June 30, 1975

MEMORANDUM

TO: Honorable John Farias, Director
Department of Agriculture

SUBJECT: Acceptance of Final Environmental Impact Statement
for an Agricultural Park on Oahu at Pohakea in Kunia, Oahu

Based upon the recommendation of the Office of Environmental Quality Control, I am pleased to accept the subject document as satisfactory fulfillment of the requirements of Chapter 343, Hawaii Revised Statutes and the Executive Order of August 23, 1971. This environmental impact statement will be a useful tool in the process of deciding whether or not the action described therein should or should not be allowed to proceed. My acceptance of the statement is an affirmation of the adequacy of that statement under the applicable laws, and does not constitute an endorsement of the proposed action.

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

George Ariyoshi

bcc: Hon. Richard Marland
✓ Environmental Quality Commission

FINAL
ENVIRONMENTAL IMPACT STATEMENT
for an
AGRICULTURAL PARK ON OAHU
at
POHAKEA IN KUNIA

for the

DEPARTMENT OF AGRICULTURE
State of Hawaii

DECEMBER 1973 and MARCH 1975

PREPARED BY: HENRY A. ALEXANDER & COMPANY, INC.
MANAGEMENT CONSULTANTS

STATE OF HAWAII
DEPARTMENT OF AGRICULTURE
HONOLULU, HAWAII

May 20, 1975

MEMORANDUM

TO: Kunia Agricultural Park Steering Committee
and Interested Individuals, Agencies and Organizations

RE: Final Environmental Impact Statement (E.I.S.) for an Agricultural Park on Oahu at Pohakea in Kunia.

Attached for information and retention is a copy of the Final E.I.S. recently completed by the consultant firm, Henry A. Alexander & Company, Inc. This Final E.I.S. is a follow-up to a Draft E.I.S. completed in August 1973 and a Supplement to the Draft E.I.S. completed in December 1973, both of which were sent to interested recipients in January 1974. The Draft E.I.S., its Supplement and Final E.I.S. deal only with the Pohakea site which, in 1974, was again leased to Oahu Sugar Company for an additional six and one-half years for the cultivation of pineapple. The Pohakea site, therefore, was dropped in 1974 for the first incremental planning phase of an agricultural park in Kunia. The current or new site area, comprising approximately 600 acres now in sugarcane, is located alongside the Pohakea site and is similar in terrain and shape. Section V of the attached Final E.I.S contains a map showing the location of both sites.

To date, the Legislature has made two appropriations totaling $4,000,000 for land, design and construction of statewide agricultural parks. A portion of another appropriation totaling $5,000,000 can be utilized for on-and-off site construction of water facilities at agricultural parks.

Negotiations for State leasing of the new park site at Kunia are in the final stage and should be completed shortly. The Governor has authorized Department of Agriculture to proceed with the preliminary engineering phase at the site, as soon as leasing negotiations are completed. The estimated time for the Kunia Agricultural Park to be fully developed is 36 months. When fully developed, negotiations for a second incremental site will hopefully be in the final stage of completion to accommodate more farmer leasees.

Your patience, assistance and support in planning and development of the agricultural park project is appreciated. As new developments occur, we will keep you informed.

John Farias, Jr.
Chairman, Board of Agriculture

ctt

Attachment: Final E.I.S.

SECTIONAL INDEX FOR ENVIRONMENTAL IMPACT STATEMENT

CROSS-REFERENCE GUIDE FOR THE SUPPLEMENT TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

Topic in Supplement	Page Number in Draft EIS	Page Number in Supplement
Constraints and Conditions	i, v	3
Underlying Geology	16	5
Soil Characteristics	13	6
Water	15, 23	9
Animal Waste Management	24	14
Agricultural Park Management	7	19
Construction Period	21	21
Social and Economic Factors	52	21
Energy Relationships	51	27
Miscellaneous Comments	Section II of EIS	30
Alternatives	48	32
Need for Followup	"Conceptual Design"*	34
Revised Detailed Plan	"Conceptual Design"*	35

*These topics were discussed at length in the Conceptual Design and Cost Comparisons for an Agricultural Park on Oahu, published in August, 1973

STUDY FOR AN AGRICULTURAL PARK ON OAHU

DRAFT ENVIRONMENTAL IMPACT STATEMENT

RESPONSIBLE OFFICE: DEPARTMENT OF AGRICULTURE, STATE OF HAWAII

STATE ACTION

SUMMARY:

The Pohakea site in the Kunia area of the Waianae mountains is recommended for the proposed agricultural park. Projected diversified agricultural ventures in the first phase include dairies, swine, poultry, feedlot, and meat packing, vegetable growers, and nursery operations. Expected impacts include:

1. support for diversified agriculture and a step toward prevention of urbanization of agricultural lands;
2. some changes in use of the land, roads, and water; and
3. a significant amount of animal wastes to be utilized or disposed of.

The major impact would result from animal waste management. Concern over infiltration of inorganic salts into ground water may be the factor which determines choice of waste management techniques and hence cost. Costs for waste management will be the major influence on economic viability of the project.

Alternative sites were evaluated and a site at Kahuku is second choice. Both the Pohakea and the Kahuku sites are zoned and general planned by the City and County of Honolulu and the State of Hawaii for agricultural use.

TABLE OF CONTENTS

TABLE OF EXHIBITS

INTRODUCTION

This Draft Environmental Impact Statement was prepared to fulfill one requirement of the Contract for Economic Planning and Conceptual Design Services, dated February 15, 1973, between the Department of Agriculture, State of Hawaii, and Henry A. Alexander & Company, Inc. This contract calls for preparation of:

1) a Preliminary Site Selection Study for an Agricultural Park on Oahu;

2) Conceptual Design of the Park;

3) Environmental Impact Statement

A further requirement of the project is that the tasks should be completed by making use of available data and opinions in lieu of original research and investigation.

After completion of item 1, the Preliminary Site Selection Study, in which a site at Kunia on State land adjacent to Wheeler Field was the preferred location, this land was again leased to Del Monte for an additional six and one-half years for pineapple cultivation. Accordingly, a new site on the Kunia side of the Waianae foothills was selected. It is approximately one half mile west of Kunia Road, adjacent to the forest reserve. This is the least desirable pineapple land in the area due to its dryness and steepness. The land owner, Campbell Estate, is willing to cooperate in the development of an agricultural park in this location.

The technical portion of this draft statement has been prepared by Dr. D.R.V. Golding for Henry A. Alexander & Company, Inc. Dr. Golding, while Technical Director at Dole Hawaii, has been directly concerned with all aspects of environmental impact. He participated in the Pearl Harbor Task Force and the Solid Waste Advisory Commission.

Substantial data for this draft statement is drawn from the Preliminary Site Selection Study for an Agricultural Park on Oahu, dated May, 1973, and from the Conceptual Design and Cost Comparisons for an Agricultural Park on Oahu, dated August, 1973. Henry A. Alexander & Company, Inc. prepared both reports, and was assisted by Belt, Collins & Associates, Ltd. in the latter study.

Preparation of this statement was aided greatly by the informed and enthusiastic assistance of many persons in the public, academic, and private sectors of the community as noted in the following section. Their assistance and support is gratefully acknowledged.

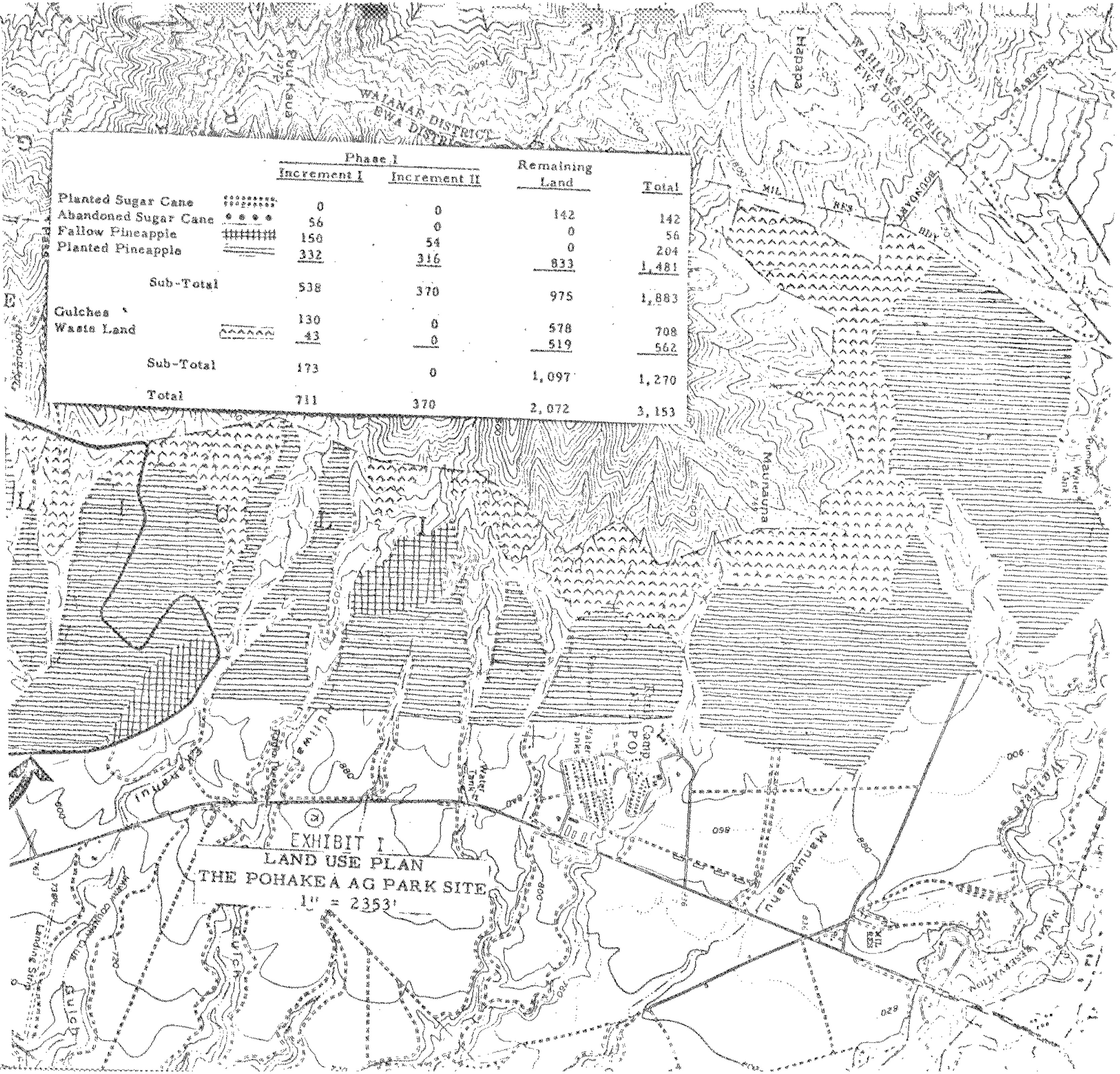
1. THE ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

1) PROJECT LOCATION

The proposed site consists of approximately 2,000 acres in the foothills of the Waianae Range adjacent to the Honouliuli Forest Reserve. The site runs more or less parallel to Kunia Road, and is bounded at the north end by Schofield Barracks, and at the south end by Oahu Sugar Company lands in sugar cane production. The map in Exhibit I shows the area involved and its location. At present, most of the land is being used by Del Monte for pineapple production. Approximately 1,000 acres would be used for the first phase of the ag park, probably beginning with those lands at the southern end of the site. The land is owned by the Campbell Estate. The trustees have agreed in principle to the concept of an agricultural park at this site.

The Pohakea site is zoned and general planned by the City and County of Honolulu and the State of Hawaii for agricultural use. The City's Oahu General Plan shows the site as agricultural, and the City's Comprehensive Zoning Code zones the site in the AG-1 restricted agricultural district. The State Land Use Commission classification is agricultural. Thus, present use of the site is restricted to agriculture as defined in the State Land Use Regulations and Comprehensive Zoning Code.

To include hogs in the ag park will require rezoning by the City and County of Honolulu Department of Land Utilization in order to change the area from AG-1 to AG-2.



	Phase I Increment I	Phase I Increment II	Remaining Land	Total
Planted Sugar Cane	0	0	142	142
Abandoned Sugar Cane	56	0	0	56
Fallow Pineapple	150	54	0	204
Planted Pineapple	332	316	833	1,481
Sub-Total	538	370	975	1,883
Gulches	130	0	578	708
Waste Land	43	0	519	562
Sub-Total	173	0	1,097	1,270
Total	711	370	2,072	3,153

EXHIBIT I
LAND USE PLAN
THE POHAKEA AG PARK SITE
1" = 2353'

2) IDENTIFICATION OF ALL FEDERAL, STATE AND LOCAL AGENCIES, OTHER ORGANIZATIONS, AND INDIVIDUALS CONSULTED IN PREPARING THE EIS.

The following is a listing of those agencies, organizations, and individuals contacted for assistance in preparation of the environmental impact statement for the agricultural park project.

FEDERAL AGENCIES

ENVIRONMENTAL PROTECTION AGENCY

Melvin K. Kotzumi - Director (New)
Charles Seeley -- Director

NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION

Saul Price -- Hydrologist

U.S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

Otis Gryde -- District Conservationist
Leslie H. Williamson -- Civil Engineer

U.S. GEOLOGICAL SURVEY

Robert Dale -- Hydrologist

U.S. NAVY -- CIVIL ENGINEERING CORPS

Capt. L. G. Timberlake -- Officer in Charge of Construction, Mid-Pacific

UNIVERSITY OF HAWAII

College of Tropical Agriculture

Duane Bartholomew - Plant Physiology
Richard Criley - Horticulture
Ruth Gay - Botany
Harris Gitlin - Agricultural Engineering
Dale Godell - Associate Director, Extension Services
Richard Green - Agronomy
William Hugh - Animal Science
Y. Kanehiro - Agronomy
James Koshi - Animal Science
Albert Martinez - Plant Pathology
Henry Y. Nakasone - Horticulture
Fred Rauch - Horticulture
Richard Stanley - Animal Science
Goro Uehara - Agronomy
C. Pearrs Wilson - Director and Dean

Land Study Bureau

Harold L. Baker - Director

School of Public Health

Nathan Burbank - Environmental Health

Water Resources Research Center

Gordon Dugan - Associate Professor
Paul Ekern - Hydrologist
Reginald Young - Assistant Director

STATE AGENCIES

DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES

KeNam Kim - Director

DEPARTMENT OF AGRICULTURE

Masao Hanaoka - Health Physicist
Roy Matsuura - Milk Commissioner

DEPARTMENT OF BUDGET AND FINANCE

Hiram Kamaka - Director

DEPARTMENT OF EDUCATION

Shiro Amioka - Director
Edward Hamasu - Staff Specialist

DEPARTMENT OF HEALTH

Dennis Lau - Environmental Planner
Henri Minette - Deputy Director
Jacqueline Parnell - Environmental Planner
Walter B. Ouisenberry, M.D. - Director
Harold Youngquist - Environmental Engineer

DEPARTMENT OF LAND AND NATURAL RESOURCES

Sunao Kido - Chairman
Herbert Yanimura - Agricultural Land Use Specialist

DEPARTMENT OF PERSONNEL SERVICES

James H. Takushi - Director

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

Shelley M. Mark - Director

DEPARTMENT OF TAXATION

Ralph W. Kondo - Director
Melvin K. Soong - Deputy Director

DEPARTMENT OF TRANSPORTATION

E. Alvey Wright - Director

OFFICE OF ENVIRONMENTAL QUALITY CONTROL

David Higa - Environmental Specialist
Richard Marland - Interim Director

CITY AND COUNTY OF HONOLULU

BOARD OF WATER SUPPLY

Richard W. K. Lum - Chief Planning, Resources, and Research Engineer
Lawrence N. Y. Whang - Head, Research and Development
George Yuen - Manager and Chief Engineer

FIRE DEPARTMENT

Boniface K. Aiu - Fire Chief

DEPARTMENT OF GENERAL PLANNING

Betsy Ross Marcincus - Staff Planner
Robert Rider - Head, Policy Planning Division
Robert R. Way - Chief Planning Officer

DEPARTMENT OF LAND UTILIZATION

George Moriguchi - Director

DEPARTMENT OF PARKS AND RECREATION

Young Suk Ko - Director

POLICE DEPARTMENT

Francis Keala - Police Chief

PUBLIC WORKS DEPARTMENT

Edward Hirata - Director and Chief Engineer

OTHER AGENCIES AND INDIVIDUALS

BISHOP MUSEUM

Dr. Roland Force - Director
Wayne Gagne - Associate Entomologist
Mary Judd - Associate Anthropologist

EGG PRODUCERS ASSOCIATION

Thomas Kakasu

HAWAII ASSOCIATION OF NURSERYMEN

Toshio Sugita - President

HAWAII FARM BUREAU

Billy Tokuda

HAWAII SUGAR PLANTERS EXPERIMENTAL STATION

Minoru Isobe - Head, Agronomy Department

PINEAPPLE GROWERS ASSOCIATION

John Tolan

PORK PRODUCERS ASSOCIATION

Calvin Wong

INDIVIDUALS

Daniel Kuhn
Edward Otsuji
David Wong, Jr.

The environmental impact statement was prepared by the firm of Henry A. Alexander & Company, Inc. with the assistance of Dr. D.R.V. Golding.

3) GOALS AND OBJECTIVES OF THE PROJECT

The Concept

The objective of the agricultural park is to strengthen diversified agriculture in Hawaii. By combining a number of relatively small, independent agricultural operations in one area, the effects of urban pressures will be minimized or eliminated and some economies of scale should be realized.

Like an industrial park, an ag park would bring together industries with common interests to jointly solve common problems. A central organization would be formed at the ag park which would provide mutual assistance and adequate controls, particularly for waste management.

The extent to which the state or the land owners should participate in financing and managing the ag park remains to be determined. The basic concept is that a suitable area of land should be dedicated to diversified agriculture for at least 50 years to make possible proper financing. Roads, drainage control, utilities, and waste management facilities would be provided. Parcels of land of appropriate size would then be made available for diversified agriculture. If the concept is successful, as expected, it can serve as a prototype for other similar developments throughout the State.

While it is planned that the State would take an active role in the management of the park at first, it is anticipated that a steering committee of farmer lessees would later take over the management of the facility, perhaps as a cooperative.

The Need

Hawaii needs as many basic, productive industries as possible to ensure a stable economy. The two largest factors in the economy, military installations and tourism, are both vulnerable to political and social change. In contrast agriculture, especially the production of food, faces a steady and apparently rising demand.

Ideally, because of our vulnerability to interruptions in shipping, Hawaii should be self-sufficient in as many foods as possible. Diversified agriculture accounts for significant parts of the food supply of vegetables, milk, eggs, beef, pork, and chicken. The more serious problems facing diversified agriculture which have led to the development of the Ag Park concept are reviewed in the Draft Report: Preliminary Site Selection Study for an Agricultural Park on Oahu (ref. 19). Briefly, these are:

1) Increased cost of capital and higher operating costs in all farming operations;

2) Additional costs to meet pollution control requirements, especially for livestock

3) Lack of tenure to amortize capital improvements such as irrigation equipment and waste disposal facilities;

4) Greater competition from low-priced imports which are grown and packed under mass production methods on the mainland;

5) Absence of additional land to meet increased demands and to take advantage of economies of scale.

The fact that there are very large and growing markets for Hawaiian agriculture has been reestablished recently by both the U. S. Department of Agriculture through the work of Howard Hogn, and the Hawaii State Department of Agriculture through studies by A. M. Dollar. On this basis, the DOA has set supply goals based on partial or full self-sufficiency; self-sufficiency meaning all consumption demands would be matched by supplies from within the state.

Illustrations of the supply and demand projections for beef, pork, eggs, chicken, milk, and vegetables are taken from ref. 10 and shown in Exhibits II - VII. These projections are based on the work of Hoag and Dollar. The DOA projections shown in these graphs are based on the results of the Oahu Ag Park, the neighbor island task forces, and other recent improvements in agriculture, while the USDA projections are based primarily on past experience and recent trends.

Exhibit VIII, taken from the Preliminary Site Selection Study, shows the estimated additional acreage needed in production to make Hawaii self-sufficient in various agricultural products.

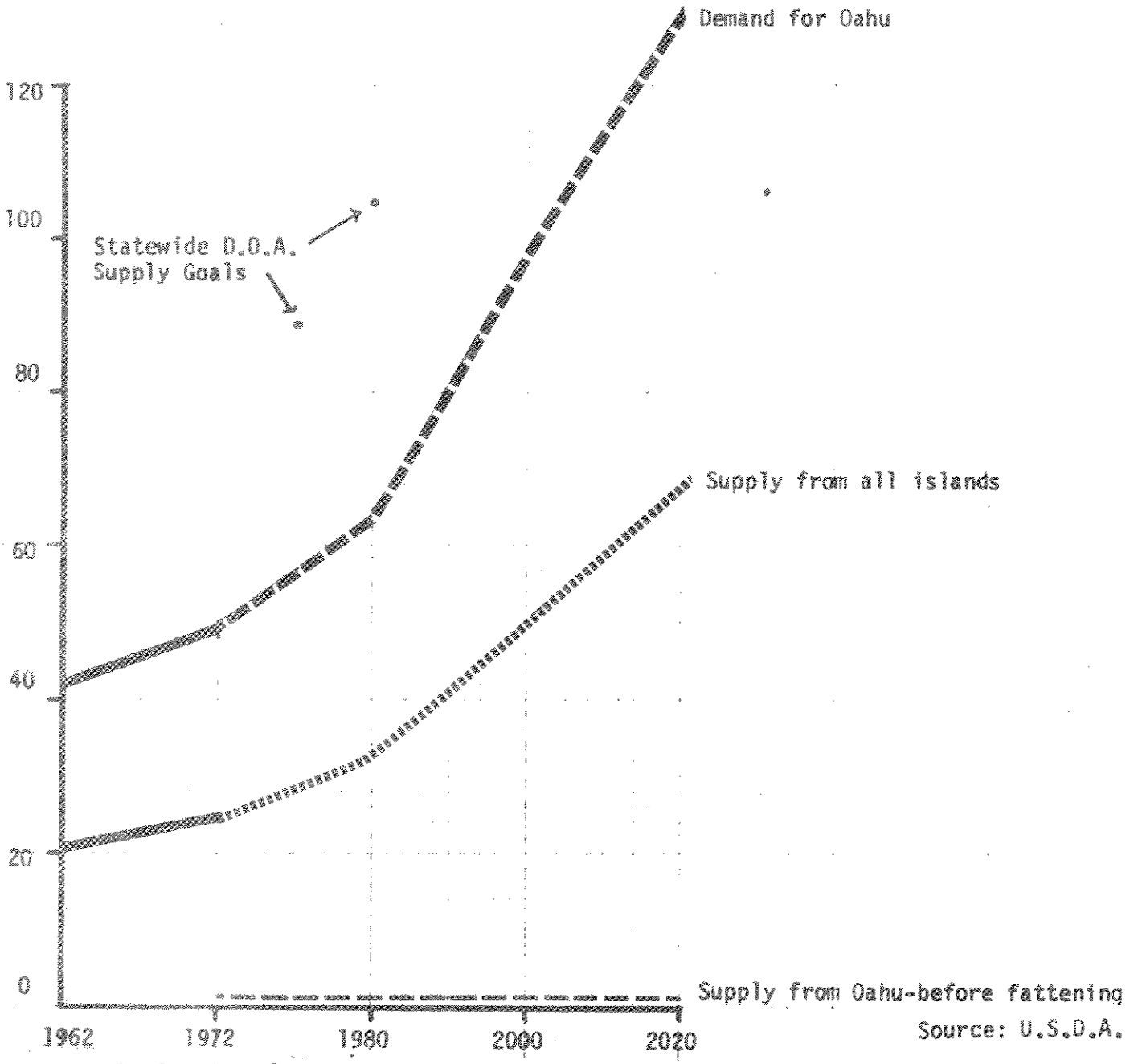
Export of agricultural products to the mainland, particularly exports of flower and nursery products, may help to replace the income Hawaii is losing in reduced pineapple shipments.

Flower and nursery growers who have been pressing for land at the Ag Park have almost doubled their production between 1969 and 1972 (up to $7.0 million from a $3.9 million level.) Projections for this industry are that annual sales will more than double again to $19.0 million by 1980. Expansion is expected to take place in the export market - both domestic and foreign.

In addition to providing physical facilities suitable for diversified agriculture, at least one other factor is essential for success of the project--namely, viable economics. The costs for a farmer to establish and maintain his operation within the

EXHIBIT II

BEEF SUPPLY AND DEMAND PROJECTIONS, OAHU, 1962 - 2020



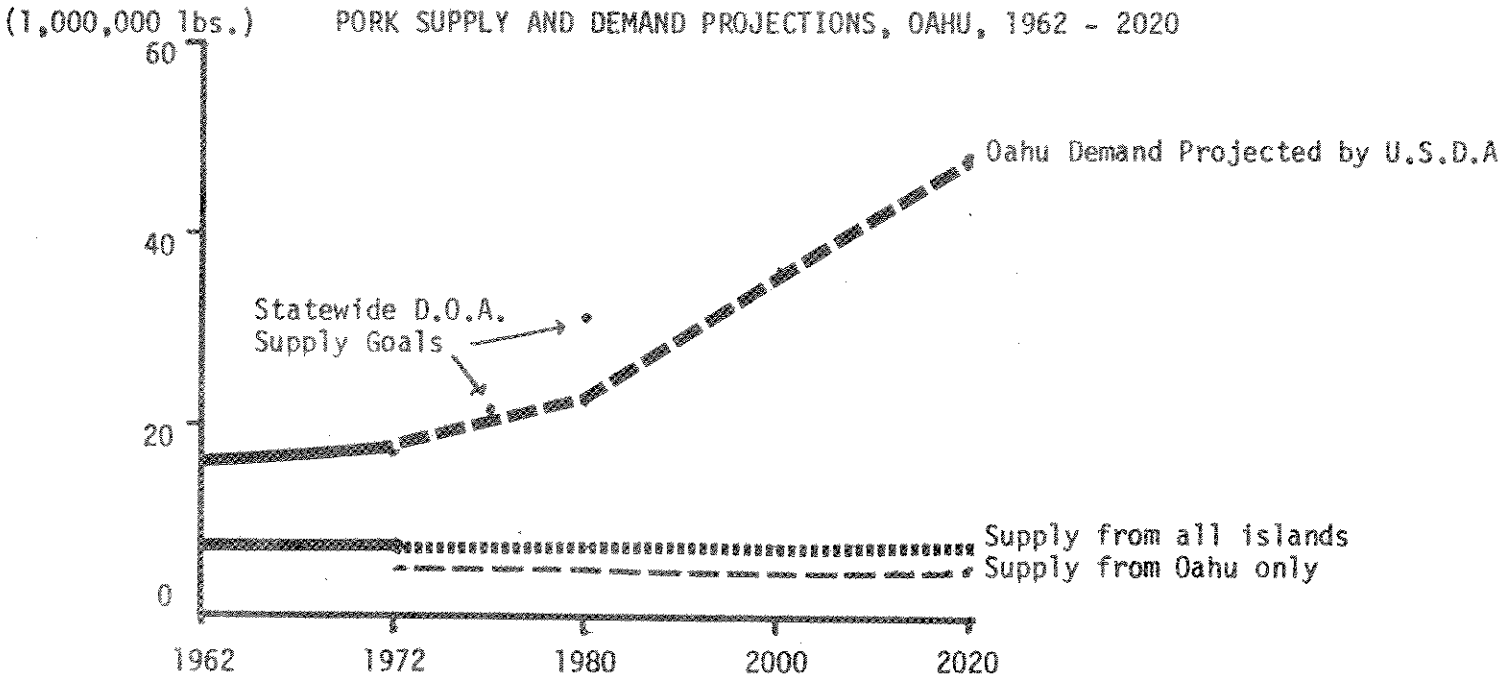
Beef and Veal

Hawaii per capita consumption of beef and veal was 80.66 pounds in 1971. This compares to a U.S. mainland level of 115.7 pounds in 1971, and an estimated 1972 level of 118 pounds. The estimated statewide demand function is statistically acceptable with trend (which serves as proxy for consumer tastes and preferences) and price the most significant explanatory variables. Consumer income was only marginally significant. The function explained 93 percent of the variation in beef and veal consumption during the period. Honolulu estimates are made by multiplying statewide per capita consumption figures by de facto Honolulu population estimates.

Although declining consumption rates for red meat have been predicted due to the real price increases, this has not been borne out to date nationally. Also, worldwide demand shows no signs of softening, tending to draw world supplies elsewhere.

Source: Hawaii Agricultural Experiment Station publication (in progress)

EXHIBIT III



Source: U.S.D.A.

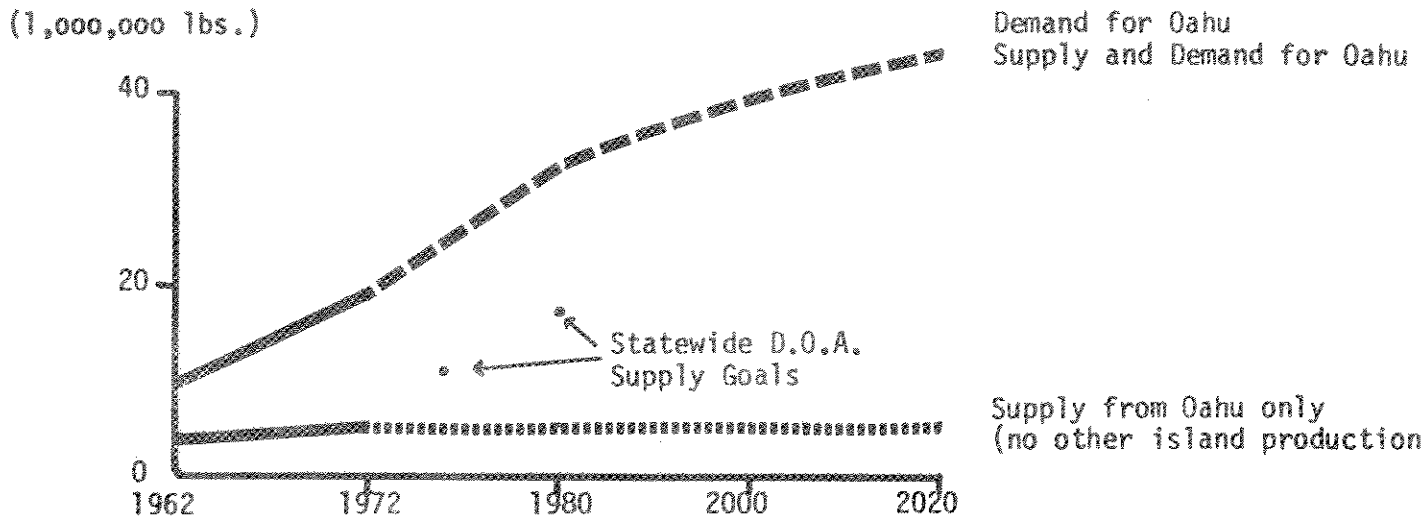
Pork

The simple trend equation fitted by Renaud[1] was used to estimate aggregate quantities of pork sold. State per capita consumption levels were then calculated and multiplied by Honolulu population estimates for the projected demand levels. Statistically the function "explained" 92 percent of the variation in consumption. However, as a simple trend equation no insight is gained as to the nature of the indicated changes.

Source: Renaud

EXHIBIT IV

CHICKEN SUPPLY AND DEMAND PROJECTIONS, OAHU, 1962 - 2020



Source: U.S.D.A.

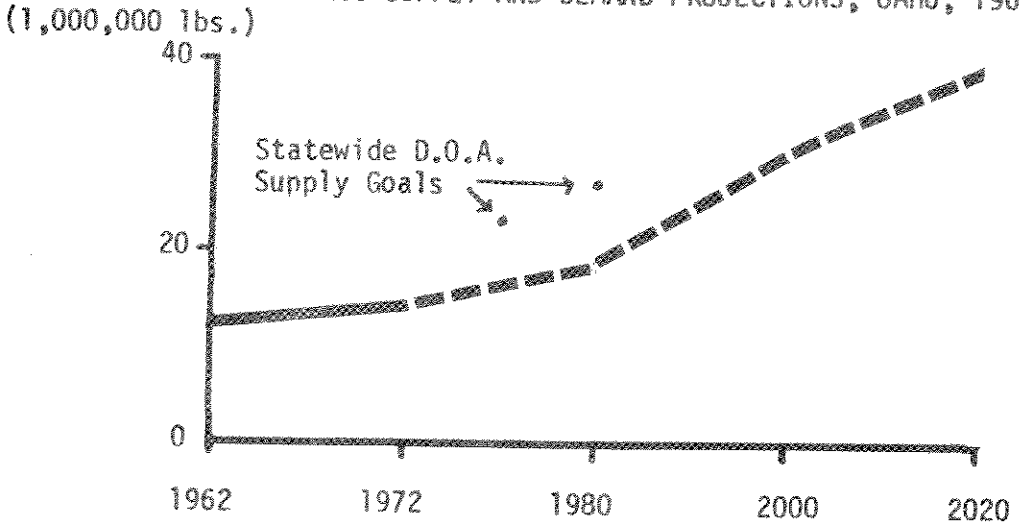
Chicken

Hawaii consumption of chicken in 1971 was 29.9 pounds per capita compared to 41.4 pounds for the U. S. as a whole. The estimated demand function accounted for 98 percent of the variation in chicken consumption during the study period, and predicts a rising per capita demand reaching 42.8 pounds in 1980. Honolulu aggregate demand levels were estimated from state per capita consumption levels by multiplying by Honolulu population estimates.

Source: Hogg

EXHIBIT V

EGG SUPPLY AND DEMAND PROJECTIONS, OAHU, 1962 - 2020



Source: U.S.D.A.

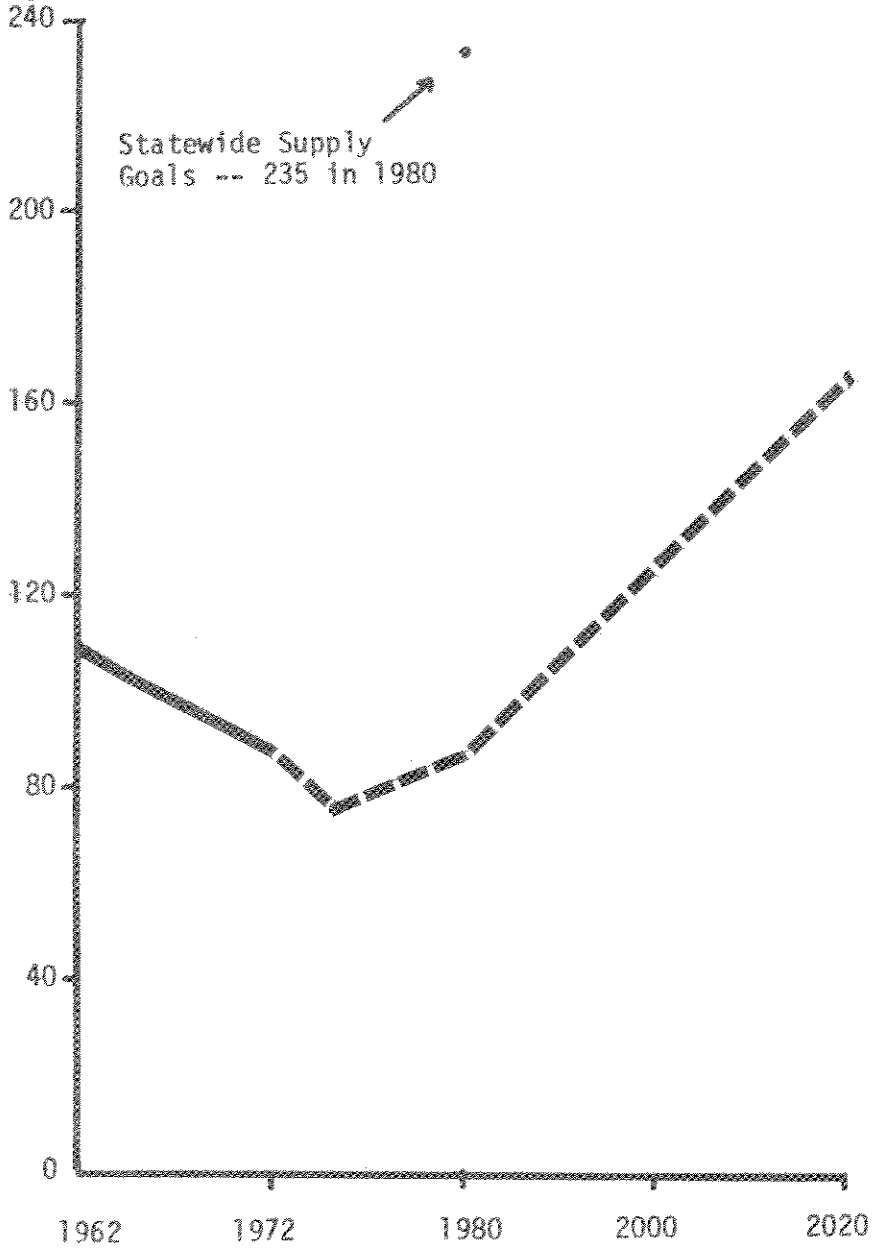
Eggs

Egg consumption estimates are made from a demand function which includes trend and income variables. Trend is the only significant explanatory variable but the equation explained is 95 percent of the variation in egg consumption during the study period. Again, the function was fitted to statewide data to estimate state per capita consumption. This value was subsequently multiplied by Honolulu de facto population estimates to calculate aggregate Honolulu consumption. The function estimated a state per capita consumption of 22.4 dozen for 1972 as compared to the U.S. average of 26.4 dozen. U.S. consumption levels have been relatively stable for the past 10 years but Hawaii consumption is expected to rise by about .3 dozens per year to 1980.

Source: Renaud

EXHIBIT VI

(1,000,000 lbs.)FRESH MILK SUPPLY AND DEMAND PROJECTIONS, OAHU, 1962 - 2020

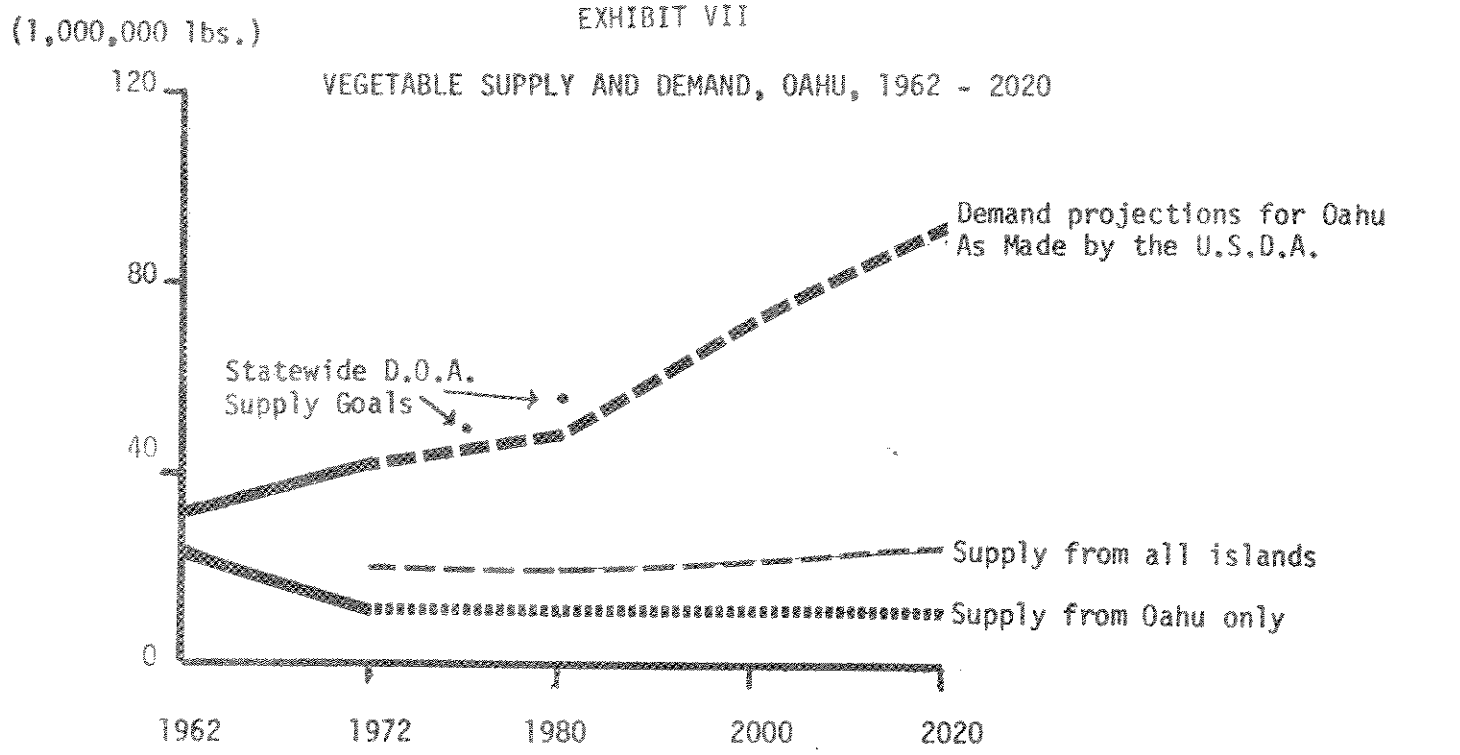


Milk

Milk consumption in Hawaii was about 160 pounds per capita in 1969 compared to a U. S. mainland level of 271 pounds. The estimated demand function, which was statistically sound, accounted for 65 percent of the variation in state production during the study period.

Source: Hogg

EXHIBIT VII



(These figures do not include all vegetables--only those studied by the U.S.D.A.)

Vegetables

The vegetables studied by the U.S.D.A. were: snap beans, sweet corn, cucumbers, daikon, egg plant, Manoa lettuce, lotus root, green onions, green peppers, tomatoes, sweet potatoes, watermelon and mustard cabbage. This list does not include all vegetables grown in Hawaii. Vegetable consumption is expected to rise due to population increase, although per capita consumption is expected to decline for many vegetables as noted earlier. (Supplies from Hawaii are generally expected to remain about the same over the years.)

EXHIBIT VIII

IMPORTS INTO THE OAHU MARKET, 1980

and

ACREAGES NEEDED TO REPLACE IMPORTS

Product	Hogg Imports (1,000 lbs.)	Oahu yield/acre/crop (1967-1971 Average 1,000 lbs.)	Acreage Required to Replace Imports (Acres) Crop Acres	Crops/year	Acres Needed
Beef/veal	31,460		219 (feedlots)		
Pork	16,780		1,203		
Chicken	26,870		561		
Eggs (1,000 dozen)	0		0		
Fresh Milk	0		0		
Subtotal Livestock	0				1,983
Snap Beans	0		0		
Sweet Corn	0		0		
Cucumber	0		0		
Daikon	0		0		
Eggplant	359	32.7	11	2	6
Lettuce	16,233	15.7	1,034	3	345
Lotus Root	0	--	--	--	--
Green Onions	523	13.9	38	3	13
Green Peppers	640	17.4	37	2	19
Tomatoes	6,944	20.4	340	2	170
Sweet Potatoes	0	--	--	--	--
Watermelon	3,574	10.0	357	2	179
Watercress	0	--	--	--	--
Mustard Cabbage	283	14.4	20	3	7
Subtotal Vegetables					739
Total livestock and Vegetables					2,722* Acres

To be supplied by State as a whole for 100% self-sufficiency

park must be consistent with the return which might reasonably be expected from such a venture. These costs are included in The Concentual Design and Cost Comparisons for an Agricultural Park on Oahu.

Recent Legislative Action Supporting Agriculture

The preservation and stimulation of agriculture within Hawaii is an objective which is considered to be in the public interest, using as criterion the actions of the Legislature. This program for an agricultural park was initiated in the 1972 session by Act 110 which included funds for implementation.* In the 1973 session, agriculture, land use and planning were the subjects of many bills and resolutions with important consequences. Most of these bills still are pending. Several bills are concerned with the establishment of agricultural preserves and in particular with establishing more equitable tax status for land that is dedicated in a bona fide manner to agriculture. Several bills in the environmental quality area are concerned with ensuring proper planning and conservation of our resources of which agricultural land is an important part.

In addition, the Legislature determined that this subject was sufficiently important and urgent that it created the Temporary Commission on Environmental Policy to recommend specific, unified state policies. In its policy guideline which was just established, the Commission has said that agricultural land should be protected and urban sprawl discouraged. The commission also called for support of diversified agriculture, and the development of export markets for produce. (ref. 28)

*Act 202, Session Laws of Hawaii, 1972, Items 4b -13a

The proposed agricultural park will provide some of this needed change and will at least partially relieve some of the economic pressures on farmers and allow for more orderly urban expansion.

One economic factor affecting existing livestock operations is the cost of pollution control. Problems of complying with regulations at some of the existing livestock operations are in some cases severe since the operations were established long before the present environmental regulations were conceived. Furthermore, since these regulations continue to change, it is often not possible even to predict the extent of future expense involved.

In accordance with Act 110 of the 1972 legislature which authorized the agricultural park (see Exhibit IX), preference will be given to those farmers being displaced by urbanization from other locations on Oahu. Others interested in occupying the park are those who need agricultural land for expansion, and those who want to start new agricultural ventures.

Approximately 460 acres of the proposed park will be used for livestock. The projections and acreages are : 3 dairies -300 acres; 10 hog farms - 100 acres; 3 poultry farms - 20 acres; 1 feedlot (and meat processing plant) - 35 acres; 1 feed storage facility - 4 acres. About 690 acres are projected for vegetables and ornamentals or nursery stock. These estimates are based on requests submitted to the State Department of Agriculture by individual farmers and farm groups.

EXHIBIT IX

ACT 110 H. B. NO. 2524-72

A Bill for an Act Relating to the Acquisition and Disposition of Lands for Agricultural Purposes.

Be It Enacted by the Legislature of the State of Hawaii:

SECTION 1. The legislature finds that there is a growing scarcity of agricultural lands throughout the State caused by urban encroachment which has made it difficult for agricultural enterprises to survive and has caused the erosion of the agricultural base of the economy; that urban encroachment has caused the unplanned relocation of livestock operations many times in the past twenty years; that urban plans have not placed the necessary emphasis on agriculture and location of agricultural enterprises to insure the survival of agriculture; that there is a need for agricultural land-use planning, particularly, the planning of alternative uses for lands such as Kahuku which have been phased out of sugar without clear use alternatives; and that the acquisition of private property for agriculture purposes is a public purpose or use necessary to facilitate sound agricultural land-use planning.

SECTION 2. Chapter 171, Hawaii Revised Statutes, is amended by adding the following sections to said chapter:

"**Sec. 171- Acquisition.** The board of land and natural resources is hereby authorized to acquire by lease, exchange, direct purchase or eminent domain private property for disposition for agricultural purposes, including but not limited to agricultural parks.

"**Sec. 171- Definition of agricultural park.** For the purposes of this Act, agricultural park shall mean any planned agricultural complex which combines and concentrates in a common location a number of agricultural activities for the purpose of realizing production and distribution economies. Agricultural buildings, farm residences, and employee dwellings necessary to the production and distribution of agricultural commodities shall be considered part of the agricultural park.

"**Sec. 171- Disposition.** Any provision of this chapter to the contrary notwithstanding, the board of land and natural resources is hereby authorized to directly dispose of such land by negotiation and without recourse to public auction. All such dispositions shall be by lease only and shall be subject to the requirements set forth in Article X, section 4 of the State Constitution and in sections 171-33, 171-34, 171-35, 171-36, 171-37, and 171-66 and subject also the following limitations:

"(1) The property shall be disposed of for agricultural purposes only.

"(2) The lessee shall derive the major portion of his total annual income from his activities on the premises;

"(3) The lessee must comply with all Federal and State laws regarding environmental quality control;

"(4) Other terms and conditions as may be set by the board.

"The violation of any provision herein contained shall be sufficient cause for the board after notice as provided in section 171-20 to cancel said lease and take possession of said land.

"**Sec. 171- Applicants.** A person shall be eligible to apply for a lease hereunder if he meets the qualifications set forth in section 171-68.

"**Sec. 171- Preference right.** A displaced farmer who is otherwise qualified to take a farm lot, or any farmer whose farm is located in a zoning district where such use is a non-conforming use, shall be given preference in obtaining a lot."

SECTION 3. This Act shall take effect upon its approval.

(Approved May 23, 1972.)

Other bills are concerned with research and development in new areas such as ornamental plants and the promotion of Hawaiian agricultural products. Still other bills are concerned specifically with agriculture on Oahu and, in particular, with problems of the livestock industry on Oahu.

In summary, one may conclude that the Legislature is actively concerned that agriculture should be a viable, vigorous part of the state economy.

The proposed project, which extends the concept of the industrial park to agriculture would be an innovative and precedent-setting step toward this public objective.

Because this is the feasibility and conceptual design stage of this project, this statement must necessarily present impacts in somewhat general terms and as a series of alternatives depending on which course of action must finally be chosen to satisfy environmental and social requirements.

4) EXISTING CHARACTERISTICS OF THE AREA

Topography and Soils

The land rises steadily from Kunia Road to the Waianae Ridge. The arable portions have been used primarily for pineapple production for decades. The pineapple fields, though sloping, are relatively flat and are provided with drainage control by means of terraces, diversions, grassed waterways, retention ponds, etc. Gulches cut across the land running roughly from the mountains to - and across - Kunia Road. The area is part of the Pearl Harbor drainage basin. Because of the special effort to clean up Pearl Harbor under the authority of the Pearl Harbor Enforcement Conference, extra precautions must be taken to prevent water pollution from erosion or other sources of contaminants.

At the north end, the area expands into the valley to the west toward Kolekole Pass, and is bounded by forest reserve and by the military reservation. The boundary parallel to Kunia Road follows approximately the 900 foot elevation contour, as shown in Exhibit X.

Most of the soils within the proposed site fall into two or more classes. At the upper levels much of it is Mahana silty clay loam (MC) along with Kolekole silty clay loam (Ku). At slightly lower levels there also is some Kunia silty clay loam. The Mahana series is a well drained soil on steep uplands. Erosion hazard is moderate to severe depending on slope which ranges from 6 - 12% (C_2) to 20 - 35% (E_2). The soil is highly permeable but often eroded. (see Exhibit XI)

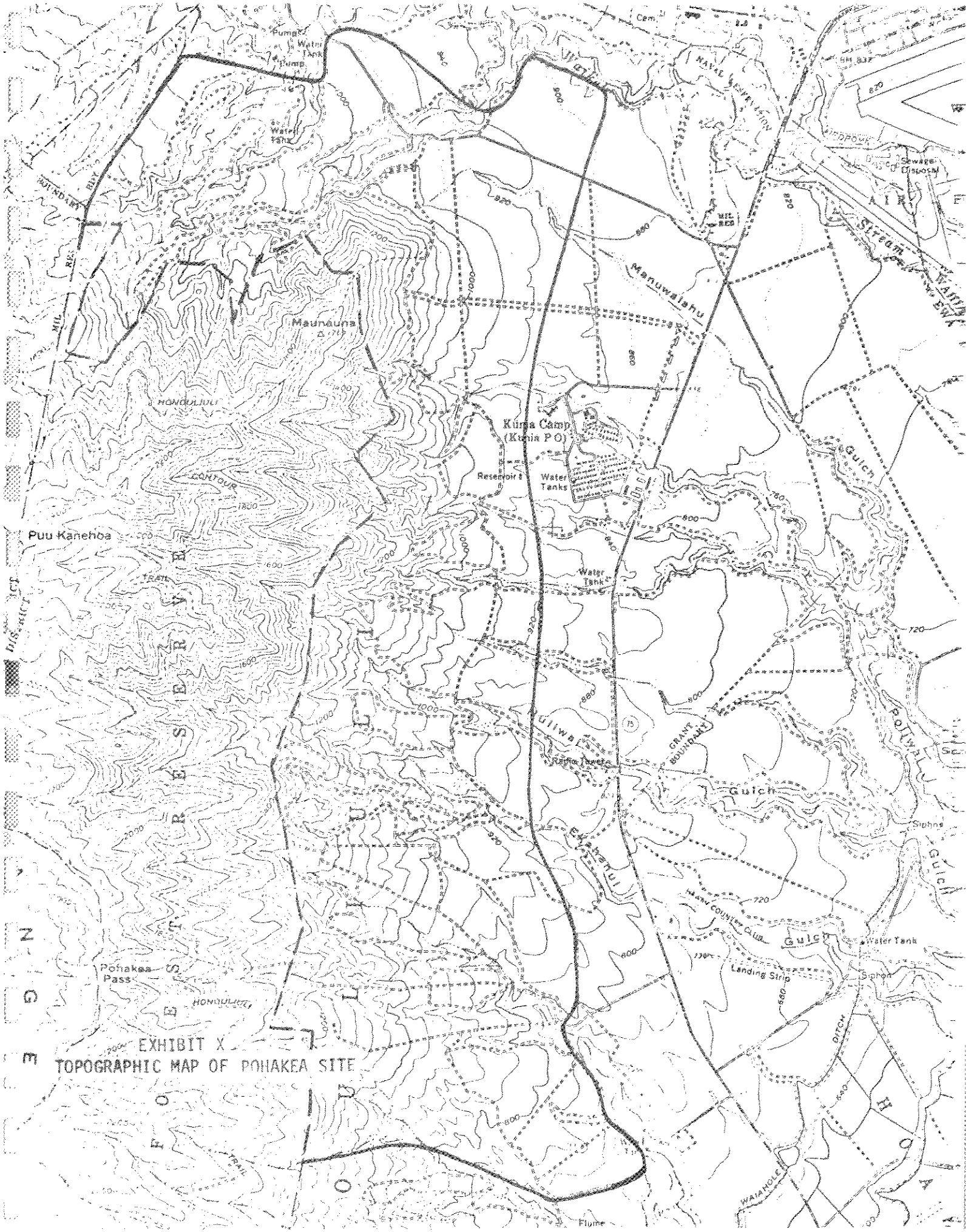

Pumping Station
Water Tank
Pump
Water Tank
Cem.
Naval Ammunition Depot
Sewage Disposal
Stream
Manuwaiahu
Maunauna
Kuna Camp (Kunia P.O.)
Reservoir
Water Tanks
Water Tank
Puu Kanehoa
Gulch
Siphon
Gulch
Waiawa Country Club
Landing Strip
Water Tank
Siphon
Pohakea Pass
Ditch
Flume
EXHIBIT X
TOPOGRAPHIC MAP OF POHAKEA SITE


EXHIBIT 7I
SOILS MAP OF POHAKEA SITE
Pohakea Pass
Puu Kanehoa
Puu Kaua
Kunia Camp

Soils in the adjacent forest reserve are classified as Tropohumults-Dystrandepts. Soils are well drained and acidic. The topography is one of steep ridges and deep drainage ways. Soils at the summits are poorly drained with an accumulation of organic matter.

Slopes of 1 to 6% (A and B) usually are considered ideal for cultivated agriculture and slopes of 6 to 20% are acceptable for the ag park if the soils are provided with suitable erosion control. Areas with slopes over 20% (E) are not considered suitable for cultivated agriculture but some should be suitable for pasture.

Rainfall and Wind

Mean annual rainfall throughout the area is estimated to be quite uniform since the 40 inch isopleth passes through the ag park site parallel to the ridge line. The northwesterly end may have somewhat higher mean annual rainfall. Monthly mean rainfall for the driest summer month and the wettest winter month vary by factors of 2 to 3; i.e. the variation in moderate. (ref. 16)

Rainfall maxima predicted (ref. 15) for the area are as follows:

	10-year (inches)	100-year (inches)
24 hour maximum	8 to 10	14 to 16
1 hour maximum	2.5 to 3	3 to 4

Wind direction is influenced by the trade wind pattern but there are diurnal and seasonal patterns, especially since the area is inland. Exhibit XII shows typical data from the Wheeler Field station (ref. 16) The exhibit includes annual averages for direction and speed and typical daytime (1200 - 1400 hours) and nighttime (0000 - 0200 hours) patterns for winter and summer. It is apparent that the trade winds (NE to E) are much more prominent in July than in January and that wind speed decreases at night, often with a change in direction. Calms frequently occur at night. During calm periods, drainage of cooler air from higher to lower elevations may be expected.

EXHIBIT XII

PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED
WHEELER FIELD - OAHU

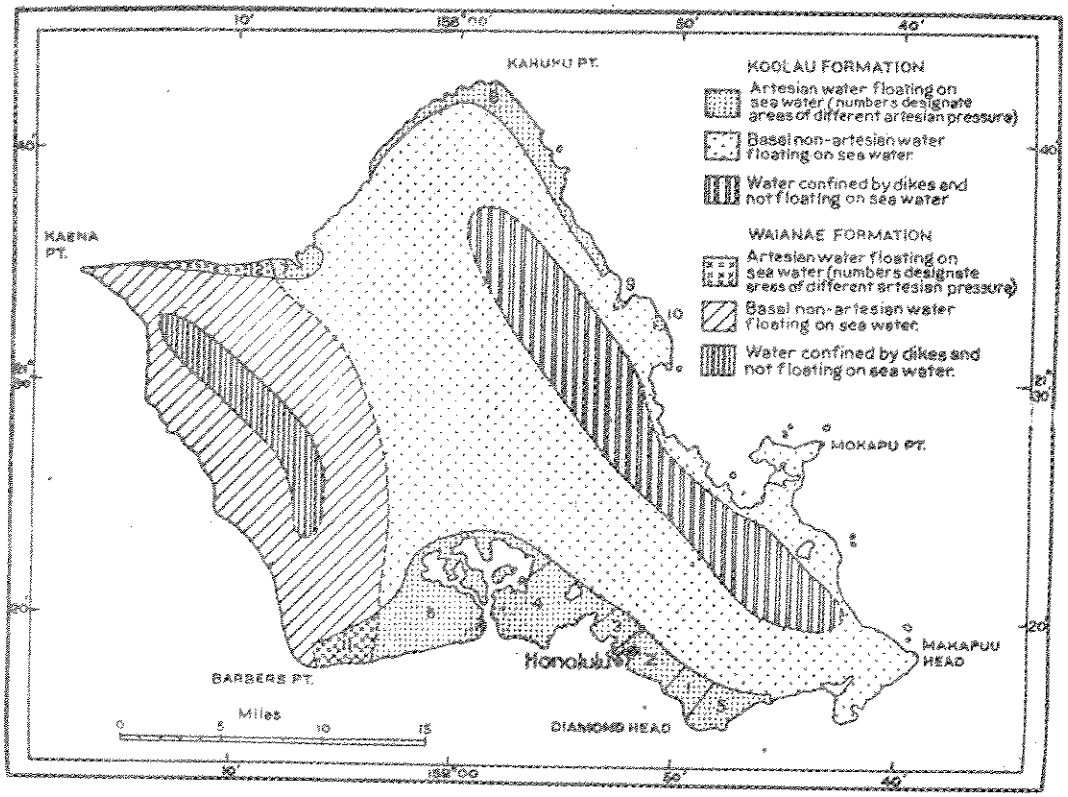
	ANNUAL AVERAGES		JANUARY				JULY			
	time	speed	1200-1400		0000-0200		1200-1400		0000-0200	
	%	knots	%	kt.	%	kt.	%	kt.	%	kt.
N	7	5	7	9	12	6	3	8	7	4
NNE	4	7	5	10	4	7	4	11	6	4
NE	17	8	9	10	7	4	30	11	14	5
ENE	13	9	7	10	2	4	31	12	4	7
E	12	8	11	10	4	4	23	12	11	6
ESE	4	8	5	9	2	5	3	11	4	6
SE	5	6	8	9	5	6	2	8	3	5
SSE	3	8	9	11	4	6	1	9	1	4
S	3	7	12	11	3	8	1	7	3	4
SSW	1	7	2	8	2	5	0	8	1	3
SW	1	6	3	9	1	5	0	5	1	3
WSW	1	5	1	7	1	4	0	10	1	3
W	3	4	3	7	3	4	0	6	6	3
WNW	3	4	2	6	3	4	0	6	4	4
NW	9	4	9	8	16	4	1	8	13	4
NNW	4	5	5	8	8	4	1	8	2	4
CALM	12	-	4	-	23	-	1	-	17	-

Geology with Reference to Hydrology

The geology of the area in relation to availability and movement of water is dominated by the fact that the Koolau lava flow meets the Waianae flow along a line which approximately underlies the proposed site as shown on Exhibit XIII and XIV. This estimate, from the local U.S. Geological Survey office (ref. 17) is based on the fact that the wells along Kunia Road appear to be fed by the Koolau aquifer, while the much higher water level reported for wells at the northwesterly corner of the area indicates that this is in the Waianae aquifer. Similar differences can be observed in the Waipahu area. The boundary between the two aquifers is not known in detail. (See also Exhibit XIII from ref. 22, pp. 264, and 373 therein). It is possible, for example, that the well at Hawaii Country Club may be within the Waianae aquifer because of its relatively low yield.

EXHIBIT XIII

GEOLOGY OF OAHU



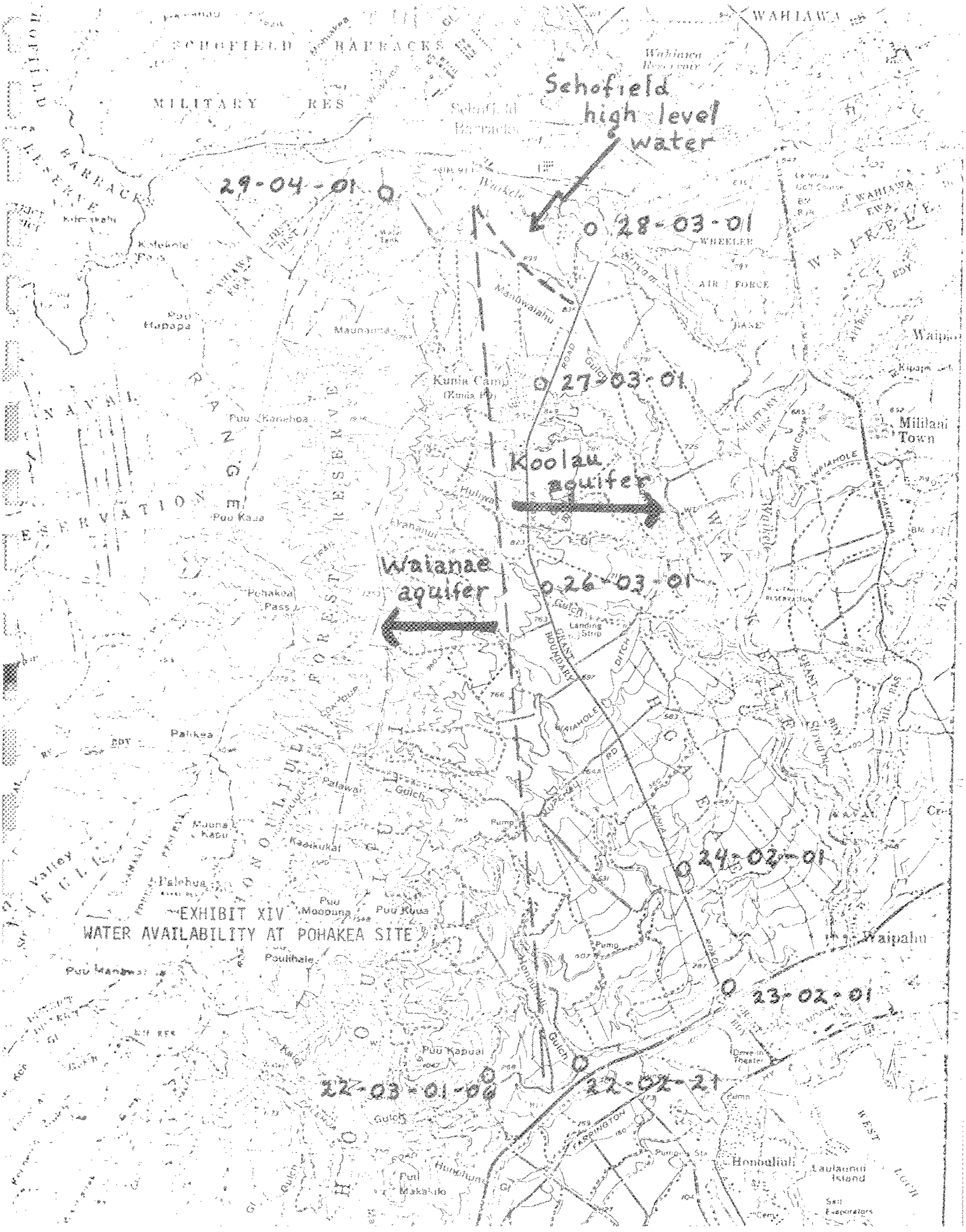


EXHIBIT XIV
WATER AVAILABILITY AT POHAKEA SITE

In contrast to the highly permeable Koolau system, the Waianae rocks are relatively impermeable so that water moves only slowly through it.

Analytical data for wells in the vicinity of Kunia Road are shown in Exhibit XV . The wells in the sugar cane area show the effects of irrigation water infiltration and/or intrusion of sea water since salt content is generally higher and nitrate content reported is 3 to 11 ppm. In contrast, the more northerly wells are relatively low in nitrate, 0.3 to 1.3 ppm. Nitrate content of the well at the Naval Reservation near Schofield Barracks is 5.3 ppm. This may reflect the flow of nutrients from pineapple operations in the Wahiawa area. Water flows from the Koolaus toward the Waianaes. Only chloride data are available for the DelMonte wells in the northwesterly corner of the proposed Ag Park site.

EXHIBIT XV

WATER ANALYSIS AT LOCATIONS ADJACENT TO POHAKEA SITE

Well	Location	Date	SiO_2	Ca	Mg	Na	K	HCO_3	CO_3	SO_4	Cl	F	NO_3	Cond.	T°C
23-02-01	Waipahu Cloverleaf	8-58	66	18	20	84	--	110	0	54	126	0.1	4.0	--	--
		8-59	74	17	17	85	3.7	106	0	48	112	0.2	10	597	--
		10-64	73	14	15	80	3.4	106	0	39	98	0.2	11	597	21.8
		11-66	76	14	15	78	0.7	109	0	39	98	0.2	3.3	587	--
		2-68	73	14	16	80	3.6	107	0	37	103	0.2	8.4	622	--
24-02-01	Kunia Road - BWS	5-71	71	13	18	79	3.5	106	0	37	105	0.3	8.3	601	--
26-03-01	Hawaii CC	11-66	75	17	15	26	0.9	83	0	23	48	0.2	3.8	349	22.8
		5-72	75	17	16	28	2.2	84	0	20	53	0.1	9.6	357	22.0
27-03-01	Kunia Camp	12-49	17	50	8.1	11	--	170	0	13	23	0.1	1.3	--	--
		11-67	61	9.5	10	30	10	85	0	12	36	0.2	0.8	--	--
28-03-02	Naval Reservation	6-67	74	5.6	6	22	1.6	73	0	10	26	0.1	5.3		23.3
29-04-01	DelMonte	10-41	--	--	--	--	--	--	--	--	28	--	--	--	--
		10-54	--	--	--	--	--	--	--	--	21	--	--	--	--
		8-58	--	--	--	--	--	--	--	--	19	--	--	--	--

Vegetation

Vegetation within the area is confined to the areas not cultivated. This is mostly regrowth since in the past the area was severely overgrazed and eroded. Botanists familiar with the area report that the Waianaes do contain native flora, some of which may be rare or possibly on the endangered list. However, most if not all of these plants are found within the forest reserve; for example near the Honouliuli Contour Trail rather than at the lower elevations. (ref. 18)

Historical Value

There is an historical account which refers to houses in the area between Puu Pahehoa and Puu Kaua, but no recent record of house sites is known. They may have been obliterated by earlier agricultural operations.

5) THE MOST SIGNIFICANT IMPACTS OF THE PROPOSED PROJECT ON THE ENVIRONMENT

In summary, the significant impacts of the proposed project are:

a. economic and social

b. erection of structures at low density on land now vacant

c. possible utilization of additional unused land for agriculture

d. change in the pattern of agriculture

e. increase in water use

f. slight increase in traffic

g. major amount of animal waste to be utilized or disposed of

Economic and Social

When implemented, the project should have a major role in reversing the decline in diversified agriculture on Oahu, and eventually throughout the State. In particular, it will assist livestock production which faces the usual urban paradox: the products of the industry are in great demand, but generally no one wants the industry near them. Swine producers, for which Ag 2 zoning is required, are especially under pressure as urbanization spreads. The Pohakea site is zoned AG 1; rezoning to AG 2 is necessary if swine are to be raised at Pohakea. The project would materiallly assist in increasing local livestock and produce operations, thereby reducing dependence on mainland supplies. (see Exhibits II - VIII)

The effect of a basic productive local industry on the economy is beneficial in that it provides for use of local labor and services which in turn demand more local labor and services. For example, when local products replace imports each labor dollar spend in production is worth 1.72 new dollars in the local economy due to the multiplier effect. (ref. 25)

If the proposed Pohakea site were used, some pineapple production would be displaced. The pineapple industry does not release production costs so that a quantitative estimate of the effect of this change in acreage is not generally available.

The only figures reported show that dairy operations use approximately twice as much labor per acre as pineapple at its 1972 level of canned and fresh fruit sales. ($1,600 per acre in payroll for Oahu dairies vs. $900 per acre in payroll for all pineapple operations in Hawaii.) With pineapple production on Oahu turning to shipment of more fresh fruit, the payroll dollars per acre for pineapple could diminish significantly.

Although reduced barriers to importation of U.S.-grown pineapples are being sought in Japan to encourage production in Hawaii, "present import patterns suggest that the Philippines, Taiwan, and Malaysia would be the major beneficiaries of import liberalization".* They are the major suppliers of fresh pineapple to Japan now.

However, other factors should also be considered. First, pineapple acreage in Hawaii has been decreasing steadily as production overseas by both Dole and Del Monte has increased. Second, vacant land suitable for pineapple is available, not only on Kauai and Molokai, but also on Oahu. The vacant land on Oahu has been or is being withdrawn from agriculture with the intent of converting it to urban use. The final decision with regard to land use rests with the community through its zoning and land use requirements. Conversion of prime agricultural land to urban use is for all practical purposes an irretrievable commitment of a resource limited in supply. Oahu contains 29% of the prime agricultural land in the state, more than any other single island (ref. 26).

*Honolulu Advertiser, August 16, 1973

Establishment of the ag park is not proposed for these prime lands because urban encroachment already has begun in adjacent areas. Since Ag-2 zoning is needed for the ag park, this would represent poor planning and even if such zoning could be obtained, the juxtaposition of urban and Ag-2 lands almost certainly would lead to conflict.

The proposed Pohakea site has buffer zones in the form of forest reserves on one side and AG 1 zoning adjacent to Kunia Road.

The present lease from Campbell Estate to Del Monte does not include the right to withdraw the lease. Hence, condemnation of the lease (not the land) might be necessary, depending upon Del Monte's plans.

The Physical Environment

Impact of the project physically on the land would be relatively small since the change would be from one form of agriculture to another. Some use of lands not now in agriculture might also be made, using parts of the gulches, rocky areas, and the higher lands between the pineapple fields and the forest reserve for pasture or buildings.

Prevention of water pollution is a prerequisite for any new livestock operations. Control of drainage, erosion, and storm runoff would necessarily be at least as good as at present. Current practices in pineapple are generally considered good. The growers have worked with the Soil Conservation Service for some time. Terraces, diversions, grassed waterways, and detention ponds were installed in the early stages of the soil conservation program. These practices are at present under surveillance as a result of the Pearl Harbor Enforcement Conference. They are described in detail in the first semi-annual report submitted by DelMonte Corporation, the present tenant of the land (ref. 9).

Structures would be erected for dairy, beef, swine, poultry, and nursery operations. Power lines would be overhead. There are no structures in the immediate area of the proposed project at present. Paving and/or covering of corrals may be necessary for control of waste infiltration. Since this paving or cover would be for the purpose of preventing water pollution, its design would also take into account the usual adverse effects of storm runoff from paved and covered areas.

Approximately 25 to 50 dwellings will be built on the individual farms, only to satisfy the need for resident management. An urban or rural subdivision is not planned. Residential waste disposal would be by septic tank with perhaps use of one of the newer concepts for incinerating or composting household wastes; e.g. The Clivus developed in Sweden, or an incineration system.

The only uncultivated vegetation remaining in the area is in the gulches and areas considered too rocky to clear, or too high to be economically useful for intensive pineapple or sugar cultivation. Vegetation, especially at the Ewa end which is drier is sparse regrowth. In the past the area was subjected to severe overgrazing. It is probable that this will be replaced in part by more productive pastures or nursery operations. This may result in loss of some wildlife habitat. However, the area involved is small in comparison with the adjacent forest reserves. Before clearing, the area should be examined for endangered Hawaiian species although the probability of finding these plants there is small.

The crop cycle for vegetables is much shorter than the 3 to 4 year cycle for pineapple. Most vegetable crops can be grown in three to six months. Hence, the land used for such crops will be bare or newly planted more frequently than it has been in pineapple. However, this does not mean that the total intercycle time with bare land will necessarily be any longer over a comparable span of three to four years, since pineapple lands may be idle for one to six months. The net effect on susceptibility to erosion is not known. Erosion control features such as contours, diversions, grassed waterways, and detention ponds already established will be retained and, if necessary, extended.

Water Requirements

Nursery and vegetable crops require more water than pineapple. Exact data are not available and requirements vary with crop and site. However, 1 to 3 inches of water per week, or 50 to 150 inches of water per year, are probably the order of magnitude required. In contrast, pineapple can be grown with less than 40 inches per year. Annual rainfall is about 40 inches; any water required beyond the natural rainfall level would have to be supplied through an irrigation system on each crop farm.

Livestock operations may require 400,000 to 500,000 gallons per day (15 to 18 acre inches). Total requirements will thus be 700 to 800 acre inches per week or 2.5 to 3 mgd when the entire first phase of the park is in operation, with the exception of the slaughterhouse and packing plant. The addition of these operations would require at least 0.5 mgd more. Not all of this water use represents net increase. Some would represent transfer of water use from other locations. Cooling water--2 mgd -- is available at the Navy's Kunia facility. Rights to this discharge belong to the state.

Traffic

Vehicular traffic probably will increase somewhat compared with the present level, with a resident and non-resident work force of 100-200 persons adding to the flow. Heavy seasonal use of Kunia Road would be reduced in proportion to the land taken out of pineapple by the agricultural park. Traffic density on Kunia Road is highest when used by morning and afternoon commuters traveling to and from nearby military bases. Any added load would consist of trucks and commercial vehicles servicing the agricultural operations. Estimated traffic for feed and finished product shipment is about 20 trucks per day.

Major roads into the park would be paved. Hence, even though traffic might be increased, dust would be reduced compared with present traffic on unpaved roads. Since Kunia Road is only two lanes, the slower-moving trucks using the highway might increase congestion, especially during commuting hours. Highway need studies forecast that Kunia Road will be adequate at least until 1990. Coordination of access road development with the Department of Transportation is necessary. Contribution of engine emissions to air pollution is estimated to be not significant in the area.

Waste Management

The projected population of cattle, swine, and poultry is expected to produce almost 300 tons per day of manure of which about 36 tons is solids. Management of these wastes in an environmentally acceptable manner is one of the most critical factors in implementing the agricultural park concept. However, they may be managed more economically by a group of livestock farmers working together than by each individual farmer working independently.

General concepts of relationships to the environment and of waste management methods are discussed in Appendix I, which is attached. Briefly, the factors to be considered relate primarily to water pollution. Whereas BOD is usually considered the most troublesome contaminant, consideration of animal waste management techniques shows that inorganic solids, potassium, sodium, and ammonium salts, plus nitrates, may be the major problem. Animal wastes, in contrast to municipal wastes, are not considered a significant public health problem, even though some agents infectious to man may be carried by animals. This assumes that wastes are handled properly so that pests do not breed in them. BOD of animal wastes can be reduced by standard techniques, although because concentrations are higher throughout the processing, effluent from treatment systems considered practical usually is not suitable for discharge directly to receiving waters. For use as irrigation water, BOD content is not important, unless it results in odors. However, salt and nutrient content, especially nitrates, must be considered with regard to possible accumulation in fresh water supplies. Traditionally, manure has been recycled to crops as a nutrient and a study of feedlots sponsored by the EPA concluded that this still is the most practical disposal method. (ref. 1) Problems arise only when quantities become so great that local high concentrations exceed the natural capacity of the land to assimilate the nutrients.

Pesticides

There may be some indirect effect on pineapple operations immediately adjacent to the project. Methods by which they apply agricultural chemicals might require modification to prevent drift of certain agents on sensitive crops or on to livestock. For example, herbicides might damage vegetable or nursery stock. Insecticides may not be cleared for specific vegetable crops. If such crops were accidently contaminated, present regulations would prohibit sale for use as food. Similar considerations apply to contamination of livestock, especially dairy cows and hence milk.

Since nearly all pesticides are applied directly to the soil (nematicides) or by boom spray, very little actual hazard from this is anticipated. Chemicals applied by boom spray include malathion, diazinon, heptachlor, diuron, monuron, bromacil, ethylene, sodium naphthalene acetate. Of these, ethylene which is volatile is the only one which might be carried a significant distance. It is non-toxic and non-contaminating, but does have a hormone action on plants.

The one chemical applied by air is the ant bait, Mirex. This could cause contamination of livestock if the bait (ground corn cobs) is carried into livestock areas by accident.

Conversely, nursery and vegetable operations within the park would be under equal pressure to confine all agricultural chemicals used within the boundaries of their own operations. This is especially important where food crops and livestock are involved since any food contaminated with a chemical for which clearance has not been granted is considered unfit for sale regardless of the actual hazard which usually is negligible.

Other Impacts

With a permanent resident population of less than 200, impacts associated with population are minor:

(1) Schools are adequate, but school bus service would be required. In this respect, the second choice site at Kahuku might be preferable.

(2) Fire protection service would continue as at present. Adequate water supply for emergency use is recommended.

(3) Police protection would be supplied by the present regional staff. Roadways must be planned for safe intersection with Kunia Road.

(4) Commercial services such as stores, restaurants, etc. are not expected to change as a result of this development.

2. ADVERSE ENVIRONMENTAL EFFECTS SHOULD THE PROPOSAL BE IMPLEMENTED

Animal waste management may have an environmental effect. The most probable problem area is water pollution. Two pollution modes must be considered: contamination of surface waters and contamination of ground waters. Since this is a feasibility and concentual design study, we can at this point only discuss alternatives. In Appendix I general considerations are discussed:

a. Surface runoff from corrals, etc. should be segregated and controlled or prevented;

b. Effects of disposal on land, including infiltration from unpaved corrals, depends upon the relationship to fresh water aquifers.

DIRECT DISPOSAL ON LAND - THE SIMPLEST METHOD

Direct disposal on land is the traditional and simplest method if acceptable and, as noted, a recent study for EPA concluded that this is still the most practical method. (ref. 1) It is also the process which occurs naturally with the indigenous animal population. Provided that application rates are low enough, nutrients are absorbed by the crop or plant cover. Nitrogen is a critical nutrient. Capacities reported for nitrogen utilization range from 100 - 600 pounds per acre per year. Organic matter and BOD will be metabolized and incorporated into the soil. Soluble salts such as sodium chloride also will be deposited in the soil. Depending on rainfall, irrigation and evaporation rates, soil structure these salts may remain in the surface layer or may be leached into the aquifer. Order of magnitude of the load from the park would be 500 pounds per day of sodium chloride. If about 2,500 acres of crop land were available, all nitrogen could be utilized. Except for whatever the

vegetable and nursery crops could utilize within the park, the only suitable adjacent crop or land areas are the forest reserve, pineapple, and sugar cane lands. One possible procedure would be to spread as much as possible on crop land or pineapple land before planting, add the remainder to Waiahole Ditch*if the sugar cane can tolerate the nutrients and, when all else fails, spread the remaining material on the forest reserve. In this way, the nutrients would be used in place of other forms of fertilizer. With present practice, sugar cane is fertilized only during the first year of growth. Nitrogen is considered undesirable in the period before harvest.

There would be a beneficial effect of the manure addition to the forest reserve and adjacent lands; namely, the eventual renovation and restoration of lands which in the past were badly abused. Severe overgrazing by cattle and feral animals led to loss of vegetation, erosion, and extensive damage to this area. With improved management, it now is recovering. It has been shown in tests on the mainland that application of organic wastes, with proper balance of nutrients, results in substantial improvement on strip mined areas. (ref. 20, 21)

To prevent contamination of surface waters by storm runoff from freshly applied wastes, it might be necessary to apply the manure slurry in furrows which immediately would be covered. This also eliminates odor and pest problems. However, this does not appear to be practical in the forest reserve which consists primarily of ridges and gulches. If these areas were used, almost the only practical method of application would be to the surface via large nozzles suitable for handling slurries. (ref. 6)

*Addition to the Waiahole Ditch is not desired by Oahu Sugar Company (ref. 27) since sugar cane nearing its harvest should not be fed additional nutrients. However, with the world supply of fossil fuels diminishing rapidly, and since most nitrogen fertilizers are byproducts of the refinery process, this attitude could change. Prices are increasing and supplies of nitrate fertilizers are decreasing already.

If this method of disposal were used, the potential for surface water pollution would depend on the elapsed time between applications and rainfall, and on the intensity of that rainfall. The relation between rainfall and contamination of runoff has been studied exhaustively. (ref. 1, 6) The worst case would occur if rain fell immediately after application at a rate exceeding the infiltration rate, so that leaching and steady runoff occurred.

Hence, to be practical this procedure would require a means for forecasting rain within a few hours of application. According to S. Price (ref. 16), the raw data for predicting probability of rain within a specified, relatively short period are available for the Kunia area, but would require analysis for this specific purpose. If this waste management plan is considered acceptable, the type of forecast which can be made should be determined with the help of the Weather Service.

Permeability of the soils in question is reported in ref. 2. The Mahana series found at the upper levels, just below the forest reserve is well drained, with permeability of 2.0 - 6.3 inches per hour. However, runoff potential from the eroded portions is considered severe, i.e. the soils need rehabilitation. The Tropohumults - Dystrandepts in the forest reserve are well drained layered soils, with permeability of 2.0 - 6.3 inches per hour. Only in areas at the top where several feet of organic matter has accumulated over basalt is the drainage poor. These general permeability classifications are consistent with infiltration rates reported for various similar Oahu soils which range from 1.5 - 3.4 inches per hour in one reference (ref. 7) and approximately 2 - 10 inches per hour in another (ref. 8)

Expected 1 hour maximum rainfall rate in this area is 2.5 - 3 inches in 10 years and 3 - 4 inches in 100 years. (ref. 15)

Provisions for controlling runoff already are installed in some gulches. (ref. 9) This system could be extended and its capacity increased. However at some point the capacity of any water retention system will be exceeded. For the control and segregation of runoff in the livestock areas, a ten year storm has been used as the design criterion. Feasiblity of similar control of runoff from the forest reserves would depend on the size of the drainage area feeding each gulch. However, intuitively such a system seems unrealistic economically.

A more realistic approach would be to determine experimentally whether infiltration rates were sufficiently high to prevent contaminated runoff from leaving the site under adverse conditions which might reasonably be expected.

FLUID WASTE MANAGEMENT SYSTEM

If direct application to land is not acceptable, alternative fluid waste management systems involve collection of wastes in some retention structure. (oxidation ditch, lagoon, etc) with added water for fluidity,(ref 1,6) Various degrees of treatment to remove BOD are possible (see Appendix) The solid phase usually is separated as a sludge which must be disposed of separately or composted. The water then can be used for irrigation provided that the nutrient content can be assimilated or tolerated by the land available. If evaporation rates are sufficiently high, and lagoon area sufficiently great, there may be no need for water disposal . Pan evaporation rates and solar radiation are shown in Exhibits XVI and XVII . Sludge disposal will be necessary periodically - perhaps annually or semi-annually.

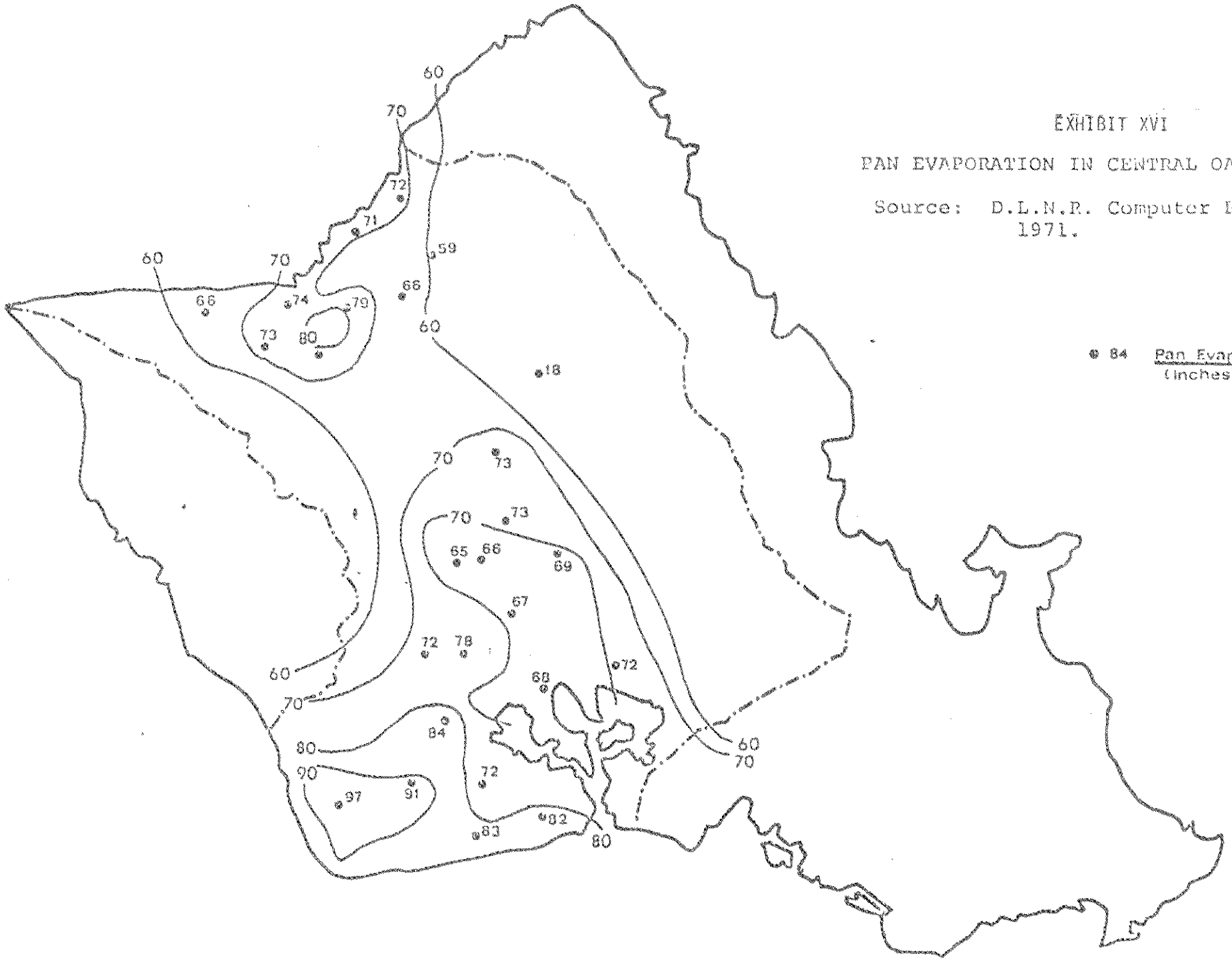


EXHIBIT XVI

PAN EVAPORATION IN CENTRAL OAHU

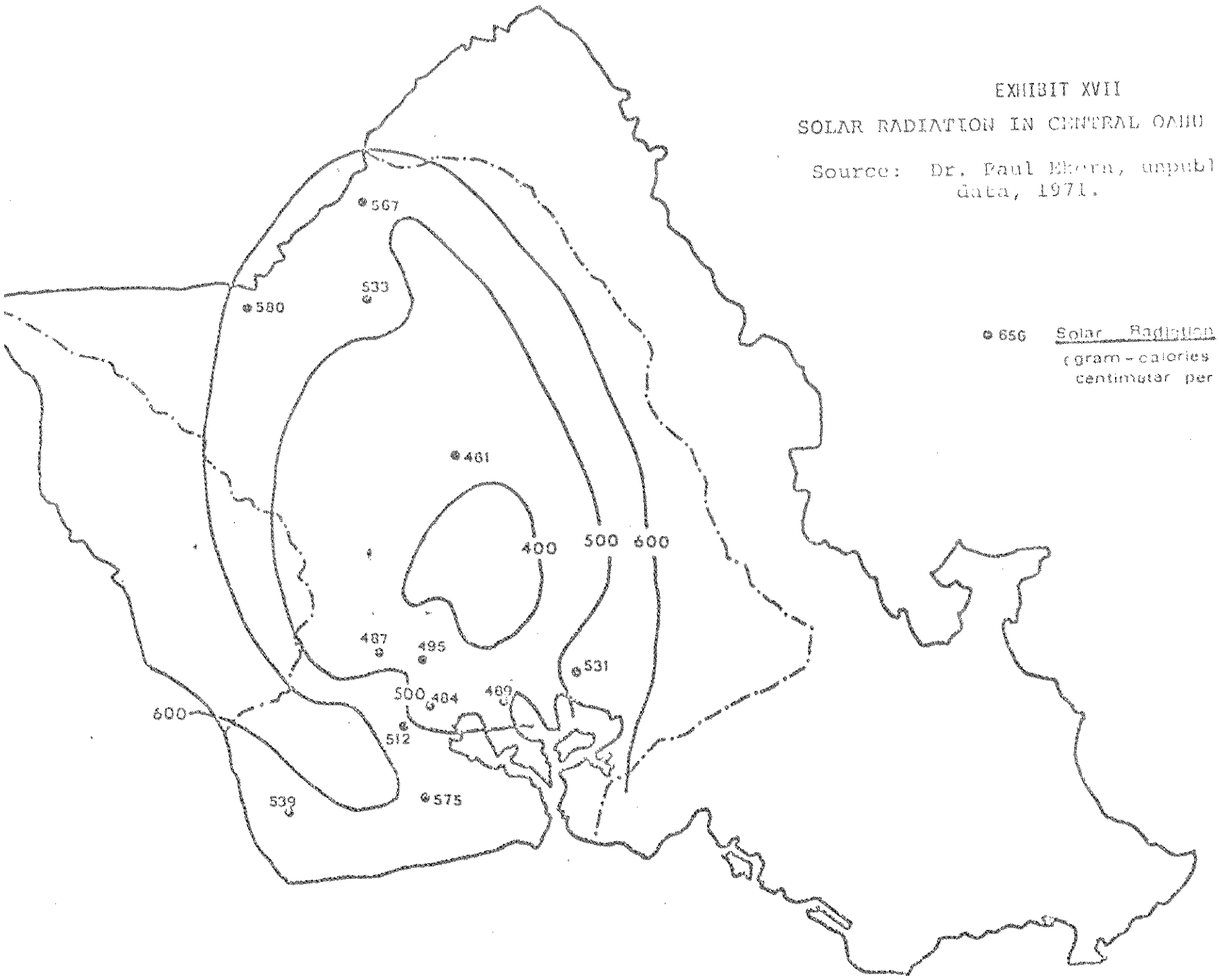
Source: D.L.N.R. Computer Printout, 1971.

● 84 Pan Evaporation (inches per year)

EXHIBIT XVII

SOLAR RADIATION IN CENTRAL OAHU

Source: Dr. Paul Ekern, unpublished data, 1971.



DRY MANAGEMENT VIA COMPOST

Still another alternative is to collect as much of the manure as possible in solid, "dry" form, then compost it aerobically to prevent odor. This really is a variant of one method for handling sludge produced by any of the waste treatment processes. The first objective of this approach is to reduce to a minimum the amount of liquid which must be handled and treated.

A second objective is to convert the waste into a product which can be transported economically. Transportation of solids is not normally less costly than transporting liquid. The advantage to be gained here would be that the compost should have some economic value, especially since, once loaded in a truck, it can be delivered to any point on the island. Value of the liquid is limited because of the limited range of pipelines as well as the aesthetic limitations. Liquids can also be transported by truck, but the "dead" weight of the added water makes this alternative less attractive.

Composted manure will contain most of the nutrients and salts from the original manure. Hence, if applied to lawns, parks, etc. on Oahu it is in effect adding these nutrients and salts to the natural water cycle. The only differences between applying manure directly to soil and converting it to compost are: first, that it is spread over a wider area, and second, that concentrations may be lower so that nutrients, especially nitrogen, will be assimilated. This will depend on how the compost is used.

Thus, if we are willing to accept the use of compost perhaps we should also accept the concept of direct application to land.. Studies have been made by the university of composting and the possible market for it. (ref 13) In 1971, the market was estimated to be about 500 tons per month. Potential production by the agricultural park might be on the order of 50 tons per day. The excess presumably would be used on public lands, parks, etc.

The liquid phase from either a composting process or from any low-volume treatment method can be renovated more readily just because the volume is manageable. The "Barrier Layer Water Renovation System" is one example of a method, now in the development stage, which should be applicable. Treatment consists of passing the water through a soil structure designed to create zones for both aerobic and anaerobic action on the wastes. This is done by placing about 6 - 8 feet of soil on a plastic sheet such that saturated, anaerobic conditions develop adjacent to the plastic while aerobic action occurs in the upper layer and nutrients also are absorbed by vegetation on the surface. BOD and nitrogen removal efficiencies are reported to be at least 85%, and there is no reason why they should not be much higher. Liquid phase to be treated would be drainage from the manure plus water used for cleaning in the milking center, etc. BOD might be on the order of 4,000 to 5,000 ppm.

One further step to control pollution is possible with a "dry" composting process: namely, covered corrals so that there will be no runoff from contaminated surfaces. Obviously this would add to the cost of the installation, perhaps $4.00 to $5.00 per square foot of covered corral if slotted floors and manure trenches are installed also.

FATE OF DISSOLVED SOLIDS APPLIED TO SOIL

Movement of nutrients or contaminants in the soil and underlying layers is affected by many factors; composition of the soil, pH, physical structure of the soil and rocks, and amount of water applied as rain or irrigation. For example, it is possible for water to penetrate to greater depths than might be predicted on the basis of soil porosity because some of the smaller pores may be inaccessible so that water actually moves through a much smaller network of large pores. (ref. 12) The presence of impermeable subsurface layers as observed in the WRRC tests at Wililani (ref. 10) can have a substantial effect on water movement. The Kolekole soil series found at some of the lower portions of the site has a brittle pan under the surface layer.

Finally, even if nutrients or salts reach the aquifer, this does not necessarily mean that there will be an accumulation. The situation is dynamic rather than static, with water being withdrawn as well as added. In some areas such as the Pearl Harbor basin, withdrawal rate is close to, if not in excess of, recharge rate. And since the aquifer is far from a perfectly mixed system, short circuiting of recharge and withdrawal water might easily occur. Nitrate levels in wells in the sugar cane areas suggest that perhaps this does occur.

Therefore, we would be ill-advised to draw final conclusions for or against any waste management system solely by extrapolating existing information. Ideally, one or more approaches should be tested experimentally to determine more definitely the probability of adverse effects, if any.

ODOR

Odor is also a possible adverse effect of livestock operations. Control is possible in several ways. Immediate removal of wastes, either by the use of slotted floors and scraping, or by repeated surface scraping and flushing, reduces odors to a minimum. Aerobic treatment methods such as oxidation ditches are considered to be without odor. Anaerobic treatment methods, if totally enclosed, like digesters, do not release odors to the surroundings. Confinement of animals in buildings localizes odors. This is feasible for poultry and swine and, to some extent, for cattle. For poultry it has been shown that odor coming from buildings can be reduced to acceptable levels by simple wet baffles placed in the exhaust vent (ref. 6) Finally, location of the park, together with the direction of the prevailing winds is such that odors, if present, should not be a nuisance to residential areas. The nearest residential area is Kunia Camp.

In the description of the site, typical weather data are given. Proposed plans are to begin at the southern end of the site. Hence, odors are most likely to reach Kunia Camp, the nearest residences, when the wind is from the south. Fortunately, on the average, wind comes from the southerly directions about 10% of the time only. However, it is when the winds are southerly that there is a substantial variation from day to night. It is presumably only during these periods that Kunia Camp might receive odors from the park.

VISUAL IMPACT

The structures to be built will be visible from almost any point in the central valley, and from portions of urban Honolulu from which the Kunia side of the Waianae mountains can be seen. Structures will include dwellings, shelters for cattle, swine, poultry, and dairy operations as well as shade houses or greenhouses for for nursery operations. Power and telephone lines will be overhead. These structures will be at elevations of about 1,000 to 1,200 feet, which is a very visible portion of the area. The structures may be expected to be utilitarian. As in industrial parks, architectural approval can be required. Eventual visual screening of structures considered objectionable could be accomplished by planting trees and shrubbery, which may also be desired for windbreaks.

MAINTAINING BALANCE IN FOREST RESERVE

To maintain a vigorous cover of vegetation in the forest reserve it is essential to prevent the population of grazing animals from increasing as they did in the past, with disastrous effects. Hence, it is important to maintain the hunting pressure on the feral population, and to prevent livestock from the park from gaining access to the forest reserve. The reserve also is considered of botanical interest. Hence, public access to the forest reserve, both for study and hunting, should be maintained. Engineering and management of the park should provide for this on a non-interfering basis.

3. ALTERNATIVES TO THE PROPOSED ACTION

ALTERNATIVE SITES CONSIDERED

In selecting the proposed Kunia site, more than ten alternative sites were considered. The reasons for choosing Kunia are given in The Preliminary Site Selection Study. Briefly, the Kunia site was selected because of the favorable economics resulting from the central location and the probable availability of land on acceptable terms. Suitability of the site for animals, in particular the lower mean temperatures at the higher elevation which is favorable for dairies, were also important factors in the decision.

FACTORS AND CRITERIA CONSIDERED IN THE SITE ANALYSIS

The basic guidelines for the site selection are contained in Act 110, Session Laws of Hawaii, 1972, the legislative hearings relating to this Act, and the Contract for Economic Planning and Conceptual Design Services dated February 15, 1973 between the Department of Agriculture and Henry A. Alexander & Company, Inc.

The concept of an ag park developed in response to unplanned relocation of farms, especially livestock. An important feature of the concept is the development of a planned complex of farms. Special emphasis was given to the need to comply with all environmental standards, and regulations--federal, state, and local.

*The original Kunia site has been modified since the State land in the initial area has been leased to Del Monte for 6-1/2 years.

Criteria considered in the selection process were:

1. Size of land area

Initially, estimated needs were 500 to 2,500 acres. It was assumed that one park should satisfy at least a major part of these needs.

2. Cooperation of land owners

Even though right of eminent domain could be exercised, it is less costly and more expeditious if the land owner is cooperative.

3. Length of tenure

Tenure is important if capital improvements necessary for pollution control are to be justified and financed. To obtain favorable financing, for example from the Federal Land Bank of Berkeley, leases of 55 years are needed. Minimum acceptable tenure is probably at least 20 years.

4. Time required for development

With continuing urbanization of Oahu it is urgent that the project be implemented.

5. Environmental impact

The project must meet the criteria established in the Governor's Executive Order dated August 23, 1971

6. Physical characteristics

This includes climate, topography, soils, hazards, accessibility, and the environmental considerations already noted.

7. Acquisition and Development costs

This is a major practical consideration since cost of the land, if purchased, and development costs could easily exceed the appropriation, Act 202, Session Laws of Hawaii 1972, items 4b - 13a, of one million dollars.

8. Transportation and other site-related farm costs

Transportation costs usually are higher for livestock operations because of the need to bring in feed.

9. Agricultural Productivity

Agricultural productivity varies from site to site, depending upon the agricultural commodity to be grown there.

10. Value of the land to Hawaii

This is a consideration of whether there are higher and better uses of the land for the State as a whole.

Alternative sites were compared by applying subjective relative ratings for each of the above criteria. A scale of ten points (high) was used so that an individual site could score a maximum of one hundred or a minimum of ten. As specified in the contract, conclusions were reached on the basis of existing data and opinions in lieu of original research and investigation. (ref. 19)

The eleven sites considered in the original selection are shown in Exhibit XVIII . The ratings are summarized in Exhibit XIX On this basis, Kunia and Kahuku were clearly the first two choices.

Subsequent to the completion of this selection process, the site proposed at Kunia, which was State land in the Upper Pouhala area adjacent to Schofield and Wheeler Field, was again leased to Del Monte for pineapple. Accordingly, a second choice of land in the Kunia area was made, consisting of the area between approximately the 900 foot contour and the Forest Reserve to the west of Kunia Road. While this also is mostly pineapple, it is less desirable land because of slope, topography and, at the southern end, rainfall. It has been identified as the Pohakea site.

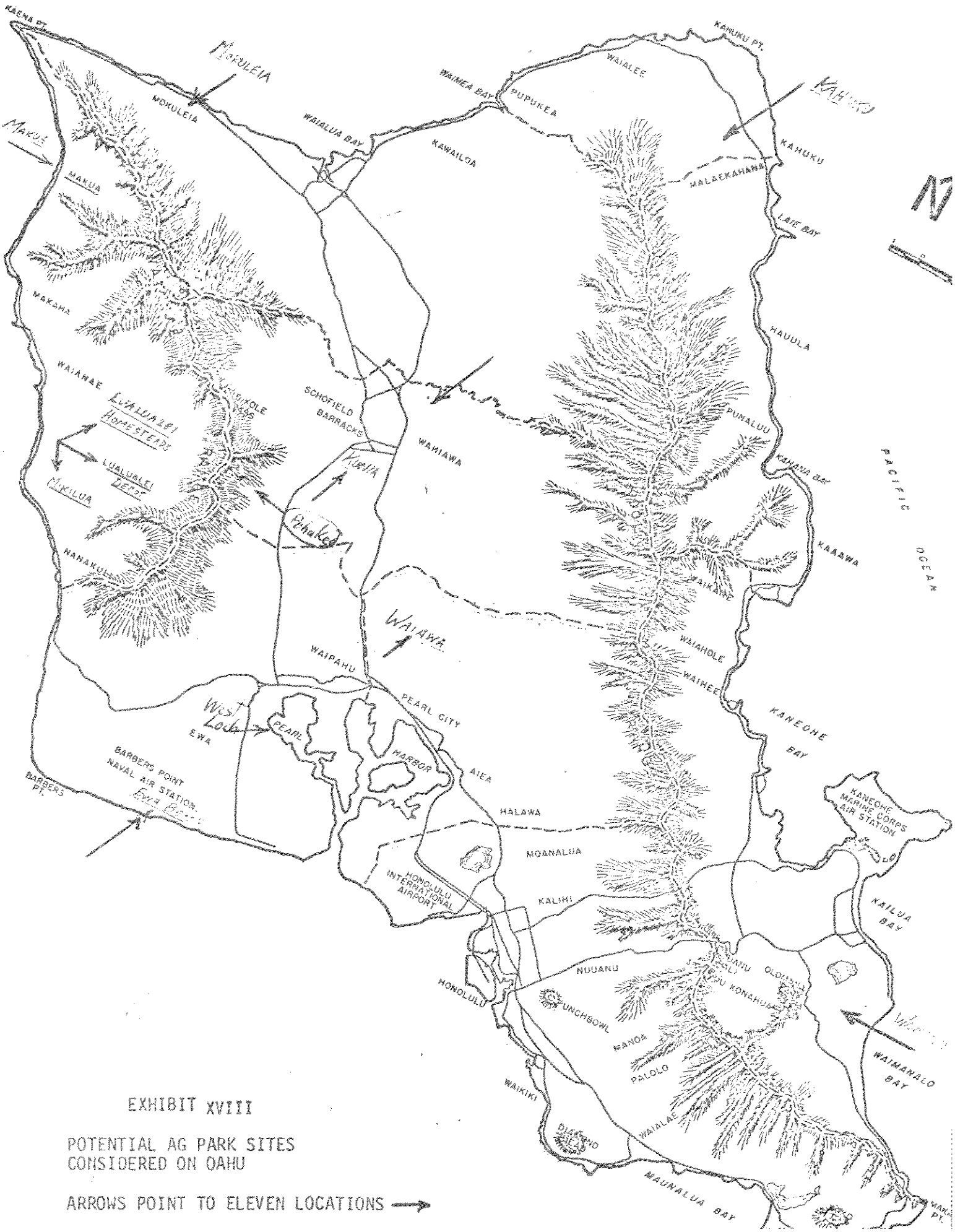


EXHIBIT XVIII

POTENTIAL AG PARK SITES
CONSIDERED ON OAHU

ARROWS POINT TO ELEVEN LOCATIONS →

EXHIBIT XIX

PRELIMINARY EVALUATION*OF AGRICULTURAL PARK SITES FOR RANKING PURPOSES

Suggested Sites	Size of Land Area	Cooperation of Owners	Length of Tenure	Time Required for Development	Environmental Impact	Physical Characteristics	Development & Acquisition Costs	Transportation & Other Farm Costs	Agricultural Productivity	Value to the State	Total Points	Order of Ranking
Kunia	10	10	10	10	7	10	7	10	10	6	90	1
Kahuku	8	6	6	10	8	8	8	6	8	10	78	2
Waiawa	10	1	6	2	4	10	1	10	10	4	58	5
Ewa Beach	10	2	6	2	6	8	6	9	7	6	62	3
Wahiawa/Waialua	10	1	6	2	4	10	1	8	10	4	56	7
Mokuleia	9	1	6	2	6	8	1	5	7	4	49	8
Mikilua	4	4	10	2	8	6	3	8	8	4	57	6
Lualualei Homestead	6	4	10	2	8	8	3	8	8	4	61	4
Waimanalo	6	2	10	2	6	8	3	5	8	6	56	7
Lualualei Naval Depot	10	1	1	1	10	8	6	8	8	8	61	4
Makua Valley	6	1	1	1	8	6	3	3	6	10	45	9

*Evaluation will be updated for the top two candidates on the basis of findings of the next phase of the study

This evaluation taken from ref. 19 of the Preliminary Site Selection Study, May, 1973.

Kahuku Alternative Site

Location:

Second choice of the site was approximately 900 acres in the Pump 5 section of James Campbell Estate lands. The area is shown on the map, Exhibit XX . It is west and south of Kahuku town, adjacent to the steeply rising highlands. The area is zoned Agricultural 1 and shown as agricultural in the master plan. Change to Agricultural 2 zoning would be required if swine are to be included in the park.

Topography and Soils:

The land is rolling but mostly usable. It is abandoned sugar cane land. In addition to the arable portions, there are gulches and rocky areas. Some of the gulches are not as steep as at Kunia and probably could be used for pasture or for certain types of nursery operations. Rocky areas would be suitable for structures although perhaps more costly to build upon.

Distribution and classification of soils is shown in the soils map, Exhibit XXI . There are two major soil types at Kahuku: Paumalu silty clay (P_e) and Lahaina silty clay (L_a). Both are considered well drained, moderately permeable soils for which the erosion hazard is moderate, depending on the slope. There are a few smaller areas of Kaena clay (Ka) which is poorly drained, low in permeability, and which

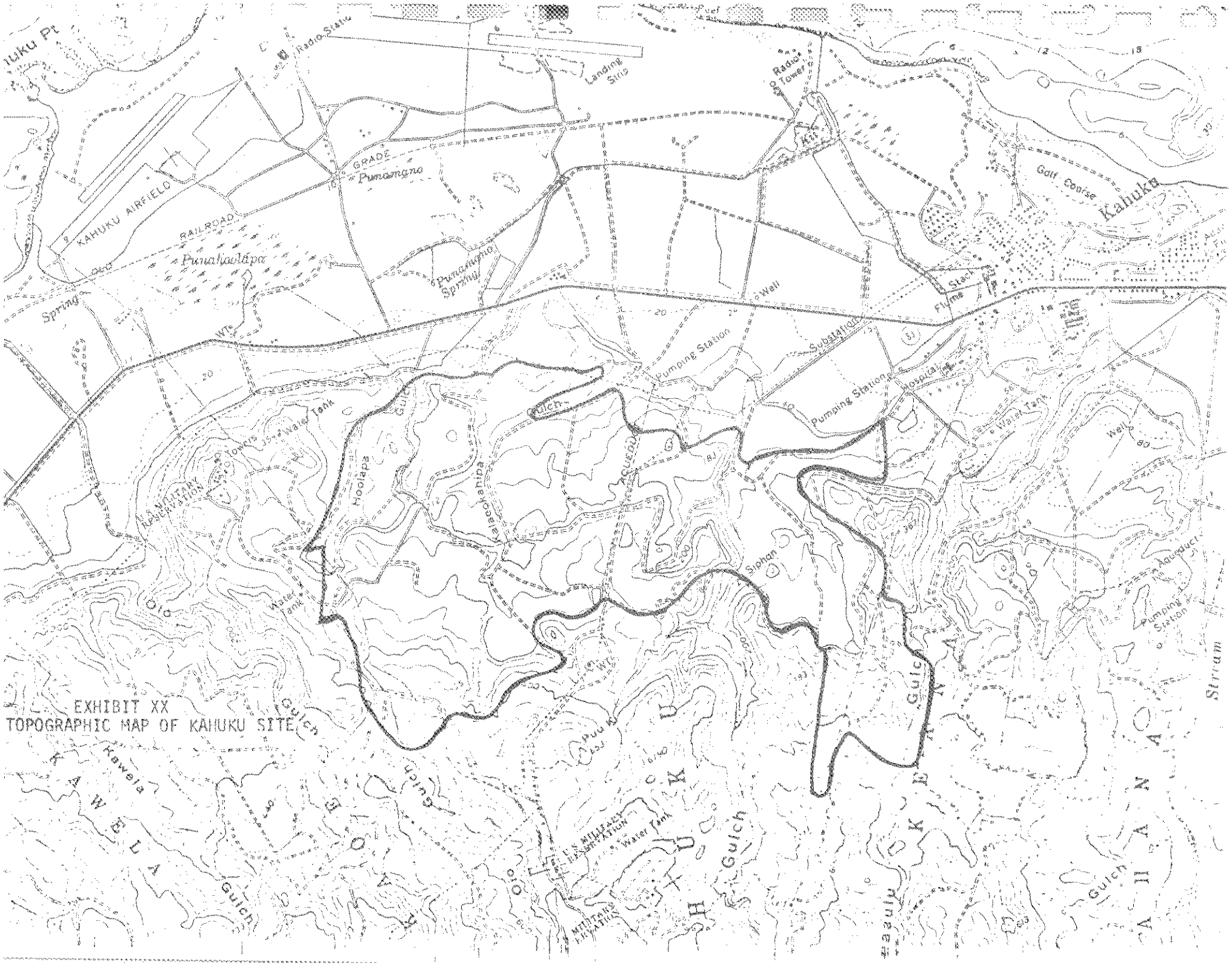
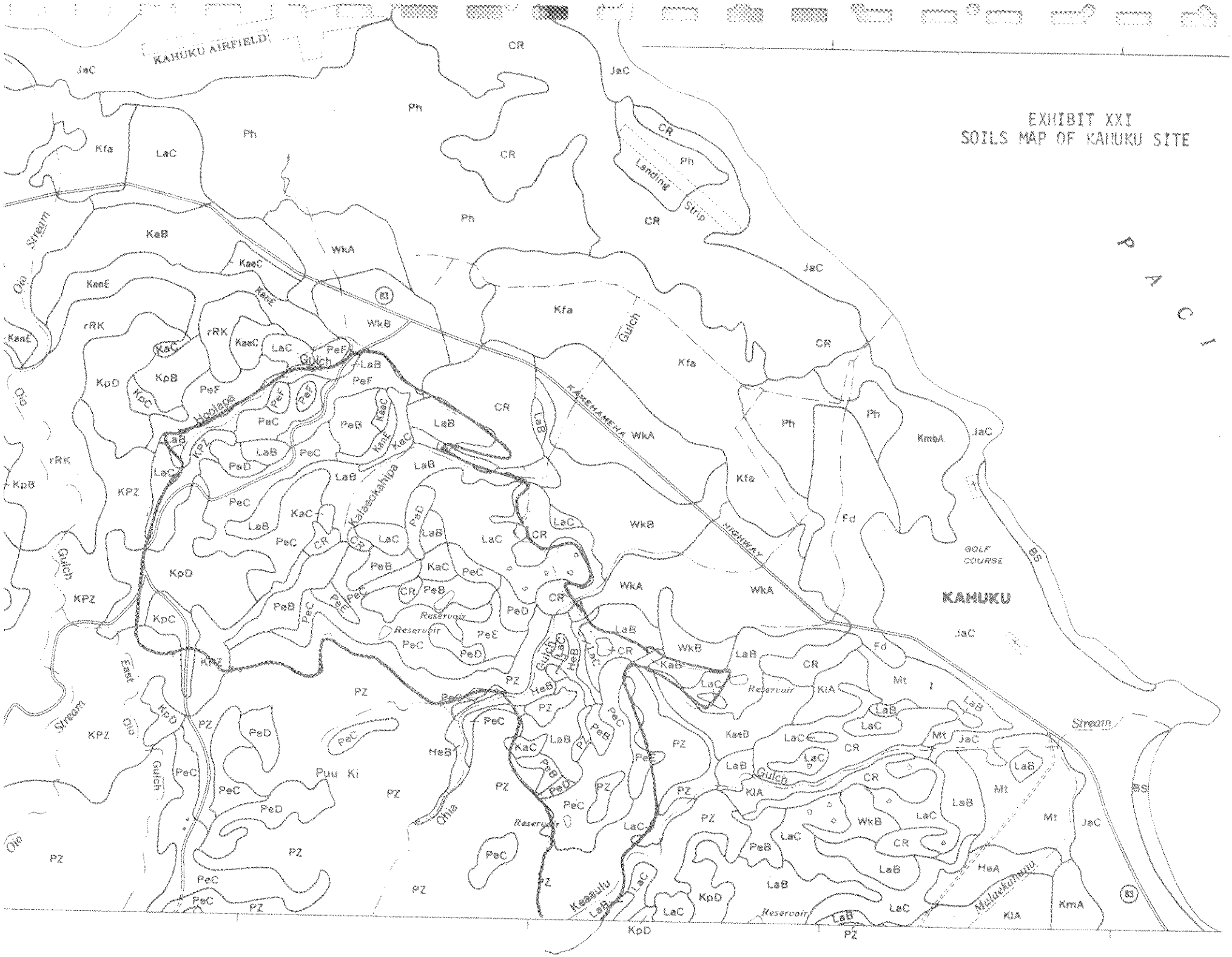


EXHIBIT XX
TOPOGRAPHIC MAP OF KAHUKU SITE

EXHIBIT XXI
SOILS MAP OF KAHUKU SITE



will shrink and swell. The non-arable portions are rocky badlands (PZ) or coral outcroppings (CR) Slopes range from 2% - 6% (B) to 25% - 40% (E), and higher in the unusable portions.

Rainfall and Wind:

Mean annual rainfall is about 40 inches and distribution is also similar to that at Kunia. Rainfall maxima also are similar (ref. 15, 16).

	10 year inches	100 year inches
24 hour maximum	8 - 10	14 - 16
1 hour maximum	2.5 - 3	4 - 5

Wind direction and intensity should be similar to that for Kaneohe Marine Corps Air Station shown in the Exhibit XXII. Wind is more directional than at Kunia, being more strongly influenced by the trades from the ocean. This is advantageous since it means that Kahuku town will be upwind from any possible odors most of the time. There are, however, periods in the winter when winds from the south or southwest occur.

Rainfall and evaporation rates are summarized in Exhibit XXIII reproduced from page 12, ref. 14, "Water in the Kahuku Area".

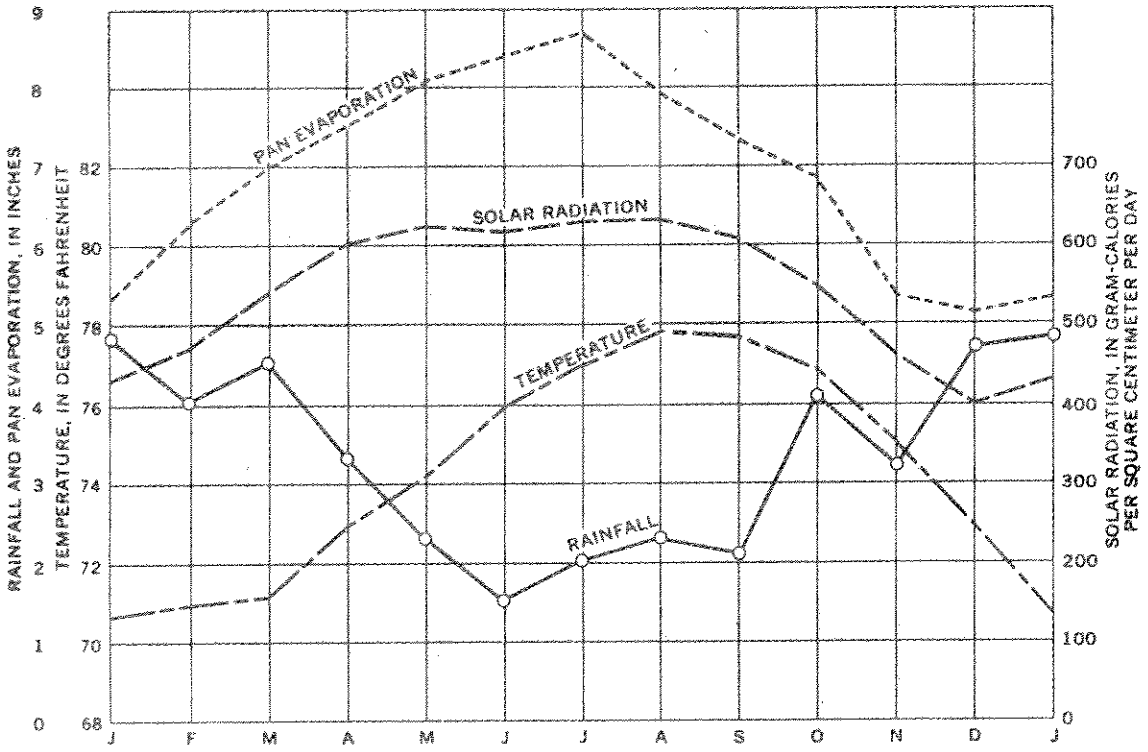
EXHIBIT XXII

PERCENTAGE FREQUENCY OF WIND DIRECTION AND SPEED
KANEOHE MARINE CORPS AIR STATION

	ANNUAL AVERAGES		JANUARY				JULY			
	time	speed	1200-1400		0000-0200		1200-1400		0000-0200	
	%	knots	%	kts.	%	kts.	%	kts.	%	kts.
N	2	9	7	8	3	10	1	8	0	7
NNE	6	9	11	10	6	11	9	10	3	8
NE	14	11	12	12	9	12	23	12	11	10
ENE	35	12	13	12	14	11	43	13	50	11
E	19	12	14	11	14	11	18	14	30	11
ESE	6	11	12	10	5	12	6	13	4	9
SE	1	7	4	8	3	5	0	9	0	7
SSE	1	7	3	10	3	8			0	3
S	2	7	5	11	8	7			0	
SSW	3	7	8	12	9	7			0	5
SW	2	6	4	12	7	7	0	5	0	4
WSW	1	5	1	10	3	6	0	11	1	4
W	1	5	1	8	2	5	0	6	0	5
WNW	1	6	1	7	2	6			0	5
NW	1	7	1	7	1	6			0	4
NNW	1	9	2	11	1	10	0	8		
CALM	4	-	2	-	11	-	-	-	1	-

EXHIBIT XXIII

PAN EVAPORATION AND SOLAR RADIATION IN KAHUKU



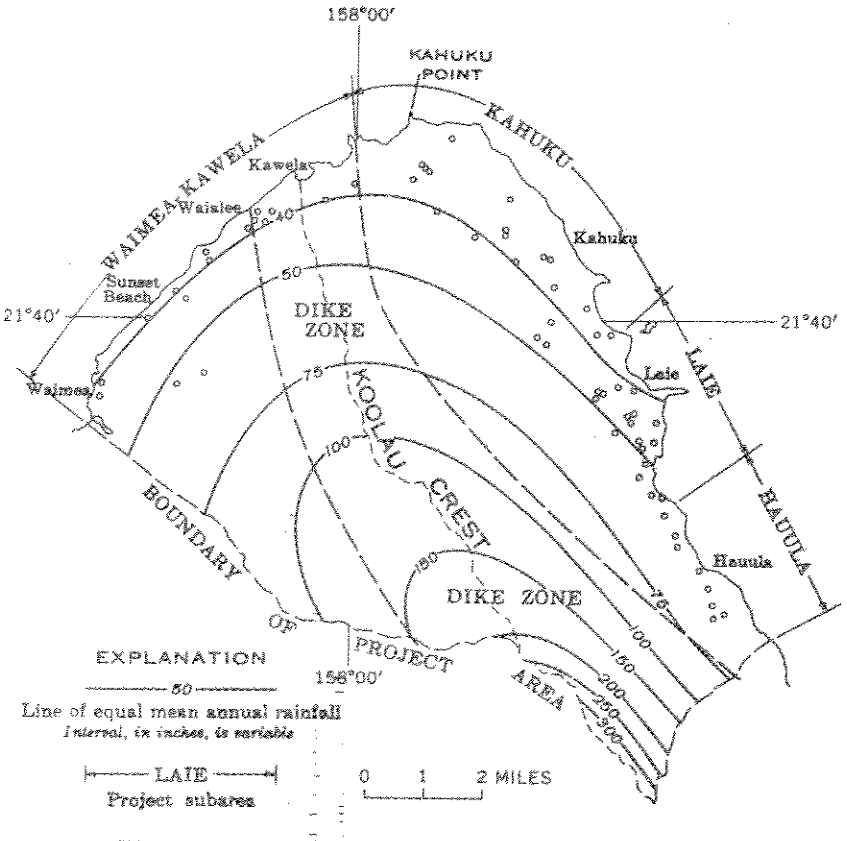
Mean monthly rainfall, temperature, solar radiation, and pan evaporation at station 912 near the town of Kahuku. Rainfall and temperature data from U.S. Weather Bureau; solar radiation and pan evaporation data from Hawaiian Sugar Planters' Association.

Geology with Reference to Hydrology:

Geologically, the Kahuku area consists of a dike zone in the Koolau ridge which follows the ridge meeting the shoreline at Kawela Bay. Windward of the dike zone and ridge are the permeable Koolau lavas and the sedimentary coastal plain. This is shown in Exhibit XXIV , also from reference 14, pg. 13.

EXHIBIT XXIV

DISTRIBUTION OF MEAN ANNUAL RAINFALL IN KAHUKU



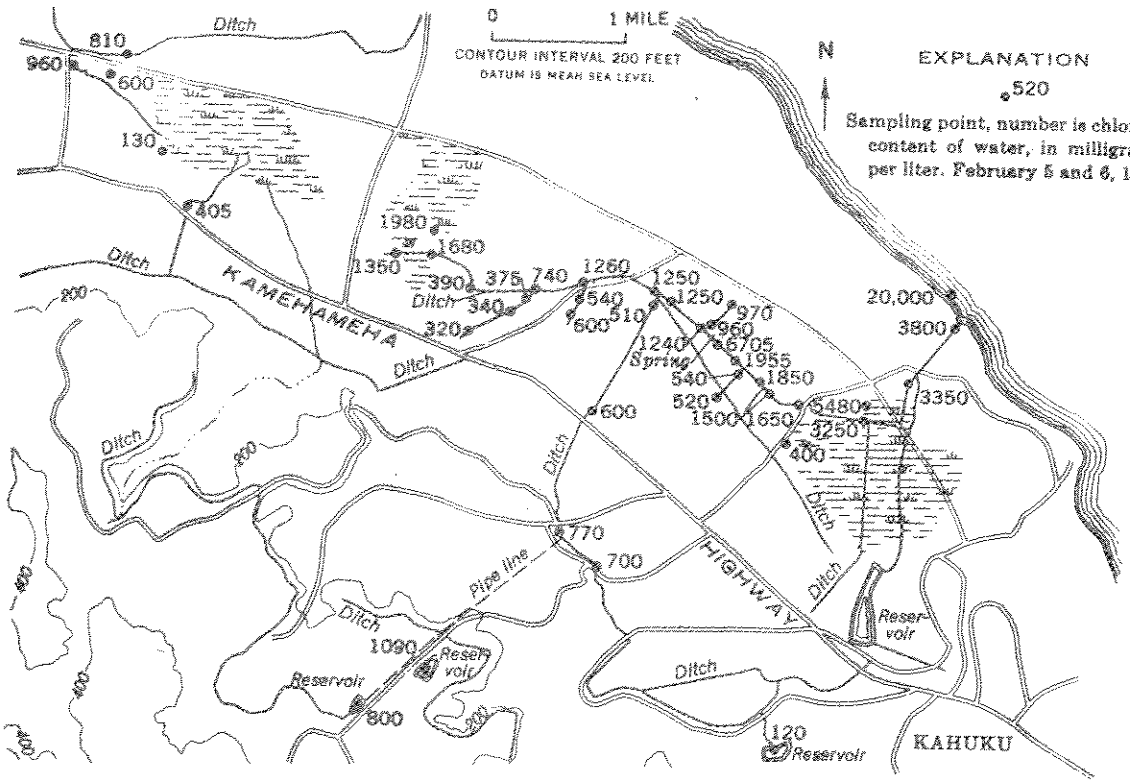
Distribution of mean annual rainfall. Rainfall data furnished by the Honolulu Board of Water Supply, 1963.

Ground water windward of the dike zone is basal water. The available data are discussed in detail in reference 14. The area has been closely observed because of the limited water supply and heavy use during sugar production. In particular, the salinity of wells in the coastal area has been reported in detail, e.g. Exhibit XXV from p. 38, of reference 14. Nitrate content in 1964 ranged from 0.6 to 6.2 ppm with most values in the 1 to 3 range. This presumably represented return irrigation waters.

In summary, one conclusion of the study is that the Kahuku area has been overdrafted. The present conclusion of the Board of Water Supply (ref. 23) is that total water available in the Kahuku area is 11 mgd, and that the most that could be made available to an agricultural park would be 2 mgd.

EXHIBIT XXV

SALINITY OF WELLS AT KAHUKU SITE



Chloride content of water in reservoirs, ditches, and marshes in the northeastern part of the Kahuku area.

Because the water underlying the coastal plain is brackish, the Board of Water Supply has no objections to use of waste water on lands in the brackish area makai of the highway.

Vegetation and Historical:

Because of the intensive use for agriculture, essentially no uncultivated vegetation remains except in the gulches. While no specific historical sites are known in the proposed project site, the Kahuku area is known to contain artifacts.

Significant Impacts of the Proposed Project:

The impacts of the proposed project would be very similar to those for the Pohakea site:

a. economic and social
b. erection of structures on land now vacant
c. possible utilization of gulch land or rocky land
d. need for water (which may not be available in sufficient quantities)
e. slight increase in traffic
f. major amount of animal waste to be utilized or disposed of

The economic and social impact of the project will be essentially the same regardless of location. In Kahuku the project would not be displacing other agriculture. Structures to be erected may not be as visible at Pohakea. The highway is now considered inadequate so that the added traffic would cause further congestion.

The police department has advised that they have forecast construction of a new facility in the area proposed for the project.

Disposal of animal wastes, after stabilization in a lagoon, would be feasible by piping them to land over the brackish water areas makai of the highway. This assumes that sufficient land is available and will remain available for as long as needed; i.e., more than 50 years if this method of waste disposal or utilization were to be used for the life of the project. It is also possible, of course, that new waste management technology will be developed. Local golf courses now use effluent for grounds maintenance.

By using an area with brackish ground water, we might assume that high rates of application might be used, permitting salts to leach into the brackish water. This would reduce the amount of land required to reasonable area. The limitation would be the rate at which the land could assimilate water; i.e., the sustained infiltration rate.

Precautions would still be necessary to prevent wastes from infiltrating at the site to contaminate the basal fresh water which underlies the site. Past experience with irrigation return flow shows that contamination could be expected.

Odor should be controlled by sanitation practices. However, complete control probably is not realistic. The predominance of off-shore winds should keep odors away from Kahuku town, and the Kahuku resort area most of the time, but there will be some periods of little or no wind, or of southerly winds.

Agriculture in the West Loch Area

Campbell Estate is considering the development of diversified agriculture in the area adjacent to West Loch which is considered unsuitable for urban use because of the possible blast hazard from naval ships. The area is at present being used for sugar cane but could be converted to some diversified agriculture since it is of marginal productivity in sugar cane.

Primarily, the area is being considered for nurseries since much of their production is grown in pots above ground. The initial area, which is planned for 150 acres, with another 150 acres developable with the same capital investment, could reduce the demand for ag park land somewhat.

If this area were used for the agricultural park this would obviate the concerns of the Board of Water Supply about salts entering the water supply. However, it is probable that the Department of Health and/or the Environmental Protection Agency would be forced to object to location of livestock adjacent to the Class AA waters of West Loch because of the requirements in state and federal water quality laws. Factual data would be required for a definitive conclusion. The effects of ground water quality on quality of the receiving waters are now under study.

Also, the site is close to present and proposed urban development of other relatively poor agricultural land. The location is shown in Exhibit XXVI.

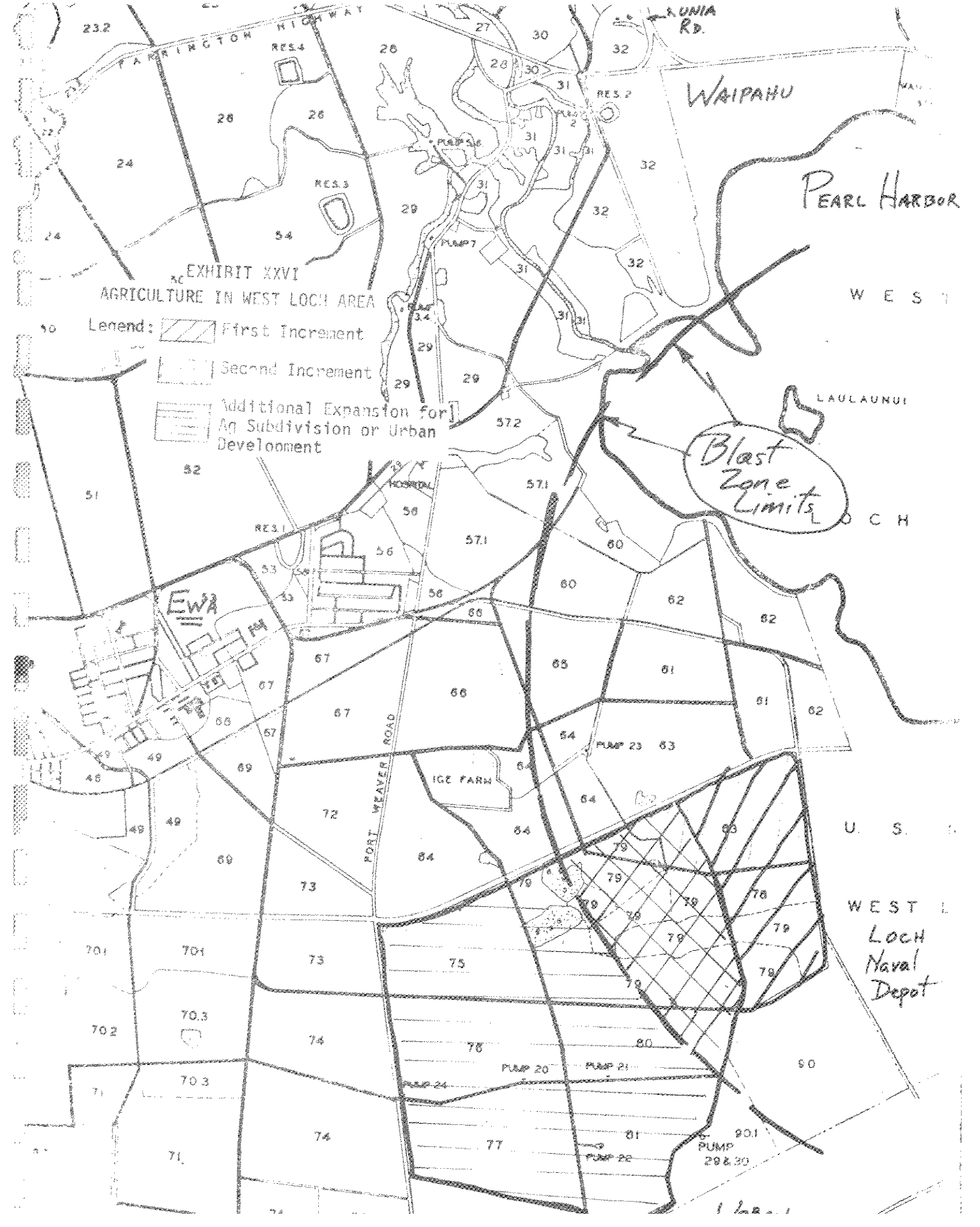


EXHIBIT XXVI
AGRICULTURE IN WEST LOCH AREA
Legend:
First Increment
Second Increment
Additional Expansion for Ag Subdivision or Urban Development
WAIPAHU
PEARL HARBOR
WEST LOCH
LAULAUNUI
Blast Zone Limits
EWA
FORT WEAVER ROAD
ICE FARM
HOSPITAL
PUMP 7
PUMP 23
PUMP 20
PUMP 21
PUMP 24
PUMP 22
PUMP 29 & 30
WEST LOCH Naval Depot
U. S.

The Alternative of No Project

If the project were not implemented (as an alternative) the consequences would be primarily social and economic. Urbanization pressures force land prices higher with resulting pressures on small farmers through loss of lease or temptation to sell if the land is owned in fee. Social pressure also is brought to bear on farmers as residential areas approach them. Most residents object to living next to farming activity, particularly livestock operations. With all of these pressures, the trend is to abandon farming in present locations. If there are no alternative sites available, which seems to be the case, the result is a decrease in diversified farming.

The land at Pohakea is at present partly in pineapple, partly unimproved pasture, and partly unused. Adjacent acreage at the ewa end is in sugar cane, but this is at elevations above the main water supply, Waiahole Ditch, and it does not appear likely that sugar will expand to the proposed Pohakea agricultural park site if pineapple vacates the area completely.

Mitigation Measures and Costs:

In discussing the impact of waste management systems on the environment, we have stressed the simplest systems although alternative methods have been offered, because to succeed, the project must be economically viable. The cost to the farmer of doing business must be commensurate with the return he may reasonably expect.

Obviously, the technology exists whereby the waste waters from the park could be given the equivalent of tertiary treatment and discharged to the receiving waters. Covering all pens, corrals, etc. so that there is no storm run-off gives almost complete control of wastes and probably makes feasible a dry system except for the wash waters and excess moisture in the manure. These waters should be low enough in volume and nutrient content to be disposed of on crop land or possibly by evaporation.

It is also obvious that the small or medium sized farmers may not be able to pay the costs of such treatment, at least in the present market. If the decision is made that extensive treatment is required then, for the park to succeed, some form of subsidy is necessary. There are many precedents for subsidy of certain enterprises by the community. One possible problem area relates to considerations of equitable treatment for farmers not participating in the agricultural park.

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

An objective of the proposed project is to demonstrate a way to preserve and expand diversified agriculture in Hawaii by providing the land and associated utilities at a cost which both the farmer and the community can afford. If successful, the project should be a prototype for similar ventures throughout the state.

Since the project is agricultural, the land remains available for other uses without the sacrifice of large capital investments, unless a large investment in waste management facilities is required. One proposed guideline for the project is that leases should be available for at least 50 years so that properly constructed facilities for dairies, swine, etc. can be justified and financed.

Economic and social contributions of a successful project will be substantial. The project will demonstrate a way to maintain and expand a sound, profitable agricultural industry as a basic element of Hawaii's economy. It should be a step toward self-sufficiency in meat and vegetable production and a step toward expansion of our export business in ornamentals and nursery stock.

Use of the land for this purpose is proposed for at least 50 years. The capital commitment is not as great as urbanization so that the cost of premature termination would not be as great.

5. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION

No direct irreversible commitment of resources is anticipated. Indirectly it might be argued that urbanization of agricultural lands now occupied by prospective tenants of the park will occur if and when they move to the park. However, it may also be argued that such urbanization will occur whether the ag park is created or not, if rezoning is permitted.

The water required to operate the park may be regarded as committed for the duration of its operation. To the extent that salts are deposited in the soil and/or carried into the water supply, there may be some long term effects. Again these effects are reversible after cessation of the operation, although it may take some time to reverse these effects.

6. ECONOMIC AND SOCIAL ANALYSIS

Several points have been discussed in other sections of this report: (1) the interest of the community, expressed in actions of the Legislature, in preserving and strengthening agriculture in Hawaii; (2) the economic advantages of a basic, productive industry in Hawaii; (3) the negligible effect of the project on the current use of the land for pineapple.

The interrelation of the project to land use and lifestyles in other parts of Oahu has also been mentioned, but deserves further analysis. To the extent that the park makes it possible for farmers to leave their present locations with consequent urbanization of their lands, the effect of the park is not necessarily beneficial. Urbanization of areas in Nanakuli and Waianae, for example, which now are agricultural could have far-reaching effects on lifestyles of the present residents. Urbanization, at present housing standards and prices, will quickly cause a rise in housing prices, land prices, and taxes throughout the area. This may result in displacement of families with lower incomes who are now resident in the area, which will only aggravate the problems of providing housing for families with low or moderate incomes. One might argue that the presence of agricultural operations, especially swine operations, ensures a stability for the neighborhood which can be achieved in no other way under today's conditions.

The community does have independent control of this, however, through zoning and land use restrictions; i.e., it need not permit conversion of agricultural land to urban use. Hence, it is not completely correct to say that creation of the ag park per se would accelerate urbanization.

In particular, creation of the agricultural park as proposed would not satisfy the need for acreage of diversified agriculture to replace imports of meat and produce as discussed under "Goals and Objectives". Thus, to permit rezoning of other land on Oahu from agricultural to urban use merely because of the agricultural park is self-defeating. First phase of the park will contain only about 1,000 acres and may contain only the 460 acres forecast for livestock. Total new acreage needed for Hawaii is estimated to be more than 2,700 acres.

Of this, 1,200 acres are needed for swine production. While it might be argued that this production could occur on the other islands, this is not true for swine if they are to be fed garbage, as the hotels and military bases, the chief suppliers of garbage, are concentrated on Oahu. Alternative feeds are available but use of garbage for this purpose represents an economic use of material which otherwise would be a waste for which disposal would be an expense.

The alternative of producing vegetables and meat other than pork on the other islands has also been discussed in ref. 19. Added costs and delays of of transportation make this unattractive. The additional costs for transportation vary with the commodity. For milk, for which firm cost data are available, the price on Hawaii is $11.70/cwt. compared with $12.25/cwt on Oahu, a difference of $0.55/cwt. However, freight is $2.50/cwt. Hence, a reduction in freight rate of about 80% would be needed to make Hawaii milk competitive on Oahu.

In the case of milk, freight rates are about 20% of the wholesale price. For other commodities, the rate is not as great a percentage and economies on the other islands might balance the cost of freight. For example, freight costs (ref. 19) are only 2% - 4% of wholesale price for meat, 8% - 10% for tomatoes, and 13% - 13% for lettuce depending on island and mehtod of transportation. Cost of interisland transport has been one factor leading to the cessation of pineapple production on Molokai.

In addition to the land needed for diversified agriculture, to be truly self-sufficient, feed for the livestock is also needed. It is not clear at this time whether all feed can be produced competitively in Hawaii. The assumption usually is made that at least some grains would be imported. However, regardless of the amount produced in Hawaii, whatever is grown probably can be grown most economically on other islands where land values are not as high.

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APPENDIX A

ANIMAL WASTES AND THE ENVIRONMENT

In the " wild" state animal wastes are part of the natural food cycle. Animals consume flora and/or fauna and the metabolic products are returned to the air, water, or land. Yet today animal wastes are considered a significant environmental problem, especially with regard to water pollution. The reason is that man has altered conditions by concentrating large numbers of animals in small areas, because land costs have risen and operating economics can be achieved through intensive feeding. Instead of one or two acres per head of cattle, we now have hundreds of cattle per acre in dairies and feedlots.

The biochemical processes by which wastes reenter the food cycle are unchanged. Like most biochemical processes, they proceed best under more or less dilute conditions. In particular, the rates of these processes do not increase in proportion to the increase in animal concentrations, or at least they do not increase without some engineering assistance from man.

Hence, with increased animal populations under traditional conditions, animal wastes have accumulated and often become environmentally undesirable in two ways: (1) as undecomposed or partially decomposed wastes, and (2) as unassimilated conversion products such as nitrate.

Nitrate accumulation is now considered a major problem because nitrate salts are very soluble in water and, in the absence of specific organisms, quite stable. Hence, once past the active soil layer, nitrates can enter the water supply and remain there. Maximum recommended concentration for drinking water is 45 ppm nitrate, or 10 ppm nitrogen.

Nitrate accumulation is not the result of an "unnatural" process but rather the failure of natural processes to assimilate the high concentrations of nitrate and ammonium present in the concentrated wastes. In the natural cycle, microorganisms convert organic nitrogen to ammonium ion. This can then be assimilated directly, or after further conversion to nitrate. Nitrogen fixed by plants and cycled in this way is essentially the only natural source of nitrogen for the food cycle. Synthetic fertilizers merely supplement the amounts entering the cycle through plants. Rain in Hawaii contains 0.5 ppm nitrate.

Thus the changes which lead to nitrate accumulation are of degree rather than kind, and it is reasonable to try to utilize the natural cycle to assimilate larger quantities of nitrogen, for example by increasing the efficiency of the natural processes.

The ionic forms of nitrogen - ammonium ion, nitrate ion, or nitrite ion - are absorbed as nutrients by plants of all kinds ranging from algae to trees. Algae are a functional part of aerobic disposal ponds. Culture of algae as a means of converting nutrients to protein has often been considered, but has not been applied commercially because of the energy and equipment required for mixing, separation, etc. under production conditions.

Applications to grasses and other crops still is the most practical method for utilizing such nutrients. The limiting factor is the rate at which the crop can assimilate and use the nutrient. On grasses, an excess of nitrate may have adverse effects either by depressing growth or by being assimilated in amounts toxic to cattle if the grass is used as feed. Considering only assimilation rate, Ekern (ref. 10) has shown that continually harvested Bermuda grass assimilated the equivalent of 50 pounds of nitrogen per acre per month in experiments at the Mililani sewage treatment plant using secondary sewage effluent. Under similar conditions, sugar cane absorbed only 20 pounds of nitrogen per acre per month.

Denitrification, a process in which anaerobic microorganisms reduce nitrate to nitrogen gas, is another way in which nitrate is removed. This requires not only anaerobic conditions but also an oxygen receptor such as organic carbon (BOD). It does occur naturally in soils impervious to oxygen; in layers of settled sludge in lagoons or settling basins and in lagoons which are sufficiently deep so that oxygen is consumed by BOD in the surface layer.

Efficient use of the process requires engineering. Experimentally, suitable conditions have been created by placing a layer of soil on a water-impermeable barrier: plastic sheets (ref. 1, 6). Percolation of waste water through the soil at appropriate rates creates an aerobic zone in the upper layers and anaerobic at the bottom. Hence, conversion of nitrogenous compounds occurs by both processes. Denitrification occurs if the appropriate energy source (carbon compounds) is available. Data

on rates and capacities of such a system are not yet available for Hawaiian conditions but extrapolation of mainland data gives estimated capacity for denitrifying four tons of nitrogen per acre per year based on direct application of septic manure waste. Higher rates probably could be achieved with pretreated effluent.

Other constituents of animal wastes also enter the cycle. Under natural conditions their effects were minimal but, as we concentrate animals, we must consider them more carefully. Other inorganic nutrients and nonnutrients are present -- in particular, sodium, potassium, and phosphate. On Hawaiian soils phosphate is readily absorbed and is not considered a problem. However, sodium and potassium many produce undesirable effects. If they reach the fresh water aquifer they increase the salinity. If exchange occurs with multivalent cations such as calcium in certain clay minerals, the effect on soil properties is usually undesirable, e.g. a loss in permeability.

Man has introduced additional factors which also may affect the environment through animal wastes: namely, the use of additives for therapeutic, prophylactic purposes or to enhance the efficiency with which feed is assimilated by the animals. These additives are all used on a cost-effective basis and contribute significantly to the high efficiencies being achieved in animal production. They may be expected to have a beneficial effect in helping to reduce costs and prices.

Environmental concern with additives relates either to their presence in wastes or to possible secondary effects. With regard to their presence in the wastes, the hazard seems minimal since most are biodegradable organic compounds used at very low rates in the feed, hence present at even lower rates if at all in the wastes. The exception would be persistent materials such as arsenic. The possible secondary effect causing concern at present is the development of resistant strains of microorganisms in response to doses of antibiotics. The fear is that resistant strains pathogenic to man will develop and be transmitted.

This area is the subject of current research, debate, and actual or proposed regulatory actions by federal agencies. The outcome of these presumably will be an elimination of any conceivable hazard.

With or without the use of feed additives, animal wastes may contain microorganisms potentially hazardous to man or other species. Bacteria and larger microorganisms are not considered a major problem for water which passes through soil. However, viruses and soluble salts as already discussed are potential contaminants of ground water. The degree of hazard from possible contamination by animal viruses is not known. Past experience with traditional methods of animal husbandry suggests that the hazard is not great, and animal wastes are not considered a significant hazard from this standpoint.

The fate of contaminants such as viruses and dissolved solids in waste waters applied to soil is the subject of a research project cosponsored by the Board of Water Supply and the City and County of Honolulu now in progress at the Water Resources Research Center at the University of Hawaii. This project is concerned specifically with recycle of municipal sewage effluent by irrigation. A similar project has been in progress at Pennsylvania State University (ref. 24). The first progress report for Hawaii was issued in November, 1972 (ref. 10). This report not only summarizes the status of the project but also conclusions from similar work at other locations. Current status of the project was reviewed with personnel active on the recycle phase.

Briefly, the present conclusions are that the most significant problems are the accumulation of dissolved solids and loss of permeability of the soil. There is some evidence that virus may travel through soil and that conventional chlorination procedures may not always inactivate virus in primary effluent. However, under proper conditions, chlorination will always inactivate virus.

In this project, Ekern has been observing the movement of secondary sewage effluent through the soil at Mililani. He finds nearly impervious subsoil and tillage pan layers which impede the downward flow of water with a maximum permeation rate through these layers of one-half inch per day when saturated. However, water can move laterally along these impervious layers until it reaches a permeable spot, for example at a gulch.

Movement of water in the soil also will be affected by evaporation rates. For central Oahu, Ekern reports evaporation rates of 60 - 90 inches per year with the high value at the Barbers Point area. HSPA reports over 70 inches per year at Kahuku and confirms Ekern's values for the Pearl Harbor-Ewa area. To the extent that evaporation exceeds rainfall plus water added by irrigation one may postulate that little or no penetration to ground water will occur. A corollary is that salts will accumulate in a surface layer. However, these are average values and infiltration still may occur during transient periods of high rainfall.

Two studies of infiltration rates have been reported by the University of Hawaii. In most soils, the steady state infiltration rate ranged from 0.5 to 5 inches per hour. The Soil Survey published by the Soil Conservation Service lists permeabilities for the soil types. For most of the soils in the proposed Kunia site, the permeability is given as 2 to 6 inches per hour (ref. 2). Initial infiltration rates for dry or partially dry soil may be greater than these by a factor of 5. Confirming the implications of these data, R. Green (ref. 12) has observed pesticide penetration to depths greater than those predicted from soil porosity and rainfall. Presumably salts, etc. deposited in a surface layer also would be carried into the soil during such events.

WASTE MANAGEMENT AT THE AGRICULTURAL PARK

Waste management at the proposed agricultural park must take into consideration the various factors discussed and also maintain costs at a realistic level. Certain general characteristics which any systems should have are apparent:

1. During rainfall, surface runoff from the livestock operations must be controlled and segregated from the clean surface waters.
2. Depending on the site location and characteristics, infiltration from animal corrals may or may not be permissible, i.e., paving may be required.
3. Direct disposal of wastes on land is feasible only if sufficient area of suitable land is available continuously. Nitrogen utilization and the ultimate fate of dissoved solids are the determining factors.
4. For environmental safety and for economy, waste management practices should be integrated from the animal to final disposal.

Estimates of the animal population and the resulting daily waste are given in the table which follows. Choice of waste management system will depend on final site selection, but some general considerations will apply to most sites.

ANIMAL WASTE QUANTITIES

	Dairy	Beef	Swine	Poultry*	Total
No. of Animals	2,000	3,600	20,000	200,000	
Area in Acres	250	18	105	4	377
Gross Density					
Animal/Acre	8	200	190	50,000	
SF/Animal	3,500	220	230	0.9	
(Units per day in 1000's)					
Total Manure					
#/day	210	220	100	51	581
CF/day	3	4	3	0.3	11
Gal/day	22	27	20	7	76
Total Solids - #/day	22	22	14	15	73
Volatile Solids	17	17	12	11	57
BOD	4	5	4	4	17
COD	25	32	13	14	84
Nitrogen	0.85	1.70	0.81	0.85	4.22
P_2O_6	0.24	0.26	0.36	0.78	1.64
K	0.37	0.39	0.20	0.31	1.27

NaCl 0.1 lb/day/head cattle

* Sludge removal only or dry processing

Since water quality is a major consideration, an ideal system would have no waste water discharges. A "dry" system would consist of a composting operation. Composting of animal wastes has been demonstrated by many investigators. In particular, it has been demonstrated in Hawaii (ref. 13, and later work).

It is generally agreed that the ideal conditions for composting to eliminate odor and produce a compost with good handling characteristics are aeration and a moisture content in the range 50% to 65%. But the average moisture content of the daily composite manure from the park is estimated to be 87% without considering additional water from washing, runoff, etc. This could be reduced by diluting with dry or partially dry material such as sawdust, bagasse, dried compost, etc. However, to reduce the moisture content from 90% to 60% the mixture must contain 75% of a diluent with 50% moisture or 37.5% of a diluent with 10% moisture.

Conventional drying or solar drying are possible, but require use of fuel and/or capital equipment and, in the case of solar drying, the effect of cloudy weather must be considered. The heat generated during composting will evaporate some water although apparently there are no quantitative measurements of the amount of heat generated. An estimate might be based on heats of combustion along with amounts of organic solids converted to carbon dioxide.

All things considered, a completely "dry" waste management system may not be within the present state of the art economically. If compost is produced we also must consider whether it has economic value and whether the market is large enough to accept the total production which might be on the order of 50 tons per day. However, this is in part an academic consideration. Regardless of the disposal method selected there will be solids accumulation. These solids must be utilized or disposed of.

Compost does have fertilizer value and is beneficial as a soil amendment. However, this nutrient content also limits the amount which can be applied. In addition, unless the solids have been leached at some stage in the processing, the salt content of compost will be significant. We will in effect be disposing of salts by spreading them on land in solid form rather than in liquid effluent. Total salt (sodium chloride) content of the manure will be at least 500 pounds per day from the cattle alone. Potassium content of the composite manure is estimated to be 1,200 pounds per day (2,300 pounds as potassium chloride).

An alternative composting method would be to drain or press the solids, then compost the wet solids with aeration and mixing to prevent development of odorous anaerobic conditions since the moisture content would be higher than optimum. Depending on volume, the liquid phase might be treated in an oxidation ditch, aerated lagoon, or possibly renovated by passing through a bed of soil under controlled conditions as already described.

Economics and sanitation considerations may lead to the conclusion that all wastes within corrals and pens must be transported in water and that therefore a liquid treatment method must be selected. The simplest method for disposal would be to spread the entire slurry on land. This is being evaluated in some areas on the mainland. The limiting factors of nitrogen assimilation and infiltration of salts into the groundwater have already been discussed.

In locations where infiltration would not affect the fresh water supply, this would be an acceptable method provided that sufficient land were available. The amount of land needed would depend on how the land was managed. For maximum yield of a crop, nitrogen should be balanced with crop requirements. The daily output of 4,200 pounds of nitrogen would require about 7 acres per day, or about 2,500 acres per year.

If excess nitrogen can be tolerated, it is conceivable that the land could function merely as a primary filter and the area needed would be determined by infiltration rates and odor control. Acceptability of such a disposal method obviously is strongly dependent on the site and on the ultimate fate of the dissolved solids. If odor control or flies appeared to be a potential problem, there are methods for depositing the slurry in a furrow which is immediately closed so that the material is never exposed on the surface. If this were done on a small enough area, it is conceivable that a synthetic topsoil would accumulate which would have economic value.

Without the ideal conditions which would make land disposal feasible, some form of treatment is needed. The various systems which have been proposed or evaluated all are engineering variants or combinations of two basic processes: anaerobic and aerobic. The advantages of anaerobic processes are considered to be (1) decomposition of more organic matter per unit volume than aerobic; (2) methane produced can be used as fuel; (3) sludge dewaters easily; and (4) lower cost. Disadvantages are considered to be (1) greater odor production than aerobic; and (2) requires more careful control and is more easily upset. Covered digesters are the preferred equipment for anaerobic treatment, although anaerobic tanks or ponds often have been used. In the latter case, it is probable that the surface layer is aerobic, which helps to control odor. An anaerobic-aerobic lagoon was operated successfully with food processing wastes, i.e. aerobic surface with anaerobic lower layers.

By aerating mechanically it is possible to operate lagoons aerobically with the same volume and depth as anaerobic lagoons, hence to conserve surface land area. There is the added cost of aeration. There are no odors. Combination of anaerobic and aerobic in separate ponds also has been reported.

One recent trend is to collect wastes, especially from swine, directly through slotted floors in a circulating, aerated, elliptical ditch or raceway which serves as an oxidation ditch. This serves not only as a collection mechanism, but also as a holding and partial treatment tank. There is no odor. This can reduce total solids by 30% to 50% and total BOD by 50% to 75%. Some denitrification can occur in the sludge. With collection and treatment units such as these at each livestock unit, the load on a central waste treatment facility could be reduced significantly.

The central treatment facility presumably would treat the waste slurries by standard aerobic or anaerobic procedures. Regardless of the treatment methods selected, or the degree of pretreatment at the source, certain fundamentals will remain the same. The treatment systems remove BOD primarily. It is probable that high removal efficiencies can be obtained. However, the nitrogen, potassium, and sodium contents will remain nearly unchanged.

In addition to differences in cost and efficiency in removing BOD, the only differences among various disposal systems will be the distribution of of nitrogen, potassium, and sodium between the sludge phase and the effluent water. All systems, except the completely "dry" composting one, will produce both a sludge and a water effluent. Both will be innocuous except for the presence of the nutrients and the salts. Disposal therefore reduces in every case to what we are willing to permit and/or able to do with these materials.

One further possibility should be discussed although at this time it is premature to consider as an acceptable disposal method. This is the recycle of wastes as components of feed. Experimentally, this has been shown to be feasible. Various techniques have been used such as direct addition of dried wastes to rations, ensiling manure with green fodder, or growth of yeasts, etc. on extracts of manure. The ensiling and yeast cultures are of course methods which utilize the nutrients as food for microorganisms. These may be considered variants of standard disposal methods. A further possibility is to combine with other food-producing operations. For example, fishponds have traditionally been fertilized with human or animal wastes in other parts of the world.

One major question at this time is regulatory. FDA has taken the position that the law requires that the safety of these feeds be demonstrated as it does for any new food or food ingredient.

It is probable that, even if recycle became acceptable, total recycle would not be practical and some waste disposal would be necessary. However, the magnitude of the problems would be reduced. Combination with aquaculture or horticulture would still remain as possibilities.

SECTION II

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

December 10, 1973

STATE OF HAWAII

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

P. O. BOX 2359 • HONOLULU, HAWAII 96804

JOHN A. BURNS
Governor

SHELLEY M. MARK
Director

EDWARD J. GREANEY, JR.
Deputy Director

October 29, 1973

Ref. No. 9841

MEMORANDUM

TO: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

FROM: Shelley M. Mark, Director

SUBJECT: Draft Environmental Impact Statement for an Agricultural Park Near Kunia, Oahu

We have reviewed this Environmental Impact Statement and the supplemental reports entitled, "Preliminary Site Selection Study for an Agricultural Park on Oahu" and "Conceptual Design and Cost Comparisons for an Agricultural Park on Oahu." These reports provide detailed analyses of the problems, issues and need in support of locating this type of facility on Oahu.

The Environmental Impact Statement seems to adequately cover the probable effects of the proposed action. We note that control of animal wastes in an environmentally acceptable manner will be one of the most critical impact factors to be considered in implementing the agricultural park concept. Consequently, further investigation of waste management techniques may be necessary, as the entire park becomes fully developed.

In view of the many complex and divergent factors which must be considered in an important proposal such as this, we feel that the Department of Agriculture should further discuss the design and site concerns with the Agricultural Coordinating Committee, DLNR and DPED prior to final selection of the site.

It may also be necessary that further consultation be made with the Department of Land Utilization of the City and County of Honolulu with regard to specific animal husbandry (hog-raising) uses proposed within the agricultural park.

We appreciate this opportunity to review these reports.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
440 Alexander Young Bldg., Honolulu, HI 96813

November 5, 1973

Dr. Richard E. Marland
Office of Environmental Quality
Control
550 Halekauwila Street
Honolulu, HI 96813

Dear Dr. Marland:

Re: Draft Environmental Impact Statement for an Agricultural Park near Kunia, Oahu.

We have reviewed the above-mentioned draft and offer the following comments for your consideration:

1. The Pohakea site appears to offer a suitable setting for the various proposed agricultural uses, in terms of soils, topography, and climate. There are sizable acreages of gently sloping soils well-suited for cultivated crops. Some of the land has moderate limitations for cultivated crops; it would be better-suited for livestock operations. We also recommend that the steep gulches and mountainsides remain in permanent, undisturbed vegetative cover.

2. Careful consideration should be given to soil types in planning the location of various agricultural enterprises. It appears that some of the sites planned for dairy and swine use are located on soils better-suited for pasture. In our opinion, soils well-suited for cultivation should be utilized for that purpose. Soils with limitations for cultivation should be dedicated to less intensive uses to control erosion.

3. More than 1,000 acres of land would be displaced from pineapple production by the Pohakea site. What effect would the proposed condemnation of the lease for pineapple land have on the land user? We recommend that the state work closely with the plantation to explore possible alternatives.

4. There are 487 acres of state land in the Upper Pouhala area, east of Kunia Road, that was originally proposed for the agricultural park. This land has recently been leased for pineapple production. We feel that this site offers excellent potential for diversified, cultivated crops. Since this land

is already in state ownership, condemnation of this lease may be a more suitable alternative to condemning privately owned land.

5. Soil Conservation Service assistance in solving conservation problems and planning erosion control measures is available through the West Oahu Soil and Water Conservation District.

We appreciate the opportunity to comment on this draft.

Sincerely,

Francis C. H. Lum
State Conservationist

November 8, 1973

ERRATA

Item 2. Line 4

a. "pasture" should read "cropping"

b. Add missing sentence: "Also, some of the soils planned for cropping use are better suited for pasture".

UNIVERSITY OF HAWAII

Environmental Center

Office of the Director

October 31, 1973

MEMORANDUM

TO: Richard E. Marland

FROM: Jerry M. Johnson

SUBJECT: Draft EIS for Kunia Agricultural Park

Enclosed herein are our review comments as requested. They were prepared by Tamotsu Sahara, Land Classification Specialist.

Jerry M. Johnson
Acting Director

cc: T. Sahara

2540 Maile Way · Honolulu, Hawaii 96822 · Phone 944-7361

Review Comments Concerning
Draft EIS for Kunia Agricultural Park

October 31, 1973

By
Tamotsu Sahara, Land Classification Specialist

The draft of the EIS for the Kunia Agricultural Park discusses at length the disposal methods of the animal wastes. In order to develop specific development plans for the elimination of animal wastes, a system must be adopted and described to evaluate the system. A more in-depth study should be made for the waste disposal and a selection be suggested.

As long as the animal corrals are not paved, there will be soil erosion as the constant trampling will greatly reduce the infiltration of water into the soil. All vegetative cover will be destroyed, exposing the soils to erosion even during the usual type of rainfall. The areas around the feed and watering troughs must be paved as the constant trampling by the livestock will soften the soils in these areas.

I strongly disagree that basing runoff and rainfall totals for a 10-year rainstorm is adequate. Rainfall data for at least a 25-year storm should be used. Soil erosion problems are greatest during the heavy rainstorms. Situated below the forest reserve, surface runoff in the gulches will be very rapid and large.

Livestock enterprises are proposed to be located in close proximity to each other. Although nothing has been discussed in the EIS, I assume there will be adequate sanitary and preventive measures taken to prevent the spread of diseases and parasites.

There will be certain commitments of resources if the agricultural park is developed. In the EIS, mention is made that the corrals will be paved if erosion is severe. Paving of the corrals will constitute a change in the land and should be considered as an irreversible commitment of resources. If any of the farm roads are paved this is also a permanent alteration to the soil and must be considered as an irreversible commitment of our land resources. If the agricultural park is terminated, these paved areas can be reclaimed but in all probability will not be to the original condition.

JOHN A. BURNS
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
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WALTER B. QUISENBERRY, M.P.H., M.D.
DIRECTOR OF HEALTH

WILBUR S. LUMMIS JR., M.S., M.D.
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RALPH B. BERRY, M.P.H., M.D.
DEPUTY DIRECTOR OF HEALTH

HENRI P. MINETTE, M.P.H., DR.P.H.
DEPUTY DIRECTOR OF HEALTH

October 30, 1973

In replying, please refer to:
File: EH-SE

TO: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

FROM: Acting Director of Health

SUBJECT: Draft Environmental Impact Statement for an Agricultural Park on Oahu

We have reviewed the draft Environmental Impact Statement (EIS). The following comments are submitted for your consideration.

A. Occupational Health and Noise

1. We do not anticipate any abnormal noise problems.

B. Air Pollution

1. Care must be taken to minimize the fugitive dust emissions during the construction and landscaping phases.

2. Odor nuisances may occur from any of the anaerobic treatment proposals as well as the animals' living areas without a regular schedule of removal to treatment facilities. The latter is more likely to occur during rainy periods with Kona Wind as related to Kunia Camp residents.

3. Provision should be made to treat the odor laden water from wet baffles in the exhaust vents of the poultry buildings.

C. Sanitation

1. Dairy, hog and poultry farms are incompatible with the truck farm in terms of odors and fly nuisances. There should be a buffer zone between them.

2. The effect of sugar cane burning (smoke) on hogs, cattle and poultry should be considered.

3. Storage of manure (described in the odor section, p. 35) with a public health problem because of heavy rainfall in the area. Composting and selling the waste to neighboring farms will ease the problem only if there is an adequate market for the product.

D. Vector Control

1. We recommend an eighth item be added to the major environmental impacts of the project listed on page 19 of the EIS. The item is:

   8. Possible increase of mosquitoes, flies and rats, and their econimic and Public Health impact on the neighboring farms and communities.

   This recommendation is based on the following considerations:

   a) Mosquitoes are water associated vectors of economic and public health importance. Mosquito injury to milk cows or laying hens for example result in reduction of productivity and profitability. Impounding agricultural waste waters to meet water pollution requirements can contribute to mosquito problems. Preplanning, implementation and management are necessary to prevent mosquito problems in waste water management systems.

   b) Flies, especially filth flies, breed in animal waste containing sufficient moisture to support their development. Flies cause unthrifty livestock production by spreading animal diseases. They become a nuisance and menace to public health of the human community within a five mile radius of their generation point. Fly control is at best difficult, even with good preplanning. Good continuing management must be provided.

   c) Hawaiian livestock farms offer near optimal conditions of climate, food and shelter required by rodent populations. Rodents cause severe economic damage to all areas of livestocks operations (e.g. stored grain and feed will be consumed and contaminated; slaughterhouses, milk rooms and farms are subject to infestation and contamination). Provisions to build rodents out of vital operational facilities should be preplanned. A continuing rodent population control program should be preplanned.

E. Water Pollution

1. Any waste management system adopted must conform to the "new Source Performance Standards for Feedlots" to be promulgated by the U.S. Environmental Protection Agency before November, 1973, as required by the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500).

a) As now proposed, these new source standards call for no discharge of waste water pollutants from feedlots to the navigable waters of the U.S. (the term "navigable waters" as used here includes all tributaries of navigable waters as the term might be commonly defined), except runoff from storm events in excess of the 25 year, 24 hour storm as defined by the U.S. Weather Bureau for the feedlot site.

2. Any waste management system adopted, which includes effluent reuse for irrigation, must meet the requirements of the Public Health Regulations for the State of Hawaii, Chapter 38, section 7B. In essence, section 7B requires secondary treatment of wastes prior to effluent reuse for irrigation.

3. The EIS takes cognizance of the fact that effluent reuse in irrigation, direct land disposal of wastes or composting systems must be considered with extreme care to avoid causing generalized, non-point source, surface and ground water pollution.

Several types of studies needed to avoid this substitution of one source of pollution for another are referred to in the EIS. However, these studies referred to are incomplete or non-existant at this time. The types of information needed include:

a) short term weather forecasting ability,

b) soil infiltration/precipitation rates, and

c) evaporation/precipitation rates specifically for any land disposal system, site and waste load; and

d) feasibility of waste reuse in sugar cane irrigation with commitments for acceptance by sugar growers

e) possibilities of viral, nitrate, and salt contamination of ground resources.

F. Summary

1. No specific objections are directed toward the Agricultural Park concept or to any site studied.

2. Serious concern was expressed in regard to lack of planning consideration for:

a) construction phase dust control

b) odor controls

c) mosquito, fly and rodent controls

d) water quality regulatory requirements for waste management systems

e) specific types of information needed to predetermine the possibility of creating generalized non-point source pollution of surface and ground water through implementation of waste management discussed.

3) Environmental costs may well determine the economic viability of the Agricultral Park concept. We recommend these costs be calculated as quickly as possible and given public consideration. The Environmental Impact Statement fails to accomplish this.

WILBUR S. LUMMIS, JR., M.D.
Acting Director of Health

cc: Air Sanitation Branch
Sanitation Branch
Vector Control Branch

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, CORPS OF ENGINEERS
BUILDING 96, FORT ARMSTRONG
HONOLULU, HAWAII 96813

PODED-P

29 October 1973

Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Dr. Marland:

We have reviewed the Draft Environmental Impact Statement for an Agricultural Park on Oahu. Comparison of the summary statement on page i with the discussion on page 12 causes some confusion as to its purpose. The Goals and Objective section (ending on page 12) seems to address the feasibility and conceptual aspects of establishing an agricultural park, whereas the summary appears to focus on a site selection decision for the park in the Kunia area.

Waste disposal, particularly wastewater management, is given proper emphasis in the impact statement. In view of the Federal Government's expression of particular interest in the Pearl Harbor watershed, as evidenced by E.P.A.'s enforcement conferences concerning Pearl Harbor, selection of a specific site within that watershed, such as at Kunia, should be accompanied by a specific plan as to how the waste products will be managed.

The section on Economic and Social Analysis is particularly helpful for consideration of the feasibility and conceptual aspects of the project.

We appreciate the opportunity to review the Impact Statement.

Sincerely yours,

R. L. NICHOLS
Chief, Engineering Division

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

PAUL DEVENS
MANAGING DIRECTOR

EDWARD Y. HIRATA
DIRECTOR AND CHIEF ENGINEER

KAZU HAYASHIDA
DEPUTY DIRECTOR AND
DEPUTY CHIEF ENGINEER

ENV 73-325

October 29, 1973

Office of Environmental Quality Control
Office of the Governor
550 Halekauwila Street
Tani Office Building, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Subject: Draft Environmental Impact Statement for an Agricultural Park Near Kunia, Oahu, your letter dated October 2, 1973

The draft of the statement is satisfactory.

Very truly yours,

EDWARD Y. HIRATA
Director and Chief Engineer

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 15th AIR BASE WING (PACAF)
APO SAN FRANCISCO 96553

29 OCT 1973

REPLY TO ATTN OF: DEEE

SUBJECT: Draft Environmental Impact Statements

TO: Office of Environmental Quality Control
Office of the Governor
550 Halekauwila Street
Tani Office Building, Third Floor
Honolulu, Hawaii 96813

1. Reference is made to your letter of 2 Oct 73 which forwarded the draft environmental impact statements for the Kunia Agricultural Park Project and the Proposed Waiakea/Olaa Forest Reserves Reforestation Project for our review.

2. We have no comment to render relative to our review of the draft environmental impact statement for the Proposed Waiakea/Olaa Reforestation Project.

3. Paragraph 2 of the statement for the Kunia Agricultural Park Project, covering adverse environmental effects, addresses the on-land method for the disposal of animal waste. The forest reserve land located directly west of the proposed agricultural park is identified as the possible disposal site for such waste. On page 35 of the Concept Design and Cost Comparison Report it is further suggested that the rate of application of such waste could be as high as "1/2 to 3 inches per week, or 2,000 to 13,000 gpd/acre." We question the advisability of such a waste disposal method based on a precedence of sorts. In 1965, the South Tahoe Public Utility Board did experiment with a similar method of effluent disposal in their initial efforts to abate pollution flow into Lake Tahoe. That experiment ended in failure. We realize that the conditions may not be identical. However, we would strongly suggest that a thorough on-site investigation be conducted to precisely determine the assimilative capacity of the forest land before such a method of waste disposal is ever adopted.

LAWRENCE M. YAMAMURA
Asst Dep Comdr for Civil Engrg

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
POST OFFICE BOX 3410
HONOLULU, HAWAII 96843

October 26, 1973

Dr. Richard E. Marland
Interim Director
Office of Environmental Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Dr. Marland:

Subject: Draft Environmental Impact Statement for an Agricultural Park near Kunia

Thank you for sending us the draft environmental impact statement for our review and comments.

Our comments on the two sites mentioned are as follows:

POHAKEA: 1) Water: Our system will be able to supply water for domestic use only. Other than the 2 mgd that may be made available from the U. S. Navy wells, little or no additional water may be developed in the area for diversified agriculture. The water resources in this area are already fully developed, or committed to meet domestic demands in the immediate future.

Water for the future will depend on several alternatives which we are now pursuing, one of which is the development of sources in Wahiawa and Waialua. Another is sewage reclamation. However, the fruition of either of these prospects is not expected in the immediate future.

2) Waste Disposal: Our guidelines mentioned on pages 28 and 29 of the "Conceptual Design and Cost Comparisons for an Agricultural Park on Oahu" should be adhered to unless results from the WRRC study on use of secondary treated waste effluent for irrigation show the safety of such a scheme.

KAHUKU: 1) Water: Two million gallons per day may be developed for the initial phase of the agricultural park subject to future restrictions by higher domestic use. Additional water required for the park will depend on the availability of water resources as determined by our studies and severity of domestic water demands.

2) Waste Disposal: We recommend adherence to our guidelines on page 29 of the "Conceptual Design and Cost Comparisons for an Agricultural Park on Oahu".

Please contact us for further information desired on the matter.

Very truly yours,

George Yuen
Manager and Chief Engineer

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
629 POHUKAINA STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

GEORGE S. MORIGUCHI
DIRECTOR

WILLIAM E. WANKET
DEPUTY DIRECTOR

LU10/73-1155
(WEW)

October 19, 1973

MEMORANDUM

TO : DR. RICHARD E. MARLAND, INTERIM DIRECTOR
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

FROM : GEORGE S. MORIGUCHI, DIRECTOR OF LAND UTILIZATION

SUBJECT : DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR AN AGRICULTURAL PARK NEAR KUNIA, OAHU

We note the Pohakea site in the Kunia area is zoned AG-1 and that the agricultural park is proposed to include the raising of swine. The raising of swine would require an application for rezoning to AG-2. Upon submittal of an application for rezoning, an evaluation of the project will be made.

GEORGE S. MORIGUCHI
Director

GSM:rh

JOHN A. BURNS
GOVERNOR OF HAWAII

DIVISIONS:
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

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

November 13, 1973

MEMORANDUM

To: R. E. Marland, Interim Director
Office of Environmental Quality Control

From: Sunao Kido, Chairman
Board of Land and Natural Resources

Subject: Comments on the Following Environmental Impact Statement

Draft Environmental Impact Statement for an Agricultural Park, Kunia, Oahu

After reviewing this impact statement which covers a proposed agricultural park at Kunia, Oahu, we suggest that great care and consideration be exercised in safeguarding adverse effects of waste water on the water resources in the area, and to proper conservation programs in cooperation with the U. S. Soil and Water Conservation Service.

Proper precautions should be taken to prevent wastes from infiltrating at the site and contaminate the basal fresh water. Waste runoff should also be controlled to prevent contamination of surface water sources. Possible methods of protection would be either a system with no waste water discharge or a system where the waste waters are given the equivalent of tertiary treatment before being discharged into the receiving gulches.

Sunao Kido

SUNAO KIDO
Chairman and Member

PARTMENT OF GENERAL PLANNIN
CITY AND COUNTY OF HONOLULU
629 POHUKAINA STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ROBERT R. WAY
CHIEF PLANNING OFFICER

DONALD A. CLEGG
DEPUTY CHIEF PLANNING OFFICER

DGP10/73-685(RSY)

November 14, 1973

MEMORANDUM

TO : DR. RICHARD E. MARLAND, INTERIM DIRECTOR
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

FROM : ROBERT R. WAY, CHIEF PLANNING OFFICER

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR AN AGRICULTURAL PARK NEAR KUNIA, AUGUST 1973--COMMENTS REQUESTED, OCTOBER 2, 1973

We have reviewed the reports which you transmitted to us in the context of the General Plan of the City and County of Honolulu and find no apparent conflicts.

However, we note that major issues are discussed but are not conclusively resolved. For this reason, there may be some question on the actual feasibility of the project and, perhaps, this may complicate rezoning to AG-2 more than initially anticipated. For example:

1. The draft EIS indicates an equivalent waste load from the livestock operation at 90,000 people for the BOD and 140,000 for nitrogen. The nutrients of this waste load would require about 2,500 acres of crop lands to be assimilated as fertilizer. However, the project does not include crop lands of that magnitude and there is no conclusion as to the actual way in which the waste load will be disposed. Further, there is a question as to whether or not such a method of disposal would have an adverse impact upon the City's potable water supply. Still further, there appears to be an unresolved question as to the impact of the effluent from the waste disposal system upon the waters of Pearl Harbor. The feasibility of the project and the basis for rezoning may depend upon a conclusive resolution of this issue.

2. Likewise, water requirements, odor control and feed requirements are issues discussed but are not conclusively resolved.

3. The economic and social issues are also not conclusively resolved and not adequately addressed. It is not clear whether or not the required livestock feed can be provided locally or whether the project site is appropriate in relation to the possible sources. The question of an adequate labor supply and the manner in which residential requirements of employees or owners will be met is not addressed. The public facility requirements are not conclusively determined and the total cost is uncertain. Moreover, the source of funding is unclear and, therefore, the economic viability of the project appears questionable at this time.

4. Inasmuch as major issues are not conclusively resolved for this particular site, the question remains as to whether or not this site is the most appropriate. In this respect, the alternative of a neighbor island location, in addition to other sites on Oahu, may still be open.

I hope these comments are helpful.

ROBERT R. WAY
Chief Planning Officer

RRW:ak

UNIVERSITY OF HAWAII
Water Resources Research Center
Office of the Director

MEMORANDUM

November 2, 1973

MEMO TO: Richard E. Marland
Interim Director, OEQC

FROM: Reginald H. F. Young
Asst. Director, WRRC

SUBJECT: Draft EIS, Agricultural Park for Oahu

Forwarded herewith are WRRC review comments on the subject EIS from Gordon Dugan, Paul Ekern, and Hiroshi Yamauchi.

EKERN: (also see attached bibliography for supplemental information)

P. 13. There exists a large backlog of yield data for Del Monte fields which might be tapped for historical and potential returns from this area. Del Monte should be approached, as should PRI to see if this body can be made available. I have some moisture release data for these fields.

The exhibits would wisely include the soils descriptions taken from the new Soil Survey, for the major series involved. Their selection would be greatly aided if a legende were provided for the map. Exh. XI. The descriptive materials on the soils indicate origins and hazards, such as the dense subsoil in the Kolekole.

The geologic map of the area might well be added, since that from Stearns Bull. 5 supplement indicates that most of the proposed area of soils is on alluvium or colluvium, in marked contrast to the major portions of the Wahiawa plain. This fact has major import to the manner in which root penetration, deep percolate, and possible ground waters exist and are renewed.

P. 14. Term rainfall quite uniform not good, perhaps similar, since uniform implies uniformity in time---a fact hardly true. Perhaps could say little variation with topography over the area?? A much better index for the area would be the median rainfall values, by month, and their deviation in tabule as derived from Taliferro, 1961. RR of Hawaii.

From this info can be gained probable need for irrigation, etc.

Riehl's aged paper, Some aspects of Hawn RR, TP 180, PRI-HSPA Meteor. or Bil Amer. Met Soc. 30:176-187. 1949, deals specifically with this area.

Leopold, 1948. Diurnal weather pattern Oahu & Lanai, includes Wheeler Fd. data.

What period does the cited Wheeler data encompass?

P. 16. The explanation of the Schofield hi level water seems to me faulty, and does he mean that the NW hi level water is Waianae?? The exhibit XIV seems capable of greater deail and should have greater detail along the western rim where the deep percolates might enter the ground flows.

Exhibit XIII does not show the salinity of the wells.

Seems to me well water levels, perhaps logs, might help delineate the water gradients and expected flow directions here.

The speculations of intergraded Kolekole and Koolau flows and possible effects on water movements from Stearns 1940 ought to be cited, p. 48. What of the surface water drainages, current and paleo?

P. 17. How get intrusion of sea water into the Kunia road wells? Statements even on return irrigation flow seems to be speculative at best. That 27-03-01 drop in NO3 and rise in SiO_2 is hard to fathom.

Is there any chance the geomorphologic efforts evident in Ruhe et al., 1965.

Nature of soil parent materials in Ewa-Waipahu area, Oahu-SSSA P 29:282-287, have been extended to the Kunia area, say along the drill holes 1-5, 1-4, 1-3, 1-2, etc.

Ruhe et al. extend this somewhat, 1965. J. Geol. 73:485-497 - Shorelines on Oahu - with a further discussion on p. 494 of the alluvial fans above Waipahu.

P. 18. Vegetation--wild??

P. 21. Where are the temperature data and Rel/Humidity data?

Some available for Wheeler, I have old PRI data.

Should by all means combine the solar radiation, temperature, etc. data, into growth potentials and heat loads on animals.

Would be wise to use the universal soil loss equation approach to qualify the climatic erosional hazard of the site, and estimate the effects of soil disturbance on rates of sediment production. From this approach can be derived estimates of required conservation practices to generate tolerable rates of erosion.

P. 23. Sunlight, wind, TT, RH, and pan data should be combined with rainfall to line out anticipated water deficits and seasonal demands for water for irrigation for any cropping enterprise.

Required data must be weekly or monthly values - which can be found.

A separate section on available water sources to meet these demands should be prepared.

P. 26. Presume "they" refers to pineapple company operation, though can is more liable to use aerial applns. Similarly, the Agr. Complex must specify the hazard it in turn might generate to surrounding croplands.

P. 28. Perhaps should defend the N sink aspects of 100 to 600 #/yr cropped though ultimate sink for this N is still not certain.

Series of papers on the anticipated movement of most elements in the effluent are available, see my listing for the AWRA session.

P. 30. The stated rates of sustained infiltration (much less the initial high rates) would not permit any runoff to occur--an obvious fallacy.

P. 31. Actual field experiment must be performed on infiltration and profile percolation rates, particularly under the tillage conditions of compaction conditions proposed for the operation.

Perhaps here I should demand an energy budgeting for the operation--to see if the required energy subsidy from fossil fuels for the operation is greater than the input required for product importation alone.

Exhibit XVI is pretty but of no use--requirements are for seasonal short term distributions of rainfall amounts for assessment of irrigation needs and excess intensities for erosional hazard. Moreover the season to season variability is imperative, to assess the probability of drought or flood.

XVII--surely 600 ly line does not compass the ridge tops--major error in data interpretation.

P. 34. Details of chemical nature of movt of constituents should be reviewed--see my reference list. Development of tillage pans and the general engineering properties of these soils should be outlined, e.g., Kawano and Holmes on Strux props.

Exhibit XXIII should be developed and expanded for Kunia site.

P. 50. Ideal spot to develop the required energy subsidy to obtain such a park project.

The appendix section A is much too general and seems an after thought rather than a deliberate attempt to support and defend the earlier positions in the text.

Table after p. A-8 must be P_2O_5.

YAMAUCHI:

The economic justification for this Ag Park is based on some long run projections of the supplies and demands for the major diversified agricultural products expected to be produced in the proposed Ag Park. These projections extend for about 50 years into the future (from 1972 to 2020) and beyond the immediate future are of highly questionable validity. The uncertainties associated with such long range forecasts are too great and increase at an increasing rate with the distance of time the projections are extended into the future.

On page 9, line 3, the following statement is made, "The projections are based on the work of Hogg and Dollar." Yet these projections are essentially based on the work of Renaud (a 1969 HAES publication) with apparent modifications by Hogg and Dollar. The basis for such modification and the generally contradictory conclusions reached by Renaud are not fully disclosed.

The proposed Ag Park is apparently justified more on political rather than economic grounds as evidenced by the past legislatures action. It is quite likely that the project may eventually prove economically feasible and justified, but the likelihood of such an outcome is not evident in the draft EIS.

DUGAN:

The need for an Ag Park is implicit. Inasmuch as animal waste disposal for economic reasons cannot be as sophisticated as municipal waste treatment, some measure of leniency should be considered.

Water, P. 23. Is the 2.5 to 3 mgd water necessary for livestock operations available besides resorting to cooling water from the Navy's facility?

Is the cooling water of adequatequality for livestock use?

Water Management. In general this aspect is handled very lightly.

P. 34, last paragraph. This appears to be very poor reasoning.

P. A-3, second paragraph, last sentence. This sentence is erroneous--depth of lagoon is not related to O_2 being consumed by BOD at the surface layer.

Animal Waste Quantities. Some of the additions are wrong, particularly Nitrogen. However, it appears to be conservative.

RHFY:jmn
cc: G. Dugan
F. Ekern
H. Yamauchi

WINDWARD REGIONAL COUNCIL

13 November 1973

Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

We have reviewed with considerable interest the draft environmental impact statement for an agricultural park on Oahu. First we would like to extend our commendation to the authors of this report for their thoroughness.

Since this report is titled a draft, we presume that a subsequent EIS is contemplated. In its present condition, this EIS does not fully answer the questions it raises about the most important environmental aspect of an agricultural district, that of waste reuse.

Having preached the potential benefits of planned agricultural districts (based upon my professional agricultural planning experiences in California) since arriving in Hawaii 14 years ago, I am most pleased to see this concept at last approaching fruition. Consequently I am a bit surprised that so few of the positive benefits and so many of the potential negative impacts in the social field, even those that appear to be rather improbable, received attention.

Aside from more effective handling of waste, probably the most important payoff from large planned agricultural districts is the chance to buffer relatively noxious uses from urban incursion and thereby greatly increase the possibility of maintaining agriculture for many decades to come. Surprisingly this environmental impact receives little or no acknowledgment.

If any portion needs extensive revision in this EIS it is #6, Economic and Social Analysis. We look forward to reviewing any subsequent editions of this EIS.

Sincerely,

Leonard C. Moffitt
Executive Director

LCM:hc

JOHN A. BURNS
GOVERNOR

E. ALVEY WRIGHT
DIRECTOR

LAWRENCE F. O. CHUN
DEPUTY DIRECTOR

MUNNY Y. M. LEE
DEPUTY DIRECTOR

DOUGLAS S. SAKAMOTO
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

IN REPLY REFER TO
ATP 8.2399

November 5, 1973

Dr. Richard E. Marland
Interim Director
Office of Environmental
Quality Control
550 Halekauwila St., Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

Subject: Draft EIS - Agricultural
Park on Oahu

We have reviewed the subject environmental statement and have no comments to offer as it relates to and affects our transportation program.

Sincerely,

Douglas S. Sakamoto
for E. ALVEY WRIGHT
Director

JOHN A. BURNS
GOVERNOR

FREDERICK C. ERSKINE
CHAIRMAN, BOARD OF AGRICULTURE

WILLIAM E. FERNANDES
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF AGRICULTURE
1428 SO. KING STREET
HONOLULU, HAWAII 96814

November 29, 1973

MEMORANDUM

TO: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

SUBJECT: Draft Environmental Impact Statement for an Agricultural Park near Kunia, Oahu

The Department has reviewed this environmental impact statement. This is part of a study which has been supported by a contract administered by this Department.

Report of the Conceptual Design and Cost Comparisons For An Agricultural Park On Oahu, by Henry A. Alexander & Co., Inc., and Belt, Collins and Associates, Ltd., was consulted for details on the effects of population load and animal densities.

The report dwells at length on water supply commitments and animal waste treatment and disposal. It should be noted that all recognized rational alternatives for animal waste management were considered in detail. Only a minimum change in demand on public facilities and services are anticipated.

Alternative sites were considered and the Kahuku site reviewed in detail.

The Pohakea site offers the best and the Kahuku site the next best alternative. Another alternative, no agricultural park, would be inconsistent with statewide environmental policy favoring strong diversified agriculture.

The critical problem of waste water disposal has been carefully evaluated with recognition of the Board of Water Supply concerns. The basic hydrology of the Pohakea site was considered. There is considerable area for interpretation and investigation to determine the boundaries of each basin.

Page 16 - Geology with Reference to Hydrology

> The statement, ". . . while the much higher water level reported for wells at the northwesterly corner of the area indicates that this is in the Waianae aquifer." is perhaps misleading. These higher levels may be in the Wahiawa supply which is confined by dikes and is essentially a perched supply. The lower yield at the Hawaii Country Club site indicates that it may originate within the Waianae aquifer which may also be part of the basal water which feeds the Navy tunnel system

supplying the Barber's Point area. More complete data on this latter system would assist in evaluating the complex problem.

Exhibit XV - Water Analysis at Locations Adjacent to Pohakea Site

Water analyses indicate that wells 23-02-01, 24-02-01, 26-03-01 and 28-03-02 may derive their water from an aquifer fed by the Wahiawa supply system. Well number 27-03-01 is probably in the Koolau system but is influenced by a spill from the Wahiawa supply. Much more complete data on well-water analyses and well logs would be required to assess the boundaries of the basal water supplies which may be affected by surface water discharges and percolates.

The most significant features of the proposed Pohakea and Kahuku agricultural park sites are discussed beginning at page 19. The alternative measures required to recycle agricultural liquid and solid wastes are developed adequately. These are supported by relatively complete conceptual design and operating cost analyses to allow adequate review and decision. Waste treatment receives the most comprehensive consideration possible within the scope of present state-of-art knowledge available.

The Department of Agriculture supports approval of this impact statement.

Frederick C Erskine

FREDERICK C. ERSKINE
Chairman, Board of Agriculture

SECTION III

SUPPLEMENT TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

December 10, 1973

HENRY A. ALEXANDER & COMPANY, INC.
MANAGEMENT CONSULTANTS

Suite 307
401 Kamakee Street
Honolulu, Hawaii 96814
Telephone 521-4702

December 10, 1973

Mr. Frederick C. Erskine
Chairman, Board of Agriculture
1428 South King Street
Honolulu, Hawaii, 96814

Attention: Mr. Roy Matsuura

Dear Mr. Erskine:

You will find attached twelve copies of our "Supplement to the Draft Environmental Impact Statement". This was written in response to comments on the Draft made by various agencies and organizations.

The Office of Environmental Quality Control, State of Hawaii, has accepted this Supplement in lieu of their preparation of a comment on our report, and as a way of answering the comments submitted in a more effective manner than writing separate replies to each comment. With you approval, they will circulate this Supplement to those commenting on the Draft Statement.

We believe that this completes our responsibilities regarding our contract dated February 15, 1973 for""Economic Planning and Conceptual Design Services" in connection with the Preliminary Site Selection and Conceptual Plan for an Agricultural Park on Oahu. The Supplement referred to above had been agreed to earlier this month as a substitute for the Summary Overview which was originally called for in the contract.

The Office of Environmental Quality Control has suggested that this Supplement be bound with the original Draft Statement with a new cover which calls attention to the inclusion of the Supplement. They have approximately thirty-five unissued copies of the Draft Statement which could be used for this purpose.

We have appreciated working with you and your staff on this very interesting project, which we believe will be very beneficial to the State of Hawaii. Please do not hesitate to call on us if there are any further questions or if we may be of assistance to you in the future.

Yours truly,

Henry A. Alexander

Henry A. Alexander,,President
HENRY A. ALEXANDER & COMPANY, INC.

STUDY FOR AN AGRICULTURAL PARK ON OAHU

DRAFT ENVIRONMENTAL IMPACT STATEMENT

RESPONSIBLE OFFICE: DEPARTMENT OF AGRICULTURE, STATE OF HAWAII

STATE ACTION

SUPPLEMENT: RESPONSES TO COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

The review of the comments which we received, and the investigation which we performed for this reply, have not changed our conclusions or recommendations. The policy guidelines provided by the Department of Health and the Board of Water Supply in response to our Draft Environmental Impact Statement do make it possible for our answers to be more specific and detailed.

This supplement should more completely satisfy all agencies and organizations responding to our Draft Statement. Those agencies which responded were:

Department of the Army, Honolulu District, Corps of Engineers
Department of the Air Force, Civil Engineering Division
United State Department of Agriculture, Soil Conservation Service
Department of Agriculture, State of Hawaii
Department of Health, State of Hawaii
Department of Land and Natural Resources, State of Hawaii
Department of Planning and Economic Development, State of Hawaii
University of Hawaii, Environmental Center
University of Hawaii, Water Resources Research Center
Board of Water Supply, City and County of Honolulu
Department of General Planning, City and County of Honolulu
Department of Land Utilization, City and County of Honolulu
Department of Public Works, City and County of Honolulu
Windward Regional Council

Copies of the letters received from these agencies are attached to this report.

CROSS-REFERENCE INDEX FOR THIS SECTION FOLLOWS THE TABLE OF CONTENTS

The Supplement to the Draft Environmental Impact Statement is indexed as follows:

The technical portion of this supplement has been prepared by Dr. D.R.V. Golding for Henry A. Alexander & Company, Inc. The assistance of Ray Tabata of the Hawaii State Office of Environmental Quality Control in coordinating the comments received and reviewing the Draft Environmental Impact Statement is gratefully acknowledged.

Constraints and Conditions

In considering the impact statement and the comments thereon, certain constraints and conditions should be kept in mind. First, one condition of the contract which authorized this study is that only existing data are to be used. No new experimental work is to be done in preparing the statement. While this was in part a budgetary restriction, the contracting department did not consider experimental work necessary at this stage of planning.

Second, the environmental impact statement was prepared for the project at the earliest possible point, during the planning and conceptual design stage. It is generally agreed that impact should be considered as soon as possible, rather than waiting until the project reaches the final design stage. In this early stage, the evaluation is necessarily more general.

Third, since the public should have the opportunity to exert the greatest influence on the direction of a project, the statement is written in a style which, as much as possible, should be intelligible to the lay reader. For example, the purpose of the appendix is to describe in reasonable detail the principles of waste disposal for the benefit of the lay reader.

Fourth, it was apparent that certain policy decisions would have significant effects on costs and types of operations suitable for the park. These constraints were (1) the amount of water which would be available to the park, and (2) the methods of waste management which are considered acceptable. Accordingly, alternatives were presented. Comments from the Department of Health and from the Board of Water Supply established official guidelines: water supply is limited to about two million gallons per day at either site, and essentially complete containment of wastes is required, with the equivalent of secondary treatment if water were to be reused for irrigation.

Fifth, this project was named: "A Preliminary Site Selection and Conceptual Plan for an Agricultural Park on Oahu, Hawaii". The scope of work that was contracted for was economic planning and conceptual design services. In Act 202, Session Laws of Hawaii 1972, Item 4-B-13a, $80,000 was appropriated for preliminary planning of the ag park. To date, only one half of this appropriation has been expended.

Finally, there is a continuing need for the State to "Keep up with new developments and demonstrations in animal waste management" because this field, and the guidelines covering it, are "changing very rapidly" and improvements in the methods outlined in the report may still be considered before the Ag Park is designed and constructed". (reference S-6)* This is seen already in the very recent EPA guidelines for feedlots and animal facilities, and in positive requests for the animal waste from the Ag Park for making fuels -- a request which did not surface before the recent concern for energy conservation grew so significant. (See reference S-20)

*Supplement exhibits and references are designated as S-I, S-II, etc. Exhibits tables and references from the original Draft are designated by numbers without letters. See also references attached to WRRC comments.

Underlying Geology of Pohakea

More data relating to soils and water were requested. Exhibit S-I from reference S-2 shows the geology of the Waianae range.

The approximate outline of the proposed Pohakea aq park has been sketched on the map. These data show that two types of lava from the Waianae series underlie the site. The Koolau lava and the sedimentary deposits lie to the east of the site.

Hence, as postulated in the Draft statement, the site is over the Waianae aquifer which is less permeable than the Koolau. This fact may be a favorable factor in considering the future possibility of waste water recycled to the land, depending on the outcome of the WRRC study. (reference 10).

Further support of this hypothesis comes from estimates of the aquifer boundaries prepared by the local office of the U.S. Geological Survey. (reference 17). These boundaries have been sketched on the map. (See also Exhibit XIV). They show the Waianae aquifer, the Koolau basal water, and

EXHIBIT S-I

Reference S-2

BULLETIN 6, PLATE 6

DIVISION OF HYDROGRAPHY

GEOLOGIC MAP OF THE WAIANAE RANGE, OAHU.

PACIFIC OCEAN

KAENA PT

Waialua

BASAL

Puu Makakoa

Makua

OAHU

Honolulu

KEAAU

WAIANAE

HIGH LEVEL

Puu Keaau

Makaha Valley

Puu Kawiwi

Kole Kole Pass

Puu Kailio

Scale

0 1 2 3 Miles

Waianae

Puu Pahehee

Mauna Kuwale

Waianae Valley

AG PARK SITE

Pohakea Pass

Kunia Road

Puu Heleakala

Mauna Kapu

Puu Kuaia

Nanakuli

Nanakuli Valley

Puu Kapuai

Puu Makakilo

Puu Palailai

Puu Kapolei

BARBERS PT

EXPLANATION

HAWAIIAN VOLCANIC SERIES

TERTIARY AND QUATERNARY

QUATERNARY

Non-calcareous sediments
Chiefly alluvium and talus

Calcareous marine sediments

Basalt of Koolau volcanic series

Trachyte of Kuwale Ridge

Cinder cones

Lavas of upper member

Breccia

Lavas of lower and middle members

Specimens described in text

Specimens studied microscopically but not described in text

See geologic map of Oahu, Plate 2, Bulletin 2 for locations of dikes and tuff beds

Fault *Concealed fault* *Inferred fault*

Geology by H T Stearns and G A Macdonald, 1940

the Schofield high level water. The boundaries were estimated from dike surveys and from well heads and flows. It is apparent that the relationships in the Schofield area where the three aquifers meet is complex.

Soil Characteristics at Pohakea

As noted in the draft, and shown on the Soil Conservation map, Exhibit XI, the major soil types are Kunia, Kolokole, and Mchana, especially at the southern end. Descriptions of these soil types are taken from reference 2, and are given in Appendix S-A.

Application of the soil loss equation to these soils can give an approximate means for comparing one soil with another. However, according to the Soil Conservation Service, this equation is not yet refined to the point at which it can be used in Hawaii to predict the amount of silt carried into Pearl Harbor. In other words, the equation can predict movement within a field, but cannot accurately account for the effects of changes in slope, erosion control practices, etc.

The soil loss equation is $A = RKLSCP$

A = soil loss by sheet and rill erosion, tons/acre/year

R = rainfall factor, erosion index units/year

K = soil erodability, erosion per unit of erosion index under continuous cultivated fallow conditions, 9% slope, 72.6 feet long

L = slope length factor, ratio of soil loss in field to loss at 72.6 feet with equal slope. Note that each change in slope constitutes a new "field".

S = slope gradient factor, ratio of soil loss at field slope to loss at 9%

C = crop management factor, ratio of loss under specific crop conditions to loss under cultivated continuous fallow

P = erosion control factor, ratio of loss with practices to loss with straight row, up and down farming

For a given point or field, R and K are constant. Similarily, if the field is not changed, the slope and length also would be constant if, for example, we want to compare theoretical soil loss for pineapple and for one of the new uses proposed for the ag park. Control practices with pineapple are generally considered good.

Hence, if we compare on such basis, RKLS becomes a constant and the differences relate to differences in C and P. Unpublished data from the Soil Conservation Service (reference S-3) and from U.S.D.A. Handbook 282 for the soils and location are:

Map Identification	Soil Type	Percent Slope	K	S	P	
					Pineapple	Contour Furrow
KuB	Kolekole	1% - 6%	.28	0.3	.50	.25
KuC	Kolekole	6% - 12%	.28	1.0	.55	.27
KuD	Kolekole	12% - 25%	.28	3.1	.80	.40
KyB	Kunia	3% - 8%	.28	0.5	.50	.25
KyC	Kunia	8% - 15%	.28	1.5	.60	.30
McC_2	Mahana	6% - 12% eroded	.49	1.0	.55	.27
McD_2	Mahana	12% - 20% eroded	.49	2.4	.80	.40

R is approximately 300. The P Values have been estimated for pineapple culture and for contour irrigation furrows (cane). P values for truck crops are not available. The effect of terraces and diversions is accounted for in L, length of slope.

C factors have been estimated for pineapple: .142 for fresh fruit, and .240 for cannery fruit. Other C factors are available only for pasture, rangeland, woodland or idle land under mainland conditions. If we estimate that a truck crop corresponds to open land with about 50% canopy and 30% cover, C = 0.14. For pasture with no canopy and 80% cover C = 0.04. With sufficient cover C of course becomes quite small, about 0.003.

Hence, at this point we can estimate soil losses within field, (not soil lost to waterways) under current pineapple practices for Kunia or Kolekole with 9% slope and 72.6 foot length:

$$A = (300)\ (.28)\ (1)\ (1)\ (.2)\ (.6)$$

$$A = 10.8 \text{ tons per acre per year}$$

If the field is converted to pasture but otherwise unchanged, C changes to .04, so that the ratio is .04/.2 or 0.2, since all other factors remain constant. For truck crops, if the factor is .14 as assumed above, the ratio is .14/.2, or 0.7. With the present state of the art we probably should say merely that no great change would be expected in changing from pineapple to truck crops, provided that appropriate conservation practices were were retained. This is the postulate made in the Draft statement.

Soils can be compared using the "K" values as an erodability index. Thus, Mahana soils are roughly twice as subject to erosion as Kolekole or Kunia. "K" values for the major soil types at Pohakea and Kahuku are given in the table below. Gulches will not be disturbed.

"K" VALUES FOR MAJOR AG PARK SOIL TYPES

Kaena	0.17	Lahaina	0.24
Kolekole	0.28	Mahana	0.49
Kunia	0.28	Manana	0.10
		Paumalu	0.10

Descriptions of these soil types may be found in Appendix S-A.

As noted in the soils description and in the Draft Kolekole soils have a hard pan layer about 40 inches below the soil surface which inhibits root growth. If deeply rooted crops were to be grown there, particularly tree crops, the pan layer would need to be loosened, possibly by chisel plows.

As was mentioned in the Draft, infiltration rates for these soils, as for many Hawaiian soils, are quite high -- 2 - 6 inches per hour. This would seem to imply that runoff would almost never occur. Actually, for much of the year this may be correct. Mink, (reference S-4) in a study of the upper Kipapa basin forest area, concluded that runoff accounted for only 25% of the annual rainfall, rising to 40% during wet periods, but falling to 5% during dry periods. Rainfall in the area he investigated is two to four times that of the Pohakea site.

Two factors might favor infiltration over runoff during most of the year: first, the generally drier conditions; and second, the resulting lack of heavy vegetative cover and accompanying layer of less permeable organic mulch. Obviously, runoff does occur at times, and over the years, Del Monte has installed an extensive network of erosion control practices. (reference 9).

Water - Supply, Demand, and Disposal

An assumption which should have been stated more explicitly in the Draft Impact Statement is that an assured water supply must be available for all or nearly all of the ventures proposed for the park, because of the labor-intensive, high-value crops and capital investment involved in livestock, nursery and produce operations. Few if any crop failures due to lack of water can be tolerated.

Rainfall cannot be considered a reliable source of water. Median annual rainfall reported in the area (reference S-1) ranged from 29 inches at the Ewa end in the cane fields to 45 inches at Leilehua Camp near Kolekole Pass. Minimum annual rainfalls ranged from 11 to 24 inches. Monthly rainfalls may be 1 inch or less for 4 to 7 months beginning in April or May.

During dry years, rainfall may be less than 1 inch per month during most of the year. This pattern results from the strong dependence on storms for much of the rainfall in the area. Exhibit S-II shows monthly rainfall records for some stations in the area (S-1).

Actually, if disposal of waste water must take place within the park by treatment and irrigation, then low rainfall is advantageous. Otherwise, storage of waste water must be provided during rainy periods.

Hence, water from rainfall can best be considered a bonus. Perhaps to utilize rainfall, relatively less valuable crops could be grown during the winter months. Planning must be done on the basis of regularly available water which, according to the Board of Water Supply, is two million gallons per day, which would be available as cooling water from the naval facility at Kunia. Quality of the water is good. The Navy reports that only heat is added to the water during their use.

EXHIBIT S-II

MONTHLY RAINFALL IN POHAKEA AREA

Station No.	734			729			807			805		
Location	Kunia Field 138			Field 85-6			Field 84			Leilehua Camp		
Elevation (ft.)	450'			880'			810'			920'		
Period	1939-1956			1944-1959			1924-1959			1924-1959		
Years	12 years			14 years			33 years			33 years		
Annual Rainfall in inches												
Maximum	51.7"			54.9"			62.9"			77.9"		
Mean	28.9"			35.2"			30.9"			44.6"		
Minimum	11.1"			18.4"			15.3"			18.7"		
Month	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.
January	15.5	4.1	0.1	18.4	4.3	0.1	17.6	3.3	0.1	22.8	4.1	0.3
February	13.5	2.6	0.0	15.5	4.2	1.1	14.6	2.8	0.4	24.4	4.4	0.3
March	21.4	2.3	0.0	19.6	2.5	0.5	20.1	2.8	0.0	26.8	3.8	0.7
April	11.1	1.5	0.0	13.4	1.5	0.2	12.4	1.4	0.3	13.3	2.3	0.6
May	5.7	0.1	0.0	2.0	0.4	0.1	3.5	0.8	0.0	5.1	1.4	T
June	2.3	0.1	0.0	1.4	0.4	0.0	5.8	0.5	0.0	4.4	0.8	0.2
July	8.3	0.2	0.0	6.1	0.6	0.1	5.4	0.6	0.1	5.2	1.2	0.3
August	4.7	0.8	0.0	4.6	1.1	0.1	4.1	0.9	0.1	6.3	1.5	0.2
September	5.5	0.2	0.0	4.2	0.7	0.1	7.7	1.1	T	9.5	1.6	0.2
October	12.7	0.6	0.0	10.6	1.0	0.2	14.0	1.6	0.0	17.2	1.7	0.1
November	10.7	1.2	0.2	11.5	1.7	0.7	12.6	2.0	0.2	14.9	3.2	0.2
December	6.3	3.3	0.4	15.0	5.5	1.0	31.6	3.1	0.3	34.7	4.8	0.3

W.J. Taliaferro; "Rainfall of the Hawaiian Islands", 1959; Hawaii Water Authority

Demand for water with the original livestock forecast of three dairies (2,000 head), one feedlot (3,600 head), ten swine farms (20,000 head), and three poultry farms (200,000 birds) is about 300,000 gallons per day, without allowing for peaks. However, it is now probable that feedlots will be developed at Kohala, Hawaii and on Kauai, which may eliminate the need for a feedlot at Pohakea.

This would reduce livestock demand for water to about 225,000 gallons per day, with no allowance for peak demands, or 550,000 gallons per day if the slaughterhouse were retained in the park. This leaves about 1.4 to 1.7 million gallons per day available for crops. If crops require an average of 0.2 inches per day, or roughly 6,000 gallons per acre per day, this water would support about 200 to 300 acres, depending on their usage. Elimination of the feedlot would result in a gain of only 10 to 30 acres under cultivation.

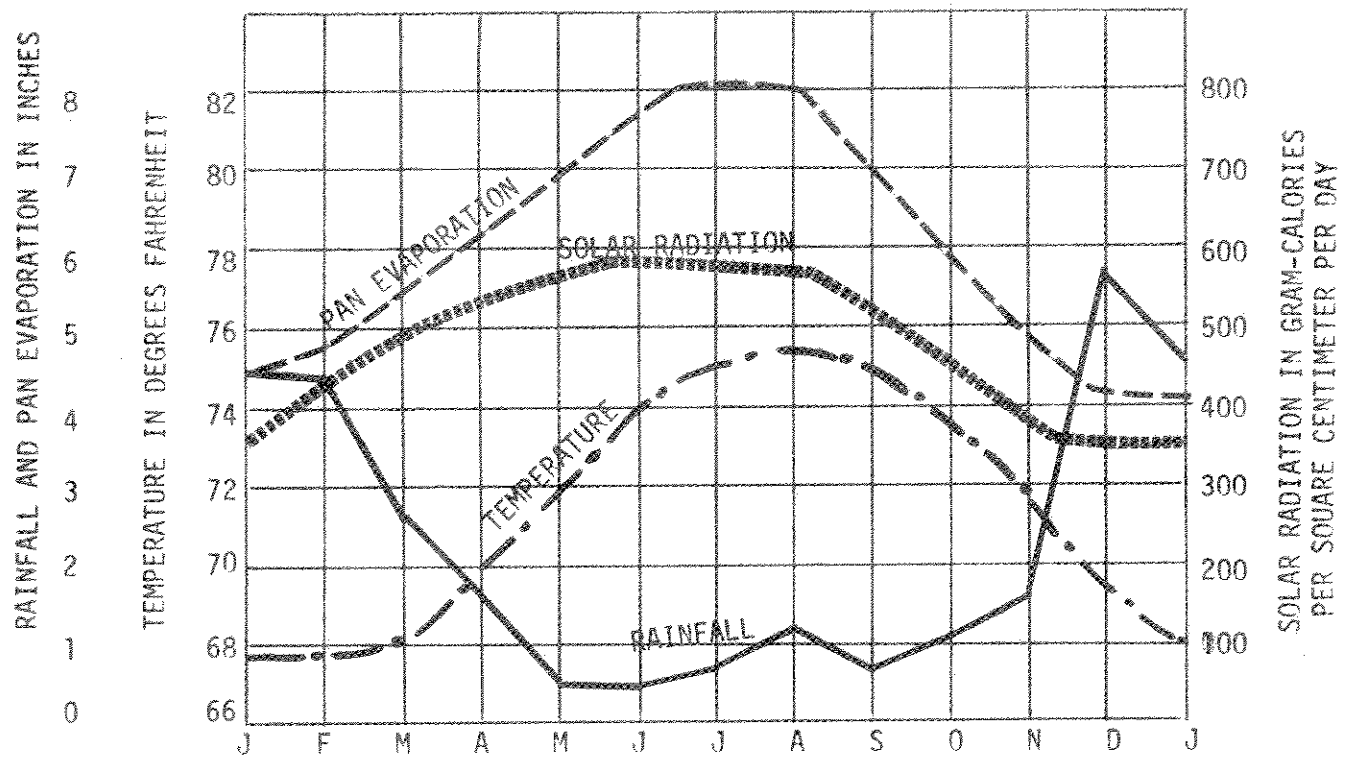
Alternatively, if we consider pan evaporation as criterion of water usage by crops, we reach approximately the same conclusion; namely, that annual demand is about 72 inches. Exhibit S-III shows pan evaporation, net radiation, rainfall and temperature for the area. It is apparent that maximum demand for water will occur during summer when rainfall is least. Hence, the number of acres which can be supported may be the lower figure, particularly in the summer. The maximum pan evaporation rate of 8 inches per month corresponds to about 8,000 gallons per acre per day.

The relationship between pan evaporation and/or radiation measurements has been discussed by scientists Ekern and Chang. Further information can be found in references S-7, S-8, S-9, S-10, S-11 and S-12.

After the equivalent of secondary treatment as required by the Department of Health, water used for livestock will then serve as irrigation water containing nutrients. If the Board of Water Supply

EXHIBIT S-III

PAN EVAPORATION AND SOLAR RADIATION IN KUNIA



finds, as a result of the Water Resources Research Center project, (reference 10) that such water can be used in central Oahu, then the water would be available for use in the park. If we assume that poultry waste will be handled as dry waste, then the daily nutrient content will be about 1,700 lbs. N, 600 lbs. P_2O_5, and 600 lbs. K, plus the load from the slaughterhouse. It would also contain about 200 lbs. per day of sodium chloride. The slaughterhouse could contribute about 480 lbs. N plus relatively small amounts of other nutrients. The slaughterhouse would be primarily for beef, but could logically include pork as well. Poultry could be packed there, but this operation is most frequently performed on the poultry farms at the present time.

Depending on the accumulation rate, this will require 3 to 4 acres per day for the nitrogen, with the minimum value corresponding to the 600 lbs. per acre per year rate observed by Ekern in the WRRC project in Mililani (reference 10). Thus, at least 1,100 acres would be needed on the basis of this assumption. If about 200 acres of pasture were available at the dairies, plus 200 to 300 acres of crops, this leaves a deficit of 600 to 700 acres of presumably additional pasture needed for best use of the nutrients. None of the pasture could be irrigated with fresh water since it is assumed that this water must be reserved for the high value crops.

If the waste water treatment system were designed to achieve some nitrification-denitrification, this would reduce somewhat the nitrogen load. However, a conservative approach is to assume that all nitrogen carries through the treatment system into the treated water.

To clarify a statement in the Draft Appendix, page A-3, second paragraph: anaerobic conditions can be developed in deep lagoons while maintaining aerobic conditions on the surface. In fact, it has been

demonstrated with food processing waste that a deep lagoon can be operated in this way deliberately. The intent is to minimize odors usually associated with anaerobic conditions.

As discussed in the Draft statement, the major reservations of the Board of Water Supply about the recycling of waste water relate to the return of salts, and possibly virus, to the main aquifer. The study now being performed by the Water Resources Research Center (reference 10) will provide quantitative data for recycled municipal sewage effluent. The results with virus reported by WRRC and others are not yet conclusive, but indicate that virus is removed after sufficient travel through soil.

On the other hand, it seems quite probable that inorganic salts which pass the root zone will be carried into the aquifer. Ekern, for example, has provided additional references in his comments relating to movement in the soil. Phosphate may be absorbed by iron oxide which is quite prevalent in the soils, but sodium, potassium, ammonium, nitrate, etc. may be expected to move with the water, at least under long term "steady-state" conditions. There is, of course, base exchange between the monovalent ions and calcium or magnesium in the soil minerals -- usually with adverse effects on soil physical properties. This can be counteracted by addition of lime.

Assuming that these salts reach the aquifer, the question then arises, do they spread uniformly throughout the entire lens? Our hypothesis in the draft was that this would not occur, and that in fact it is possible that short circuiting can occur, especially in the Pearl Harbor basin from which water is being withdrawn as fast or faster than it is being added. Our interpretation of the salinity of the wells in the Ewa plain and at the Ewa end of Kunia Road is that local overdraft conditions cause mixing and diffusion of the salt water from the lens interface.

If we consider the lens as a vessel to which water is being added and removed continuously, this is analogous to a continuous tank reactor for which extensive experimental and theoretical studies have been made -- usually with the objective of determining how effective the mixing must be to prevent short circuiting. Hence, by extension of these concepts it is logical to assume that in a very poorly mixed or unmixed vessel, short circuiting is inevitable; i.e., return of salts in recycled water will probably be confined to the immediate area, and will be removed in nearby wells. (See references S-13, S-14, S-15)

Animal Waste Management

A majority of the comments were concerned with management of the site and especially with waste management. In the Draft Statement, several alternative waste management techniques were discussed, and costs of two specific alternatives were compared: One was the conservative technique of complete containment, and the other the more or less direct application to the land. The comparative costs for Pohakea were $3.9 million vs. $2.5 million for these two alternatives.

Costs for the waste disposal system alone, for the park but not for the individual farms, is estimated to be $1.22 million, including the 25-year storm requirement. Of this amount, $.48 million will be for on-site facilities.

Costs For Park Waste Disposal Facilities
(do not include costs of individual farm systems)

Collection System	$170,000	
Common Storage Lagoon	310,000	
Subtotal On-Site		$480,000
Disposal Pipeline to Caprock Area		740,000
Total Park Disposal System		$1,220,000

Waste loads were calculated by taking an average value of total manure produced per head per day, and multiplying these values by the espected annual populations, e.g. 2,000 dairy cattle, each producing 105 lbs. of manure per day. The parameters used for waste were taken from reference 8 of the Conceptual Design: "Water Quality Program for Oahu, with Special Emphasis on Waste Disposal", City and County of Honolulu, Department of Public Works, 1971. See also references 1, 3, and 6 of the Draft Statement. Values given in the several sources vary. The values used in the following table, which is reproduced from Table 3 of the Conceptual Design Study, are generally conservative.

ANIMAL RAW WASTE QUANTITIES

	Dairy	Beef	Swine	Poultry	Livestock Total	Slaughterhouse Processing Total
No. of Animals	2,000	3,600	20,000	200,000	-----	
Area - acres	240	18	100	4	362	
Gross Density-						
Animal/ acre	8	200	200	50,000		
SF/Animal	5,500	200	220			
Total Manure (in '000's)						
Lbs./Day	210	220	100	51	581	
CF/Day	3	4	3	0.8	11	
Gal/Day	22	27	20	7	76	242
Total Solids						
Lbs/Day	22	22	14	15	73	
Volatile Solids						
Lb./Day	17	17	12	11	57	
BOD-Lb./Day	4	5	4	4	17	1.4
COD-Lb./Day	25	32	13	14	84*	
Nitrogen						
Lb./Day	0.86*	1.70	0.81	0.85	4.22*	0.48
P_2O_5 - Lb./Day	0.24	0.26	0.36	0.78	1.64	0.02
K-Lb./Day	0.37	0.39	0.20	0.31*	1.26*	
NaCl-Lb./Day	0.20	0.36	----	----	0.56	

*Corrected typographical errors from Appendix A in the Draft Environmental Impact Statement

Comments from the Department of Health and from the Board of Water Supply define the present official guidelines which require essentially complete containment of wastes. If waste water is to be returned to the ground as irrigation water, the Department of Health requires the equivalent of secondary treatment, as required by Chapter 38, Section 7B. However, the Board of Water Supply does not agree to the reuse of water except in caprock areas, at least until the Water Resources Research Center study (reference 10) is complete and the results have been evaluated.

In August 1973, after our Draft Statement had been issued, the Environmental Protection Agency, pursuant to public law 92-500, issued guidelines for feedlots and animal facilities (reference S-5) which defined the "best practicable treatment" and the "best available treatment", as well as specifying that facilities must be designed to handle a 25-year, 24-hour rain. Best practicable treatment is specified to be the containment of all contaminated waters, and the application of these together with solid wastes to crop land at a rate of application which permits utilization by the crops. No discharge to navigable waters is permitted.

These same guidelines will apply to present livestock installations. The best practicable treatment is to be instituted by 1977, and the best available treatment is to be effected by 1984. The objective of both new installations and improved present operations is zero discharge of waste water pollutants by July 1, 1983. New sources must meet this standard now.

For best available technology, the Environmental Protection Agency considers the various waste refeeding techniques, such as wastelage or dehydration and direct refeeding, or oxidation ditch with refeeding. These techniques reuse 40% to 75% of the animal waste, thus reducing the amounts to be disposed of. However, they do not now have FDA approval. The other alternative presented as best available technology is an activated sludge process, which would be handled in the same way as the end product from any secondary sewage plant.

Hence, it is almost certain that a liquid waste collection and treatment system of some type will be required, which is designed to handle the contaminated runoff from a 25-year, 24-hour storm. The 25-year requirement, in place of the 10-year one, adds 15% to the cost of the storage lagoons as shown in the Conceptual Design Study in Table 8, or an added $40,000 to the cost of the ag park.

Substantial savings are still possible if the water could be used for irrigation at the site, and if unlined lagoons could be used. This depends on whether the present position of the Board of Water Supply will be altered by the WRRC results.

The dry form of animal waste disposal was discussed as composting in the Draft statement, but has become an increasingly important potential method. Several companies have expressed interest in contracting for all the animal waste produced in the ag park: one would compost the waste, while the other two companies would convert the waste to a useable fuel. These alternatives are considered further under the section on Energy Relationships.

It is apparent that pilot studies should be undertaken to provide specific data for the site and for the method(s) selected. For example, the Department of Health cites the need for:

a) Short term weather forecasting (Available as an extension of their normal forecasting service; they now make special forecasts for farmers)

b) Soil infiltration rates

c) Evaporation/precipitation rates (Pan data plus weather data give an approximation, as in Exhibit S-III)

d) Waste reuse by sugar cane (Oahu Sugar is reluctant to take the nutrients on a continuing basis)

e) Viral, nitrate, and salt contamination possibilities (Results of WRRC study should give approximation)

The question of whether lagoons must be lined is important economically. Hence, measurements are needed to determine whether sludge accumulation will seal the bottom of an unlined lagoon.

As noted in the Draft statement, runoff from corrals and pens, and all other contaminated runoff, must be controlled. Paving may be necessary if soil erosion occurs, or if unpaved corrals are considered inadmissible by the Board of Water Supply or the Department of Health. The usual assumption is that the soil surface quickly becomes sealed by the trampling and the manure. (reference 6)

Ag Park Management

The waste management system at the Ag Park will resemble a municipal system in many respects. Consequently, as implied in several comments, management of the park must have sufficient sophistication and authority to ensure that necessary sanitation procedures are followed consistently. This is essential to control odors, flies and other insects, and rodents, and to prevent contamination of clean surface waters. Proper control of these nuisances must begin with design of the buildings and facilities, Hence, review and approval of all plans for individual farms should include consideration of these factors.

The Department of Health considers this sufficiently important to specify an additional major impact:

> "Possible increase of mosquitoes, flies, and rats, and their economic and public health impact on the neighboring farms and communities"

As noted, we interpret this to emphasize the need for adequate planning and for continuing conscientious supervision of manure storage, general sanitation, and waste management practices, which means that some form of centralized management is needed, just as in an industrial park.

We should note in passing that facilities at the park should represent an improvement over present facilities. Hence, to the extent that occupants of the park are those displaced from other locations on Oahu, there should be a net improvement in rodent and insect control for the islands as a whole. But at the Pohakea site a potential rodent problem will be created.

A planned program for control of mosquitoes and other insects is definitely needed for livestock operations. The principles for control are well established: good housekeeping and sanitation, plus pest control measures, as needed. Collection ponds and lagoons can become breeding areas, especailly for mosquitoes. Control measures include pest control agents such as Dursban, use of fish in the ponds, and construction of ponds to eliminate shallow, standing water.

The truck farms and nursery operations are considered as potential buffer zones between the livestock operations and the adjoining pineapple and sugar lands. The sugar and pineapple lands in turn are buffers between the ag park and the general public.

The smoke from burning of sugar and pineapple fields should not be a problem to livestock farmers, since no significant adverse effect of smoke on animals under expected conditions of field burning has ever been observed. Appendix I* of our Preliminary Site Selection Study for An Agricultural Park on Oahu pointed out that, except for the separation of layer and meat birds, "for operations in which animals are housed or penned, there is not much need for separation". Thru-fence contact between animals of different farms is to be avoided, however.

* By Dr. Wallace T. Nagao, Veterinary Medical Officer, State of Hawaii Department of Agriculture.

Construction Period

During the construction period, dust and erosion control measures will be required. These are, or soon will be, part of the grading and construction ordinances. The Soil Conservation Service has prepared recommendations for erosion control during construction showing the advantages of proper control of runoff, and the use of mulches or ground covers.

Social and Economic Factors

Although social and economic considerations were discussed to some extent in the Draft Statement, several comments were (quite properly) concerned with various aspects of the planning, economic or social aspects of the park. There is little new data available. However, it may be helpful to restate the issues.

1. Agricultural land is being consumed by urban encroachment.

Oahu contains more of Hawaii's total agricultural land than any other single island. Many elements of the community strongly favor preservation of agriculture on Oahu. Recent studies such as the Overview Report, and the Report of the Temporary Commission on Environmental Policy recommend its preservation.

2. Maintenance and expansion of agriculture as a basic factor in Hawaii's economy is desirable to lessen dependence on military spending and tourism as economic bases.

There is public support for the encouragement of all types of agriculture. Some elements of the public give higher priority to agriculture for export, while others maintain that products consumed within the state have an equivalent beneficial effect on the state's balance of payments.

3. Past urban encroachment on agricultural land has been the result of lack of planning, or what now appears to have been poor planning.

Past planning permitted residential development adjacent to agriculture, with consequent economic and social pressure on the agricultural land owner. The public and some elements of state government are now aware of the unfortunate consequences of overdevelopment of agricultural lands, and it is assumed that planning will in the future reflect this new community concern. The community has no obligation to land speculators who deal in agricultural land with the expectation that its zoning can be changed to urban, and potential developers will have to face the growing public disapproval of this misuse of open space.

4. Preference in the Ag Park is to be given to those displaced by urban pressure.

This raises the question of whether the ag park will result in a net increase for agriculture. This depends in part on actions discussed in "3" above, i.e., what use of the lands vacated by the farmers is permitted. There are, however, new farmers, and some farmers who desire to expand their operations, who may be included in the ag park.

5. The Ag Park is not meant to detract from neighbor island agricultural production.

Rather, the emphasis should be on those crops and livestock which are best grown adjacent to the market, or near international airports, for a better competitive position. Statistics on the additional cost of bringing agricultural production to Oahu are given in reference 19.

6. The Ag Park is not intended to be a new source of employment per se.

It is intended to be an area where displaced farmers may continue to produce and expand; and the crops produced therein may be an important source of employment replacing employment in pineapple cultivation and harvesting, which appears to be in serious jeopardy at present.

7. Occupants of the Ag Park will come primarily from areas on Oahu, but could come from the neighbor islands as well.

In this process, there may be a consolidation of agricultural production such as in small egg producers getting together at the Ag Park for purposes of economies of scale. Waianae and Waimanalo are the principal areas from which ag park tenants will come, but nearly every agricultural area on Oahu would supply farms for the ag park. (See page 11 of the Draft for details of the projected farms and the areas they would occupy.)

8. Cooperative marketing of products produced in the Ag Park could be helpful in the marketing of these products.

This could be stimulated by the initial management of the ag park, and would apply to products sold locally as well as to exported products. For example, the marketing of plant nursery products will be best accomplished by working together rather than competing for the same market.

9. The actual economic impact on the farmers relocating to the Ag Park depends to a great degree on the amount of financing of the off-site and on-site improvements that will have to be borne by the ag park tenant (since the Board of Health and the Board of Water Supply have formally established their policy guidelines in their replies to our draft statement).

A bill has been prepared for submission to the next State legislature to provide additional State funds of $1,000,000 to add to the existing appropriation of $1,000,000. Although the State has subsidized previous agricultural subdivisions, they also have sought to recover part of these costs from the tenants of those developments.

A joint effort of public and private capital would be desirable. Such a combination is discussed on pages 65 and 66 of the Draft Statement under the section titled "Alternate Means of Financing". Future lease rent adjustments would be minimized if the ag park tenants were to participate in this program.

Revenue bonds at favorable interest rates may be issued for improvements which which would be for the purpose of controlling pollution as certified by the State Department of Health, Act 161 of the 1973 legislature. Improvements in waste management at the ag park should qualify for this program.

The actual means of financing the ag park remains one of the primary issues to be resolved. The Department of Agriculture has taken the initiative in in resolving this problem, but will need the assistance of other State, Federal, and County agencies and of private enterprise as well.

10. The policy of the James Campbell Estate regarding the ag park has been stated in a letter to the Del Monte Corporation (reference S-17).

The letter covers essentially the following points:

a. "the Trustees will abide by the terms of their lease commitment to Del Monte Corporation" but feel that the diversified agricultural park on a portion of their land would merit further consideration if:

1. "Del Monte Corporation is provided with lands which they consider to be equally functional from an operational point of view and of comparable productivity;"
2. "The agricultural park is confined to areas above the 850-foot elevation, the present practical limit for the irrigation of sugar cane:"
3. "The agricultural park can pay a rent competitive with sugar rental,"
4. "Adverse environmental and economic problems are adequately dealt with; and"
5. "The cost benefits for the agricultural park result in benefits to all of us involved at least as great as with the lands remaining in the cultivation of pineapple and sugar."

b. "the Trustees have at no time considered financing any of the improvements projected for the implementation of the agricultural park." That is, the Estate is not structured for the internal financing of such projects.

It should also be noted that the Trustees of the James Campbell Estate are not in favor of establishing an agricultural park at the Kahuku site, because Del Webb Corporation has made a substantial investment in the Kuilima Hotel and residential developments in that area. The Trustees prefer not to have the ag park at Kahuku since they do not want intensive livestock operations on lands surrounding the Kuilima development.

11. The Department of Agriculture has met with success in working with all major land owners in central Oahu to prevent a reduction in Del Monte acreage with the establishment of the first increment of the Ag Park.

We understand that Oceanic Properties has offered other, better pineapple land to Del Monte Corporation in an amount equal to or larger than the amount of land which would be occupied in the first increment of the Ag Park at Pohakea. This commitment was made at the time of a hearing before the State Land Use Commission concerning the expansion of Mililani Town.

As pointed out by Leonard C. Moffitt, the Executive Director of the Windward Regional Council, in his review of the Draft Impact Statement:

"Aside from more effective handling of waste, probably the most important payoff from large planned agricultural districts is the chance to buffer relatively noxious uses from urban inclusion, and thereby greatly increase the possibility of maintaining agriculture for many decades to come."

Energy Relationships

Calculation of the cost in energy for the Ag Park depends on the assumptions which one chooses to make. Hence, the energy balance is not as significant as the assumptions. Two types of energy must be considered: capital and operating.

The capital costs are of course one time investments made in establishment of the park: energy expended in site preparation, buildings, facilities, utilities, etc. The simplest approach to these costs is to assume that a certain fraction of the capital cost in money represents energy. Here again the assumptions are important. If we choose to trace all the way back to raw materials such as iron ore and sand, then the energy portion of the cost may perhaps reach 25%. If we look only at the final step--construction of the Ag Park--the energy cost is significantly lower.

As for the operating requirements, again our assumptions are influential. If we assume that most or all of the park enterprises were in business elsewhere prior to their move to the park, then there is to a first approximation no net operating cost attributable to the ag park per se. However, there is one cost which probably can be attributed uniquely to the ag park: that of pumping 2 million gallons of water per day from Kunia Road to the site. This assumes that the farms were closer to their source of water at the previous locations, so that their pumping costs were then negligible.

Energy expended in trucking or transport of other commodities to and from the park is not as clearly defined in terms of incremental cost. Moving vehicles up the hill obviously requires energy, but a case by case study of previous hauling costs would be needed for comparison of any new expenditure for energy.

On a more fundamental level, there is an energy gain for growing crops, although we may not necessarily recover this energy as such, or as food value from such crops as ornamentals.

Only new crops can be considered a credit to the park. The area is now planted mostly in pineapple, which is a solar energy converter as efficient as cane.

An energy gain can be attributed to economic uses of the waste products. Such economic use is more likely to take place at a large installation such as the ag park than at the present individual farms.

Waste utilization may be handled in several ways. Composting has been discussed in the draft. It should be noted that a recycling effort for similar wastes is now being considered for another agricultural location on Oahu. It is expected that it will be profitable, and in operation by 1974. (See reference S-16.)

Conversion of organic wastes to practical energy sources has been demonstrated in several ways. Various thermal treatments of wastes convert the material into an oil suitable for use as fuel (e.g. reference S-6) Conversion of organic waste to oil of 25% to 35% are reported in the reference.

Technology for producing methane by anaerobic treatment of wastes is well developed. In the past, it has been considered more costly in capital investment than aerobic waste water treatment techniques because of the need for closed tanks or lagoons, and gas storage equipment. However, perspectives may change as the cost of energy increases. Simple, small installations are used by individual farmers in many parts of the world, especially in developing countries (Exhibits S-IV, S-V). It has been reported (reference 3) that, for animal wastes, at least 75% of the organic solids can be converted to gas, and that 7-10 $ft.^3/lb.$ of volatile solids are obtained. The gas is 60% methane with a heating value of 570BTU/$ft.^3$. The principal diluent presumably is carbon dioxide. Dilute fuel gas can be used in gas turbines, for example. Relative costs of three processes are given in reference S-20.

None of these technologies are proposed as an integral part of the ag park. However, once the wastes and waste water are collected and treated, disposal becomes an expense. Finding ways to develop economic uses for these materials is a logical next step. (reference S-19)

The Environmental Protection Agency lists as "best available treatment" for feedlot wastes by July 1, 1983, three alternative methods of utilizing the material by refeeding: wastelage, dehydration, and oxidation ditches with refeeding. This reuses about 40% -60% of the waste. However, as discussed in the Draft, this requires F.D.A. approval, which has not yet been obtained.

EXHIBIT S-IV

there are OTHER sources of energy

By DONALD BREMNER
Los Angeles Times Service

So much of the power in modern society comes from burning some form of oil or coal that it is easy to forget that the world is full of potential energy in other forms.

Not all of these alternative forms are easily converted to warm a house, move a vehicle or turn a machine. Nor are they necessarily cheap. But, they are available, generally clean, and could be developed to take much of the load off the dwindling supply of fossil fuels.

Here are some alternative sources of energy, apart from oil, natural gas, coal and nuclear power.

SOLAR — Energy reaching the earth from the sun each year has been calculated as equivalent to the energy released from burning 120 trillion tons of coal — about 25 times the world's estimated coal reserves. The supply is infinite and free, but the difficulties in harnessing it are that it is vastly diffused, and cut off at night or on cloudy days. The problem, though, is more one of costs than of technology.

On a small scale, rooftop collectors could gather solar rays to heat water in homes, raising it to perhaps 125 degrees fahrenheit, leaving only 20 or 30 degrees to be added by a gas or electric heater, which would do the whole job when sunlight was unavailable. Solar water heaters were used in Florida and California years ago, and are in use today in Israel, Australia and Japan.

SIMILARLY, homes and commercial buildings could be heated — at least partially — by solar heat trapped by roof panels, and even cooled by solar air conditioning using the absorption-refrigeration process, eventually saving perhaps half of the energy now used for heating and cooling buildings, which together account for 20 per cent of U.S. energy consumption.

Cost of the equipment to harness the free sunlight is expected to range from a few hundred dollars for a large water heater to a few thousand dollars for a combination heating-cooling system for a home. Savings on fuel over the years would pay for the equipment, which could be purchased by the building owner, or installed and leased to him by a utility company as telephones are now.

METHANE — Clean-burning methane gas, the chief component of natural gas, is produced in nature by the bacterial decay of vegetable matter and animal wastes in the absence of air.

Several thousand Taiwan farmers pipe it from pig-manure pits for clean, odor-free kitchen cooking, and one British car owner has used pig-manure methane to run his car for 17 years. (He figures that 100 gallons of manure yields methane equal to eight gallons of gasoline). And the manure residue makes fine fertilizer afterward.

Such small-scale use might be impractical in the United States, but large municipal sanitation plants could be equipped to produce methane, whose potential from this source has been estimated at roughly equal to present natural gas consumption in this country.

HYDROGEN — Touted as an ideal future fuel, hydrogen burns cleanly and is abundant in nature, most importantly in water. It is highly efficient in liquid or gas form, and as safe to use as gasoline or natural gas. It can substitute for natural gas in homes and factories, and for gasoline in the engines of cars and trucks, with engine modifications.

When burned, it produces no pollutants, only steam, which returns to the atmosphere and is recycled naturally with other water vapor.

But large-scale production of hydrogen requires enormous amounts of power — probably electricity used in electrolysis to decompose water into hydrogen and oxygen.

Thus, an abundant supply of nuclear, solar or some other form of energy would be needed for a hydrogen-based economy, in which this fuel would be the medium for efficient transmission and clean use of energy.

GEOTHERMAL — "Earth heat" from the geysers of northern California generates electricity for the Pacific Gas and Electric Co., and trapped steam in other areas could be similarly used.

TIDES — Water at high tide runs through turbines to enter an artificial basin or dyked-off bay, then out through turbines again when the tide goes out.

Energy flow is intermittent as the tide changes.

HYDROELECTRIC — Power dams generate clean power, but dammed rivers spread out and inundate valuable land. Sedimentation can be a problem in the river and tributaries, and siltation often limits the dam's life expectancy. Shortage of new sites limits the potential for more power dams.

WIND — Windmills that used to pump water and generate electricity on farms fell idle as rural electrification spread. More efficient windmills now could be used to electrolyze water, producing storable hydrogen fuel, thus offsetting the wind's unpredictability

EXHIBIT S-V

THE CHRISTIAN SCIENCE MONITOR
Tuesday, November 27, 1973

Make your own fuel

By Peter Tonge

Northford, Conn.

On the outskirts of this small Connecticut town, Alan Ellason is busy producing the gas that will heat his greenhouse all winter long.

A few buckets of chicken manure and several bushels of chopped-up vegetable matter "will do the trick," he explains. They go into his few lengths of piping -- which processes the waste into methane.

Not far from Muncie, Ind., farmer Dick Shuttleworth likewise turns the manure from his black Angus cattle into gas. For several months now, his homemade fuel has run a gas stove, gas lights, a 1948 Chevrolet engine, and sundry other pieces of motorized equipment.

In San Diego County, hog farmer George W. Groth generates his own electricity using home-brewed gas. And in England, George Bate has been driving his "chicken powered" car down the roads and lanes of Devonshire for several years now. Bottled gas, the product of chicken manure, fuels the Bate car.

Natural process

Increasingly, people are producing gas from wastes by duplicating the process that takes place naturally in marshes around the world.

That process is anaerobic decay, the biological breakdown of animal and vegetable matter in the absence of oxygen. The twin products of this breakdown are a nitrogen-rich fertilizer residue and methane gas. Methane is first cousin to natural gas and an increasingly desirable product in energy-short Europe and North America.

The process then is simple. "I just mix the wastes with water [into a thick slurry] throw it into an air-tight tank and let nature take over," says Mr. Ellason. The equipment need not be elaborate either, as the Ellason digester bears testimony.

The cost of methane production units can vary considerably, however, depending on size and sophistication. Plans for the erection of some completely automated plants, based on Mr. Shuttleworth's digestor, are currently being drawn up by The Mother Earth News of Hendersonville, N.C. Such units may cost between $1,000 and $5,000 to install. In contrast, Mr. Ellason's tank and piping cost just a few hundred dollars. Then there are even less expensive operations.

Simple materials

Down in Blue Ridge, Ga., Dycus made a methane unit out of a barrel, some plumbing fixtures, and a tractor-tire inner tube. The inner tube inflates as the gas is generated. In this instance, the methane is led off to a small gas stove. One day's production will keep a burner going at maximum flame for 30 minutes.

L. John Fry is recognized as a world authority on home methane production through his experimental work while farming in South Africa. He has designed a unit using only an inner tube and a plastic mouthpiece.

Mix a shovelful of manure with a bucket of water, pour it into the inner tube," says the now-California-based Mr. Fry, and in a day's time it will produce enough gas to cook a day's meals for a family of four.

The inner tube unit was designed specifically to meet the needs of the peasant family in underdeveloped parts of the world. In contrast, his own farm unit in South Africa cost $10,000 including an electric generator powered by the methane. But the value of its 8,000 cubic feet a day of gas would have paid for the installation in just three years if he could have sold it commercially. Much of it was thrown away.

Labor cost saved

In addition, the digestor "saved me far more than that in labor costs [disposing of the 2 tons of manure his hog farm produced each day] and I realized a still greater return in the fertilizing value of the effluent returned to the soil."

Many gas producers limit themselves to processing animal manures (with U.S. agriculture producing 200 million tons of it every year who needs anything else, they ask). But another renowned authority on biogas, India's Ram Bux Singh, recommends a mixture of plant and animal waste.

In fact, says Mr. Singh, "one pound of dry leaves can generate seven cubic feet of gas whereas one pound of cow manure will produce only one cubic foot of gas."

Standard city refuse can be used, too. Experiments by Dr. John Pfeffer, professor of Sanitary Engineering, University of Illinois, have resulted in "good methane conversion rates."

Temperature important

The four to five pounds of trash generated by every American every day would produce about 15 pounds of methane, says Dr. Pfeffer. On a national basis this would amount to 8 to 10 percent of the country's present needs.

Mr. Ellason runs his digester on 30 percent chicken manure with 70 percent plant waste which is mixed with water to form a slurry. This mixture began producing gas within three weeks when he started the operation during the warm days of August.

Temperature is important. The system works best between 90 and 110 degrees F. Production falls off rapidly below 70 degrees. For this reason, many digestors are heavily insulated against the cold. Mr. Ellason's approach: "I have my unit inside my greenhouse. As the unit warms up the air for the plants it keeps itself warm enough to go on producing."

Miscellaneous

Some of the comments which would not be classified under the above headings are grouped below as miscellaneous topics:

1. Ag-2 rezoning is necessary for swine raising, as was noted in the Draft statement. The question of rezoning is under the jurisdiction of the City and County of Honolulu. Until grain is successfully grown on a large scale on the neighbor islands, swine will have to remain on Oahu for the most economical production and marketing of pork.

2. Paving of roads and pens will constitute an irreversible change in the soil in that the initial grading will strip the topsoil, and compaction of the soil will be more severe than it would be in most agricultural operations.

3. The block of State-owned land in upper Pouhala was recognized initially as the most ideal area for the ag park. While this would have been the best land for diversified, cultivated crops, the land has been leased to Del Monte for the immediate future. This section may, however, be put to its highest agricultural use in sugar cane production, especially if other less productive sugar lands are urbanized.

4. The portions of the Pohakea site which are best suited for crops should be used in crop production, as was pointed out by the U.S.D.A. Soil Conservation Service. However, compromises may be necessary in utility planning and waste handling.

5. In the economic justification for the Ag Park provided in the Draft Statement, credit was not given to Renaud, on whose work Hogg's projections are based. He was given credit in reference 19, however.

Dollar's projections, "The Statewide Goals", which are referred to in the same section of the Draft Statement, are quite different from Hogg's. They are "blue sky" projections and are based on partial or full self-sufficiency -- meaning that all consumption demands would be matched by supplies from within the State. However, it is not anticipated that the production planned for the first increment of the ag park would come close to fulfilling these goals for any crop, although it would help to meet them.

The long range forecasts are based on the latest population projections available to Dollar and Hogg. These may not be realized with recent movements to limit the population growth of Hawaii, and particularly of Oahu. The long range forecasts also are based on increased demand with affluency of Hawaii's population. This also may not be realized.

6. The wind data in Exhibit XII of the Draft Statement were taken from data for 1939 to 1948, and from 1963 to 1965. Apparently no data were collected between 1948 and 1963.

Alternatives to the Proposed Action

Zero discharge of all waste water pollutants and contaminated runoff from all feedlots and animal operations by July 1, 1983 - a new EPA guideline issued in August, 1973 as required by public law 92-500 - further intensifies the need for an agricultural park. Unless small feedlots and animal operations are brought together for economies of scale in waste water control through developments such as the ag park, they may not be able to survive financially. This applies to all of the animal operations on all of the Hawaiian Islands because any flow from these sites may end up in the navigable waters which surround all of the islands. This applies to new operations now and to existing operations by July 1, 1983.

Hence, any thought of moving intensive animal operations to the neighbor islands to escape strict pollution control regulations on Oahu is fallacious. The only advantage that neighbor island operations may have is (1) they may be located where ground water resources may not be endangered; (2) the waste water may be disposed of over more area; or (3) there may be more water available for an ag park on neighbor islands.

Each ag park consideration, whether on Oahu or on another island, will need to strike a balance between the added costs of several small waste disposal systems rather than one or two large ones. This would need to be examined on an individual basis, and could depend largely on the site itself.

Also to be considered are the costs of on-farm improvements. If these are too costly when taken together with the cost of occupancy at the ag park, the farmers may not be able to afford to move there. The alternative to the proposed action is then for the farmer to stay where he is and at his present level of production until forced to comply with the EPA regulations in 1983.

At that time, if he cannot economically comply at the existing location, he would seek an ag park situation where the sharing of waste disposal costs would help to make his costs manageable, or he would go out of business.

No quantitative estimates of these costs are available at this time. This could be part of the additional research suggested above. The on-farm costs were excluded by contract from this study.

To date, where the terrain and site have been chosen for their ability to meet environmental standards and where the installation is sizeable, on-farm costs have not been prohibitive. This has been true even where containment of all of the waste water has been on-farm. Therefore, where the ultimate disposal need not be on the farm (as at the ag park), the other costs required to meet the new environmental standards are not expected to be prohibitive. If other livestock farmers were not required to meet the new environmental standards, the livestock farmer with the new facilities could be at a competitive disadvantage, and could end up with an uneconomical operation.

If grains are successfully grown on the neighbor islands - a hope which has not yet been realized - some animal production may be more economical there. The economics of grain production in Hawaii, and acreage required to supply grain requirements in the future are shown in reference 18. However, as pointed out earlier in this supplement and our other reports, production close to the major market (Oahu) is definitely advantageous due to high interisland transportation costs and ease in timely supply of the market with fresh products.

It does not appear possible to grow grain economically, or in much volume, on Oahu except at Kahuku, and that appears to be only as a green chop suitable for and in amounts sufficient only for dairy cattle. This suggests that the feedlot proposed for the ag park on Oahu needs to look elsewhere for its supply of grain - probably to the mainland U.S.A.

Need for Followup

The final recommendations in our report, "Conceptual Design and Cost Comparisons for an Agricultural Park on Oahu, (pages 72 and 73) are repeated here due to their importance in bringing the Oahu Ag Park into reality.

"A committee or task force should be established of those concerned with the ag park implementation to coordinate and followup on this complex project. Without the concerted effort of all concerned and without regular followup, the ag park concept and the plans developed herein could easily fall by the wayside."

"A critical path planning network should be developed for the ag park project. With visual control of the project, and by making all interested parties aware of the problems and timing of related aspects of the ag park, the project may be held to a close timetable. Without controls, the proposed task force may not be able to implement the ag park within a reasonable time frame."

Additionally:

The task force should work with and encourage the potential purchasers of the ag park animal waste who want to use this material for fuel or compost. Refeeding technology should also be evaluated if and when FDA approves this form of recycling. This is important because the design of the on-site and off-site waste management facilities would be quite different if the wastes were to be used for fuel manufacture rather than recycled in other ways. Less water, or in some cases, no water would be needed for the collection of animal waste if it were to be used for fuel or compost or if it were to be recycled as refeeding material.

Revised Development Plan

A development schedule has been suggested (reference 19) and is shown below as revised:

December 15, 1973	Rewrite of E.I.S. completed
January 10, 1974	Decision made on site, and on direction to be taken in waste management
January, 1974 thru April, 1974	Additional funds sought from legislature and from other sources
May, 1974	Start process for Ag-2 zoning
May, 1974	Planning funds released and engineering drawings started for Ag Park
September, 1974	Drawings reviewed by government agencies; revised
December, 1974	Bid specifications completed and out for bid
January, 1975	Construction of on-site and farm improvements begun
July, 1975	Farmers located on site

Unless this schedule is refined in detail and followed closely, the actual relocation of farmers to the ag park could extend to late 1975, or even into 1976.

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APPENDIX S-A
DESCRIPTION OF SOIL TYPES
AT POHAKEA AND KAHUKU

Symbol		Description
KaeC	*	Kaena stony clay, 6 to 12 percent slopes.--This is a poorly drained, very dark-gray soil on moderately sloping alluvial fans. The soil is very sticky and very plastic when wet. The shrink-swell potential is high. Stones are common on the surface. The amount of stones in the subsoil increases with depth. Depth to bedrock is more than five feet. Permeability is slow and erosion hazard is slight to moderate. Land capability class III.
KaB	*	Kaena clay, 2 to 6 percent slopes.--This soil is similar to Kaena stony clay, 6 to 12 percent slopes except there are few or no stones in the surface layer, and slopes are gentle. The erosion hazard is slight. Land capability class III, irrigated.
KaC	(K)	Kaena clay, 6 to 12 percent slopes.--This soil is similar to Kaena stony clay, 6 to 12 percent slopes except there are few or no stones in the surface layer. Land capability class III, irrigated.
KaeB	*	Kaena stony clay, 2 to 6 percent slopes.--This soil is similar to Kaena stony clay, 6 to 12 percent slopes except for gentle slopes. The erosion hazard is slight. Land capability class III, irrigated.
KaeD	*	Kaena stony clay, 12 to 20 percent slopes.--This soil is similar to Kaena stony clay, 6 to 12 percent slopes except slopes are moderately sloping. The erosion hazard is moderate. Land capability class IV, irrigated.
KanE	*	Kaena very stony clay, 10 to 35 percent slopes.--This very stony soil occurs on talus slopes and alluvial fans. It is similar to Kaena stony clay, 6 to 12 percent slopes except there are many stones on the surface and in the profile. Slopes are moderately sloping to steep. The erosion hazard is moderate to severe. Land capability class VI.

Location:
P=Pohakea
K=Kahuku
*=Not at Park Sites (included for purposes of comparison only)

Symbol		Description
KuB	(P)	Kolekole silty clay loam, 1 to 6 percent slopes.--This is a well-drained, dark reddish brown soil on gently sloping uplands. There is a compact pan-like layer that is typically 24 to 40 inches below the surface. Roots are restricted by this compact layer. Permeability is moderately rapid to the pan-like layer and moderate in the compact subsoil. The erosion hazard is light. Land capability class II, irrigated.
KuC	(P)	Kolekole silty clay loam, 6 to 12 percent slopes.--This soil is similar to Kolekole silty clay loam, 1 to 6 percent slopes, except it is moderately sloping. The erosion hazard is moderate. Land capability class III.
KuD	(P)	Kolekole silty clay loam, 12 to 25 percent slopes.--This soil occurs on narrow side slopes mainly along drainageways. It is similar to Kolekole silty clay loam, 1 to 6 percent slopes except it is moderately steep. The erosion hazard is moderate to severe. Included are small eroded spots. Land capability class IV.
KyA	(P)	Kunia silty clay, 0 to 3 percent slopes.--This is a well-drained, dark reddish-brown soil on nearly level smooth slopes. Depth to bedrock is more than five feet. Gravelly alluvium may underlie the soil at depths below four feet. Permeability is moderate and erosion hazard is none to slight. Land capability class I, irrigated.
KyB	(P)	Kunia silty clay, 3 to 8 percent slopes.--This soil is similar to Kunia silty clay, 0 to 3 percent slopes except for gentle slopes. The erosion hazard is slight. Land capability class II, irrigated.
KyC	(P)	Kunia silty clay, 8 to 15 percent slopes.--This soil occurs on narrow side slopes mainly along drainageways. It is similar to Kunia silty clay, 0 to 3 percent slopes except it is moderately sloping. The erosion hazard is moderate. Land capability class III.
LaA	(K)	Lahaina silty clay, 0 to 3 percent slopes.--This is a well-drained, dark reddish-brown soil on smooth nearly level uplands. Depth to bedrock is more than five feet. Permeability is moderate, and erosion hazard is none to slight. Land capability class I, irrigated.

Location:
P=Pohakea
K=Kahuku
*=Not at park sites (included for comparison purposes only)

Symbol		Description
LaB	(K)	Lahaina silty clay, 3 to 7 percent slopes.--This soil is similar to Lahaina silty clay, 0 to 3 percent slopes except it is gently sloping and has a slight erosion hazard. Land capability class II, irrigated.
LaC	*	Lahaina silty clay, 7 to 15 percent slopes.--This soil is similar to Lahaina silty clay, 0 to 3 percent slopes except it is moderately sloping and the erosion hazard is moderate. Land capability class III.
LaC3	*	Lahaina silty clay, 7 to 15 percent slopes, severely eroded. This soil is similar to Lahaina silty clay, 7 to 15 percent slopes except it is moderately sloping and most of the surface layer and part of the subsoil have been removed by erosion. The erosion hazard is severe. Included are small blown-out spots and gullies and small very stony areas eroded to weathered rock. Land capability class IV.
McE2	(P)	Mahana silty clay loam, 20 to 35 percent slopes, eroded.--This is a well-drained soil on steep uplands. The surface layer is dark reddish-brown and the subsoil is dark red. This soil is eroded but the degree of erosion is not uniform. In most places the surface layer has been removed by erosion; small areas are not eroded. Depth to bedrock is more than five feet. Permeability is moderately rapid and the erosion hazard is very severe. Land capability class VI.
McC2	(P)	Mahana silty clay loam, 6 to 12 percent slopes, eroded.--This soil is similar to Mahana silty clay loam, 20 to 35 percent slopes, eroded, except it is moderately sloping. The erosion hazard is moderate. Included with this soil are areas with less than 6 percent slopes. Land capability class III, irrigated.
McD2	(P)	Mahana silty clay loam, 12 to 20 percent slopes, eroded.--This soil is similar to Mahana silty clay loam, 20 to 35 percent slopes, eroded, except it is moderately steep. The erosion hazard is severe. Land capability class IV.
MBL	*	Mahana-Badland complex.--This unit consists of soils of the Mahana series and Badland occurring together in a complex pattern. Slopes range from 10 to 70 percent. The Mahana soils occupy 40 to 70 percent of the area. They are similar to Mahana silty clay loam, 20 to 35 percent slopes, eroded, except slopes range from moderately steep to very steep. The erosion hazard is moderate to very severe. Badland consists of nearly barren land that has remained after the Mahana soils were removed by wind and water erosion. Land capability class VII.

Location:
P=Pohakea
K=Kahuku
*=Not at park sites (included for purposes of comparison only)

Symbol		Description
MoC	(P)	Manana silty clay loam, 6 to 12 percent slopes.--This is a well-drained dark reddish-brown soil on moderately sloping uplands. The surface layer is a silty clay loam and the subsoil is a silty clay. There is a panlike sheet 1/8 to 1/4 inch thick at depths ranging from 15 to 30 inches. This sheet affects root penetration. The soil below the panlike sheet is compact in place. Permeability is moderately rapid above the panlike layer and moderate below. The erosion hazard is slight to moderate. Land capability class III, irrigated.
MoB	*	Manana silty clay loam, 2 to 6 percent slopes.--This soil is similar to Manana silty clay loam, 6 to 12 percent slopes except for gentle slopes. The erosion hazard is slight. Land capability class II, irrigated.
MoD2	*	Manana silty clay loam, 12 to 25 percent slopes, eroded.--This soil is similar to Manana silty clay loam, 6 to 12 percent slopes except it is moderately steep and most of the surface layer and part of the subsoil have been removed by erosion. The erosion hazard is moderate to severe. Depth to the panlike layer is less than 15 inches. Land capability class VI.
MpB	*	Manana silty clay, 3 to 8 percent slopes.--This soil is similar to Manana silty clay loam, 6 to 12 percent slopes except the surface texture is silty clay and slopes are gentle. The erosion hazard is slight. Depth to the panlike layer is 30 to 50 inches. Land capability class II.
MpC	*	Manana silty clay, 8 to 15 percent slopes.--This soil is similar to Manana silty clay loam, 6 to 12 percent slopes except the surface texture is silty clay. Depth to the panlike layer is 30 to 50 inches. Land capability class III.
MpD	*	Manana silty clay, 15 to 25 percent slopes.--This soil is similar to Manana silty clay loam, 6 to 12 percent slopes except the surface texture is silty clay and slopes are moderately steep. The erosion hazard is moderate. Depth to the panlike layer is 30 to 50 inches. Land capability class IV.
MpD2	*	Manana silty clay, 12 to 25 percent slopes, eroded.--This soil is similar to Manana silty clay loam, 6 to 12 percent slopes except the surface texture is silty clay, slopes are moderately steep and the original surface layer and part of the subsoil have been removed by erosion. The erosion hazard is severe. Land capability class VI.
MpE	*	Manana silty clay, 25 to 40 percent slopes.--This soil is similar to Manana silty clay loam, 6 to 12 percent slopes except texture of the surface layer is silty clay and slopes are steep. The erosion hazard is moderate to severe. Land capability class VI.

Location:
P=Pohakea
K=Kahuku
*=Not at park sites (included for purposes of comparison only)

Symbol		Description
PeC	(K)	Paumalu silty clay, 8 to 15 percent slopes.--This soil is similar to Paumalu silty clay, 3 to 8 percent slopes except for moderate slopes. The erosion hazard is slight to moderate. Land capability class III.
PeD	(K)	Paumalu silty clay, 15 to 25 percent slopes.--This soil is similar to Paumalu silty clay, 3 to 8 percent slopes except for moderately steep slopes. The erosion hazard is moderate. Included are small eroded and stony areas. Land capability class IV.
PeE	(K)	Paumalu silty clay, 25 to 40 percent slopes.--This soil is similar to Paumalu silty clay, 3 to 8 percent slopes except slopes are steep. The erosion hazard is moderate to severe. Included are small eroded and stony areas. Land capability class VI.
PeF	(K)	Paumalu silty clay, 40 to 70 percent slopes.--This soil is similar to Paumalu silty clay, 3 to 8 percent slopes except slopes are very steep. The erosion hazard is severe. Included are small eroded and stony areas. Land capability class VII.
PZ	(K)	Paumalu-Badland complex.--This unit consists of Paumalu soils and Badland occurring on 10 to 70 percent slopes. Paumalu soils occupy 40 to 80 percent of the area and Badland occupies the remaining areas. Badland consists of nearly barren, eroded areas and includes some rock outcrop and stones. Land capability class VII.
PeB	(K)	Paumalu silty clay, 3 to 8 percent slopes.--This is a well-drained dark reddish-brown soil on gently sloping uplands. Depth to soft weathered rock ranges from 30 to 60 inches. Depth to bedrock is more than five feet. Permeability is moderately rapid and the erosion hazard is slight. Land capability class II.

Location:
P=Pohakea
K=Kahuku
*=Not at park sites (included only for purposes of comparison)

SECTION IV

COMMENTS ON THE SUPPLEMENT TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

MARCH 19, 1975

HENRY A. ALEXANDER & COMPANY, INC.
MANAGEMENT CONSULTANTS

Suite 307
401 Kamakee Street
Honolulu, Hawaii 96814
Telephone 521-4702

December 6, 1973

Mr. Frederick C. Erskine
Chairman, Board of Agriculture
1428 South King Street
Honolulu, Hawaii, 96814

Attention: Mr. Roy Matsuura

Dear Mr. Erskine:

On February 15, 1973, our firm signed a contract with the Board of Agriculture, State of Hawaii for economic planning and conceptual design services directed toward the establishment of an agricultural park on Oahu.

We have submitted to your office to date:

Draft Preliminary Site Selection Study for an Agricultural Park on Oahu
Conceptual Design and Cost Comparisons for an Agricultural Park on Oahu
Draft Environmental Impact Statement for an Agricultural Park on Oahu

We have received comments from those agencies reviewing our Draft Environmental Impact Statement, and have done further research to prepare answers to these comments. These answers, in responding to the most crucial questions about the ag park, and in restating the main topics covered in our previous submittals, are bound into a fourth submittal, the Supplement to the Draft Environmental Impact Statement for an Agricultural Park on Oahu. We feel that this Supplement serves adequately as a substitute for the Summary Overview which is called for in the contract.

Our contract states that:

> "After approval of all drafts by the State, including the Office of Environmental Quality Control, submit 12 copies of a single bound report comprising the Preliminary Site Selection Study, Conceptual Design Study, and the Environmental Impact Statement with a Summary Overview of the overall consulting project."

We have discussed with Roy Matsuura, and hereby request, that, in view of the bulk of our submittals, these submittals be accepted as separate parts of our total effort, rather than being bound into a single report of impractical size.

1.49

We further request that the Supplement to the Draft Environmental Impact Statement be accepted as the final portion of our report, in lieu of a "Summary Overview", in that the Supplement performs the same functions as were intended for the "Summary Overview".. We have spoken with Roy Matsuura on these two requests, and he is in agreement that these modifications would be practical.

If there are further questions about these requests, please contact us. Otherwise, we will look forward to your quick approval, and will submit the final product, the Supplement, to your office within a few days. Thank you for your attention to this request.

Yours truly,

Henry A. Alexander

Henry A. Alexander, President

DEC 24 1973

15

December 21, 1973

Mr. Henry A. Alexander
Henry A. Alexander & Company, Inc.
401 Kamakee Street, Suite 307
Honolulu, Hawaii 96814

Dear Mr. Alexander:

Receipt is acknowledged of the Summary Overview in the form of your Supplement to the Draft Environmental Impact Statement as required by Sections 6 and 7 of the agricultural park contract dated February 15, 1973.

We have reviewed the Supplement and accept this submittal as a separate part of the past two reports and as the final portion of your report.

Under Section 8d concerning final payment, please submit your statement along with a certification of work performed and a copy of your tax clearance form.

Sincerely,

Frederick C. Erskine
Chairman, Board of Agriculture

1.49

OFFICE OF ENVIRONMENTAL QUALITY CONTROL
OFFICE OF THE GOVERNOR
550 Halekauwila Street
Tani Office Building, Third Floor
Honolulu, Hawaii 96813

January 23, 1974

MEMORANDUM

FROM: Richard E. Marland, Interim Director
Office of Environmental Quality Control

SUBJECT: SUPPLEMENT TO DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED AGRICULTURAL PARK FOR KUNIA, OAHU

Enclosed for your review is a supplement to the subject statement. Rather than prepare separate replies to each respondent, the Department of Agriculture chose to consider all comments together in a supplement which is being distributed to those agencies and individuals who participated in reviewing the draft statement. Your comments, if any, should address whether the supplement adequately considers major environmental concerns. Because this is a supplementary review for the purpose of documenting the consideration of review comments, we have established a deadline of February 8, 1974, for receipt of additional comments.

Mahalo for your consideration and assistance in reviewing the draft supplement.

cc: The Honorable Fred Erskine
Henry Alexander & Company Inc.

JOHN A. BURNS
GOVERNOR

RICHARD E. MARLAND, PH.D.
INTERIM DIRECTOR

TELEPHONE NO
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
OFFICE OF THE GOVERNOR
550 HALEKAUWILA ST
ROOM 301
HONOLULU, HAWAII 96813

March 19, 1974

MEMORANDUM

TO: Honorable Fred Erskine
Department of Agriculture

FROM: Richard E. Marland
Office of Environmental Quality Control

SUBJECT: Ag Park, Kunia, Oahu

Enclosed for your evaluation and consideration are copies of comments received on the Supplement to the Draft Statement. To date, the following provided comments:

State Agencies:
Department of Health
Department of Planning and Economic Development

City and County of Honolulu:
Department of General Planning
Department of Public Works
Board of Water Supply

Federal Agencies:
U.S. Army, Corps of Engineers
Soil Conservation Service
U.S. Air Force, 15ABWG/DEEE

Our official comments on the Draft Statement and on the accompanying Supplement are forthcoming. In the meantime, please provide written responses to those agencies that made substantive comments to the Supplement. We would appreciate receiving a copy of your responses.

cc: Henry Alexander
(Suite 307, 401 Kamakee St.,96814)

Enclosure

JOHN A. BURNS
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

WALTER B. QUISENBERRY, M.P.H., M.D.
DIRECTOR OF HEALTH

WILBUR S. LUMMIS JR., M.S., M.D.
DEPUTY DIRECTOR OF HEALTH

RALPH B. BERRY, M.P.H., M.D.
DEPUTY DIRECTOR OF HEALTH

HENRI P. MINETTE, M.P.H., DR.P.H.
DEPUTY DIRECTOR OF HEALTH

February 8, 1974

In reply, please refer to:
File: EH-SE

To: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

From: Director of Health

Subject: Supplement to Draft Environmental Impact Statement for Proposed Agricultural Park for Kunia, Oahu

We have reviewed the subject Environmental Impact Statement (EIS) Supplement from the standpoints of sanitation, vector control, solid waste, air and water quality control. The Supplement gives greater consideration to potential problems in these areas than did the draft EIS. We have no additional comments to make regarding the subject project at this time.

Walter B. Quisenberry
WALTER B. QUISENBERRY, M.D.

DLC

STATE OF HAWAII

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

P. O. BOX 2359 • HONOLULU, HAWAII 96804

JOHN A. BURNS
Governor

SHELLEY M. MARK
Director

EDWARD J. GREANEY, JR.
Deputy Director

February 12, 1974

Ref. No. 0400

MEMORANDUM

TO: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

FROM: Shelley M. Mark, Director

SUBJECT: Supplement to Draft Environmental Impact Statement for Proposed Agricultural Park for Kunia, Oahu

We have reviewed this "Supplement to the Draft Environmental Impact Statement" which was written in response to comments made by various agencies and organizations on the draft statement.

The supplement appears to adequately consider major environmental concerns and issues relative to the proposed project.

Please note that before the project may be implemented, it must obtain the concurrence of the Governor's Agricultural Coordinator, Chairman of the Board of Land and Natural Resources, and Director of Planning and Economic Development.

We appreciate this opportunity to comment on the supplement.

C/C

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, CORPS OF ENGINEERS
BUILDING 96, FORT ARMSTRONG
HONOLULU, HAWAII 96813

PODED-P

12 February 1974

Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control
State of Hawaii
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Dr. Marland:

The Supplement to the Draft Environmental Impact Statement for the Proposed Agricultural Park for Oahu appears to indicate that the conceptual aspects of the agricultural park are the objects of immediate decision, rather than the selection of a specific site. It appears that proper environmental planning and evaluation would require a fuller comparison of several potential sites, such as Kunia and Kahuku, rather than emphasis on only one, Kunia. The problems of water supply and wastewater treatment are so important to developing a site for diverse agricultural use, and especially livestock husbandry, that they need detailed point by point comparisons to assure good use of the water resource, and a good choice of site.

Sincerely yours,

R. L. NICHOLS
Chief, Engineering Division

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
440 Alexander Young Building, Honolulu, Hawaii 96813

February 8, 1974

Dr. Richard E. Marland
Office of Environmental
Quality Control
Rm. 301, 550 Halekauwila St.
Honolulu, Hawaii 96813

Dear Dr. Marland:

Subject: Supplement to Draft Environmental Impact Statement for Proposed Agricultural Park for Kunia, Oahu

We have reviewed the above-mentioned draft as you requested.

We have no further comments to offer other than those made in our letter to you dated November 5, 1973.

Sincerely,

Francis C. H. Lum
State Conservationist

FEB 11 1974

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 15th AIR BASE WING (PACAF)
APO SAN FRANCISCO 96553

REPLY TO ATTN OF: DEEE

6 FEB 1974

SUBJECT: Supplement to Draft Environmental Impact Statement for Proposed Agricultural Park for Kunia, Oahu

TO: Office of Environmental Quality Control
Office of the Governor
550 Halekauwila Street
Tani Office Building, Third Floor
Honolulu, Hawaii 96813

1. Reference is made to your letter of 23 Jan 1974, subject as above.

2. This office has no comments to render relative to the supplement to subject draft environmental impact statement.

ALLAN M. YAMADA
Asst Dep Comdr for Civil Engrg

816

ARTMENT OF GENERAL PLANN
CITY AND COUNTY OF HONOLULU
629 POHUKAINA STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ROBERT R. WAY
CHIEF PLANNING OFFICER

DONALD A. CLEGG
DEPUTY CHIEF PLANNING OFFICER

DGP1/74-147(CT)

February 12, 1974

MEMORANDUM

TO : DR. RICHARD E. MARLAND, INTERIM DIRECTOR
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

FROM : ROBERT R. WAY, CHIEF PLANNING OFFICER

SUBJECT: PROPOSED AGRICULTURAL PARK AT KUNIA, SUPPLEMENT TO DRAFT ENVIRONMENTAL IMPACT STATEMENT, DECEMBER 1973

We have reviewed the additional information presented in the supplement to the draft EIS for the proposed Agricultural Park at Kunia, the comments submitted by other agencies, and our earlier comments on the draft EIS.

We note that major issues are still not conclusively resolved, and therefore find the discussion of the environmental impacts of the proposed project still incomplete. For example:

1. Waste treatment technology is discussed in general, but the specific method of waste disposal has not been selected. The Department of Health review is more direct: "Environmental costs [of waste disposal] may well determine the economic viability of the Agricultural Park concept. We recommend these costs be calculated as quickly as possible and given public consideration. The Environmental Impact Statement fails to accomplish this." (Letter to Dr. Marland, October 30, 1973, p. 4, item 3.) It should also be noted that the supplement fails to accomplish this.

2. The draft EIS includes a reproduction of a Soil Conservation Service soil classification map of the area (Exhibit XI, p. 13). The soil descriptions are provided in the supplement, but there is no evaluation with respect to suitability for various agricultural uses and no indication of what specific uses will be proposed for specific areas in the agricultural park.

3. In our review of the draft EIS it was indicated that water requirements, odor control, and feed requirements are issues discussed but not conclusively resolved. Moreover, the supplement indicates that feedlot proposals at Kohala, Hawaii and on Kauai may eliminate the need for a feedlot at Pohakea (p. 11). A reevaluation of the specific proposals for the agricultural park should be provided so that public and other costs can be established. The economic viability of the project still appears questionable at this time.

4. Inasmuch as major issues are still not conclusively resolved for this particular site, the question remains as to whether or not this site is the most appropriate. In this respect, the alternatives of a neighbor island location, in addition to other sites on Oahu, may still be open.

I hope these comments are helpful.

Sincerely,

ROBERT R. WAY
Chief Planning Officer

RRW:et

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

PAUL DEVENS
MANAGING DIRECTOR

EDWARD Y. HIRATA
DIRECTOR AND CHIEF ENGINEER

KAZU HAYASHIDA
DEPUTY DIRECTOR AND
DEPUTY CHIEF ENGINEER

ENV 74-24

February 4, 1974

Office of Environmental Quality Control
Office of the Governor
550 Halekauwila Street
Tani Office Building, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Subject: Supplement to Draft Environmental Impact Statement for Proposed Agricultural Park for Kunia, Oahu

We have reviewed the supplement to the draft statement and found it satisfactory. We have no further comments to offer at this time.

Very truly yours,

EDWARD Y. HIRATA
Director and Chief Engineer

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
POST OFFICE BOX 3410
HONOLULU, HAWAII ~~96804~~ 96843

February 4, 1974

Dr. Richard E. Marland
Interim Director
Office of Environmental Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Dr. Marland:

SUBJECT: Supplement to Draft Environmental Impact Statement for Proposed Agricultural Park for Kunia, Oahu

Thank you for sending us the subject supplement for our review and comments.

There are two items which we feel should be clarified. First, on pages 5 and 6, the agricultural park site is located almost entirely on Waianae lava flows. These lavas are permeable and the susceptibility to contamination of groundwater resources by deep infiltration of waste liquids is essentially the same as for the basalt of Koolau volcanic series.

The second item refers to the two million gallons per day of cooling water mentioned in the fourth paragraph on page 10. Inasmuch as this water is from Navy sources, the use of it must be negotiated with the Navy.

Very truly yours,

George Yuen

George Yuen
Manager and Chief Engineer

SECTION V

FOLLOWUP TO SUPPLEMENT TO DRAFT ENVIRONMENTAL IMPACT STATEMENT

March 19, 1975

HENRY J. ALEXANDER & COMPANY, INC.
MANAGEMENT CONSULTANTS

SUITE 707
737 Bishop Street
Honolulu, Hawaii 96813
Telephone 521-1702

March 19, 1975

Mr. John Farias, Chairman
Board of Agriculture
1428 South King Street
Honolulu, Hawaii, 96814

Attention: Mr. Roy Matsuura

Dear Mr. Farias:

Following publication of the Supplement to the Draft Environmental Impact Statement for an Agricultural Park on Oahu, the Office of Environmental Quality Control received and forwarded to us final comments made by eight government agencies on the supplement. All of these comments were quite properly concerned that an acceptable method of waste water treatment had not yet been determined, and that in their opinion, the most serious environmental impact had therefore not been adequately treated.

On March 20th and 25th, 1974, Mr. George Yuen of the Board of Water Supply sent letters to Mitsuo Uechi, the Chairman of the House Agricultural Committee, stating a new position of the Board of Water Supply related to the disposal of the effluent from the anticipated waste water treatment system envisioned for the park. Mr. Yuen provided additional clarification of their position during his personal testimony before the Committee on March 22nd, 1974.

With this final statement by the Board of Water Supply, we were able to write a definite response to the comments made, in our letter of April 30th, 1974. This final submittal was forwarded to Dr. Richard Marland, who forwarded copies to all responding agencies.

An additional verbal comment received on the supplement in February, 1975, was that no cross-reference guide was provided to assist in comparing the Supplement with the Draft. To meet this need, we have provided a new cross-reference index immediately after the Sectional Index to be used in comparing the Supplement and the Draft. With this additional documentation, our reports, the comments, and this followup, the requirements for the Final Environmental Impact Statement for an Agricultural Park on Oahu at the Pohakea Site should be complete. Had we known earlier of the need for a cross-reference, it could have been produced in April, 1974 rather than now, but we hope that it will be a useful addition even at this late date.

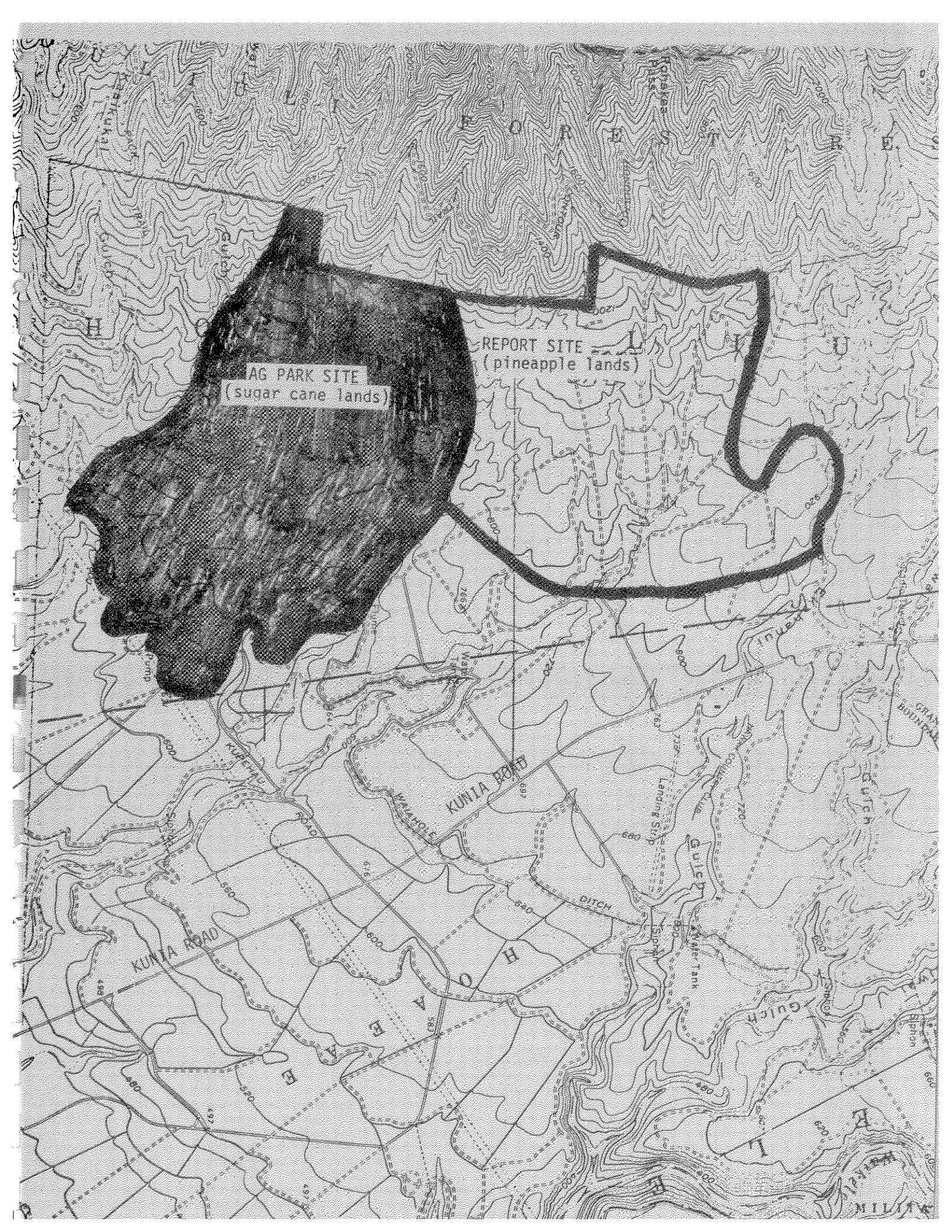
It is now anticipated that the site for the agricultural park be moved across a gulch from what are now pineapple lands to an area presently in sugar cane. For this reason, some revisions are expected to be necessary under separate contract before the engineering work for the Oahu Agricultural Park can proceed.

The new area is shown in a map following this page, outlining its relationship to the location of the agricultural park lands covered in this report. From the contours, it can readily be seen that the area is similar in terrain, location, and shape.

Yours, truly,

Henry A. Alexander

Henry A. Alexander, President


REPORT SITE
(pineapple lands)
(sugar cane lands)
KUNIA ROAD
KUNIA ROAD
DITCH
MILITA

May 3, 1974

Dr. Richard E. Marland, Director
Office of Environmental Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Dr. Marland:

We have received from your office copies of the comments and questions raised by the government agencies reviewing the Supplement to the Draft Environmental Impact Statement for an Agricultural Park on Oahu, which was prepared for the Department of Agriculture by Henry A. Alexander & Company, Inc.

We have forwarded these questions and comments to Mr. Alexander, and the firm has made a reply via the attached letter. We believe it should adequately answer the latest series of questions raised on the Supplement.

Would you please forward copies of this reply to those agencies which have commented on the Supplement? We appreciate your cooperation in this review of the consultant's work.

Sincerely,

Frederick C. Erskine
Chairman, Board of Agriculture

Enc.

HENRY A. ALEXANDER & COMPANY, INC.
MANAGEMENT CONSULTANTS

Suite 307
401 Kamakee Street
Honolulu, Hawaii 96814
Telephone 521-4702

April 30, 1974

Mr. Frederick C. Erskine
Chairman, Board of Agriculture
1428 South King Street
Honolulu, Hawaii, 96814

Attention: Mr. Roy Matsuura

Dear Mr. Erskine:

We have received from your office copies of the comments and questions made by the government agencies reviewing our Supplement to the Draft Environmental Impact Statement for an Agricultural Park on Oahu. Rather than write separate replies to individual agencies, we believe a more effective method of reply would be to answer these remaining questions through a single letter.

The Supplement was written to respond to questions on the Draft Environmental Impact Statement for an Agricultural Park on Oahu. Because the Department of Agriculture, State of Hawaii, had selected the Pohakea site near Kunia as its first choice, and Kahuku as its second choice, the agencies replying addressed most of their questions to specific problems at Kunia. Where general questions about all sites were asked, the response for Kahuku was provided, but the Supplement dealt primarily with the Pohakea site. Likewise, no further discussion of neighbor island sites was made, because the Department had already made their decision on a first and second choice site, and the question of a neighbor island site had been covered in the original report.

In preparing our full report, we completed a Conceptual Design study for An Agricultural Park on Oahu. This was prepared in general terms, rather than for a specific site, in order to have an estimate of the ultimate cost of such a park to the state, to have a basis for evaluating the environmental impact of a park under specific conditions, and to bring out the possible problems and potential solutions which would be encountered in the ultimate engineering of such a park.

Because of the background work accomplished during the course of this study, the Department of Agriculture has been able to choose a possible site, enter into negotiations for the use of the land, and begin work toward final design and implementation of the site. Also, because of this background work, the difficult question of water use and waste disposal has been resolved. The Board of Water Supply has ruled that, since the ag park would be situated over the Waianae aquifer, it will be permissable for the farmers to spread the waste water on the land as a waste disposal method, and to reuse the limited water available. (See Exhibits I and II attached)

These decisions by the Board of Water Supply were a major factor in proving the economic viability of the ag park concept. The cost of bringing sewer lines from the site across Farrington Highway, and of installing treatment systems on the site, would have been prohibitive. Also, the Navy's two million gallons per day of water was indicated in our report as a logical water supply, but use of that water has not yet been negotiated for with the Navy. The new guidelines from the Board of Water Supply permit a much lower investment cost for the State, and lower costs for the tenant farmers, and permit recycling of water available at the site.

The State will be continuing its negotiations for the use of the site, and will soon begin designing the actual park and its individual farm operations. The land at the Pohakea site is highly suited to many agricultural uses, and the actual layout of the site will place the farms in the specific areas which are best suited to their operations. With the design work, the particular costs to the State will be available. These final cost figures should reflect the economic viability of the ag park as a state investment.

We believe that the above comments will satisfactorily answer the questions raised since the publication of the Supplement. We would appreciate hearing further from those agencies who would like further information of clarification of the Ag Park project.

Yours truly,

Henry A. Alexander

Henry A. Alexander, President

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
POST OFFICE BOX 3410
HONOLULU, HAWAII 96843

March 20, 1974

Representative Mitsuo Uechi, Chairman
Committee on Agriculture
House of Representatives
Seventh Legislature
Regular Session, 1974
State of Hawaii

Dear Representative Uechi:

This is in response to your request for our comments relative to a proposed agricultural park in the Kunia-Pohakea area of Central Oahu. The Board of Water Supply is not objecting to the concept of an agricultural park. We wish to point out, however, two matters which must be considered before a final decision is made, namely, water supply and liquid waste disposal.

1. Water Supply

Our present system will be able to supply water for domestic use only. The facilities needed for this include a pipeline extending from our existing distribution system in Wahiawa to the agriculture park. This will supply sufficient domestic water for the proposed resident population, but insufficient for irrigation needs. Other than the 2 mgd cooling water that may be made available from the U. S. Navy Kunia facility little or no additional water may be developed in the area for diversified agriculture. The water resources in this area are already fully developed or committed to meet domestic demands in the immediate future.

Water for the future will depend on several alternatives which we are now studying, one of which is the development of sources in Wahiawa and Waialua. Other potential sources are sewage reclamation and use of West Loch for surface water impoundment. However, these are relatively long-term alternatives and we do not anticipate utilization of these sources in the near future.

2. Liquid Waste Disposal

Our concern in liquid waste disposal lies in the effect this may have on the groundwater resources on which we rely for domestic water sources. Ground disposal of liquid wastes in the

Kunia-Pohakea area may result in a long-term buildup of nitrogen, total dissolved solids or the possibility of viral contamination. Until research rules out the possibilities of these types of contamination, we are recommending that the following guidelines be followed.

A. For the area overlying the Koolau aquifer:

(1) A wastewater collection and treatment system with disposal of effluent in an area wherein domestic groundwater resources will not be adversely affected (generally makai of Farrington Highway) is acceptable if infiltration of liquids is eliminated from dairy and feed lot corrals by suitable paving and all liquid wastes are collected in lined lagoons.

(2) A solids collection and composting system is acceptable if all liquid wastes from dairy washdown, dairy and feed lot runoff and liquids from composting are collected in lined lagoons and disposed of in areas as specified in paragraph A(1) above. Dairy and feed lot corrals shall be paved.

(3) A wastewater treatment system with ground disposal is not acceptable.

B. For the area overlying the Waianae aquifer:

(1) A wastewater treatment system with ground disposal is acceptable. However, treated wastewater shall not be allowed to run off onto lands overlying the Koolau aquifer.

(2) Liquid wastes may be collected and treated in unlined lagoons. Disposal of the treated wastewater shall be as specified in paragraph B(1) above.

(3) Dairy and feed lot corrals shall be paved.

In all cases, the Board of Water Supply requires a review and approval of each disposal method and site in accordance with our rules and regulations.

Very truly yours,

George Yuen
Manager and Chief Engineer

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
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HONOLULU, HAWAII 96843

March 25, 1974

Representative Mitsuo Uechi, Chairman
Committee on Agriculture
House of Representatives
Seventh Legislature
Regular Session, 1974
State of Hawaii

Dear Representative Uechi:

In reviewing our letter of March 20, 1974 and our testimony of March 22, 1974 on the proposed agricultural park in the Kunia-Pohakea area of Central Oahu, we discovered an error which we would like to call to your attention.

The error is in paragraph B(2) dealing with our guidelines for waste disposal in the area overlying the Waianae aquifer. The word "unlined" should be changed to "lined" so that the corrected paragraph B(2) should read:

> "(2) Liquid wastes may be collected and treated in lined lagoons. Disposal of the treated wastewater shall be as specified in paragraph B(1) above."

We apologize for any inconvenience that this error may cause and would appreciate it if the correction is made. Copies of this letter will be sent to the State Department of Agriculture, Department of Health, and the Office of Environmental Control for their information.

Very truly yours,

George Yuen

George Yuen
Manager and Chief Engineer