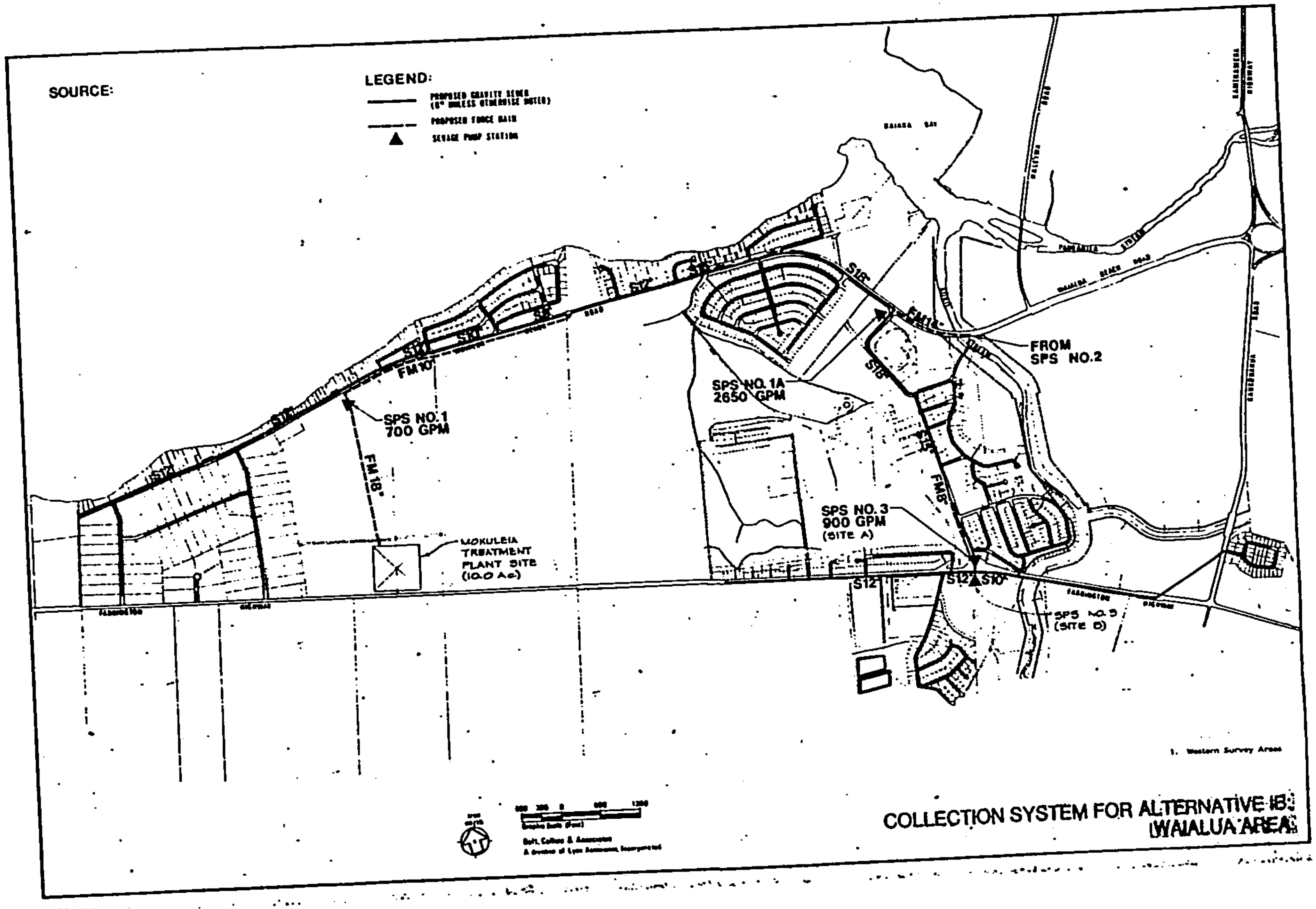


Figure 3.

Portion of Haleiwa, Hawaii U.S.G.S 7.5 Minute Quadrangle Showing Survey Area and Previously Recorded Historic Sites



COLLECTION SYSTEM FOR ALTERNATIVE IB:
HALEIWA AREA



COLLECTION SYSTEM FOR ALTERNATIVE IB:
WAIALUA AREA

APPENDIX B

DERIVATION OF DESIGN POPULATION

1.0 LIMITS IMPOSED BY LAND USE CONTROLS

1.1 O'ahu General Plan Population Allocation

The 1982 revised O'ahu General Plan, the County's principle policy planning document, allocated very little growth to the North Shore Area, i.e., Census Tracts 99.01, 99.02, and 100 (Honolulu, City & County of; January 5, 1978). The population range for the area in the year 2000 was established as between 14,700 and 16,500, or approximately 1600 to 3400 persons more than the drafters of the revised General Plan believed were there in 1980. At the same time, the General Plan designated the Kahuku area encompassing Kuilima as a potential secondary resort area.

1.2 North Shore Development Plan Population and Land Use Allocations

The Waialua District (study area) is similar to the North Shore Development Plan Area (NSDPA) for which there is the officially adopted population allocation mentioned above. However, the North Shore Development Plan (NSDP) which implement the General Plan policies utilize different boundaries than the

Waialua District Study Area. The North Shore Development Plan Area includes a portion of Census Tract 101 lying between Waimea Bay and Waiale'e (Census Block Group 2) as well as the three census tracts (99.01, 99.02, and 100) that comprise the Waialua District/NSGPA (see Figure 4-1). Because of this difference in boundaries and because the proposed NSDP population allocation is available only in aggregate form (i.e. for the entire NSDP area), it is impossible to use the NSDP population target as the basis of wastewater facilities planning for the study area.

However, the Department of General Planning (DGP) has also prepared a land use map which reflects the population target of the NSDP. Because it is geographically specific, the April 1982 NSDP land use map, and the land use data upon which it was based, were used to disaggregate the population allocations. The methodology used by DGP was followed (Honolulu, City & County of, Department of General Planning, April 1980). This data was subsequently updated using the 1980 NSDP & 1982 Existing Land Use Map (ELUM). Thus, the Waialua-Hale'iwa wastewater facilities' capacities have been planned to support only that population which the County's plans allow.

2.0 PROJECTED LAND USE

There are approximately 3,682 existing single family and apartment units in the Waialua District (see footnotes in Table 1 for sources of data). The 1985 NSDP map provides for 824 additional dwelling units within the Waialua District; these are expected to be developed on land that is currently vacant or underutilized.

It is worth noting that the figures for additional development shown above refer only to residential units constructed on urban-designated land. According to the Department of General Planning (April 1980), there are also 681 agricultural-district lots in the NSDP area on which there is now no single-family home. However, since nearly all of the lots in this category situated within the Waialua District are isolated and/or mauka of the "no-pass" line, it is unlikely that a house would be built on a significant proportion of these lots. For the purposes of this study we have assumed the number would be zero. This is consistent with the treatment afforded these parcels by the Department of General Planning in their analytical work for the revised Development Plans (April 1982).

Table 1. Existing and Additional Residential Development Through 2000: Waialua District.

TMK Plat #	Existing Dwelling Units[a] S.F.	Existing Dwelling Units[a] Apt.	Additional Dwelling Units[b] S.F.[c] Vacant Land	Additional Dwelling Units[b] S.F.[c] Under-Utilized Land	Additional Dwelling Units[b] Apt.[d] Vacant Land	Total Year 2000 Dwelling Units S.F.	Total Year 2000 Dwelling Units Apt.
CT 100							
6-1-02	3	—	—	—	—	3	—
6-1-03	18	—	2	15	—	35	—
6-1-04	37	—	1	—	—	38	—
6-1-05	72	—	—	—	—	72	—
6-1-08	25	—	—	4	—	29	—
6-1-09	15	—	4[e]	3	—	22	—
6-1-10	28	—	—	4	—	32	—
6-1-11	87	—	5	—	—	92	—
6-1-12	31	—	1	4	—	36	—
6-2-01	1	—	—	—	—	1	—
6-2-02	8	—	—	—	—	8	—
6-2-03	22	—	—	—	—	22	—
6-2-04	8	—	—	—	—	8	—
6-2-05	33	—	—	—	—	33	—
6-2-06	6	—	7	—	—	13	—
6-2-07	9	—	28[f]	—	—	37	—
6-2-09	42	—	—	—	—	42	—
6-2-12	42	—	—	—	—	42	—
6-4-06	27	—	—	—	—	27	—
6-5-01	5	—	—	—	—	5	—
6-5-03	47	—	6	—	—	53	—
CT 99.02							
6-6-01	37	—	1	—	—	38	—
6-6-03	54	—	11	6	—	71	—
6-6-04	7	—	—	—	—	7	—
6-6-05	58	—	9	6	—	73	—
6-6-06	5	51[g]	2	—	—	7	51
6-6-08	72	—	15	5	—	92	—
6-6-09	22	—	—	—	—	22	—
6-6-10	17	—	12	—	—	29	—
6-6-12	9	—	—	—	—	9	—
6-6-13	20	—	—	—	—	20	—
6-6-14	14	—	—	—	—	14	—
6-6-16	26	—	9	—	—	35	—
6-6-17	56	—	8	4	—	68	—
6-6-18	82	—	—	—	—	82	—
6-6-19	59	—	50	—	—	109	—
6-6-20	26	—	—	—	—	26	—
6-6-21	44	—	1	—	—	45	—
6-6-23	22	—	53	—	—	75	—
6-6-24	1	—	—	—	—	1	—
6-6-25	14	—	—	—	—	14	—
6-6-29	43	—	3	—	—	46	—
6-6-30	67	—	3	—	—	70	—
6-6-31	44	—	16	8	—	68	—
6-6-32	108	—	—	—	—	108	—
6-6-33	144	—	—	—	—	144	—
6-6-34	70	—	—	—	—	70	—
CT 99.01							
6-6-27	33	—	—	11	—	44	—
6-7-01	139	—	—	—	—	139	—
6-7-02	13	—	—	—	—	13	—
6-7-05	86	—	4	—	—	90	—
6-7-06	86	—	—	—	—	86	—
6-7-07	92	—	—	—	—	92	—
6-7-08	82	—	—	—	—	82	—
6-7-09	66	—	—	—	—	66	—
6-7-10	78	—	1	—	—	79	—
6-7-11	74	—	—	—	—	74	—
6-7-12	55	—	4	4	—	63	—
6-7-13	9	—	24	—	—	33	—
6-7-14	35	—	10	—	—	45	—
6-7-15	115	—	1	—	—	116	—
6-7-16	67	—	2	1	—	70	—
6-7-17	123	—	—	—	—	123	—
6-8-03	29	—	—	—	—	29	—
6-8-04	52	—	6	4	—	62	—
6-8-05	57	—	4	4	—	65	—
6-8-06	19	—	3	—	—	22	—
6-8-07	1	—	—	—	—	1	—
6-8-08	10	—	—	—	—	10	—
6-8-09	91	—	—	—	—	91	—
6-8-10	29	—	—	—	—	29	—
6-8-11	6	318	—	—	367	6	685
6-8-12	49	—	13	—	—	62	—
6-8-13	—	—	65[h]	—	—	65	—
6-9-04	30	—	—	—	—	30	—
Total	3,213	369	384	83	367	3,680	736

Footnotes for Table 1

[a] Based on the City & County of Honolulu, Department of Land Utilization (DLU) Existing Land Use Map (ELUMs). Data on the ELUMs was updated a few months before the census and therefore the totals differ slightly from the U.S. Census housing count shown in Table 4-14. Since the Pa'ala'a Kai Subdivision was being developed in 1979-80, the ELUM shows only 27 houses constructed and census data shows 87 houses for sale in that portion of Census Tract 99.02 (Enumeration District 187). Since all 307 houses have been constructed and occupied, we have included them all in our tabulations for the existing column, although the data base for most of the information in this table is late 1979/early 1980.

[b] Calculation of additional units was based on vacant and underutilized land which is designated for residential or apartment use on the NSDP. Computer printouts of this information, with a data base date of December 1979, was provided by the City & County Department of General Planning (DGP). Note that DGP's methodology does not account for theoretically possible additional development on agriculture-zoned land. These figures were updated based on the 1985 NSDP Land Use Map and 1982 ELUM.

[c] Additional single-family dwelling units were calculated by multiplying the vacant land acreage for each plat, as shown on DGP's computer printout, by the density figure of 6.82 units to the acre used by DGP in their calculation of the North Shore Development Plan population figures (Honolulu, City and County of, Department of General Planning; April 1982:16) and rounding to the nearest unit. DGP used the following definition of underutilized land:

"a parcel was considered underutilized when either of the following two conditions was met:

1) The assessed value of the improvements was less than $500.

2) The assessed value of the improvements was less than 10% of the assessed value of the land."

DGP's assumption that 50 percent of these lands would be redeveloped by the year 2000 was followed in the calculations here. The same density figure of 6.82 units to the acre was applied, but replacements for existing units had to be taken into account, and therefore only the net gain is recorded in this table.

[d] Additional apartment units were calculated using the same methodology described above for the single-family units, except the density figures is different. Vacant land shown on the ELUM, which is designated for low-density apartment use on the April 1982 NSDP, was multiplied by 30 units to the acre, the maximum density allowed under this designation. Plans for two parcels shown as vacant on the ELUM (TMK 6-8-11:42 and 6-8-11:74) have already filed with the Department of Land Utilization and their approval for 45 units has been granted. There is no underutilized apartment land in the NSDP.

[e] Although 2.97 acres in the plat are shown as vacant on DGP's computer printout, almost all of this is in either a narrow, rocky ledge or in a roadway serving other parcels of the plat. Thus, it was estimated that only four additional dwelling units could be constructed in this plat.

[f] There is a vacant lot of 0.034 acre in this plat but that is too small for a house lot.

[g] Number of apartment units noted on ELUM seemed too high, so the manager of Hale'iwa Surf Condominiums was contacted and reported 51 units there.

[h] This 65-lot agriculture subdivision has been constructed and is being marketed. It is expected that one house would be built on each lot.

Source: Compiled by Belt, Collins & Associates from sources noted above.

3.0 DESIGN POPULATION

In order to use the land use (dwelling unit) counts and projections presented in the preceding section as the basis for wastewater facilities planning, it was necessary to convert them first into design population figures and then into estimates of wastewater flows. The remainder of this subsection outlines the methodology that was used to calculate the design population and presents the results.

The dwelling unit counts and projections in Table 1 were multiplied by household size factors derived from the U.S. Census (see discussion in next paragraph) to obtain design population figures. It should be noted that "design population" differs from "resident population" as counted by the U.S. Census Bureau. The "design population" is higher than "resident population" because there are dwelling units in the Waialua District which are held for occasional use, or occupied by persons who do not qualify as "residents," or which are vacant at the time of the census. The "design population" represents the number of people in the District if all of the available dwelling units were occupied at the same time. While the number of occasions when this would occur are limited, prudence requires that wastewater treatment facilities be designed to handle these situations. Thus, the design calculations made in this report are based on this concept.

Data from the 1980 U.S. Census of Population and Housing indicating the average number of persons per occupied dwelling unit for various subareas of Waialua District are presented in Table 2. The totals for the areas with no apartment units in the housing stock indicate that the average household size for single-family dwellings in the Waialua District is about 3.6. To obtain an average household size for apartment units, census data at the block level had to be examined. Only blocks 105 and 110 in CT 99.01 were composed entirely of apartment units; population data for these were available from the census but dwelling units numbers were only available from the ELUM. Dividing the 368 residents in these two blocks (U.S. Department of Commerce, Bureau of the Census; February 13, 1981:63) by the 182 apartment units there suggests an average household size in the District's apartment areas on 2.0 persons per unit.

To further substantiate the 2.0 number, several of the larger apartment complexes with private wastewater treatment plants in the Waialua-Haleiwa planning area were contacted by telephone in June 1986. Apartment complexes with design capacities greater than 2,500 gallons per day were considered candidates for the survey. The survey covered a total of 241 apartment units, or a combined capacity of approximately 47 percent of the total private treatment plant capacity in the area. Data obtained from this survey are summarized in Table 3.

Table 2. Average Household Size in Various Sub-Areas of Waialua District.

Area[1]	Within Census Tract	Population Not in Group Quarters	Occupied Units	Household Size
Waialua CDP	99.01	4,021	1,102	3.65
Remainder of CT	99.01	1,299	511	2.54
Portion of Hale'iwa CDP	99.02	2,067	607	3.41
Remainder of CT	99.02	545	146	3.73
Portion of Hale'iwa CDP	100	345	110	3.14
Remainder of CT	100	1,246	368	3.39
Total of Areas w/no apt. units		6,157	1,726	3.57

[1] See Figure 4-1 for area boundaries.

Source: U.S. Bureau of the Census (1981). Census of Population and Housing, 1980: Summary Tape File 1A, Hawaii (items 1, 5, and 35 and special tabulation by DPED).

Table 3. Average Apartment Occupancy in the Waialua-Haleiwa Planning Area.

Property	One Bdrms	Persons Per Unit	Two Bdrms	Persons Per Unit	Total Persons	Total Units	Ave. Pers. Per Unit
MOKULEIA BEACH COLONY (B. Zimmerman 637-9311)	54	2.0	0	0	108	54	2.00
HALEIWA SURF (H. Chelgren 637-4511)	39	1.5	12	2.5	90	51	1.76
MOKULEIA BEACH (I. Inouye 637-6507)	2	1.5	18	2.5	48	20	2.40
MOKULEIA SANDS (same as above 637-7507)	71	2.0	0	0	142	71	2.00
KONANE KAI (J. Shannon 637-7021)	25	2.0	20	2	90	45	2.00
TOTALS	191		50		478	241	1.98

Note: Resident managers from the following apartment complexes could not be contacted or could not provide information for their units:

Sunset Paradise Apartments
Pu'uiki Hale
Kupuna Home'o Waialua
Mokuleia Shores
Mokuleia Surf
Ono Vista
Sunset Shore

Overall, the average number of persons per apartment unit is equal to just under 2.0. This appears to be due to the prevalence of one bedroom units in the unit mix. It was also noted that quite a few of all the two bedroom units were occupied by only two persons per unit. The resident managers interviewed indicated that the majority of their clients are single or couples with an occasional couple with child. There were no studio apartments.

In view of the preceding, it was decided to utilize 3.6 persons per single-family dwelling unit and 2.0 persons per apartment unit as the basis for the design population calculations in this study.

The design population figures are summarized by Census Tracts in Table 4. Actual design calculations were made with data disaggregated to the plat level.

Table 4. Design Population: Waialua District.

Census Tract	Existing Design Population	Year 2000 Design Population
99.01	6,130	7,443
99.02	4,138	4,937
100	2,038	2,340
TOTAL	12,306	14,720

Source: Belt, Collins & Associates based on data noted in text.

APPENDIX C

VEGETATION AND ENVIRONMENTAL IMPACTS ASSOCIATED WITH THE PROPOSED WAIALUA-HALE'IWA DISTRICT WASTEWATER FACILITIES PLAN

Prepared for
Belt Collins & Associates

By

EARTHWATCH
May 1982

VEGETATION SURVEY FINDINGS

I. Mokuleia Project Area

A. Mokuleia Sewage Treatment Plant

The Mokuleia STP would occupy about 10 acres in the midst of 100's of acres of sugar cane fields found mauka and makai of Farrington Highway. The STP site, makai of the highway, is almost entirely under sugar cane cultivation, with weedy grasses and forbs scattered throughout the cane, and with weedy exotics typical of roadside areas near the highway. Sugar cane (*Saccharum officinarum*) is the dominant plant species with almost 100% cover. Species scattered throughout the sugar cane include swollen fingergrass (*Chloris inflata*), yellow wood sorrel and pink wood sorrel (*Oxalis corniculata* and *O. martiana*), and jungle-rice (*Echinochloa colona*). Roadside weeds include species found commonly in disturbed roadside areas throughout Hawaii: Bermuda grass (*Cynodon dactylon*), wiregrass (*Eleusine indica*), garden spurge (*Euphorbia hirta*) and spiny amaranth (*Amaranthus spinosus*). No native species were observed at this site.

B. Sewage Pump Stations

1. SPS No. 1 is located mauka of Crozier Dr., between a beach residential area and sugar cane fields. It is bordered by a windbreak of ironwood (*Casuarina equisetifolia*) and koa-haole (*Leucaena leucocephala*) trees. The site is characterized by exotic trees and shrubs such as koa-haole, castor bean (*Ricinus communis*), southern pokeberry (*Phytolacca octandra*), and weedy grasses and forbs such as guinea grass (*Panicum maximum*), scarlet pimpernel (*Anagalis arvensis*) and fireweed (*Erechtites hieracifolia*).

2. SPS No. 1a is located near the intersection of Goodale and Waialua Beach Rd., near the Waialua Sugar Mill. This site is under sugar cane cultivation, with associated scattered weeds typical of disturbed and

roadside areas, such as Bermuda grass, wiregrass, garden spurge and spiny amaranth. No native species were observed.

3. SPS No. 3a is located at a small, mowed grassy clearing at the intersection of Goodale and Farrington Hwy. The site is surrounded by paved roads, with tall, dense koa-haole thickets on the makai side of the roads, and cane fields on the mauka side. Weedy grasses and other herbs that can withstand repeated disturbance such as mowing are the only species found here, including Bermuda grass, paspalum grass (*Paspalum dilatatum*) and spiny amaranth.

4. SPS No. 3b is located across Farrington Hwy. from SPS No. 3a. A drainage ditch runs through the site, and sugar cane fields extend mauka of the site which is characterized by weedy exotics typical of disturbed roadside and cultivated areas. Plant species include common roadside weeds observed at previous sites as well as other weedy exotics such as little bell (*Ipomoea triloba*), Mexican fire plant (*Euphorbia heterophylla*), Christmas berry shrubs (*Schinus terebinthifolius*) and red pua-lele (*Emilia javanica*).

C. Gravity Sewers and Force Mains would be located primarily along existing roadways. Vegetation along the proposed alignments include common roadside weeds and ornamentals or landscape plants found in residential areas. These areas were not specifically surveyed for this study.

D. Land Treatment (Irrigation) Sites are covered primarily by sugar cane, with associated scattered weeds. In localized areas along irrigation ditches, common ruderal species such as honohono (*Commelina diffusa*) and California grass (*Brachiaria mutica*) also occur, but most species observed in these sites were located in cultivated or roadside areas.

II. Kawailoa Project Area

A. Kawailoa Sewage Treatment Plant

The Kawailoa STP would occupy about 10 acres of land in vegetation characterized by dense koa-haole thickets with a grassy/shrub understory and occasional grassy clearings. The site is located near the landfill and Ukoa Pond; however, it is surrounded primarily by similar koa-haole thicket vegetation. A cane road also runs through the site.

Trees and shrubs, providing a 75-100% canopy over most of the site, are dominated by koa-haole (*Leucaena leucocephala*). Other tree and shrub species observed include the African tulip tree (*Spathodea campanulata*), java plum (*Eugenia cumini*), kalamona (*Cassia surattensis*), manila tamarind (*Pithecellobium dulce*) and kiawe (*Prosopis pallida*). In highly shaded areas, the understory consists primarily of leaf litter and basaltic boulders, with scattered shade-tolerant forbs. Less shaded areas include an understory of Chinese violet (*Asystasia gangetica*) and tall grasses (*Panicum maximum, Tricachne insularis*). Pepperomia (*Pepperomia* spp.), or 'ala'ala-wai-nui, was commonly found throughout the site growing on large boulders and stone structures.

Some mauka portions of the site are characterized by more open vegetation, some areas with less than 50% tree canopy. These sunnier clearings include grasses and forbs such as fingergrass (*Chloris* spp.), guinea grass (*Panicum maximum*), beggar's tick (*Bidens pilosa*) and lions-ear (*Leonotis nepetaefolia*).

No rare or endangered plant species were known to exist or were observed in this area. The few native species observed are species found in areas with similar elevations and rainfall throughout Hawaii, and include koali (*Ipomoea cairica*), koali-'awania (*I. congesta*) and huehue (*Cocculus ferrandianus*).

B. Sewage Pump Stations

1. SPS No. 5 is located in an ironwood grove at the intersection of Kawailoa Dr. and Kamehameha Hwy. The site is characterized by tall ironwood (*Casuarina equisetifolia*) trees with a typically sparse understory beneath the ironwood. Koa-haole shrubs and seedlings are found along the edges of the grove, with weedy roadside vegetation between the highway and the ironwood. Other plant species observed include buffelgrass (*Cenchrus ciliaris*), sandbur (*C. echinatus*), beggar's tick and southern pokeberry (*Phytolacca octandra*).

2. SPS No. 4 is located in the area of Kaika State Recreation Area, across the road from a residential area. This site is characterized by tall shrubs and grasses. Tree and shrub species observed include koa-haole, African tulip, castor bean, kiawe and red hibiscus (*Hibiscus rosa-sinensis*); some of these were covered by moon flower vine (*Ipomoea alba*). Grasses and forbs were those typical of disturbed and roadside areas such as guinea grass, sandbur, swollen fingergrass, spiny amaranth and false mallow (*Malvastrum coromandelium*).

3. SPS No. 2a is located at the intersection of Haleiwa and Waialua Rds., near a taro field. The cover is primarily sugar cane, with a drainage ditch between the sugar cane field and the highway. Weedy roadside species are located between the highway and the cane fields, such as wiregrass, sourgrass, guinea grass, spiny amaranth, beggar's tick and little bell. Small trees and shrubs include African tulip tree, manila tamarind and java plum. The native alena (*Boerhavia diffusa*) was observed at this site. It is an indigenous species found throughout the islands, usually near the coast.

4. SPS No. 2b is located across from SPS 2a at the Haleiwa and Waialua Rds. intersection. This site is characterized by tall grasses such as California grass (*Brachiaria mutica*) and guinea grass, and scattered shrubs such as Christmas berry and koa-haole. Most species are weedy exotics, except for koali (*Ipomoea cairica*), a common indigenous species.

C. Gravity Sewer and Force Main areas were not specifically surveyed for this study. As most of the proposed lines are located along existing roadways, vegetation would be primarily weedy exotics found in disturbed roadway areas, as well as some ornamental species associated with residential or landscaped areas.

D. Disposal Well Sites are located on the makai side of Kamehameha Highway near the intersection of Kawailoa Dr. The site is characterized by weedy roadside species near the highway (beggar's tick, spiny amaranth, garden spurge and wiregrass), grading into taller grasses and shrubs (guinea grass, koa-haole, Christmas berry), with a row of tall ironwood trees (40 ft. height. Huehue occurs beneath the ironwood trees; this endemic species is not rare, but is found less commonly today. A deep layer of leaf litter and sandy substrate was found over much of the site.

AN AVIFAUNAL AND FERAL MAMMAL SURVEY OF MOKULE'IA PROPERTY DESIGNATED FOR POSSIBLE DEVELOPMENT OF THE WAIALUA-HALEIWA WASTEWATER FACILITY

Prepared for

Belt, Collins and Associates

By

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9 July 1986

AN AVIFAUNAL AND FERAL MAMMAL SURVEY OF MOKULE'IA PROPERTY DESIGNATED FOR POSSIBLE DEVELOPMENT OF THE WAIALUA-HALEIWA WASTEWATER FACILITY

INTRODUCTION

The purpose of this report is to summarize the results of a three day (27,28,29 June 1986) field survey of birds and feral mammals at Mokule'ia, Oahu. The property surveyed has been designated as a possible site for a wastewater facility. References to pertinent published literature and unpublished reports are also included.

The objectives of the field survey were to document what bird and feral mammal species occur on the site and at what relative densities. In addition a limited assessment of habitat preferences was made using knowledge from previous field work in similar habitat elsewhere in Hawaii and from observations gained on this survey. In the event "endangered" species were found on the site a primary goal was to make a special effort to assess their use of the habitat and the importance of this area for these species.

STUDY METHODS AND GENERAL SITE DESCRIPTION

METHODS:

Field observations were taken with the aid of binoculars and by listening for vocalizations while walking along existing roads and trails within the project site. At ten separate stations, located in all types of available habitat, eight minute counts of all birds seen or heard were made on each of the three survey days. These counts were confined to early morning and late afternoon hours (peak bird activity periods). Information acquired through these methods form the basis for population estimates given in this report and additionally were helpful in determining general distribution patterns at the project site and habitat preferences.

Observations of feral mammals were limited to visual sightings and evidence in the form of tracks and scats. Attempts to trap mammals in order to obtain data on density and distribution were not made.

GENERAL SITE DESCRIPTION:

Weather during the three day survey was variable with same cloudy periods but no heavy rainshowers. Winds were out of the east. Four general habitats occur at the project site: 1- cultivated sugar cane fields 2- an area of scrubby second growth dominated by Koa Haole (Leucaena leucocephala) 3- an upland region on the mauka side of project area composed of larger trees including kukui (Aleurites moluccana) and milo (Thespesia populnea) 4- wetland habitat with deep water ponds and ephemeral shallow marshland.

RESULTS AND DISCUSSION

Resident Indigenous (native) Birds:

American Coot (Fulica americana alai) - Recent (1983-85) waterbird surveys conducted by Division of Forestry and Wildlife, State of Hawaii, have averaged 24 coot at Dillingham Quarry Pond, one coot at the ephemeral Dillingham Field Pond, and 82 coot recorded in July of 1983 at the Crowbar Ranch Pond. (Div. of Forestry and Wildlife 1985). The present study revealed only eight coot at the Quary Pond, none on Dillingham

Field since it was dry, and 17 at the Crowbar Ranch Pond. The sizable difference in numbers between years at these sites might reflect food availability, changing water levels, reproductive success, recruitment, or a combination of a number of factors. The Crowbar Ranch Pond is easily the most productive and valuable site for coot. The irrigation reservoirs located mauka of the sugar cane fields contained no coot although these ponds appeared to be suitable for this species.

Common Moorhen (*Gallinula chloropus sandvicensis*) - The winter 1985 survey by the Div. of Forestry and Wildlife of the ephemeral Dillingham Field Pond recorded two moorhen. No moorhen were observed on the project site during this present study. This species is quite secretive and thus could easily escape detection. The Div. of Forestry and Wildlife (1983) reports (latest available for the Crowbar Ranch Pond) surprisingly do not record moorhen at this site despite what appears to be good habitat. The Quarry Pond and irrigation ponds are probably too steep sided and deep to be much used by moorhen.

Black-necked Stilt (*Himantopus mexicanus knudseni*) - The 1983 Div. of Forestry and Wildlife waterbird survey reported six stilt at the Crowbar Ranch Pond. Five stilt were seen on all three days of the present study. The stilt population would appear from these data to be very stable. Stilt undoubtably use the flooded fields at Dillingham althought no recent data exists to support this assumption. The Shallenberger (1977) study likewise did not record this species.

Black-crowned Night Heron (<u>Nycticorax nycticorax hoactli</u>) -

No night heron are reported from any of the wetlands within the project area by recent Div. of Forestry and Wildlife surveys. The Shallenberger (1977) study recorded a single night heron at the ephemeral Dillingham Field wetland. Two night heron were observed at the Crowbar Ranch Pond on 27 June 1986, but not on subsequent visits. The steep sides of the Quarry Pond and the irrigation reservoirs probably restricts extensive use of these areas by night heron since they forage primarily by wading along the edges in shallow water (Hawaii Audubon Society 1984, Pratt et al. 1986).

Hawaiian Duck (<u>Anas wyvilliana</u>) -

The Div. of Forestry and Wildlife 1983 report for the Crowbar Ranch Pond records two Hawaiian Duck. None were observed on this present survey although the

Crowbar Ranch Pond, Quarry Pond, and irrigation ponds are all suitable habitats for this species and probably from time to time do contain Hawaiian Duck.

Migratory Indigenous Birds:

Shallengerger (1977) records Pacific Golden Plover (*Pluvialis fulva*) at the Dillingham Airfield. None were seen on the present survey which is not unexpected since they do not return from the breeding grounds until early August (Johnson et al. 1981). No other migratory shorebirds are recorded from the project area in either the Shallenberger (1977) surveys or the 1983-85 Div. of Forestry and Wildlife surveys. It is, however, very likely that other common shorebird migrants such as Wandering Tattler (*Heteroscelus incanus*), Ruddy Turnstone (*Arenaria interpres*) and Sanderling (*Calidris alba*) also occur in the area during the winter months especially when the Dillingham Fields become flooded.

Introduced (Exotic) Birds:

A total of 15 species were recorded during the three day survey. Table 1 describes their relative abundance and general habitat preferences. An earlier study (Bruner 1982) looked at a much smaller area in Mokule'ia that was primarily in sugar cane. That survey recorded, as should be expected, far fewer species. However, the Ring-necked Pheasant (Phasianus colchicus) was recorded on the 1982 survey as well as in Shallenberger's 1977 study but did not turnup in the present 1986 survey. Erckel's Francolin (Francolinus erckelii) has been studied in some detail recently (Div. of Forestry and Wildlife 1983-85). This species was present in low numbers in the more mauka sections of the project site. The occurance of the Common Waxbill (Estrilda astrild) was unexpected and marks a new locality record on Oahu for this species.

Feral Mammals:

Early studies (Shallenberger 1977, and Bruner 1982) recorded dogs, cats and mongoose (Herpestes auropunctatus) at the site. The present survey likewise found evidence of all three mammals. Mongoose were especially abundant with a total of 42 sightings in three days! No trapping to determine rat and mice populations in the area was attempted. The native Hoary Bat (Lasiurus cinereus) is reported from Oahu (Tomich, 1969) but no specimen records from the Waialua area exist. It is probably rare on Oahu and would not be expected to occur on the study site.

CONCLUSIONS AND RECOMMENDATIONS

The proposed project site contains a diversity of habitats with permanent and ephemeral wetlands, second growth scrubby forest, an upland forest of larger trees, and cultivated sugar cane fields. The wetland in and adjacent to the study area are of greatest importance in terms of native birds. Endangered species occur at these sites and depend on them for food and shelter. The exotic birds in the area are the typical mix of species one would expect in similar habitat elsewhere on Oahu. Erckel's Francolin is a somewhat localized species which does not occur in all suitable habitats but exhibits a patchy distribution on Oahu. The presence of Common Waxbill was a surprise but this species also has a discontinuous distribution on Oahu. Red-Crested Cardinals were exceedingly abundant in the sugar cane fields in the project area. Feral mammals present were typical of these types of habitats on Oahu. Mongoose were abundant in the sugar cane fields and second growth areas. Although not censused it is likely that rat and mice populations in the area are likewise similar to comparable sites elsewhere on Oahu.

Alteration of present conditions in the project area as a result of development will have an influence on the abundance and distribution of birds and mammals. Areas with dense growth are **preferred by** some species but not others. Clearing of such sites will result in a reduction of the population of these species and an increase in the occurrence of other species. Of most concern is the influence development might have on the wetlands. Care should be exercised to insure that negative impacts such as siltation and organic pollution do not occur in these wetlands. Endangered species rely completely on these sites for essential resources. The creation of storage ponds as part of the wastewater project can potentially have a positive effect for water birds especially if such ponds are large enough to support birds and have emergent vegetation along their edges to provide cover and additional foraging sites. The presence of fish in the ponds will also increase their value to such birds as Black-crowned Night Heron. If the ponds are graduated in depth with shallow portions (1-6 inches) and deeper sections (3 feet) both wading birds like Black-necked Stilt and migratory shorebirds as well as coot and duck could equally utilize these ponds for foraging.

It is thus recommended that the location of the wastewater facility be in the sugar cane sections of the project area as this will cause the least disruption of terrestrial bird populations and with proper pond construction and management could have a positive effect on the resident and migratory waterbirds.

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9 July 81

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Table No. 5 Exotic bird species found in the vicinity of Dillingham Airfield

Relative abundance and general habitat preferences of exotic birds recorded at Mokule'ia, Oahu 27,28,29 June 1986.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*	HABITAT*
Erckel's Francolin	*Francolinus erckelii*	U = 1.2	T
Spotted Dove	*Streptopelia chinensis*	C = 6.8	E
Zebra Dove	*Geopelia striata*	A = 10.9	E,G,T
Common Myna	*Acridotheres tristis*	C = 8.3	E,G
Northern Mockingbird	*Mimus polyglottos*	U = 1.1	T
Japanese White-eye	*Zosterops japonica*	A = 11.6	T
Northern Cardinal	*Cardinalis cardinalis*	C = 5.8	T
Red-crested Cardinal	*Paroaria coronata*	C = 8.1	E,T,G
White-rumped Shama	*Copsychus malabaricus*	C = 6.0	T
Japanese Bush-warbler	*Cettia diphone*	U = 2.1	T
Red-vented Bulbul	*Pycnonotus cafer*	A = 10.3	T,E
House Sparrow	*Passer domesticus*	U = 3.1	G
House Finch	*Carpodacus mexicanus*	U = 3.4	T,E
Nutmeg Mannikin	*Lonchura punctulata*	C = 9.1	G,E
Common Waxbill	*Estrilda astrild*	C = 8.5	G

* (See page 13 for key to symbols)

KEY TO TABLE 1

RELATIVE ABUNDANCE = Number of times observed during survey or frequency on eight-minute counts plus walking counts.

A = Abundant (ave. 10+) (number which follow is ave. of all survey days)

C = Common (ave. 5-10) "

U = Uncommon (ave. less than 5) "

HABITAT = Area most frequented. Order of most preferred or utilized begins at left.

E = Edge of roads or other breaks in the vegetation.

T = Thickets of dense vegetation

G = open grassland

RECEIVED
JUL 18 1986
BELT, COLLINS & ASSOCIATES

CHAR & ASSOCIATES

Botanical/Environmental Consultants
4471 Puu Panini Ave.
Honolulu, Hawaii 96816
(808) 734-7828

17 July 1986

Mr. Perry White
Belt Collins & Associates
606 Coral Street
Honolulu, Hawaii 96813

Dear Perry:

A detailed report on the flora survey for the proposed Waialua-Hale'iwa Wastewater Treatment Plant and Irrigation Areas is attached.

There are no major constraints regarding the flora for siting the wastewater treatment facilities on the larger area designated on your map. The vegetation on the project area is dominated by introduced species and appears to have been disturbed for a long period of time. There are no native plant communities remaining on the area. The few native species found on the project site are widespread throughout the islands; some, in fact, are rather weedy natives which do best in disturbed habitats.

If you have any questions regarding the report, do not hesitate to call me at 734-7828.

Sincerely,

Winona P. Char

Winona P. Char

attachment:

FLORA SURVEY

WAI-A-LUA - HALE-'IWA WASTEWATER FACILITY PLAN

WAI-A-LUA DISTRICT, ISLAND OF O'AHU

by

Winona P. Char

CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawaii

Prepared for: BELT, COLLINS & ASSOCIATES

July 1986

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INTRODUCTION

The City and County of Honolulu proposes to develop a wastewater treatment plant near the Dillingham Airfield. The treated effluent would also be used for irrigation. The proposed Wai'a'lua - Hale-'iwa Wastewater Treatment Plant and effluent irrigation areas will cover approximately 1,000 acres.

At present, the proposed site for the wastewater treatment plant and irrigation locations is in sugar cane cultivation on lands belonging to Castle and Cooke and Wai'a'lua Sugar Company. Potential irrigation areas include the nearby Dillingham Airfield complex. Also included in the project area are Mokule'ia Homesteads land used for grazing cattle and horses.

A botanical survey to describe the major vegetation types; inventory the flora; and search for rare, threatened, or endangered plant species on the project area was conducted in June 1986.

SURVEY METHODS

Prior to the field survey, a review was made of the pertinent botanical literature which dealt with the study area or adjacent sites.

Existing topographic maps and aerial photographs were examined to determine access, terrain characteristics, and potential logistical and technical problems which might be encountered during the field survey. Locations of potentially suitable survey transects were evaluated and plotted for future reference.

A walk-through survey method was employed. Areas which were likely to support native species were more intensively surveyed. Surveys were not conducted as intensively in the more disturbed, cultivated areas.

Observations were made and recorded on the major vegetation types and general terrain throughout the study area. Criteria such as the dominant life form, structure, and plant species association were used in identifying and describing each vegetation type. Species identifications were made in the field. Plants which could not be positively identified were collected for later determination in the herbarium and laboratory. Notation of species present in each vegetation type was made and is presented in the plant checklist. A visual estimate of abundance, using a modified Braun-Blanquet scale (Mueller-Dombois and Ellenberg 1974), was made for each species.

LIMITATIONS OF THE SURVEY

Vegetation types which were less disturbed, such as the koa-haole thickets and kiawe woodlands, were surveyed more intensively than the disturbed, cultivated areas such as the cane fields. These less-disturbed areas are more likely to support native plant species. Thus, a few weedy species associated with cultivated areas may have been omitted from the species list.

The species inventoried are indicative of the season and environmental conditions under which the survey was made. A survey taken at a different season and under varying environmental conditions would no doubt yield slight variations in the species list, especially of the annual species. The woody plants have been censused to a greater degree of reliability.

RESULTS

No extensive flora survey has been made of the entire project area; however, there have been a number of studies conducted on certain portions of the area.

An Environmental Impact Statement (EIS) was prepared for the sand mining operations which occurred adjacent to the Crowbar Ranch (Warren Corp. 1973).

A survey of the Dillingham Military Reservation, including the airfield, was made during the USASCH (U. S. Army Support Command, Hawaii) environmental studies (Char and Yoshida 1977). Weedy, introduced species predominated in the area around the airfield. In the back of the airfield koa-haole (Leucaena leucocephala) and Guinea grass (Panicum maximum) were the prominent components. On the rocky slopes above the powerline, a number of native species were found.

Mokule'ia Development Corporation is proposing to develop a recreational resort community on some of its lands. A biological survey of these lands was recently conducted by Char and Linney (1986). Eight vegetation types were recognized on the Mokule'ia project site, ranging from the strand vegetation along the coast to the rocky hillside vegetation in the Kapuna Gulch section. Introduced species dominated all vegetation types except the strand.

During the present survey, 146 species of vascular plant species were inventoried. Of these, 129 (88.4%) are introduced or exotic species, 12 (8.2%) are native, and 5 (3.4%) are of Polynesian origin. No rare, threatened, or endangered species were encountered. Five major vegetation types are recognized and discussed below. All are dominated by introduced species.

The maintained areas around the airfield and its facilities were not surveyed, as these areas are regularly mowed and weeded. Plantings of ornamental species are also frequently encountered in these areas.

Description of the Vegetation

1. Cane fields. The cane fields and their associated network of unpaved cane haul roads as well as irrigation systems covers the largest portion of the project area. Agricultural lands are dynamic systems, changing with the different stages or practices of cultivation. The monodominant stands of sugar cane (*Saccharum officinarum*) quickly crowd out nearly all weedy species. Weedy species appear and disappear with the various stages of cultivation.

Weedy species are associated with the margins of the fields, the irrigation channels, and the roadsides. Plants in those areas are often treated with herbicides. Among the weedy species most often encountered are nutgrass (*Cyperus rotundus*), swollen fingergrass (*Chloris inflata*), Bermuda grass (*Cynodon dactylon*), wiregrass (*Eleusine indica*), spiny amaranth (*Amaranthus spinosus*), and wild bitter melon (*Momordica charantia* var. *pavel*).

On the roadways which have not been used for some time, Guinea grass (*Panicum maximum*) forms dense clumps up to 2 meters tall. In the fields which lie near to other vegetation types such as pasture lands, koa-haole (*Leucaena leucocephala*) thickets, or kiawe (*Prosopis pallida*) woodlands, a few shrub and tree saplings such as Java plum (*Syzygium cumini*), Christmas berry (*Schinus terebinthifolius*), and koa-haole may be found.

2. Koa-haole thickets. The composition and structure of this vegetation type is quite variable on the project area. Generally, this vegetation type consists of tall-statured koa-haole (*Leucaena leucocephala*) plants, 5 to 6 meters high, often with their crowns meeting to form a closed canopy. Under the koa-haole thickets in which grazing occurs (Mokule'ia

Homesteads' land), the dominant ground cover is green panicgrass (Panicum maximum var. trichoglume), a forage grass. Green panicgrass usually forms a solid grass cover except in areas where overgrazing, trampling, or other disturbances have occurred. In such areas the more weedy, generally unpalatable, species such as sour grass (Tricachne insularis), purple lionsear (Leonotis leonurus), spiny amaranth (Amaranthus spinosus), and false ragweed (Franseria strigulosa) occur in greater abundance.

In the koa-haole thickets which are not used for grazing Guinea grass (Panicum maximum) is the dominant ground cover, often forming a dense, almost impenetrable, grass cover up to 2 to 3 meters tall. Yellow liliko'i (Passiflora edulis f. flavicarpa) vines are frequently found sprawling over the koa-haole plants.

An old, abandoned network of asphalt-covered roadways, long overgrown by the koa-haole thickets, is found in the area immediately behind the airfield complex and some of the cane fields. Here asystasia (Asystasia gangetica), Indian pluchea (Pluchea indica), and Christmas berry (Schinus terebinthifolius) are locally common.

Scattered clumps of trees such as ironwood (Casuarina equisetifolia), Chinaberry (Melia azedarach), Java plum (Syzygium cumini), and silk-oak (Grevillea robusta) are occasionally found in some of the koa-haole thickets.

In some places the koa-haole may be spaced further apart with the canopy open and the plants 2 to 3 meters tall. In these areas the ground cover consists of a mixture of plant species such as pitted beardgrass (Andropogon pertusus), sour grass (Tricachne insularis), Guinea grass, false ragweed, indigo (Indigofera suffruticosa), and partridge pea (Cassia lechenaultiana). The koali vine (Ipomoea cairica) and castor bean (Ricinus communis) are usually more frequently observed in these open thickets.

3. Pasture lands. Pasture lands are wide-open grassy areas with scattered shrubs. The vegetation on these lands has been greatly modified by the planting of various forage grasses and legumes and by the grazing of cattle and horses. Within the project area, Californiagrass (Brachiaria mutica) is the dominant species of the pasture lands. However, in heavily grazed areas or where the animals tend to congregate, swollen fingergrass (Chloris inflata) or Bermuda grass (Cynodon dactylon) may be locally common.

Scattered throughout the pastures are small trees and shrubs of Java plum (Syzygium cumini), guava (Psidium guajava), lantana (Lantana camara), kiawe (Prosopis pallida), klu (Acacia farnesiana), and koa-haole (Leucaena leucocephala). A number of weedy annual species found throughout most of the other vegetation types are also observed in the pasture lands. These include the ubiquitous spiny amaranth (Amaranthus spinosus), false ragweed (Franseria strigulosa), cocklebur (Xanthium saccharatum), burbush (Triumfetta semitriloba), and Achyranthes indica.

4. Kiawe woodlands. On the Mokule'ia Homesteads' land, mauka of the sugar cane fields, are a few kiawe (Prosopis pallida) woodlands. The kiawe trees form open to closed stands varying in height from 6 to 9 meters tall. In some stands the trees appear to be planted in rows; kiawe wood is harvested in these areas. Where the kiawe woodland lies adjacent to the koa-haole (Leucaena leucocephala) thicket, there is often a mixed woodland/thicket zone. In these areas, koa-haole forms a rather dense subcanopy layer, 3 to 6 meters tall, beneath the kiawe trees.

Guinea grass (Panicum maximum) is the dominant ground cover in the kiawe woodland and the mixed kiawe/koa-haole association. Scattered shrubs of klu (Acacia farnesiana), Christmas berry (Schinus terebinthifolius), pluchea (Pluchea odorata), wild basil (Ocimum gratissimum), and lantana (Lantana camara) are occasionally found.

5. Pond areas and drainage ways. The vegetation in these areas occupy only a small portion of the project site and lie adjacent to fresh to slightly brackish running or standing water. These wet areas have either been greatly modified by man or are man-made. Generally, the vegetation around these areas consists of those plant species already growing in the adjacent communities, though much greener and much more numerous here. California-grass (Brachiaria mutica) is often abundant in these wet areas, forming a dense grass cover along the banks of the drainage ways and pond areas. Locally common in medium- to large-sized patches are Job's tears (Coix lachryma-jobi), castor bean (Ricinus communis), and wild bitter melon (Momordica charantia var. pavel). Along some drainage ways the common four o'clock (Mirabilis jalapa) forms dense stands up to 1.5 meters tall.

The largest body of water is the Crowbar Ranch pond which is a former borrow pit from sand mining operations. It has been modified to provide habitat and nesting sites for native waterbirds. Three species of wetland plants--cattail (Typha latifolia), umbrella plant (Cyperus alternifolius), and the great bulrush or aka'akai (Scirpus validus)--are found only in this portion of the project area.

The Ka-wai-hapai Reservoir is surrounded by a dense koa-haole (Leucaena leucocephala) thicket with a mixed assortment of various tree species such as Java plum (Syzygium cumini), monkeypod (Samanea saman), African tulip (Spathodea campanulata), pink tecoma (Tabebuia pentaphylla), and silk oak (Grevillea robusta). Around the reservoir's edge is a dense growth of Guinea grass (Panicum maximum) and several small thickets of Christmas berry (Schinus terebinthifolius) and guava (Psidium guajava).

Threatened or Endangered Species

In their survey of the Dillingham Military Reservation, Char and Yoshida (1977) found a few scattered remnant stands of native lowland forest communities on the steep slopes above the project area. Among the native species encountered were wiliwili (*Erythrina sandwicensis*), aulu (*Sapindus oahuensis*), 'aheahea (*Chenopodium oahuensis*), 'akoko (*Euphorbia celastroides*), alahe'e (*Canthium odoratum*), ma'oli'oli (*Schiedea kealiae*), naio (*Myoporum sandwicense*), 'ohe makai (*Reynoldsia sandwicensis*), and hao (*Rauvolfia sandwicensis*). Of these, the ma'oli'oli and the 'ohe makai are candidate threatened or endangered species (U. S. Fish and Wildlife Service 1980). Char and Yoshida noted, however, that these native plants occurred on the slopes above the powerline. This is outside the project area.

During this survey an intensive search was made of the area along and immediately below (or makai of) the powerline. Much of this site has already been disturbed by the old airfield complex. No listed, proposed, or candidate threatened or endangered plant species were found.

SUMMARY AND RECOMMENDATIONS

The vegetation on the project area has been greatly disturbed. Large areas are covered by sugar cane fields or the former Dillingham Military Reservation airfield complex. Old asphalt-covered areas and concrete structures are frequently found in the airfield complex. The other areas are used for grazing cattle and horses. All vegetation types are dominated by introduced or exotic species.

The site proposed for the waste water treatment plant, as well as irrigation locations, is occupied by cane fields. The Dillingham airfield complex which is proposed as another potential irrigation area has been greatly disturbed and the vegetation modified. No native plant communities are found in any of these areas or on the project site. The proposed project should have no significant impact on the total island populations of the species involved, the majority of which are introduced. The native species found on the site are found in similar environmental habitats throughout the islands.

PLANT SPECIES CHECKLIST--Wai-a-lua - Hale'iwa Wastewater Facility Plan, O'ahu.

Families are arranged alphabetically within each of two groups: Monocotyledons and Dicotyledons. Taxonomy and nomenclature of the flowering plants (Monocotyledons and Dicotyledons) follow St. John (1973) except where more recently accepted names are listed. Hawaiian names used in the checklist are in accordance with Porter (1972) or St. John (1973).

For each species the following information is provided:

1. Scientific name with author citation.
2. Common English or Hawaiian name, when known.
3. Biogeographic status of the species. The following symbols are used:

   E = endemic = native to the Hawaiian Islands only, not occurring naturally elsewhere.

   I = indigenous = native to the Hawaiian Islands and also to one or more other geographic areas.

   P = Polynesian = plants of Polynesian introduction; all those plants brought by the Polynesian immigrants prior to contact with the Western world.

   X = exotic or introduced = not native to the Hawaiian Islands; brought here intentionally or accidentally by man after Western contact.

4. Vegetation types and abundance. Five vegetation types are recognized in the study area and are discussed in detail in the report. The number heading each of the columns refers to the following vegetation types:

   1 Cane fields

   2 Koa-haole thickets

3 Pasture lands

4 Kiawe woodlands

5 Pond areas and drainage ways

Within each of the vegetation type columns the relative abundance of each species or absence (-) is given. These ratings reflect the abundance of a particular species within the study area and are not applicable to areas outside the project. The following symbols are used:

A = abundant = the major or dominant species in a given vegetation type.

C = common = distributed throughout a given vegetation type in large numbers.

LC = locally common = found in large localized patches, although within a given vegetation type it may be occasional to rare.

O = occasional = generally widely distributed throughout a given vegetation type.

U = uncommon = observed infrequently but more than 10 times in a given vegetation type.

R = rare = observed 1 to 10 times in a given vegetation type.

Scientific name	Common name	Status	Vegetation types 1	2	3	4	5
MONOCOTYLEDONS							
AMARYLLIDACEAE (Amaryllis Family)							
Crinum asiaticum L.	spider lily	X	-	R	-	-	-
ARACEAE (Arum Family)							
Alocasia macrorrhiza (L.) Sweet	'ape, apii	P	-	-	-	-	R
COMMELINACEAE (Spiderwort Family)							
Commelina benghalensis L.	hairy honohono	X	U	-	O	-	R
Commelina diffusa Burm. f.	honohono	X	-	-	R	-	LC
CYPERACEAE (Sedge Family)							
Cyperus alternifolius L.	umbrella plant	X	-	-	-	-	LC
Cyperus rotundus L.	nut grass, kili'o'opu	X	O	-	-	-	-
Kyllinga brevifolia Rottb.	kyllinga, kili'o'opu	X	-	-	-	-	LC
Scirpus validus Vahl	great bulrush, aka'akai	I	-	-	-	-	LC
GRAMINEAE (Grass Family)							
Andropogon pertusus (L.) Willd.	pitted beardgrass	X	-	LC	-	-	-
Brachiaria mutica (Forsk.) Stapf	Californiagrass, paragrass	X	U	O	A	R	A
Cenchrus ciliaris L.	buffelgrass	X	U	U	U	U	-
Chloris inflata Link	swollen fingergrass, mau'ulei	X	O	O	LC	O	U
Coix lachryma-jobi L.	Job's tears	X	U	-	-	-	LC
Cynodon dactylon (L.) Pers.	Bermuda grass, manienie	X	O	LC	LC	LC	C
Digitaria radicosa (Presl) Miq.		X	-	R	-	-	R
Echinochloa colona (L.) Link	jungle-rice	X	O	-	-	-	O
Echinochloa crusgalli (L.) Beauv.	barnyard grass	X	-	-	-	-	U
Eleusine indica (L.) Gaertn.	wiregrass, manienie-ali'i	X	O	-	O	-	R
Eragrostis tenella (L.) Beauv. ex R. & S.	lovegrass	X	-	-	O	-	-
Panicum maximum Jacq. var. maximum	Guinea grass	X	O	A	A	C	LC
Panicum maximum var. trichoglume Eyles ex Robyns	green panicgrass	X	R	A	U	A	U
Paspalum dilatatum Poir.	Dallis grass	X	-	-	R	-	-
Pennisetum purpureum Schumach.	napiergrass	X	-	-	LC	-	LC
Rhynchelytrum repens (Willd.) C. E. Hubb.	Natal redtop	X	-	U	U	-	-
Saccharum officinarum L.	sugar cane, ko	P	A	-	-	-	-

Scientific name	Common name	Status	Vegetation types 1	2	3	4	5
Setaria verticillata (L.) Beauv.	bristly foxtail	X	R	R	U	R	U
Sporobolus africanus (Poir.) Robyns & Tournay	African dropseed	X	-	-	U	-	-
Stenotaphrum secundatum (Walt.) Ktze.	St. Augustine grass, buffalo grass	X	-	R	-	-	-
Tricachne insularis (L.) Nees	sourgrass	X	U	LC	LC	O	U
LILIACEAE (Lily Family)							
Sansevieria thyrsiflora Thunb.	bowstring hemp	X	-	R	-	-	-
MUSACEAE (Banana Family)							
Musa x nana Lour.	Chinese banana	X	-	R	-	-	-
PALMAE (Palm Family)							
Cocos nucifera L.	coconut, niu	P	-	R	-	-	-
TYPHACEAE (Cattail Family)							
Typha latifolia L.	common cattail	X	-	-	-	-	LC
DICOTYLEDONS							
ACANTHACEAE (Acanthus Family)							
Asystasia gangetica (L.) T. Anders.	asystasia	X	-	LC	-	-	LC
AMARANTHACEAE (Amaranth Family)							
Achyranthes indica (L.) Mill.		X	-	O	R	O	R
Amaranthus spinosus L.	spiny amaranth, pakai-kuku	X	U	LC	LC	R	U
Amaranthus viridis L.	slender amaranth, pakai	X	-	U	O	U	U
ANACARDIACEAE (Mango Family)							
Schinus terebinthifolius Raddi	Christmas berry, wilelaiki	X	R	LC	U	U	O
BIGNONIACEAE (Bignonia Family)							
Spathodea campanulata Beauv.	African tulip tree	X	-	U	R	U	R
Tabebuia pentaphylla (L.) Hemsl.	pink tecoma	X	-	R	-	-	-
Tecomaria capensis (Thunb.) Spach	Cape honeysuckle, 'i'iwi haole	X	-	R	-	-	-

Scientific name	Common name	Status	Vegetation types 1	2	3	4	5
BORAGINACEAE (Heliotrope Family)							
Heliotropium procumbens P. Mill.	weedy heliotrope	X	-	-	-	-	R
CASUARINACEAE (Casuarina Family)							
Casuarina equisetifolia Stickm.	ironwood, paina	X	-	LC	-	R	LC
CHENOPODIACEAE (Goosefoot Family)							
Chenopodium ambrosioides L.	Mexican tea	X	-	-	-	-	R
Chenopodium murale L.	nettle-leaved goosefoot	X	-	-	R	-	R
COMPOSITAE (Daisy Family)							
Ageratum conyzoides L.	ageratum, maile-hohono	X	R	U	U	U	U
Bidens pilosa L. var. pilosa	Spanish needle, beggar's tick, ko'oko'olau	X	-	LC	U	LC	U
Bidens pilosa var. minor (Bl.) Sherff		X	R	-	R	-	-
Calyptocarpus vialis Less.	hierba del cabello	X	-	LC	LC	U	U
Crassocephalum crepidioides (Benth.) S. Moore	crassocephalum	X	R	R	-	R	U
Eclipta alba (L.) Hassk.	false daisy	X	-	-	-	-	U
Emilia fosbergii Nicolson	Flora's paintbrush	X	R	U	U	U	U
Erechtites valerianaefolia (Wolf) DC.	purple erechtites	X	-	-	-	-	R
Erigeron bonariensis L.	hairy horseweed, ilioha	X	-	R	O	R	R
Erigeron canadensis L.	Canada fleabane	X	-	-	R	-	R
Franseria strigulosa Rydb.	false ragweed	X	-	LC	LC	LC	U
Pluchea x fosbergii Cooperrider & Galang	hybrid pluchea	X	-	LC	-	-	R
Pluchea indica (L.) Less.	Indian pluchea	X	-	LC	R	-	U
Pluchea odorata (L.) Cass.	pluchea	X	-	U	U	U	O
Sonchus asper (L.) Hill	spiny sow thistle	X	-	-	-	-	R
Sonchus oleraceus L.	sow thistle, pua-lele	X	-	U	U	U	U
Synedrella nodiflora (L.) Gaertn.	synedrella	X	-	U	-	U	-
Tridax procumbens L.	coat buttons	X	-	U	U	U	-
Verbesina encelioides (Cav.) B. & H. ex Gray	golden crown-beard	X	-	U	LC	R	LC
Vernonia cinerea (L.) Less.	ironweed	X	-	U	U	U	R
Xanthium saccharatum Wallr.	cocklebur, kikania	X	-	O	LC	O	-
CONVOLVULACEAE (Morning-glory Family)							
Ipomoea cairica (L.) Sweet	koali	I	-	U	R	R	R

Scientific name	Common name	Status	Vegetation types 1	2	3	4	5
Ipomoea indica (Burm.) Merr.	koali-'awania	I	-	-	-	U	U
Ipomoea obscura (L.) Ker-Gawl		X	-	-	-	-	R
Ipomoea triloba L.	little bell	X	U	-	-	-	LC
Merremia aegyptia (L.) Urban	hairy merremia, koali-kua-hulu	I	-	O	-	O	-
CRUCIFERAE (Mustard Family)							
Coronopus didymus (L.) Sm.	swine cress, wartcress	X	-	-	-	-	R
Lepidium virginicum L.	wild peppergrass	X	-	U	U	U	U
CUCURBITACEAE (Squash Family)							
Cucumis dipsaceus Ehrenb. ex Spach	wild cucumber	X	-	R	U	R	-
Momordica charantia var. pavel Crantz	wild bitter melon	X	U	LC	U	U	LC
Sicyos microcarpus Mann	sicyos	E	-	U	R	-	-
EUPHORBIACEAE (Spurge Family)							
Aleurites moluccana (L.) Willd.	kukui, tutui	P	-	R	-	-	U
Euphorbia geniculata Ortega	wild spurge, kaliko	X	-	-	R	-	-
Euphorbia glomerifera (Millsp.) L. C. Wheeler	glomerate spurge	X	U	-	-	-	-
Euphorbia hirta L.	garden spurge, koko-kahiki	X	U	O	O	O	R
Phyllanthus debilis Klein ex Willd.	phyllanthus weed	X	-	-	R	R	R
Ricinus communis L.	castor bean, koli	X	R	LC	R	U	LC
GENTIANACEAE (Gentian Family)							
Centaurium erythraea Rafn.	bitter herb	X	-	U	O	R	-
LABIATAE (Mint Family)							
Hyptis pectinata (L.) Poit.	comb hyptis	X	-	O	O	U	U
Leonotis leonurus (L.) R. Br.	purple lions-ear	X	-	LC	-	-	-
Leonotis nepetaefolia (L.) Ait.	orange lions-ear	X	-	U	LC	U	LC
Ocimum gratissimum L.	wild basil	X	-	LC	-	LC	-
LEGUMINOSAE (Pea Family)							
Acacia farnesiana (L.) Willd.	klu, kolu	X	-	O	O	O	-
Calopogonium mucunoides Desv.	calopogonium	X	-	LC	-	-	LC
Cassia bicapsularis L.		X	-	O	O	U	-

Scientific name	Common name	Status	Vegetation types 1	2	3	4	5
Cassia lechenaultiana DC.	partridge pea, lauki	X	-	LC	LC	U	-
Cassia occidentalis L.	coffee senna, 'auko'i	X	-	U	U	U	R
Crotalaria incana L.	fuzzy rattlepod, kukae-hoki	X	R	-	-	-	-
Crotalaria pallida Aiton		X	R	O	O	O	-
Desmanthus virgatus (L.) Willd.	virgate mimosa	X	R	O	LC	O	-
Desmodium canum (Gmel.) Schinz & Thell.	Spanish clover, ka'imi	X	-	U	O	U	U
Indigofera suffruticosa Mill.	indigo, 'iniko	X	-	O	LC	O	U
Leucaena leucocephala (Lam.) de Wit	koa-haole, ekoa	X	R	A	C	C	C
Medicago polymorpha L.	bur clover	X	R	-	R	-	-
Mimosa pudica var. unijuga (Duchess. & Walp.) Griseb.	sensitive plant, pua-hilahila	X	-	R	O	R	-
Phaseolus atropurpureus DC.	wild bushbean	X	-	U	-	-	LC
Phaseolus lathyroides L.	cow pea	X	-	U	O	U	U
Pithecellobium dulce (Roxb.) Benth.	'opiuma	X	-	-	-	-	LC
Prosopis pallida (Humb. & Bonpl. ex Willd.) HBK.	kiawe, algaroba	X	-	O	C	A	LC
Samanea saman (Jacq.) Merr.	monkeypod	X	-	U	U	U	U
LOGANIACEAE (Strychnine Family)							
Buddleja asiatica Lour.	Asiatic butterfly bush, dogtail, huelo-'ilio	X	-	LC	-	-	R
MALVACEAE (Mallow Family)							
Abutilon grandifolium (Willd.) Sweet	hairy abutilon, ma'o	X	-	U	U	U	R
Hibiscus rosa-sinensis L.	red hibiscus	X	-	R	-	-	-
Hibiscus cv. "Pink Waterfall"		X	-	R	-	-	-
Hibiscus tiliaceus L.	hau	I	-	-	-	-	R
Malva parviflora L.	little mallow, cheeseweed	X	-	U	O	R	O
Malvastrum coromandelianum (L.) Garcke	false mallow, hauuoi	X	U	O	O	U	U
Sida acuta Burm.	'ilima	X	-	U	O	R	-
Sida fallax Walp.	'ilima	I	-	U	-	-	-
Sida rhombifolia L.	Cuba jute	X	-	U	-	-	-
Sida spinosa L.	prickly sida	X	R	-	-	-	-
Thespesia populnea (L.) Soland. ex Correa	milo	P	-	R	-	-	R

Scientific name	Common name	Status	Vegetation types 1	2	3	4	5
MELIACEAE (Mahogany Family)							
Melia azedarach L.	pride of India, Chinaberry tree, 'inia	X	-	LC	U	R	-
MORACEAE (Mulberry Family)							
Ficus microcarpa L. f.	Chinese banyan	X	-	U	-	U	R
Morus nigra L.	black mulberry, kilika	X	-	R	-	-	-
MYRTACEAE (Myrtle Family)							
Psidium guajava L.	guava, kuawa	X	-	-	U	-	R
Syzygium cumini (L.) Skeels	Java plum, palama	X	R	LC	LC	LC	LC
NYCTAGINACEAE (Four O'clock Family)							
Mirabilis jalapa L.	common four o'clock, nani ahiahi	X	R	LC	-	U	LC
ONAGRACEAE (Evening Primrose Family)							
Ludwigia octivalvis (Jacq.) Raven	primrose willow, kamole	I	-	-	-	-	O
OXALIDACEAE (Wood Sorrel Family)							
Oxalis corniculata L.	yellow wood sorrel, 'ihi	I	-	U	U	U	O
PASSIFLORACEAE (Passion Flower Family)							
Passiflora edulis f. flavicarpa Deg.	yellow liliko'i	X	R	LC	-	O	U
Passiflora foetida L.	scarlet-fruited passionflower, pohapoha	X	-	O	-	O	-
Passiflora suberosa L.	huehue-haole	X	-	R	-	-	-
PHYTOLACCACEAE (Pokeweed Family)							
Phytolacca octandra L.	southern pokeberry	X	-	R	-	-	-
PLANTAGINACEAE (Plantain Family)							
Plantago lanceolata L.	narrow-leaved plantain	X	-	U	U	U	U
Plantago major L.	common plantain	X	U	R	U	R	O
PLUMBAGINACEAE (Leadwort Family)							
Plumbago zeylanica L.	'ilie'e, hilie'e	I	-	LC	-	LC	-

Scientific name	Common name	Status	Vegetation types 1	2	3	4	5
PORTULACACEAE (Purslane Family)							
Portulaca oleracea L.	common purslane, pigweed	X	-	U	O	U	O
PRIMULACEAE (Primrose Family)							
Anagallis arvensis L.	scarlet pimpernel	X	-	U	O	-	-
PROTEACEAE (Silk Oak Family)							
Grevillea robusta A. Cunn.	silk oak, 'oka-kalika	X	-	R	U	R	R
SOLANACEAE (Tomato Family)							
Lycopersicon pimpinellifolium Mill.	currant tomato, 'ohi'a-ma-kanahele	X	-	LC	U	U	LC
Nicandra physalodes (L.) Gaertn.	apple-of-Peru	X	-	R	R	R	-
Solanum nigrum L.	popolo	I?	R	U	U	U	O
Solanum seaforthianum Andr.	blue potato vine	X	-	R	-	-	-
Solanum sodomeum L.	apple of Sodom, popolo-kikania	X	-	U	LC	U	R
STERCULIACEAE (Cocoa Family)							
Waltheria indica var. americana (L.) R. Brown ex Hosaka	hi'aloa, 'uhaloa	I	-	U	C	-	-
TILIACEAE (Linden Family)							
Triumfetta semitriloba (L.) Jacq.	burbush	X	-	U	-	-	-
UMBELLIFERAE (Carrot Family)							
Apium tenuifolium (Moench) Thell. ex Hegi	apium	X	R	O	O	R	O
VERBENACEAE (Verbena Family)							
Lantana camara L.	lantana, lakana	X	-	O	LC	O	U
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain, owi, oi	X	R	U	R	R	U
Verbena litoralis HBK.	weed verbena, ha'uowi	X	-	R	U	R	U

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Scientific name	Common name	Status	Vegetation types 1	2	3	4	5
PORTULACACEAE (Purslane Family)							
Portulaca oleracea L.	common purslane, pigweed	X	–	U	O	U	O
PRIMULACEAE (Primrose Family)							
Anagallis arvensis L.	scarlet pimpernel	X	–	U	O	–	–
PROTEACEAE (Silk Oak Family)							
Grevillea robusta A. Cunn.	silk oak, 'oka-kalika	X	–	R	U	R	R
SOLANACEAE (Tomato Family)							
Lycopersicon pimpinellifolium Mill.	currant tomato, 'ohi'a-ma-kanahele	X	–	LC	U	U	LC
Nicandra physalodes (L.) Gaertn.	apple-of-Peru	X	–	R	R	R	–
Solanum nigrum L.	popolo	I?	R	U	U	U	O
Solanum seaforthianum Andr.	blue potato vine	X	–	R	–	–	–
Solanum sodomeum L.	apple of Sodom, popolo-kikania	X	–	U	LC	U	R
STERCULIACEAE (Cocoa Family)							
Waltheria indica var. americana (L.) R. Brown ex Hosaka	hi'aloa, 'uhaloa	I	–	U	C	–	–
TILIACEAE (Linden Family)							
Triumfetta semitriloba (L.) Jacq.	burbush	X	–	U	–	–	–
UMBELLIFERAE (Carrot Family)							
Apium tenuifolium (Moench) Thell. ex Hegi	apium	X	R	O	O	R	O
VERBENACEAE (Verbena Family)							
Lantana camara L.	lantana, lakana	X	–	O	LC	O	U
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain, owi, oi	X	R	U	R	R	U
Verbena litoralis HBK.	weed verbena, ha'uowi	X	–	R	U	R	U

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CORRECTION

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

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