Final Environmental Impact Statement

The Oceanic Institute Master Plan for The Center for Applied Aquaculture

Makapuu Point, Oahu

The Oceanic Institute

Makapuu Point P.O. Box 25280 Honolulu, Hawaii 96825

March 1990

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
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FRANK F. FASI
MAYOR

DONALD A. CLEGG
DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

89/SMA-60(BWM)

May 8, 1990

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

Dear Dr. Miura:

Final Environmental Impact Statement (EIS)
The Oceanic Institute Master Plan for the
Center for Applied Aquaculture, Makapuu Point, Oahu
Tax Map Key: 4-1-14: 04

We are notifying you that the above is an acceptable Final EIS document, pursuant to Chapter 343, HRS, and Title 11, Administrative Rules, Department of Health, Chapter 200, Environmental Impact Statement Rules.

A copy of our acceptance report is attached. If you have any questions, please contact Bennett Mark at 527-5038.

Very truly yours,

DONALD A. CLEGG
Director of Land Utilization

DAC:sl
0311N/3

cc: E. Dias and W. C. Rowland
Oceanic Institute
DLNR

The Oceanic Institute Master Plan for The Center for Applied Aquaculture Final Environmental Impact Statement

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Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.

Prepared by:

APPLIED ANALYSIS INC.
P.O. BOX 10631
HONOLULU, HAWAII 96816-0631
(808) 735-9938

March 1990

SUMMARY SHEET

1 INTRODUCTION

This environmental impact statement explains the probable environmental consequences of construction and operation of The Oceanic Institute Master Plan for the Center for Applied Aquaculture. The environmental implications of the project are presented and all relevant and feasible consequences of the action are discussed.

2 APPLICANT

The Oceanic Institute
Makapuu Point
P.O. Box 25280
Honolulu, Hawaii 96825

The Oceanic Institute (OI) is a scientific organization that develops practical technology for commercial aquaculture and oceanographic operations.

OI assists commercial aquaculture in Hawaii by developing and transferring:

1. Reproducible production systems.
2. Management procedures.
3. Applied aquaculture information.
4. Aquaculture marketing strategies.

OI fills the void between entrepreneurs and traditional research institutions.

Recorded Fee Owner: State of Hawaii, Department of Land and Natural Resources

Agent: Applied Analysis, Inc., P.O. Box 10631, Honolulu, Hawaii 96816

Tax Map Key: 4-1-14:04

Lot Area: 56 acres

3 BRIEF DESCRIPTION OF THE ACTION

The United States Congress has appropriated $6.125 million through the United States Department of Agriculture (USDA) Cooperative State Research Service (CSRS) for the construction of the Center for Applied Aquaculture (CAA). The State of Hawaii is matching the federal appropriation with a $5 million grant administered by the Department of Land and Natural Resources (DLNR) through its Division of Water and Land (DWL).

CAA is an applied aquaculture research facility supporting the development of commercial aquaculture in Hawaii and the United States. CAA will be equipped to provide services to the commercial aquaculture industry that are unavailable from traditional sources.

Operations will include:

1. Applied research to solve operational and production problems of commercial aquaculture operations.
2. Finfish and crustacean maturation, hatchery, and growout technology development.
3. Aquaculture nutrition research.
4. Aquaculture information services, including design, engineering, economics, and management of aquaculture operations.
5. Industry assistance, including training, prototype development, and effluent discharge analysis.

Buildings will include:

1. A three building administrative complex.
2. A general services building with storage and utilities.
3. A laboratory/office building.
4. Ten research modules with adjacent tank fields.
5. A maintenance building.

Infrastructure will include:

1. A salt water supply, storage, distribution, and disposal system.
2. A parking lot, roads, and sidewalks.

4 SIGNIFICANT BENEFICIAL AND ADVERSE IMPACTS

4.1 Beneficial Impacts

1. A world-class aquaculture production problem solving facility to assist Hawaiian and U.S. commercial aquaculture.
2. Growth of the Hawaiian and U.S. aquaculture industry.
3. Increased employment opportunities at the Center for Applied Aquaculture and in the aquaculture sector of the Hawaiian and U.S. economies.

4.2 Adverse Impacts

1. Construction of low level structures on conservation district land.

5 PROPOSED MITIGATION MEASURES

5.1 Visual Impact

The project has been designed to minimize visual impact. All new structures are one story and will blend with the natural environment.

5.2 Effluent Discharge

Projected master plan effluent discharge volume is no more than 10% of the current discharge of aquaculture effluent (1,400 gpm present up to 1,540 gpm projected). Concentrations of effluent constituents are not expected to change. Permitted dispersion wells will be used in conjunction with surface discharge into the ocean. The aquaculture effluent will be used to research solutions to aquaculture discharge problems throughout Hawaii and the U.S.

5.3 Traffic

An increase of 100 employees to approximately 200 employees at full Master Plan build-out will be mitigated by a new entrance at the west end of the site opposite Makai Pier. Projected additional traffic will not decrease the level of service of Kalanianaole Highway.

5.4 Natural Hazards

5.4.1 Geology

The unstable nature of the cliff above the project site will be mitigated by a protective ditch and barriers designed to absorb and/or deflect any descending projectiles.

5.4.2 Tsunami

All construction in the federally designated Flood Hazard District will be in compliance with the provisions of the Coastal High Hazard District. Workers will be evacuated if there is a tsunami warning.

5.4.3 Wind

Structures are designed to withstand the occasional strong Kona winds amplified by the Venturi effect through Makapuu Head.

6 ALTERNATIVES CONSIDERED

The only alternative considered for this project was the grouping of all functions into one large structure, it was rejected to minimize visual impact.

7 COMPATIBILITY WITH LAND USE PLANS AND POLICIES

7.1 Federal Land Use Regulations

There are no federal land use regulations that affect this project. The CAA will not require any construction in navigable waters, alteration of any wetlands, or impact any endangered species or sanctuaries.

7.2 State Land Use Regulations

7.2.1 Conservation District

The Oceanic Institute leasehold property is designated as Conservation by the State of Hawaii. The property was placed in a "Special Subzone" called the "Sea Life Park Special Subzone" in 1981. The subzone is designated for recreational, educational, and commercial purposes as delineated on the map entitled "O-15, Koko Head, Oahu", dated June 4, 1981, on file with the Department of Land and Natural Resources.

Development at the Makapuu site will not require a Conservation District Use Permit (CDUP). The Master Lease for Kaupo Park (the project site) was signed in 1962. That is two years before Regulation No. 4 was promulgated in 1964 and therefore, no CDUP is required. The Board of Land and Natural Resources stipulates in the Master Lease that the lessee (The Oceanic Institute) shall build and maintain first-class research facilities.

7.2.2 Historic Site

The OI property has been surveyed and researched for historic sites. There is no visual evidence and no record of a historic site on the property.

7.2.3 Designated Groundwater

The OI property is not in a Designated Ground Water Control Area.

7.2.4 Well Drilling

New water supply or injection wells required by the project will be approved by the State Department of Health Underground Injection Control Program and DLNR before they are constructed or operated.

7.2.5 Department of Transportation

7.2.5.1 Harbors Division

No modifications to the shoreline or the ocean environment will be made.

7.2.5.2 Highways Division

Highway modifications to improve the western entrance (opposite Makai Pier) will require the permission and cooperation of the Highways Division.

7.2.6 Department of Health - NPDES

A National Pollution Discharge Elimination System permit is not required.

7.3 City and County of Honolulu Land Use Regulations

7.3.1 Shoreline Management Area

A Shoreline Management Area (SMA) permit will be required for this project. The Oceanic Institute at Makapuu Point is listed as a Use of Special Benefit in the Final Environmental Impact Statement for the Hawaii Coastal Zone Management Program (1978) in recognition of its unique function requiring a coastal location.

7.3.2 Shoreline Setback

No shoreline setback variances are required for this project.

7.3.3 Development Plan

The project site is designated Preservation on the Koolaupoko Development Plan Land Use Map.

7.3.4 Zoning

7.3.4.1 Preservation District

The project site is designated Preservation (P-1) by the City and County of Honolulu. The Land Use Ordinance describes Preservation Districts as they relate to the project site:

7.3.4.2 Preservation Districts: Purpose and Intent (5-10)

The purpose of the preservation districts is to preserve and manage major open space and recreation lands and lands of scenic and other natural resource value.

It is intended that all lands within a State-designated Conservation District be zoned P-1 Restricted Preservation District.

7.3.4.3 Preservation Uses and Development Standards (5.10-1)

Within the P-1 Restricted Preservation District, all uses, structures and development standards shall be governed by the appropriate State agencies.

Section 5.10-1 above clearly defers all regulatory control (except for the SMA permit) over new construction on OI property to the Department of Land and Natural Resources.

7.3.4.4 Flood Hazard District

A portion of the OI property below the 20 foot elevation is included in a designated Flood Hazard District (Coastal High Hazard District).

7.3.4.4.1 Flood Hazard Districts: Purpose (7.10)

Certain areas within the City are subject to periodic inundation by flooding and/or tsunami which may result in loss of life and property, creation of health and safety hazards, disruption of commerce and governmental services as well as extraordinary public expenditures for flood and tsunami protection and relief.

7.3.4.4.2 Coastal High Hazard District (7.10-7)

Within the Coastal High Hazard District, the uses permitted in the underlying zoning district shall be permitted, provided such uses, improvements, structures and utilities are in compliance with the provisions of this section.

7.3.5 Grading- City and County of Honolulu Building Department

All grading work will require a grading permit from the Building Department.

7.3.6 Building- City and County of Honolulu Building Department

Building permits will be acquired for all buildings.

8 LIST OF PERMITS OR APPROVALS

1. Special Management Area Use Permit - City and County of Honolulu Department of Land Utilization (Application is made after the EIS is accepted).
2. City and County of Honolulu Grading Permit (application prior to construction).
3. City and County of Honolulu Building Permit (application prior to construction).
4. Highway modification approval from the Department of Transportation.
5. Underground Injection Control Permit - State of Hawaii Department of Health.

Contents

Figures

Tables

1 PROJECT PURPOSE

This is the Final Environmental Impact Statement (DEIS) for The Oceanic Institute (OI) Master Plan incorporating the Center for Applied Aquaculture (CAA). This Master Plan is a revision of the existing Oceanic Institute Master Plan on file with the State of Hawaii Department of Land and Natural Resources (DLNR) to incorporate the Center for Applied Aquaculture at Makapuu Point, Oahu. This EIS is required by the City and County of Honolulu Department of Land Utilization for issuance of a Shoreline Management Permit (SMP).

The United States Congress has appropriated $6.125 million through the United States Department of Agriculture (USDA) Cooperative State Research Service (CSRS) for the construction of the Center for Applied Aquaculture. The State of Hawaii is matching the federal appropriation with a $5 million grant administered by DLNR through the Division of Water and Land (DWL).

The Center for Applied Aquaculture is an applied aquaculture research facility supporting the development of commercial aquaculture in Hawaii and the United States. CAA will be equipped to provide services to the commercial aquaculture industry that are unavailable from traditional sources.

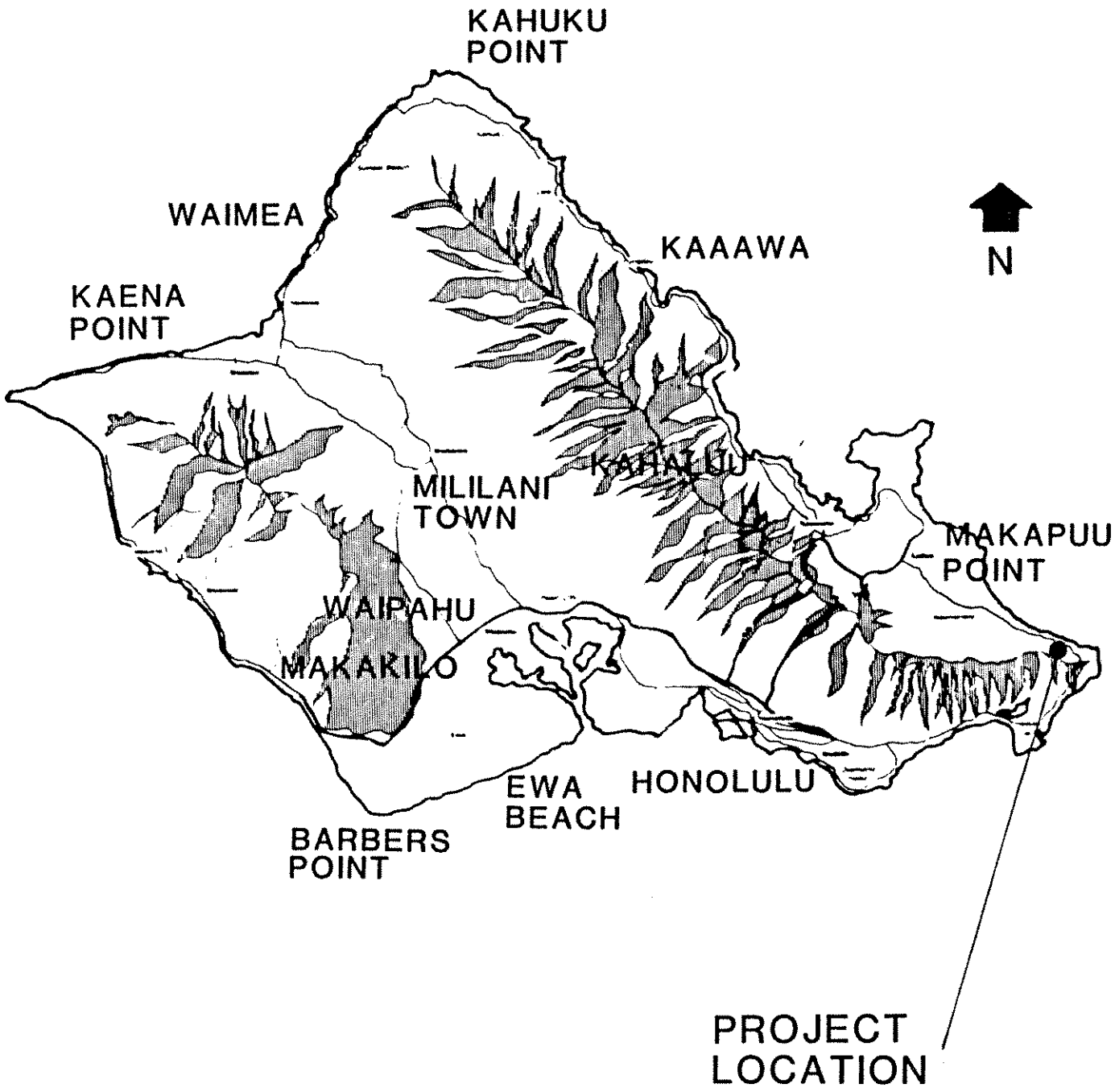
Operations will include:

1. Applied research to solve operational and production problems of commercial aquaculture operations.
2. Finfish and crustacean maturation, hatchery, and growout technology development.
3. Aquaculture nutrition research.
4. Aquaculture information services, including design, engineering, economics, and management of aquaculture operations.
5. Industry assistance, including training, prototype development, and effluent/discharge analysis.

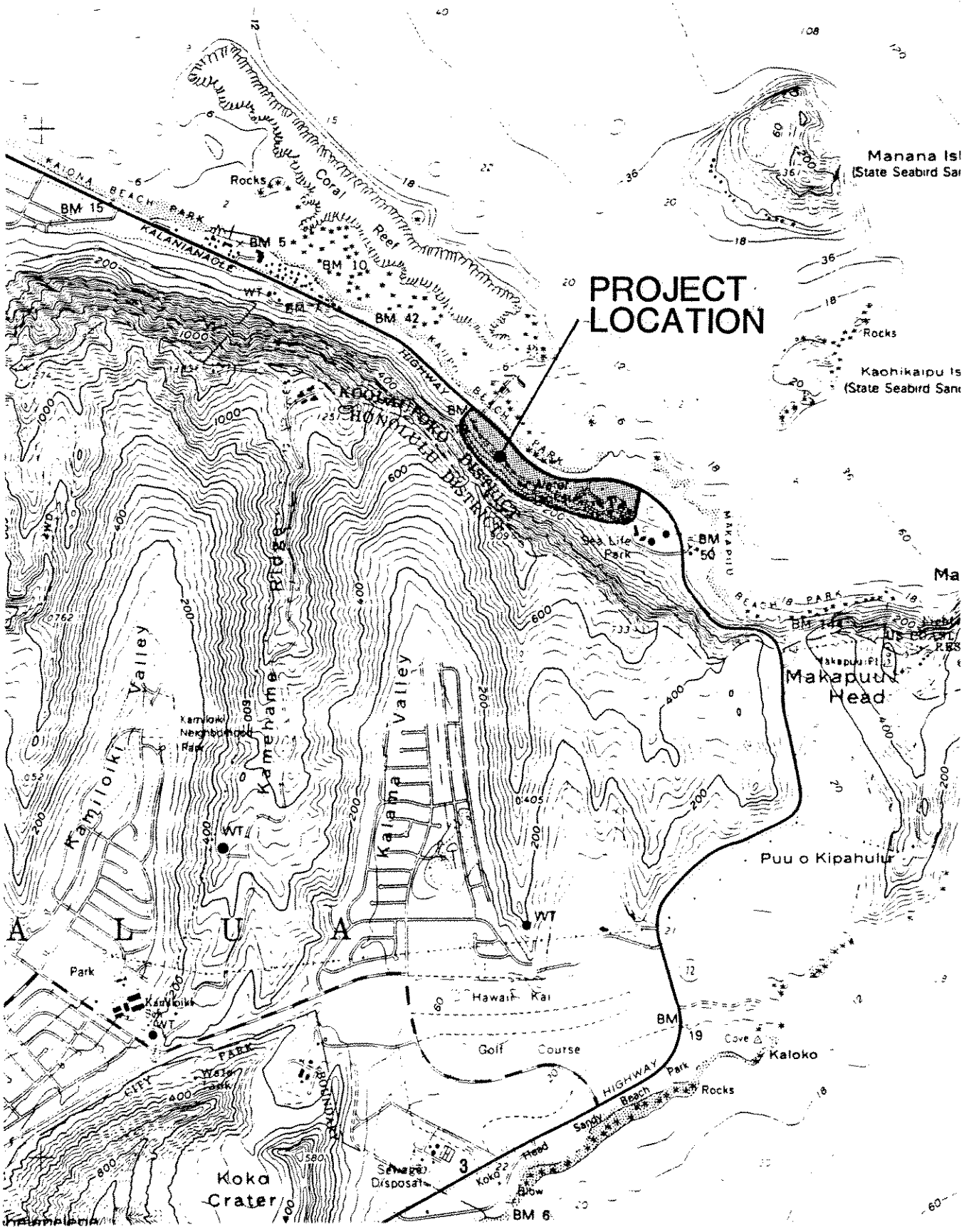
The Oceanic Institute has been investigating the marine environment and its benefits to mankind for over 25 years. The next 10 years will be decisive in controlling profitable production of marine animals for human consumption, and OI will be an important part of the research effort with the CAA.

2 PROJECT DESCRIPTION

2.1 Regional Map



2.2 Location Map



2.3 Master Plan - Phase 1

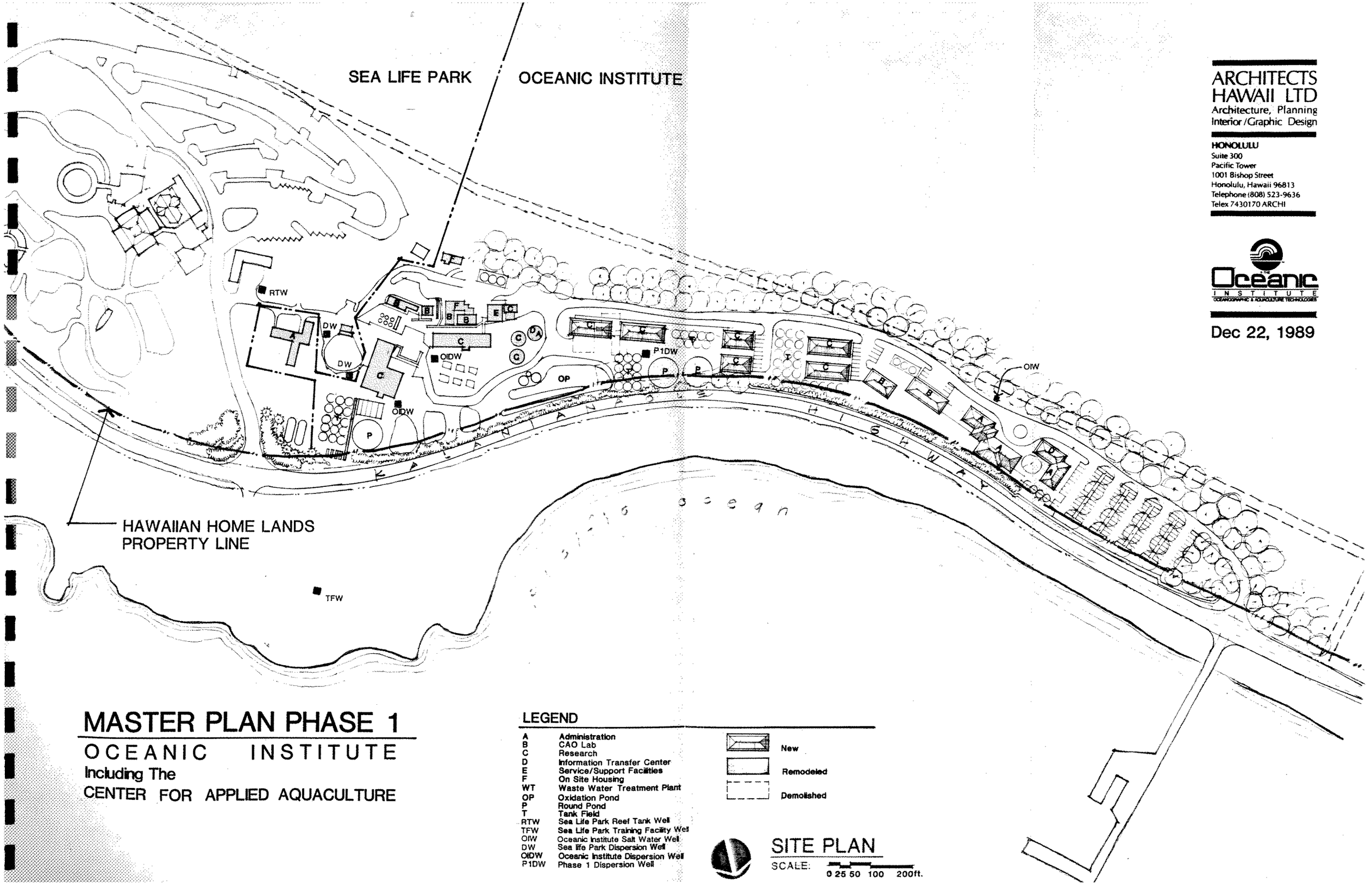
Phase 1 of The Oceanic Institute Master Plan is construction of:

1. A three building administrative complex.
2. A general services building with storage and utilities.
3. A laboratory/office building.
4. Six research modules with adjacent tank fields.
5. A landscaped buffer strip along the highway.
6. A salt water supply, storage, distribution, and disposal system.
7. A parking lot, roads, and sidewalks.

2.4 Master Plan - Ultimate

The Ultimate Master Plan is additional construction of:

1. Four research modules with adjacent tank fields.
2. A maintenance building.



MASTER PLAN PHASE 1

OCEANIC INSTITUTE

Including The

CENTER FOR APPLIED AQUACULTURE

LEGEND

A	Administration
B	CAO Lab
C	Research
D	Information Transfer Center
E	Service/Support Facilities
F	On Site Housing
WT	Waste Water Treatment Plant
OP	Oxidation Pond
P	Round Pond
T	Tank Field
RTW	Sea Life Park Reef Tank Well
TFW	Sea Life Park Training Facility Well
OIW	Oceanic Institute Salt Water Well
DW	Sea life Park Dispersion Well
OIDW	Oceanic Institute Dispersion Well
P1DW	Phase 1 Dispersion Well

New

Remodeled

Demolished

SITE PLAN

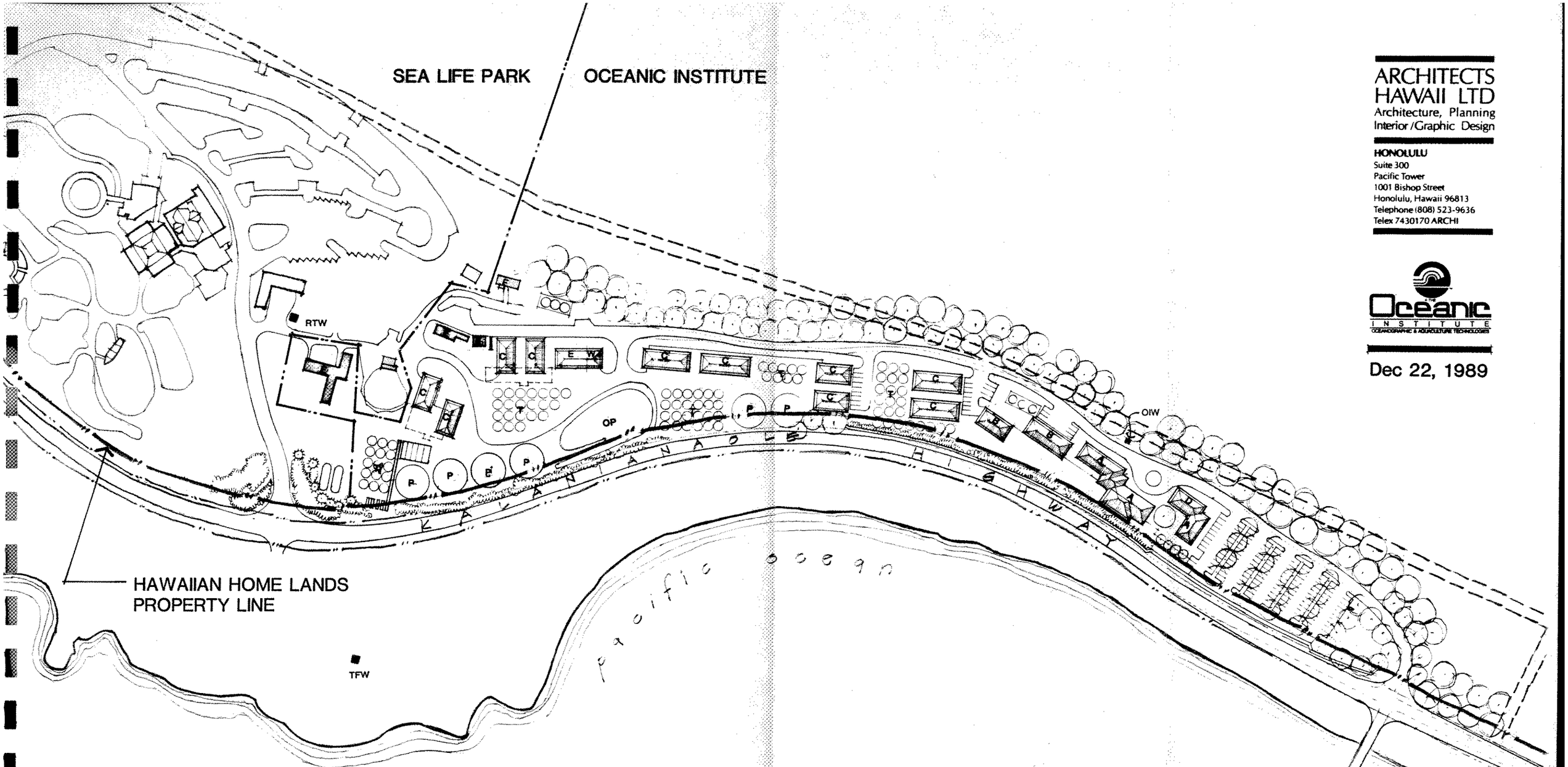
SCALE: 0 25 50 100 200ft.

ARCHITECTS HAWAII LTD
Architecture, Planning
Interior/Graphic Design

HONOLULU
Suite 300
Pacific Tower
1001 Bishop Street
Honolulu, Hawaii 96813
Telephone (808) 523-9636
Telex 7430170 ARCHI

The Oceanic Institute
Oceanographic & Aquaculture Technologies

Dec 22, 1989



MASTER PLAN
ULTIMATE PLAN

OCEANIC INSTITUTE

Including The

CENTER FOR APPLIED AQUACULTURE

LEGEND

A	Administration
B	CAO Lab
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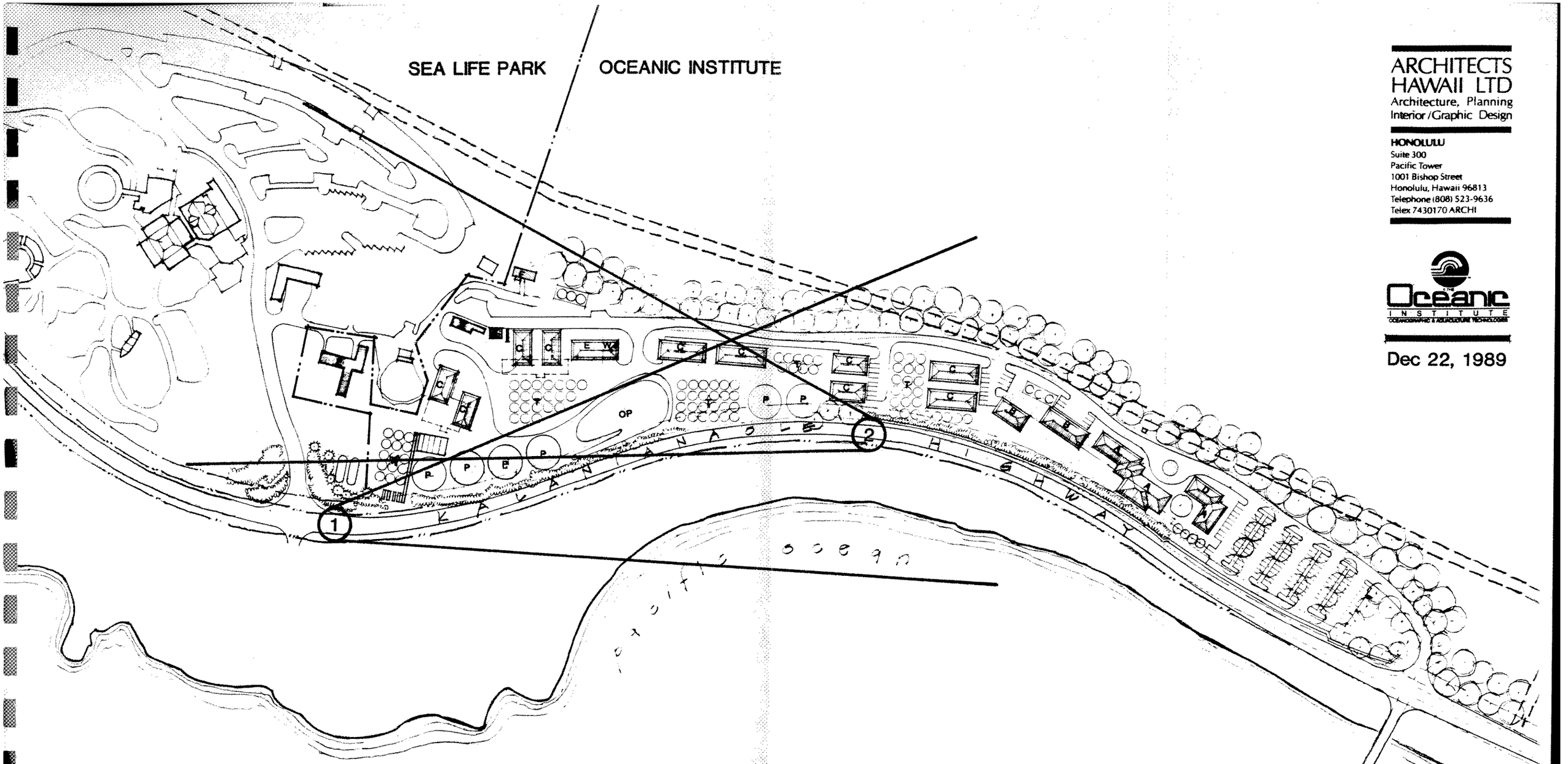

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Oceanographic & Aquaculture Technologies

Dec 22, 1989

MASTER PLAN
ULTIMATE PLAN

OCEANIC INSTITUTE
Including The
CENTER FOR APPLIED AQUACULTURE

LEGEND

A	Administration
B	CAO Lab
C	Research
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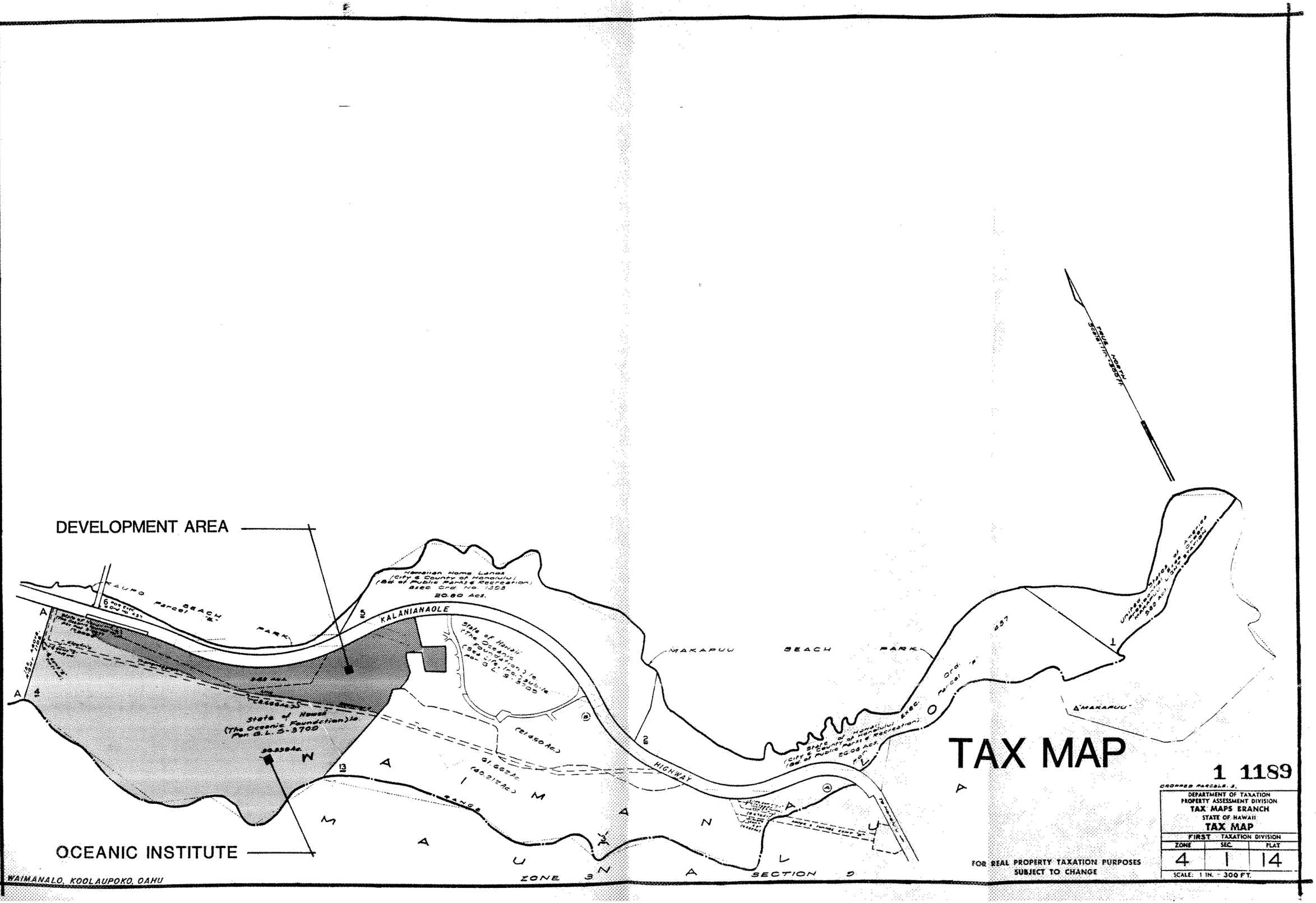
P	Round Pond
T	Tank Field

New
Remodeled
Demolished

N

SITE PLAN
SCALE: 0 25 50 100 200ft.

VIEW STUDY LOCATION MAP
MAP 1


DEVELOPMENT AREA
OCEANIC INSTITUTE
KAUPO BEACH PARK
KALANIANAOLE
HIGHWAY
MAKAPUU BEACH PARK
MAKAPUU
TRUE NORTH
WAIMANALO, KOOLAUPOKO, OAHU
ZONE 3
SECTION 9
TAX MAP
1 1189
FOR REAL PROPERTY TAXATION PURPOSES
SUBJECT TO CHANGE
DEPARTMENT OF TAXATION
PROPERTY ASSESSMENT DIVISION
TAX MAPS BRANCH
STATE OF HAWAII
TAX MAP
FIRST TAXATION DIVISION
ZONE 4
SEC. 1
PLAT 14
SCALE: 1 IN. = 300 FT.

2.5 Statement of Objectives

The primary objective of this project is to provide a functional working environment for applied aquaculture research. The secondary objective is to fulfill the intent of the United States Congress and the State of Hawaii to construct an applied aquaculture research center at The Oceanic Institute to assist the development of the U.S. and Hawaiian aquaculture industry. The tertiary objective is to fulfill the conditions of the State of Hawaii's Kaupo Park Master Lease by constructing and maintaining first class research facilities.

Other objectives:

1. Construction of a high quality research facility that serves as a model for commercial aquaculture operations.
2. Construction of durable, modular, flexible, adaptable working research facilities with maximum life spans.
3. Integration of the facility into the natural environment.

2.6 Public Funds and Lands

2.6.1 Funds

The United States Congress has appropriated $6.125 million through the United States Department of Agriculture (USDA) Cooperative State Research Service (CSRS) for the construction of the Center for Applied Aquaculture (CAA) at The Oceanic Institute (OI). The State of Hawaii is matching the federal appropriation with a $5 million grant administered by the Department of Land and Natural Resources (DLNR).

2.6.2 Lands

The project is on public land owned by the State of Hawaii. The Oceanic Institute leases the 56 acre property from the Department of Land and Natural Resources.

OI property is designated as Conservation by the State of Hawaii. In 1981 the property was placed in a "Special Subzone" called the "Sea Life Park Special Subzone". The subzone is designated for recreational, educational, and commercial purposes as delineated on the map entitled "O-15, Koko Head, Oahu", dated June 4, 1981, on file with the Department of Land and Natural Resources.

A 3.856 acre strip of Hawaiian Homes Land property 40 feet wide that parallels the Kalanianaole Highway will be the site of a vegetated buffer strip that will improve the visual impact of the project site. A long term lease co-terminus with the DLNR lease has been approved by the Hawaiian Homes Commission.

2.7 Phasing and Timing

Construction will begin in late summer/early fall of 1990. Construction schedules will be finalized when schematic design is complete. Phase 1 should be completed and operations underway by the summer of 1992. Construction of Phase 2 depends on future funding.

2.8 Historic Perspective

The Oceanic Institute has been operating on the project site for approximately 25 years. The construction site for Phase 1 of the Master Plan was completely cleared and graded over 20 years ago, but was allowed to accumulate trash and become overgrown. The Phase 2 area contains existing structures that will eventually be replaced.

Operations similar to the proposed project have been carried out for over two decades without any environmental problems or land use conflicts. The State of Hawaii designated the project site for purposes identical to this project in 1962.

Aquaculture has the potential to make a significant contribution to the world food supply, but many limitations have prevented it from becoming a major sector of American agriculture. The limitations identified by numerous studies over the past several years have shown a lack of government assistance for industry-oriented programs of coordinated research to solve the problems of the U.S. aquaculture industry.

Research and development is necessary because of the complexity of aquaculture production. The water medium poses different problems than terrestrial agriculture. There is a need for greater understanding of the chemical, biological, and environmental requirements of aquatic species.

The 1984 National Aquaculture Development Plan states that knowledge in these critical areas is lacking:

1. Nutrition
2. Genetics
3. Reproduction
4. Growth and Behavior
5. Health Maintenance
6. Disease Organisms
7. Seed Production
8. Predation and Mortality

Applied research facilities will help acquire this knowledge. New technology will be incorporated into expanded aquaculture facilities. The National Aquaculture Development Plan noted the serious lack of experimental and demonstration facilities required for applying laboratory technology to commercial field applications. Prototype production facilities are essential to industry expansion.

The aquaculture industry needs trained technicians. Aquaculture professionals are necessary for production facilities, research, and training. Improved research and applied training facilities will help eliminate this constraint to industry growth.

Marketing expertise is required for a successful commercial industry. Facilities that can provide aquaculture marketing information will help establish a demand for the products of the U.S. aquaculture industry.

Many obstacles to aquaculture progress can be overcome by construction of applied research facilities with access to commercial scale production sites. These applied research facilities must provide a full range of services to commercial industry that include new technology development, personnel training, marketing information, business management assistance, biological research, nutrition research, and disease control.

2.9 Project Characteristics

2.9.1 Technical Characteristics

2.9.1.1 Operations

The Oceanic Institute/Center for Applied Aquaculture performs applied aquaculture research for the commercial sector. The purpose of operations is to create and maintain a profitable aquaculture industry in Hawaii and the United States with directed, focused research. Current research programs are supported entirely by government funding, but the private sector will increasingly fund future operations as profit potential is demonstrated.

OI/CAA operations are based on research programs that solve specific problems of commercial aquaculture. Programs must have applicability to the commercial sector. The United States Government is supporting these programs through the Agency for International Development (USAID), the Department of Agriculture (USDA), and the National Marine Fisheries Service (NMFS). The State of Hawaii supports operations through DLNR.

The Center for Applied Aquaculture is a component of The Oceanic Institute. CAA programs, projects, personnel, and procedures will adhere to OI regulations.

2.9.1.1.1 Administration

CAA will have an administration component that will direct applied aquaculture technology research. CAA administration will report directly to the president of OI.

2.9.1.1.2 Research

CAA personnel will perform applied aquaculture research. CAA is physically designed to easily accommodate research program changes to pursue the most important topics to the aquaculture industry.

2.9.1.1.3 Remote Sites

Remote sites will be utilized for commercial scale production programs. These technical sites will be complementary to the small scale research initiated at Makapuu.

2.9.1.2 Buildings

2.9.1.2.1 Administrative Complex

Multipurpose Room

Conference Room(s)

The conference room divides into one, two, or three separate spaces with movable, acoustically sound partitions. It holds 100 people in the large configuration.

Information Center

The information center is a repository of information available within OI containing books, journals, reprints, reports, that will be stored as hard copy, digitized, or on video tape. A computerized database of available information is the basis of the information center. The information center will be a component in a fiber optic local area network.

Offices

Offices will serve administrators, program managers, staff, secretaries, and visiting clients or subcontractors. Offices may be enclosed rooms or modular. Modular office space is generic as possible. Walls are easily movable and have self contained utilities.

2.9.1.2.2 Storage

A central lab and office storage area is between the administrative complex and the laboratories. The loading dock and storeroom are adjacent to the accounting office so deliveries can be supervised.

2.9.1.2.3 Laboratory/Office

The laboratory/office building contains laboratory modules, offices, and expensive equipment that cannot be duplicated in the research modules. It is functionally located between the research modules and the administrative complex. Preliminary environmental control functions include light, water temperature, and quarantine.

Laboratories are outfitted to withstand extreme conditions of the marine environment. Waterproof floors and walls, stainless steel or resin or epoxy fixtures, clean rooms, and quarantine areas are included.

2.9.1.2.4 Research Modules and Tank Fields

Research Village Concept

The operational concept for the Makapuu facilities is a "research village" with discrete, modular, self-contained, independent, interchangeably componentized, research modules working at the program level. Each research module is identical in shape to allow use of the same equipment throughout the village and has a corresponding adjacent "tank field" pre-wired with water lines, drains, and power for any number and arrangement of tiered, gravity flow tanks. The modules are connected by a common service road, main sea water trunk line, and an electrical/information conduit.

The research module is approximately 3,500 sq. ft. under roof. The interior of each module is identical to the others and modifiable through interchangeable components that include: snap-on, screw together, plastic pipes, modular lab benches with roll-out cabinets, pre-wired movable electrical, computer, and telephone lines, lighting fixtures, office desks and chairs, and lab equipment. Advantages of this concept are:

1. Accommodation of program-style operations.
2. Flexibility.
3. Discrete cost centers.
4. Smaller building masses for less visual impact.
5. No disruption to other programs during a program change-over.
6. Programs pay for modifying the module to their specifications.
7. Private users can rent and secure a module for proprietary research.
8. Modular components are stored in an easily accountable storage area.
9. Future funding can add another module using the Master Plan.

Research Module Assumptions

1. Each of the major research programs at OI will be able to carry out a significant portion of their indoor work in a research module.
2. Each module will contain both the wet and dry experimental and office area needed by the program assigned to that module.
3. Each program will be independent with respect to providing its own live feed material for larval culture, unless specific arrangements are made between two programs to coordinate this work.
4. Final water disposal is not a research module function.
5. Highly specialized needs will be accommodated outside of the standard research module. Examples of special needs include maturation/spawning tanks, feed storage, CAO, and animal quarantine functions.

Preliminary Module Assignments

Ten research modules are constructed in the Master Plan. Six modules are constructed on the west end in Phase 1 of the Master Plan. Four modules are constructed on the eastern end in Phase 2. These preliminary module assignments are examples of how the Master Planned facilities will accommodate program work.

Module 1 - Finfish

Module 2 - Finfish

Module 3 - Stock Enhancement/Mahimahi

Module 4 - Aquaculture Research Service

Module 5 - Shrimp

Module 6 - Shrimp

Module 7 - Phase 2

Module 8 - Phase 2

Module 9 - Phase 2

Module 10 - Phase 2

2.9.1.2.5 Maintenance

Office

Office space in the maintenance building accommodates the maintenance staff.

Workshop

Fully equipped plumbing and electricity shops are part of the maintenance facility.

Storage

The maintenance storage area contains parts and equipment for maintaining the research modules, tank fields, water system, and other infrastructure systems.

2.9.1.3 Infrastructure Systems

2.9.1.3.1 Salt Water System

The salt water system will supply a maximum of 3,000 gallons per minute (gpm). Average use will be less than 2,000 gpm. The major components of the system are:

1. Salt water management program.
2. Supply and distribution.
3. Drainage and discharge.

Intake

Wells and pumps are backed-up with wells and pumps of comparable capacity. Each source unit (multiple wells and/or multiple pumps) meets the targeted flow rate for the salt water system.

Pre-treatment

Sand filters of a rated capacity at least equal to the flow rate for the salt water system are installed between the source and storage reservoir. Additional filtration and treatment of supply water is specified by each research module for its own use.

Storage

A 4 hour storage for the entire facility will be maintained and individual lab storage units are maintained for animals of critical importance.

Water supplies are engineered to have "on line" alternate pumps or have adequate storage in reservoirs to avoid jeopardizing all research projects in case of pump failures.

Reservoirs

Two separate reservoirs with 720,000 gallon capacity (four hour turnover at 3,000 gpm) each are sited to supply the driving head to all ponds and tanks. Siting and design of the reservoir includes protection from falling rocks.

West Storage Tanks

Existing west storage tanks are removed and replaced by larger tanks at a higher elevation.

East Storage Tanks

New storage tanks are sited near the existing redwood tank.

Distribution

Salt water will be distributed to research modules and tank fields by gravity flow.

All water supplies to research modules are duplicated, so one system can be shut down for cleaning or maintenance while an uninterrupted flow is maintained.

All indoor water supply is by various sizes of pvc pipes and valves that clip on to the walls or are suspended from ceilings of the wet labs. Pipe lengths, connections, and valves are kept to a minimum to enhance flow efficiency. All water lines are sloped to outlets or clean-out plugs to avoid settling and facilitate cleaning.

All outdoor water supply is by various sizes of pvc pipes and valves placed in open concrete trenches covered by plastic grating, wooden planks, or pre-cast concrete covers.

Disposal

Drains

All drainage is by open concrete trenches covered by plastic grating, wooden planks, or pre-cast concrete covers. Where possible the supply lines will share trench space with drainage water.

Water drainage in wet labs is designed to handle extreme quantities. Drainage systems provide for potential treatment, containment, isolation, or neutralization of the discharge.

Discharge

Discharge is injected into dispersion wells or treated and discharged to the ocean. If required, treatment is by filtration and purification methods to render the discharge harmless.

2.9.1.3.2 Water Management System

The water management system is a computerized system with continuous monitoring, alarm, control, automatic data gathering and analysis, and chronology of water events. This provides 24 hour, centralized supervision of water operations and processes.

2.9.1.3.3 Energy System

Solar energy is a major energy source with solar water heating and the use of photovoltaic cells.

2.9.1.3.4 Transportation

Transportation of people and moderate to small equipment loads is by solar powered golf carts. Large equipment loads are transported by truck.

2.9.1.3.5 Landscaping

Highway Buffer

A buffer strip of landscaping is constructed on the Hawaiian Homes Land strip of land along the highway. The swale and berm earthwork and endemic plants will shield some of the construction work and completed facilities from public view.

Interior

Interior landscaping is primarily to mitigate the visual impact of the new buildings. Xeriscape landscaping will be used.

2.9.2 Economic Characteristics

2.9.2.1 Employment

2.9.2.1.1 Primary

Construction

Construction employment will be approximately 50-75 jobs of various types including the normal construction job descriptions.

Operation

Research

The new facility will provide additional research jobs. A maximum of 80 new research positions will be created in the first five years of operation.

Support

Research will require additional support personnel such as administration and maintenance. Approximately 20 new support positions will be created.

2.9.2.1.2 Secondary

Aquaculture Industry

The research at the new facility will increase employment opportunities in the aquaculture sector of the Hawaiian economy.

2.9.3 Social Characteristics

The Center for Applied Aquaculture will have the social characteristics of a combined office complex, scientific research laboratory, and small scale aquaculture facility. CAA's social impact is a more productive commercial aquaculture sector and increased aquaculture-related employment opportunities in Hawaii and the U.S.

2.9.4 Environmental Characteristics

2.9.4.1 Visual

The project has been designed to minimize visual impact. The structures are one story and will blend in with the natural environment.

2.9.4.2 Effluent Discharge

Projected Master Plan effluent discharge is no more than a 10% increase over the current discharge of aquaculture effluent (1,400 gpm up to 1,540 gpm). Concentrations of effluent constituents are not expected to change. Permitted dispersion wells will be used in conjunction with limited surface discharge into the ocean. The aquaculture effluent system will be designed to solve operational discharge problems of the industry.

2.9.4.3 Traffic

An increase of 100 employees at full Master Plan build-out will be mitigated by a new entrance at the west end of the site opposite Makai Pier. Projected additional traffic will not decrease the level of service of Kalanianaole Highway.

2.9.4.4 Natural Hazards

The unstable nature of the cliff above the project site will be mitigated by a protective ditch and barriers designed to absorb and/or deflect any descending projectiles.

All construction in the federally designated Flood Hazard District will be in compliance with the provisions of the Coastal High Hazard District.

Structures are designed to withstand the occasional strong Kona winds amplified by the Venturi effect through Makapuu Head.

3 ENVIRONMENTAL SETTING

3.1 Climate

The climate at Makapuu is transitional between windward and leeward Hawaiian coastal areas, with relatively low rainfall, mostly in the winter months. Average annual rainfall at Makapuu Point is approximately 23 inches.

3.2 Earth

3.2.1 Topography

The project site is on a narrow coastal strip formed mainly of talus and alluvial fans at the base of the Koolau Range. The overall slope from the base of the cliff to the shoreline is approximately 5 percent, but the topography has been modified by grading and construction.

The project site is a narrow parcel between the steep cliff of the Koolaus and the Kalanianaole Highway. The widest section is on the Makapuu end and it tapers down to a very narrow strip at the Waimanalo end west of the Makai Pier.

Elevations on the property range from 7 feet above sea level near the highway to 60 feet above sea level at the base of the cliff.

3.2.2 Area

The OI property is approximately 56 acres. The developable area shown in the ultimate Master Plan involves approximately 15 acres.

3.2.3 Geology

The project site is located near the southeast end of the Koolau Volcano within its southeast rift zone. The Koolau volcano is formed of many layers of basalt, each representing an individual lava flow, and the volcano possesses rift zones radiating from the eruptive center. These rift zones are the location of most flank eruptions and contain numerous intrusive dikes which originally were subsurface conduits for the lava. The dikes act as dams to groundwater flow and confine groundwater at levels higher than otherwise would be the case. The geology underlying OI is known only as a "marginal zone of dikes". No dikes are shown in the vicinity on geology maps on file at the State Department of Land and Natural Resources.

Talus and alluvial fan deposits of basalt boulders and silty clay extend to about sea level. Coralline deposits underlie that material to a depth of about 50 feet, roughly 30 feet below sea level, and rest on basalt bedrock.

All of Oahu is classified as Seismic Zone 1 (low seismicity) by the Uniform Building Code. Earthquake size and frequency generally diminishes from southeast to northwest along the Hawaiian Island chain. The largest earthquakes on record in the vicinity of Oahu have been of Richter magnitudes between 4 and 5, but highest earth quake intensities on Oahu have been caused by the largest earthquakes on the island of Hawaii; Modified Mercalli intensities of IV to V (minor damage) have been estimated for Oahu.

The project site is located on the slope of talus alluvial material which is at the base of a high basaltic cliff. The slope of the talus material varies around a 1:1 slope and the slope of the high cliff varies around a 1/2:1 slope.

The talus material consists of boulders ranging from six inches to five feet and greater in diameter. These boulders are mixed with a talus-alluvial material which includes brown clay and adobe or expansive soils.

3.2.4 Soil

The site is in an area designated as Kaena stony clay, 2 to 6 percent (KaeB), Kawaipahi stony clay loan, 2 to 6 percent slope (KLaB), Rock Land (rRK), Rock Outcrop (rRO) and Fill Land, mixed (FL).

The Kaena Series consists of very deep, poorly drained soils on alluvial fans and talus slopes on the islands of Oahu and Kauai. These soils developed in alluvium and colluvium from basic igneous material. They are gently sloping to steep and are commonly stony.

The Kawaihapai Series consists of well-drained soils in drainageways and on alluvial fans on the coastal plains on the islands of Oahu and Molokai. These soils formed in alluvium derived from basic igneous rock in humid uplands. They are nearly level to moderately sloping.

Rock Land is made up of areas where exposed rock covers 25 to 90 percent of the surface. It occurs on all five islands. The rock outcrops and very shallow soils are the main characteristics. The rock outcrops are mainly basalt and andesite. The soil material associated with the rock outcrops is very sticky and very plastic. It also has high shrink-swell potential.

Rock Outcrop consists of areas where exposed bedrock covers more than 90 percent of the surface. It occurs on all five islands. The rock outcrops are mainly basalt and andesite. This land type is gently sloping to precipitous.

Fill land consists of areas filled with material from dredging, excavation from adjacent uplands, garbage, and bagasse and slurry from sugar mills. This type of land occurs mostly near Pearl Harbor and in Honolulu, adjacent to the ocean. From the USDA Soil Conservation Service "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii", (USDA, 1972, pp. 31, 49-50, 63-64, and 119, Plate 67).

3.2.5 Archaeology

3.2.5.1 Historical and Archaeological Background

The project area, consisting of land *mauka* of Kalanianaole Highway, abuts the west side of Sea Life Park. It is in a narrow strip of land between the southeast end of the Ko'olau Range and the sea. The southeastern extremity of Waimanalo *ahupua'a* is dry and supports drought tolerant shrubs and cactus. This land between Waimanalo Valley and Makapu'u Point was traditionally called Ko'o o na pou and was used as a fishing settlement and for sweet potato planting (Handy and Handy 1972:459). Offshore lie the islands of Kaohikaipu and Manana (Rabbit Island).

There have been a number of archaeological sites located in the general area from 1934 onwards. McAllister (1934) describes one site complex which he called "Kaupo Village."

"Because of the local interest in this "deserted village" the area has been set aside as a public park. This site has probably neither the great antiquity nor the importance commonly attributed to it. In its prime, it consisted of a few fishing huts, a fishing shrine (*ko'a*) and possibly a small *heiau*. Most of the structures appear to have been built in recent times. As a public park this land is continually used by campers which account for many poorly constructed wind breaks near the beach and the absence of rafters, boards, and other inflammable material, as firewood is at a premium here. Mr. Chalmers, Manager of the Waimanalo Sugar Company was told years ago that the village was built about 1835 during

the disastrous small pox epidemic when the Hawaiians attempted to escape the quarantine. On the official map of the Bishop Museum the area is indicated as "koanapou." "Kaupo" is undoubtedly incorrect (McAllister 1933:133).

McAllister also provides a map of the structural features comprising the village with individual feature descriptions (*Ibid.* 194, Fig. 67).

It is clear from the McAllister map that none of the features of the former village are located within the present study area.

In addition to this village remnant, Sterling and Summers - Sites of O'ahu - recorded 3 more archaeological sites as follows:

Site 21

> "above the road and a little to the west of the Castle Gate (41051 Kalanianaole Highway) lies a large rock, Kuni. It is a female rock that attracted akule and oio fish to this place. It used to be lower down, but when the road was put through, it was tossed up there" (Sterling and Summers 1978:250).

Site 22

> "We got out of the car here (Kaluahine) and walked down to the shore. We came to a small fish shrine covered over by vines. The stones were still neatly piled one on top of the others. Alona told us that he remembered seeing the fishermen place on this shrine the fish they caught. They then were left to rot away of themselves" *(Ibid.:251)*.

Site 23

> a Stone called Pohaku paakiki "This stone is on the Waimanalo side of 'Kaupo Park' on the edge of the beach. At low tide it is washed by waves, at high tide in the water" (*Ibid.*:252)

This stone was reported to have been used as an offering place where awa was presented to the shark god Kamahoalii.

The original source of information for all three of these sites is Charles Alona in Place Names of O'ahu, a manuscript in the Bishop Museum dated to 1939.

It is clear from these sources that all previously recorded archaeological sites and important places are outside the present project area.

The Kaupo Village complex was located to the east, site 21 to the west near the Castle residence and sites 22 and 23 along the shoreline makai of the present Kalanianaole Highway.

3.2.5.2 Reconnaissance Results and Recommendations

3.2.5.2.1 Description of the Study Area

The 3.9-acre study area lies between the west side of Sea Life Park and the Makai Range Pier on the mauka side of Kalanianaole Highway. It is bounded by the highway on the north side, a series of aquacultural ponds on the east side, a road and steep talus slope on the southwest side, and an entry road from the main highway on the northwest side. The entire parcel has been heavily graded for highway construction and there is a 7 to 10 foot walled bank fronting the highway. The relatively level stepped contour of the parcel appears to be entirely man made. The only natural topography visible is upslope on the mauka side of the entry road. There is danger of rock fall from the steep talus deposits upslope and it is possible that this strip of land mauka of the highway was artificially

terraced during highway construction to protect the road from falling rocks. Vegetation consists of secondary growth of "koa haole" (*Leucana glauca*). The study area is presently used as a dump and there are 3 water tanks at the eastern corner of the project.

3.3 Water

Fresh water is supplied by a 4 inch water main from the Board of Water Supply 30 inch main. Average fresh water consumption by OI for 1988 was 24,000 gallons per day (gpd). Sanitary wastes are collected at the source in underground pipes and are conveyed to one of four cavitette treatment units where solid breakdown and partial oxidation occurs. The majority of the sanitary wastes are discharged through two dispersion wells; wastes from the Administration Building are discharged through a dispersion well maintained by Sea Life Park (SLP).

Salt water is produced from three sources: the OI salt water well (1160 gpm); the SLP training facility salt water well (230 gpm); and the SLP reef tank wells (30 gpm). Disposal of all but 120 gpm of the salt water used is through a surface discharge to the ocean at Kaupo Beach Park. Drain lines from all experimental tanks and ponds except those in the Doherty Building discharge into the oxidation pond. Flow from the oxidation pond crosses under Kalanianaole Highway in a 22" culvert. Flow from Doherty Building is discharged through a dispersion well.

Current tank and pond numbers, volumes, and flows are summarized in the table below. A total of 243 containers of sizes ranging from 20 to 2,550,000 liters contain a total volume of 6,630,000 liters of sea water, with a total daily flow of 7,365,000 liters per day. Of this total flow, approximately 85% is generated by programs which culture marine fish, and 15% is generated by programs working with marine shrimp.

The mean concentration of selected water quality parameters in marine fish and shrimp aquaculture effluents (Ziemann, 1989) are presented below. The total discharge loading to the oxidation pond was calculated as the total * % fish/shrimp * mean concentration for each parameter. The total daily loading of material to the oxidation pond is also presented in the table. The oxidation pond serves to remove some particulate materials through sedimentation, and some dissolved nutrients via uptake by emergent aquatic vegetation and phytoplankton populations. The amount of the reduction is not quantified at this time, but probably constitutes only a small percentage of the total input.

The effluent water from the Doherty building, part of the Photoperiod building, and the secondary treated sewage water from the four cavitettes at OI drain into two dispersion wells OI maintains with Department of Health Permits. One is located at the northern corner of the Doherty building, and it receives all the salt water effluent from Doherty along with Doherty's cavitette discharge water. This well is 206 ft. deep and has a 16 in. diameter solid casing that extends 30 ft. below the ground surface. The well capacity is more than sufficient for the 120 gpm from Doherty and the cavitette flow.

Oceanic Institute Tank Inventory

TANK	LOCATION	SIZE (L)	FLOW (L/MIN)	NUMBER	TOTAL VOLUME (L)	TOTAL FLOW (L/min)
FEEDS						
Fiberglass	Mahi	20	4	24	480	96
Aquarium	Feed Lab	50	0.8	75	3750	62
Aquarium	ARS	50	0.4	10	500	4
Fiberglass	Mahi	1500	8	2	3000	16
Fiberglass	OML	1500	0.6	24	36000	15
Fiberglass	Pad	1500	3	16	24000	48
Plywood	ARS	3000	10	1	3000	10
Fiberglass	Mahi	5000	10	3	15000	30
Total					85730	281
STOCK ENHANCEMENT						
Fiberglass	Algae	1000	0.7	4	4000	3
Fiberglass		1700	5	12	20400	60
Fiberglass		5000	14	4	20000	56
Concrete		40000	5.5	4	160000	22
Concrete		50000	7	1	50000	7
Pond	406	200000	27	3	600000	81
Total					854400	229
SHRIMP						
Fiberglass	Hatchery	1000	0.5	4	4000	2
Plywood	Photo	10000	14	3	30000	42
Fiberglass	VT	30000	8	3	90000	24
Pond	406	200000	42	4	800000	168
Pond	RP	337000	117	1	337000	117
Pond	OI3	425000	88	1	425000	88
Total					1686000	441
FINFISH						
Fiberglass	Hatchery	5000	2	10	50000	20
Plywood	Photo	12000	2	6	72000	12
Rubber	Rubber	28600	16	6	171600	96
Concrete	ELR	30000	2	5	150000	10
Fiberglass	VT	30000	55	10	300000	550
Concrete	IKKO	40000	140	4	160000	560
Pond	OI1,2	275000	158	2	550000	316
Pond	Acre	2550000	2600	1	2550000	2600
Total					4003600	4164
OI TOTAL				243	6629730	5115

Mean Concentrations of selected water quality parameters in aquaculture effluents, and mass loading in aquaculture discharges - existing OI conditions

Concentration Parameter	Fish	Shrimp	Loading Parameter	Fish	Shrimp	Total
NO3 (µg/l)	256	34	NO3 (kg/d)	1.2	0.1	1.2
NH4 (µ/l)	87	60	NH4 (kg/d)	0.4	0.2	0.5
TN (µ/l)	564	693	TN (kg/d)	2.4	2.0	4.4
PO4 (µ/l)	67	39	PO4 (kg/d)	0.3	0.1	0.4
TP (µ/l)	98	226	TP (kg/d)	0.4	0.7	1.1
SS (µ/l)	7	34	SS (kg/d)	30	98	128

The second OI dispersion well is adjacent to the eastern end of the rubber ponds. This well is 185 ft. deep and has a solid 40 ft. PVC casing, 12 in. in diameter. This well receives salt water from labs within the Photoperiod building and from two cavitette discharges.

The Department of Health Underground Injection Control Permits on each of the injection wells were obtained in 1986 and are good until July 31, 1991. The permitted water flows to each well include 55.5 gpm (88,000 gpd) of untreated aquaculture wastewater and 0.76 gpm (1,100) gpd of secondary treated sewage water. OI monitors these three parameters on a continuous basis as required by the permit:

1. Type of injected fluid
2. Quantity of injected fluid
3. Rate of injection

3.4 Plants

3.4.1 Botanical Survey

Field studies to assess the botanical resources on the project site were conducted on May 8, 1989. The primary objectives of the field studies were to:

1. Provide a general description of the vegetation.
2. Inventory the terrestrial, vascular flora.
3. Search for rare, threatened, or endangered plants on the site.

3.4.2 Survey Methods

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other studies conducted in the general area. Topographic maps were examined to determine access, terrain characteristics, boundaries, and reference points.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, topography, exposure, etc. Species identification was made in the field; plants which could not be positively determined were collected for later identification in the herbarium and for comparison with the taxonomic literature.

3.4.3 Description of the Vegetation

The site appears to have been extensively disturbed in the past, probably during construction of the adjacent highway. Piles of sand and dirt, dredge material, metal framing and pipes, abandoned automobiles, and a dump are found on the site. Introduced or alien species typify the vegetation on the site. On the Waimanalo end of the property and along its mauka boundary, vegetation consists of dense koa-haole shrubland. Toward the Sea Life Park end of the property and fronting most of Kalanianaole Highway, vegetation consists of an open grassy scrub with scattered koa-haole. Ruderal or wasteland species are associated with the roadside areas.

The koa-haole (*Leucaena leucocephala*) shrubs may vary in height from 10 to 12 to as much as 18 ft. high in the koa-haole shrubland. Ground cover, consisting primarily of Guinea grass (*Panicum maximum*), is very dense and tends to crowd out other species, although, in places, patches of Chinese violet (*Asystasia gangetica*) may be locally abundant. Two native members of the morning-glory family, koali-awahia (*Ipomoea indica*) and koali (*Ipomoea cairica*), are quite conspicuous as they climb up onto the koa-haole shrubs and form dense tangles with many pale lavender or pinkish-blue flowers.

The open grassy scrub is composed of a mixture of grasses such as Guinea grass, finger grass (*Chloris barbata*), Johnson grass (*Sorghum halapense*), and sour grass (*Digitaria insularis*) with very scattered, low-stature (3 to 5 ft. tall) koa-haole shrubs. Many of the koa-haole shrubs are in poor condition due to heavy infestations of the sap-sucking, jumping plant louse (*Heteropsylla* sp.). Locally common are patches of Chinese violet and koali.

Along Kalanianaole Highway and on the narrow roadway which runs along the mauka length of the property and to a dump site, is a weedy assortment of plants commonly associated with more or less disturbed areas. Common elements along the Kalanianaole highway are hurricane grass (*Bothriochloa pertusa*), Wilder grass (*Dichanthium aristatum*), Australian bluestem (*Dichanthium sericeum*), purslane (*Portulaca oleracea*), and Spanish needle (*Bidens pilosa*). The narrow, coral lined roadway is overgrown in many places with plants of Guinea grass, lion's ear (*Leonotis nepetifolia*), Spanish needle, and sand spurry (*Spergularia marina*). Also recorded from this plant association are trianthema (*Trianthema portulacastrum*) and coccinia (*Coccinia grandis*) two weedy species which are spreading throughout Oahu.

Low-lying depressions on the site fill with water during heavy rains and support species requiring slightly moister conditions such as California grass (*Brachiaria mutica*), jungle rice (*Echinochloa colona*), Judd grass (*Leptochloa uninervia*), and pycreus (*Pycreus* aff. *rivularis*).

A list of all plants inventoried during the field studies is presented in the Appendix.

3.5 Animals

3.5.1 Introduction

The purpose of this report is to summarize the findings of a one day (21 June 1989) bird and mammal field survey at The Oceanic Institute property, Oahu. Also included are references to pertinent literature as well as unpublished reports. The objectives of the field survey were to:

1. Document what bird and mammal species occur on the property or may likely occur given the range of habitats available.
2. Provide some baseline data on the relative abundance of each species.
3. Supplement these findings with published and/or unpublished data.
4. Evaluate the possible changes that might occur in the bird and mammal populations following the proposed development of the property.

3.5.2 General Site Description

The property is located on the southeast shore of Oahu. This sector of Oahu normally receives relatively light precipitation and strong tradewinds and hence is somewhat arid and wind swept in appearance. Vegetation on the property consists of mostly exotic (introduced) trees with an understory of exotic weeds and grasses. Kiawe (*Prosopis pallida*) and Koa Haole (*Leucana glauca*) are the dominant trees. The property mauka of the site is more densely covered with brush as well as several large Banyan (*Ficus* sp.) and Christmas Berry (*Schinus terebinthifolius*) trees. The topography of this mauka property is steep and provides an important refuge, foraging and roosting area for birds.

Weather during the field survey was clear and warm. Winds were light NE trades.

3.5.3 Study Methods

Field observations were made with the aid of binoculars and by listening for vocalizations. These observations were concentrated during the peak activity periods of early morning. Attention was also paid to the presence of tracks and scats as indicators of bird and mammal activity.

At various locations eight minute counts were made of all birds seen or heard. Between these count stations walking tallys of birds seen or heard were also kept. These counts provide the basis for the population estimates given in this report. Census data on birds contained in the annual Christmas bird surveys conducted by the Hawaii Audubon Society were also consulted along with unpublished records and reports of birds in order to acquire a more complete picture of avifauna activity on the site and on adjacent lands (Pyle 1987, 1988). Observations of feral mammals were limited to visual sightings and evidence in the form of scats and tracks. No attempts were made to trap mammals in order to obtain data on their relative abundance and distribution.

Scientific names used herein follow those given in the most recent American Ornithologists Union Checklist (A.O.U. 1983), Hawaii's Birds (Hawaii Audubon Society 1984) and Mammal Species of the World (Honacki et al. 1982).

3.5.4 Results and Discussion

A brief field survey can at best provide a limited perspective of the wildlife present in any given area. Not all species will necessarily be observed and information on their use of the site must be sketched together from brief observations and the available literature. The number of species and the relative abundance of each species may vary throughout the year due to available resources and reproductive success. Species which are migratory will quite obviously be a part of the ecological picture only at certain times during the year. Exotic species sometimes prosper for a time only to later disappear or become a less significant part of the ecosystem (Williams 1987). Thus only long term studies can provide the insights necessary to acquire a complete understanding of the bird and mammal populations in a particular area. However, when brief studies are coupled with data gathered from other similar habitats the value of the conclusions drawn are significantly increased.

3.5.4.1 Resident Endemic (Native) Land Birds

No endemic land birds were recorded during the course of the field survey. The only possible species in this category that might occur from time to time in this locality is the Short-eared Owl or Pueo (*Asio flammeus sandwichensis*). This species has been recorded on the slopes of Koko Crater near Kalona Point (Bruner 1988b). This endemic subspecies is listed as endangered on Oahu by the State of Hawaii Department of Land and Natural Resources Division of forestry and Wildlife. No endemic land birds are known to occur on the property nor would any be expected given the nature of the present habitat.

3.5.4.2 Migratory Indigenous (Native) Birds

No migrating birds were recorded which is to be expected at this time of year when they are on their arctic breeding grounds. However, because of the type of habitat available, the only likely species that might occur on the open sections of the site would be the Pacific Golden Plover (*Pluvialis fulva*). Plovers prefer open areas such as mud flats and lawns. They arrive in Hawaii in early August and depart to their arctic breeding grounds during the last week of April. Johnson et al. (1981) and Bruner (1983) have shown plover are extremely site-faithful on their wintering grounds and many establish foraging territories which they defend vigorously. Such behavior makes it possible to acquire a fairly good estimate of the abundance of plover in any one area. These populations likewise remain relatively stable over many years.

Other species which occur along the shoreline makai of the site include Wandering Tattler (*Heteroscelus incanus*), Ruddy Turnstone (*Arenaria interpres*) and Sanderling (*Calidris alba*) (Berger 1972, Hawaii Audubon Society 1984, Pratt et al. 1987).

3.5.4.3 Resident Indigenous (Native) Land Birds

Black-crowned Night Heron (*Nycticorax nycticorax*) were observed flying over the site, foraging around the aquaculture ponds adjacent to the property and roosting in trees along the mauka slope. The population of this species at this locality may exceed 50 birds. Night herons have been known from this area prior to any urbanization. They prey on the seabird colonies on Manana Island.

3.5.4.4 Resident Indigenous (Native) Seabirds

If one is patient and spends enough time virtually all the seabirds common to Hawaiian waters could likely be seen from this sector of Oahu's coastline. The following is a list of only those species recorded during this survey.

Brown Noddy (*Anous stolidus*)
Sooty Tern (*Sterna fuscata*)
Red-tailed Tropicbird (*Phaethon rubricauda*)
Red-footed Booby (*Sula sula*)
Great Frigatebird (*Fregata minor*)

Seabirds typically nest on offshore islands which are free from disturbance by dogs, cats, mongoose, and rats. However, there are areas on the main islands where predators lack access and nesting can be successful (Bruner 1988a). the first nesting activity of the White Tern on Oahu was recorded at Koko Head (Ord 1961). Red-tailed Tropicbirds nested successfully in 1987 at Makapuu Point (Bruner personal observation). Wedge-tailed Shearwaters and Bulwer's Petrel (*Bulweria bulwerii*) nest in burrows and under ledges in cliff faces. It would not be surprising to find these two species nesting on the inaccessible seaward facing cliffs at Makapuu.

Laysan Albatross have recently been observed in increasing numbers on the main Hawaiian Islands (Moriarty et al. 1986). This event may be due to space limitations in the Leeward N.W. Hawaiian Islands. Predators, however, will likely limit the success of this strategy.

3.5.4.5 Exotic (Introduced) Birds

A total of 12 species of exotic birds were recorded during the field survey. Table One shows the relative abundance of these species. The most abundant species during the survey were Japanese White-eye (*Zosterops japonicus*), Zebra Dove (*Geopelia striata*), and Red-vented Bulbul (*Pycnonotus cafer*). Exotic species not recorded on the actual survey but which potentially could occur at this locality include: Common Barn Owl (*Tyto alba*), Common waxbill (*Estrilda astrild*), Chestnut Mannikin (*Lonchura malacca*), Warbling Silverbill (*Lonchura malabarica*), Melodious Laughing-Thrush (*Garrulax canorus*), Ring-necked Pheasant (*Phasianus colchicus*), Northern Mockingbird (*Mimus polyglottos*), Java Sparrows (*Padda oryzivora*), Japanese Bush-warbler (*Cettia diphone*), and Cattle Egret (*Bubulcus ibis*) (Hawaii Audubon Society 1984, Conant 1984, Pratt et al. 1987).

Warbling Silverbill has had a rather spotty history of occurrence in the area. First recorded on Oahu at Sandy Beach (Conant 1984) it has subsequently been reported from a variety of localities along the leeward coast (Pyle 1987), but to date no actual breeding populations are known for Oahu. This species has shown a spectacular display of dispersal ability since its first introduction to Hawaii (Berger 1975; Hirai 1980; Conant 1983; Starrett 1984).

Red-vented Bulbul have become one of Oahu's most abundant species in recent years. The adaptability of this species to a wide variety of habitats and its remarkable population increase have been well documented (Williams 1983, Williams and Giddings 1984, and Williams and Evenson 1985).

3.5.4.6 Feral Mammals

The only feral mammal observed during the survey was the Small Indian Mongoose (*Herpestes auropunctatus*). No cats, rats or mice were recorded but it would be highly unusual if these ubiquitous mammals did not occur on the property. Without a trapping program it is difficult to conclude anything about the relative abundance of rats, mice, mongooses, and cats. However, it is likely that their numbers are typical of what one would find elsewhere in similar habitat on Oahu.

Records of the endemic and endangered Hawaiian Hoary Bat (*Lasiurus cinerus semotus*) are sketchy but the species has been reported from Oahu (Tomich 1986). None were observed on this field survey. However, bats have been observed in dry coastal habitat elsewhere in Hawaii (Bruner 1985).

3.5.5 Relative Abundance of Exotic Birds

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE
Spotted Dove	*Streptopelia chinensis*	U = 3
Zebra Dove	*Geopelia striata*	A = 12
Rock Dove	*Columba livia*	C = 7
White-rumped Shama	*Copsychus malabaricus*	R = 1
Common Myna	*Acridotheres tristis*	C = 9
Red-vented Bulbul	*Pycnonotus cafer*	A = 16
Northern Cardinal	*Cardinalis cardinalis*	U = 2
Red-crested Cardinal	*Paroria coranata*	U = 3
Japanese White-eye	*Zosterops japonicus*	A = 13
House Sparrow	*Passer domesticus*	U = 4
House Finch	*Carpodacus mexicanus*	C = 6
Nutmeg Mannikin	*Lonchura punctulata*	C = 8

Relative abundance = Number of individuals observed during walking survey or frequency on eight minute counts in appropriate habitat.

A = Abundant (10+) on 8 min. counts
C = Common (5-10) on 8 min. counts
U = Uncommon (Less than 5) on 8 min. counts
R = Rare (Number which follows is total recorded)

3.6 Traffic

3.6.1 Introduction

This traffic study is an operational analysis of the impact on levels of service (LOS) for the Kalanianaole Highway by The Oceanic Institute Master Plan using data collected by the Hawaii State Department of Transportation, Highway Planning Section, at the Makapuu Point Lookout. The levels of service and historical traffic records are the basis for evaluating the impact of projected increases in traffic generated by full build-out of the Master Plan.

Methodologies for the analysis were taken from the Third Edition of the Highway Capacity Manual published as a special report by the National Research Council (U.S.) Transportation Research Board in 1985.

There is no degradation in level of service or significant increase in projected total traffic volume. No identifiable traffic impact is projected, given the worst case scenarios for increased traffic generated by the OI Master Plan and various traffic parameters.

3.6.2 Analysis

The general terrain methodology estimates average traffic operational measures along a section of highway based on average terrain, geometric, and traffic conditions. Terrain is classified as level, rolling, or mountainous. The general terrain procedure is applied to highway sections of at least 2 miles.

Highway geometric features include a general description of longitudinal section characteristics and specific roadway cross-section information. Longitudinal section characteristics are described by the average percentage of the highway, in both directions, having no passing zones. For this analysis, the average percentage of no passing zones was set at 100 percent. Roadway cross-section data include lane width and usable shoulder width. For this analysis the lane width was 11 feet with 0 feet of usable shoulder width.

Traffic data used to apply the general terrain methodology include the two-way hourly volume, a peak hour factor, and the directional distribution of traffic flow. Traffic data also include the proportion of trucks, recreational vehicles, and buses in the traffic stream.

Traffic Data Table

The general relationship describing traffic operations on general terrain segments is as follows:

Equation 1. $$SF_i = 2,800 \times \left(\frac{v}{c}\right)_i \times f_d \times f_w \times f_{HV}$$

where:

SF_i = total service flow rate in both directions for prevailing roadway and traffic conditions, for level of service *i*, in vph;

$(v/c)_i$ = ratio of flow rate to ideal capacity for level of service *i*;

f_d = adjustment factor for directional distribution of traffic;

f_w = adjustment factor for narrow lanes and restricted shoulder width;

f_{HV} = adjustment factor for the presence of heavy vehicles in the traffic stream, computed as:

f_{HV} = $1/[1 + P_T(E_T - 1) + P_R(E_R - 1) + P_B(E_B - 1)]$

where:

P_T = proportion of trucks in the traffic stream, expressed as a decimal;

P_R = proportion of RV's in the traffic stream, expressed as a decimal;

P_B = proportion of buses in the traffic stream, expressed as a decimal;

E_T = passenger-car equivalent for trucks;

E_R = passenger-car equivalent for RV's; and

E_B = passenger-car equivalent for buses.

Equation 1. Takes an ideal capacity of 2,800 pcph, and adjusts it to reflect a *v/c* ratio appropriate for the desired level of service, directional distributions other than 50/50, lane width restrictions and narrow shoulders, and heavy vehicles in the traffic stream.

3.6.3 Results

Traffic Data for Makapuu Point 1989 *

Peak Flow	Total Vol. Both dir.	PHF	Flow Rate (Vol./PHF)	Directional Distribution		Traffic Composition TrucksRVBuses		
11-12 AM	622 vph	.954	652 vph	54.7%	42.6%	4.66%	1.77%	1.77%
3-4 PM	779 vph	.964	808 vph	55.7%	44.3%	1.41%	0.90%	1.16%

* Hawaii State Department of Transportation, 3/6-7/89 (Mon-Tue)

Level-of-Service Flow Rates (vph) for Makapuu Point During AM and PM Peaks

AM	Terrain		
LOS	Mount.	Rolling	Level
A	12	42	63
B	108	174	251
C	173	374	502
D	335	583	913
E	999	1541	2021

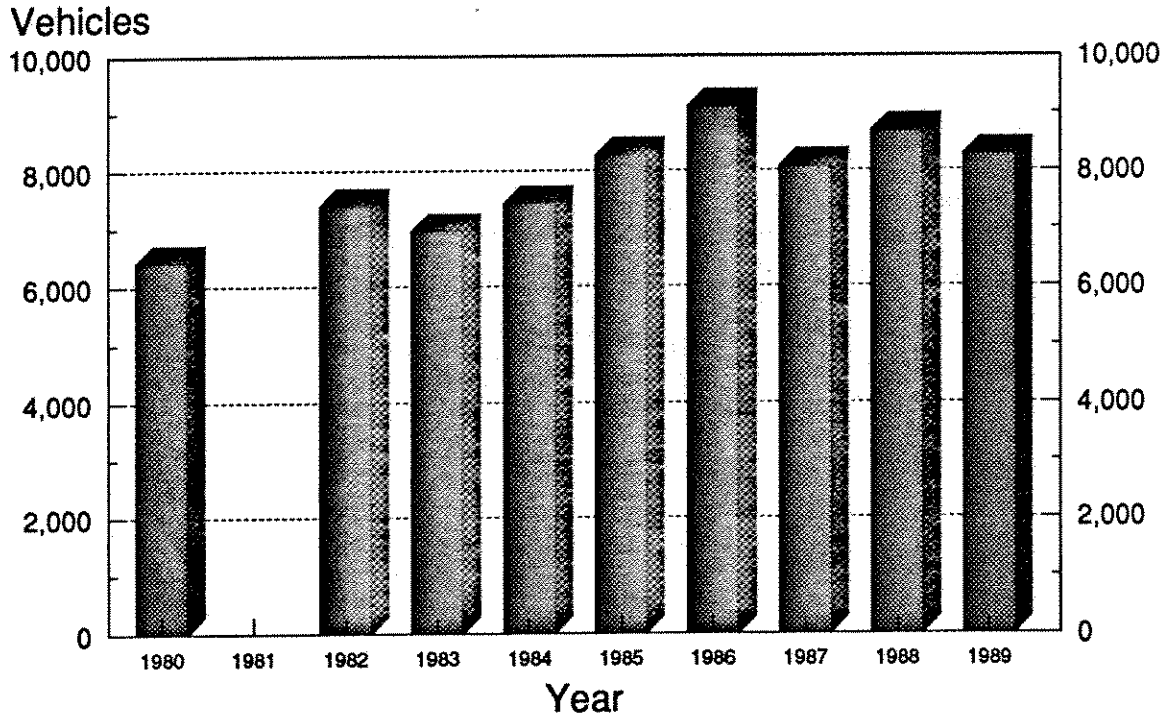
AM Flow Rate = 652vph

PM	Terrain		
LOS	Mount.	Rolling	Level
A	15	47	66
B	140	200	263
C	224	431	527
D	449	669	950
E	1340	1767	2103

PM Flow Rate = 808vph

Makapuu Point Traffic Record

24-Hour Volume



The 24 hour volume passing Makapuu Point has increased by about 240 vehicles per year since 1980. This figure is based on a regression analysis of the above table.

3.7 Visual

Panoramic ocean views including the off-shore Manana Island (Rabbit Island) and Mokapu Peninsula beyond, are visible from the Makapuu Point lookout. The Oceanic Institute is not visible from the lookout. Traveling westward along the Kalanianaole Highway, ocean views continue to command attention. The Oceanic Institute does not come into view until after Sea Life Park.

Traveling eastward, from Waimanalo, views of the ocean, the Pali, and Makapuu Head are the focus of attention. The Oceanic Institute is in view at certain points. Phase 1 construction will be almost unseen from this direction.

3.8 Coastal

3.8.1 Flood Channels

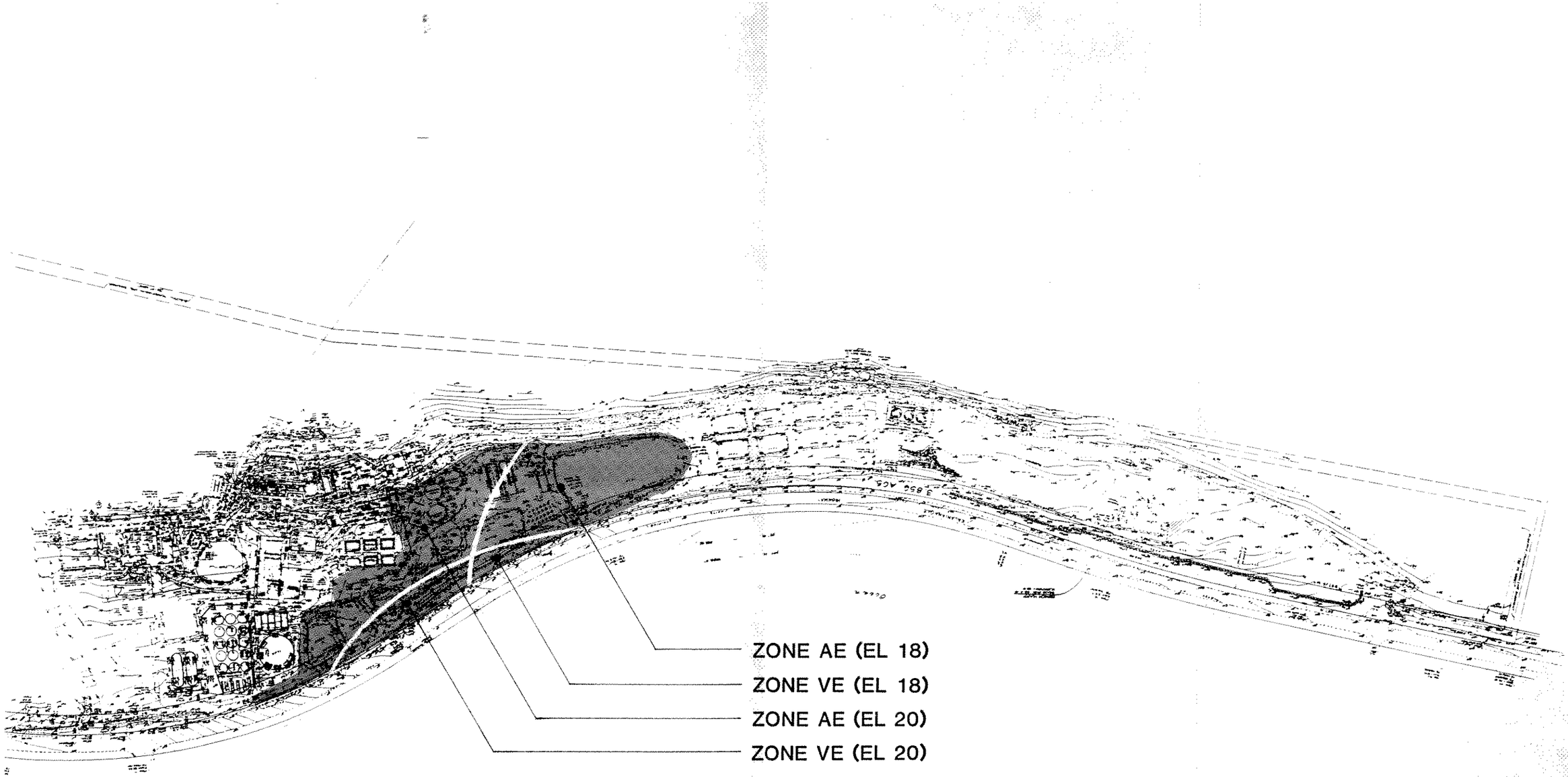
There are no major flood channels on the property.

3.8.2 High Tides/Storms

The portion of the project site below 20 feet is in the Coastal High Hazard District. The OI property could be subject to limited damage from a combination high tide and severe storm. Damage would be limited to the ponds or tanks nearest the highway. No exotic species will be contained below the 20 foot elevation.

3.8.3 Tsunami

The portion of the project site below the 40 foot elevation is on the Civil Defense Tsunami Inundation Map. A typical tsunami at Makapuu would reach 15 feet above sea level. The OI/CAA Master Plan has a few ponds and tanks below this elevation and potential damage would depend on their construction. Tsunamis occurred in the Makapuu area in 1946 (up to 36 ft. above sea level), 1952 (10 ft. above sea level), and 1960 (6.6 ft. above sea level).



FLOOD HAZARD ZONES

3.9 Vicinity

3.9.1 Local Perspective

The project site is adjacent to Sea Life Park, a major tourist attraction. Kaupo Beach Park is directly across the highway from the project site. Makai Pier is at the western end of the project site.

The project will not impact the use, enjoyment, or access of Sea Life Park or the beach recreational areas.

3.9.2 Regional Perspective

The project site is a relatively isolated semi-rural area. The residential/agricultural community of Waimanalo is two miles to the northwest and the residential/commercial community of Hawaii Kai is four road miles to the south. The project will not create adverse impacts for either community.

3.10 Related Projects

There are no related projects.

3.11 Population and Growth Assumptions

This project will not contribute to population growth or regional development in general. The project is intended to promote the growth of the commercial aquaculture sector in Hawaii and the United States.

3.12 Secondary Population and Growth Impacts

No secondary population or growth impacts will be generated by this project aside from development of commercial aquaculture throughout Hawaii and the U.S.

4 ENVIRONMENTAL IMPACTS AND MITIGATION

4.1 Earth

4.1.1 Geology

There will be no construction on the talus-alluvial slope material because a disturbance of this material in its present site configuration could lead to unpredictable sliding and settlement. Falling rocks from the adjoining high cliff will also be a constant hazard to the structure, especially during inclement periods and earthquakes.

The slope will be used as a buffer zone for falling debris and rocks. An alternate site could be relocated at the toe of the talus-alluvial slope. Either a retaining wall or a compacted embankment located at the toe of the slope could be used to define the buffer zone and the site of construction. A drainage system will be installed that can adequately divert the movement of water away from the supporting structures or foundations.

4.1.2 Soil

Summary of preliminary soils investigation:

1. Thirteen (13) test pits were excavated to depths of 8 to 15 feet. In general, the area was found to be under lain by brown and gray-brown stiff CLAY with boulders and cobbles to the final depths of the test pits.
2. No groundwater was found in any of the test pits at the time of the investigation.
3. Based on the preliminary information obtained from this investigation, the site appears suitable for development. It appears that spread footings may be used to support structures.
4. Special considerations will be required in the design and construction of the project. These considerations include:
   - 4.1 Boulders will be encountered in excavations and will likely hamper the excavation work. Heavy equipment will probably be required in removing the boulders.
   - 4.2 The clay materials have high to very high expansion potential. Concrete slabs-on-grade will require additional granular fill beneath the slab in order to minimize the possible adverse effects from soil expansion. In addition, footings will require additional embedment depth.
   - 4.3 The steep slope above the site is composed of talus boulders. Protection devices such as retaining walls or chain-link fencing should be provided along the uphill side property line to "protect" structures located beneath the talus slope area.

Details of the findings and recommendations are presented in the Appendix under Preliminary Soils Investigation - Soils Report Findings and Recommendations.

4.1.3 Grading and Drainage

A conceptual grading and drainage report is included in sec. 10.8 in the Appendix. The final drainage report and complete grading details will be submitted to the Building Department to acquire a grading permit.

All construction work will conform to the Soil Erosion Standards and Guidelines of the City and County of Honolulu and Grading, Soil Erosion and Sediment Control - Chapter 23, Revised Ordinances of Honolulu, 1969, as amended.

4.1.4 Archaeology

The entire parcel was inspected on foot on July 3, 1988. No sign of existing or former archaeological or historical remains were observed. Given the extent of recent land modification there is virtually no chance that cultural material survives below the surface. The level terrain and the mixed boulders and site deposits indicate extensive grading and filling, almost certainly as a part of the Kalanianaole Highway construction.

For these reasons, the use of the property for expanded facilities would have no impact on archaeological and historical resources and no further investigation is recommended.

4.2 Water

4.2.1 Construction

Site grading and construction activities will be strictly controlled to prevent sediment run-off into Waimanalo Bay. Drainage ways, sediment traps, and sediment screens will be used.

All work will conform to the Soil Erosion Standards and Guidelines of the City and County of Honolulu and Grading, Soil Erosion and Sediment Control - Chapter 23, Revised Ordinances of Honolulu, 1969, as amended.

4.2.2 Operation

There are no discernible impacts to the marine receiving waters at the shoreline discharge or to the underlying groundwater resource under existing or planned discharge conditions. The total daily load of dissolved and particulate material discharged from the proposed project will not increase by more than 10%. There is no potential for significant impact to the water resources of the area with this small increase in loading. Concentrations of effluent constituents are not expected to change. Permitted dispersion wells will be used in conjunction with surface discharge into the ocean. Dye tests have shown the dispersion wells to have no direct communication with the ocean.

The actual volume of water contained in various sized containers and the total volume flow using the OI Master Plan projections will change only slightly. The volume flow projected for the new facilities is 5,530 liter per minute, or 7,963,000 liter per day, an increase of approximately 8% over current use. The mix of organism culture will also change somewhat. Currently, fish culture occupies approximately 85% of the tank volume, while shrimp utilize only 15%; under projected Master Plan usage, fish will occupy 60% of tank volume and shrimp will occupy 40%.

The increase in flow and change in tank usage will result in slight changes in the discharge loadings, as shown below, compared with present conditions described in Sec. 3.3.

Mean concentrations of selected water quality parameters in aquaculture effluents, and mass loading in aquaculture discharges from Oceanic Institute projected Master Plan use.

Concentration Parameter	Fish	Shrimp	Loading Parameter	Fish	Shrimp	Total
NO3 (µg/l)	256	34	NO3 (kg/d)	1.2	0.1	1.2
NH4 (µ/l)	87	60	NH4 (kg/d)	0.4	0.2	0.5
TN (µ/l)	564	693	TN (kg/d)	2.7	2.2	4.9
PO4 (µ/l)	67	39	PO4 (kg/d)	0.3	0.1	0.4
TP (µ/l)	98	226	TP (kg/d)	0.5	0.7	1.2
SS (µ/l)	7	34	SS (kg/d)	33	108	142

4.3 Plants

Piles of fill material, sand, scrap metal, abandoned machinery, etc., in places largely overgrown, are found throughout the project site. The type of vegetation on the site is indicative of these past and present disturbances as it is dominated by introduced species. No sensitive native plant communities exist on the site nor are there any rare, threatened or endangered species (Herbst 1987; U.S. Fish and Wildlife Service 1985).

Of a total of 95 species inventoried, 88 (93%) are introduced; six (6%) are native or questionably native; and one (1%) is probably of Polynesian introduction.

There is little of botanical interest and the planned development is not expected to have a significant negative impact on the total island populations of the species involved as the majority (93%) are introduced species. Native species occurring on the site are found throughout the Hawaiian Islands and elsewhere in the Pacific in similar environmental habitats. Some, such as the 'uhaloa (*Waltheria indica*), seaside heliotrope or kipukai (*Heliotropium curassavicum*), and popolo (*Solanum americanum*), are considered "weedy natives" as they prefer more open, disturbed sites.

4.4 Animals

4.4.1 Existing

The project will have insignificant impact on the bird and mammal population of the project site. These are some broad conclusions related to bird and mammal activity on the property:

1. The present environment provides a limited range of habitats which are utilized by the typical array of exotic birds one would expect at this elevation and in this type of environment on Oahu.
2. In order to obtain more data on mammals, a trapping program would be required. The brief observations of this survey did not reveal any unusual mammal activity.
3. The proposed development will create more open space which will favor species like plover, doves, myna, and House Sparrows. Northern Cardinal and Japanese White-eye, two species which inhabit forest and brushy habitats, will decrease in number at this site.

4.4.2 Future

Any exotic animal species imported into the state for research purposes will be kept under strict quarantine according to state regulations. Any importation will be subject to an importation permit from the state Department of Agriculture Plant Quarantine Division. Proper screening, animal containment, and animal captivity requirements will be followed. No exotic species will be contained below the 20 foot elevation.

4.5 Traffic

There is no degradation in level of service or significant increase in projected total traffic volume. No identifiable traffic impact is projected, given worst case scenarios for increased traffic generated by the OI Master Plan and various traffic parameters.

OI has approximately 100 employees at the time of this study in 1989. The proposed expansion may allow an increase of staff to 200 in the next 5 to 10 years. Approximately 40 percent of employees presently pass Makapuu Point going to and from work. Assuming 40 percent of the additional staff pass Makapuu Point going to and from work in their own vehicle, then an additional 40 vehicles will pass Makapuu Point twice a day.

An estimated fewer than 10 percent of OI employees make working trips past Makapuu Point per day. Assuming 100 new staff, then 10 additional vehicles pass Makapuu Point twice a day.

An increase in the flow rate by 50 (40 + 10) vehicles per hour at the AM and PM peaks does not affect the relative level-of-service at Makapuu point. See level-of-service flow rate table in Section 3.6.3.

An increase in 24 hour volume by 100 vehicles over the next 10 years represents only 4 percent of the increase expected from a continuation of the trend over the last 10 years.

An increase of 100 employees at full Master Plan build-out will be mitigated by a new entrance at the west end of the site opposite Makai Pier. Projected additional traffic will not decrease the level of service of Kalanianaole Highway.

4.6 Visual

The project has minimal visual impact. The new structures are one story and construction materials will blend in with the natural environment.

The project will not alter any views of the ocean from the highway. The project will be only slightly visible from the Makapuu lookout, the view will not be altered by the small scale buildings that are visible in relation to the Pali.

Development of the project will result in altering limited landward views from Kalanianaole Highway. The View Study in the Appendix shows a new landscape screen/buffer strip that replaces the existing chain link fence bordering the property along Kalanianaole Highway. This buffer will feature attractive natural landscaping and will screen views of buildings and tanks.

The Master Plan calls for demolition of some buildings and the construction of new buildings while maintaining the small scale and village like character of the existing site. The Master Plan simplifies the types of building design and organizes tanks and ponds for minimal visual impact.

See the View Study in the Appendix sec. 10.7.

5 ALTERNATIVES

5.1 No action or postponing action for more study.

The no action alternative would result in no applied scientific facility for the research and assistance of commercial aquaculture in Hawaii. Postponing the action for more study could result in the loss of the time-specific portion of the project funding.

5.2 Different alternatives with similar benefits/different impacts.

The only significantly different alternative to the project with similar benefits but different impacts is the siting of some project functions at remote locations.

5.3 Alternatives of different design with different impacts.

Original designs for the project featured one large building of significant visual mass. The alternative of one large building was rejected to reduce the visual impact of the project.

6 LAND USE PLANS, POLICIES, AND CONTROLS

6.1 Federal Land Use Regulations

There are no federal land use regulations that affect this project. The CAA will not require any construction in navigable waters, alteration of any wetlands, or impact any endangered species or sanctuaries.

6.2 State Land Use Regulations

6.2.1 Conservation District

The Oceanic Institute property is designated as Conservation by the State of Hawaii. In 1981 the property was placed in a "Special Subzone" called the "Sea Life Park Special Subzone". The subzone is designated for recreational, educational, and commercial purposes as delineated on the map entitled "O-15, Koko Head, Oahu", dated June 4, 1981, on file with the Department of Land and Natural Resources.

Development at the Makapuu site will not require a Conservation District Use Permit (CDUP). The Master Lease for Kaupo Park (the project site) was signed in 1962. That is two years before Regulation No. 4 was promulgated in 1964 and therefore no CDUP is required. Furthermore, the Board of Land and Natural Resources stipulates in the Master Lease that the Oceanic Institute shall build and maintain first-class research facilities.

6.2.2 Historic Site

The OI property has been surveyed and researched for historic sites. There is no visual evidence and no record of a historic site on the property.

6.2.3 Designated Groundwater

The OI property is not in a Designated Ground Water Control Area.

6.2.4 Well Drilling

New water supply or injection wells required by the project will be approved by the Department of Health Underground Injection Control Program and DLNR before they are constructed.

6.2.5 Department of Transportation

6.2.5.1 Harbors Division

No modifications to the shoreline or the ocean environment are anticipated in developing the Center for Applied Aquaculture.

6.2.5.2 Highways Division

Highway modifications to improve the western entrance (opposite Makai Pier) will require the permission and cooperation of the Highways Division.

6.2.6 Department of Health - NPDES

A National Pollution Discharge Elimination System permit will not be required.

6.3 City and County of Honolulu Land Use Regulations

6.3.1 Shoreline Management Area

A Shoreline Management Area (SMA) permit will be required for this project. The Oceanic Institute at Makapuu Point is listed as a Use of Special Benefit in the Final Environmental Impact Statement for the Hawaii Coastal Zone Management Program (1978) in recognition of its unique function requiring a coastal location.

6.3.2 Shoreline Setback

The project is not in the shoreline setback area and no shoreline setback variance will be necessary.

6.3.3 Development Plan

The project site is designated Preservation on the Koolaupoko Development Plan Land Use Map.

6.3.4 Zoning

6.3.4.1 Preservation District

The project site is designated Preservation (P-1) by the City and County of Honolulu. The Land Use Ordinance describes Preservation Districts as they relate to the project site:

6.3.4.2 Preservation Districts: Purpose and Intent (5-10)

The purpose of the preservation districts is to preserve and manage major open space and recreation lands and lands of scenic and other natural resource value.

It is intended that all lands within a State-designated Conservation District be zoned P-1 Restricted Preservation District.

6.3.4.3 Preservation Uses and Development Standards (5.10-1)

Within the P-1 Restricted Preservation District, all uses, structures and development standards shall be governed by the appropriate State agencies.

Section 5.10-1 above clearly defers all regulatory control (except for the SMA permit) over new construction on OI property to the Department of Land and Natural Resources.

6.3.4.4 Flood Hazard District

A portion of the OI property below 20 feet in elevation is included in a designated Flood Hazard District (Coastal High Hazard District).

6.3.4.4.1 Flood Hazard Districts: Purpose (7.10)

Certain areas within the City are subject to periodic inundation by flooding and/or tsunami which may result in loss of life and property, creation of health and safety hazards, disruption of commerce and governmental services as well as extraordinary public expenditures for flood and tsunami protection and relief.

6.3.4.4.2 Coastal High Hazard District (7.10-7)

Within the Coastal High Hazard District, the uses permitted in the underlying zoning district shall be permitted, provided such uses, improvements, structures and utilities are in compliance with the provisions of this section.

6.3.5 Grading- City and County of Honolulu Building Department

All grading work will require a grading permit from the Building Department.

6.3.6 Building- City and County of Honolulu Building Department

Building permits will be acquired for all buildings.

7 GOVERNMENT APPROVALS

1. Special Management Area Use Permit - City and County of Honolulu Department of Land Utilization (Application is made after the EIS is accepted).
2. City and County of Honolulu Grading Permit (application prior to construction).
3. City and County of Honolulu Building Permit (application prior to construction).
4. Highway modification approval from the Department of Transportation.
5. Underground Injection Control Permit - State of Hawaii Department of Health.

8 ENVIRONMENTAL DISCUSSION

8.1 Short term vs. long term relationship

This project represents a long-term productive use of the land at the project site. The benefits to the state and the nation as a whole compared to the minimal visual intrusion into a previously undeveloped area is very favorable. The long-term introduction of one story buildings on the project site is mitigated by their location and landscaping. The long-term benefits of improved aquaculture production are potentially great.

8.2 Resource commitments

There are no irreversible or irretrievable resource commitments aside from the public project funding and the construction materials used. The only unavoidable impact is the construction of low, landscaped, environmentally integrated buildings at the project site.

8.3 Adverse impacts which cannot be avoided

The only adverse impact which cannot be avoided is the construction of low level structures in a visible area.

9 LIST OF CONTACTS

Department of Land and Natural Resources - State of Hawaii
Department of Land Utilization - City & County of Honolulu
Department of General Planning - City & County of Honolulu
Department of Public Works - City & County of Honolulu
Honolulu Board of Water Supply
Department of Health - State of Hawaii
Department of Transportation - Highways Division - State of Hawaii
Department of Transportation - Harbors Division - State of Hawaii
Honolulu Fire Department
Honolulu Police Department
Hawaiian Electric
Hawaiian Telephone
Waimanalo Neighborhood Board No. 32
Department of Hawaiian Home Lands - State of Hawaii
University of Hawaii - Hawaii Institute of Marine Biology
University of Hawaii - Environmental Center
U.S. Army Corps of Engineers
U.S. Department of Agriculture, Soil Conservation Service
Office of Environmental Quality Control - State of Hawaii

10 APPENDIX

10.1 Plant Species List

Following is a checklist of all those vascular plant species inventoried during the field studies of the Oceanic Institute property. Plant families are arranged alphabetically within each of two groups of flowering plants: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (in press). In most cases, common English and/or Hawaiian names given follow St. John (1973).

For each species the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used:

I = indigenous = native to the Hawaiian Islands and also to one or more other geographic areas.

P = Polynesian = plants of Polynesian introduction prior to Western contact (1778); not native.

X = introduced or alien = all those plants brought to the islands intentionally or accidentally after Western contact; not native.

SPECIES LIST

SCIENTIFIC NAME	COMMON NAME	STATUS
MONOCOTS		
Araceae		
Syngonium podophyllum Schott	syngonium	X
Cyperaceae		
Cyperus rotundus L.	nut grass, nut sedge	X
Pycreus aff. *rivularis* (Kunth) Palla	pycreus	X
Gramineae		
Bothriochloa pertusa (L.) A. Camus	hurricane grass	X
Brachiaria mutica (Forssk.) Stapf	California grass	X
Cenchrus ciliaris L.	buffel grass	X
Cenchrus echinatus L.	sandbur	X
Chloris barbata (L.) Sw.	finger grass	X
Chloris radiata (L.) Sw.	plush grass	X
Cynodon dactylon (L.) Pers.	Bermuda grass	X
Dactyloctenium aegyptium (L.) Willd.	beach wire grass	X
Dichanthium aristatum (Poir.) Hubb.	Wilder grass	X
Dichanthium sericeum (R. Br.) A. Camus	Australian bluestem	X
Digitaria insularis (L.) Mez ex Ekman	sour grass	X
Echinochloa colona (L.) Link	jungle rice	X
Eleusine indica (L.) Gaertn.	goose grass	X
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	Japanese love-grass	X
Leptochloa univervia (K. Presl.) Hitchc. & Chase	Judd grass	X
Panicum maximum Jacq.	Guinea grass	X
Panicum maximum var. *trichoglume* Eyles ex Robyns	green panic grass	X
Setaria verticillata (L.) P. Beauv.	bristly foxtail	X
Sorghum halapense (L.) Pers.	Johnson grass	X

SCIENTIFIC NAME	COMMON NAME	STATUS
DICOTS		
Acanthaceae		
Asystasia gangetica (L.) T. Anderson	Chinese violet	X
Aizoaceae		
Trianthema portulacastrum L.	trianthema	X
Amaranthaceae		
Alternanthera pungens Kunth	alternanthera	X
Amaranthus spinosus L.	spiny pig weed	X
Amaranthus viridis L.	amaranthus	X
Anacardiaceae		
Schinus terebinthifolius Raddi	Christmas berry	X
Bataceae		
Batis maritima L.	pickleweed	X
Boraginaceae		
Heliotropium curassavicum L.	seaside heliotrope	I
Heliotropium procumbens Mill. var. *depressum* (Cham.) Fosb.	heliotrope	X
Caryophyllaceae		
Spergularia marina (L.) Vill.	sand spurry	X
Chenopodiaceae		
Atriplex suberecta Verdoorn	saltbush	X
Combretaceae		
Terminalia catappa L.	false kamani, Indian almond	X
Compositae		
Ageratum conyzoides L.	ageratum	X
Bidens alba (L.) DC.	Spanish needle	X
Bidens pilosa L.	Spanish needle	X
Calyptocarpus vialis Less.	hierba de caballo	X
Eclipta alba (L.) Hassk.	eclipta	X
Emilia coccinea (Sims) G. Don	emilia	X
Emilia fosbergii Nicolson	emilia	X
Pluchea indica (L.) Less.	pluchea	X
Pluchea symphytifolia (Mill.) Gillis	pluchea	X
Sonchus oleraceus L.	sowthistle	X
Synedrella nodiflora (L.) Gaertn.	synedrella	X
Tridax procumbens L.	coat buttons	X
Verbesina encelioides (Cav.) Benth. & Hook.	golden crownbeard	X
Wedelia trilobata (L.) Hitchc.	wedelia	X
Convolvulaceae		
Ipomoea cairica (L.) Sweet	koali	X?
Ipomoea indica (J. Burm.)	koali-awahia	I
Ipomoea obscura (L.) Ker-Gawl.	white bindweed	X
Ipomoea triloba L.	pink bindweed	X
Jacquemontia ovalifolia (Choisy) H. Hallier	pa'u-o-hi'i'aka	I
Merremia aegyptia (L.) Urb.	koali-kua-hulu	X?
Cruciferae		
Lepidium virginicum L.	peppergrass	X
Cucurbitaceae		
Coccinia grandis (L.) Voigt	coccinia	X
Cucumis dipsaceus Ehrenb. ex Spach	spiny cucumber	X
Momordica charantia L.	bittermelon	X

SCIENTIFIC NAME	COMMON NAME	STATUS
Euphorbiaceae		
Chamaesyce hirta (L.) Millsp.	euphorbia	X
Chamaesyce hypericifolia (L.) Millsp.	euphorbia	X
Chamaesyce prostrata (Aiton) Small	euphorbia	X
Chamaesyce thymifolia (L.) Millsp.	euphorbia	X
Euphorbia cyathophora J. A. Murray	summer poinsettia	X
Phyllanthus debilis Klein ex Willd.	phyllanthus	X
Ricinus communis L.	castorbean	X
Labiatae		
Leonotis nepetifolia (L.) R. Br.	lion's ear	X
Ocimum gratissimum L.	basil	X
Leguminosae		
Alysicarpus vaginalis (L.) DC.	alysicarpus	X
Clitoria ternata L.	clitoria	X
Desmanthus virgatus (L.) Willd.	desmanthus	X
Desmodium tortuosum (Sw.) DC.	beggar's ticks	X
Indigofera spicata Forssk.	indigo	X
Indigofera suffruticosa Mill.	indigo	X
Glycine wightii (Wight & Arnott) Verdc.	glycine	X
Leucaena leucocephala (Lam.) deWit	koa-haole	X
Macroptilium lathyroides (L.) Urb.	wild bean	X
Medicago lupulina L.	medick	X
Melilotus indica (L.) All.	sweetclover	X
Mimosa pudica L.	sleepinggrass	X
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X
Malvaceae		
Abutilon grandifolium (Willd.) Sweet	ma'o	X
Malvastrum coromandelianum (L.) Garcke	malvastrum	X
Sida fallax Walp.	'ilima	I
Sida spinosa L.	sida	X
Nyctaginaceae		
Boerhavia coccinea Mill.	boerhavia	X
Oxalidaceae		
Oxalis corniculata L.	yellow wood sorrel	P?
Passifloraceae		
Passiflora suberosa L.	passiflora	X
Phytolaccaceae		
Rivina humilis L.	rouge plant	X
Portulacaceae		
Portulaca oleracea L.	purslane	X
Portulaca pilosa L.	portulaca	X
Primulaceae		
Angallis arvensis L.	scarlet pimpernel	X
Solanaceae		
Lycopersicon pimpinellifolium (Jusl.) Mill.	currant tomato	X
Solanum americanum Mill.	popolo	I?
Sterculiaceae		
Waltheria indica L.	'uhaloa, hi'aloa	I?
Verbenaceae		
Stachytarpheta jamaicensis (L.) Vahl	stachytarpheta	X

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10.5 Preliminary Soils Investigation (Soils International)

10.5.1 Introduction

This investigation was made for the purpose of obtaining preliminary information on the subsurface conditions in order to determine the suitability of the site for development of the proposed additions to the Oceanic Institute located on Kalanianaole Highway at Makapuu Point, Oahu, Hawaii. The location of the site, relative to the existing streets and landmarks, is shown on the Vicinity Map, Plate 1.

10.5.2 Scope of Work

The services included excavating 13 test pits to depths of 8 to 15 feet, obtaining samples of the underlying soils, performing laboratory tests on the samples, and performing preliminary engineering analysis from the data gathered. In general, the following information is provided for use by the Architect and/or Engineer:

1. General subsurface conditions, as disclosed by the test pits.
2. Physical characteristics of the soils encountered.
3. Preliminary recommendations for foundation and pavement design.
4. Recommendations for placement of fill and backfill.
5. Special considerations.

10.5.3 Planned Development

From the information provided, the project will consist of constructing additions to the existing Oceanic Institute facility. Various areas of the property are being studied as possible sites for the additions.

10.5.4 Site Conditions

10.5.4.1 Surface

The property, designated by Tax Map Key Number 4-1-14:4, is located at Makapuu Point on the mauka side of Kalanianaole Highway. Sea Life Park is located immediately southeast of the property. The proposed study area extends from the existing Oceanic Institute offices/buildings to the northwesterly boundary of the parcel (opposite the Makai Pier). Along the mauka boundary of the site, the adjoining property slopes steeply upwards to the mountain ridge line. Along the Kalanianaole Highway side of the parcel, there is a rock wall. At the time of the investigation, the northwesterly end of the lot was covered with a dense growth of kiawe trees, brush, weeds, and piles of rubbish. The rubbish piles contained navigational equipment, boulders, and scrap metal. We were informed that this area may have buried oxygen tanks.

Between the densely vegetated area and the existing Oceanic Institute building area, there are numerous fish ponds and above ground fish tanks.

From the topographic map provided, surface elevations range from about +25 to +37 feet along the mauka edge of the site to about +9 to +37 feet along the highway side of the parcel.

10.5.4.2 Subsurface

The subsurface conditions at the site were explored by excavating 13 test pits to depths of 8 to 15 feet. The locations of the test pits, which are shown on the Plot Plan, Plate 2, were selected based on possible development areas and on the accessibility to these areas. Detailed logs of the test pits are presented in the Appendix to this report.

In general, the site was found to be underlain by brown and gray-brown, moderately stiff to stiff CLAY with boulders and cobbles. The upper layer of clay was determined to be old fill and contained various amounts of debris. The amounts of boulders and cobbles made excavation very difficult. At the bottom of the test pits, the boulders were generally in point to point contact.

In Test Pit 5 (below the CLAY fill), light brown, moist, loose to moderately dense calcareous SAND was found to the final depth of the test pit at 11 feet.

At Test Pit 1, fill material consisting of tan gray, slightly moist to moist, loose silty SAND was found to a depth of 3 feet followed by brown, slightly moist to moist, moderately stiff CLAY to the final depth of the test pit at 8.0 feet.

At Test Pit 13, fill material consisting of gray, moist, moderately dense silty GRAVEL was found to a depth of 1 foot followed by tank moist, moderately dense silty SAND to depths of 2.5 feet. Beneath the silty SAND, dark gray, moist, moderately stiff to stiff CLAY was found to a depth of 4 feet followed by tan white, moderately dense clayey calcareous GRAVEL to a depth of 5 feet. Below the clayey GRAVEL, dark gray, very moist, moderately stiff (natural) organic CLAY was found to the final depth of the test pit at 10.5 feet.

No groundwater was found in any of the test pits at the time of the investigation.

From the USDA Soil Conservation Service "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii", the site is located in an area designated as Kaena stony clay, 2 to 6 percent (KaeB), Kawaipahi stony clay loan, 2 to 6 percent slope (KLaB), Rock Land (rRK), Rock Outcrop (rRO) and Fill Land, mixed (FL).

The Kaena Series consists of very deep, poorly drained soils on alluvial fans and talus slopes on the islands of Oahu and Kauai. These soils developed in alluvium and colluvium from basic igneous material. They are gently sloping to steep and are commonly stony.

The Kawaihapai Series consists of well-drained soils in drainageways and on alluvial fans on the coastal plains on the islands of Oahu and Molokai. These soils formed in alluvium derived from basic igneous rock in humid uplands. They are nearly level to moderately sloping.

Rock Land is made up of areas where exposed rock covers 25 to 90 percent of the surface. It occurs on all five islands. The rock outcrops and very shallow soils are the main characteristics. The rock outcrops are mainly basalt and andesite. The soil material associated with the rock outcrops is very sticky and very plastic. It also has high shrink-swell potential.

Rock Outcrop consists of areas where exposed bedrock covers more than 90 percent of the surface. It occurs on all five islands. The rock outcrops are mainly basalt and andesite. This land type is gently sloping to precipitous.

Fill land consists of areas filled with material from dredging, excavation from adjacent uplands, garbage, and bagasse and slurry from sugar mills. This type of land occurs mostly near Pearl Harbor and in Honolulu, adjacent to the ocean (USDA, 1972, pp. 31, 49-50, 63-64, and 119, Plate 67).

10.5.4.3 Geology

The site is located on the windward side of the Koolau Mountain range. The mountain range is believed to have formed during late Tertiary/early Pleistocene time (between 1 to 12 million years ago). Lavas flowed from rift zones which roughly paralleling the existing mountain crest trends to from the main shield of the volcano. After cessation of the volcanic activity, streams cut deep amphitheater-headed valleys into the mountain. During changes in sea level, the valleys were alluviated grading to the high sea stands. Late-stage volcanic eruptions occurred on the southeasterly end of the Koolau mountains. These late-stage eruptions, known as the Honolulu Volcanic Series, form familiar landmarks on Oahu such as Diamond head, Punchbowl, Tantalus, Round Top and Slat Lake craters (Stearns and Vaksvik, 1935).

The upper soil layer is generally fill of unknown origin and age. The fill layer is generally underlain by talus material that consists of boulders and clay. Beneath the talus material, Koolau basalts will likely be found. In some areas of the site, calcareous deposits of sand and coral may be found.

10.5.5 Preliminary Conclusions and Recommendations

10.5.5.1 General

Based on the findings and observations of this investigation, development of any portion of the study area will require special considerations in the design and construction of structures and roadways.

10.5.5.2 Special Considerations

The entire study area was found to have subsurface conditions which generally consisted of clay with boulders. The boulders are large in some areas and are generally in point to point contact at depths of about 9 to 12 feet below existing grade. The upper soil layer is old fill which contained debris. Special considerations for design and construction of foundations and roadways are as follows:

a. Boulders will be encountered in excavations and will hamper the excavation work. The Komatsu backhoe and the Case 580E hopto had great difficulty in excavating the test pits. Large boulders up to 5 feet in diameter were found in some of the test pits. In all of the test pits except 2,3, and 8, the boulders generally became more abundant and in point to point contact at the bottom of the pits thereby preventing deeper excavation.

b. The clay materials have high to very high expansion potential. Concrete slabs-on-grade will require additional granular fill (about 24 to 36 inches thick) beneath the slab in order to minimize the possible adverse effects from soil expansion. In addition, footings will require additional embedment depth (on the order of 24 to 36 inches below lowest adjacent grade).

c. The steep slopes above the site are composed of talus boulders. There was a past incident of boulder damage to the water tank located near the toe of the slope. Protection devices such as retaining walls or chain-link fencing should be provided along the uphill side property line in order to "protect" structures from boulders which may roll down the hill.

10.5.5.3 Foundations

It appears that support of the proposed structures may be obtained using spread or continuous foundations. An allowable bearing value on the order of 2,000 to 3,000 pounds per square foot appears reasonable at this time. The footing embedment depth for footings bearing on the on-site clay should be between 24 to 36 inches below lowest adjacent grade due to the high to very high shrink-swell potential of the on-site soils. If the on-site CLAY soils are removed and replaced with materials with low shrink-swell potential, the footing embedment depth can be decreased to about 12 inches below adjacent grade.

For footings located adjacent to new or existing utility trenches, the bottom of the footing should be deepened below a 1 horizontal to 1 vertical plane projected upwards from the edge of the utility trench.

For footings located on or adjacent to slopes, the footing should be deepened such that there is a minimum horizontal distance of 5 feet or twice the footing width, whichever is greater, from the edge of the footing to the slope face.

10.5.5.4 Retaining Walls

Retaining walls will require additional sizing in order to retain the clayey soil backfill. For the clay soils, the retaining walls will likely require design for an active earth pressure on the order of 45 to 60 pounds per square foot per foot of depth.

In order to reduce the design pressure, additional granular fill should be placed behind the walls. The lateral extent of the granular fill should be at least 1/2 times the wall height behind the wall in order to reduce the design lateral earth pressure to 35 pcf.

10.5.5.5 Slab-on-Grade

The on-site clay soils have high to very high expansion potential, i.e. the soil will swell with increase in moisture content. Additional granular fill should be placed beneath concrete slabs-on-grade in order to minimize cracking from soil expansion.

Site grading should be designed to minimize ponding of water adjacent to slab and footing areas.

10.5.5.6 Slopes

Cut and fill slopes for site grading shall not exceed 2 horizontal to 1 vertical.

Cutting adjacent to the existing toe of the uphill side boulder slope should be avoided.

We recommend that a topographic map (either field survey or aerial topograph) be prepared to determine the areal extent and gradient of the boulder area in order to provide some data for determination of the slope stability. Since this area is not in the subject property and the gradient of the surface is very steep, explorations in this area are deemed impractical. The stability of the boulder mass will be difficult to determine and assumptions as to the depth of the boulders, the type and strength of underlying materials whether soil or rock, and the possible dip of the contact zone will have to be made in order to provide a "best guess" of the mass stability.

10.5.5.7 Pavement Design

Roadways will generally require additional select borrow beneath the pavement section. Typically, 18 to 24 inches of select borrow beneath 2 inches of asphaltic concrete and 6 inches of base course gravel will be required for areas of heavy traffic. For lightly-loaded vehicular traffic (cars and vans), the select borrow thickness can generally be reduced to 12 inches of select borrow.

10.5.5.8 Site Grading

Excavations for utility trenches and mass grading will generally be difficult due to the boulders with clay layer. At depth of about 9 to 12 feet, the boulders are in point to point contact. Some of the boulders found in the test pits exceeded 4 feet in diameter.

Soils which are excavated form the site will generally be unsuitable for embankment material due to the clay content and amounts of large material. The calcareous sands and gravel will be suitable as fill material.

10.5.5.9 Protection of Structures

The upper talus slope of boulders is steep (about 1H:1V). There is a potential for the isolated boulders to roll down the hill. If structures are to be located below this hillside, devices such as heavy-duty chain-link fencing and earth berms should be constructed to "protect" the structures from damage. The choice of protection device will require careful study since the boulders are large and the impact forces will be great.

10.5.6 Remarks

The conclusions and recommendations contained herein are preliminary and are based on the findings and observations made at the test pit locations. After selection of the development area, it is recommended that a full soils investigation be performed to more accurately define the subsurface conditions for foundation design.

10.6 Definition of Traffic Terms

Operational analysis - An application determining the level-of-service for an existing two-lane highway with existing traffic and roadway conditions, or for projected conditions. It is presented for general terrain segments and specific grades.

Level-of-service (LOS) - A qualitative measure describing operational conditions within a traffic stream, and users' perception of those conditions, in terms of speed and travel time, freedom to maneuver, traffic interruption, comfort and convenience, and safety, etc.

Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from level-of-service A: best operating conditions, through F: worst operating conditions.

LOS A - Free flow. Users virtually do not affect one another in the traffic stream. Freedom to select speeds and to maneuver is extremely high. The level of comfort and convenience for the user is excellent. Delay time by slow-moving vehicles is no more than 30 percent.

LOS B - Stable flow. Users begin to affect one another in the traffic stream. Freedom to select speed is relatively unaffected, but maneuverability is reduced from LOS A. The level of comfort and convenience is somewhat less than at LOS A. Delay time reaches 45 percent.

LOS C - Stable flow. Users significantly affect one another's interactions in the traffic stream. Freedom to select speed is now affected, and maneuvering requires great care. The level of comfort and convenience is reduced noticeably. While traffic flow is stable, it is susceptible to congestion due to turning traffic and slow-moving vehicles. Delay time reaches 60 percent.

LOS D - High-density, but stable flow. Speed and maneuverability are severely restricted, and the level of comfort and convenience is poor. Small increases in traffic flow may cause operational problems. Turning vehicles or roadside distractions cause major shock waves in the traffic stream. Delay time reaches 75 percent.

LOS E - Operating conditions at or near the capacity. All speeds are low, but relatively uniform. Maneuvering is extremely difficult. The level of comfort and convenience is extremely low, and users become frustrated. Operations are unstable; small increases in flow or minor perturbations cause breakdowns. Delay time is more than 75 percent.

LOS F - Forced or breakdown flow. This occurs wherever the amount of traffic approaching a point exceeds that which can traverse the point. Queues form. Operations within queues are characterized by stop-and-go waves, and are extremely unstable.

Percent time delay - The average percentage of time that all vehicles are delayed while traveling in platoons due to the inability to pass.

Capacity utilization - The ratio of the demand flow rate to the capacity of the facility. Characterized by the *v/c* ratio in this analysis.

Total volume - The total number of vehicles that pass over a given point during a given time interval.

Peak-hour factor - The ratio of total hourly volume to the maximum 15 minute rate of flow with the hour.

Service flow rate - The service flow rate is the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of roadway during a given time period under prevailing roadway, traffic, and control conditions while maintaining a designated level of service.

Level terrain - Any combination of grades and horizontal and vertical alignment permitting heavy vehicles to maintain approximately the same speed as passenger cars; this generally includes short grades of no more than 1 to 2 percent.

Rolling terrain - Any combination of grades and horizontal or vertical alignment causing heavy vehicles to reduce their speeds substantially below those of passenger cars, but not causing heavy vehicles to operate at crawl speeds for any significant length of time.

Mountainous terrain - Any combination of grades and horizontal and vertical alignment causing heavy vehicles to operate at crawl speeds for significant distances or at frequent intervals.

Heavy vehicles - Trucks, recreational vehicles (RV's), and buses.

10.7 View Study

3.9 Vicinity

3.9.1 Local Perspective

The project site is adjacent to Sea Life Park, a major tourist attraction. Kaupo Beach Park is directly across the highway from the project site. Makai Pier is at the western end of the project site.

The project will not impact the use, enjoyment, or access of Sea Life Park or the beach recreational areas.

3.9.2 Regional Perspective

The project site is a relatively isolated semi-rural area. The residential/agricultural community of Waimanalo is two miles to the northwest and the residential/commercial community of Hawaii Kai is four road miles to the south. The project will not create adverse impacts for either community.

3.10 Related Projects

There are no related projects.

3.11 Population and Growth Assumptions

This project will not contribute to population growth or regional development in general. The project is intended to promote the growth of the commercial aquaculture sector in Hawaii and the United States.

3.12 Secondary Population and Growth Impacts

No secondary population or growth impacts will be generated by this project aside from development of commercial aquaculture throughout Hawaii and the U.S.

4 ENVIRONMENTAL IMPACTS AND MITIGATION

4.1 Earth

4.1.1 Geology

There will be no construction on the talus-alluvial slope material because a disturbance of this material in its present site configuration could lead to unpredictable sliding and settlement. Falling rocks from the adjoining high cliff will also be a constant hazard to the structure, especially during inclement periods and earthquakes.

The slope will be used as a buffer zone for falling debris and rocks. An alternate site could be relocated at the toe of the talus-alluvial slope. Either a retaining wall or a compacted embankment located at the toe of the slope could be used to define the buffer zone and the site of construction. A drainage system will be installed that can adequately divert the movement of water away from the supporting structures or foundations.

4.1.2 Soil

Summary of preliminary soils investigation:

1. Thirteen (13) test pits were excavated to depths of 8 to 15 feet. In general, the area was found to be under lain by brown and gray-brown stiff CLAY with boulders and cobbles to the final depths of the test pits.
2. No groundwater was found in any of the test pits at the time of the investigation.
3. Based on the preliminary information obtained from this investigation, the site appears suitable for development. It appears that spread footings may be used to support structures.
4. Special considerations will be required in the design and construction of the project. These considerations include:
   - 4.1 Boulders will be encountered in excavations and will likely hamper the excavation work. Heavy equipment will probably be required in removing the boulders.
   - 4.2 The clay materials have high to very high expansion potential. Concrete slabs-on-grade will require additional granular fill beneath the slab in order to minimize the possible adverse effects from soil expansion. In addition, footings will require additional embedment depth.
   - 4.3 The steep slope above the site is composed of talus boulders. Protection devices such as retaining walls or chain-link fencing should be provided along the uphill side property line to "protect" structures located beneath the talus slope area.

Details of the findings and recommendations are presented in the Appendix under Preliminary Soils Investigation - Soils Report Findings and Recommendations.

4.1.3 Grading and Drainage

A conceptual grading and drainage report is included in sec. 10.8 in the Appendix. The final drainage report and complete grading details will be submitted to the Building Department to acquire a grading permit.

All construction work will conform to the Soil Erosion Standards and Guidelines of the City and County of Honolulu and Grading, Soil Erosion and Sediment Control - Chapter 23, Revised Ordinances of Honolulu, 1969, as amended.

4.1.4 Archaeology

The entire parcel was inspected on foot on July 3, 1988. No sign of existing or former archaeological or historical remains were observed. Given the extent of recent land modification there is virtually no chance that cultural material survives below the surface. The level terrain and the mixed boulders and site deposits indicate extensive grading and filling, almost certainly as a part of the Kalanianaole Highway construction.

For these reasons, the use of the property for expanded facilities would have no impact on archaeological and historical resources and no further investigation is recommended.

4.2 Water

4.2.1 Construction

Site grading and construction activities will be strictly controlled to prevent sediment run-off into Waimanalo Bay. Drainage ways, sediment traps, and sediment screens will be used.

All work will conform to the Soil Erosion Standards and Guidelines of the City and County of Honolulu and Grading, Soil Erosion and Sediment Control - Chapter 23, Revised Ordinances of Honolulu, 1969, as amended.

4.2.2 Operation

There are no discernible impacts to the marine receiving waters at the shoreline discharge or to the underlying groundwater resource under existing or planned discharge conditions. The total daily load of dissolved and particulate material discharged from the proposed project will not increase by more than 10%. There is no potential for significant impact to the water resources of the area with this small increase in loading. Concentrations of effluent constituents are not expected to change. Permitted dispersion wells will be used in conjunction with surface discharge into the ocean. Dye tests have shown the dispersion wells to have no direct communication with the ocean.

The actual volume of water contained in various sized containers and the total volume flow using the OI Master Plan projections will change only slightly. The volume flow projected for the new facilities is 5,530 liter per minute, or 7,963,000 liter per day, an increase of approximately 8% over current use. The mix of organism culture will also change somewhat. Currently, fish culture occupies approximately 85% of the tank volume, while shrimp utilize only 15%; under projected Master Plan usage, fish will occupy 60% of tank volume and shrimp will occupy 40%.

The increase in flow and change in tank usage will result in slight changes in the discharge loadings, as shown below, compared with present conditions described in Sec. 3.3.

Mean concentrations of selected water quality parameters in aquaculture effluents, and mass loading in aquaculture discharges from Oceanic Institute projected Master Plan use.

Concentration Parameter	Fish	Shrimp	Loading Parameter	Fish	Shrimp	Total
NO3 (µg/l)	256	34	NO3 (kg/d)	1.2	0.1	1.2
NH4 (µ/l)	87	60	NH4 (kg/d)	0.4	0.2	0.5
TN (µ/l)	564	693	TN (kg/d)	2.7	2.2	4.9
PO4 (µ/l)	67	39	PO4 (kg/d)	0.3	0.1	0.4
TP (µ/l)	98	226	TP (kg/d)	0.5	0.7	1.2
SS (µ/l)	7	34	SS (kg/d)	33	108	142

4.3 Plants

Piles of fill material, sand, scrap metal, abandoned machinery, etc., in places largely overgrown, are found throughout the project site. The type of vegetation on the site is indicative of these past and present disturbances as it is dominated by introduced species. No sensitive native plant communities exist on the site nor are there any rare, threatened or endangered species (Herbst 1987; U.S. Fish and Wildlife Service 1985).

Of a total of 95 species inventoried, 88 (93%) are introduced; six (6%) are native or questionably native; and one (1%) is probably of Polynesian introduction.

There is little of botanical interest and the planned development is not expected to have a significant negative impact on the total island populations of the species involved as the majority (93%) are introduced species. Native species occurring on the site are found throughout the Hawaiian Islands and elsewhere in the Pacific in similar environmental habitats. Some, such as the 'uhaloa (*Waltheria indica*), seaside heliotrope or kipukai (*Heliotropium curassavicum*), and popolo (*Solanum americanum*), are considered "weedy natives" as they prefer more open, disturbed sites.

4.4 Animals

4.4.1 Existing

The project will have insignificant impact on the bird and mammal population of the project site. These are some broad conclusions related to bird and mammal activity on the property:

1. The present environment provides a limited range of habitats which are utilized by the typical array of exotic birds one would expect at this elevation and in this type of environment on Oahu.
2. In order to obtain more data on mammals, a trapping program would be required. The brief observations of this survey did not reveal any unusual mammal activity.
3. The proposed development will create more open space which will favor species like plover, doves, myna, and House Sparrows. Northern Cardinal and Japanese White-eye, two species which inhabit forest and brushy habitats, will decrease in number at this site.

4.4.2 Future

Any exotic animal species imported into the state for research purposes will be kept under strict quarantine according to state regulations. Any importation will be subject to an importation permit from the state Department of Agriculture Plant Quarantine Division. Proper screening, animal containment, and animal captivity requirements will be followed. No exotic species will be contained below the 20 foot elevation.

4.5 Traffic

There is no degradation in level of service or significant increase in projected total traffic volume. No identifiable traffic impact is projected, given worst case scenarios for increased traffic generated by the OI Master Plan and various traffic parameters.

OI has approximately 100 employees at the time of this study in 1989. The proposed expansion may allow an increase of staff to 200 in the next 5 to 10 years. Approximately 40 percent of employees presently pass Makapuu Point going to and from work. Assuming 40 percent of the additional staff pass Makapuu Point going to and from work in their own vehicle, then an additional 40 vehicles will pass Makapuu Point twice a day.

An estimated fewer than 10 percent of OI employees make working trips past Makapuu Point per day. Assuming 100 new staff, then 10 additional vehicles pass Makapuu Point twice a day.

An increase in the flow rate by 50 (40 + 10) vehicles per hour at the AM and PM peaks does not affect the relative level-of-service at Makapuu point. See level-of-service flow rate table in Section 3.6.3.

An increase in 24 hour volume by 100 vehicles over the next 10 years represents only 4 percent of the increase expected from a continuation of the trend over the last 10 years.

An increase of 100 employees at full Master Plan build-out will be mitigated by a new entrance at the west end of the site opposite Makai Pier. Projected additional traffic will not decrease the level of service of Kalanianaole Highway.

4.6 Visual

The project has minimal visual impact. The new structures are one story and construction materials will blend in with the natural environment.

The project will not alter any views of the ocean from the highway. The project will be only slightly visible from the Makapuu lookout, the view will not be altered by the small scale buildings that are visible in relation to the Pali.

Development of the project will result in altering limited landward views from Kalanianaole Highway. The View Study in the Appendix shows a new landscape screen/buffer strip that replaces the existing chain link fence bordering the property along Kalanianaole Highway. This buffer will feature attractive natural landscaping and will screen views of buildings and tanks.

The Master Plan calls for demolition of some buildings and the construction of new buildings while maintaining the small scale and village like character of the existing site. The Master Plan simplifies the types of building design and organizes tanks and ponds for minimal visual impact.

See the View Study in the Appendix sec. 10.7.

5 ALTERNATIVES

5.1 No action or postponing action for more study.

The no action alternative would result in no applied scientific facility for the research and assistance of commercial aquaculture in Hawaii. Postponing the action for more study could result in the loss of the time-specific portion of the project funding.

5.2 Different alternatives with similar benefits/different impacts.

The only significantly different alternative to the project with similar benefits but different impacts is the siting of some project functions at remote locations.

5.3 Alternatives of different design with different impacts.

Original designs for the project featured one large building of significant visual mass. The alternative of one large building was rejected to reduce the visual impact of the project.

6 LAND USE PLANS, POLICIES, AND CONTROLS

6.1 Federal Land Use Regulations

There are no federal land use regulations that affect this project. The CAA will not require any construction in navigable waters, alteration of any wetlands, or impact any endangered species or sanctuaries.

6.2 State Land Use Regulations

6.2.1 Conservation District

The Oceanic Institute property is designated as Conservation by the State of Hawaii. In 1981 the property was placed in a "Special Subzone" called the "Sea Life Park Special Subzone". The subzone is designated for recreational, educational, and commercial purposes as delineated on the map entitled "O-15, Koko Head, Oahu", dated June 4, 1981, on file with the Department of Land and Natural Resources.

Development at the Makapuu site will not require a Conservation District Use Permit (CDUP). The Master Lease for Kaupo Park (the project site) was signed in 1962. That is two years before Regulation No. 4 was promulgated in 1964 and therefore no CDUP is required. Furthermore, the Board of Land and Natural Resources stipulates in the Master Lease that the Oceanic Institute shall build and maintain first-class research facilities.

6.2.2 Historic Site

The OI property has been surveyed and researched for historic sites. There is no visual evidence and no record of a historic site on the property.

6.2.3 Designated Groundwater

The OI property is not in a Designated Ground Water Control Area.

6.2.4 Well Drilling

New water supply or injection wells required by the project will be approved by the Department of Health Underground Injection Control Program and DLNR before they are constructed.

6.2.5 Department of Transportation

6.2.5.1 Harbors Division

No modifications to the shoreline or the ocean environment are anticipated in developing the Center for Applied Aquaculture.

6.2.5.2 Highways Division

Highway modifications to improve the western entrance (opposite Makai Pier) will require the permission and cooperation of the Highways Division.

6.2.6 Department of Health - NPDES

A National Pollution Discharge Elimination System permit will not be required.

6.3 City and County of Honolulu Land Use Regulations

6.3.1 Shoreline Management Area

A Shoreline Management Area (SMA) permit will be required for this project. The Oceanic Institute at Makapuu Point is listed as a Use of Special Benefit in the Final Environmental Impact Statement for the Hawaii Coastal Zone Management Program (1978) in recognition of its unique function requiring a coastal location.

6.3.2 Shoreline Setback

The project is not in the shoreline setback area and no shoreline setback variance will be necessary.

6.3.3 Development Plan

The project site is designated Preservation on the Koolaupoko Development Plan Land Use Map.

6.3.4 Zoning

6.3.4.1 Preservation District

The project site is designated Preservation (P-1) by the City and County of Honolulu. The Land Use Ordinance describes Preservation Districts as they relate to the project site:

6.3.4.2 Preservation Districts: Purpose and Intent (5-10)

The purpose of the preservation districts is to preserve and manage major open space and recreation lands and lands of scenic and other natural resource value.

It is intended that all lands within a State-designated Conservation District be zoned P-1 Restricted Preservation District.

6.3.4.3 Preservation Uses and Development Standards (5.10-1)

Within the P-1 Restricted Preservation District, all uses, structures and development standards shall be governed by the appropriate State agencies.

Section 5.10-1 above clearly defers all regulatory control (except for the SMA permit) over new construction on OI property to the Department of Land and Natural Resources.

6.3.4.4 Flood Hazard District

A portion of the OI property below 20 feet in elevation is included in a designated Flood Hazard District (Coastal High Hazard District).

6.3.4.4.1 Flood Hazard Districts: Purpose (7.10)

Certain areas within the City are subject to periodic inundation by flooding and/or tsunami which may result in loss of life and property, creation of health and safety hazards, disruption of commerce and governmental services as well as extraordinary public expenditures for flood and tsunami protection and relief.

6.3.4.4.2 Coastal High Hazard District (7.10-7)

Within the Coastal High Hazard District, the uses permitted in the underlying zoning district shall be permitted, provided such uses, improvements, structures and utilities are in compliance with the provisions of this section.

6.3.5 Grading- City and County of Honolulu Building Department

All grading work will require a grading permit from the Building Department.

6.3.6 Building- City and County of Honolulu Building Department

Building permits will be acquired for all buildings.

7 GOVERNMENT APPROVALS

1. Special Management Area Use Permit - City and County of Honolulu Department of Land Utilization (Application is made after the EIS is accepted).
2. City and County of Honolulu Grading Permit (application prior to construction).
3. City and County of Honolulu Building Permit (application prior to construction).
4. Highway modification approval from the Department of Transportation.
5. Underground Injection Control Permit - State of Hawaii Department of Health.

8 ENVIRONMENTAL DISCUSSION

8.1 Short term vs. long term relationship

This project represents a long-term productive use of the land at the project site. The benefits to the state and the nation as a whole compared to the minimal visual intrusion into a previously undeveloped area is very favorable. The long-term introduction of one story buildings on the project site is mitigated by their location and landscaping. The long-term benefits of improved aquaculture production are potentially great.

8.2 Resource commitments

There are no irreversible or irretrievable resource commitments aside from the public project funding and the construction materials used. The only unavoidable impact is the construction of low, landscaped, environmentally integrated buildings at the project site.

8.3 Adverse impacts which cannot be avoided

The only adverse impact which cannot be avoided is the construction of low level structures in a visible area.

9 LIST OF CONTACTS

Department of Land and Natural Resources - State of Hawaii
Department of Land Utilization - City & County of Honolulu
Department of General Planning - City & County of Honolulu
Department of Public Works - City & County of Honolulu
Honolulu Board of Water Supply
Department of Health - State of Hawaii
Department of Transportation - Highways Division - State of Hawaii
Department of Transportation - Harbors Division - State of Hawaii
Honolulu Fire Department
Honolulu Police Department
Hawaiian Electric
Hawaiian Telephone
Waimanalo Neighborhood Board No. 32
Department of Hawaiian Home Lands - State of Hawaii
University of Hawaii - Hawaii Institute of Marine Biology
University of Hawaii - Environmental Center
U.S. Army Corps of Engineers
U.S. Department of Agriculture, Soil Conservation Service
Office of Environmental Quality Control - State of Hawaii

10 APPENDIX

10.1 Plant Species List

Following is a checklist of all those vascular plant species inventoried during the field studies of the Oceanic Institute property. Plant families are arranged alphabetically within each of two groups of flowering plants: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (in press). In most cases, common English and/or Hawaiian names given follow St. John (1973).

For each species the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used:

I = indigenous = native to the Hawaiian Islands and also to one or more other geographic areas.

P = Polynesian = plants of Polynesian introduction prior to Western contact (1778); not native.

X = introduced or alien = all those plants brought to the islands intentionally or accidentally after Western contact; not native.

SPECIES LIST

SCIENTIFIC NAME	COMMON NAME	STATUS
MONOCOTS		
Araceae		
Syngonium podophyllum Schott	syngonium	X
Cyperaceae		
Cyperus rotundus L.	nut grass, nut sedge	X
Pycreus aff. *rivularis* (Kunth) Palla	pycreus	X
Gramineae		
Bothriochloa pertusa (L.) A. Camus	hurricane grass	X
Brachiaria mutica (Forssk.) Stapf	California grass	X
Cenchrus ciliaris L.	buffel grass	X
Cenchrus echinatus L.	sandbur	X
Chloris barbata (L.) Sw.	finger grass	X
Chloris radiata (L.) Sw.	plush grass	X
Cynodon dactylon (L.) Pers.	Bermuda grass	X
Dactyloctenium aegyptium (L.) Willd.	beach wire grass	X
Dichanthium aristatum (Poir.) Hubb.	Wilder grass	X
Dichanthium sericeum (R. Br.) A. Camus	Australian bluestem	X
Digitaria insularis (L.) Mez ex Ekman	sour grass	X
Echinochloa colona (L.) Link	jungle rice	X
Eleusine indica (L.) Gaertn.	goose grass	X
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	Japanese love-grass	X
Leptochloa univervia (K. Presl.) Hitchc. & Chase	Judd grass	X
Panicum maximum Jacq.	Guinea grass	X
Panicum maximum var. *trichoglume* Eyles ex Robyns	green panic grass	X
Setaria verticillata (L.) P. Beauv.	bristly foxtail	X
Sorghum halapense (L.) Pers.	Johnson grass	X

SCIENTIFIC NAME	COMMON NAME	STATUS
DICOTS		
Acanthaceae		
Asystasia gangetica (L.) T. Anderson	Chinese violet	X
Aizoaceae		
Trianthema portulacastrum L.	trianthema	X
Amaranthaceae		
Alternanthera pungens Kunth	alternanthera	X
Amaranthus spinosus L.	spiny pig weed	X
Amaranthus viridis L.	amaranthus	X
Anacardiaceae		
Schinus terebinthifolius Raddi	Christmas berry	X
Bataceae		
Batis maritima L.	pickleweed	X
Boraginaceae		
Heliotropium curassavicum L.	seaside heliotrope	I
Heliotropium procumbens Mill. var. *depressum* (Cham.) Fosb.	heliotrope	X
Caryophyllaceae		
Spergularia marina (L.) Vill.	sand spurry	X
Chenopodiaceae		
Atriplex suberecta Verdoorn	saltbush	X
Combretaceae		
Terminalia catappa L.	false kamani, Indian almond	X
Compositae		
Ageratum conyzoides L.	ageratum	X
Bidens alba (L.) DC.	Spanish needle	X
Bidens pilosa L.	Spanish needle	X
Calyptocarpus vialis Less.	hierba de caballo	X
Eclipta alba (L.) Hassk.	eclipta	X
Emilia coccinea (Sims) G. Don	emilia	X
Emilia fosbergii Nicolson	emilia	X
Pluchea indica (L.) Less.	pluchea	X
Pluchea symphytifolia (Mill.) Gillis	pluchea	X
Sonchus oleraceus L.	sowthistle	X
Synedrella nodiflora (L.) Gaertn.	synedrella	X
Tridax procumbens L.	coat buttons	X
Verbesina encelioides (Cav.) Benth. & Hook.	golden crownbeard	X
Wedelia trilobata (L.) Hitchc.	wedelia	X
Convolvulaceae		
Ipomoea cairica (L.) Sweet	koali	X?
Ipomoea indica (J. Burm.)	koali-awahia	I
Ipomoea obscura (L.) Ker-Gawl.	white bindweed	X
Ipomoea triloba L.	pink bindweed	X
Jacquemontia ovalifolia (Choisy) H. Hallier	pa'u-o-hi'i'aka	I
Merremia aegyptia (L.) Urb.	koali-kua-hulu	X?
Cruciferae		
Lepidium virginicum L.	peppergrass	X
Cucurbitaceae		
Coccinia grandis (L.) Voigt	coccinia	X
Cucumis dipsaceus Ehrenb. ex Spach	spiny cucumber	X
Momordica charantia L.	bittermelon	X

SCIENTIFIC NAME	COMMON NAME	STATUS
Euphorbiaceae		
Chamaesyce hirta (L.) Millsp.	euphorbia	X
Chamaesyce hypericifolia (L.) Millsp.	euphorbia	X
Chamaesyce prostrata (Aiton) Small	euphorbia	X
Chamaesyce thymifolia (L.) Millsp.	euphorbia	X
Euphorbia cyathophora J. A. Murray	summer poinsettia	X
Phyllanthus debilis Klein ex Willd.	phyllanthus	X
Ricinus communis L.	castorbean	X
Labiatae		
Leonotis nepetifolia (L.) R. Br.	lion's ear	X
Ocimum gratissimum L.	basil	X
Leguminosae		
Alysicarpus vaginalis (L.) DC.	alysicarpus	X
Clitoria ternata L.	clitoria	X
Desmanthus virgatus (L.) Willd.	desmanthus	X
Desmodium tortuosum (Sw.) DC.	beggar's ticks	X
Indigofera spicata Forssk.	indigo	X
Indigofera suffruticosa Mill.	indigo	X
Glycine wightii (Wight & Arnott) Verdc.	glycine	X
Leucaena leucocephala (Lam.) deWit	koa-haole	X
Macroptilium lathyroides (L.) Urb.	wild bean	X
Medicago lupulina L.	medick	X
Melilotus indica (L.) All.	sweetclover	X
Mimosa pudica L.	sleepinggrass	X
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X
Malvaceae		
Abutilon grandifolium (Willd.) Sweet	ma'o	X
Malvastrum coromandelianum (L.) Garcke	malvastrum	X
Sida fallax Walp.	'ilima	I
Sida spinosa L.	sida	X
Nyctaginaceae		
Boerhavia coccinea Mill.	boerhavia	X
Oxalidaceae		
Oxalis corniculata L.	yellow wood sorrel	P?
Passifloraceae		
Passiflora suberosa L.	passiflora	X
Phytolaccaceae		
Rivina humilis L.	rouge plant	X
Portulacaceae		
Portulaca oleracea L.	purslane	X
Portulaca pilosa L.	portulaca	X
Primulaceae		
Angallis arvensis L.	scarlet pimpernel	X
Solanaceae		
Lycopersicon pimpinellifolium (Jusl.) Mill.	currant tomato	X
Solanum americanum Mill.	popolo	I?
Sterculiaceae		
Waltheria indica L.	'uhaloa, hi'aloa	I?
Verbenaceae		
Stachytarpheta jamaicensis (L.) Vahl	stachytarpheta	X

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10.5 Preliminary Soils Investigation (Soils International)

10.5.1 Introduction

This investigation was made for the purpose of obtaining preliminary information on the subsurface conditions in order to determine the suitability of the site for development of the proposed additions to the Oceanic Institute located on Kalanianaole Highway at Makapuu Point, Oahu, Hawaii. The location of the site, relative to the existing streets and landmarks, is shown on the Vicinity Map, Plate 1.

10.5.2 Scope of Work

The services included excavating 13 test pits to depths of 8 to 15 feet, obtaining samples of the underlying soils, performing laboratory tests on the samples, and performing preliminary engineering analysis from the data gathered. In general, the following information is provided for use by the Architect and/or Engineer:

1. General subsurface conditions, as disclosed by the test pits.
2. Physical characteristics of the soils encountered.
3. Preliminary recommendations for foundation and pavement design.
4. Recommendations for placement of fill and backfill.
5. Special considerations.

10.5.3 Planned Development

From the information provided, the project will consist of constructing additions to the existing Oceanic Institute facility. Various areas of the property are being studied as possible sites for the additions.

10.5.4 Site Conditions

10.5.4.1 Surface

The property, designated by Tax Map Key Number 4-1-14:4, is located at Makapuu Point on the mauka side of Kalanianaole Highway. Sea Life Park is located immediately southeast of the property. The proposed study area extends from the existing Oceanic Institute offices/buildings to the northwesterly boundary of the parcel (opposite the Makai Pier). Along the mauka boundary of the site, the adjoining property slopes steeply upwards to the mountain ridge line. Along the Kalanianaole Highway side of the parcel, there is a rock wall. At the time of the investigation, the northwesterly end of the lot was covered with a dense growth of kiawe trees, brush, weeds, and piles of rubbish. The rubbish piles contained navigational equipment, boulders, and scrap metal. We were informed that this area may have buried oxygen tanks.

Between the densely vegetated area and the existing Oceanic Institute building area, there are numerous fish ponds and above ground fish tanks.

From the topographic map provided, surface elevations range from about +25 to +37 feet along the mauka edge of the site to about +9 to +37 feet along the highway side of the parcel.

10.5.4.2 Subsurface

The subsurface conditions at the site were explored by excavating 13 test pits to depths of 8 to 15 feet. The locations of the test pits, which are shown on the Plot Plan, Plate 2, were selected based on possible development areas and on the accessibility to these areas. Detailed logs of the test pits are presented in the Appendix to this report.

In general, the site was found to be underlain by brown and gray-brown, moderately stiff to stiff CLAY with boulders and cobbles. The upper layer of clay was determined to be old fill and contained various amounts of debris. The amounts of boulders and cobbles made excavation very difficult. At the bottom of the test pits, the boulders were generally in point to point contact.

In Test Pit 5 (below the CLAY fill), light brown, moist, loose to moderately dense calcareous SAND was found to the final depth of the test pit at 11 feet.

At Test Pit 1, fill material consisting of tan gray, slightly moist to moist, loose silty SAND was found to a depth of 3 feet followed by brown, slightly moist to moist, moderately stiff CLAY to the final depth of the test pit at 8.0 feet.

At Test Pit 13, fill material consisting of gray, moist, moderately dense silty GRAVEL was found to a depth of 1 foot followed by tank moist, moderately dense silty SAND to depths of 2.5 feet. Beneath the silty SAND, dark gray, moist, moderately stiff to stiff CLAY was found to a depth of 4 feet followed by tan white, moderately dense clayey calcareous GRAVEL to a depth of 5 feet. Below the clayey GRAVEL, dark gray, very moist, moderately stiff (natural) organic CLAY was found to the final depth of the test pit at 10.5 feet.

No groundwater was found in any of the test pits at the time of the investigation.

From the USDA Soil Conservation Service "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii", the site is located in an area designated as Kaena stony clay, 2 to 6 percent (KaeB), Kawaipahi stony clay loan, 2 to 6 percent slope (KLaB), Rock Land (rRK), Rock Outcrop (rRO) and Fill Land, mixed (FL).

The Kaena Series consists of very deep, poorly drained soils on alluvial fans and talus slopes on the islands of Oahu and Kauai. These soils developed in alluvium and colluvium from basic igneous material. They are gently sloping to steep and are commonly stony.

The Kawaihapai Series consists of well-drained soils in drainageways and on alluvial fans on the coastal plains on the islands of Oahu and Molokai. These soils formed in alluvium derived from basic igneous rock in humid uplands. They are nearly level to moderately sloping.

Rock Land is made up of areas where exposed rock covers 25 to 90 percent of the surface. It occurs on all five islands. The rock outcrops and very shallow soils are the main characteristics. The rock outcrops are mainly basalt and andesite. The soil material associated with the rock outcrops is very sticky and very plastic. It also has high shrink-swell potential.

Rock Outcrop consists of areas where exposed bedrock covers more than 90 percent of the surface. It occurs on all five islands. The rock outcrops are mainly basalt and andesite. This land type is gently sloping to precipitous.

Fill land consists of areas filled with material from dredging, excavation from adjacent uplands, garbage, and bagasse and slurry from sugar mills. This type of land occurs mostly near Pearl Harbor and in Honolulu, adjacent to the ocean (USDA, 1972, pp. 31, 49-50, 63-64, and 119, Plate 67).

10.5.4.3 Geology

The site is located on the windward side of the Koolau Mountain range. The mountain range is believed to have formed during late Tertiary/early Pleistocene time (between 1 to 12 million years ago). Lavas flowed from rift zones which roughly paralleling the existing mountain crest trends to from the main shield of the volcano. After cessation of the volcanic activity, streams cut deep amphitheater-headed valleys into the mountain. During changes in sea level, the valleys were alluviated grading to the high sea stands. Late-stage volcanic eruptions occurred on the southeasterly end of the Koolau mountains. These late-stage eruptions, known as the Honolulu Volcanic Series, form familiar landmarks on Oahu such as Diamond head, Punchbowl, Tantalus, Round Top and Slat Lake craters (Stearns and Vaksvik, 1935).

The upper soil layer is generally fill of unknown origin and age. The fill layer is generally underlain by talus material that consists of boulders and clay. Beneath the talus material, Koolau basalts will likely be found. In some areas of the site, calcareous deposits of sand and coral may be found.

10.5.5 Preliminary Conclusions and Recommendations

10.5.5.1 General

Based on the findings and observations of this investigation, development of any portion of the study area will require special considerations in the design and construction of structures and roadways.

10.5.5.2 Special Considerations

The entire study area was found to have subsurface conditions which generally consisted of clay with boulders. The boulders are large in some areas and are generally in point to point contact at depths of about 9 to 12 feet below existing grade. The upper soil layer is old fill which contained debris. Special considerations for design and construction of foundations and roadways are as follows:

a. Boulders will be encountered in excavations and will hamper the excavation work. The Komatsu backhoe and the Case 580E hopto had great difficulty in excavating the test pits. Large boulders up to 5 feet in diameter were found in some of the test pits. In all of the test pits except 2,3, and 8, the boulders generally became more abundant and in point to point contact at the bottom of the pits thereby preventing deeper excavation.

b. The clay materials have high to very high expansion potential. Concrete slabs-on-grade will require additional granular fill (about 24 to 36 inches thick) beneath the slab in order to minimize the possible adverse effects from soil expansion. In addition, footings will require additional embedment depth (on the order of 24 to 36 inches below lowest adjacent grade).

c. The steep slopes above the site are composed of talus boulders. There was a past incident of boulder damage to the water tank located near the toe of the slope. Protection devices such as retaining walls or chain-link fencing should be provided along the uphill side property line in order to "protect" structures from boulders which may roll down the hill.

10.5.5.3 Foundations

It appears that support of the proposed structures may be obtained using spread or continuous foundations. An allowable bearing value on the order of 2,000 to 3,000 pounds per square foot appears reasonable at this time. The footing embedment depth for footings bearing on the on-site clay should be between 24 to 36 inches below lowest adjacent grade due to the high to very high shrink-swell potential of the on-site soils. If the on-site CLAY soils are removed and replaced with materials with low shrink-swell potential, the footing embedment depth can be decreased to about 12 inches below adjacent grade.

For footings located adjacent to new or existing utility trenches, the bottom of the footing should be deepened below a 1 horizontal to 1 vertical plane projected upwards from the edge of the utility trench.

For footings located on or adjacent to slopes, the footing should be deepened such that there is a minimum horizontal distance of 5 feet or twice the footing width, whichever is greater, from the edge of the footing to the slope face.

10.5.5.4 Retaining Walls

Retaining walls will require additional sizing in order to retain the clayey soil backfill. For the clay soils, the retaining walls will likely require design for an active earth pressure on the order of 45 to 60 pounds per square foot per foot of depth.

In order to reduce the design pressure, additional granular fill should be placed behind the walls. The lateral extent of the granular fill should be at least 1/2 times the wall height behind the wall in order to reduce the design lateral earth pressure to 35 pcf.

10.5.5.5 Slab-on-Grade

The on-site clay soils have high to very high expansion potential, i.e. the soil will swell with increase in moisture content. Additional granular fill should be placed beneath concrete slabs-on-grade in order to minimize cracking from soil expansion.

Site grading should be designed to minimize ponding of water adjacent to slab and footing areas.

10.5.5.6 Slopes

Cut and fill slopes for site grading shall not exceed 2 horizontal to 1 vertical.

Cutting adjacent to the existing toe of the uphill side boulder slope should be avoided.

We recommend that a topographic map (either field survey or aerial topograph) be prepared to determine the areal extent and gradient of the boulder area in order to provide some data for determination of the slope stability. Since this area is not in the subject property and the gradient of the surface is very steep, explorations in this area are deemed impractical. The stability of the boulder mass will be difficult to determine and assumptions as to the depth of the boulders, the type and strength of underlying materials whether soil or rock, and the possible dip of the contact zone will have to be made in order to provide a "best guess" of the mass stability.

10.5.5.7 Pavement Design

Roadways will generally require additional select borrow beneath the pavement section. Typically, 18 to 24 inches of select borrow beneath 2 inches of asphaltic concrete and 6 inches of base course gravel will be required for areas of heavy traffic. For lightly-loaded vehicular traffic (cars and vans), the select borrow thickness can generally be reduced to 12 inches of select borrow.

10.5.5.8 Site Grading

Excavations for utility trenches and mass grading will generally be difficult due to the boulders with clay layer. At depth of about 9 to 12 feet, the boulders are in point to point contact. Some of the boulders found in the test pits exceeded 4 feet in diameter.

Soils which are excavated form the site will generally be unsuitable for embankment material due to the clay content and amounts of large material. The calcareous sands and gravel will be suitable as fill material.

10.5.5.9 Protection of Structures

The upper talus slope of boulders is steep (about 1H:1V). There is a potential for the isolated boulders to roll down the hill. If structures are to be located below this hillside, devices such as heavy-duty chain-link fencing and earth berms should be constructed to "protect" the structures from damage. The choice of protection device will require careful study since the boulders are large and the impact forces will be great.

10.5.6 Remarks

The conclusions and recommendations contained herein are preliminary and are based on the findings and observations made at the test pit locations. After selection of the development area, it is recommended that a full soils investigation be performed to more accurately define the subsurface conditions for foundation design.

10.6 Definition of Traffic Terms

Operational analysis - An application determining the level-of-service for an existing two-lane highway with existing traffic and roadway conditions, or for projected conditions. It is presented for general terrain segments and specific grades.

Level-of-service (LOS) - A qualitative measure describing operational conditions within a traffic stream, and users' perception of those conditions, in terms of speed and travel time, freedom to maneuver, traffic interruption, comfort and convenience, and safety, etc.

Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from level-of-service A: best operating conditions, through F: worst operating conditions.

LOS A - Free flow. Users virtually do not affect one another in the traffic stream. Freedom to select speeds and to maneuver is extremely high. The level of comfort and convenience for the user is excellent. Delay time by slow-moving vehicles is no more than 30 percent.

LOS B - Stable flow. Users begin to affect one another in the traffic stream. Freedom to select speed is relatively unaffected, but maneuverability is reduced from LOS A. The level of comfort and convenience is somewhat less than at LOS A. Delay time reaches 45 percent.

LOS C - Stable flow. Users significantly affect one another's interactions in the traffic stream. Freedom to select speed is now affected, and maneuvering requires great care. The level of comfort and convenience is reduced noticeably. While traffic flow is stable, it is susceptible to congestion due to turning traffic and slow-moving vehicles. Delay time reaches 60 percent.

LOS D - High-density, but stable flow. Speed and maneuverability are severely restricted, and the level of comfort and convenience is poor. Small increases in traffic flow may cause operational problems. Turning vehicles or roadside distractions cause major shock waves in the traffic stream. Delay time reaches 75 percent.

LOS E - Operating conditions at or near the capacity. All speeds are low, but relatively uniform. Maneuvering is extremely difficult. The level of comfort and convenience is extremely low, and users become frustrated. Operations are unstable; small increases in flow or minor perturbations cause breakdowns. Delay time is more than 75 percent.

LOS F - Forced or breakdown flow. This occurs wherever the amount of traffic approaching a point exceeds that which can traverse the point. Queues form. Operations within queues are characterized by stop-and-go waves, and are extremely unstable.

Percent time delay - The average percentage of time that all vehicles are delayed while traveling in platoons due to the inability to pass.

Capacity utilization - The ratio of the demand flow rate to the capacity of the facility. Characterized by the *v/c* ratio in this analysis.

Total volume - The total number of vehicles that pass over a given point during a given time interval.

Peak-hour factor - The ratio of total hourly volume to the maximum 15 minute rate of flow with the hour.

Service flow rate - The service flow rate is the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of roadway during a given time period under prevailing roadway, traffic, and control conditions while maintaining a designated level of service.

Level terrain - Any combination of grades and horizontal and vertical alignment permitting heavy vehicles to maintain approximately the same speed as passenger cars; this generally includes short grades of no more than 1 to 2 percent.

Rolling terrain - Any combination of grades and horizontal or vertical alignment causing heavy vehicles to reduce their speeds substantially below those of passenger cars, but not causing heavy vehicles to operate at crawl speeds for any significant length of time.

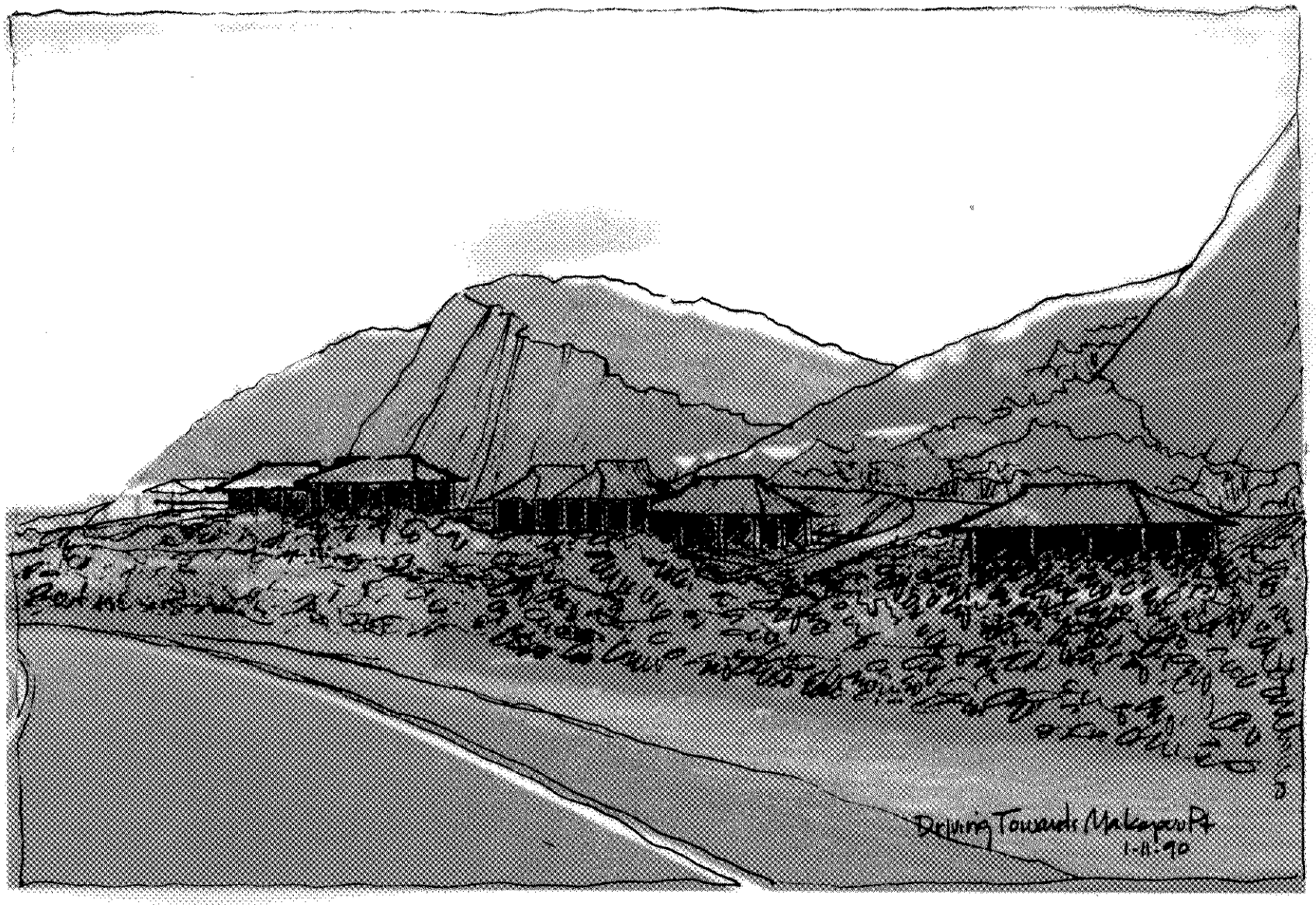
Mountainous terrain - Any combination of grades and horizontal and vertical alignment causing heavy vehicles to operate at crawl speeds for significant distances or at frequent intervals.

Heavy vehicles - Trucks, recreational vehicles (RV's), and buses.

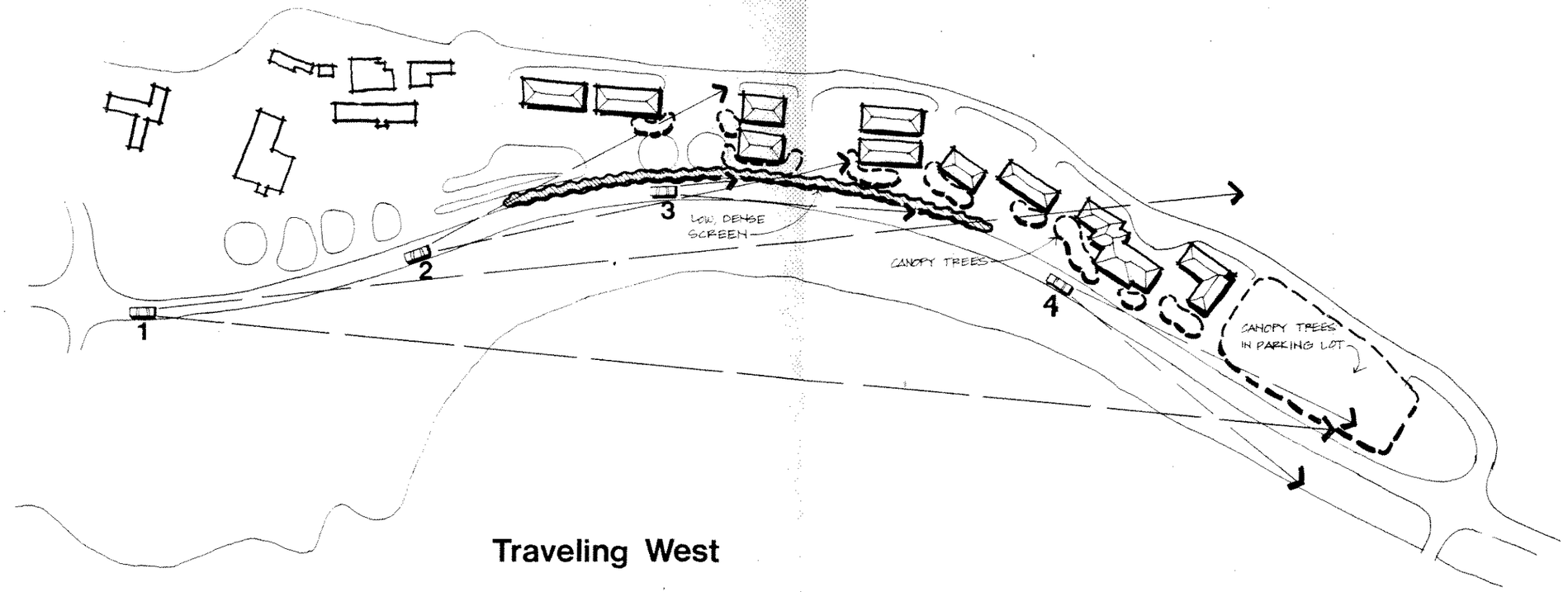
10.7 View Study

KALANIANAOLE HIGHWAY WESTBOUND

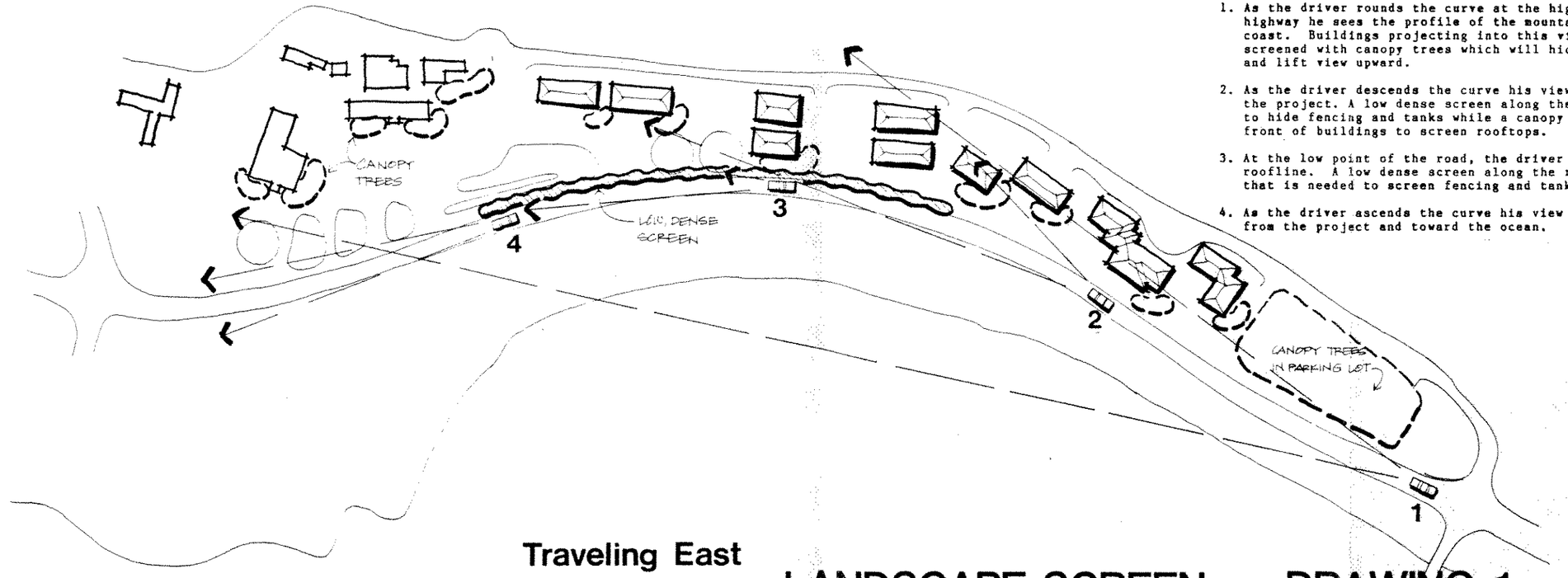
PHOTO 1 **SKETCH 1**



KALANIANAOLE HIGHWAY EASTBOUND PHOTO 2 **SKETCH 2**



Traveling West



Traveling East

1. As the driver rounds the curve at the high point of the highway he sees the profile of the mountain range and coast. Buildings projecting into this view should be screened with canopy trees which will hide the rooftops and lift view upward.

2. As the driver descends the curve his view is directed into the project. A low dense screen along the road is needed to hide fencing and tanks while a canopy tree is needed in front of buildings to screen rooftops.

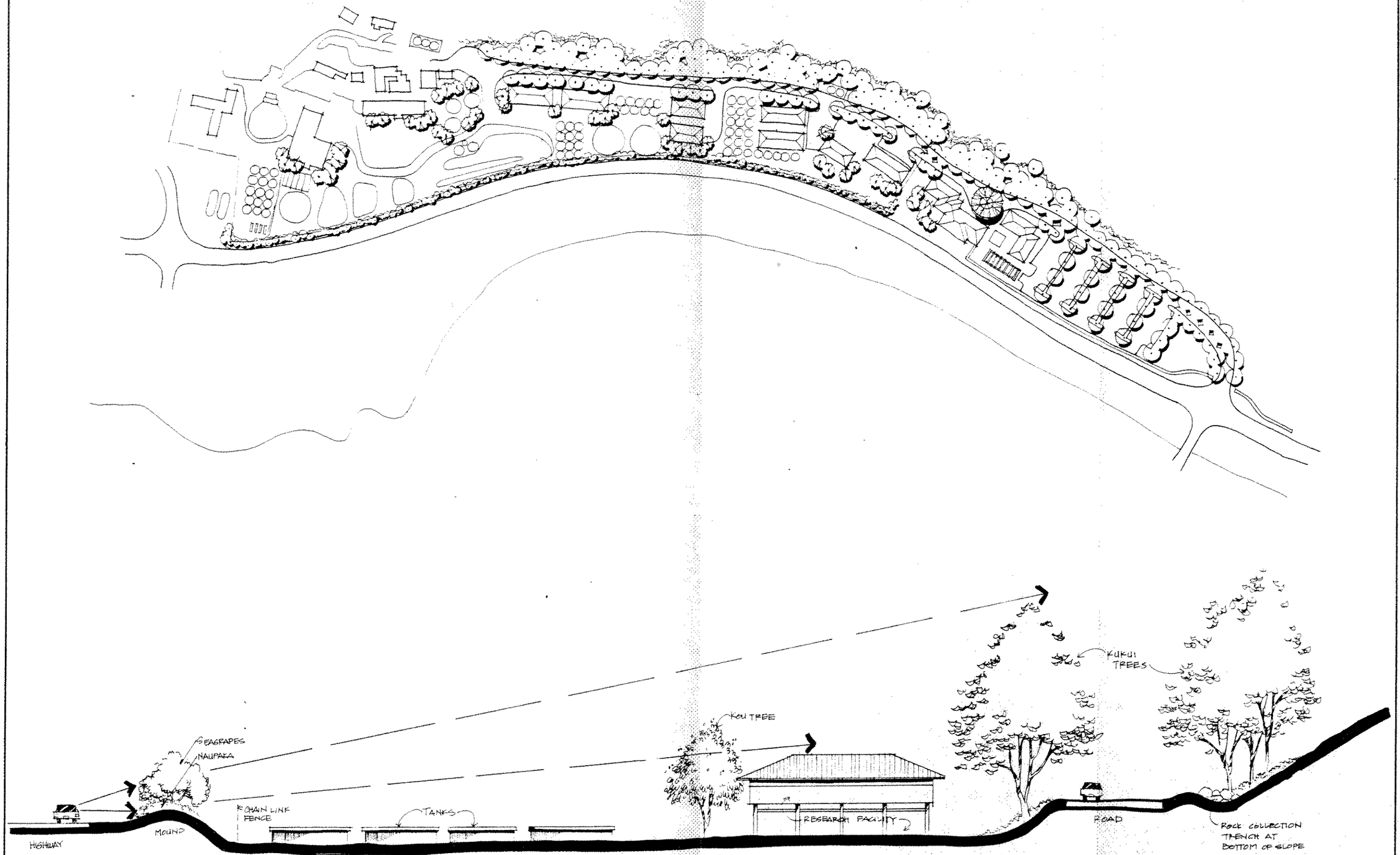
3. At the low point of the road, the driver is below the roofline. A low dense screen along the road edge is all that is needed to screen fencing and tanks.

4. As the driver ascends the curve his view is outward away from the project and toward the ocean.

LANDSCAPE SCREEN DRAWING 1

REVISIONS	BY

Date
Scale
Drawn
Job
Sheet
Of Sheets



LANDSCAPE SCREEN DRAWING 2

REVISIONS	BY

Date
Scale
Drawn
Job
Sheet
Of Sheets

TOTAL ESTIMATED EARTHWORK QUANTITIES
EXCAVATION: 10,000 CY
FILL: 30,000 CY

TOTAL ESTIMATED RUNOFF FROM OCEANIC INSTITUTE AND HAWAIIAN HOME LANDS		
	RAINFALL INTERVAL	
	50 YEAR	25 YEAR
Q_E	137 cfs	117 cfs
Q_P	160 cfs	137 cfs
Q_Δ	23 cfs	20 cfs

TRUE NORTH
SCALE, 1" = 80'

FLOOD HAZARD ZONE AE (EL. 20)

FLOOD HAZARD ZONE AE (EL. 18)

PROPOSED CULVERT

SEA LIFE PARK

TANK

BLDG.

A.C. PAV'T

TANKS

POND

PORTABLE TANKS

COVERED TANK

GRAVEL PARKING AREA

A.C. PAV'T

GRAVEL ROAD

TO WAIMANALO

HIGHWAY

FLOOD HAZARD ZONE VE (EL. 18)

PROPOSED CULVERT

KALANIANAOLE

RAINFALL INTERVAL		
	50 YEAR	25 YEAR
Q_E	107 cfs	91 cfs
Q_P	110 cfs	94 cfs
Q_Δ	3 cfs	3 cfs

TO HAWAII KAI

FLOOD HAZARD ZONE VE (EL. 20)

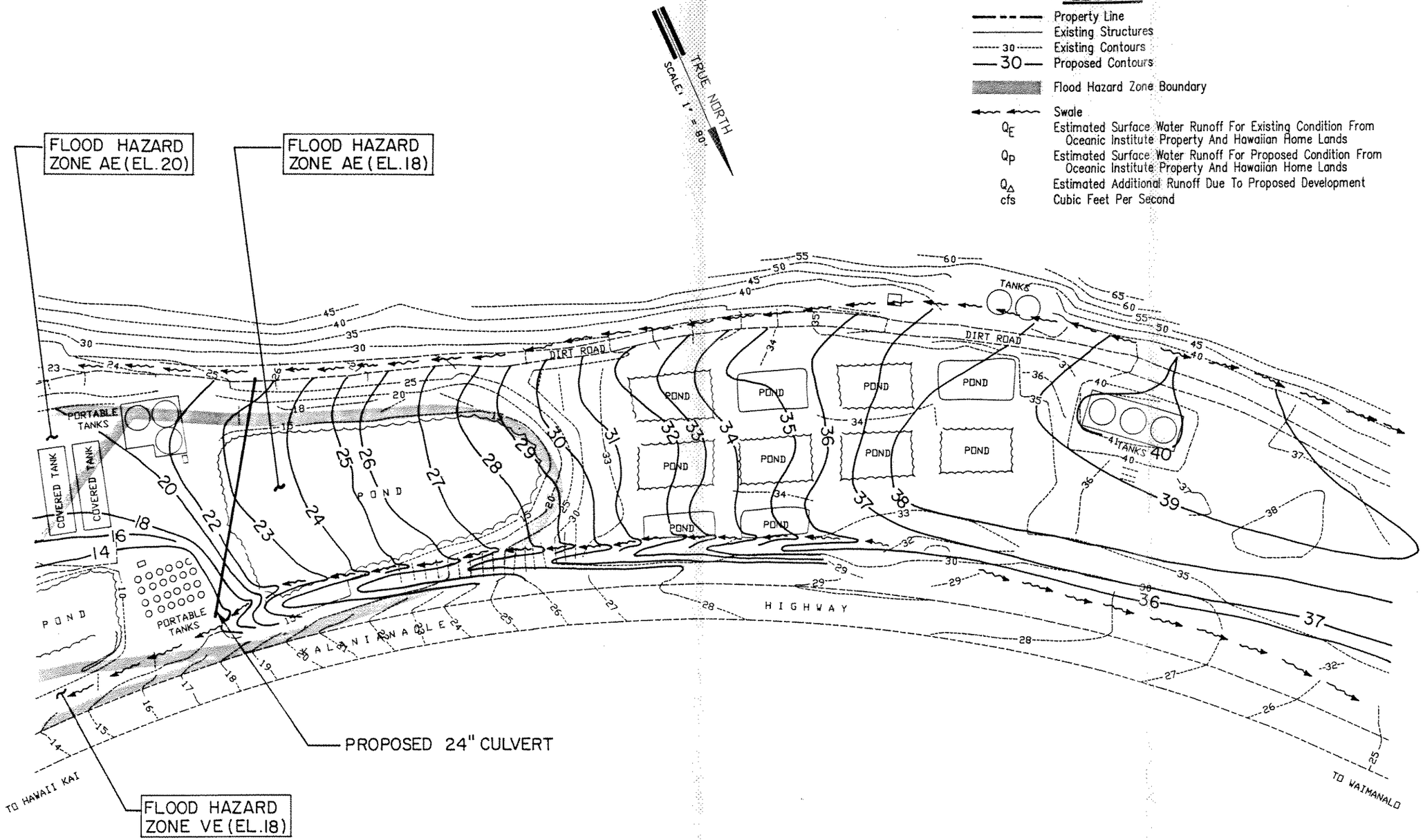
EXISTING BOX CULVERT (8' WIDE x 3' HIGH)

LEGEND

- Property Line
- Existing Structures
- 30 Existing Contours
- 30 Proposed Contours
- Flood Hazard Zone Boundary
- Swale
- Q_E Estimated Surface Water Runoff For Existing Condition From Oceanic Institute Property And Hawaiian Home Lands
- Q_P Estimated Surface Water Runoff For Proposed Condition From Oceanic Institute Property And Hawaiian Home Lands
- Q_Δ Estimated Additional Runoff Due To Proposed Development
- cfs Cubic Feet Per Second

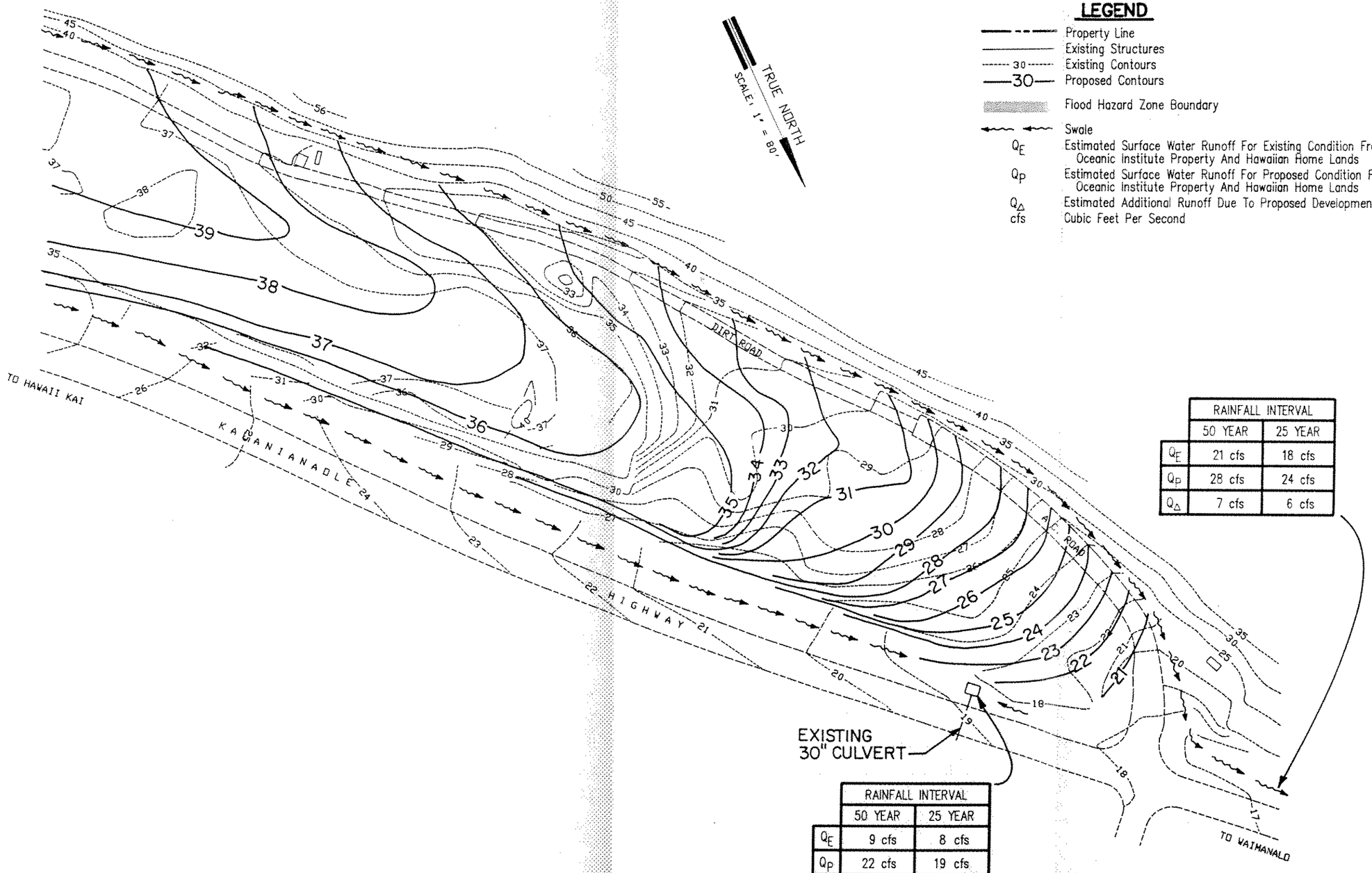
FLOOD HAZARD ZONES, CONCEPTUAL GRADING AND DRAINAGE

SHEET NO. 1 OF 3 SHEETS



FLOOD HAZARD ZONES, CONCEPTUAL GRADING AND DRAINAGE

SHEET NO. 2 OF 3 SHEETS



LEGEND

- Property Line
- Existing Structures
- 30 Existing Contours
- 30 Proposed Contours
- Flood Hazard Zone Boundary
- Swale
- Q_E Estimated Surface Water Runoff For Existing Condition From Oceanic Institute Property And Hawaiian Home Lands
- Q_P Estimated Surface Water Runoff For Proposed Condition From Oceanic Institute Property And Hawaiian Home Lands
- Q_Δ Estimated Additional Runoff Due To Proposed Development
- cfs Cubic Feet Per Second

	RAINFALL INTERVAL	
	50 YEAR	25 YEAR
Q_E	21 cfs	18 cfs
Q_P	28 cfs	24 cfs
Q_Δ	7 cfs	6 cfs

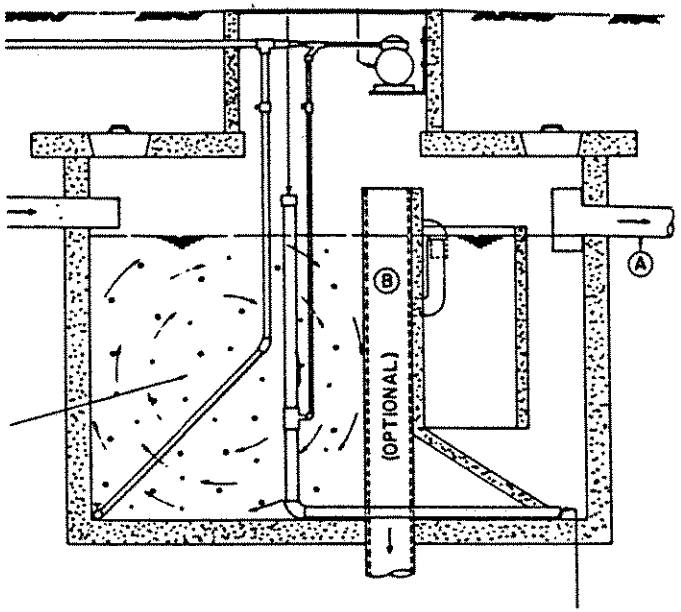
	RAINFALL INTERVAL	
	50 YEAR	25 YEAR
Q_E	9 cfs	8 cfs
Q_P	22 cfs	19 cfs
Q_Δ	13 cfs	11 cfs

FLOOD HAZARD ZONES, CONCEPTUAL GRADING AND DRAINAGE

SHEET NO. 3 OF 3 SHEETS

Sewage Treatment Systems

As leaders in the industry, we offer the finest systems to provide state of the art wastewater treatment that will comply with D.O.H. requirements for any size project.



H.E. VERTICAL SYSTEM

An entirely new sewage system. The most efficient and trouble free system on the market today.

For use on jobs from single family dwellings to small townhouse projects.

Compare the Advantages:

- No submerged moving parts - Nothing to deteriorate - all PVC piping to convey compressed air to sewage and return sludge from clarifier.
- Available in 6', 8', 10' and 12' diameters
- Capacities up to 10,000 GPD
- Especially designed for minimum space, making it easier to comply with Department of Health setback requirements.
- All replacement parts readily available locally.
- (A) unit can be adapted to horizontal discharge with external flow to separate drain pit by replacing (B) with horizontal drain pipe and weir as shown or can be used both ways at same time.
- H.E. Horizontal systems available for larger flows.

H.E. HORIZONTAL SYSTEM

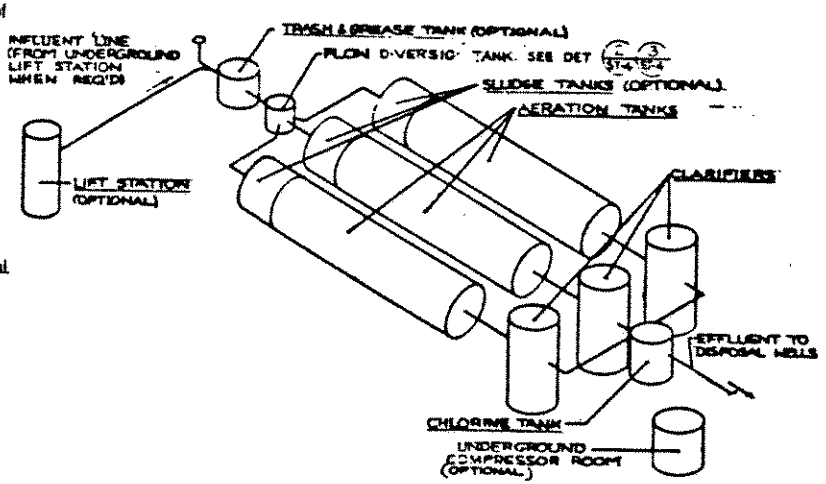
Preserve valuable land...

Go underground with H.E.'s Horizontal Waste Treatment Systems. Under parking lots, driveways and landscaped areas.

For larger multi-family units, industrial and commercial applications.

Compare the advantages:

- H.E. Treatment is a new, totally enclosed underground waste treatment system, preserving land otherwise needed to hide unsightly above ground sanitation facilities.
- No noxious odors emitted.
- Sound proofed equipment rooms above or below ground eliminate noise pollution.
- Completely new, all concrete construction with PVC internal and external piping eliminates deterioration, provides dependable, maintenance free service.
- Steel or fiberglass systems also available.
- New modular system compensates for minimum or maximum loads through individual or simultaneous phasing.
- Repairs and maintenance performed without loss of operation.
- Systems designed to meet exact requirement regardless of capacity.
- Certified and approved.
- Where condition won't permit an underground system, H.E. can install totally enclosed above-ground facilities.
- Prompt delivery and installation after plans approval.
- Concrete, steel or fiberglass built lift stations.
- Fully automatic, completely dependable sanitation system, designed and manufactured locally.
- Cost efficient and economical.



11 RESPONSES TO THE DRAFT EIS

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860-5020

IN REPLY REFER TO:

5090
Ser 00F2/180
24 Jan 1990

City and County of Honolulu
Department of Land Utilization
Environmental Affairs
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Gentlemen:

THE OCEANIC INSTITUTE MASTER PLAN FOR THE CENTER FOR APPLIED AQUACULTURE

The Draft Environmental Impact Statement for the Oceanic Institute Master Plan for the Center for Applied Aquaculture, Makapuu Point, has been reviewed, and we have no comments to offer. Since we have no further use for the document, it is being returned to the Office of Environmental Quality Control.

Thank you for the opportunity to review the draft.

Sincerely,

W. K. LIU
Assistant Base Civil Engineer
By direction of
the Commander

Copy to:
The Oceanic Institute
OEQC (w/DEIS)

(P)1046.0

JAN 25 1990

City and County of Honolulu
Department of Land Utilization
Environmental Affairs
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Gentlemen:

Subject: The Oceanic Institute Master Plan
for the Center for Applied Aquaculture
Draft Environmental Impact Statement

Thank you for the opportunity to review the subject document. We have no comments to offer.

Should there be any questions, please contact Mr. Cedric Takamoto of the Planning Branch at 548-7192.

Very truly yours,

T. Tominaga

TEUANE TOMINAGA
State Public Works Engineer

CT:jk
cc: The Oceanic Institute
Dr. Marvin Miura

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
1455 SOUTH BERETANIA STREET, ROOM 305
HONOLULU, HAWAII 96814

FRANK F. FASI
MAYOR

LIONEL E. CAMARA
FIRE CHIEF

DONALD S.M. CHANG
DEPUTY FIRE CHIEF

February 2, 1990

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: LIONEL E. CAMARA, FIRE CHIEF

SUBJECT: OCEANIC INSTITUTE MASTER PLAN FOR THE CENTER FOR APPLIED AQUACULTURE, MAKAPUU POINT, OAHU

We have reviewed the subject material provided and have no comments.

Should you have any questions, please contact Battalion Chief Michael Zablan of our Administrative Services Bureau at 943-3838.

Lionel E Camara

LIONEL E. CAMARA
Fire Chief

MZ:ny

Copy to: The Oceanic Institute
Marvin T. Miura, Ph.D., Director

PB 90-107

February 6, 1990

MEMO TO: DONALD CLEGG, DIRECTOR
DEPARTMENT OF GENERAL PLANNING

FROM: HERBERT K. MURAOKA
DIRECTOR AND BUILDING SUPERINTENDENT

SUBJECT: THE OCEANIC INSTITUTE MASTER PLAN FOR
THE CENTER FOR APPLIED AQUACULTURE
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

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

Should there be any questions, please have your staff contact Douglas Collinson at local 6375.

HERBERT K. MURAOKA
Director and Building Superintendent

DC:jo
cc: J. Harada
The Oceanic Institute
Off. of Environ. Quality Control

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

February 9, 1990

MEMORANDUM

TO: Marvin T. Miura, Ph.D., OEQC

FROM: Don Hibbard, Director, Historic Preservation Program

SUBJECT: Review of The Oceanic Institute Master Plan for the Center for Applied Aquaculture
Makapuu, Koolaupoko, O'ahu
TMK: 4-1-14: 04

Thank you for forwarding this DEIS for our review and comment.

We found when reviewing the Environmental Assessment for this project that an archaeological reconnaissance had been carried out and no historic sites were left on the property. The original grading in 1962, done prior to passage of Hawaii's historic preservation law, destroyed any sites which may have been there.

We believe the current project will have "no effect" on significant historic sites.

DON HIBBARD

cc: The Oceanic Institute

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

FRANK F. FASI
MAYOR

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

C. MICHAEL STREET
DEPUTY DIRECTOR

In reply refer to:
ENV 90-30(449)

February 12, 1990

MEMORANDUM

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: SAM CALLEJO, DIRECTOR AND CHIEF ENGINEER

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
THE OCEANIC INSTITUTE MASTER PLAN FOR THE CENTER
FOR APPLIED AQUACULTURE (TAX MAP KEY: 4-1-14: 04)

We have reviewed the subject DEIS and have the following comments:

1. There are no municipal sewers in the area and none are planned in the near future.

2. We do not have drainage comments at this time.

SAM CALLEJO
Director and Chief Engineer

cc: OEQC
The Oceanic Institute (Robert Rowland)

DEPARTMENT OF TRANSPORTATION SERVICES

CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR

JOSEPH M. MAGALDI, JR.
DEPUTY DIRECTOR

TE-442
PL90.1.032

February 14, 1990

MEMORANDUM

TO: DONALD A CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: ALFRED J. THIEDE, DIRECTOR

SUBJECT: OCEANIC INSTITUTE MASTER PLAN
DRAFT ENVIRONMENTAL IMPACT STATEMENT
TMK: 4-1-14: 04

This is in response to a letter received on January 24, 1990 from the Office of Environmental Quality Control requesting our comments on the subject project.

The proposed project will access Kalanianaole Highway, a State facility. Therefore, we have no comments to offer at this time.

Should you have any questions, please contact Mike Oshiro of my staff at Local 5031.

(for) ALFRED J. THIEDE

cc: The Oceanic Institute
Office of Environmental Quality Control

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

FRANK F. FASI
MAYOR

BENJAMIN B. LEE
CHIEF PLANNING OFFICER

ROLAND D. LIBBY, JR
DEPUTY CHIEF PLANNING OFFICER

MM/DGP 1/90-234

February 20, 1990

MEMORANDUM

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: BENJAMIN B. LEE, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR THE OCEANIC INSTITUTE MASTER PLAN FOR THE CENTER FOR APPLIED AQUACULTURE

We reviewed the Draft EIS and offer the following comments with regard to the preparation of the Final EIS.

1. The section on "City and County of Honolulu Land Use Regulation" should indicate that the subject site is designated for Preservation on the Koolaupoko Development Plan Land Use Map.

2. The report should elaborate on the extent of effluent discharge, well drilling, cut and fill, and traffic which would result from the project.

3. It should also be more definitive in terms of the shoreline setback variances that would be necessary.

Thank you for the opportunity to comment on this matter.

BENJAMIN B. LEE
Chief Planning Officer

BBL:lh

cc: OEQC
The Oceanic Institute

APPLIED ANALYSIS INC.
P.O. BOX 10631
HONOLULU, HAWAII 96816-0631
(808) 735-9938

March 26, 1990

Benjamin B. Lee
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Lee:

This letter is a response to your comments on the Draft Environmental Impact Statement (DEIS) for the Oceanic Institute Master Plan for the Center for Applied Aquaculture submitted to the Department of Land Utilization.

1. The EIS has been amended to include the Koolaupoko Development Plan Land Use Map designation for the project site.
2. Cut and fill figures for the project have been included in the Final EIS in sec. 10.8 of the Appendix. One new dispersion well will be drilled in accordance with Department of Land and Natural Resource regulations and the Department of Health Underground Injection Control program. The extent of effluent discharge is presented in sec. 4.2 on page 31 of the Draft EIS. The traffic impacts of the project are presented in sec. 4.5 on page 33 of the Draft EIS.
3. No shoreline setback variances will be required for the project.

Thank you for your comments,

Robert Rowland

Robert Rowland
Applied Analysis, Inc.

cc: The Oceanic Institute
DLU

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU
1455 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96814 • AREA CODE (808) 943-3111

FRANK F. FASI
MAYOR

HAROLD KAWASAKI
CHIEF

OUR REFERENCE SS-LK

February 26, 1990

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: HAROLD KAWASAKI, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) -
THE OCEANIC INSTITUTE MASTER PLAN FOR THE CENTER FOR APPLIED AQUACULTURE, MAKAPUU POINT, OAHU,
TAX MAP KEY: 4-1-14:04

We have reviewed the DEIS for the above-referenced project and do not foresee this development having a major impact on police services in the area.

Thank you for the opportunity to provide comments.

HAROLD KAWASAKI
Chief of Police

By
JOSEPH AVEIRO
Assistant Chief of Police
Support Services Bureau

cc: Robert Rowland
Marvin T. Miura, Ph.D.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

February 27, 1990

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR THE OCEANIC INSTITUTE MASTER PLAN FOR THE CENTER FOR APPLIED AQUACULTURE, MAKAPUU POINT, OAHU

We have the following comments on the proposed project:

1. The pipe size of the Board of Water Supply main from which the 4-inch water main is connected as stated on pages 16 and 34 of the report is erroneous and should be corrected from 32-inch to 30-inch.

2. In order to determine the adequacy of the existing 4-inch meter serving the facility, we request that present and future water demands be stated separately in terms of gallons per minute (gpm) and gallons per day (gpd). If the meter needs to be enlarged, construction plans should be submitted for our review and approval.

3. The availability of additional water for future expansion of the facility will be determined when the building permit application is submitted for our review and approval. If water is made available, the developer will be assessed the applicable water system facilities and meter charges.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

4. Plans should be coordinated with the Honolulu Fire Department to determine the adequacy of on-site and off-site fire protection requirements.

If you have any questions, please contact Lawrence Whang at 527-6138.

cc: The Oceanic Institute
c/o Applied Analysis, Inc.
Robert Rowland

Marvin T. Miura, Ph.D.
Director
Office of Environmental Quality Control

APPLIED ANALYSIS INC.
P.O. BOX 10631
HONOLULU, HAWAII 96816-0631
(808) 735-9938

March 26, 1990

Mr. Kazu Hayashida
Manager and Chief Engineer
Honolulu Board of Water Supply
Beretania Street
Honolulu, Hawaii

Dear Mr. Hayashida:

This letter is in response to your memo to the Department of Land Utilization concerning the Draft Environmental Impact Statement for the Oceanic Institute Master Plan for the Center for Applied Aquaculture at Makapuu Point.

1. The description of the Board of Water Supply main has been changed from 32 inch to 30 inch throughout the Final EIS.
2. Present and future water demands are now stated in terms of both gallons per day and gallons per minute in the Final EIS.

Thank you for your comments,

Robert Rowland

Robert Rowland
Applied Analysis, Inc.

cc: The Oceanic Institute
DLU

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-00

ENV 2-1
JA/G

William A. Bonnet
Manager
Environmental Department

February 28, 1990

City and County of Honolulu
Department of Land Utilization
Environmental Affairs
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Sir:

Subject: Draft Environmental Impact Statement (EIS) for the Oceanic Institute Master Plan for the Center for Applied Aquaculture

We have reviewed the subject EIS and have the following comment:

We have provided a marked up copy of the proposed development site plan that indicates the location of our existing electrical overhead facilities in the property area (noted in red in Attachment). As noted HECO has an existing line adjacent to the proposed development. However, the effect of this project on the line should be minimal.

Sincerely,

William A. Bonnet

Attachment

cc: Robert Rowland
The Oceanic Institute

Marvin T. Miura, Ph.D.
Office of Environmental Quality Control

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET, 5TH FLOOR
HONOLULU, HAWAII 96813
PHONE: 523-4427 • FAX 527-5498

FRANK F. FASI
MAYOR

MICHAEL N. SCARFONE
DIRECTOR

RONALD B. MUN
DEPUTY DIRECTOR

March 6, 1990

Mr. Donald Clegg, Director
Department of Land Utilization
Environmental Affairs
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Subject: Draft Environmental Impact Statement
The Oceanic Institute Master Plan
for the Center for Applied Aquaculture

Thank you for the opportunity to review the Draft EIS for the Oceanic Institute Master Plan for the Center for Applied Aquaculture.

We have no comments at this time. We will retain a copy of the Draft EIS for our files.

Sincerely,

MICHAEL N. SCARFONE
Director

cc: Applied Analysis, Inc.
Office of Environmental
Quality Control

JOHN WAIHEE
GOVERNOR

YUKIO KITAGAWA
CHAIRPERSON, BOARD OF AGRICULTURE

SUZANNE D. PETERSON
DEPUTY TO THE CHAIRPERSON

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

FAX: 548-6100

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822-0159

March 6, 1990

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

Dear Mr. Clegg:

Subject: Draft Environmental Impact Statement (DEIS) for
The Oceanic Institute Master Plan for the Center
for Applied Aquaculture
The Oceanic Institute
TMK: 4-1-14: 4 Waimanalo, Oahu
Area: 56 acres

The Department of Agriculture has reviewed the subject DEIS and has no comments to offer.

Thank you for the opportunity to comment.

Sincerely,

Yukio Kitagawa

YUKIO KITAGAWA
Chairperson, Board of Agriculture

cc: The Oceanic Institute ✓
Office of Environmental Quality Control

Island Fresh

JOHN WAIHEE
GOVERNOR

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) 543-6841

IN REPLY REFER TO:

90:PLNG/1081 jt

March 7, 1990

MEMORANDUM

TO: Department of Land Utilization,
Environmental Affairs

FROM: Joseph K. Conant

SUBJECT: Draft Environmental Impact Statement for the Oceanic Institute Master Plan for the Center for Applied Aquaculture

Thank you for the opportunity to review the subject draft EIS. We have no comments to offer.

JOSEPH K. CONANT
Executive Director

cc: Robert Rowland, Oceanic Institute
Dr. Marvin Miura, OEQC (with enclosed EIS)

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

March 7, 1990
RE:0549

Environmental Affairs
Department of Land Utilization
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Sirs:

Draft Environmental Impact Statement (EIS)
Oceanic Institute Master Plan
(The Center for Applied Aquaculture)
Makapuu Point, Oahu

The referenced document describes anticipated impacts of construction and continued operations of an $11 million state and federally funded project.

Our review was prepared with the assistance of Yu-Si Fok, Water Resources Research Center; Christopher Brown, Hawaii Institute of Marine Biology; and Robert Irwin, Environmental Center.

Coastal Flood Hazard Zone

Our reviewers note that the portion of the site below 20 feet elevation is located in the Coastal High Hazard District, and the entire site falls within the tsunami inundation map. It is advisable that any exotic species being housed at the Center should be kept in tanks above 20 ft. elevation to reduce the risk of inadvertent introduction to the Hawaiian marine environment in the event of a combined high tide and very high surf. Shrimp tanks, which may contain "IHHN" virus, probably should be housed above this level. In addition, mitigative measures for possible tsunami inundation should be considered and documented.

IHHN Virus Management

A persistent problem in extant shrimp aquaculture facilities in Hawaii, IHHN virus should be anticipated, planned for, and carefully monitored. Mitigative measures should be implemented to contain the spread of the virus. Actions such as isolating infested modules and treating them to

prevent releasing the virus into nearshore waters are recommended. It would appear from the information listed under "Disposal" on page 11 that planning in this area is underway.

Saltwater Intake, Dispersion, and Discharge Infrastructure

Several important aspects of the proposed salt water system remain unclear:

> page 10: "The salt water system will supply a maximum of 3,000 gallons per minute (gpm)."
>
> page 16: "Salt water is [currently] produced from three sources: the OI salt water well (1160 gpm); the SLP training facility salt water well (230 gpm); and the SLP reef tank wells (30 gpm)."

The combined salt water output of the 3 existing sources is only 1420 gpm; this leaves a difference of 1580 gpm between the maximum expected rate of production and current production rates. Are new wells to be constructed? If so, they should be located on the project map and discussed in the Draft EIS. Locations of any new wells along the coastline should be made available for public review at the draft stage of the document.

Also, how can the large potential increase in influx salt water (1580 gpm) be reconciled with the minimal (10 percent) efflux increase projected? Locations of the planned subsurface "dispersion wells" for discharged waters should be disclosed. Discharge of chemical and biological constituents, and their subsequent emergence in coastal waters could have significant implications for nearshore marine ecosystems.

Thank you for this opportunity to comment on this document.

Yours truly,

John T. Harrison, Ph.D.
Environmental Coordinator

cc: OEQC
Robert Rowland, Oceanic Institute ✓
L. Stephen Lau
Yu-Si Fok
Christopher Brown
Robert Kai Irwin

APPLIED ANALYSIS INC.
P.O. BOX 10631
HONOLULU, HAWAII 96816-0631
(808) 735-9938

March 26, 1990

John T. Harrison, Ph.D.
University of Hawaii Environmental Center
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Mr. Harrison:

This letter is a response to your comments to the Department of Land Utilization on the Draft Environmental Impact Statement (DEIS) for the Oceanic Institute Master Plan for the Center for Applied Aquaculture.

Coastal Flood Hazard Zone

The federal grant for this project prohibits use of federal funds for construction in federally designated flood hazard zones. Therefore, no construction is planned in areas designated Zone AE and Zone VE in the Flood Insurance Rate Map (FIRM). Land beneath any structures on the Master Plan now in Zone AE will be filled to above 20 feet. The EIS has been amended to include reference to the Civil Defense Tsunami Inundation Map designation for the project site. The EIS also now includes a statement that all exotic species will be contained above the 20 foot elevation. Tsunami inundation mitigation will consist of evacuating employees in the event of a tsunami warning.

IHHN Virus Management

State Department of Agriculture Animal Quarantine Branch specifications for disease are followed rigorously at the Oceanic Institute. Shrimp are regularly inspected by Dr. Jim Brock, State of Hawaii Aquatic Veterinarian. All discharge of possible virus infected water is strictly controlled. The Center for Applied Aquaculture will continue these practices. Shrimp hatchery and maturation effluent is directed to a dispersion well. Dye tests have shown the dispersion wells have no direct communication with the ocean.

Saltwater Intake, Dispersion, and Discharge Infrastructure

The 3,000 gpm figure for the salt water system is for source design purposes. The source system is over-designed to handle peak usage, such as simultaneous tank or pond filling. The discharge system will be designed to handle peak effluent flows in excess of the projected average gpm flow. The projected effluent flow remains at 10% over present levels.

There may be no need for additional water supply wells as the increased supply may come from existing Sea Life Park sources. The Oceanic Institute has an agreement with Sea Life Park for source water.

No new water supply wells have been sited to date for this project. Any future proposed water supply wells in the shoreline area will be implemented through the normal regulatory process at the federal, state, and local levels.

Any new wells on Oceanic Institute property will be constructed according to Department of Land and Natural Resources regulations and appropriate well drilling and operation permits will be sought from the Department of Health Underground Injection Control Program at the appropriate time. One additional dispersion well has been preliminary sited for this project.

No harmful chemical or biological constituents will be discharged into the ocean or dispersion wells. As mentioned above, dye tests have shown the dispersion wells have no direct communication with the ocean.

The DEIS has been amended to reflect your comments.

Thank you,

Robert Rowland

Robert Rowland
Applied Analysis, Inc.

cc: DLU
The Oceanic Institute

LU 3/90 1642

JOHN WAIHEE
GOVERNOR

MARVIN T. MIURA, PH.D.
DIRECTOR

TELEPHONE NO.
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

March 8, 1990

Environmental Affairs
City and County of Honolulu
Department of Land Utilization
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Sir:

Subject: Comments on the Oceanic Institute Master Plan for the Center for Applied Aquaculture

The following are our comments for your consideration:

- On page 17, the flow rate in the table entitled "Oceanic Institute Tank Inventory" is mislabeled as 1/min. Please use the correct units for the flow rate.

- The site plan does not show the location of the waste water treatment plant, the ocean discharge, or the dispersion wells. These should be identified on the site plan.

- The EIS should discuss the effects of the ocean discharge. The bay in which the Makai Pier is located is used by fishermen and by children learning to surf. The ocean discharge could have an effect upon these activities.

Thank you for providing us this opportunity to review this EIS.

Sincerely,

Marvin T. Miura, Ph.D.
Director, Office of Environmental Quality Control

APPLIED ANALYSIS INC.
P.O. BOX 10631
HONOLULU, HAWAII 96816-0631
(808) 735-9938

March 26, 1990

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

Dear Mr. Miura:

This letter is a response to your comments to DLU on the Draft Environmental Impact Statement for the Oceanic Institute Master Plan for the Center for Applied Aquaculture.

Tank flow rate labeling

The labeling for the flow rates in the Tank Inventory table is now correctly labeled as L/min (liters per minute).

Site plan

The site plan in the Final EIS now includes the location of the dispersion wells. The ocean discharge culvert is shown on the grading and drainage plan in sec. 10.8 of the Appendix. Waste water treatment is labeled WT on the site plan in the Draft and Final EIS.

Effects of ocean discharge

The effects of the ocean discharge are discussed in sec. 4.2.2 on page 31 of the Draft EIS. The Oceanic Institute has discharged aquaculture effluent into the ocean at this location for over 15 years with no observable impact on the water quality or recreational activities. The small increase in volume and slight change in effluent constituents is negligible.

Sincerely,

Robert Rowland

Robert Rowland
Applied Analysis, Inc.

cc: The Oceanic Institute
DLU

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432

FRANK F. FASI
MAYOR

DONALD A. CLEGG
DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

89/SMA-60(BWM)

March 9, 1990

Mr. Robert Rowland
Applied Analysis, Inc.
P. O. Box 10631
Honolulu, Hawaii 96816-0631

Dear Mr. Rowland:

Comments on Draft Environmental Impact Statement (EIS)
Center for Applied Aquaculture, Makapuu Point, Oahu
Tax Map Key: 4-1-14: 04

We have reviewed your DEIS and have the following comments, questions, and recommendations:

1. Underground Injection of Effluent

The "List of Permits or Approvals" should note that modification to the Underground Injection Control (UIC) permits issued by the State Department of Health (DOH) will be needed. Describe the changes, in terms of volume flow and content (suspended solid and biological oxygen demand). Indicate if additional injection wells will be needed. A discussion on the impact of underground injection of effluent should appear in Chapter 4.

2. Sanitary Waste Disposal

You have noted that sanitary wastes will be disposed via the use of cavitette treatment units and the effluent disposal discharged through two dispersion wells. We are not familiar with the treatment systems you have named, and recommend that you provide a description of the process involved with the waste disposal. We assume that you are proposing an individual wastewater disposal system with secondary treatment capability. If this is so, we recommend you note this in the Final EIS.

You should also note the typical existing and proposed volume and content (suspended solid and biological oxygen demand) of the sanitary wastes.

3. Aquaculture Effluent Disposal into the Ocean

The EIS should note the NPDES permits already in place for the project, and whether modification to these permits will be necessary.

You have noted that aquaculture effluent disposal will be by permitted dispersion wells in conjunction with limited surface discharge into the ocean. It is unclear how this will work. Is the aquaculture effluent now being discharged primarily through the dispersion wells? In what cases will the aquaculture effluent be discharged on the surface to the ocean? What are the filtration and purification methods used to render the aquaculture discharge harmless? Describe how the oxidation pond fits into the aquaculture effluent disposal process.

4. Grading and Drainage

The Final EIS should contain a grading and drainage analysis. While it is not necessary to have an analysis in copious engineering detail, generalized estimates of the cut and fill volume (perhaps to the nearest 1,000 cubic yards) and a flow volume (perhaps to the nearest 100 cubic feet per second) should be included.

You should include a topographic map, clearly showing elevation contours, in the Final EIS. The topographic base map used with the Flood Hazard Zone figure is too difficult to read. Existing elevation contours should be shown with dotted lines, final elevation contours should be shown with solid lines. Drainage swales, lines, sedimentation basins, and outlets should be shown on this figure.

5. Salt Water System

The Final EIS should show the location of the three salt water intake wells. It would also be helpful to provide a figure showing the system's pipe, pre-treatment, storage, distribution, and disposal components.

6. Fresh Water System

The Final EIS should note the projected fresh water consumption.

7. Escape of Exotic Species

As requested by the U.S. Army Corps of Engineers, a discussion of the potential and hazards of escape of exotic species should be discussed.

8. Site Plan

The site plan should clearly delineate the entire Oceanic Institute property, the portion where development is proposed, and the Hawaiian Home Lands property.

9. View Analysis

The Final EIS should relate the project's impact upon Kalanianaole Highway's "continuous coastal views" as described in the City's "Coastal View Study." We suggest that cross-sectional profiles be drawn for typical views from the highway in both the westbound and eastbound directions. The text of this section should also address both the westbound and eastbound highway views.

If you have any questions regarding this letter, please call Bennett Mark of our Environmental Affairs Branch at 527-5038.

Very truly yours,

Donald Clegg

DONALD A. CLEGG
Director of Land Utilization

DAC:sl
0284N

APPLIED ANALYSIS INC.
P.O. BOX 10631
HONOLULU, HAWAII 96816-0631
(808) 735-9938

March 26, 1990

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

Dear Mr. Clegg:

This letter is a response to your comments, questions, and recommendations on the Draft Environmental Impact Statement (DEIS) for the Oceanic Institute Master Plan for the Center for Applied Aquaculture.

1. Underground Injection of Effluent

Sec. 7 Government Approvals has been amended to include an Underground Injection Control permit for an additional injection well and permit modification for the existing injection wells if they handle additional flows.

Sec. 6.2.4 Well Drilling on page 37 of the Draft EIS states that new injection wells will be approved by the Underground Injection Control program before they are constructed.

One additional injection well will be required by this project. It will handle the secondary treated sanitary wastes from the new administrative complex on the west end of the project site.

Sec 4.2.2 Operation (Water) on page 31 of the Draft EIS states "There are no discernible impacts to the marine receiving waters at the shoreline discharge or to the underlying groundwater resource under existing or planned discharge conditions."

The underground dispersion wells are now described in more detail in sec. 3.3 Water on page 16 of the Final EIS.

2. Sanitary Waste Disposal

A description of the dispersion well system is provided in sec. 3.3 Water on page 16 of the Final EIS. The existing cavitette system of sanitary waste disposal is described in sec. 3.3 Water on page 16 of the Final EIS. The proposed sewage treatment system is described in sec. 4.11 Sanitary Waste Disposal on page 35 of the Final EIS. A diagram of the proposed sewage treatment system is in the Appendix sec. 10.9.

The sanitary waste volume will increase by approximately 2,000 gallons per day (100% increase over current levels). The content of the treated effluent is expected to meet these DOH requirements:

- BOD5: less than 30 mg/l
- Suspended solids: less than 30 mg/l
- Chlorine residuals: greater than 0.1 mg/l

An extended aeration system providing secondary treatment is planned. It will include:

- trash/grease trap
- aerobic unit with clarifier
- sludge aeration tank
- chlorinator and chlorine contact tank
- surge tank

The wastes to be generated are expected to be of a standard domestic nature. No industrial/chemical wastes are expected. Levels of BOD5 and suspended solids are expected to be within these ranges:

- BOD5: 400 to 110 mg/l
- Suspended solids: 350 to 100 mg/l

3. Aquaculture Effluent Disposal into the Ocean

Sec. 6.2.6 Department of Health - NPDES on page 38 of the Draft EIS states that an NPDES permit will not be required for this project. The Oceanic Institute is not required to be permitted to discharge to Class AA water under the NPDES system because OI is a facility conducting oceanographic and scientific experimentation. The Department of Health has inspected the surface discharge and has indicated it will continue to be exempt from permitting.

Sec. 3.3 Water on page 16 of the Draft EIS states that all but 120 gpm of the salt water used is discharged into the ocean through a culvert under the highway.

Aquaculture effluent will be discharged on the surface to the ocean at approximately the same rate as present.

The existing and proposed aquaculture effluent is harmless. The statement on page 11 about filtration and purification refers to possible future projects that may be required to treat their effluent at the module level.

Sec. 3.3 Water paragraph 4 on page 16 of the Draft EIS contains a description of how the oxidation pond functions in the effluent disposal process.

4. Grading and Drainage

The Final EIS contains a grading and drainage analysis in sec. 10.8 of the Appendix. A topographic map clearly showing existing and final elevations, flood hazard zones, drainage swales, outlets, flow volumes, and estimated earthwork quantities is included.

5. Salt Water System

The location of the salt water wells is shown on the Master Plan in the Final EIS. A figure showing the components of the salt water system is unavailable because final design drawings are not complete.

6. Fresh Water System

The Draft EIS states in sec. 4.10.1 Fresh Water Usage on page 34 "the projected fresh water consumption at full operation of the project as 40,000 gallons per day with a one day maximum consumption of 60,000 gpd."

7. Escape of Exotic Species

The Draft EIS contains a discussion of exotic animal species in sec. 4.4.2 Future (Animals) on page 33.

8. Site Plan

The fold-out site plans inserted between pages 4 and 5 of the Draft EIS clearly shows the property boundary, the extent of development (the structures, tanks, and roads illustrated), and the Hawaiian Homes Land property (the line bounding the strip of bushes parallel to the highway, also described on page 5). The Final EIS contains a tax map showing the portion of the property where development is proposed and a site plan with the Hawaiian Homes Land boundary labeled.

9. View Analysis

The project will not impact "continuous coastal views" from Kalanianaole Highway. Traffic in either direction will have unimpeded views of the coast and the ocean. The landward view from the highway will be slightly altered by the construction of a landscaped berm and low buildings.

The Draft EIS contains a textual description of the visual setting at Makapuu in sec. 3.7 Visual on page 26 and a textual discussion of the visual impact of the project in sec. 4.6 Visual on page 33.

Sec. 10.7 in the Appendix contains a view study with overlaid sketches of views in the westbound and eastbound directions from the highway. Drawings 1 and 2 describing the landscape screen contain a textual description and diagram of both the westbound and eastbound highway views and a cross-sectional profile of a typical view from the highway.

The view from the highway traveling in each direction is almost a mirror image (see drawings 1 and 2) because of the high points on both ends of the curve that provide a partial view of the sight and the low point at the middle of the curve where the drivers vision is of the landscaped berm and then directed outward toward the ocean.

The westbound and eastbound direction view studies have been labeled in the Final EIS.

Sincerely,

Robert Rowland

Robert Rowland
Applied Analysis Inc.

cc: The Oceanic Institute